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Final**

ADVANCED FINANCIAL MANAGEMENT

VOLUME I
CA Dinesh Jain
(AIR 3 in CA Final)

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ADVANCED FINANCIAL MANAGEMENT

**FOR CA FINAL NEW
SYLLABUS [MAY 2024
ONWARDS]**

VOLUME I

BY CA. DINESH JAIN

**DEDICATED TO MY LOVABLE
FATHER [RAMESH JAIN]**

Unique Features of Book:

This book is useful for CA Final (New) students and comes with the following features:

- ❖ **One-stop solution:** The book has extensive coverage of theory and practical problems. I have considered the important problems of institute study material, RTP, MTP and suggested answers while preparing the book. This book can act as one-stop solution for students and they need not refer multiple sources for preparation of AFM. It covers 600+ questions and includes relevant questions from old syllabus study material as well
- ❖ **Theory coverage:** The material has extensive coverage of AFM theory in a simple bullet point format. Last day revision notes for theory in concise format has also been provided
- ❖ **Last day revision notes:** One of the most important problems of students is on how to revise day before exam. I have made summary notes covering theory and important adjustments of 600+ problems. Hence a student reading the summary theory can revise all 600+ problems and all theory questions.
- ❖ **Latest RTP/MTP/SA:** We would be covering latest RTP/MTP/SA once they are issued by ICAI through additional material. You can send message to me on +91 90256 40862 to get softcopy of additional material.

This book wouldn't have been possible without a strong support group. Firstly, my parents (**Ramesh Jain and Leela Jain**) who have not just supported me in all my endeavours but also have been a constant source of inspiration. Secondly my dearest wife (**Aarthi Jain**) whose constant support and motivation kept me going. Thirdly, my family members and well-wishers who have always believed in me.

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My gratitude also goes to my students for giving feedback on my teaching materials which enabled me to improve them and publish this book.

Any suggestions/feedback will be highly appreciated and incorporated in future editions.

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Summary of syllabus

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S.No	Topic	Chapter No.
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Chapter 1 – Financial Policy and Corporate Strategy**1. Explain about the Advanced role of CFO in various matters including value creation?**

- CFO's traditional role focused on **wealth maximization** for shareholders, but due to globalization, information and communication growth, and pandemics, their responsibilities have expanded due to complexity and changing expectations.
- CFOs now support **strategic and operational decision-making** in addition to governance, compliance, and business ethics.
- Following are the emerging roles of CFO:

- | |
|---|
| • Risk Management: CFOs now responsible for managing an organization's risk management framework. |
| • Supply Chain: Post-pandemic challenges supply chain management, requiring CFOs to prioritize financial viability and sustainability for sustainable growth |
| • Mergers, acquisitions, and Corporate Restructuring: Recent growth and market share acquisitions have increased the importance of CFOs' role in strategic decisions, as errors can lead to business collapse. |
| • Environmental, Social and Governance (ESG) Financing: With the evolving concept of ESG, CFO role has been shifted from traditional financing to sustainability financing. |

2. What are the three essential elements of any business?

Business need to have the following three fundamental essential elements

- A clear and realistic **strategy**,
- The **financial** resources, controls and systems to see it through and
- The right **management** team and processes to make it happen.

We may summarise this by saying that:

Strategy + Finance + Management = Fundamentals of Business

3. Write short note on strategy?

- Strategy may be defined **as the long-term direction** and scope of an organization to achieve competitive advantage through the **configuration of resources** within a changing environment for the **fulfilment of stakeholder's aspirations and expectations**.

4. What are the functions of Strategic Financial Management?

- Strategic Financial Management is a corporate strategic plan that involves **investment and financing decisions for achieving objectives**.
- It distinguishes between **strategic, tactical, and operational financial planning**, with senior management deciding strategy, middle management deciding tactics, and operational management overseeing operations.
- Investment and financial decisions will involve the following:
 - Continual search for best investment opportunities
 - Selection of the best profitable opportunities
 - Determination of optimal mix of funds for the opportunities
 - Establishment of systems for internal controls; and
 - Analysis of results for future decision-making

5. What are the key decisions falling within the scope of financial strategy? [Nov 2020 RTP, Nov 2019 (exam), Nov 2019 MTP, Jan 2021, May 2021 MTP]

The key decisions falling within the scope of financial strategy include the following:

- **Financing decisions:** These decisions deal with the mode of financing or **mix of equity capital and debt capital**.
- **Investment decisions:** These decisions involve **the profitable utilization of firm's funds especially in long-term projects** (capital projects). Since the future benefits associated with such projects are not known with certainty, investment decisions necessarily involve risk. The projects are therefore evaluated in relation to their expected return and risk.
- **Dividend decisions:** These decisions **determine the division of earnings** between payments to shareholders and reinvestment in the company.

- **Portfolio decisions:** These decisions involve evaluation of investments based on their contribution to the aggregate performance of the entire corporation rather than on the isolated characteristics of the investments themselves.

6. Explain the different types of strategy? [Jan 2021]

Following are the three different types of strategy:

- **Corporate Level Strategy:** Corporate level strategy fundamentally is concerned with selection of businesses in which a company should compete and also with the development and coordination of that portfolio of businesses. Corporate level strategy should be able to answer three basic questions namely suitability, feasibility and acceptability
- **Business Unit Level Strategy:** Strategic business unit (SBU) may be any profit centre that can be planned independently from the other business units of a corporation. At the business unit level, the strategic issues are about practical coordination of operating units and developing and sustaining a competitive advantage for the products and services that are produced.
- **Functional Level Strategy:** The functional level is the level of the operating divisions and departments. The strategic issues at this level are related to functional business processes and value chain. Functional level strategies in R&D, operations, manufacturing, marketing, finance, and human resources involve the development and coordination of resources through which business unit level strategies can be executed effectively and efficiently.

7. What is financial planning and what are the components of financial planning?

- Financial planning is the backbone of the business planning and corporate planning. It helps in defining the feasible area of operation for all types of activities and thereby defines the overall planning framework.
- Financial planning is a systematic approach whereby the financial planner helps the customer to maximize his existing financial resources by utilizing financial tools to achieve his financial goals.

There are 3 major components of Financial planning:

- Financial Resources (FR)
- Financial Tools (FT)
- Financial Goals (FG)

Financial Planning: $FR + FT = FG$

8. Explain outcomes of the Financial Planning? [Nov 2022 MTP, May 2022]

- Outcomes of the financial planning are the financial objectives, financial decision-making and financial measures for the evaluation of the corporate performance.
- Financial objectives are to be decided at the very outset so that rest of the decisions can be taken accordingly. The objectives need to be consistent with the corporate mission and corporate objectives.
- Financial decision making helps in analyzing the financial problems that are being faced by the corporate and accordingly deciding the course of action to be taken by it.
- The financial measures like ratio analysis, analysis of cash flow statement are used to evaluate the performance of the Company. The selection of these measures again depends upon the Corporate objectives.

9. Explain the interface between financial policy and strategic management? [May 2018, Nov 2020]

- ❖ The interface of strategic management and financial policy will be clearly understood if we appreciate the fact that the starting point of an organization is money and the end point of that organization is also money.
- ❖ Sources of finance and capital structure are the most important dimensions of a strategic plan. The need for fund mobilization to support the expansion activity of firm is very vital for any organization.
- ❖ Along with the mobilization of funds, policy makers should decide on the capital structure to indicate the desired mix of equity capital and debt capital. There are some norms for debt equity ratio which need to be followed for minimizing the risks of excessive loans
- ❖ Another important dimension of strategic management and financial policy interface is the investment and fund allocation decisions. A planner has to frame policies for regulating investments in fixed assets and for restraining of current assets

- ❖ **Dividend policy is yet another area** for making financial policy decisions affecting the strategic performance of the company. A close interface is needed to frame the policy to be beneficial for all
- ❖ Thus, the **financial policy of a company cannot be worked out in isolation of other functional policies.** It has a wider appeal and closer link with the overall organizational performance and direction of growth

10. How financial goals can be balanced with vis-à-vis sustainable growth? [May 2020 RTP, Nov 2018 MTP, May 2019 MTP]

- ❖ The concept of **sustainable growth can be helpful for planning healthy corporate growth.** This concept forces managers to **consider the financial consequences of sales increases** and to set sales growth goals that are consistent with the operating and financial policies of the firm.
- ❖ Often, a conflict can arise if growth objectives are not consistent with the value of the organization's sustainable growth. **Question concerning right distribution of resources may take a difficult shape if we take into consideration the rightness not for the current stakeholders but for the future stakeholders also.**
- ❖ To take an illustration, **let us refer to fuel industry where resources are limited in quantity and a judicious use of resources is needed to cater to the need of the future customers along with the need of the present customers.**
- ❖ One may have noticed the **save fuel campaign, a demarketing campaign that deviates from the usual approach of sales growth strategy and preaches for conservation of fuel** for their use across generation. This is an example of stable growth strategy adopted by the oil industry as a whole under resource constraints and the long run objective of survival over years.
- ❖ **Incremental growth strategy, profit strategy and pause strategy are other variants of stable growth strategy.**
- ❖ Sustainable growth is important to enterprise long-term development. Too fast or too slow growth will go against enterprise growth and development, so financial should play important role in enterprise development, adopt suitable financial policy initiative to make sure enterprise growth speed close to sustainable growth ratio and have sustainable healthy development

11. What makes an organization financially sustainable? [May 2021 MTP, May 2021 RTP]

To be financially sustainable, an organisation must:

- ❖ have more than one source of income;
- ❖ have more than one way of generating income;
- ❖ do strategic, action and financial planning regularly;
- ❖ have adequate financial systems;
- ❖ have a good public image;
- ❖ be clear about its values (value clarity); and
- ❖ have financial autonomy.

12. Write short note on sustainable growth rate (SGR)? (OR) "Sustainable growth is important to enterprise long-term development". Explain this statement in context of planning healthy corporate growth [Nov 2020 MTP]

- ❖ The sustainable growth rate (SGR), concept by Robert C. Higgins, of a firm is the **maximum rate of growth in sales that can be achieved**, given the firm's profitability, asset utilization, and desired dividend payout and debt (financial leverage) ratios.
- ❖ The sustainable growth rate is a measure of **how much a firm can grow without borrowing more money**. After the firm has passed this rate, it must borrow funds from another source to facilitate growth.
- ❖ Variables typically include the net profit margin on new and existing revenues; the asset turnover ratio, which is the ratio of sales revenues to total assets; the assets to beginning of period equity ratio; and the retention rate, which is defined as the fraction of earnings retained in the business.

$$\text{SGR} = \text{ROE} \times (1 - \text{Dividend payment ratio})$$

- ❖ Sustainable growth models assume that the business wants to:
 - maintain a target capital structure without issuing new equity;
 - maintain a target dividend payment ratio; and
 - increase sales as rapidly as market conditions allow.

13. Often, a conflict can arise if growth objectives are not consistent with the value of the organization's sustainable growth. EXPLAIN [May 2022 MTP]

- The concept of sustainable growth can be helpful for planning healthy corporate growth. This concept forces managers to consider the financial consequences of sales increases and to set sales growth goals that are consistent with the operating and financial policies of the firm.
- **Often, a conflict can arise if growth objectives are not consistent with the value of the organization's sustainable growth.** Question concerning right distribution of resources may take a difficult shape if we take into consideration the rightness not for the current stakeholders but for the future stakeholders also.
- To take an illustration, let us refer to fuel industry where resources are limited in quantity and a judicious use of resources is needed to cater to the need of the future customers along with the need of the present customers.
- One may have noticed the save fuel campaign, a demarketing campaign that deviates from the usual approach of sales growth strategy and preaches for conservation of fuel for their use across generation. This is an example of stable growth strategy adopted by the oil industry as a whole under resource constraints and the long run objective of survival over years.
- Incremental growth strategy, profit strategy and pause strategy are other variants of stable growth strategy. Sustainable growth is important to enterprise long-term development. Too fast or too slow growth will go against enterprise growth and development, so financial should play important role in enterprise development, adopt suitable financial policy initiative to make sure enterprise growth speed close to sustainable growth ratio and have sustainable healthy development

14. What makes an organization sustainable?

In order to be sustainable, an organisation must:

- have a clear **strategic direction**;
- be able to scan its environment or context to **identify opportunities for its work**;
- be able to attract, manage and **retain competent staff**;
- have an adequate **administrative and financial infrastructure**;
- be able to demonstrate its effectiveness and impact in order to **leverage further resources**; and
- get community support for, and involvement in its work.

15. **Sustainable growth rate** [Nov 2022 SA]

Mr. X has submitted the following data:

Particulars	Amount in lacs
Total Assets	250
Total Liabilities	220
Net Income	12
Dividend Paid	4.50
Sales	100

Mr. X wants to know to what extent sales can be increased without going for additional borrowings by using Sustainable Growth Rate (SGR) concept?

Answer:

Sustainable growth rate = ROE x Retention Ratio

$$ROE = \frac{\text{Net income}}{\text{Equity}} = \frac{12}{250 - 220} \times 100 = 40.00\%$$

$$\text{Retention Ratio} = \frac{\text{Retained earnings}}{\text{Total earnings}} = \frac{12 - 4.50}{12} \times 100 = 62.50\%$$

$$\text{Sustainable growth rate} = ROE \times \text{Retention Ratio} = 40.00\% \times 62.50\% = 25.00\%$$

- Maximum sales that can be increased without going for additional borrowings is equal to Rs.125 lacs (100 + 25%)

Chapter 2 – Risk Management**1. What are the different types of risks faced by an organization?**

Strategic Risk	❖ Strategic risk is a risk in which a <u>company's strategy becomes less effective and it struggles to achieve its goal.</u> ❖ It could be due to technological changes, a new competitor entering the market, shifts in customer demand, increase in the costs of raw materials, or any number of other large-scale changes
Compliance Risk	❖ <u>Non-compliance with rules and regulations is known as compliance risk</u> and the same can lead to penalties in the form of fine and imprisonment ❖ If the company <u>fails to comply with laws related to a new area or industry or sector</u>, it will pose a <u>serious threat to its survival</u>
Operational Risk	❖ Operational risk (<u>also known as internal risk</u>) relates to failure on the part of the <u>company to cope with day to day operational problems</u>. Operational risk relates to 'people' as well as 'process'.
Financial Risk	❖ Financial Risk is referred as the <u>unexpected changes in financial conditions</u> such as prices, exchange rate, Credit rating, and interest rate etc.

2. What are the various types of financial risk?

Counter Party Risk	❖ This risk occurs <u>due to non-honoring of obligations by the counter party</u> which can be failure to deliver the goods for the payment already made or vice-versa or repayment of borrowings and interest etc. ❖ This risk also covers the <u>credit risk</u> i.e. default by the counter party.
Political Risk	❖ This type of risk is <u>faced by overseas investors</u>, as the adverse action by the government of host country may lead to huge losses. ❖ This can arise due to confiscation or destruction of properties, rationing of remittance to home country, restriction on borrowings, invalidation of patents, price control of products, restriction on conversion of local currency of host country into foreign country
Interest rate risk	❖ This risk occurs <u>due to change in interest rate</u> resulting in change in asset and liabilities ❖ This risk is <u>more important for banking companies</u> as their balance sheet's items are more interest sensitive and their base of earning is spread between borrowing and lending rates.
Currency risk	❖ This risk <u>mainly affects the organization dealing with foreign exchange</u> as their cash flows changes with the movement in the currency exchange rates.
Liquidity risk	❖ This can be defined as <u>inability of organization to meet its liabilities</u> whenever they become due

3. What is financial risk? Also the financial risk can be viewed from different perspective. Explain? [Nov 2020 RTP, Nov 2018 (exam), May 2018 MTP, Nov 2018 MTP, May 2020 MTP, May 2021 MTP]

- ❖ Financial Risk is referred as the unexpected changes in financial conditions such as prices, exchange rate, Credit rating, and interest rate etc. Though political risk is not a financial risk in direct sense but same can be included as any unexpected political change in any foreign country may lead to country risk which may ultimately result in financial loss
- ❖ From stakeholder's point of view: Major stakeholders of a business are equity shareholders and they view financial gearing i.e. ratio of debt in capital structure of company as risk since in event of winding up of a company they will be least prioritized. Even for a lender, existing gearing is also a risk since company having high gearing faces more risk in default of payment of interest and principal repayment.
- ❖ From Company's point of view: From company's point of view if a company borrows excessively or lend to someone who defaults, then it can be forced to go into liquidation.
- ❖ From Government's point of view: From Government's point of view, the financial risk can be viewed as failure of any bank or (like Lehman Brothers) down grading of any financial institution leading to spread of distrust among society at large. Even this risk also includes willful defaulters. This can also be extended to sovereign debt crisis

4. What is value-at-risk (VAR) and explain its features and application? [May 2018 RTP, May 2020 RTP, May 2019 (exam), May 2018 MTP, Nov 2018 MTP]

Meaning	VAR is a measure of risk of investment . VAR answers two basic questions namely (i) What is the worst-case scenario? And (ii) What will be the loss?
Features	❖ Components of calculations: VAR is based on time period, confidence level (95% or 99%) and loss in percentage or amount ❖ Statistical method: It is type of statistical tool based on standard deviation ❖ Time horizon: VAR can be applied for different time horizons say one day, one week, one month and so on. ❖ Probability: Assuming the values are normally attributed, probability of maximum loss can be predicted. ❖ Control Risk: Risk can be controlled by setting limits for maximum loss. ❖ Z score: Z Score indicates how many standard Deviations is away from Mean value of a population. $VAR = Z \text{ score} \times \text{standard deviation}$
Application	❖ to measure the maximum possible loss on any portfolio or a trading position. ❖ as a benchmark for performance measurement of any operation or trading. ❖ to fix limits for individuals dealing in front office of a treasury department. ❖ to enable the management to decide the trading strategies. ❖ as a tool for Asset and Liability Management especially in banks.

5. What are the various hints indicating counter party risk and how to manage the same? [Nov 2019 MTP]

Hints	❖ Failure to obtain necessary resources to complete the project or transaction undertaken. ❖ Any regulatory restrictions from the Government. ❖ Hostile action of foreign government. ❖ Let down by third party. ❖ Have become insolvent
Techniques to manage	❖ Carrying out Due Diligence before dealing with any third party. ❖ Do not over commit to a single entity or group or connected entities. ❖ Know your exposure limits. ❖ Review the limits and procedure for credit approval regularly. ❖ Rapid action in the event of any likelihood of defaults. ❖ Use of performance guarantee, insurance or other instruments

6. How to assess political risk and techniques to manage the same? [OR] Explain how an organization interested in making investment in foreign country can assess Country risk and mitigate the risk? [May 2021 RTP]

Identification of Political risk	❖ This can be identified through actions of the host country Government. Actions such as insistence of local labour, restriction on currency conversion, take-over of assets by Government or price fixation
Ways to assess Country risk	Country risk is main component of political risk and the same can be identified with the following: ❖ By referring political ranking published by different business magazines. ❖ By evaluating country's macro-economic conditions. ❖ By analyzing the popularity of current government and assess their stability. ❖ By taking advises from the embassies of the home country in the host countries.
Techniques to manage	❖ Local sourcing of raw materials and labour. ❖ Entering into joint ventures ❖ Local financing ❖ Prior negotiations

7. How to identify interest rate risk?

Identification of interest rate risk:

- ❖ Monetary Policy of the Government.
- ❖ Any action by Government such as demonetization etc.

- ❖ Economic Growth
- ❖ Release of Industrial Data
- ❖ Investment by foreign investors
- ❖ Stock market changes

8. DESCRIBE the various parameters to identify the currency risk? [Nov 2018 RTP, Nov 2019 RTP, Nov 2019 MTP]

Identification of currency risk:

- ❖ **Government Action:** The Government action of any country has visual impact in its currency.
- ❖ **Nominal Interest Rate:** As per interest rate parity (IRP) the currency exchange rate depends on the nominal interest of that country.
- ❖ **Inflation Rate:** Purchasing power parity theory discussed in later chapters impact the value of currency.
- ❖ **Natural Calamities:** Any natural calamity can have negative impact.
- ❖ **War, Coup, Rebellion etc.:** All these actions can have far reaching impact on currency's exchange rates.
- ❖ **Change of Government:** The change of government and its attitude towards investment also helps to identify the currency risk.

9. Risk exposure (Nov 2020 MTP):

TRC Cables Ltd. (an Indian Company) is in the business of manufacturing Electrical Cables and Data Cables including Fiber Optics cables. While mainly it exports the manufactured cables to other countries it has also established its production facilities at some African countries' due availability of raw material and cheap labour there. Some of the major raw material such as copper, aluminum and other non-ferrous metals are also imported from foreign countries. Hence overall TRC has frequent receipts and expenditure items denominated in Non-INR currencies.

Though TRC make use of Long-Term Debts and Equity to meet its long term fund requirements but to finance its operations it make use of short-term financial instruments such as Commercial Papers, Bank Credit and Term Loans from the banks etc. If any surplus cash is left with TRC it is invested in interest yielding securities. Recently due to stiff competition from its competitors TRC has relaxed its policy for granting credit and to manage receivables it has formed a separate credit division.

Further to hedge itself against the various risk it has entered into various OTC Derivatives Contracts settled outside the Exchange.

Required:

Evaluate the major risks to which TRC Ltd. is exposed to

Answer:

Following are main categories of risks to which TRC Cables is exposed to:

(i) Financial Risks: TRC is exposed to following financial risks:

- **Currency Risk:** Since most of the Receipts and Payments of TRC are denominated in Non-INR currencies it is exposed to Currency Risk.
- **Commodity Risk:** As major constituents of production of TRC are commodities such copper, aluminum etc. it is subject to Commodity Risk.
- **Interest Rate Risk:** As TRC borrows and invest money in short-term instruments it is exposed to Interest Rate Risk.
- **Counter Party Risk:** Due to relaxation of norms for granting credits certainly the receivable amount must have increased resulting in increased in Credit Risk.
- **Liquidity Risk:** Since for short-term funding requirements TRC is using Commercial Papers etc. they are exposed to Liquidity Risk as in time of need if funds are not available from these sources then securities shall be sold at discounted price.
- **Political Risk:** As TRC is operating in various other countries it is also exposed to Political Risks such as Restriction on Conversion of local earnings into foreign currency, restrictions on remittance etc.

(ii) Settlement Risk: The use of OTC Derivatives by TRC also expose it to the settlement risk as the parties with whom it has entered into the contract may not honor the same.

How VAR is calculated?

A VAR statistic has three components:

- ❖ Time period – This can be for a week, month or a year
- ❖ Confidence level – Confidence level can be 95% or 99%. **The multiple for 95 percent is 1.65 and for 99 percent is 2.33**
- ❖ **Loss amount:**
 - Loss for a single day = Daily standard deviation x Multiple for respective confidence level
 - Loss for 20 days = Daily loss x $\sqrt{20}$
 - Loss for 250 days = Daily loss x $\sqrt{250}$

Practical Problems**Author's Note:**

- Please refer problems in this chapter post completion of Portfolio Management. You will need understanding of Standard Deviation concept to solve questions in this chapter

1. Simple problem on VAR [Nov 2019 (exam)]

Consider a portfolio consisting of a Rs. 200,00,000 investment in share XYZ and a Rs. 200,00,000 investment in share ABC. The daily standard deviation of both shares is 1% and that the coefficient of correlation between them is 0.3. You are required to determine the 10-day 99% value at risk for the portfolio?

Answer:

WN 1: Computation of SD of portfolio:

Variance = $(W_{XYZ} \times \sigma_{XYZ})^2 + (W_{ABC} \times \sigma_{ABC})^2 + 2W_{XYZ}W_{ABC}\sigma_{XYZ}\sigma_{ABC}COR_{ABCXYZ}$
Variance = $(0.5 \times 1)^2 + (0.5 \times 1)^2 + 2(0.5)(0.5)(1)(1)(0.3)$
Variance = $0.25 + 0.25 + 0.15 = 0.65\%$
Standard Deviation = $\sqrt{0.65} = 0.8062\%$

WN 2: Computation of Value at Risk:

Daily standard deviation (in Rs.) = $0.8062\% \times 400 \text{ lacs} = 3.2248 \text{ lacs}$
VAR for single day = Daily SD in rupees x Multiple for 99% VAR
VAR for single day = $3.2248 \times 2.33 = 7.5138 \text{ lacs}$
VAR for ten days = Loss for single day x $\sqrt{10}$
VAR for ten days = $7.5138 \times \sqrt{10} = \text{Rs. } 23.7607 \text{ lacs}$

2. Determination of maximum loss [May 2018]

Suppose you hold Rs.2 Crores shares of X Limited whose market price standard deviation is 2% per day. Assuming 252 trading days a year, determine maximum loss over the period of 1 trading day and 10 trading days with 99% confidence level.

Answer:

Daily std deviation in %	2%
Daily std deviation in Rs	$200 \text{ Lakhs} \times 2\% = 4 \text{ Lakhs}$
Daily loss at 99% (VAR)	$4 \text{ Lakhs} \times 2.33 = 9.32 \text{ Lakhs}$
Maximum loss for 10 days	$\text{Daily loss} \times \sqrt{10} = 9.32 \times \sqrt{10} = 29.47 \text{ Lakhs}$

3. Determination of portfolio risk:

ABC Limited is holding the portfolio of XYZ shares that is worth Rs.18,480. The volatility of the returns on the share is 21% per annum. How could you measure the risk of the portfolio over the next one month?

Answer:

Annual SD in %	21%
Annual SD in Rs	$18,480 \times 21\% = \text{Rs. } 3,880.80$
VAR at 95% confidence level for a year	$\text{Rs. } 3,880.80 \times 1.65 = \text{Rs. } 6,403$
VAR at 99% confidence level for a year	$\text{Rs. } 3,880.80 \times 2.33 = \text{Rs. } 9,042$
VAR at 95% confidence level for a month	VAR for year = $\frac{6,403}{\sqrt{12}} = \frac{6,403}{3.464} = \text{Rs. } 1,848$
VAR at 99% confidence level for a month	VAR for year = $\frac{9,042}{\sqrt{12}} = \frac{9,042}{3.464} = \text{Rs. } 2,610$

4. Computation of maximum possible investment [Nov 2020 Exam]

On Tuesday morning (before opening of the capital market) an investor, while going through his bank statement, has observed that an amount of Rs. 7 lakhs is lying in his bank account. This amount is available for use from Tuesday till Friday. The Bank requires a minimum balance of Rs. 1000 all the time. The investor desires to make a maximum possible investment where Value at Risk (VaR) should not exceed the balance lying in his bank account. The standard deviation of market price of the security is 1.5 per cent per day. The required confidence level is 99 per cent.

Answer:

- The bank account has balance of Rs.7,00,000. We are required to maintain a minimum balance of Rs.1,000
- Acceptable VAR (Loss) = Rs.7,00,000 – 1,000 = Rs.6,99,000

Let us assume investment to be A

Daily std deviation in %	1.5%
Daily std deviation in Rs	(A) × 1.5% = 0.015A
Multiple for 99% confidence interval	2.33
Daily loss at 99% (VAR)	0.015A × 2.33 = 0.03495A
Maximum loss for 4 days [Tuesday to Friday]	0.03495A × $\sqrt{4}$ = 6,99,000 0.0699A = 6,99,000
Maximum investment	$\frac{6,99,000}{0.0699} = \text{Rs. } 1,00,00,000$

5. Computation of probability [May 2021 MTP]

ABC Ltd. is considering a project X, which is normally distributed and has mean return of Rs. 2 crore with Standard Deviation of Rs. 1.60 crore. In case ABC Ltd. loses on any project more than Rs. 1.00 crore there will be financial difficulties. Determine the probability the company will be in financial difficulty.

Given: Standard Normal Distribution Table (Z-Score) providing area between Mean and Z score

Z Score	Area
1.85	0.4678
1.86	0.4686
1.87	0.4693
1.88	0.4699
1.89	0.4706

Answer:

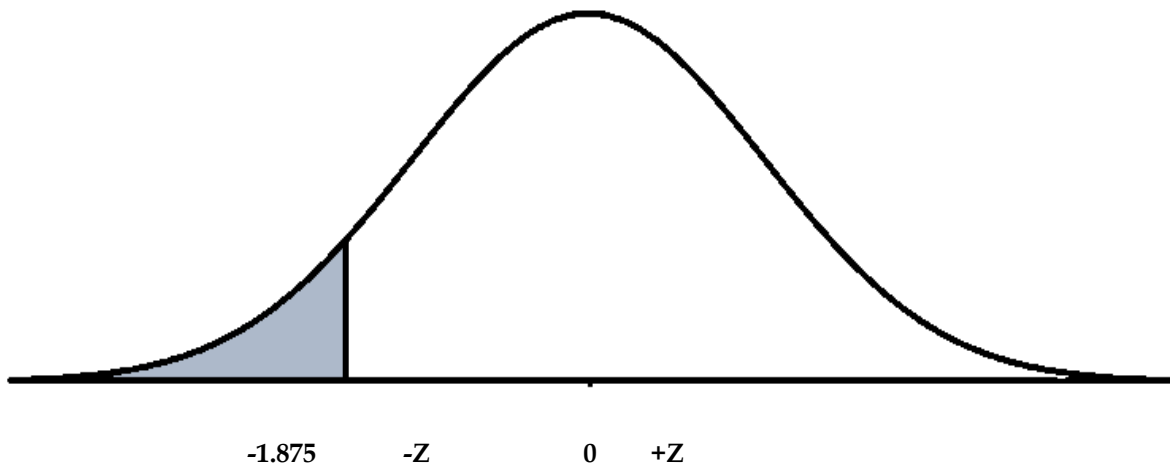
- The company will get into financial difficulty if the loss is more than 1 crores. Hence target return is -1 Crores

$$Z = \frac{\text{Target return} - \text{Average return}}{\text{SD of return}}$$

$$Z = \frac{-1 - 2}{1.60} = -1.875$$

We need to find probability for Z value of -1.875.

Z-value	Probability
1.87	0.4693
1.88	0.4699
1.875 (Average)	0.4696



- ❖ Z of -1.875 corresponds to probability of 0.4696 or 46.96%. Computed Z values are to the left-side of the area and we are required to find the area to the left of binominal curve. This is because we are required to find out the probability of profits less than -1 crores [Basically losses being higher than 1 crore]
- ❖ **Probability of financial difficulty = 50% - 46.96% = 3.04%**

Note:

- ICAI solution to this question is wrong.
- You will need basic understanding of Z-values and normal distribution to solve this question. You will understand about Z-values in Black-Scholes model of Derivatives Analysis and valuation chapter

Chapter 3 – Advanced Capital Budgeting Decisions**1. What is the impact of inflation on capital budgeting decision?**

- Adjustment for inflation is a necessity for capital investment appraisal. **This is because inflation will raise the revenues & costs of the project.** The net revenues after adjustment for inflation shall be equal to net revenues in current terms
- Depreciation charges are based on historical costs. Tax benefits accruing from depreciation charges do not keep parity with inflation
- Costs of capital considered for investment appraisals contain a premium for anticipated inflation. Due to inflation investors require the nominal rate of return to be equal to **Required Rate of Return in real terms plus Rate of Inflation.**

2. Explain about the impact of change in technology on capital budgeting decision?

- Capital budgeting decisions often focus on monetary terms, **neglecting critical factors like technology.**
- Analyzing the impact of technology change on capital budgeting is crucial for understanding future cash flows and **determining the need for replacement machinery with improved technology.**

Impact of change in technology:

- Change in technology can significantly **alter production process**
- Changes can also yield benefits such as **improved quality, delivery time greater flexibility, etc.**
- Changed technology can also result in **reduction in cost of capital**
- **Improved cash inflows** can be achieved through technological changes
- There may be need to incur additional cost in the form of **additional capital expenditure**
- The sale volume can be impacted as the **anticipated life cycle of the product can be shortened** because of change in consumer preference

Incorporation of risk in capital budgeting decisions:

- Capital Budgeting decisions can incorporate technology change impact **using techniques like sensitivity analysis, scenario analysis, and simulation analysis.**
- After launching a project, analyze its positive or negative impact and revise monetary estimates.
- If continuation is unviable, consider **abandonment options** and adjust discounting rates accordingly.

3. Write short note on impact of change in Government policies on Capital Budgeting Decisions?

- Government policies significantly impact capital budgeting decisions, as they affect future cash flows for firms. **These policies can affect suppliers, buyers, customers, and service providers.** Analyzing and revising estimates is crucial, and firms should consider abandoning projects if necessary.
- Government policy changes impact domestic and international capital budgeting decisions.
- Government policies change over time, with some lasting five to ten years, while others change quarterly to a year. The impact of each policy varies.
- Some policies which are frequently announced/reviewed within a year are **Fiscal policy and Monetary Policy.** Fiscal policy involves government spending, taxation, and borrowing to influence economic activity and growth. Monetary policy regulates money and credit availability to promote economic growth, price stability, and balance of payments equilibrium

4. Explain about the impact of change in Government policies on Domestic Capital Budgeting Decision?

- **Revision in interest rates:** Government-determined interest rate changes can impact the cost of capital, as the cost of debt is dependent on bank interest rates. While not significantly affecting capital budgeting, **they can significantly impact working capital decisions due to the impact on bank overdrafts and cash flow estimation.** Small changes in interest rates can be ignored, but major changes, like 100 basis points, can impact cash flows and require revision of estimates.
- **Fiscal policy:** Additionally, changes in fiscal policy, tax rates, and annual cash flows may also require revision of estimated cash flows

5. How does a change in government policies impact international capital budgeting decisions?

- **Monetary policy:** Foreign exchange rate plays a crucial role in International Capital Budgeting decisions. Changes in bank rates and money supply, may require revision of estimates.
- **Fiscal policy:** Change in Tax Rates relating to Foreign Income or changes in provisions of Double Tax Avoiding Agreement (DTAA) as decided in Fiscal Policy may call revision of estimates
- Forecasting policy changes and incorporating proper provisions in expected cash flows are essential.

6. What is risk and uncertainty?

Risk: Risk is a situation where: ❖ Several outcomes are possible ❖ Within this, any one outcome can occur ❖ Each outcome has a known probability ❖ Such probabilities are assessed with respect to past information	Uncertainty: Uncertainty is a situation where ❖ The range of outcomes is unknown ❖ The probability of outcomes is not known

Note: RISK CAN BE MEASURED WHEREAS UNCERTAINTY CANNOT BE MEASURED

7. Why risk is required to be adjusted in capital budgeting decisions?

- ❖ There is an **opportunity cost involved while investing in a project for the level of risk**. Adjustment of risk is necessary to help make the decision as to whether the returns out of the project are proportionate with the risks borne and whether it is worth investing in the project over the other investment options available
- ❖ Risk adjustment is required to know **the real value of the Cash Inflows**

8. What are the various sources of risk?

Internal Factors	
Project specific risk	Risks which are related to a particular project and affects the project's cash flows , it includes completion of the project in scheduled time, error of estimation in resources and allocation, estimation of cash flows etc.
Company specific risk	Risk which arise due to company specific factors like downgrading of credit rating, changes in key managerial persons, cases for violation of Intellectual Property Rights (IPR) and other laws and regulations, dispute with workers etc
External Factors	
Industry specific risk	These are the risks which effects the whole industry in which the company operates . The risks include regulatory restrictions on industry, changes in technologies etc
Market risk	The risk which arise due to market related conditions like entry of substitute, changes in demand conditions, availability and access to resources etc.
Competition risk	These are risks related with competition in the market in which a company operates. These risks are risk of entry of rival, product dynamism and change in taste and preference of consumers etc
Risk due to economic conditions	These are the risks which are related with macro-economic conditions like changes in monetary policies by central banks, changes in fiscal policies like introduction of new taxes and cess, inflation etc.
International risk	These are risk which are related with conditions which are caused by global economic conditions

9. Mention the various tools available for incorporating risk in capital budgeting?

Statistical Techniques	Conventional Techniques	Other Techniques
• Probability • Variance or SD • Coefficient of variation	• Risk-adjusted Discount Rate • Certainty equivalent	• Sensitivity Analysis • Scenario Analysis • Simulation Analysis • Decision Tree

10. How are projects evaluated using risk-adjusted discount rate approach? [Nov 2020]

- ❖ The project with a higher risk will be discounted at a higher rate (RADR). Select the project with higher risk adjusted NPV
- ❖ $RADR = \text{Risk free rate} + \text{Risk Premium}$

Advantages:

- ❖ Easy to understand
- ❖ Incorporates risk premium in the discounting factor

Limitations:

- ❖ Difficulty in finding risk premium and risk-adjusted discount rate
- ❖ Though NPV can be calculated but it is not possible to calculate Standard Deviation of a given project

11. Explain certainty equivalents, one of the techniques of risk analysis? [Nov 2020 MTP, Nov 2018]

- ❖ As per CIMA terminology, **"An approach to dealing with risk in a capital budgeting context"**. It involves expressing risky future cash flows in terms of the certain cashflow which would be considered, by the decision maker, as their equivalent, **that is the decision maker would be indifferent between the risky amount and the (lower) riskless amount considered to be its equivalent."**
- ❖ The certainty equivalent is a **guaranteed return that the management would accept rather than accepting a higher but uncertain return**. This approach allows the decision maker to incorporate his or her utility function into the analysis. In this approach a set of risk less cash flow is generated in place of the original cash flows.

Advantages:

- The certainty equivalent method is simple and easy to understand and apply.
- It can easily be calculated for **different risk levels applicable to different cash flows**. For example, if in a particular year, a higher risk is associated with the cash flow, it can be easily adjusted and the NPV can be recalculated accordingly.

Disadvantages:

- There is no objective or mathematical method to estimate certainty equivalents. Certainty Equivalents are subjective and vary as per each individual's estimate
- Certainty equivalents are decided by the management based on their perception of risk. However, the risk perception of the shareholders who are the money lenders for the project is ignored. Hence, it is not used often in corporate decision making

12. What are the key differences between the Certainty Equivalent approach and the RADR (Risk-Adjusted Discount Rate) method?"

- Certainty Equivalent Method **is superior to Risk Adjusted Discount Rate Method as it does not assume that risk increases with time at constant rate**. Each year's Certainty Equivalent Coefficient is based on level of risk impacting its cash flow.
- Despite its soundness, it is not preferable like Risk Adjusted Discount Rate Method. **It is difficult to specify a series of Certainty Equivalent Coefficients but simple to adjust discount rates**

13. Explain the concept of sensitivity analysis? [May 2019, May 2022 MTP, Nov 2021 MTP]

- Sensitivity analysis is a risk assessment procedure used in Capital Budgeting to study the impact of changes in variables on project outcomes. It considers the importance of variables identified as of special significance.
- Sensitivity analysis studies the impact of a single variable on the project's NPV (or IRR), determining the more sensitive the variable is to the project's outcome.

Advantages:

- Identifies critical issues that impact project success/failure
- Simple technique

Disadvantages:

- This analysis assumes that all variables are independent i.e. they are not related to each other, which is unlikely in real life.
- This analysis does not look to the probability of changes in the variables.

14. What is scenario analysis and how does it help in decision-making and risk assessment?**Scenario Analysis:**

- ❖ Sensitivity analysis is probably the most widely used risk analysis technique, it does have limitations. Therefore, we need to extend sensitivity analysis to deal with the probability distributions of the inputs.
- ❖ In addition, it would be useful to vary more than one variable at a time so we could see the combined effects of changes in the variables. Scenario analysis provides answer to these situations of extensions.
- ❖ This analysis brings in the probabilities of changes in key variables and also allows us to change more than one variable at a time.
- ❖ This analysis begins with base case or most likely set of values for the input variables. Then, go for worst case scenario (low unit sales, low sale price, high variable cost and so on) and best case scenario. So, in a nutshell Scenario analysis examine the risk of investment, so as to analyse the impact of alternative combinations of variables, on the project's NPV (or IRR).

15. What are the main differences between Scenario Analysis and Sensitivity Analysis?

- Sensitivity analysis calculates the NPV or IRR of a single input variable, while scenario analysis considers a scenario where all input variables change simultaneously
- Scenario analysis is more complex than sensitivity analysis, as all inputs are changed simultaneously, while sensitivity analysis only changes one input.

16. Write short note on Monte Carlo Simulation?

- Simulation analysis is a technique that **involves infinite calculations** to obtain possible outcomes and probabilities for an action.
- Monte Carlo simulation, based on casino gambling mathematics, provides decision-makers with a probability distribution of expected net present values (NPVs) rather than single-point estimates.
- It involves **modeling investment projects, cash flows, and key factors affecting cash receipt** and payments, and specifies a range for probability distributions for each model's assumptions.

Advantages:

- Simulation analysis offers advantages in predicting market situations, handling complex inter-relationships, and requiring decision-makers to explicitly consider uncertainties in projects.

Limitations:

- Simulation has several limitations, including difficulty modeling projects and specifying exogenous variables' probability distributions.
- Simulation is imprecise, providing rough approximations of NPV probability distributions.
- Realistic simulation models are likely constructed by management experts, making them difficult for decision-makers with limited understanding.
- Determine NPV in simulation run, risk free discount rate is used. **It is done to avoid prejudging risk**, which is reflected in the dispersion of the distribution of N.P.V. This derived measure of NPV takes a different meaning from its original value, and, therefore, is difficult to interpret

17. Could you provide a brief overview of decision tree analysis and its applications in decision-making processes?

- The Decision Tree technique is a technique used to **handle sequential investment decisions** that may impact future decisions and events.
- It involves a graphic display of the relationship between a present decision and future events.
- **Finance managers face two types of situations: Decision, where they have control over the outcome, and Event, where they have no control.**
- The probability distribution is assigned to the outcomes, and the manager should act rationally in these situations.

Theory to solve problems**Special items impacting cash flows:**

Depreciation	Depreciation is a non-cash item and does not affect the cash flow. <u>However, we must consider tax shield or benefit from depreciation in our analysis.</u> Since this benefit reduces cash outflow for taxes it is considered as cash inflow
Opportunity cost	Opportunity cost can occur both at the time of initial outlay or during the tenure of the project. For example, if a company owns a piece of land acquired 10 years ago for Rs.1 crore at that time, today it can be sold for Rs.10 crore. If company uses this piece of land for a project then its sale value i.e. 10 crore forms the part of initial outlay. <u>The cost of acquisition 10 years ago shall be irrelevant for decision making.</u>
Sunk cost	Sunk cost is <u>an outlay that has already incurred</u> and hence should be excluded from capital budgeting analysis.
Working capital	<u>Initial working capital requirement should be treated as cash outflow and at the end of the project its release should be treated as cash inflow.</u> Further there may be also a possibility that <u>additional working capital may be required during the life of the project.</u> In such cases the additional working capital required is treated as cash outflow at that period of time. Similarly, any reduction in working capital shall be treated as cash inflow
Allocated / General / corporate overheads	Allocated overheads are charged on the basis of some rational basis such as machine hour, labour hour, direct material consumption etc. <u>Since, expenditures already incurred are allocated to new proposal; they should not be considered as cash flows.</u> However, it is expected that <u>overhead cost shall be increased due to acceptance of any proposal then incremental overhead cost shall be treated as cash outflow</u>
Additional capital investment	Capital investment can also be required during the continuance of the project. In such cases it shall be treated as <u>cash outflows</u>
Financing costs	When cash flows relating to long-term funds are being defined, <u>financing costs of long-term funds (interest on long-term debt and equity dividend) should be excluded from the analysis.</u> The question arises why? <u>The weighted average cost of capital used for evaluating by discounting the cash flows takes into account the cost of long-term funds.</u> Putting it differently, the interest and dividend payments are reflected in the weighted average cost of capital. <u>Hence, if interest on long-term debt and dividend on equity capital are deducted in defining the cash flows, the cost of long-term funds will be counted twice</u>
Post-tax cash flows	Tax payments like other payments must be properly deducted in deriving the cash flows. That is, cash flows must be defined in post-tax terms
Incremental cash flows	It is the <u>incremental cash flow</u> and not total cash flow after tax

Steps for computation of cash flows:**Step 1: Initial Outflow**

Particulars	Amount
Capital expenditure	(XXX)
Working capital	(XXX)
Total outflow	(XXX)

Step 2: In-between cash flows:

Particulars	Amount
Revenues	XXX
Less: All costs other than depreciation	(XXX)
Profit before depreciation and tax (PBDT)	XXX
Less: Depreciation	(XXX)
Profit before Tax (PBT)	XXX
Less: Tax	(XXX)
Profit after Tax (PAT)	XXX
Add: Depreciation	XXX
Cash flow after tax (CFAT)	XXX
Add/Less: Increase/decrease in Working capital	XXX

Less: Purchase of additional machinery / payment for original machine	(XXX)
Revised CFAT	XXX

Step 3: Terminal flow:

Particulars	Amount
Net salvage value of capital expenditure (Note 1)	XXX
Recapture of working capital	XXX
Total terminal flow	XXX

Note 1: Calculation of Net Salvage Value:

Particulars	Amount
Sale value	XXX
Less: Book value	(XXX)
Capital gain/loss	XXX
Tax Paid/saved	XXX
Net salvage value (Sale value + Tax saved - Tax Paid)	XXX

Step 4: Consolidate the cash flows in the below format and calculate appropriate technique (assuming life of 5 years):

Year	Cash flow
0	Step 1
1	Step 2
2	Step 2
3	Step 2
4	Step 2
5	Step 2 + Step 3

Computation of payback:

Meaning	Payback refer to the time period in which initial investment in the project will be recovered			
Formula	$\text{Base Year} + \frac{\text{Unrecovered cash flow of Base Year}}{\text{Cash flow of next year}}$ Note: Base year refer to the last year in which cumulative cash flow is negative			
Format		Year	Cash flow	Cumulative cash flow
		0	Outflow	
		1	Inflow	
		2	Inflow	
		3	Inflow	

Computation of Accounting rate of return:

Meaning	The accounting rate of return of an investment measures the average annual net income of the project (incremental income) as a percentage of the investment.				
Formula	$\text{ARR} = \frac{\text{Average PAT}}{\text{Initial or Average Investment}} \times 100$ Initial investment = Initial outflow Average investment = Average of initial outflow and salvage value				
Format		Year	Cash flow	Depreciation	PAT
		1			
		2			
		3			

Computation of discounted payback:

Meaning	Discounted payback refer to the time period in which initial investment in the project will be recovered considering time value of money	
Formula	$\text{Base year} + \frac{\text{Unrecovered discounted cash flow of base year}}{\text{Discounted cash flow of next year}}$	

Note: Base year refer to the last year in which cumulative cash flow is negative						
Format		Year	Cash flow	PVF	DCF	Cumulative DCF
		0	Outflow			
		1	Inflow			
		2	Inflow			
		3	Inflow			

Computation of Net Present Value:

Meaning	NPV refer to the difference between the PV of cash inflows and PV of cash outflows					
Formula	PV of cash inflows - PV of cash outflows					
Format		Year	Cash flow	PVF	Discounted Cash Flow	
		0				
		1				
		2				
		3				

Computation of profitability index:

Meaning	This measure the ratio of benefits (PV of cash inflows) to costs (PV of cash outflows)					
Formula	$\frac{\text{PV of cash inflows}}{\text{PV of cash outflows}}$					
Format		Year	Cash flow	PVF	Discounted Cash Flow	
		0				
		1				
		2				
		3				

Computation of Internal Rate of Return:

Meaning	Internal rate of return for an investment proposal is the discount rate that equates the present value of the expected net cash flows with the initial cash outflow.					
Steps	❖ Step 1: Compute NPV at initial guess rate ❖ Step 2: If NPV under step 1 is positive NPV, then compute NPV at higher discount rate. If NPV under step 1 is negative, then compute NPV at lower discount rate ❖ Step 3: Repeat step 2 till we get one positive and one negative NPV					
Formula	$L_1 + \frac{\text{NPV at } L_1}{\text{NPV at } L_1 - \text{NPV at } L_2} \times (L_2 - L_1)$ Where: L1 = Lower rate with + NPV L2 = Higher rate with - NPV					
Format		Year	Cash flow	PVF	Discounted Cash Flow	
		0				
		1				
		2				
		3				

Equated Annual Benefit (EAB) and Equated Annual Cost (EAC):

$$\text{EAB} = \frac{\text{NPV}}{\text{PVAF}(r, \text{life})}$$

$$\text{EAC} = \frac{\text{PV of Outflow}}{\text{PVAF}(r, \text{life})}$$

How to decide on abandonment of an asset?

Step 1: Initial outflow	
Particulars	Amount
NSV of existing asset at year 0	(XXX)
Working capital	(XXX)
Total outflow	(XXX)

Step 2: In-between flows – No change**Step3: Terminal flow:**

Particulars	Amount
NSV of existing asset at the end of life	XXX
Recapture of working capital	XXX
Total terminal flow	XXX

Step 4: Consolidation of cash flows and calculation of NPV – No change

Conclusion: If the NPV of the project is positive then we should continue with the asset. However if the same is negative then we have to abandon the asset

How to decide on replacement?**Method 1 : Total Approach:**

- ❖ Step 1: Compute NPV of continuation option
- ❖ Step 2: Compute NPV of purchase option
- ❖ Step 3: Decide by comparing step 1 & step 2
 - If step 1 is greater than we should continue with existing asset
 - If step 2 is greater than we should replace the asset

Method 2: Incremental approach:

- ❖ Step 1: Compute incremental initial outflow
- ❖ Step 2: Compute incremental in between cash flows
- ❖ Step 3: Compute incremental terminal flow
- ❖ Step 4: If the NPV is positive then we should go ahead with replacement.

Inflation:

- ❖ Inflation means “rise in prices”
- ❖ If cash flow includes inflation, they are said to be in money terms and if it excludes inflation they are said to be in real terms
- ❖ If discount rate include inflation it is said to be in money term and if it excludes inflation then it is said to be in real terms

Particulars	Cash flow	Discount rate
Money	Include inflation	Include inflation
Real	Exclude inflation	Exclude inflation

- ❖ Real terms do not mean that they are Present value
- ❖ We can move from money cash flow to real cash flow by discounting it at inflation rate
- ❖ We can move from real cash flow to present value by discounting it at real discount rate
- ❖ We can move from money cash flow to present value by discounting it at money discount rate
- ❖ Real cash flow and present value are not same because RCF eliminates only inflation and not risk while present value exclude both inflation and risk
- ❖ **$(1 + \text{Money Discount Rate}) = (1 + \text{Real Discount Rate}) \times (1 + \text{Inflation rate})$**

Expected Value:

Expected value is the weighted average value with probability of occurrence being the assigned weight

- ❖ Expected value is a measure of return

$$\text{Expected Value} = \sum P * R$$

P = Probability of occurrence; R = Return

- ❖ Other things remaining same, the alternative with higher expected value is to be selected

Expected NPV:

- Expected NPV is the weighted average of various possible NPV with probability being the assigned weight
- Alternatively, NPV computed on the basis of expected cash flows (weighted average) is also expected NPV

Standard Deviation:

- ❖ Standard deviation is the deviation from the mean
- ❖ It is a measure of risk

$$SD = \sqrt{pd^2}$$

$$d = X - (\text{Average of } X)$$

- ❖ Other things remaining same the alternative with lower standard deviation should be selected

Standard Deviation for dependent and independent cash flows:

- ❖ Hillier looked at alternative ways of computing return & risk
- ❖ **Return:** If the risky rate is used for discounting, then it automatically incorporates risk and gives the risk adjusted NPV. But since risk is computed separately, the NPV is arrived at by discounting the same at risk-free rate.

Types of cash flow:

- ❖ **Dependent cash flow:** Cash flow of succeeding periods are perfectly correlated to earlier periods
- ❖ **Independent cash flow:** Cash flow of succeeding periods are not dependent on earlier years

Steps for computation of risk:

Independent cash flow	Dependent cash flow
1. Compute SD of each year	1. Compute SD of each year
2. Discount the SD and get the discounted SD	2. Discount the SD and get the discounted SD
3. Square and sum up the values of step 2	3. Sum the value of step 2
4. Extract the square root of step 3 value and arrive at standard deviation	4. The value in step 3 is the standard deviation

Co-efficient of variation:

- ❖ Co-efficient of variation measures risk per unit of return

$$CV = \frac{\text{Expected Value}}{\text{Standard Deviation}}$$

- ❖ The project with lower CV should be selected

RADR:

- Risky projects will have a higher discount rate and vice versa
- Discount rate = Risk-free rate + Risk premium

Certainty equivalent approach:

- ❖ Certainty equivalent factor (CEF) is ratio of certain cash flows to uncertain cash flows
- ❖ Less the certainty, lower the value of CEF. Hence risk is considered to be more when CEF is less
- ❖ We should select a project with higher NPV

Steps:

- ❖ Convert uncertain cash flows into certain cash flows
 - $CCF = UCF \times CEF$
- ❖ The appropriate discount rate is risk-free rate of return
- ❖ Compute NPV

Sensitivity Analysis:

- ❖ It measures the percentage change in input parameters that would lead to a reversal in investment decision

$$\text{Sensitivity \%} = \frac{\text{Change}}{\text{Base}} \times 100$$

- ❖ The input parameters and the direction of change leading to sensitivity are as under

Parameter	Direction
Size	↑
Cash Flows	↓
Discount Rate	↑
Life	↓

- ❖ A project is more sensitive to that input parameter whose sensitivity percent is least. This is because a small change would lead to a reversal of investment decision

Sensitivity Analysis - Uneven cash flows:

- ❖ Compute PV of uneven cash flows
- ❖ The above value has to change by the amount of NPV for the project to become unviable

$$\text{Sensitivity \%} = \frac{\text{NPV}}{\text{PV of Uneven Cash flows}} \times 100$$

Simulation:

- Simulation involves creating a model of project in respect of which various outcomes are possible
- In doing a simulation exercise we must identify the parameters and variables
- Parameters are those which do not change during a project period
- Variables are those which change during a project period
- Parameters do not have probability whereas variables have probability

Steps:

- **Step 1:** Identify parameters and variables
- **Step 2a:** For each variable, arrange the values in ascending order and calculate cumulative probability at the end of each value
- **Step 2b:** Construct random number class interval for each variable
- **Step 3:** Based on random number and class interval, select the values of various variables
- **Step 4:** Compute NPV of each set. The appropriate discount rate to be used is risk-free rate
- **Step 5:** The simple average of the computed NPV is the final NPV.

Decision Tree:

- A decision tree is a diagrammatic representation of the various alternative courses of action leading to an investment decision

Rules:

- **Rule 1:** A decision tree begins with a decision point. A decision point is represented by a rectangle
- **Rule 2:** An outcome point (also known as chance node) is denoted by a circle
- **Rule 3:** A decision tree is drawn from left to right whereas the evaluation is done from right to left
- **Rule 4:** The value of a chance node is the sum of expected values of the various branches emanating from the chance node
- **Rule 5:** The value of a decision node is the highest amongst the values of the various branches which arise from the decision node

Adjusted Present Value:

- The Adjusted Present Value (APV) Method is an alternative approach to evaluating capital projects, separating investment and financing decisions.
- **Adjusted Present value = Base case NPV + PV of financing benefits – Issue costs**
- Base Case is calculating using the Unlevered Cost of Equity

Practical Problems**Part 1 - Basics of Capital Budgeting****1. Techniques of capital budgeting:**

Lockwood Limited wants to replace its old machine with a new automatic machine. Two models A and B are available at the same cost of Rs.5 lakhs each. Salvage value of the old machine is Rs.1 lakh. The utilities of the existing machine can be used if the company purchases A. Additional cost of utilities to be purchased in that case are Rs.1 lakh. If the company purchases B then all the existing utilities will have to be replaced with new utilities costing Rs.2 lakhs. The salvage value of the old utilities will be Rs.0.20 lakhs. The cash flows are expected to be:

Year	Project A	Project B	PVF @ 15%
1	1,00,000	2,00,000	0.87
2	1,50,000	2,10,000	0.76
3	1,80,000	1,80,000	0.66
4	2,00,000	1,70,000	0.57
5	1,70,000	40,000	0.50
Salvage value at end of year 5	50,000	60,000	

The targeted return on capital is 15%. You are required to

- (i) Compute, for the two machines separately, net present value, payback, Accounting Rate of Return, discounted payback period and desirability factor and (ii) Advice which of the machines is to be selected?

Answer:**WN 1: Analysis of Project A:**

Year	CF	CCF	PVF @ 15%	DCF	CDCF

0	-5,00,000	-5,00,000	1.00	-5,00,000	-5,00,000
1	1,00,000	-4,00,000	0.87	87,000	-4,13,000
2	1,50,000	-2,50,000	0.76	1,14,000	-2,99,000
3	1,80,000	-70,000	0.66	1,18,800	-1,80,200
4	2,00,000	1,30,000	0.57	1,14,000	-66,200
5	2,20,000	3,50,000	0.50	1,10,000	43,800

Note:

- Initial outflow = Purchase price of Rs.5,00,000 – Inflow of Rs.1,00,000 (sale value of old machine) + Purchase of utilities of Rs.1,00,000 = Rs.5,00,000
- Year 5 inflow = Rs.1,70,000 + Rs.50,000 (salvage value) = Rs.2,20,000
- Total Profits of the project = Inflows – Outflows = 8,50,000 – 5,00,000 = Rs.3,50,000
- Average profit per year = Rs.70,000

Particulars	Calculation	Answer
Payback	Base year + $\frac{\text{Unrecovered cash flow of Base year}}{\text{Cash flow of next year}}$ $= 3 + \frac{70,000}{2,00,000} = 3 + 0.35$	3.35 years (or) 3 years and 4.2 months
Discounted Payback	Base year + $\frac{\text{Unrecovered discounted cash flow of Base year}}{\text{Discounted flow of next year}}$ $= 4 + \frac{66,200}{1,10,000} = 4 + 0.60$	4.60 years (or) 4 years and 7 months
ARR on initial investment	$\frac{\text{Average Profit After Tax}}{\text{Initial Investment}} \times 100 = \frac{70,000}{5,00,000} \times 100$	14.00%
ARR on average investment	$\frac{\text{Average Profit After Tax}}{\text{Average Investment}} \times 100 = \frac{70,000}{\left(\frac{5,00,000 + 50,000}{2}\right)} \times 100$	25.45%
NPV	= PV of inflows – PV of outflow $= 5,43,800 - 5,00,000$	43,800
Desirability factor (in %)	$\frac{\text{PV of inflows}}{\text{PV of outflows}} \times 100 = \frac{5,43,800}{5,00,000} \times 100$	108.76%
Desirability factor (in Times)	$\frac{\text{PV of inflows}}{\text{PV of outflows}} = \frac{5,43,800}{5,00,000}$	1.09 Times

WN 2: Analysis of Project B:

Year	CF	CCF	PVF @ 15%	DCF	CDCF
0	-5,80,000	-5,80,000	1.00	-5,80,000	-5,80,000
1	2,00,000	-3,80,000	0.87	1,74,000	-4,06,000
2	2,10,000	-1,70,000	0.76	1,59,600	-2,46,400
3	1,80,000	10,000	0.66	1,18,800	-1,27,600
4	1,70,000	1,80,000	0.57	96,900	-30,700
5	1,00,000	2,80,000	0.50	50,000	19,300

Note:

- Initial outflow = Purchase price of Rs.5,00,000 – Inflow of Rs.1,00,000 (sale value of old machine) + Purchase of utilities of Rs.2,00,000 – inflow of Rs.20,000 (sale value of utilities) = Rs.5,80,000
- Year 5 inflow = Rs.40,000 + Rs.60,000 (salvage value) = Rs.1,00,000
- Total Profits of the project = Inflows – Outflows = 8,60,000 – 5,80,000 = Rs.2,80,000
- Average profit per year = Rs.56,000

Particulars	Calculation	Answer
Payback	Base year + $\frac{\text{Unrecovered cash flow of Base year}}{\text{Cash flow of next year}}$	2.94 years (or) 2 years and 11.33 months

	$= 2 + \frac{1,70,000}{1,80,000} = 2 + 0.94$	
Discounted Payback	Base year + $\frac{\text{Unrecovered discounted cash flow of Base year}}{\text{Discounted flow of next year}}$ $= 4 + \frac{30,700}{50,000} = 4 + 0.61$	4.61 years (or) 4 years and 7 months
ARR on initial investment	$\frac{\text{Average Profit After Tax}}{\text{Initial Investment}} \times 100 = \frac{56,000}{5,80,000} \times 100$	9.66%
ARR on average investment	$\frac{\text{Average Profit After Tax}}{\text{Average Investment}} \times 100 = \frac{56,000}{\left(\frac{5,80,000 + 60,000}{2}\right)} \times 100$	17.50%
NPV	$= \text{PV of inflows} - \text{PV of outflow}$ $= 5,99,300 - 5,80,000$	19,300
Desirability factor (in %)	$\frac{\text{PV of inflows}}{\text{PV of outflows}} \times 100 = \frac{5,99,300}{5,80,000} \times 100$	103.33%
Desirability factor (in Times)	$\frac{\text{PV of inflows}}{\text{PV of outflows}} = \frac{5,99,300}{5,80,000}$	1.03 Times

Conclusion:

We should go ahead with Project A as it has better NPV and profitability index. Discounted payback for both projects is almost similar.

2. Calculation of IRR

- Find the IRR of a project with a cash outflow of Rs.20,000 in year 0 and a cash inflow two years later of Rs.25,992
- Find the IRR of a project with a cash outflow in year 0 of Rs.50,000 and which produces cash inflows in perpetuity of Rs.8,750
- Find the IRR of a project with a cash outlay of Rs.50,000 and a four year annuity inflow of Rs.15,500
- Find the IRR of the project whose cash flow is as under

Year	0	1	2	3
Cash flow	(1000)	450	425	400

Answer:**Question No.2a****Basic Information:**

Present value (outflow)	20,000
IRR (rate of interest)	?
n (time period)	2 years
Future value (Amount)	25,992

$$\text{Amount} = P \times (1 + r)^n$$

$$25,992 = 20,000 \times (1 + r)^2$$

$$(1 + r)^2 = \frac{25,992}{20,000} = 1.2996$$

$$(1 + r) = 1.14; r = 14\%$$

Hence IRR of the cash flow is 14%.

Question No.2b:**Basic information:**

Type of cash flow	Perpetuity
Perpetuity Amount	8,750
n (time period)	NA
r (rate of interest)	?
Present value of Perpetuity	50,000
Growth rate	0%

$$\text{Present value} = \frac{\text{Perpetuity Amount}}{\text{Rate of Interest} - \text{Growth Rate}}$$

$$50,000 = \frac{8,750}{\text{Rate of Interest} - 0\%}$$

$$\text{Rate of interest} = \frac{8,750}{50,000} = 0.175 \text{ (or) } 17.50\%$$

Hence IRR of the cash flow is 17.50%.

Question No.2c:

WN 1: Computation of initial guess rate for IRR computation:

Particulars	Calculation	Amount
Initial outflow		50,000
Sum of inflows	$15,500 \times 4$	62,000
Total profit of project		12,000
Average profit of project	$\frac{12,000}{4}$	3,000
Average investment	$\frac{50,000 + 0}{2}$	25,000
ARR on average investment	$\frac{3,000}{25,000} \times 100$	12%
Initial guess rate	$\frac{2}{3} \times 12$	8%

- In order to compute IRR, we need one positive and one negative NPV. We need to start with some rate for discounting. We take that as 2/3rd of ARR on average investment as final IRR is expected to be closer to this number.

WN 2: Computation of IRR:

Let us assume an initial discount rate of 8 percent and compute NPV

Year	Cash flow	PVF @ 8%	DCF	PVF @ 10%	DCF
0	-50,000	1	-50,000	1	-50,000
1 to 4	15,500	3.312	51,336	3.17	49,135
			1,336		-865

- We have to increase the discount rate if NPV is positive and discount rate is to be reduced if initial NPV is negative. We will need one positive and one negative NPV to compute IRR.

IRR computation:

$$\text{IRR} = L_1 + \frac{\text{NPV at } L_1}{\text{NPV at } L_1 - \text{NPV at } L_2} \times (L_2 - L_1)$$

$$\text{IRR} = 8\% + \frac{1,336}{1,336 - (-865)} \times (10\% - 8\%) = 8\% + 1.21\% = 9.21\%$$

Note:

- L1 = Lower discount rate
- NPV at L1 = NPV at lower rate
- L2 = Higher discount rate
- NPV at L2 = NPV at higher rate

Question No.2d:

WN 1: Computation of initial guess rate for IRR computation:

Particulars	Calculation	Amount
Initial outflow		1,000
Sum of inflows		1,275
Total profit of project		275
Average profit of project	$\frac{275}{3}$	92
Average investment	$\frac{1,000 + 0}{2}$	500
ARR on average investment	$\frac{92}{500} \times 100$	18.40

Initial guess rate	$\frac{2}{3} \times 18.40$	12.27 ~ 12%

WN 2: Computation of IRR

Let us assume an initial discount rate of 12 percent and compute NPV

Year	Cash flow	PVF @ 12%	DCF	PVF @ 14%	DCF
0	-1,000	1	-1,000.00	1	-1,000.00
1	450	0.893	401.85	0.877	394.65
2	425	0.797	338.73	0.769	326.83
3	400	0.712	284.80	0.675	270.00
			25.38		-8.52

IRR computation:

$$IRR = L_1 + \frac{NPV \text{ at } L_1}{NPV \text{ at } L_1 - NPV \text{ at } L_2} \times (L_2 - L_1)$$

$$IRR = 12\% + \frac{25.38}{25.38 - (-8.52)} \times (14\% - 12\%) = 12\% + 1.50\% = \mathbf{13.50\%}$$

3. Techniques of capital budgeting

Following are the data on a capital project being evaluated by the management of X Ltd.:

Particulars	Project M
Annual cost saving	40,000
Useful life	4 years
IRR	15%
Profitability Index	1.064
NPV	?
Cost of capital	?
Cost of project	?
Payback	?
Salvage value	0

Find the missing values considering the following table of discount factor only:

Discount Factor	15%	14%	13%	12%
Year 1	0.869	0.877	0.885	0.893
Year 2	0.756	0.769	0.783	0.797
Year 3	0.658	0.675	0.693	0.712
Year 4	0.572	0.592	0.613	0.636
Total	2.855	2.913	2.974	3.038

Answer:

Answer:

WN 1: Computation of cost of project:

- IRR is the rate of return at which NPV of the project is zero

Year	Cash flow	PVF @ 15%	DCF
0	-1,14,200	1.000	-1,14,200
1 to 4	40,000	2.855	1,14,200
NPV			0

- Cost of project = Rs.1,14,200 (sum of inflows as NPV is zero)

WN 2: Computation of NPV:

$$\text{Profitability index} = \frac{\text{PV of inflows}}{\text{PV of outflows}}$$

$$1.064 = \frac{\text{PV of inflows}}{1,14,200}; \text{PV of inflows} = (1,14,200 \times 1.064) = \text{Rs. } 1,21,509$$

$$\text{NPV} = \text{PV of inflow} - \text{PV of outflow} = 1,21,509 - 1,14,200 = \text{Rs. } 7,309$$

WN 3: Computation of cost of capital:

Year	Cash flow	PVF @ ??	DCF

0	-1,14,200	1.000	-1,14,200
1 to 4	40,000	3.038	1,21,509
NPV			7,309

From the given tables PVAF of 3.038 correspond to 4 years and 12 percent. Hence cost of capital is 12%

WN 4: Computation of Payback:

Year	Cash flow	Cum Cash flow
0	-1,14,200	-1,14,200
1	40,000	-74,200
2	40,000	-34,200
3	40,000	5,800
4	40,000	45,800

$$\text{Payback} = \text{Base year} + \frac{\text{Unrecovered cash flow of Base Year}}{\text{Cash flow of next year}}$$

$$\text{Payback} = 2 + \frac{34,200}{40,000} = 2 + 0.855 = 2.855 \text{ years (or) 2 years and 10 months}$$

4. NPV for step-up discount rate

Project A require investment of Rs.10,00,000 and will yield an after cash inflow of Rs.1,20,000, Rs.3,00,000, Rs.6,00,000, Rs.4,00,000 and Rs.2,00,000 over the next five years. Cost of dismantling the asset is Rs.3,00,000 and salvage value of assets is Rs.1,00,000.

- ❖ Ascertain NPV if the cost of capital is 12% over 5 years
- ❖ Ascertain the NPV if the cost of capital for year 1 is 12% and is expected to go up by 2 percent every year upto the 5th year. Should the project be accepted? What if there is no dismantling cost at the end of the project?

Answer:

WN 1: Computation of NPV if discount rate is 12% over 5 years:

Year	CF	PVF @ 12%	DCF
0	-10,00,000	1.000	-10,00,000
1	1,20,000	0.893	1,07,160
2	3,00,000	0.797	2,39,100
3	6,00,000	0.712	4,27,200
4	4,00,000	0.636	2,54,400
5	-	0.567	-
NPV			27,860

- Cash flow of year 5 = 2,00,000 + 1,00,000 - 3,00,000(dismantling cost) = 0

WN 2: Computation of NPV in case of change in discount rate:

Year	CF	PVF	DCF
0	-10,00,000	1.000	-10,00,000
1	1,20,000	0.893	1,07,160
2	3,00,000	0.783	2,34,900
3	6,00,000	0.675	4,05,000
4	4,00,000	0.572	2,28,800
5	-	0.477	-
NPV			-24,140

- Projected will be rejected as the same has negative NPV of Rs.24,140

Note:

$$\text{PVF of year 2} = \frac{\text{PVF of year 1}}{1 + 14\%} = \frac{0.893}{1.14} = 0.783$$

$$\text{PVF of year 3} = \frac{\text{PVF of year 2}}{1 + 16\%} = \frac{0.783}{1.16} = 0.675$$

WN 3: Computation of NPV in case of no dismantling cost:

Year	CF	PVF	DCF

0	-10,00,000	1.000	-10,00,000
1	1,20,000	0.893	1,07,160
2	3,00,000	0.783	2,34,900
3	6,00,000	0.675	4,05,000
4	4,00,000	0.572	2,28,800
5	3,00,000	0.477	1,43,100
NPV			1,18,960

- Project will be accepted as the same has positive NPV if the company does not incur dismantling cost

5. Calculation of breakeven sales

ABC Limited is considering whether to invest in a project which would entail immediate expenditure on capital equipment of Rs.40,000. Feasibility study at a cost of Rs.8,000 indicates the following expected sales:

Probability	Sales volume
0.10	2,000
0.25	6,000
0.40	8,000
0.15	10,000
0.10	14,000

Once sales are established at a certain volume in the first year, they will continue at the same level in subsequent years. The unit selling price will be Rs.10 and the variable cost is Rs.6. The project will have the following fixed cost:

- ❖ Rent of a factory of Rs.10,000. Annual rental of Rs.10,000 would be payable only as long as the new product is manufactured
- ❖ Head-office apportioned expense of Rs.10,000
- ❖ Other expenses of Rs.10,000

The project will have a life of 6 years, after which the equipment would be sold as scrap which would fetch Rs.3,000. The cost of capital is 10%. Ignore taxes. You are required to find:

- ❖ Expected value of the NPV of the project
- ❖ Minimum volume of sales per annum required to justify the project

Answer:

WN 1: Computation of expected sales volume:

Expected sales volume = $(0.10 \times 2,000) + (0.25 \times 6,000) + (0.40 \times 8,000) + (0.15 \times 10,000) + (0.10 \times 14,000)$

Expected sales volume = 7,800 units

WN 2: Computation of cash flows:

Note 1: Initial outflow

Particulars	Amount
Capital expenditure	-40,000
Feasibility study (sunk cost)	0
Working capital	0
Initial outflow	-40,000

Note 2: In-between flows (Year 1 to 6)

Particulars	Amount
Contribution from 7,800 units $[7,800 \times 4]$	31,200
Less: Rent (incremental cost)	-10,000
Less: Apportioned cost (irrelevant)	0
Less: Other expenses	-10,000
PBDT/CFAT	11,200

Note 3: Terminal flow (Year 6):

Particulars	Amount
Salvage value	3,000
Recapture of working capital	0
Terminal flow	3,000

WN 3: Computation of NPV:

Year	CF	PVF @ 10%	DCF
0	-40,000	1.000	-40,000
1 to 6	11,200	4.355	48,776
6	3,000	0.564	1,692
NPV			10,468

WN 4: Minimum value of sales to justify the project:

- Project will be acceptable if the NPV is ≥ 0 . Hence, we should compute the sales volume which leads to NPV of 0.

Computation of in-between inflow which will lead to zero NPV:

Year	CF	PVF @ 10%	DCF
0	-40,000	1.000	-40,000
	8,796		
1 to 6	[38,308/4.355]	4.355	38,308 (b/f)
6	3,000	0.564	1,692
NPV			0

Computation of sales volume which would lead to CFAT of Rs.8,796:

Particulars	Amount
Target contribution (reverse working)	28,796
Less: Rent (incremental cost)	-10,000
Less: Apportioned cost (irrelevant)	0
Less: Other expenses	-10,000
PBDT/CFAT	8,796

- No of units to be sold (minimum sales volume) = $28,796/4 = 7,199$ units

Part 2 – Investment Decision**6. Revenue Enhancement:**

X Ltd. an existing profit making company is planning to introduce a new product with a projected life for 8 years. Initial equipment cost will be Rs.120 lacs and additional equipment costing Rs.10 lacs will be needed at the beginning of the third year. At the end of the 8 years, the original equipment will have resale value equivalent to the cost of removal, but the additional equipment would be sold for Rs.1 lac. Working capital of Rs.15 lacs will be needed. The 100% capacity of the plant is of 4,00,000 units per annum but the production and sales volume are as under:

Year	1	2	3-5	6-8
Capacity Utilization	20	30	75	50
Advertisement expenditure (in lacs) per year	30	15	10	4

A sale price of Rs.100 per unit with a profit volume ratio of 60% is likely to be obtained. Fixed operating costs are likely to be Rs.16 lacs per annum. In addition to this the advertisement expenditure will have to be incurred as mentioned in the above table.

The company is subject to 50% tax, straight line method of depreciation (permissible for tax purposes also) and taking 12% as appropriate after-tax cost of capital should the project be accepted?

Answer:**Answer:****WN 1: Initial outflow:**

Particulars	Amount (in lacs)
Capital expenditure	(120)
Working capital	(15)
Initial outflow	(135)

WN 2: In-between cash flows:

(in lacs)

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Units sold [4 x capacity utiln]	0.80	1.20	3.00	3.00	3.00	2.00	2.00	2.00
Selling price	100	100	100	100	100	100	100	100
Revenues [Units x SP]	80.00	120.00	300.00	300.00	300.00	200.00	200.00	200.00
Less: Variable cost [Units x 40]	-32.00	-48.00	-120.00	-120.00	-120.00	-80.00	-80.00	-80.00
Less: Fixed cost	-16.00	-16.00	-16.00	-16.00	-16.00	-16.00	-16.00	-16.00
Less: Advertisement	-30.00	-15.00	-10.00	-10.00	-10.00	-4.00	-4.00	-4.00
PBDT	2.00	41.00	154.00	154.00	154.00	100.00	100.00	100.00
Less: Depreciation	-15.00	-15.00	-16.50	-16.50	-16.50	-16.50	-16.50	-16.50
PBT	-13.00	26.00	137.50	137.50	137.50	83.50	83.50	83.50
Less: Tax	6.50	-13.00	-68.75	-68.75	-68.75	-41.75	-41.75	-41.75
PAT	-6.50	13.00	68.75	68.75	68.75	41.75	41.75	41.75
Add: Depreciation	15.00	15.00	16.50	16.50	16.50	16.50	16.50	16.50
CFAT	8.50	28.00	85.25	85.25	85.25	58.25	58.25	58.25
Less: Purchase of additional machine		-10.00						
Revised CFAT	8.50	18.00	85.25	85.25	85.25	58.25	58.25	58.25

- Depreciation on original equipment (all 8 years) = $(120 - 0)/8 = 15$ lacs
- Depreciation on additional equipment (3 to 8 years) = $(10 - 1)/6 = 1.5$ lacs
- Company makes loss in year 1. It is an existing profit-making company and hence would save taxes due to loss
- Additional machine has been purchased at beginning of year 3. Beginning of year 3 will be taken as end of year 2 in cash flow analysis. This is because it is generally assumed that cash flows happen at end of the year

WN 3: Terminal cash flow:

Particulars	Amount (in lacs)
Net salvage value of original machine	0.00
Net salvage value of additional machine	1.00
Recapture of working capital	15.00
Total terminal flow	16.00

Note: Computation of Net Salvage Value:

Particulars	Original	Additional
Sale value	0.00	1.00
Less: Book value	0.00	1.00
Capital gain/loss	0.00	0.00
Tax paid/saved	0.00	0.00
Net salvage value	0.00	1.00

WN 4: Consolidation of cash flows and computation of NPV:

(in lacs)

Year	Cash flow	PVF @ 12%	DCF
0	-135.00	1.000	-135.00
1	8.50	0.893	7.59
2	18.00	0.797	14.35
3	85.25	0.712	60.70
4	85.25	0.636	54.22
5	85.25	0.567	48.34
6	58.25	0.507	29.53

7	58.25	0.452	26.33
8	74.25 [58.25 + 16.00]	0.404	30.00
NPV			136.06

Conclusion: The company should go ahead with project as it results in positive NPV of Rs.136.06 lacs.

7. Evaluation of a new project

ABC Limited is considering building an additional amusement park that will have a wild-water wave pool, buildings and restaurants. Since the firm's sales are in cash, the cash inflow from sales and gross revenues are identical. The firm's variable costs amount to 50% of the revenue, with 60% of these cost paid in cash and 40% paid on credit for one year. The new investment is Rs.200 million (Rs.100 million in equipment and Rs.100 million in buildings), plus Rs.10 million in net working capital (mainly cash).

ABC Limited will depreciate the equipment by the accelerated method (by which relatively high proportions of the asset's values are depreciated in early years) over four years, the buildings will be depreciated over 31.5 years. The buildings will be placed in service in January. The annual depreciation percentages are as follows:

Years	1	2	3	4
Equipment (%)	33.33	44.45	14.81	7.41
Buildings (%)	3.042	3.175	3.175	3.175

ABC Limited estimates annual sales at Rs.400 million for each of the next four years. As a result of the new project, the after-tax cash inflow from other amusement parks will decline by Rs.20 million a year. The firm has already paid Rs.25 million on an after tax cost basis for research and development of the new project. The value of buildings is expected to increase to an estimated Rs.110 million after four years of operation. The value of equipment after four years of use will be zero. Assume that the after tax cost of capital is 15% and the corporate tax is 34%. The firm uses vacant land for the new attraction and it has no alternative use the land for the next four years. Should the company proceed with project?

Answer:

WN 1: Initial outflow:

Particulars	Amount (in million)
Equipment cost	-100.00
Building cost	-100.00
Working capital	-10.00
Initial Outflow	-210.00

WN 2: In-between flows:

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5
Revenues	400.00	400.00	400.00	400.00	
Less: Variable cost	-200.00	-200.00	-200.00	-200.00	
Less: Depreciation on equipment	-33.33	-44.45	-14.81	-7.41	
Less: Depreciation on building	-3.04	-3.18	-3.18	-3.18	
Profit before tax	163.63	152.37	182.01	189.41	0.00
Less: Tax @ 34%	-55.63	-51.81	-61.88	-64.40	
Profit after tax	108.00	100.56	120.13	125.01	0.00
Add: Depreciation	36.37	47.63	17.99	10.59	
Less: Opportunity cost	-20.00	-20.00	-20.00	-20.00	
Add/less: Change in working capital	80.00	-	-	10.00	-80.00
Revised Cash flow after tax	204.37	128.19	118.12	125.60	-80.00

Note 1: Analysis of working capital:

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5
Cash	10.00	10.00	10.00	0.00	
Less: Creditors	-80.00	-80.00	-80.00	-80.00	0.00
Working capital	-70.00	-70.00	-70.00	-80.00	0.00
Change in WC	-80.00	0.00	0.00	-10.00	80.00

- The company had opening working capital of Rs.10 million and by the end of year working capital become negative Rs.70 million. This would mean a decrease in working capital by Rs.80 million and the same is an inflow
- Working capital declines further to negative Rs.80 million in year 4. This is because project is over and the company would have taken out the cash and used for other projects. Decrease in working capital of Rs.10 million is treated as inflow of year 4
- Working capital will become zero in year 5 as the company would have paid creditors of Rs.80 million and the same would be outflow of year 5

WN 3: Terminal flow:

Particulars	Equipment	Building
Sale value	0.00	110.00
Less: Book value	0.00	87.42
Capital gain	0.00	22.58
Tax paid	0.00	7.68
Net salvage value	0.00	102.32

WN 4: Consolidation of cash flows and computation of NPV:

Year	Cash flow	PVF @ 15%	DCF
0	-210.00	1.000	-210.00
1	204.37	0.870	177.80
2	128.19	0.756	96.91
3	118.12	0.658	77.72
	227.92		
4	[125.60 + 102.32]	0.572	130.37
5	-80.00	0.497	-39.76
NPV			233.04

Conclusion: The company should go ahead with project as the same results in positive NPV of Rs.233.04 lacs

8. Investment Decision:

ABC Ltd., a profit-making company, is engaged in the business of car manufacturing. In order to be independent in terms of its electricity needs, the company's management has proposed to put up a Solar Power Plant to generate the electricity. The details of the proposal are as follows:

- (1) Cost of the power plant = Rs.280 lacs
- (2) Cost of land = Rs.30 lacs
- (3) Subsidy of Rs.25 lakhs from state government to be received at the end of first year of installation.
- (4) Sale of electricity to State Electricity Board will be at Rs.2.25 per unit in year 1. This will increase by Rs.0.25 per unit every year till year 7. After that it will increase by Rs.0.50 per unit every year.
- (5) Maintenance cost will be Rs.4 lakhs in year 1 and the same will increase by Rs.2 lakhs every year.
- (6) Estimated life is 10 years.
- (7) Cost of capital 15%.
- (8) Residual value of power plant is nil. However, land value will go up to Rs.90 lakhs at the end of year 10.
- (9) Depreciation will be 100% of the cost of the power plant in year 1 (entire Rs.280 lakhs is to be depreciated in year 1 without considering subsidy) and the same will be allowed for tax purposes.
- (10) Gross electricity generated will be 25 lakhs units per annum. 4% of this electricity generated will be committed free to the State Electricity Board as per the agreement.
- (11) Tax rate is 50%.

You are required to suggest the viability of the proposal by calculating the 'Net Present Value' while ignoring the tax on capital profit. Assume that the tax savings, if any, are utilized in the year of their occurrence.

Answer:**WN 1: Initial outflow:**

Particulars	Amount (in lacs)
Capital expenditure - Power Plant	(280.00)
Capital expenditure - Land	(30.00)

Working capital	0
Initial outflow	(310.00)

WN 2: In-between cash flows:

Particulars	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10
Units generated	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00
Less: Free electricity [4% x 25]	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00
Units sold	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
Selling price	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.25	4.75	5.25
Sales	54.00	60.00	66.00	72.00	78.00	84.00	90.00	102.00	114.00	126.00
Less: Maintenance cost	4.00	6.00	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00
Less: Depreciation	280.00	-	-	-	-	-	-	-	-	-
Profit/loss before tax	-230.00	54.00	58.00	62.00	66.00	70.00	74.00	84.00	94.00	104.00
Add/ Less: Tax paid/ saved @ 50%	-115.00	27.00	29.00	31.00	33.00	35.00	37.00	42.00	47.00	52.00
Profit/loss after tax	-115.00	27.00	29.00	31.00	33.00	35.00	37.00	42.00	47.00	52.00
Add: Depreciation	280.00									
Add: Subsidy	25.00									
Cash flow after taxes	190.00	27.00	29.00	31.00	33.00	35.00	37.00	42.00	47.00	52.00

Note:

- Depreciation is entirely charged in year 1. The company is an existing profit-making company and hence the loss can be set-off against other existing profits. Therefore, it will save tax of Rs.115 lacs in year 1.

WN 3: Terminal flow:

Particulars	Amount (in lacs)
Salvage value of land	90.00
Salvage value of power plant	0.00
Recapture of working capital	0.00
Total terminal flow	90.00

WN 4: Consolidation of cash flows and computation of NPV:**(in lacs)**

Year	Cash flow	PVF @ 15%	DCF
0	-310.00	1.000	-310.000
1	190.00	0.870	165.300
2	27.00	0.756	20.412
3	29.00	0.658	19.082
4	31.00	0.572	17.732
5	33.00	0.497	16.401
6	35.00	0.432	15.120
7	37.00	0.376	13.912
8	42.00	0.327	13.734
9	47.00	0.284	13.348

10	142.00 [52.00 + 90.00]	0.247	35.074
NPV			20.115

The proposed project has NPV of Rs.20,11,500 and is viable to undertake

9. Comprehensive problem:

A large profit making company is considering the installation of a machine to process the waste produced by one of its existing manufacturing process to be converted into a marketable product. At present, the waste is removed by a contractor for disposal on payment by the company of Rs.150 lakh per annum for the next four years. The contract can be terminated upon installation of the aforesaid machine on payment of a compensation of Rs.90 lakh before the processing operation starts. This compensation is not allowed as deduction for tax purposes.

The machine required for carrying out the processing will cost Rs.600 lakh. At the end of the 4th year, the machine can be sold for Rs.60 lakh and the cost of dismantling and removal will be Rs.45 lakh.

Sales and direct costs of the product emerging from waste processing for 4 years are estimated as under:

Year	1	2	3	4
Sales	966	966	1,254	1,254
Material consumption	90	120	255	255
Wages	225	225	255	300
Other expenses	120	135	162	210
Factory overheads	165	180	330	435
Depreciation (as per income tax rules)	150	114	84	63

Initial stock of materials required before commencement of the processing operations is Rs.60 lakh at the start of year 1. The stock levels of materials to be maintained at the end of year 1, 2 and 3 will be Rs.165 lakh and the stocks at the end of year 4 will be nil. The storage of materials will utilise space which would otherwise have been rented out for Rs.30 lakh per annum. Labour costs include wages of 40 workers, whose transfer to this process will reduce idle time

payments of Rs.45 lakh in the year- 1 and Rs.30 lakh in the year- 2. Factory overheads include apportionment of general factory overheads except to the extent of insurance charges of Rs.90 lakh per annum payable on this venture. The company's tax rate is 30%. Consider cost of capital @ 14% and ignore tax on capital gains.

ADVISE the management on the desirability of installing the machine for processing the waste. All calculations should form part of the answer

Answer:

WN 1: Initial outflow:

Particulars	Amount (in lacs)
Capital expenditure	(600.00)
Compensation paid	(90.00)
Working capital (material)	(60.00)
Initial outflow	(750.00)

WN 2: In-between flows:

Particulars	Year 1	Year 2	Year 3	Year 4
Sales	966.00	966.00	1,254.00	1,254.00
Saving in contractor charges	150.00	150.00	150.00	150.00
Less: Material cost	-90.00	-120.00	-255.00	-255.00
Less: Wages	-180.00	-195.00	-255.00	-300.00
Less: Other expenses	-120.00	-135.00	-162.00	-210.00
Less: Factory OH	-90.00	-90.00	-90.00	-90.00
Less: Opportunity cost	-30.00	-30.00	-30.00	-30.00
Less: Depreciation	-150.00	-114.00	-84.00	-63.00
Profit before tax	456.00	432.00	528.00	456.00
Less: Tax @ 30%	-136.80	-129.60	-158.40	-136.80

Profit after tax	319.20	302.40	369.60	319.20
Add: Depreciation	150.00	114.00	84.00	63.00
Less: Increase in working capital	-105.00	-	-	-
Cash flow after taxes	364.20	416.40	453.60	382.20

WN 3: Terminal cash flows:

Particulars	Amount
Recapture of working capital	165.00
Salvage value	15.00
Total terminal flow	180.00

WN 4: Computation of NPV:

Year	Cash flow	PVF @ 14%	DCF
0	-750.00	1.000	-750.00
1	364.20	0.877	319.40
2	416.40	0.769	320.21
3	453.60	0.674	305.73
4	562.20	0.592	332.82
NPV of Project			528.16

Advice: Since the net present value of cash flows is Rs.528.16 lakh which is positive the management should install the machine for processing the waste

10. Evaluation of cost reduction project

DL Services is in the business of providing home Services like plumbing, sewerage line cleaning etc. There is a proposal before the company to purchase a mechanized sewerage cleaning line for a sum of Rs. 20 lacs. The life of the machine is 10 years. The present system of the company is to use manual labour for the job. You are provided the following information:

Cost of machine	Rs.20 lakhs
Depreciation	20% p.a. straight line
Operating cost	Rs.5 lacs per annum
Present system	200 persons Rs.10,000 (ten thousand) per person per annum
Manual labour	
Cost of manual labour	

The company has an after tax cost of funds of 10% per annum. The applicable rate of tax inclusive of surcharge and cess is 35%. Based on the above you are required to:

- ❖ State whether it is advisable to purchase the machine.
- ❖ Compute the savings/additional cost as applicable, if the machine is purchased.

Answer:**WN 1: Initial Outflow:**

Particulars	Amount
Capital expenditure	(20,00,000)
Working capital	0
Initial outflow	(20,00,000)

WN 2: In-between cash flows:

Particulars	Year 1 to 5	Year 6 to 10
Revenue/cost reduction		
Savings in labour cost (10,000 × 200)	20,00,000	20,00,000
Less: Operating cost	(5,00,000)	(5,00,000)
Profit before Depreciation and Tax (PBDT)	15,00,000	15,00,000
Less: Depreciation (20,00,000 × 20%)	(4,00,000)	-
Profit before tax (PBT)	11,00,000	15,00,000
Less: Tax @ 35%	(3,85,000)	(5,25,000)
Profit after tax (PAT)	7,15,000	9,75,000
Add: Depreciation	4,00,000	-
Cash flow after taxes (CFAT)	11,15,000	9,75,000

WN 3: Terminal cash flow:

Particulars	Amount
Net salvage value	-
Recapture of working capital	-
Total terminal flow	-

Note: Computation of Net Salvage Value:

Particulars	Amount
Sale value	0.00
Less: Book value	0.00
Capital gain/loss	0.00
Tax paid/saved	0.00
Net salvage value	0.00

WN 4: Computation of NPV:

Year	Cash flow	PVF @ 10%	DCF
0	-20,00,000	1.000	-20,00,000
1 to 5	11,15,000	3.791	42,26,965
6 to 10	9,75,000	2.354	22,95,150
10	-	0.386	-
NPV			45,22,115

Conclusion: The company should go ahead with purchase of machine as NPV is positive.

11. Investment decision – Relevance of interest cost (November 2014):

Gretel Limited is setting up a project for manufacture of boats at a cost of Rs. 300 Lakhs. It has to decide whether to locate the plant in next to the sea shore (Area A) or in an inland area with no access to any waterway (Area B). If project is located in Area B then Gretel Limited receives a cash subsidy of Rs. 20 lakhs from the Central Government. Besides, the taxable profits to the extent of 20% are exempt for 10 years in Area B. The project envisages a borrowing of 200 lakhs in either case. The rate of interest per annum is 12 % in Area A and 10 % in Area B.

The borrowing of principal has to be repaid in 4 instalments beginning from the end of 4th year. With the help of the following information, you are required to suggest the proper location for the project to the CEO of Gretel Limited. Assume straight line depreciation with no residual Value, income tax 50% and required return 15%.

Year	(EBDIT) Area A	(EBDIT) Area B
1	(6)	(50)
2	34	(50)
3	54	10
4	74	20
5	108	45
6	142	100
7	156	155
8	230	190
9	330	230
10	430	330

Answer:

- Project has financing benefit in case we set-up the project in Area B. Hence discount rate cannot be 15 percent for both areas as the financing cost is likely to be different.
- We therefore assume required return as cost of equity and compute the cash flows applicable for equity shareholders in this question. Hence interest, loan repayment and loan taken will form part of the cash flows

WN 1: Initial outflow:

Particulars	Area A	Area B
Capital expenditure	-300.00	-300.00
Subsidy received	0	20.00
Amount borrowed	200.00	200.00
Net cash outflow	-100.00	-80.00

WN 2: Computation of in-between cash flows:**Area A:**

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
EBDIT (Given)	-6	34	54	74	108	142	156	230	330	430
Less: Interest	-24	-24	-24	-24	-18	-12	-6	0	0	0
Less: Depn	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30
EBT	-60	-20	0	20	60	100	120	200	300	400
Less: Tax@ 50%	0	0	0	0	0	-50	-60	-100	-150	-200
EAT	-60	-20	0	20	60	50	60	100	150	200
Add: Depn	30	30	30	30	30	30	30	30	30	30
CFAT	-30	10	30	50	90	80	90	130	180	230
Repayment	0	0	0	-50	-50	-50	-50	0	0	0
RCFAT	-30	10	30	0	40	30	40	130	180	230

- Interest for first 4 years = 200 lacs x 12% = Rs.24 lacs
- Interest for year 5 onwards will decline due to repayment of Rs.50 lacs
- Tax will not be applicable for first two years due to losses. Accumulated losses of Rs.80 lacs will be set-off till year 5 and hence no taxes till 5 years. Tax will be paid at normal rate of 50 percent post that

Area B:

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
EBDIT (Given)	-50	-50	10	20	45	100	155	190	230	330
Less: Interest	-20	-20	-20	-20	-15	-10	-5	0	0	0
Less: Depn	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30
EBT	-100	-100	-40	-30	0	60	120	160	200	300
Less: Tax@ 50%	0	0	0	0	0	0	0	-28	-80	-120
EAT	-100	-100	-40	-30	0	60	120	132	120	180
Add: Depn	30	30	30	30	30	30	30	30	30	30
CFAT	-70	-70	-10	0	30	90	150	162	150	210
Repayment	0	0	0	-50	-50	-50	-50	0	0	0
RCFAT	-70	-70	-10	-50	-20	40	100	162	150	210

- Interest for first 4 years = 200 lacs x 10% = Rs.24 lacs
- Interest for year 5 onwards will decline due to repayment of Rs.50 lacs
- It is assumed that subsidy will not be adjusted to cost of asset and hence depreciation is claimed on entire Rs.300 lacs.
- Tax will not be applicable for first four years due to losses. Accumulated losses of Rs.270 lacs will be set-off till year 8
- Taxes of year 8 = [160 lacs – 90 lacs] x 40% = Rs.28 lacs. Effective tax rate of the company will be 40% as the company does not pay taxes on 20 percent of the profits.
- Effective tax rate = Normal tax rate x (1 – Exemption percentage) = 50% x (1 – 20%) = 40.00%

WN 3: Computation of NPV

Year	CF of A	CF of B	PVF @ 15%	DCF_A	DCF_B
0	-100	-80	1.000	-100.00	-80.00

1	-30	-70	0.870	-26.10	-60.90
2	10	-70	0.756	7.56	-52.92
3	30	-10	0.658	19.74	-6.58
4	0	-50	0.572	0.00	-28.60
5	40	-20	0.497	19.88	-9.94
6	30	40	0.432	12.96	17.28
7	40	100	0.376	15.04	37.60
8	130	162	0.327	42.51	52.97
9	180	150	0.284	51.12	42.60
10	230	210	0.247	56.81	51.87
NPV				99.52	-36.62

- The company should go ahead with project in Area A as the same has positive NPV of Rs.99.52 lacs

12. Venture capital investment

TMC is a venture capital financier. It received a proposal for financing requiring an investment of Rs.45 crore which returns Rs.600 crore after 6 years if succeeds. However, it may be possible that the project may fail at any time during the six years. The following table provide the estimates of probabilities of the failure of the projects.

Year	1	2	3	4	5	6
Probability of failure	0.28	0.25	0.22	0.18	0.18	0.10

In the above table the probability that the project fails in the second year is given that it has survived throughout year 1. Similarly for year 2 and so forth. TMC is considering an equity investment in the project. The beta of this type of project is 7. The market return and risk free rate of return are 8% and 6% respectively. You are required to compute the expected NPV of the venture capital project and advice the TMC.

Answer:

WN 1: Computation of probability of success of project:

- Probability of success till 6th year = (Probability of success in year 1 x Probability of success in year 2 x Probability of success in year 3 x Probability of success in year 4 x Probability of success in year 5 x Probability of success in year 6)
- Probability of success till 6th year = (72% x 75% x 78% x 82% x 82% x 90%) = 25.4893%

Note: Project will be successful only if it is able to succeed for all six years and hence we have to compute the joint probability of success till year 6.

WN 2: Computation of NPV

- Expected cash flow of year 6 = Rs.600 crores x 25.4893% = Rs.152.9358 crores

Year	Cash flow	PVF @ 20%	DCF
0	-45.0000	1.000	-45.0000
6	152.9358	0.335	51.2335
NPV			6.2335

- NPV of the project is positive and hence TMC can go ahead with the investment.

13. Calculation of utility value - May 2017 RTP

Jumble Consultancy Group has determined relative utilities of cash flows of two forthcoming projects of its client company as follows:

Cash flow	-15000	-10000	-4000	0	15000	10000	5000	1000
Utilities	-100	-60	-3	0	40	30	20	10

The distribution of cash flows of project A and Project B are as follows:

Project A					
Cash flow	-15000	-10000	15000	10000	5000
Probability	0.1	0.2	0.4	0.2	0.1
Project B					
Cash flow	-10000	-4000	15000	5000	10000

Probability	0.1	0.15	0.4	0.25	0.1

Which project should be selected and why?

Answer:

Project A					
Cash flow	-15000	-10000	15000	10000	5000
Probability	0.1	0.2	0.4	0.2	0.1
Utility	-100	-60	40	30	20
Expected utility	-10	-12	16	6	2
Project B					
Cash flow	-10000	-4000	15000	5000	10000
Probability	0.1	0.15	0.4	0.25	0.1
Utility	-60	-3	40	20	30
Expected utility	-6	-0.45	16	5	3

- Total utility value of project A = 2
- Total utility value of project B = 17.55
- Project B should be selected as its expected utility is more

Part 3 – Replacement Decision and Life Disparity

14. Replacement Decision:

A Company named Roby's cube decided to replace the existing Computer system of their organisation. Original cost of old system was Rs. 25,000 and it was installed 5 years ago. Current market value of old system is Rs. 5,000. Depreciation of the old system was charged with life of 10 years with Estimated Salvage value as Nil. Depreciation of the new system will be charged with life over 5 years. Present cost of the new system is Rs. 50,000. Estimated Salvage value of the new system is Rs. 1,000. Estimated cost savings with new system is Rs. 5,000 per year. Increase in sales with new system is assumed at 10% per year based on original total sales of Rs. 1,00,000. Company follows straight line method of depreciation. Cost of capital of the company is 10% whereas tax rate is 30%.

Required:

Advise whether the company should go ahead with replacement?

Answer:

WN 1: Initial outflow:

Particulars	Existing	New
NSV of existing machine on year 0	-7,250	-
Working capital blocked	-	-
Capital expenditure	-	-50,000
Total outflow	-7,250	-50,000

- Initial outflow = New machine – old machine = -50,000 – (-7,250) = -Rs.42,500

Note 1: Computation of existing machine on day 0:

Particulars	Amount
Sale value	5,000
Less: Book value [25,000 – 2,500 × 5 years]	-12,500
Capital loss	-7,500
Tax saved @ 30%	2,250
Net salvage value	7,250

WN 2: In-between cash flows:

Particulars	Amount
Increase in revenues [1,00,000 × 10%]	10,000
Saving in cost	5,000
Less: Incremental depreciation	-7,300

[9,800 – 2,500]	
Profit before tax	7,700
Less: Tax @ 30%	-2,310
Profit after tax	5,390
Add: Depreciation	7,300
Incremental CFAT	12,690

WN 3: Terminal flow:

Particulars	Existing	New
Net salvage value	0	1,000
Recapture of working capital	0	0
Total terminal flow	0	1,000

- Incremental cash flow = New – Old = Rs.1,000

WN 4: Consolidation of cash flows and computation of NPV:

Year	Cash flow	PVF @ 10%	DCF
0	-42,750	1.000	-42,750
1 to 5	12,690	3.791	48,108
5	1,000	0.621	621
NPV			5,979

Conclusion: Since NPV is positive we should accept the proposal to replace the machine.

15. Replacement Decision:

A company has an old machine having book value zero – which can be sold for Rs. 50,000. The company is thinking to choose one from following two alternatives:

- To incur additional cost of Rs. 10,00,000 to upgrade the old existing machine.
- To replace old machine with a new machine costing Rs. 20,00,000 plus installation cost of Rs. 50,000.

Both above proposals envisage useful life to be five years with salvage value to be nil. The expected after tax profits for the above three alternatives are as under:

Year	Old existing machine	Upgraded Machine	New Machine
1	5,00,000	5,50,000	6,00,000
2	5,40,000	5,90,000	6,40,000
3	5,80,000	6,10,000	6,90,000
4	6,20,000	6,50,000	7,40,000
5	6,60,000	7,00,000	8,00,000

The tax rate is 40 per cent. The company follows straight line method of depreciation. Assume cost of capital to be 15 per cent. P.V.F. of 15%, 5 = 0.870, 0.756, 0.658, 0.572 and 0.497. You are required to advise the company as to which alternative is to be adopted.

Answer:**WN 1: Evaluation of upgrading option:****Note 1: Computation of cash flows:**

Year	PAT/CFAT of Existing machine	Upgraded Machine			Incremental CFAT
		PAT	Depreciation	CFAT	
1	5,00,000	5,50,000	2,00,000	7,50,000	2,50,000
2	5,40,000	5,90,000	2,00,000	7,90,000	2,50,000
3	5,80,000	6,10,000	2,00,000	8,10,000	2,30,000
4	6,20,000	6,50,000	2,00,000	8,50,000	2,30,000
5	6,60,000	7,00,000	2,00,000	9,00,000	2,40,000

Note 2: Computation of NPV

Year	Cash flow	PVF @ 15%	DCF
0	-10,00,000	1.000	-10,00,000
1	2,50,000	0.870	2,17,500

2	2,50,000	0.756	1,89,000
3	2,30,000	0.658	1,51,340
4	2,30,000	0.572	1,31,560
5	2,40,000	0.497	1,19,280
NPV			-1,91,320

- NPV of upgradation option is negative and hence the same is not feasible

WN 2: Evaluation of new purchase option:

Note 1: Initial outflow

Particulars	Existing	New
NSV of existing machine on year 0	-30,000	-
Working capital blocked	-	-
Capital expenditure	-	-20,50,000
Total outflow	-30,000	-20,50,000

- Initial outflow = New machine – old machine = -20,50,000 – (-30,000) = -Rs.20,20,000

Note 2: Computation of existing machine on day 0:

Particulars	Amount
Sale value	50,000
Less: Book value	0
Capital gain	50,000
Tax paid @ 40%	20,000
Net salvage value	30,000

Note 3: Computation of cash flows:

Year	PAT/CFAT of Existing machine	New machine			Incremental CFAT
		PAT	Depreciation	CFAT	
1	5,00,000	6,00,000	4,10,000	10,10,000	5,10,000
2	5,40,000	6,40,000	4,10,000	10,50,000	5,10,000
3	5,80,000	6,90,000	4,10,000	11,00,000	5,20,000
4	6,20,000	7,40,000	4,10,000	11,50,000	5,30,000
5	6,60,000	8,00,000	4,10,000	12,10,000	5,50,000

Note 4: Computation of NPV

Year	Cash flow	PVF @ 15%	DCF
0	-20,20,000	1.000	-20,20,000
1	5,10,000	0.870	4,43,700
2	5,10,000	0.756	3,85,560
3	5,20,000	0.658	3,42,160
4	5,30,000	0.572	3,03,160
5	5,50,000	0.497	2,73,350
NPV			-2,72,070

- NPV of new purchase option is also negative and hence the same is not feasible
- As the NPV in both the proposals is negative, the company should continue with the existing old Machine.

16. Replacement Decision:

XYZ is interested in assessing the cash flows associated with the replacement of an old machine by a new machine. The old machine bought a few years ago has a book value of Rs.90,000 and it can be sold for Rs.90,000. It has a remaining life of five years after which its salvage value is expected to be nil. It is being depreciated annually at the rate of 20 per cent (written down value method.)

The new machine costs Rs.4,00,000. It is expected to fetch Rs.2,50,000 after five years when it will no longer be required. It will be depreciated annually at the rate of 33 1/3 per cent (written down value method.) The new machine is expected to bring a saving of Rs.1,00,000 per annum in manufacturing costs. Investment in working capital would remain unaffected. The tax rate applicable to the firm is 50 per cent. Find out the relevant cash flow for this replacement decision. (Tax on capital gain/loss to be ignored)

Answer:**WN 1: Initial outflow**

Particulars	Existing	New
NSV of existing machine on day 0	(90,000)	-
Working capital blocked	-	-
Capital expenditure	-	(4,00,000)
Total outflow	(90,000)	(4,00,000)

- Incremental cash outflow = Rs.3,10,000

WN 2: In-between flows:

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5
Saving in cost	1,00,000	1,00,000	1,00,000	1,00,000	1,00,000
Less: Depreciation [Note 1]	-1,15,333	-74,489	-47,739	-30,290	-18,964
PBT	-15,333	25,511	52,261	69,710	81,036
Less: Tax @ 50%	7,667	-12,756	-26,131	-34,855	-40,518
PAT	-7,666	12,755	26,130	34,855	40,518
Add: Depreciation	1,15,333	74,489	47,739	30,290	18,964
CFAT	1,07,667	87,244	73,869	65,145	59,482

Note 1: Computation of incremental depreciation:

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5
Existing machine:					
Opening WDV	90,000	72,000	57,600	46,080	36,864
Less: Depreciation	-18,000	-14,400	-11,520	-9,216	-7,373
Closing WDV	72,000	57,600	46,080	36,864	29,491
New Machine:					
Opening WDV	4,00,000	2,66,667	1,77,778	1,18,519	79,013
Less: Depreciation	-1,33,333	-88,889	-59,259	-39,506	-26,337
Closing WDV	2,66,667	1,77,778	1,18,519	79,013	52,676
Incremental depreciation	1,15,333	74,489	47,739	30,290	18,964

WN 3: Terminal flow:

Particulars	Existing	New
NSV of asset in year 5	-	2,50,000
Working capital released	-	0
Total terminal flow	-	2,50,000

WN 4: Consolidation of relevant cash flows:

Year	Incremental
0	-3,10,000
1	1,07,667
2	87,244
3	73,869
4	65,145
	3,09,482
5	[59,482 + 2,50,000]

17. Replacement Decision:

ABC company is having difficulties with an automated grinding machine which has 4 years of service life and its operating costs are fairly sizable compared to its revenues. For the next four years, the revenues

generated will be Rs.5,20,000 annually but the annual cost expenses will be Rs.3,80,000. In addition, it must take depreciation of Rs.80,000 per year until the machine reaches zero book value. The machine could be sold today for net cash of Rs.80,000 which is less than its current book value of Rs.1,60,000. This is not good since if the machine were held for 4 years it could probably be sold for Rs.80,000 net cash. The firm's alternative is to invest in a new grinding machine costing Rs.4,00,000, not counting the Rs.80,000 needed to transport and install it. The new machine would generate a revenue of Rs.9,20,000 with cash expense of Rs.5,80,000. It would be depreciated over a 4 year period to a book value of Rs.1,60,000 at which time it could be sold for Rs.1,40,000 net cash. Depreciation would be by the straight line method. The new machine would require tying up an additional Rs.2,00,000 of inventory and receivables over the 4 year period. What is the differential after tax cash flow stream for this proposal? Assume tax rate of 50% on Income and Capital gain

Answer:

Answer:

WN 1: Initial outflow

Particulars	Existing	New
NSV of existing machine on day 0	(1,20,000)	-
Working capital blocked	-	(2,00,000)
Capital expenditure	-	(4,80,000)
Total outflow	(1,20,000)	(6,80,000)

Note 1: Computation of NSV of existing machine on day 0:

Particulars	Amount
Sale value	80,000
Less: Book value	(1,60,000)
Capital loss	80,000
Tax saved @ 50%	40,000
Net salvage value	1,20,000

WN 2: In-between flows:

Existing machine:

Particulars	Year 1 and 2	Year 3 and 4
Revenues	5,20,000	5,20,000
Less: Expenses	-3,80,000	-3,80,000
PBDT	1,40,000	1,40,000
Less: Depreciation	-80,000	-
PBT	60,000	1,40,000
Less: Tax @ 50%	-30,000	-70,000
PAT	30,000	70,000
Add: Depreciation	80,000	-
CFAT	1,10,000	70,000

New Machine:

Particulars	Year 1 to 4
Revenues	9,20,000
Less: Expenses	-5,80,000
PBDT	3,40,000
Less: Depreciation (4,80,000 - 1,60,000)/4	-80,000
PBT	2,60,000
Less: Tax @ 50%	-1,30,000
PAT	1,30,000
Add: Depreciation	80,000
CFAT	2,10,000

WN 3: Terminal flow:

Particulars	Existing	New

NSV of asset in year 4	40,000	1,50,000
Working capital released	0	2,00,000
Total terminal flow	40,000	3,50,000

Particulars	Existing	New
Sale value	80,000	1,40,000
Less: Book value	-	1,60,000
Capital gain/loss	80,000	(20,000)
Tax paid/saved @ 50%	40,000	10,000
Net salvage value	40,000	1,50,000

WN 4: Computation of incremental cash flows

Year	Existing	New	Incremental
0	-1,20,000	-6,80,000	-5,60,000
1	1,10,000	2,10,000	1,00,000
2	1,10,000	2,10,000	1,00,000
3	70,000	2,10,000	1,40,000
4	1,10,000	5,60,000	4,50,000

18. Replacement Decision:

MNP Limited is thinking of replacing its existing machine by a new machine, which would cost Rs.60 lakhs. The company's current production is 80,000 units, and is expected to increase to 1,00,000 units, if the new machine is bought. The selling price of the product would remain unchanged at Rs.200 per unit. The following is the cost of production one unit of product using both the existing and new machine:

	Existing Machine (80,000 units)	New Machine (1,00,000 units)	Unit cost (Rs.) Difference
Materials	75.00	63.75	(11.25)
Wages & Salaries	51.25	37.50	(13.75)
Supervision	20.00	25.00	5.00
Repairs and Maintenance	11.25	7.50	(3.75)
Power and Fuel	15.50	14.25	(1.25)
Depreciation	0.25	5.00	4.75
Allocated Corporate Overheads	10.00	12.50	2.50
	183.25	165.50	(17.75)

The existing machine has an accounting book value of Rs.1,00,000 and it has been fully depreciated for tax purpose. It is estimated that machine will be useful for 5 years. The supplier of the new machine has offered to accept the old machine for Rs.2,50,000. However, the market price of old machine today is Rs.1,50,000 and it is expected to be Rs.35,000 after 5 years. The new machine has a life of 5 years and a salvage value of Rs.2,50,000 at the end of its economic life. Assume corporate Income-tax rate at 40% and depreciation is charged on straight line basis for Income-tax purpose. The opportunity cost of capital of the Company is 15%.

Required:

Estimate net present value of the replacement decision.

Answer:**WN 1: Initial outflow**

Particulars	Existing	New
NSV of existing machine on day 0	(1,50,000)	0
Working capital blocked	0	0
Capital expenditure	0	(60,00,000)
Total outflow	(1,50,000)	(60,00,000)

Note 1: Computation of NSV of existing machine on day 0:

Particulars	Amount
Sale value	2,50,000

Less: Book value	0
Capital gain	2,50,000
Tax paid @ 40%	1,00,000
Net salvage value	1,50,000

- Asset has been fully depreciated under Income Tax Act and hence the book value will be taken as zero for computing capital gains

WN 2: In-between flows:

Particulars	Existing	New
Sales	1,60,00,000	2,00,00,000
Less: Material cost	-60,00,000	-63,75,000
Less: Wages and salaries	-41,00,000	-37,50,000
Less: Supervision	-16,00,000	-25,00,000
Less: Repairs and maintenance	-9,00,000	-7,50,000
Less: Power and fuel	-12,40,000	-14,25,000
Less: Allocated corporate Overheads	-	-
PBDT	21,60,000	52,00,000
Less: Depreciation	-	-11,50,000
PBT	21,60,000	40,50,000
Less: Tax @ 40%	-8,64,000	-16,20,000
PAT	12,96,000	24,30,000
Add: Depreciation	-	11,50,000
CFAT	12,96,000	35,80,000

Note:

- Allocated corporate overheads are an irrelevant expenditure and hence not considered in cash flow computation
- Depreciation has been computed as per Income Tax Act and not companies' books

WN 3: Terminal flow:

Particulars	Existing	New
NSV of asset in year 5	21,000	2,50,000
Working capital released	0	0
Total terminal flow	21,000	2,50,000

Particulars	Existing	New
Sale value	35,000	2,50,000
Less: Book value	0	2,50,000
Capital gain/loss	35,000	0
Tax paid/saved @ 40%	14,000	0
Net salvage value	21,000	2,50,000

WN 4: Computation of incremental cash flows and NPV:

Year	Existing	New	Incremental	PVF @ 15%	DCF
0	-1,50,000	-60,00,000	-58,50,000	1.0000	-58,50,000
1 to 5	12,96,000	35,80,000	22,84,000	3.3522	76,56,425
5	21,000	2,50,000	2,29,000	0.4972	1,13,859
Incremental NPV					19,20,284

Conclusion: The company should go ahead with replacement decision as the project generates positive NPV of Rs.19,20,284.

19. Replacement Decision:

WX Limited has a machine which has been in operation for 3 yrs. Its remaining estimated useful life is 5 years with no salvage value in the end. Its current market value is Rs.2,00,000. The company is considering a

proposal to purchase a new model of machine to replace the existing machine. The relevant information is as follows:

Particulars	Existing Machine	New Machine
Cost of machine	3,30,000	10,00,000
Estimated life	8 years	5 years
Salvage value	Nil	40,000
Annual output	30,000 units	75,000 units
Selling price per unit	Rs.15	Rs.15
Annual operating hours	3,000	3,000
Material cost per unit	Rs.4	Rs.4
Labour cost per hour	Rs.40	Rs.70
Indirect cash cost per annum	Rs.50,000	Rs.65,000

The company uses written down value of depreciation @ 20% and it has several other machines in the block of assets. The Income tax rate is 30 per cent and it does not make any investment, if it yields less than 12 per cent. Advise whether existing machine is to be replaced or not.

Answer:

WN 1: Initial outflow

Particulars	Existing	New
NSV of existing machine on day 0	(2,00,00)	-
Working capital blocked	-	-
Capital expenditure	-	(10,00,000)
Total outflow	(2,00,000)	(10,00,000)

Note: Capital gain tax is ignored as the company follows block of assets method and there are other assets in the block

WN 2: In-between flows:

Note 1: Computation of incremental PBDT

Particulars	Existing	New
Sales [Units x SP]	4,50,000	11,25,000
Less: Material cost [Units x Material cost per unit]	-1,20,000	-3,00,000
Less: Labour cost [Hours x Cost per hour]	-1,20,000	-2,10,000
Less: Indirect cash cost	-50,000	-65,000
PBDT	1,60,000	5,50,000

Note:

- Incremental PBDT = 5,50,000 - 1,60,000 = Rs.3,90,000

Note 2: Computation of net increase in asset block to compute incremental depreciation:

Particulars	Calculation	Amount
WDV of existing machine		
Original cost of existing machine		3,30,000
Less: Depreciation of year 1	3,30,000 x 20%	-66,000
Less: Depreciation of year 2	66,000 x 80%	-52,800
Less: Depreciation of year 3	52,800 x 80%	-42,240
WDV of existing machine		1,68,960
Depreciation base of new machine:		
Cost of new machine		10,00,000
Add: WDV of existing machine		1,68,960
Less: Sale value of existing machine		-2,00,000
Depreciation base of new machine		9,68,960
Base for incremental depreciation	9,68,960 - 1,68,960	8,00,000
Incremental depreciation of year 1	8,00,000 x 20%	1,60,000
Incremental depreciation of year 2	1,60,000 x 80%	1,28,000
Incremental depreciation of year 3	1,28,000 x 80%	1,02,400
Incremental depreciation of year 4	1,02,400 x 80%	81,920
Incremental depreciation of year 5	81,920 x 80%	65,536

Note 3: Computation of cash flows:

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5
PBDT	3,90,000	3,90,000	3,90,000	3,90,000	3,90,000
Less: Depreciation	-1,60,000	-1,28,000	-1,02,400	-81,920	-65,536
PBT	2,30,000	2,62,000	2,87,600	3,08,080	3,24,464
Less: Tax	-69,000	-78,600	-86,280	-92,424	-97,339
PAT	1,61,000	1,83,400	2,01,320	2,15,656	2,27,125
Add: Depreciation	1,60,000	1,28,000	1,02,400	81,920	65,536
CFAT	3,21,000	3,11,400	3,03,720	2,97,576	2,92,661

WN 3: Terminal flow:

Particulars	Existing	New
NSV of asset in year 5	0	40,000
Working capital released	0	0
Total terminal flow	0	40,000

WN 4: Computation of NPV:

Year	Cash flows	PVF @ 12%	DCF
0	-8,00,000	1.000	-8,00,000
1	3,21,000	0.893	2,86,653
2	3,11,400	0.797	2,48,186
3	3,03,720	0.712	2,16,249
4	2,97,576	0.636	1,89,258
5	3,32,661	0.567	1,88,619
NPV of replacement			3,28,965

Conclusion: The company should go ahead with replacement decision as the project generates positive NPV

20. Concept of EAC

A manufacturing unit engaged in the production of automobile parts is considering a proposal of purchasing one of the two plants, details of which are given below:

Particulars	Plant A	Plant B
Cost	Rs.20,00,000	Rs.38,00,000
Installation charges	Rs.4,00,000	Rs.2,00,000
Life	20 years	15 years
Scrap value after full life	Rs.4,00,000	Rs.4,00,000
Output per minute (units)	200	400

The annual costs of the two plants are as follows:

Particulars	Plant A	Plant B
Running hours per annum	2,500	2,500
Costs	(in Rs.)	(in Rs.)
Wages	1,00,000	1,40,000
Indirect materials	4,80,000	6,00,000
Repairs	80,000	1,00,000
Power	2,40,000	2,80,000
Fixed costs	60,000	80,000

Will it be advantageous to buy Plant A or Plant B? Substantiate your answer with the help of comparative unit cost of the plants. Assume interest on capital at 10 percent. Make other relevant assumptions.

Note: 10 percent interest tables

	20 years	15 years
Present value of Rs.1	0.1486	0.2394
Annuity of Rs.1 (capital recovery factor with 10% interest)	0.1175	0.1315

Answer:

Computation of cost per unit of Plant A and Plant B:

Particulars	Plant A	Plant B

Initial outflow [Cost + Installation]	24,00,000	40,00,000
Less: PV of salvage value	-59,400 [4,00,000 × 0.1486]	-95,760 [4,00,000 × 0.2394]
Net cost of machinery	23,40,560	39,04,240
Equated annual cost on capex	2,75,016 [23,40,560 × 0.1175]	5,13,408 [39,04,240 × 0.1315]
Annual recurring expenses [Wages + Indirect material + Repairs + Power + Fixed cost]	9,60,000	12,00,000
Total cost per year [Capex + operating expense]	12,35,016	17,13,408
Annual production	3,00,00,000 [2,500 hours × 200 units × 60]	6,00,00,000 [2,500 hours × 400 units × 60]
Cost per unit	0.041167 [12,35,016/3,00,00,000]	0.028557 [17,13,408/6,00,00,000]

- The company should go ahead with Plant B as the same has lower cost per unit.

21. Concept of EAC:

ABC Limited is forced to choose between two machines A and B. The two machines are designed differently, but have identical capacity and do exactly the same job. Machine A costs Rs.1,50,000 and will last for 3 years. It costs Rs.40,000 per year to run. Machine B is an 'economy' model costing only Rs.1,00,000 but will last only for 2 years, and costs Rs.60,000 per year to run. Ignore tax. Opportunity cost of capital is 10%. Which machine ABC Ltd. should buy?

Answer:

WN 1: Computation of PV of outflow of Machine A and B:

WN 1: Computation of PV of outflow:

Machine A:

Year	Cash flow	PVF @ 10%	DCF
0	1,50,000	1.000	1,50,000
1 to 3	40,000	2.487	99,480
PV of outflow			2,49,480

Machine B:

Year	Cash flow	PVF @ 10%	DCF
0	1,00,000	1.000	1,00,000
1 to 2	60,000	1.736	1,04,160
PV of outflow			2,04,160

WN 2: Computation of Equated Annual Cost (EAC):

- Life of two projects is different and hence we have to compute EAC

Particulars	Machine A	Machine B
PV of outflow	2,49,480	2,04,160
Life	3 year	2 years
PVAF	2.487	1.736
EAC = $\frac{\text{PV of outflow}}{\text{PVAF}}$	1,00,314	1,17,604

Conclusion: Company should go ahead with Machine A as it has lower Equated Annual Cost.

22. Timing of replacement:

X Ltd. is a taxi operator. Each taxi cost to company Rs. 4,00,000 and has a useful life of 3 years. The taxi's operating cost for each of 3 years and salvage value at the end of year is as follows:

	Year 1	Year 2	Year 3
Operating cost	1,80,000	2,10,000	2,38,000
Resale value	2,80,000	2,30,000	1,68,000

You are required to determine the optimal replacement period of taxi if cost of capital of X Ltd. is 10%.

Answer:

PV of outflow and EAC if replaced at end of year 1:

Year	Cash flow	PVF @ 10%	DCF
0	-4,00,000	1.000	-4,00,000
1	1,00,000 [2,80,000 – 1,80,000]	0.909	90,900
PV of outflow			-3,09,100
Life			1 year
PVAF (1 year and 10%)			0.909
EAC			3,40,044

PV of outflow and EAC if replaced at end of year 2:

Year	Cash flow	PVF @ 10%	DCF
0	-4,00,000	1.000	-4,00,000
1	-1,80,000	0.909	-1,63,620
2	20,000 [2,30,000 – 2,10,000]	0.826	16,520
PV of outflow			-5,47,100
Life			2 years
PVAF (2 years and 10%)			1.735
EAC			3,15,331

PV of outflow and EAC if replaced at end of year 3:

Year	Cash flow	PVF @ 10%	DCF
0	-4,00,000	1.000	-4,00,000
1	-1,80,000	0.909	-1,63,620
2	-2,10,000	0.826	-1,73,460
3	-70,000 [-2,38,000 + 1,68,000]	0.751	-52,570
PV of outflow			-7,89,650
Life			3 years
PVAF (3 years and 10%)			2.486
EAC			3,17,639

Conclusion: The company incurs lowest EAC if taxi is used for 2 years; Hence the optimum replacement cycle to replace taxi in 2 years

23. Timing of replacement:

ABC uses 10% discount rate for project appraisal. It is planning to purchase a machine which has effective life of 3 years. However, the productivity drops and hence the machine can also be replaced at the end of year 1 or year 2. The financial details are as follows:

Year	0	1	2	3
Outlay	-2,00,000			
Revenues		1,80,000	1,60,000	1,40,000
Costs		80,000	70,000	70,000
Scrap value		1,30,000	80,000	30,000

Which is the appropriate replacement cycle? Rework the problem in case the company wants to decide on when to abandon the project?

Answer:

WN 1: Replacement Analysis:**Option 1: Replace at end of year 1:**

Year	Cash flow	PVF @ 10%	DCF
0	-2,00,000	1.000	-2,00,000
1	2,30,000 [1,00,000 + 1,30,000]	0.909	2,09,070
NPV			9,070
Life			1 year

PVAF (1 year and 10%)	0.909
EAB	9,978

Option 2: Replace at end of year 2:

Year	Cash flow	PVF @ 10%	DCF
0	-2,00,000	1.000	-2,00,000
1	1,00,000	0.909	90,900
2	1,70,000 [90,000 + 80,000]	0.826	1,40,420
NPV			31,320
Life			2 year
PVAF (2 year and 10%)			1.735
EAB			18,052

Option 3: Replace at end of year 3:

Year	Cash flow	PVF @ 10%	DCF
0	-2,00,000	1.000	-2,00,000
1	1,00,000	0.909	90,900
2	90,000	0.826	74,340
3	1,00,000 [70,000 + 30,000]	0.751	75,100
NPV			40,340
Life			3 years
PVAF (3 years and 10%)			2.486
EAB			16,227

Conclusion: EAB is the highest when machine is replaced at end of year 2. Hence the optimum replacement cycle is of 2 years.

WN 2: Evaluation of abandonment decision:

- EAB approach works when we are planning to repeat the exercise of buying the asset.
- In case of an abandonment decision the company does not plan to buy the machine again and hence the decision should be done on the basis of absolute NPV
- NPV is highest in third option and hence we should abandon the asset at end of year 3

24. Optimum replacement time

A & Company is contemplating whether to replace an existing machine or to spend money on overhauling it. A & Company currently pays no taxes. The replacement machine costs Rs.90,000 now and requires maintenance of Rs 10,000 at the end of every year for eight years. At the end of eight years it would have a salvage value of Rs. 20,000 and would be sold. The existing machine requires increasing amounts of maintenance each year and its salvage value falls each year as follows;

Year	Maintenance cost	Salvage value
Today	0	40,000
1	10,000	25,000
2	20,000	15,000
3	30,000	10,000
4	40,000	0

The opportunity cost of capital for A & Company is 15%. When should the company replace the machine?

Answer:

WN 1: Computation of Equated Annual Cost of New Machine:

Year	Cash flow	PVF @ 15%	DCF
0	-90,000	1.000	-90,000
1 to 8	-10,000	4.487	-44,870
8	20,000	0.327	6,540
PV of outflow			-1,28,330
Life			8 years

PVAF (8 years and 15%)	4.487
EAB	28,600

WN 2: Evaluation of optimum replacement time:

- The machine can be replaced today or at end of each of the next four years. We should compute the amount of PV of outflow to decide the optimum option

Replace immediately:

- Old machine would be used for 0 years and new machine would be used for 4 years. (New machine has utility even beyond 4 years but we restrict our cash flow analysis only for first four years to compare the cash flows across multiple options)

Year	Cash flow	PVF @ 15%	DCF
0	40,000	1.000	40,000
1 to 4	-28,600	2.855	-81,653
PV of outflow			-41,653

Replace at end of year 1:

- Old machine would be used for 1 years and new machine would be used for 3 years.

Year	Cash flow	PVF @ 15%	DCF
1	15,000		
	[-10,000 + 25,000]	0.870	13,050
2 to 4	-28,600	1.985	-56,771
PV of outflow			-43,721

Replace at end of year 2:

- Old machine would be used for 2 years and new machine would be used for 2 years.

Year	Cash flow	PVF @ 15%	DCF
1	-10,000	0.870	-8,700
	-5,000		
2	[-20,000 + 15,000]	0.756	-3,780
2 to 4	-28,600	1.229	-35,149
PV of outflow			-47,629

Replace at end of year 3:

- Old machine would be used for 3 years and new machine would be used for 1 years.

Year	Cash flow	PVF @ 15%	DCF
1	-10,000	0.870	-8,700
2	-20,000	0.756	-15,120
	-20,000		
3	[-30,000 + 10,000]	0.658	-13,160
4	-28,600	0.572	-16,359
PV of outflow			-53,339

Replace at end of year 4:

- Old machine would be used for 4 years and new machine would be used for 0 years.

Year	Cash flow	PVF @ 15%	DCF
1	-10,000	0.870	-8,700
2	-20,000	0.756	-15,120
3	-30,000	0.658	-19,740
4	-40,000	0.572	-22,880
PV of outflow			-66,440

Conclusion:

- Machine should be replaced immediately as the same has lowest PV of outflow.

25. Optimum replacement time

ABC Limited own a machine which could be used in production for two more years. The machine originally cost Rs.45,000 five years ago. Its realizable value is currently Rs.8,000 (because a special opportunity for sale has arisen), but it would be zero at all subsequent times. If the machine were to be used for two more years, it would require a major overhaul at a cost of Rs.9,000 at the end of one year.

A new model of the machine is now being marketed. It costs Rs.40,000 and has a maximum life of ten years, provided that special maintenance is undertaken at a cost of Rs.10,000 after five years, and at a cost of Rs.20,000 after eight years. The new model would have no realizable value at any time. Assume that no other model is expected to become available in the foreseeable future, and that no changes are expected in cost or demand for output of the machine. The company's cost of capital is 15% per annum. Determine when should the machine be replaced?

Answer:

- Existing machine can be replaced today or either at end of year 1 and year 2
- New machine can be used for a period of 5 years (not incurring maintenance cost) or 8 years (incurred 5th year maintenance but not 8th year) or 10 years (incurring both special maintenance)

EAC for different options:

Particulars	Life of New Machine		
	5 Years	8 Years	10 Years
Replace today	9,547	8,238	8,669
Replace end of year 1	9,194	8,198	8,559
Replace end of year 2	9,149	8,334	8,628

Conclusion: The company should replace machine at end of year 1 and use the new machine for a period of 8 years

Option 1: Replace immediately and use new machine for five years:

Year	Cash flow	PVF @ 15%	DCF
0	32,000 [40,000 – 8,000]	1.000	32,000
PV of outflow			32,000
Life			5 years
PVAF (Life and 15%)			3.352
EAB			9,547

Option 2: Replace immediately and use new machine for eight years:

Year	Cash flow	PVF @ 15%	DCF
0	32,000 [40,000 – 8,000]	1.000	32,000
5	10,000	0.497	4,970
PV of outflow			36,970
Life			8 years
PVAF (Life and 15%)			4.488
EAB			8,238

Option 3: Replace immediately and use new machine for ten years:

Year	Cash flow	PVF @ 15%	DCF
0	32,000 [40,000 – 8,000]	1.000	32,000
5	10,000	0.497	4,970
8	20,000	0.327	6,540
PV of outflow			43,510
Life			10 years
PVAF (Life and 15%)			5.019
EAB			8,669

Option 4: Replace at end of year 1 and use new machine for five years:

Year	Cash flow	PVF @ 15%	DCF
0	0	1.000	0
1	40,000	0.870	34,800
PV of outflow			34,800
Life			6 years
PVAF (Life and 15%)			3.785
EAB			9,194

Option 5: Replace at end of year 1 and use new machine for eight years:

Year	Cash flow	PVF @ 15%	DCF
0	0	1.000	0
1	40,000	0.870	34,800
6	10,000	0.432	4,320
PV of outflow			39,120
Life			9 years
PVAF (Life and 15%)			3.785
EAB			8,198

Option 6: Replace at end of year 1 and use new machine for ten years:

Year	Cash flow	PVF @ 15%	DCF
0	0	1.000	0
1	40,000	0.870	34,800
6	10,000	0.432	4,320
9	20,000	0.284	5,680
PV of outflow			44,800
Life			11 years
PVAF (Life and 15%)			5.234
EAB			8,559

Option 7: Replace at end of year 2 and use new machine for five years:

Year	Cash flow	PVF @ 15%	DCF
0	0	1.000	0
1	9,000	0.870	7,830
2	40,000	0.756	30,240
PV of outflow			38,070
Life			7 years
PVAF (Life and 15%)			4.161
EAB			9,149

Option 8: Replace at end of year 2 and use new machine for eight years:

Year	Cash flow	PVF @ 15%	DCF
0	0	1.000	0
1	9,000	0.870	7,830
2	40,000	0.756	30,240
7	10,000	0.376	3,760
PV of outflow			41,830
Life			10 years
PVAF (Life and 15%)			5.019
EAB			8,334

Option 9: Replace at end of year 2 and use new machine for ten years:

Year	Cash flow	PVF @ 15%	DCF
0	0	1.000	0
1	9,000	0.870	7,830

2	40,000	0.756	30,240
7	10,000	0.376	3,760
10	20,000	0.247	4,940
PV of outflow			46,770
Life			12 years
PVAF (Life and 15%)			5.421
EAB			8,628

26. Optimum replacement time:

Company Y is operating an elderly machine that is expected to produce a net cash inflow of Rs. 40,000 in the coming year and Rs. 40,000 next year. Current salvage value is Rs. 80,000 and next year's value is Rs. 70,000. The machine can be replaced now with a new machine, which costs Rs. 1,50,000, but is much more efficient and will provide a cash inflow of Rs. 80,000 a year for 3 years. Company Y wants to know whether it should replace the equipment now or wait a year with the clear understanding that the new machine is the best of the available alternatives and that it in turn be replaced at the optimal point. Ignore tax. Take opportunity cost of capital as 10 per cent. Advise with reasons.

Answer:**WN 1: Identification of alternatives:**

- Alternative 1 – Replace the machine today
- Alternative 2 – Replace the machine at the end of year 1

WN 2: Evaluation of Alternative 1:

Year	CF	PVF @ 10%	DCF
0	-70,000	1.000	-70,000
1	80,000	0.909	72,720
2	80,000	0.826	66,080
3	80,000	0.751	60,080
NPV			1,28,880

Note:

- Cash flow in year 0 = Purchase price of new machine of Rs.1,50,000 – Sale value of old machine of Rs.80,000 = Net outflow of Rs.70,000

WN 3: Evaluation of Alternative 2:

Year	CF	PVF @ 10%	DCF
0	-	1.000	-
1	-40,000	0.909	-36,360
2	80,000	0.826	66,080
3	80,000	0.751	60,080
4	80,000	0.683	54,640
NPV			1,44,440

Note:

- No cash flow in year 0 as the replacement is not done immediately
- Old machine will be used for one year and then replaced at end of year 1. Cash flow of year 1 = Inflow of Rs.40,000 from old machine + Sale value of Rs.70,000 of old machine – purchase price of Rs.1,50,000 of new machine = -40,000

WN 4: Selection of Alternative:

- Alternative 1 has life of 3 years whereas Alternative 2 has life of 4 years. Selection of alternative will be based on equated annual benefit

Particulars	Alt 1	Alt 2
NPV	1,28,880	1,44,440
Life	3 years	4 years
PVAF	2.486	3.169
EAB [NPV/PVAF]	51,842	45,579

Conclusion: Company should go ahead with Alternative 1 as it has higher Equated Annual Benefit and the machine should be replaced immediately.

27. Optimum replacement cycle:

A machine used on a production line must be replaced at least every four years. Costs incurred to run the machine according to its age are:

Age of the Machine (years)					
	0	1	2	3	4
Purchase price (in Rs.)	60,000				
Maintenance (in Rs.)		16,000	18,000	20,000	20,000
Repair (in Rs.)		0	4,000	8,000	16,000
Scrap Value (in Rs.)		32,000	24,000	16,000	8,000

Future replacement will be with identical machine with same cost. Revenue is unaffected by the age of the machine. Ignoring inflation and tax, determine the optimum replacement cycle. PV factors of the cost of capital of 15% for the respective four years are 0.8696, 0.7561, 0.6575 and 0.5718.

Answer:

WN 1: Replacement Analysis:

Option 1: Replace at end of year 1:

Year	Cash flow	PVF @ 15%	DCF
0	-60,000	1.0000	-60,000
1	16,000 [-16,000 + 32,000]	0.8696	13,914
PV of outflow			-46,086
Life			1 year
PVAF (1 year and 15%)			0.8686
EAC			52,997

Option 2: Replace at end of year 2:

Year	Cash flow	PVF @ 15%	DCF
0	-60,000	1.0000	-60,000
1	-16,000	0.8696	-13,914
2	2,000 [-22,000 + 24,000]	0.7561	1,512
PV of outflow			-72,402
Life			2 years
PVAF (2 year and 15%)			1.6257
EAC			44,536

Option 3: Replace at end of year 3:

Year	Cash flow	PVF @ 15%	DCF
0	-60,000	1.0000	-60,000
1	-16,000	0.8696	-13,914
2	-22,000	0.7561	-16,634
3	-12,000 [-28,000 + 16,000]	0.6575	-7,890
PV of outflow			-98,438
Life			3 years
PVAF (3 year and 15%)			2.2832
EAC			43,114

Option 4: Replace at end of year 4:

Year	Cash flow	PVF @ 15%	DCF
0	-60,000	1.0000	-60,000
1	-16,000	0.8696	-13,914

2	-22,000	0.7561	-16,634
3	-28,000	0.6575	-18,410
4	-28,000 [-36,000 + 8,000]	0.5718	-16,010
PV of outflow			-1,24,968
Life			4 years
PVAF (4 years and 15%)			2.8550
EAC			43,772

Conclusion: EAC is lowest when machine is replaced at end of year 3. Hence the optimum replacement cycle is of 3 years.

28. Optimal replacement period:

Trouble Free Solutions (TFS) is an authorized service center of a reputed domestic air conditioner manufacturing company. All complaints/service related matters of Air conditioner are attended by this service center. The service center employs a large number of mechanics, each of whom is provided with a motor bike to attend the complaints. Each mechanic travels approximately 40000 kms per annum. TFS decides to continue its present policy of always buying a new bike for its mechanics but wonders whether the present policy of replacing the bike every three year is optimal or not. It is of believe that as new models are entering into market on yearly basis, it wishes to consider whether a replacement of either one year or two years would be better option than present three year period. The fleet of bike is due for replacement shortly in near future.

The purchase price of latest model bike is Rs. 55,000. Resale value of used bike at current prices in market is as follows:

Period	Rs.
1 Year old	35,000
2 Year old	21,000
3 Year old	9,000

Running and Maintenance expenses (excluding depreciation) are as follows:

Year	Road Taxes Insurance etc. (Rs.)	Petrol Repair Maintenance etc. (Rs.)
1	3,000	30,000
2	3,000	35,000
3	3,000	43,000

Using opportunity cost of capital as 10% you are required to determine optimal replacement period of bike.

Answer:

WN 1: Replacement Analysis:

Option 1: Replace at end of year 1:

Year	Cash flow	PVF @ 10%	DCF
0	-55,000	1.000	-55,000
1	2,000 [35,000 - 33,000]	0.909	1,818
PV of outflow			-53,182
Life			1 year
PVAF (1 year and 10%)			0.909
EAC			58,506

Option 2: Replace at end of year 2:

Year	Cash flow	PVF @ 10%	DCF
0	-55,000	1.000	-55,000
1	-33,000	0.909	-29,997
2	-17,000	0.826	-14,042

	[21,000 – 38,000]	
PV of outflow		-99,039
Life		2 years
PVAF (2 year and 10%)		1.735
EAC		57,083

Option 3: Replace at end of year 3:

Year	Cash flow	PVF @ 10%	DCF
0	-55,000	1.000	-55,000
1	-33,000	0.909	-29,997
2	-38,000	0.826	-31,388
3	-37,000 -46,000 + 9,000]	0.751	-27,787
PV of outflow			-1,44,172
Life			3 years
PVAF (3 year and 10%)			2.486
EAC			57,993

Conclusion: EAC is lowest if replacement is done at end of two years and hence the optimal replacement period is 2 years.

Part 4 – Long-term funds versus equity approach

29. Project IRR and Equity IRR:

XYZ Ltd., an infrastructure company is evaluating a proposal to build, Operate and Transfer a section of 35kms of road at a project cost of Rs 200 Cr. to be financed as follows: Equity share capital Rs50 Cr. loans at the rate of interest of 15%p.a from financial Institutions Rs150 Cr. The project after completion will be opened to traffic and a toll will be collected for a period of 15 years from the vehicles using the road. The company is also required to maintain the road during the above 15 years and after the collections of that Period; it will be handed over to the highway authorities at zero value. It is estimated that the toll revenue will be Rs. 50 Cr. per annum and the annual toll collection expenses including maintenance of the road will amount 5%p.a of the project cost. The company considers to write-off the total cost of the project straight line basis. For corporate income-tax purposes the company is allowed to take depreciation @10% on WDV basis. The financial institutions are agreeable for the repayment of the loan in 15 equal annual instalment consisting of principal and interest. Calculate project IRR and Equity IRR. Ignore corporate taxation.

Answer:**WN 1: Computation of cash flows:**

Particulars	Long-term funds	Equity shareholders
Initial outflow:		
Capital expenditure	-200.00	-200.00
New loans taken	0.00	150.00
Net outflow	-200.00	-50.00
In-between cash flow:		
Toll revenues	50.00	50.00
Less: Toll expenses	-10.00	-10.00
Less: Annual loan repayment (Note 1)	0.00	-25.65
Net cash inflow	40.00	14.35

Note 1: Computation of annual loan repayment:

$$\text{Equated loan instalment} = \frac{\text{Loan Amount}}{\text{PVAF}(15\%, 15 \text{ years})} = \frac{150}{5.84737} = 25.65 \text{ Crores}$$

WN 2: Computation of Project IRR (using long-term funds approach):

Year	Cash flow	PVF @ 18%	DCF	PVF @ 20%	DCF
0	-200.00	1.000	-200.00	1.000	-200.00
1 to 15	40.00	5.092	203.68	4.675	187.00
NPV			3.68		-13.00

$$\text{Project IRR} = 18 + \left(\frac{3.68}{3.68 - (-13.00)} \times (20 - 18) \right) = 18 + 0.44 = 18.44\%$$

WN 3: Computation of Equity IRR (using Equity shareholders cash flows)

Year	Cash flow	PVF @ 28%	DCF
0	-50.00	1.000	-50.00
1 to 15	14.35	3.483	50.00
NPV			0.00

Equity IRR = 28.00%

Part 5 – Adjusted Present Value

30. Adjusted Present Value

A Project involves an initial capital expenditure of Rs.10,00,000. The annual CFAT is Rs.2,00,000 for the next 10 years. The opportunity cost of capital is 12% which reflects the project's business risk. Issue costs are 5% of the gross proceeds of the issue. The firm can borrow upto Rs.5,00,000. The cost of debt is 6% and is payable in 10 equal annual installments of principal. Tax rate is 50%.

- Compute base case NPV
- Compute adjusted NPV

Answer:**WN 1: Computation of base-case NPV:**

- Base case NPV is computed by discounting the cash flows at cost of equity assuming the project is fully funded with equity

Year	Cash flow	PVF @ 12%	DCF
0	-10,00,000	1.000	-10,00,000
1 to 10	2,00,000	5.650	11,30,000
NPV			1,30,000

WN 2: Computation of adjusted NPV:

- Adjusted NPV = Base case NPV – Issue costs + PV of financing benefit
- **Adjusted NPV = 1,30,000 – 52,632 + 65,992 = Rs.1,43,360**

Note 1: Computation of issue costs:

- Issue costs has been considered on the entire amount raised (debt + equity). We can alternatively consider issue costs only for the debt component.
- Issue cost is 5% of gross proceeds. Hence net amount raised is 95%
- Issue costs = 10,00,000 × (5/95) = Rs.52,632

Note 2: Computation of PV of financing benefit:

Year	Opening balance	Interest	Principal repayment	Closing balance	Tax saved	PVF @ 6%	DCF
1	5,00,000	30,000	50,000	4,50,000	15,000	0.943	14,145
2	4,50,000	27,000	50,000	4,00,000	13,500	0.890	12,015
3	4,00,000	24,000	50,000	3,50,000	12,000	0.840	10,080
4	3,50,000	21,000	50,000	3,00,000	10,500	0.792	8,316
5	3,00,000	18,000	50,000	2,50,000	9,000	0.747	6,723
6	2,50,000	15,000	50,000	2,00,000	7,500	0.705	5,288
7	2,00,000	12,000	50,000	1,50,000	6,000	0.665	3,990
8	1,50,000	9,000	50,000	1,00,000	4,500	0.627	2,822
9	1,00,000	6,000	50,000	50,000	3,000	0.592	1,776
10	50,000	3,000	50,000	-	1,500	0.558	837
PV of tax saved on interest							65,992

- **Tax saving on interest is discounted at pre-tax cost of debt.** This is because tax saving comes from the debt instrument and should be discounted at the risk seen in the debt. In this case investor are expecting interest of 6 percent and hence the risk associated with debt is of 6 percent.

31. Adjusted Net Present Value Method [Nov 2020 Exam]

The Management of a multinational company TL Ltd. is engaged in construction of Infrastructure Project. A proposal to construct a Toll Road in Nepal is under consideration of the Management.

The following information is available:

- The initial investment will be in purchase of equipment costing USD 250 lakhs. The economic life of the equipment is 10 years. The depreciation on the equipment will be charged on straight line method.
- EBIDTA to be collected from the Toll Road is projected to be USD 33 lakhs per annum for a period of 20 years.
- To encourage investment Nepalese government is offering a 15 year term loan of USD 150 lakhs at an interest rate of 6 per cent per annum. The interest is to be paid annually. The loan will be repaid at the end of 15 year in one tranche.
- The required rate of return for the project under all equity financing is 12 per cent per annum.
- Post tax cost of debt is 5.6 per cent per annum. Corporate Tax Rate is 30 per cent. All cash Flows will be in USD. Ignore inflation.

You are required to advise the management on the viability of the proposal by using Adjusted Net Present Value method. Given

PVIFA (12%, 10) = 5.650, PVIFA (12%, 20) = 7.469, PVIFA (8%, 15) = 8.559, PVIF (8%, 15) = 0.315

Answer:

Adjusted NPV = Base case NPV - Issue costs + PV of financing benefits

WN 1: Computation of Base case NPV:

- Base case NPV of the project is computed as if the project is solely funded out of equity.

Computation of cash flows:

Particulars	Year 1 to 10	Year 11 to 20
EBITDA	33.00	33.00
Less: Depreciation	-25.00	-
EBIT/EBT	8.00	33.00
Less: Tax @ 30%	-2.40	-9.90
EAT	5.60	23.10
Add: Depreciation	25.00	-
CFAT	30.60	23.10

Base Case NPV computation:

(in lacs)

Year	Cash flow	PVF @ 12%	DCF
0	-250.00	1.000	-250.00
1 to 10	30.60	5.650	172.89
11 to 20	23.10	1.819	42.02
Base Case NPV			-35.09

WN 2: PV of financing benefits:

- In this case the normal interest rate on borrowing is 8% (5.6/70%). However, the company has borrowed loan at 6 percent and hence company saves interest of 2 percent as well as get tax saving on interest. The same is being calculated as under:

Particulars	Period	USD lacs	PVF @ 8%	PV (USD Lacs)
Loan	0	150.00	1.000	150.000
Interest	1 to 15	(9.00)	8.559	(77.031)
Tax saving on interest	1 to 15	2.70	8.559	23.109
Repayment of principal	15	(150.00)	0.315	(47.250)
PV of financing benefit				48.828

WN 3: Adjusted NPV

- Adjusted NPV = Base case NPV + PV of financing benefits
- Adjusted NPV = -35.090 + 48.828 = 13.738 lacs
- The company can go ahead with the project as the adjusted NPV is positive at USD 13.738 lacs

32. Adjusted Present Value:

XYZ Ltd. is presently all equity financed. The directors of the company have been evaluating investment in a project which will require Rs.270 lakhs capital expenditure on new machinery. They expect the capital investment to provide annual cash flows of Rs.42 lakhs indefinitely which is net of all tax adjustments. The discount rate which it applies to such investment decisions is 14% net.

The directors of the company believe that the current capital structure fails to take advantage of tax benefits of debt and propose to finance the new project with undated perpetual debt secured on the company's assets. The company intends to issue sufficient debt to cover the cost of capital expenditure and the after tax cost of issue.

The current annual gross rate of interest required by the market on corporate undated debt of similar risk is 10%. The after tax costs of issue are expected to be Rs.10 lakhs. Company's tax rate is 30%.

You are REQUIRED to calculate the adjusted present value of the investment.

Answer:**WN 1: Computation of adjusted present value:**

Adjusted Present Value = Base Case NPV – Issue costs + PV of financing benefit

Note 1: Computation of Base Case NPV:

- Base Case NPV is computed assuming no debt funding for the project and the cash flows are discounted at the rate given for the investment decision

$$\text{Base Case NPV} = \text{PV of inflows} - \text{PV of outflows} = \left(\frac{42}{14\%} \right) - 270 = 300 - 270 = \text{Rs. 30 lacs}$$

Note 2: PV of financing benefit:

- Cost of the project is Rs.270 lacs and the issue expenses is Rs.10 lacs. Hence the company has to raise debt of Rs.280 lacs
- Interest paid on debt of Rs.280 lacs = 280 lacs × 10% = Rs.28 lacs
- Tax benefit on interest = 28 lacs × 30% = Rs.8.4 lacs
- Hence company would have a perpetual benefit of Rs.8.4 lacs due to raising of debt and the Present value of the same would be computed in the same manner of valuing perpetuity
- Value of financing benefit = [8.4 lacs/10%] = Rs.84 lacs

Adjusted NPV = 30 lacs – 10 lacs + 84 lacs = Rs.104 lacs

Part 6 – Inflation in capital budgeting**33. Basics of inflation:**

The following are the sales and cost figures for the three years. The initial investment is Rs.5 lacs.

Details	Year 1	Year 2	Year 3
Sales	5	9	15
Costs	3	6	9

Compute NPV under each of the following situations. Each situation is to be considered separately.

- Inflation is zero. The discount rate is 5 %
- All cash flows are in money terms. Inflation is 10 %. Money discount rate is 15 %
- All cash flows are in money terms. Inflation is 10%. RDR is 8%.
- All cash flows are in real terms. Inflation is 10%. Real discount rate is 6%
- All cash inflows are in real terms. Sales inflation is 10%. Cost inflation is 5%. RDR is 4%
- All cash inflows are in money terms. Sales inflation is 10%. Cost inflation is 8%. RDR is 4%

Answer:

Answer:**Situation 1:**

Year	CF	PVF @ 5%	DCF
0	-5.00	1.000	-5.00
1	2.00	0.952	1.90
2	3.00	0.907	2.72
3	6.00	0.864	5.18
NPV			4.81

Situation 2:

- Cash flows are in money terms and hence we should discount cash flows with money discount rate

Year	CF	PVF @ 15%	DCF
0	-5.00	1.000	-5.00
1	2.00	0.870	1.74
2	3.00	0.756	2.27
3	6.00	0.658	3.95
NPV			2.96

Situation 3:

- Cash flows are in money terms and hence we should discount cash flows with money terms
- $(1 + \text{MDR}) = (1 + \text{RDR}) \times (1 + \text{Inflation})$
- $(1 + \text{MDR}) = (1 + 8\%) \times (1 + 10\%)$
- $(1 + \text{MDR}) = 1.188$
- $\text{MDR} = 0.188$ (or) 18.80%

Year	CF	PVF @ 18.80%	DCF
0	-5.00	1.000	-5.00
1	2.00	0.842	1.68
2	3.00	0.709	2.13
3	6.00	0.596	3.58
NPV			2.39

Situation 4:

- Cash flows are in real terms and hence we should discount the cash flows with real discount rate

Year	CF	PVF @ 6%	DCF
0	-5.00	1.000	-5.00
1	2.00	0.943	1.89
2	3.00	0.890	2.67
3	6.00	0.840	5.04
NPV			4.60

Situation 5:

- All cash inflows are in real terms. This would mean that cash outflows are in money terms
- Real discount rate is given in the question. We should convert money outflows into real outflows by discounting at inflation rate

Year	Inflow (real)	Outflow (nominal)	Outflow (real)	Net cash flow	PVF @ 4%	DCF
0	-	5.00	5.00	-5.00	1.000	-5.00
1	5.00	3.00	2.86	2.14	0.962	2.06
2	9.00	6.00	5.44	3.56	0.925	3.29
3	15.00	9.00	7.77	7.23	0.889	6.43
NPV						6.78

- Real outflow = Nominal outflow / $(1 + \text{Inflation rate})$
- Real outflow of year 1 = 3 lacs / $(1+5\%)^1$ = Rs.2.86 lacs
- Real outflow of year 2 = 6 lacs / $(1+5\%)^2$ = Rs.5.44 lacs
- Real outflow of year 3 = 9 lacs / $(1+5\%)^3$ = Rs.7.77 lacs

Situation 6:

- Cash inflows are in money terms. This would mean that cash outflows are in real terms. Real discount rate is given in the question and hence we should convert money cash inflows into real cash inflows by discounting at inflation rate

Year	Inflow (money)	Inflow (real)	Outflow (real)	Net cash flow	PVF @ 4%	DCF
0	-	-	5.00	-5.00	1.000	-5.00
1	5.00	4.55	3.00	1.55	0.962	1.49
2	9.00	7.44	6.00	1.44	0.925	1.33
3	15.00	11.27	9.00	2.27	0.889	2.02
NPV						-0.16

34. Inflation (May 2013 RTP)

Shashi Co. Limited has projected the following cash flows from a project under evaluation:

Year	0	1	2	3
Cash flow (in '000s)	(72)	30	40	30

The above cash flows have been made at expected prices after recognizing inflation. The firm's cost of capital is 10%. The expected annual rate of inflation is 5%. State how the viability of the project is to be evaluated.

Answer:

- It is assumed that cost of capital given in question is real discount rate
- Cash flows given are in money terms and hence we will need money discount rate to compute NPV
- $(1 + \text{RDR}) \times (1 + \text{Inflation Rate}) = (1 + \text{MDR})$
- $(1 + 10\%) \times (1 + 5\%) = (1 + \text{MDR})$
- Money discount rate = 15.50%

Computation of NPV:

Year	Cash flow	PVF @ 15.50%	DCF
0	-72,000	1.000	-72,000
1	30,000	0.866	25,980
2	40,000	0.750	30,000
3	30,000	0.649	19,470
NPV			3,450

- Project has positive NPV and hence the company can go ahead with the project.

35. Inflation:

Determine NPV of the project with the following information:

Initial Outlay of project	Rs.40,000
Annual revenues (Without inflation)	Rs.30,000
Annual costs excluding depreciation (Without inflation)	Rs.10,000
Useful life	4 years
Salvage value	Nil
Tax rate	50%
Cost of capital (including inflation premium of 10%)	12%

Answer:**WN 1: Computation of nominal cash flows:**

Year	Real cash flow	Calculation	Nominal Cash flow
1	15,000	$15,000 \times 1.10$	16,500
2	15,000	$15,000 \times 1.10 \times 1.10$	18,150
3	15,000	$15,000 \times 1.10 \times 1.10 \times 1.10$	19,965
4	15,000	$15,000 \times 1.10 \times 1.10 \times 1.10 \times 1.10$	21,962

Note 1: Computation of real cash flow:

Particulars	Amount
Revenues	30,000
Less: Costs	-10,000

Less: Depreciation	-10,000
Profit before tax	10,000
Less: Tax @ 50%	-5,000
Profit after tax	5,000
Add: Depreciation	10,000
Cash flow after tax	15,000

WN 2: Computation of NPV:

Year	Cash flow	PVF @ 12%	DCF
0	-40,000	1.000	-40,000
1	16,500	0.893	14,735
2	18,150	0.797	14,466
3	19,965	0.712	14,215
4	21,962	0.636	13,968
NPV			17,384

Note: Alternatively, we can adjust the discount rate to real discount rate and compute NPV using real cash flows.

36. Inflation

XYZ Ltd. requires Rs.8,00,000 for a new project. Useful life of project - 4 years. Salvage value -Nil. Depreciation Charge Rs.2,00,000 p.a. Expected revenues & costs (excluding depreciation) ignoring inflation.

Year	1	2	3	4
Revenues	6,00,000	7,00,000	8,00,000	8,00,000
Costs	3,00,000	4,00,000	4,00,000	4,00,000

If applicable Tax Rate is 60% and cost of capital is 10% then calculate NPV of the project, if inflation rates for revenues & costs are as follows:

Year	Revenues	Costs
1	10%	12%
2	9%	10%
3	8%	9%
4	7%	8%

Answer:**WN 1: Computation of inflation adjusted revenues:**

- It is assumed that cost of capital given in the question is nominal discount rate. Cash flows given in the question are real cash flows and hence we should convert the same into nominal cash flows by compounding at inflation rate

Year	Cash flow	Inflation rate	Calculation	Inflation adjusted cash flows
1	6,00,000	10%	$6,00,000 \times (1+10\%)$	6,60,000
2	7,00,000	9%	$7,00,000 \times (1+10\%) \times (1+9\%)$	8,39,300
3	8,00,000	8%	$8,00,000 \times (1+10\%) \times (1+9\%) \times (1+8\%)$	10,35,936
4	8,00,000	7%	$8,00,000 \times (1+10\%) \times (1+9\%) \times (1+8\%) \times (1+7\%)$	11,08,452

WN 2: Computation of inflation adjusted outflows:

Year	Cash flow	Inflation rate	Calculation	Inflation adjusted outflows
1	3,00,000	12%	$3,00,000 \times (1+12\%)$	3,36,000
2	4,00,000	10%	$4,00,000 \times (1+12\%) \times (1+10\%)$	4,92,800
3	4,00,000	9%	$4,00,000 \times (1+12\%) \times (1+10\%) \times (1+9\%)$	5,37,152
4	4,00,000	8%	$4,00,000 \times (1+12\%) \times (1+10\%) \times (1+9\%) \times (1+8\%)$	5,80,124

WN 3: Computation of cash flows after tax:

Particulars	Year 1	Year 2	Year 3	Year 4

Revenues	6,60,000	8,39,300	10,35,936	11,08,452
Less: Costs	-3,36,000	-4,92,800	-5,37,152	-5,80,124
PBDT	3,24,000	3,46,500	4,98,784	5,28,328
Less: Depreciation	-2,00,000	-2,00,000	-2,00,000	-2,00,000
PBT	1,24,000	1,46,500	2,98,784	3,28,328
Less: Tax	-74,400	-87,900	-1,79,270	-1,96,997
PAT	49,600	58,600	1,19,514	1,31,331
Add: Depreciation	2,00,000	2,00,000	2,00,000	2,00,000
CFAT	2,49,600	2,58,600	3,19,514	3,31,331

WN 4: Computation of NPV:

Year	Cash flow	PVF @ 10%	DCF
0	-8,00,000	1.000	-8,00,000
1	2,49,600	0.909	2,26,886
2	2,58,600	0.826	2,13,604
3	3,19,514	0.751	2,39,955
4	3,31,331	0.683	2,26,299
NPV			1,06,744

Part 7 – Expected NPV, Standard Deviation and co-efficient of variation**37. Calculation of NPV and Standard Deviation**

Shivam Ltd. is considering two mutually exclusive projects A and B. Project A costs Rs. 36,000 and project B Rs. 30,000. You have been given below the net present value probability distribution for each project.

Project A		Project B	
NPV estimate	Probability	NPV estimate	Probability
15,000	0.2	15,000	0.1
12,000	0.3	12,000	0.4
6,000	0.3	6,000	0.4
3,000	0.2	3,000	0.1

- ❖ Compute the expected net present values of projects A and B.
- ❖ Compute the risk attached to each project i.e. standard deviation of each probability distribution.
- ❖ Compute the profitability index of each project.
- ❖ Which project do you recommend? State with reasons.

Answer:

WN 1: Computation of risk and return of Project A:

(in '000s)

NPV	Probability	Product	Deviation	Pd ²
15	0.20	3.00	6.00	7.20
12	0.30	3.60	3.00	2.70
6	0.30	1.80	-3.00	2.70
3	0.20	0.60	-6.00	7.20
Total		9.00		19.80

- Product = NPV x Probability
- Deviation = Column 1 – Sum of product
- Column 5 = Product x Deviation x Deviation

Risk and return:

Expected NPV	Sum of products	9,000
Standard deviation	$\sqrt{Pd^2} = \sqrt{19.80}$	4,450

WN 2: Computation of risk and return of Project B:

(in '000s)

NPV	Probability	Product	Deviation	Pd ²
15	0.10	1.50	6.00	3.60
12	0.40	4.80	3.00	3.60
6	0.40	2.40	-3.00	3.60
3	0.10	0.30	-6.00	3.60
Total		9.00		14.40

Risk and return:

Expected NPV	Sum of products	9,000
Standard deviation	$\sqrt{Pd^2} = \sqrt{14.40}$	3,795

WN 3: Computation of Profitability index

$$\text{Profitability Index} = \frac{\text{PV of Inflow}}{\text{PV of outflow}}$$

Particulars	Project A	Project B
PV of outflow	36,000	30,000
NPV	9,000	9,000
PV of inflow (NPV + Outflow)	45,000	39,000
Profitability Index (Inflow/Outflow)	1.25 Times	1.30 Times

Selection of project:

- Project A and B give same amount of NPV. Hence, we can say that we are indifferent between A and B if return is criteria to select the project
- Project B carries lower risk and hence the investor would prefer Project B if risk is criteria to select the project
- Considering the above analysis, it is recommended that company goes ahead with Project B.

38. Computation of expected cash flow, standard deviation and co-efficient of variation [Nov 2020, Nov 2019 MTP, May 2022 MTP]

A Ltd. is considering two mutually exclusive projects X and Y. You have been given below the Net Cash flow probability distribution of each project:

Project X		Project Y	
Net cash flow	Probability	Net cash flow	Probability
50,000	0.30	1,30,000	0.20
60,000	0.30	1,10,000	0.30
70,000	0.40	90,000	0.50

Compute the following:

- Expected net cash flow of the project
- Variance of each project
- Standard deviation of each project
- Co-efficient of variation
- Identify which project do you recommend and why

Answer:**WN 1: Analysis of project X:**

(in '000s)

Cash flow	Probability	Product	Deviation	Pd ²
50	0.30	15.00	-11.00	36.30
60	0.30	18.00	-1.00	0.30
70	0.40	28.00	9.00	32.40
Total		61.00		69.00

Risk and return:

Expected cash flow	Sum of products	61,000
Variance	$69.00 \times 1,000 \times 1,000$	6,90,00,000
Standard deviation	$\sqrt{Pd^2} = \sqrt{69.00}$	8,306
Co-efficient of variation	$8,306/61,000$	0.136 (or) 13.60%

WN 2: Analysis of project Y:

(in '000s)

Cash flow	Probability	Product	Deviation	Pd^2
130	0.20	26.00	26.00	135.20
110	0.30	33.00	6.00	10.80
90	0.50	45.00	-14.00	98.00
Total		104.00		244.00

Risk and return:

Expected cash flow	Sum of products	1,04,000
Variance	$244.00 \times 1,000 \times 1,000$	24,40,00,000
Standard deviation	$\sqrt{Pd^2} = \sqrt{244}$	15,620
Co-efficient of variation	$15,620/1,04,000$	0.150 (or) 15.00%

Conclusion:

In project X risk per rupee of cash flow is 0.136 (approx.) while in project Y it is 0.15 (approx.). Therefore, Project X is better than Project Y.

39. Selection of project:

Cyber Company is considering two mutually exclusive projects. Investment outlay of both the projects is Rs. 5,00,000 and each is expected to have a life of 5 years. Under three possible situations their annual cash flows and probabilities are as under:

Situation	Probabilities	Cash Flow (Rs.)	
		Project A	Project B
Good	0.30	6,00,000	5,00,000
Normal	0.40	4,00,000	4,00,000
Worse	0.30	2,00,000	3,00,000

The cost of capital is 7 per cent, which project should be accepted? Explain with workings.

Answer:**WN 1: Computation of expected cash flow and standard deviation of every year:****Year 1 to 5 of Project A:**

(in lacs)

Cash flow	Probability	Product	Deviation	Pd^2
6	0.3	1.80	2.00	1.20
4	0.4	1.60	0.00	0
2	0.3	0.60	-2.00	1.20
Total		4.00		2.40

Expected cash flow and SD:

Expected cash flow	Sum of products	4.00
Standard deviation	$\sqrt{Pd^2} = \sqrt{2.40}$	1.55

Year 1 to 5 of Project B:

(in lacs)

Cash flow	Probability	Product	Deviation	Pd^2

5	0.3	1.50	1.00	0.30
4	0.4	1.60	0.00	0
3	0.3	0.90	-1.00	0.30
Total		4.00		0.60

Expected cash flow and SD:

Expected cash flow	Sum of products	4.00
Standard deviation	$\sqrt{Pd^2} = \sqrt{0.60}$	0.77

WN 2: Computation of NPV and standard deviation of Project A:(in lacs)

Year	Cash flow	PVF @ 7%	DCF
0	-5.00	1.000	-5.00
1 to 5	4.00	4.100	16.40
Expected NPV			11.40

- Expected NPV = Rs.11,40,000

Computation of Standard deviation of Project A:

Year	SD	PVF @ 7%	DSD [SD x PVF]	DSD ²
1	1.55	0.935	1.45	2.10
2	1.55	0.873	1.35	1.82
3	1.55	0.816	1.26	1.59
4	1.55	0.763	1.18	1.39
5	1.55	0.713	1.11	1.23
Total			6.35	8.13

Expected SD:

SD if cash flows are dependent	Sum of DSD	Rs.6.35 lacs
SD if cash flows are independent	$\sqrt{DSD^2} = \sqrt{8.13}$	Rs.2.85 lacs

WN 3: Computation of NPV and standard deviation of Project B:(in lacs)

Year	Cash flow	PVF @ 7%	DCF
0	-5.00	1.000	-5.00
1 to 5	4.00	4.100	16.40
Expected NPV			11.40

- Expected NPV = Rs.11,40,000

Computation of Standard deviation of Project A:

Year	SD	PVF @ 7%	DSD [SD x PVF]	DSD ²
1	0.77	0.935	0.72	0.52
2	0.77	0.873	0.67	0.45
3	0.77	0.816	0.63	0.40
4	0.77	0.763	0.59	0.35
5	0.77	0.713	0.55	0.30
Total			3.16	2.02

Expected SD:

SD if cash flows are dependent	Sum of DSD	Rs.3.16 lacs
SD if cash flows are independent	$\sqrt{DSD^2} = \sqrt{2.02}$	Rs.1.42 lacs

Conclusion:

NPV in both projects being the same, the project should be decided on the basis of standard deviation and hence project 'B' should be accepted having lower standard deviation, means less risky.

40. Co-efficient of variation calculation:

A company is considering projects X and Y with following information:

Project	Expected NPV	Standard Deviation
X	1,22,000	90,000
Y	2,25,000	1,20,000

- ❖ Which project will you recommend based on the above data?
- ❖ Explain whether your opinion will change, if you use co-efficient of variation as a measure of risk

Answer:**Part 1:**

- Selection of project will depend on risk appetite of the investor
- An aggressive investor would focus on increasing the returns and he would go for Project Y as it has higher returns
- A conservative investor would focus on reducing the risk and he would go for Project X as it has lower risk

Part 2: Computation of co-efficient of variation:

Particulars	Project X	Project Y
Risk (A)	90,000	1,20,000
Return (B)	1,22,000	2,25,000
Co-efficient of variation (A/B)	0.7377	0.5333

- The company should go ahead with Project Y as it has lower co-efficient of variation.

41. Standard Deviation computation: [Nov 2016 RTP]

Jet Airways is planning to acquire a light commercial aircraft for flying class clients at an investment of Rs.50,00,000. The expected cash flow after tax for the next three years is as follows:

Year 1		Year 2		Year 3	
CFAT	Probability	CFAT	Probability	CFAT	Probability
14,00,000	0.1	15,00,000	0.1	18,00,000	0.2
18,00,000	0.2	20,00,000	0.3	25,00,000	0.5
25,00,000	0.4	32,00,000	0.4	35,00,000	0.2
40,00,000	0.3	45,00,000	0.2	48,00,000	0.1

The Company wishes to take into consideration all possible risk factor relating to an airline operations. The company wants to know:

1. The expected NPV assuming with 6 % risk free rate of interest.
2. The possible deviation in the expected value
 - a) If the cash flows are independent
 - b) If the cash flows are dependent

Answer:**WN 1: Computation of expected cash flow and standard deviation of year 1, 2 and 3:****Year 1:****(in lacs)**

Cash flow	Probability	Product	Deviation	Pd ²
14	0.1	1.40	-13.00	16.90
18	0.2	3.60	-9.00	16.20
25	0.4	10.00	-2.00	1.60
40	0.3	12.00	13.00	50.70

Total		27.00		85.40

Expected cash flow and SD:

Expected cash flow	Sum of products	27.00
Standard deviation	$\sqrt{Pd^2} = \sqrt{85.40}$	9.24

Year 2:

(in lacs)

Cash flow	Probability	Product	Deviation	Pd ²
15	0.1	1.50	-14.30	20.45
20	0.3	6.00	-9.30	25.95
32	0.4	12.80	2.70	2.92
45	0.2	9.00	15.70	49.30
Total		29.30		98.62

Expected cash flow and SD:

Expected cash flow	Sum of products	29.30
Standard deviation	$\sqrt{Pd^2} = \sqrt{98.62}$	9.93

Year 3:

(in lacs)

Cash flow	Probability	Product	Deviation	Pd ²
18	0.2	3.60	-9.90	19.60
25	0.5	12.50	-2.90	4.21
35	0.2	7.00	7.10	10.08
48	0.1	4.80	20.10	40.40
Total		27.90		74.29

Expected cash flow and SD:

Expected cash flow	Sum of products	27.90
Standard deviation	$\sqrt{Pd^2} = \sqrt{74.29}$	8.62

WN 2: Computation of expected NPV:

(in lacs)

Year	Cash flow	PVF @ 6%	DCF
0	-50.00	1.000	-50.00
1	27.00	0.943	25.46
2	29.30	0.890	26.08
3	27.90	0.840	23.44
Expected NPV			24.98

- Expected NPV = Rs.24,98,000

WN 3: Computation of Standard deviation:

Year	SD	PVF @ 6%	DSD [SD x PVF]	DSD ²
1	9.24	0.943	8.71	75.86
2	9.93	0.890	8.84	78.15
3	8.62	0.840	7.24	52.42
Total			24.79	206.43

Note:

- Dependent cash flows are considered to be riskier. In this case a weak cash flow will always be followed by a weak cash flow and a good cash flow will always be followed by a good cash flow
- Hence SD of dependent cash flows is always higher than cash flows of independent cash flows
- Sum of Discounted standard deviation (Col 4) gives the SD of dependent cash flows
- Column 5 is basically square of column 4. We square the number and sum them. Post this we take a square root. This would be called as SD if cash flows are independent

Expected SD:

SD if cash flows are dependent	Sum of DSD	Rs.24.79 lacs
SD if cash flows are independent	$\sqrt{\text{DSD}^2} = \sqrt{206.43}$	Rs.14.37 lacs

42. Selection of project:

Cyber Company is considering two mutually exclusive projects. Investment outlay of both the projects is Rs. 5,00,000 and each is expected to have a life of 5 years. Under three possible situations their annual cash flows and probabilities are as under:

Situation	Probabilities	Cash Flow (Rs.)	
		Project A	Project B
Good	0.30	6,00,000	5,00,000
Normal	0.40	4,00,000	4,00,000
Worse	0.30	2,00,000	3,00,000

The cost of capital is 7 per cent, which project should be accepted? Explain with workings.

Answer:**WN 1: Computation of expected cash flow and standard deviation of every year:****Year 1 to 5 of Project A:****(in lacs)**

Cash flow	Probability	Product	Deviation	Pd ²
6	0.3	1.80	2.00	1.20
4	0.4	1.60	0.00	0
2	0.3	0.60	-2.00	1.20
Total		4.00		2.40

Expected cash flow and SD:

Expected cash flow	Sum of products	4.00
Standard deviation	$\sqrt{\text{Pd}^2} = \sqrt{2.40}$	1.55

Year 1 to 5 of Project B:**(in lacs)**

Cash flow	Probability	Product	Deviation	Pd ²
5	0.3	1.50	1.00	0.30
4	0.4	1.60	0.00	0
3	0.3	0.90	-1.00	0.30
Total		4.00		0.60

Expected cash flow and SD:

Expected cash flow	Sum of products	4.00
Standard deviation	$\sqrt{\text{Pd}^2} = \sqrt{0.60}$	0.77

WN 2: Computation of NPV and standard deviation of Project A:**(in lacs)**

Year	Cash flow	PVF @ 7%	DCF

0	-5.00	1.000	-5.00
1 to 5	4.00	4.100	16.40
Expected NPV			11.40

- Expected NPV = Rs.11,40,000

Computation of Standard deviation of Project A:

Year	SD	PVF @ 7%	DSD [SD x PVF]	DSD ²
1	1.55	0.935	1.45	2.10
2	1.55	0.873	1.35	1.82
3	1.55	0.816	1.26	1.59
4	1.55	0.763	1.18	1.39
5	1.55	0.713	1.11	1.23
Total			6.35	8.13

Expected SD:

SD if cash flows are dependent	Sum of DSD	Rs.6.35 lacs
SD if cash flows are independent	$\sqrt{\text{DSD}^2} = \sqrt{8.13}$	Rs.2.85 lacs

WN 3: Computation of NPV and standard deviation of Project B:

(in lacs)

Year	Cash flow	PVF @ 7%	DCF
0	-5.00	1.000	-5.00
1 to 5	4.00	4.100	16.40
Expected NPV			11.40

- Expected NPV = Rs.11,40,000

Computation of Standard deviation of Project A:

Year	SD	PVF @ 7%	DSD [SD x PVF]	DSD ²
1	0.77	0.935	0.72	0.52
2	0.77	0.873	0.67	0.45
3	0.77	0.816	0.63	0.40
4	0.77	0.763	0.59	0.35
5	0.77	0.713	0.55	0.30
Total			3.16	2.02

Expected SD:

SD if cash flows are dependent	Sum of DSD	Rs.3.16 lacs
SD if cash flows are independent	$\sqrt{\text{DSD}^2} = \sqrt{2.02}$	Rs.1.42 lacs

Conclusion:

NPV in both projects being the same, the project should be decided on the basis of standard deviation and hence project 'B' should be accepted having lower standard deviation, means less risky.

43. NPV and Standard Deviation:

KLM Ltd., is considering taking up one of the two projects-Project-K and Project-So Both the projects having same life require equal investment of Rs. 80 lakhs each. Both are estimated to have almost the same yield. As the company is new to this type of business, the cash flow arising from the projects cannot be estimated with certainty. An attempt was therefore, made to use probability to analyse the pattern of cash flow from other projects during the first year of operations. This pattern is likely to continue during the life of these projects. The results of the analysis are as follows:

Project K		Project S	
Cash Flow (in Rs.)	Probability	Cash Flow (in Rs.)	Probability
11	0.1	9	0.1
13	0.2	13	0.25
15	0.4	17	0.3
17	0.2	21	0.25
19	0.1	25	0.1

Required:

- Calculate variance, standard deviation and co-efficient of variance for both the projects.
- Which of the two projects is riskier?

Answer:**WN 1: Computation of Variance, SD and Co-efficient of variation or Project K**

Cash flow	Probability	Product	Deviation	Pd ²
11	0.1	1.1	-4	1.6
13	0.2	2.6	-2	0.8
15	0.4	6	0	0
17	0.2	3.4	2	0.8
19	0.1	1.9	4	1.6
Total		15		4.8

Solution:

Expected cash flow	Sum of products	15.00
Variance		4.80
Standard deviation	$\sqrt{Pd^2} = \sqrt{4.80}$	2.19
Co-efficient of variation	$\frac{2.19}{15.00}$	0.146

WN 2: Computation of Variance, SD and Co-efficient of variation or Project S

Cash flow	Probability	Product	Deviation	Pd ²
9	0.10	0.90	-8.00	6.40
13	0.25	3.25	-4.00	4.00
17	0.30	5.10	0.00	0.00
21	0.25	5.25	4.00	4.00
25	0.10	2.50	8.00	6.40
Total		17.00		20.80

Solution:

Expected cash flow	Sum of products	17.00
Variance		20.80
Standard deviation	$\sqrt{Pd^2} = \sqrt{20.80}$	4.56
Co-efficient of variation	$\frac{4.56}{17.00}$	0.268

Project S is riskier as it has higher Coefficient of Variation

44. NPV and standard deviation [May 2019 MTP, Nov 2019, May 2018 RTP]

Project X and Project Y are under the evaluation of XY company. The estimated cash flows and their probabilities are as below:

Project X: Investment of Rs.70 lacs in year 0

Probability weights	0.30	0.40	0.30
Years	Rs.Lacs	Rs.Lacs	Rs.Lacs

1	30	50	65
2	30	40	55
3	30	40	45

Project Y: Investment of Rs.80 lacs in year 0; Life = 3 years

Probability weights	Annual cash flows through life
Years	Rs.Lacs
0.20	40
0.50	45
0.30	50

- Which project is better based on NPV, criterion with a discount rate of 10%?
- Compute the standard deviation of the present value distribution and analyse the inherent risk of the projects

Answer:

WN 1: Computation of expected cash flow and standard deviation of Project X for year 1, 2 and 3:

Year 1:

(in lacs)

Cash flow	Probability	Product	Deviation	Pd ²
30	0.3	9.00	-18.50	102.68
50	0.4	20.00	1.50	0.90
65	0.3	19.50	16.50	81.67
Total		48.50		185.25

Expected cash flow and SD:

Expected cash flow	Sum of products	48.50
Standard deviation	$\sqrt{Pd^2} = \sqrt{185.25}$	13.61

Year 2:

(in lacs)

Cash flow	Probability	Product	Deviation	Pd ²
30	0.3	9.00	-11.50	39.68
40	0.4	16.00	-1.50	0.90
55	0.3	16.50	13.50	54.67
Total		41.50		95.25

Expected cash flow and SD:

Expected cash flow	Sum of products	41.50
Standard deviation	$\sqrt{Pd^2} = \sqrt{95.25}$	9.76

Year 3:

(in lacs)

Cash flow	Probability	Product	Deviation	Pd ²
30	0.3	9.00	-8.50	21.68
40	0.4	16.00	1.50	0.90
45	0.3	13.50	6.50	12.67
Total		38.50		35.25

Expected cash flow and SD:

Expected cash flow	Sum of products	38.50
Standard deviation	$\sqrt{Pd^2} = \sqrt{35.25}$	5.94

WN 2: Computation of expected NPV of Project X:**(in lacs)**

Year	Cash flow	PVF @ 10%	DCF
0	-70.00	1.000	-70.00
1	48.50	0.909	44.09
2	41.50	0.826	34.28
3	38.50	0.751	28.91
Expected NPV			37.28

- Expected NPV = Rs.37,28,000

WN 3: Computation of Standard deviation of Project X:

Year	SD	PVF @ 10%	DSD [SD x PVF]	DSD ²
1	13.61	0.909	12.37	153.02
2	9.76	0.826	8.06	64.96
3	5.94	0.751	4.46	19.89
Total			24.89	237.87

Expected SD:

SD if cash flows are dependent	Sum of DSD	Rs.24.89 lacs
SD if cash flows are independent	$\sqrt{\text{DSD}^2} = \sqrt{237.87}$	Rs.15.42 lacs

WN 4: Computation of expected cash flow and standard deviation of Project Y for year 1, 2 and 3:**Year 1 to 3:****(in lacs)**

Cash flow	Probability	Product	Deviation	Pd ²
40	0.2	8.00	-5.50	6.05
45	0.5	22.50	-0.50	0.13
50	0.3	15.00	4.50	6.07
Total		45.50		12.25

Expected cash flow and SD:

Expected cash flow	Sum of products	45.50
Standard deviation	$\sqrt{\text{Pd}^2} = \sqrt{12.25}$	3.50

WN 5: Computation of expected NPV of Project Y:**(in lacs)**

Year	Cash flow	PVF @ 10%	DCF
0	-80.00	1.000	-80.00
1 to 3	45.50	2.487	113.16
Expected NPV			33.16

- Expected NPV = Rs.33,16,000

WN 6: Computation of Standard deviation of Project Y:

Year	SD	PVF @ 10%	DSD [SD x PVF]	DSD ²
1	3.50	0.909	3.18	10.11
2	3.50	0.826	2.89	8.35
3	3.50	0.751	2.63	6.92

Total	8.70	25.38

Expected SD:

SD if cash flows are dependent	Sum of DSD	Rs.8.70 lacs
SD if cash flows are independent	$\sqrt{\text{DSD}^2} = \sqrt{25.38}$	Rs.5.04 lacs

45. Best-case and worst-case NPV

Following are the estimates of the net cash flows and probability of a new project of ABC Limited:

	Year	P = 0.3	P = 0.5	P = 0.2
Initial investment	0	4,00,000	4,00,000	4,00,000
Inflows per year	1 to 5	1,00,000	1,10,000	1,20,000
Estimated salvage value (after tax)	5	20,000	50,000	60,000

Required rate of return from the project is 10%. Find:

- The expected NPV of the project.
- The best case and the worst case NPVs.
- The probability of occurrence of the worst case if the cash flows are perfectly dependent overtime and independent overtime.
- Standard deviation and coefficient of variation assuming that there are only three streams of cash flow, which are represented by each column of the table with the given probabilities.
- Coefficient of variation of ABC Limited on its average project which is in the range of 0.95 to 1.0. If the coefficient of variation of the project is found to be less risky than average, 100 basis points are deducted from the Company's cost of Capital Should the project be accepted by ABC Limited

Answer:**WN 1: Computation of different NPV:**

Year	Cash flow			PVF @ 10%	DCF		
	P = 0.3	P = 0.5	P = 0.2		P = 0.3	P = 0.5	P = 0.2
0	-4,00,000	-4,00,000	-4,00,000	1.000	-4,00,000	-4,00,000	-4,00,000
1 to 5	1,00,000	1,10,000	1,20,000	3.791	3,79,100	4,17,010	4,54,920
5	20,000	50,000	60,000	0.621	12,420	31,050	37,260
Total					-8,480	48,060	92,180

WN 2: Computation of expected NPV, SD and Coefficient of variation:

NPV	Probability	Product	Deviation	Pd ²
-8,480	0.30	-2,544	-48,402	70,28,26,081
48,060	0.50	24,030	8,138	3,31,13,522
92,180	0.20	18,436	52,258	54,61,79,712
Total		39,922		128,21,19,315

Risk, return and CV:

Expected NPV [Part i]	Sum of products	39,922
Standard deviation [Part iv]	$\sqrt{\text{Pd}^2} = \sqrt{128,21,19,315}$	35,807
Co-efficient of variation [Part iv]	$\frac{\text{SD}}{\text{NPV}} = \frac{35,807}{39,922}$	0.8969

WN 3: Best case, worst case and Probability Analysis:

- Best case NPV [Part ii] = Rs.92,180 [Maximum of three NPV computed in WN 1]
- Worst case NPV [Part ii] = Rs.-8,480 [Lowest of three NPV computed in WN 1]

Probability:

- Probability of worst case NPV if cash flows are dependent:** This would mean cash flows of year 2 is dependent on what happens in year 1. Probability of worst cash flow is 0.3 and if the cash flows

are dependent then the company would continue to get worst cash flow every year. Hence overall probability of worst case NPV is 30% [0.30]

- **Probability of worst case NPV if cash flows are independent:** In this case there is no dependency between cash flow of one year with another year. We should get worst cash flows in every year to get the worst case NPV. **Probability of worst case NPV = $0.30 \times 0.30 \times 0.30 \times 0.30 \times 0.30 = 0.00243$ (or) 0.243%**

Computation of revised NPV:

- Co-efficient of variation of a typical project is in the range of 0.95 to 1.0. This project has lower co-efficient of variation as reflected in CV of 0.8969
- Lower CV indicates lower risk. Normal project has discount rate of 10% and this project will have discount rate of 9%

Year	Cash flow			PVF @ 9%	DCF		
	P = 0.3	P = 0.5	P = 0.2		P = 0.3	P = 0.5	P = 0.2
0	-4,00,000	-4,00,000	-4,00,000	1.000	-4,00,000	-4,00,000	-4,00,000
1 to 5	1,00,000	1,10,000	1,20,000	3.890	3,89,000	4,27,900	4,66,800
5	20,000	50,000	60,000	0.650	13,000	32,500	39,000
Total					2,000	60,400	1,05,800

- Revised NPV of project = $(2,000 \times 0.30) + (60,400 \times 0.50) + (1,05,800 \times 0.20) = \text{Rs.}51,960$

Conclusion: Project would continue to be accepted as the same makes positive NPV of Rs.51,960.

46. Best and worst case NPV [May 2022 RTP]

ASG Ltd. is considering a project "Z" with an initial outlay of Rs.15,00,000 and life of 5 years. The estimates of project are as follows:

Particulars	Lower estimates	Base	Upper estimates
Sales (units)	9,000	10,000	11,000
	Amount	Amount	Amount
Selling price per unit	175	200	225
Variable cost per unit	100	125	150
Fixed cost	1,00,000	1,50,000	2,00,000

Depreciation included in Fixed cost is Rs.70,000 and corporate tax is 25%. Assuming the cost of capital as 15%, DETERMINE NPV in three scenarios i.e worst, base and best case scenario.

Answer:

Answer:

WN 1: Computation of CFAT under different scenarios:

- Best case = Highest units (11,000), highest SP (225), lowest VC (100) and lowest FC (1,00,000)
- Worst case = Lowest units (9,000), lowest SP (175), highest V (150) and highest FC (2,00,000)
- Base case = As given in question

Particulars	Worst	Base	Best
Sales (units)	9,000	10,000	11,000
Selling price	175	200	225
Less: VC per unit	150	125	100
Contribution per unit	25	75	125
Total Contribution	2,25,000	7,50,000	13,75,000
Less: Fixed cost	-2,00,000	-1,50,000	-1,00,000
Profit before tax	25,000	6,00,000	12,75,000
Less: Tax @ 25%	-6,250	-1,50,000	-3,18,750
Profit after tax	18,750	4,50,000	9,56,250
Add: Depreciation	70,000	70,000	70,000
Cash flow after tax	88,750	5,20,000	10,26,250

WN 2: Computation of NPV:

Particulars	Worst	Base	Best

Initial outlay	15,00,000	15,00,000	15,00,000
Cash inflow per year	88,750	5,20,000	10,26,250
Cumulative PVF for 5 years	3.353	3.353	3.353
PV of cash inflows	2,97,579	17,43,560	34,41,016
NPV	-12,02,421	2,43,560	19,41,016

47. Best case NPV and worst case NPV [Nov 2015 RTP, Nov 2021 MTP]

XY Limited has under its consideration a project with an initial investment of Rs.1,00,000. Three probable cash inflow scenarios with their probabilities of occurrence have been estimated as follows:

Annual cash inflow	20,000	30,000	40,000
Probability	0.10	0.70	0.20

The present life is 5 years and the desired rate of return is 20%. The estimated terminal values of the project assets under the three probability alternatives, respectively, are Rs.0, Rs.20,000 and Rs.30,000

You are required to:

- Find the probable NPV
- Find the worst-case NPV and the best-case NPV and
- State the probability occurrence of the worst case, if the cash flows are perfectly positively correlated over time

Answer:

WN 1: Computation of different NPV:

(in '000s)

Year	Cash flow			PVF @ 20%	DCF		
	P = 0.1	P = 0.7	P = 0.2		P = 0.1	P = 0.7	P = 0.2
0	-100	-100	-100	1.000	-100.00	-100.00	-100.00
1 to 5	20	30	40	2.991	59.82	89.73	119.64
5	0	20	30	0.402	0.00	8.04	12.06
Total					-40.18	-2.23	31.70

WN 2: Computation of probable NPV:

NPV	Probability	Product
-40.18	0.10	-4.02
-2.23	0.70	-1.56
31.70	0.20	6.34
Total		0.76

WN 3: Solution:

Probable NPV (WN 2)	760
Worst-case NPV (WN 1)	-40,180
Best-case NPV (WN 1)	31,700
Probability of worst-case NPV [Cash flows are dependent]	10%

Part 8 – RADR and CEF

48. RADR [May 2018 MTP, Nov 2018 MTP, May 2019 RTP, Nov 2019 RTP, May 2022 MTP]

An enterprise is investing Rs.100 lakhs in a project. The risk-free rate of return is 7%. Risk premium expected by the management is 7%. The life of the project is 5 years. Following are the cash flows that are estimated over the life of the project.

Year	Cash flows (in lacs)
1	25
2	60
3	75
4	80
5	65

Calculate NPV of the project based on risk-free rate and also on the basis of risk adjusted discount rate.

Answer:

Answer:

WN 1: Computation of NPV based on risk-free rate of 7%:

Year	Cash flow (in lacs)	PVF @ 7%	DCF (in lacs)
0	-100.00	1.000	-100.00
1	25.00	0.935	23.38
2	60.00	0.873	52.38
3	75.00	0.816	61.20
4	80.00	0.763	61.04
5	65.00	0.713	46.35
NPV			144.34

WN 2: Computation of NPV based on RADR of 14%:

- Risk-free rate is 7% and there is a risk premium of 7%. Hence risk-adjusted discount rate is 14%

Year	Cash flow (in lacs)	PVF @ 14%	DCF (in lacs)
0	-100.00	1.000	-100.00
1	25.00	0.877	21.93
2	60.00	0.769	46.14
3	75.00	0.675	50.63
4	80.00	0.592	47.36
5	65.00	0.519	33.74
NPV			99.80

49. RADR Approach (July 2021)

K.P. Ltd. is investing Rs.50 lakhs in a project. The life of the project is 4 years. Risk free rate of return is 6% and risk premium is 6%, other information is as under

Sales of 1 st year	Rs.50,00,000
Sales of 2 nd year	Rs.60,00,000
Sales of 3 rd year	Rs.70,00,000
Sales of 4 th year	Rs.80,00,000
PVR (same in all years)	50%
Fixed cost (excluding depreciation) of first year	Rs.10,00,000
Fixed cost (excluding depreciation) of second year	Rs.12,00,000
Fixed cost (excluding depreciation) of third year	Rs.14,00,000
Fixed cost (excluding depreciation) of fourth year	Rs.16,00,000

Ignoring interest and taxes. You are required to calculate NPV of given project on the basis of Risk Adjusted Discount Rate.

Answer:

WN 1: Computation of project cash flows:

Particulars	Year 1	Year 2	Year 3	Year 4
Sales	50,00,000	60,00,000	70,00,000	80,00,000
Contribution [Sales x PVR]	25,00,000	30,00,000	35,00,000	40,00,000
Less: Fixed cost	-10,00,000	-12,00,000	-14,00,000	-16,00,000
PBDT/CFAT	15,00,000	18,00,000	21,00,000	24,00,000

Note: Interest and taxes are to be ignored and hence PBDT would be equal to CFAT.

WN 2: Computation of Risk-adjusted NPV:

Year	Cash flow	PVF @ 12%	DCF
0	-50,00,000	1.000	-50,00,000

1	15,00,000	0.893	13,39,500
2	18,00,000	0.797	14,34,600
3	21,00,000	0.712	14,95,200
4	24,00,000	0.636	57,95,700
NPV of project			7,95,700

50. Risk Adjusted Discount Rate [May 2016]

ABC Limited is evaluating 3 projects, P-I, P-II, P-III. Following information is available in respect of these projects:

Particulars	P-I	P-II	P-III
Cost	Rs.15,00,000	Rs.11,00,000	Rs.19,00,000
Inflows-Year1	Rs.6,00,000	Rs.6,00,000	Rs.4,00,000
Year 2	Rs.6,00,000	Rs.4,00,000	Rs.6,00,000
Year 3	Rs.6,00,000	Rs.5,00,000	Rs.8,00,000
Year 4	Rs.6,00,000	Rs.2,00,000	Rs.12,00,000
Risk Index	1.80	1.00	0.60

Minimum required rate of return of the firm is 15% and applicable tax rate is 40%. The risk-free interest rate is 10%.

Required:

- (i) Find out the risk-adjusted discount rate (RADR) for these projects.
(ii) Which project is the best?

Answer:**WN 1: Computation of Risk-adjusted discount rate:**

$$\text{RADR} = R_f + \text{Risk index} \times (R_m - R_f)$$

$$\text{RADR of P1} = 10 + 1.80 \times (15 - 10) = 19.00\%$$

$$\text{RADR of P2} = 10 + 1.00 \times (15 - 10) = 15.00\%$$

$$\text{RADR of P3} = 10 + 0.60 \times (15 - 10) = 13.00\%$$

WN 2: Computation of NPV:**Project 1**

Year	Cash flow	PVF @ 19%	DCF
0	-15,00,000	1.000	-15,00,000
1	6,00,000	0.840	5,04,000
2	6,00,000	0.706	4,23,600
3	6,00,000	0.593	3,55,800
4	6,00,000	0.499	2,99,400
Risk-adjusted NPV			82,800

Project 2:

Year	Cash flow	PVF @ 15%	DCF
0	-11,00,000	1.000	-11,00,000
1	6,00,000	0.870	5,22,000
2	4,00,000	0.756	3,02,400
3	5,00,000	0.658	3,29,000
4	2,00,000	0.572	1,14,400
Risk-adjusted NPV			1,67,800

Project 3:

Year	Cash flow	PVF @ 13%	DCF
0	-19,00,000	1.000	-19,00,000

1	4,00,000	0.885	3,54,000
2	6,00,000	0.783	4,69,800
3	8,00,000	0.693	5,54,400
4	12,00,000	0.613	7,35,600
Risk-adjusted NPV			2,13,800

Conclusion:

- The company should go ahead with Project 3 as it has highest risk-adjusted NPV

51. RADR [May 2019 MTP]

Determine the risk adjusted net present value of the following projects:

Particulars	X	Y	Z
Net cash outlays	2,10,000	1,20,000	1,00,000
Project life	5 years	5 years	5 years
Annual cash inflow	70,000	42,000	30,000
Coefficient of variation	1.20	0.80	0.40

The company selects the risk-adjusted rate of discount on the basis of the co-efficient of variation:

Coefficient of variation	RADR	PV factor of 1 to 5 years at RADR
0.0	10%	3.791
0.4	12%	3.605
0.8	14%	3.433
1.2	16%	3.274
2.0	22%	2.864
More than 2.0	25%	2.689

Answer:**WN 1: Identification of discount rate for different projects:**

Project	Coefficient of variation	RADR
X	1.20	16%
Y	0.80	14%
Z	0.40	12%

WN 2: Computation of NPV:**Project X:**

Year	Cash flow	PVF @ 16%	DCF
0	-21,00,000	1.000	-2,10,000
1 to 5	70,000	3.274	2,29,180
Risk-adjusted NPV			19,180

Project Y:

Year	Cash flow	PVF @ 14%	DCF
0	-1,20,000	1.000	-1,20,000
1 to 5	42,000	3.433	1,44,186
Risk-adjusted NPV			24,186

Project Z:

Year	Cash flow	PVF @ 12%	DCF
0	-1,00,000	1.000	-1,00,000
1 to 5	30,000	3.605	1,08,150
Risk-adjusted NPV			8,150

52. CEF Approach [Jan 2021, Nov 2018 RTP, May 2020 RTP]

A project requires an outlay of Rs.3,00,000. The company uses certainty equivalent method approach to evaluate the project. The risk-free rate is 7%. Following information is available:

Year-end	Cash flow	C.E.F

1	1,00,000	0.90
2	1,50,000	0.80
3	1,15,000	0.60
4	1,00,000	0.55
5	50,000	0.50

Evaluate the above. Is investment in the project beneficial?

Answer:

Computation of NPV of Project X using Certainty equivalent factor approach:

Year	Cash flows			PVF @ 7%	DCF
	Uncertain	CEF	Certain		
0	-3,00,000	1.00	-3,00,000	1.000	-3,00,000
1	1,00,000	0.90	90,000	0.935	84,150
2	1,50,000	0.80	1,20,000	0.873	1,04,760
3	1,15,000	0.60	69,000	0.816	56,304
4	1,00,000	0.55	55,000	0.763	41,965
5	50,000	0.50	25,000	0.713	17,825
Expected NPV					5,004

Note:

- Certain cash flow = Uncertain cash flow x CEF
- DCF = Certain cash flow x PVF

Conclusion:

Since the NPV of the project is positive, it is beneficial to invest in the project

53. Certainty equivalent approach [May 2021 MTP, Nov 2020 RTP]

Oil country tubular Ltd. is considering an investment in one of the two mutually exclusive proposals – Projects X and Y, which require cash outlays of Rs.3, 40,000 and Rs.3, 30,000 respectively. The certainty-equivalent (C.E.) approach is used in incorporating risk in capital budgeting decisions. The current yield on government bond is 8% and this be used as the risk free rate. The expected net cash flows and their certainty-equivalents are as follows:

Year-end	Project X		Project Y	
	Cash flow	C.E.F	Cash flow	C.E.F
1	1,80,000	0.8	1,80,000	0.9
2	2,00,000	0.7	2,00,000	0.8
3	2,00,000	0.5	2,00,000	0.7

Required:

- Which project should be accepted?
- If risk adjusted discount rate method is used, which project would be analyzed with a higher rate?
- Discuss the advantages of certainty equivalent method?

Answer:

WN 1: Computation of NPV of Project X using Certainty equivalent factor approach:

Year	Cash flows			PVF @ 8%	DCF
	Uncertain	CEF	Certain		
0	-3,40,000	1.0	-3,40,000	1.000	-3,40,000
1	1,80,000	0.8	1,44,000	0.926	1,33,344
2	2,00,000	0.7	1,40,000	0.857	1,19,980
3	2,00,000	0.5	1,00,000	0.794	79,400
Expected NPV					-7,276

Note:

- Certain cash flow = Uncertain cash flow x CEF

- $DCF = \text{Certain cash flow} \times PVF$

WN 2: Computation of NPV of Project Y using certainty equivalent factor approach:

Year	Cash flows			PVF @ 8%	DCF
	Uncertain	CEF	Certain		
0	-3,30,000	1.0	-3,30,000	1.000	-3,30,000
1	1,80,000	0.9	1,62,000	0.926	1,50,012
2	2,00,000	0.8	1,60,000	0.857	1,37,120
3	2,00,000	0.7	1,40,000	0.794	1,11,160
Expected NPV					68,292

Conclusion:

- The company should go ahead with Project Y as it results in better NPV

Usage of RADR Approach:

- Cumulative CEF of 3 years is 2.0 and 2.4 for Project X and Project Y respectively
- Higher CEF would indicate lower risk. This would mean Project Y has lower risk and Project X has higher risk
- High-risk project needs to be discounted at higher rate and hence Project X will be discounted at higher RADR

Advantages of certainty equivalent method:

- The certainty equivalent method is simple and easy to understand and apply.
- It can easily be calculated for different risk levels applicable to different cash flows. For example, if in a particular year, a higher risk is associated with the cash flow, it can be easily adjusted and the NPV can be recalculated accordingly

Part 9 - Sensitivity Analysis and Scenario Analysis**54. Sensitivity analysis [May 2021 RTP]**

X Limited is considering its new product with the following details:

Initial capital cost	Rs.400 Crores
Annual unit sales	Rs.5 Crores
Selling Price Per unit	Rs.100
Variable cost per unit	Rs.50
Fixed costs per year	Rs.50 Crores
Discount rate	6%
Life	3 years

- ❖ Calculate NPV of the Project
- ❖ Find the impact on the project's NPV of a 2.5 percent adverse variance in each variable. Which variable is having maximum effect

Answer:**WN 1: Computation of base NPV:****Part 1: Computation of cash flows:**

Particulars	Amount (in cr)
Units sold	5.00
Selling price	100.00
Sales (A)	500.00
Variable cost per unit	50.00
Total variable cost (B)	250.00
Total Fixed cost (C)	50.00
Profit/Cash flow (A - B - C)	200.00

Part 2: Computation of NPV:**(in crores)**

Year	Cash flow	PVF @ 6%	DCF
0	-400.00	1.000	-400.00
1 to 4	200.00	3.465	693.00
Expected NPV			293.00

WN 2: Sensitivity analysis and NPV Impact:**(in crores)**

Particulars	Capital cost	Unit sales	SP	VC	Fixed cost	Discount rate
Units sold	5.00	4.875 [5.00-2.5%]	5.00	5.00	5.00	5.00
Selling price	100.00	100.00	97.50 [100-2.5%]	100.00	100.00	100.00
Sales (A)	500.00	487.50	487.50	500.00	500.00	500.00
Variable cost per unit	50.00	50.00	50.00	51.25 [50+2.5%]	50.00	50.00
Total variable cost (B)	250.00	243.75	250.00	256.25	250.00	250.00
Total Fixed cost (C)	50.00	50.00	50.00	50.00	51.25 [50+2.5%]	50.00
Profit/Cash flow [A - B - C]	200.00	193.75	187.50	193.75	198.75	200.00
PVF	3.465	3.465	3.465	3.465	3.465	3.453
PV of inflows [Cash flow x PVF]	693.00	671.34	649.69	671.34	688.67	690.60
Initial capital cost	410.00 [400+2.5%]	400.00	400.00	400.00	400.00	400.00
NPV	283.00	271.34	249.69	271.34	288.67	290.60
Change in NPV [Old NPV - New NPV]	10.00	21.66	43.31	21.66	4.33	2.40
% Change in NPV	3.41	7.39	14.78	7.39	1.48	0.82

Conclusion:

- The project is most sensitive to selling price as 2.5 percent change in SP will impact NPV by 14.78%

Note:**Sensitivity analysis of discount rate:**

- The current discount rate of the project is 6%. There is going to be an adverse variation of 2.5% in discount rate.
- New discount rate = $6 + (6 \times 2.5\%) = (6 + 0.15) = 6.15\%$
- PVAF for 4 years at 6.15% = 3.453

55. Sensitivity Analysis [May 2018 RTP, Nov 2018]

From the following details relating to a project, analyze the sensitivity of the project to changes in the initial project cost, annual cash inflow and cost of capital:

Particulars	Amount
Initial Project Cost	2,00,00,000
Annual cash inflow	60,00,000

Project life	5 years
Cost of capital	10%

To which of the 3 factors, the project is most sensitive if the variable is adversely affected by 10 percent?

Answer:

Sensitivity Analysis:

Particulars	Base case	Project cost	Cash inflow	Cost of capital
Annual inflow	60,00,000	60,00,000	54,00,000 [60,00,000-10%]	60,00,000
Discount rate	10%	10%	10%	11% [10% + 10 of 10%]
PVAF	3.791	3.791	3.791	3.696
PV of inflow (A)	2,27,46,000	2,27,46,000	2,04,71,400	2,21,76,000
Initial outflow (B)	2,00,00,000	2,20,00,000 [2,00,00,000 + 10%]	2,00,00,000	2,00,00,000
NPV (A-B)	27,46,000	7,46,000	4,71,400	21,76,000
Change in NPV	NA	20,00,000	22,74,600	5,70,000
% Change in NPV	NA	72.83	82.83	20.76

- Project is most sensitive to annual cash inflow as 10 percent change in inflow leads to 82.83 percent change in NPV

56. Sensitivity Analysis [May 2018 RTP]

PNR Limited is considering a project with the following cash flows:

Year	Cost of Plant	Running Cost	Savings
0	12,00,00,000		
1		4,00,00,000	12,00,00,000
2		5,00,00,000	14,00,00,000
3		6,00,00,000	11,00,00,000

The cost of capital is 12%. Measure the sensitivity of the project to the changes in the levels of Plant cost, running cost and savings (considering each factor at a time) such that NPV becomes zero. Determine the factor which is the most sensitive to affect the acceptability of the project?

Answer:

WN 1: Computation of NPV of Project:

Year	Cash Flow			PVF @ 12%	DCF		
	Cost of Plant	Running cost	Savings		Cost of Plant	Running cost	Savings
0	-12,00,00,000			1.000	-12,00,00,000	0	0
1		-4,00,00,000	12,00,00,000	0.892	0	-3,56,80,000	10,70,40,000
2		-5,00,00,000	14,00,00,000	0.797	0	-3,98,50,000	11,15,80,000
3		-6,00,00,000	11,00,00,000	0.711	0	-4,26,60,000	7,82,10,000
Total					-12,00,00,000	-11,81,90,000	29,68,30,000

- NPV of project = -12,00,00,000 - 11,81,90,000 + 29,68,30,000 = Rs.5,86,40,000

WN 2: Computation of sensitivity of different parameters:

Plant cost:

- The project will have zero NPV if the cost of plant increases by Rs.5,86,40,000 (amount of NPV). This is because any increase in cost of plant will reduce NPV and finally it will become zero

$$\text{Sensitivity \%} = \frac{\text{Change}}{\text{Base}} \times 100 = \frac{5,86,40,000}{12,00,00,000} \times 100 = 48.87\%$$

- Base represents current plant cost of Rs.12,00,00,000

Running cost:

- The project will have zero NPV if the PV of running cost increases by Rs.5,86,40,000 (amount of NPV). This is because any increase in increase in running cost will reduce NPV and finally it will become zero

$$\text{Sensitivity \%} = \frac{\text{Change}}{\text{Base}} \times 100 = \frac{5,86,40,000}{11,81,90,000} \times 100 = 49.61\%$$

- Base represents current running cost of Rs.11,81,90,000

Savings:

- The project will have zero NPV if the PV of savings decline by Rs.5,86,40,000 (amount of NPV). This is because any decline in savings will reduce NPV and finally it will become zero

$$\text{Sensitivity \%} = \frac{\text{Change}}{\text{Base}} \times 100 = \frac{5,86,40,000}{29,68,30,000} \times 100 = 19.75\%$$

- Base represents current savings cost of Rs.29,68,30,000

Conclusion: Project is most sensitive to savings factor as only a change beyond 19.75% in savings makes the project unacceptable.

57. Sensitivity Analysis:

ABC Limited is considering a project for which the following estimates are available:

Particulars	Amount
Initial Cost of the project	10,00,000
Sales price/unit	60
Cost/unit	40
Sales volumes	
Year 1	20,000 units
Year 2	30,000 units
Year 3	30,000 units

Discount rate 10% p.a.

You are required to measure the sensitivity of the project in relation to each of the following parameters:

- Sales Price/unit
 - Unit cost
 - Sales value
 - Initial outlay and
 - Project lifetime
- Taxation may be ignored.

Answer:**WN 1: Computation of base NPV:**

Year	Initial outlay	Sales	Costs	PVF @ 10%	PV of Plant	PV of Sales	PV of costs
0	-10,00,000	-	-	1.000	-10,00,000	-	-
1	0	12,00,000	-8,00,000	0.909	-	10,90,800	-7,27,200
2	0	18,00,000	-12,00,000	0.826	-	14,86,800	-9,91,200
3	0	18,00,000	-12,00,000	0.751	-	13,51,800	-9,91,200
Total					-10,00,000	39,29,400	-26,19,600

- NPV of project = -10,00,000 + 39,29,400 - 26,19,600 = Rs.3,09,800

WN 2: Sensitivity Analysis:**Selling price:**

- The project will have zero NPV if the present value of sales decline by Rs.3,09,800. This is because any decrease in selling price will negatively impact the NPV

$$\text{Sensitivity \%} = \frac{\text{Change}}{\text{Base}} \times 100 = \frac{3,09,800}{39,29,400} \times 100 = 7.88\%$$

Unit cost:

- The project will have zero NPV if the present value of cost increases by Rs.3,09,800. This is because any increase in cost will negatively impact the NPV

$$\text{Sensitivity \%} = \frac{\text{Change}}{\text{Base}} \times 100 = \frac{3,09,800}{26,19,600} \times 100 = 11.83\%$$

Sales value:

- Any decrease in sales will also result in decrease in cost and hence net cash inflow (Sales – cost) needs to decline by Rs.3,09,800 for the project to have zero NPV.

$$\text{Sensitivity \%} = \frac{\text{Change}}{\text{Base}} \times 100 = \frac{3,09,800}{(39,29,400 - 26,19,600)} \times 100 = 23.65\%$$

Initial Outlay:

- The project will have zero NPV if the initial outflow increase by Rs.3,09,800

$$\text{Sensitivity \%} = \frac{\text{Change}}{\text{Base}} \times 100 = \frac{3,09,800}{10,00,000} \times 100 = 30.98\%$$

Project Lifetime:

- We are required to compute the life of the project at which the project will have zero NPV. Discounted payback is basically the life at which project recovers the initial investment considering time value of money.
- Hence, we will have to first compute discounted payback.

Computation of discounted Payback:

Year	CF	PVF @ 10%	DCF	CDCF
0	-10,00,000	1	-10,00,000	-10,00,000
1	4,00,000	0.909	3,63,600	-6,36,400
2	6,00,000	0.826	4,95,600	-1,40,800
3	6,00,000	0.751	4,50,600	3,09,800

$$\text{Discounted Payback} = \text{Base year} + \frac{\text{Unrecovered CF of base year}}{\text{Discounted CF of next year}} = 2 + \frac{1,40,800}{4,50,600} = 2.312 \text{ years}$$

- Hence project will have zero NPV if life of project declines by 0.688 years (3 – 2.312)

$$\text{Sensitivity \%} = \frac{\text{Change}}{\text{Base}} \times 100 = \frac{0.688}{3} \times 100 = 22.93\%$$

58. Sensitivity analysis

Easygoing Company Limited is considering a new project with initial investment, for a product “Survival”. It is estimated that IRR of the project is 16% having an estimated life of 5 years. Financial Manager has studied the project with sensitivity analysis and informed that annual fixed cost sensitivity is 7.8416%, whereas cost of capital (discount rate) sensitivity is 60%.

Other information available are:

- ❖ Profit Volume Ratio (P/V) is 70%,
- ❖ Variable cost Rs. 60/- per unit
- ❖ Annual Cash Flow Rs. 57,500/-

Ignore Depreciation on initial investment and impact of taxation.

Calculate

- ❖ Initial Investment of the Project
- ❖ Net Present value of the Project

- ❖ Annual Fixed Cost
- ❖ Estimated annual unit of sales
- ❖ Break Even Units

Cumulative discounting factor for 5 years:

8%	9%	10%	11%	12%	13%	14%	15%	16%	17%	18%
3.993	3.890	3.791	3.696	3.605	3.517	3.433	3.352	3.274	3.199	3.127

Answer:**WN 1: Computation of discount rate:**

- IRR of the project is 16% and hence project will generate NPV of 0 at discount rate of 16%
- Cost of capital sensitivity is 60% and hence the same would mean that 60% increase in cost of capital would result in zero NPV
- We can therefore conclude that IRR is equal to 160% of cost of capital
- $16\% = 160\%$ of cost of capital
- **Cost of capital = 10.00%**

WN 2: Computation of Initial Investment:

- NPV will be zero at discount rate of 16% (IRR)

Year	CF	PVF @ 16%	DCF
0	-1,88,255	1.000	-1,88,255 (b/f)
1 to 5	57,500	3.274	1,88,255
NPV			0

- Initial Investment = Rs.1,88,255

WN 3 Computation of NPV:

Year	CF	PVF @ 10%	DCF
0	-1,88,255	1.000	-1,88,255
1 to 5	57,500	3.791	2,17,983
NPV			29,728

WN 4: Computation of Annual Fixed Cost:

- Annual fixed cost sensitivity is 7.8416% and hence 7.8416% increase in fixed cost would lead to zero NPV

$$\text{Annual increase in fixed cost} = \frac{29,728}{3.791} = \text{Rs. 7,841.60}$$

- 7.8416% increase in fixed cost = Rs.7,841.60
- Hence annual fixed cost = Rs.1,00,000

WN 5: Computation of units sold and break-even point:

Particulars	Calculation	Amount
Variable cost		Rs.60.00
PVR		70.00%
Variable cost ratio		30.00%
Selling price	60/30.00%	Rs.200.00
Contribution		1,57,500
Contribution per unit		140.00
No of units sold	$\frac{1,57,500}{140}$	1,125 units
Break-even point	$\frac{1,00,000}{140}$	714.29 units

- There is no tax in company and hence annual cash flow is equal to PBDT.
- Contribution = PBDT + Fixed cost = 57,500 + 1,00,000 = Rs.1,57,500

59. Sensitivity Analysis [May 2020 MTP]

A&R Limited has undertaken a project which has an initial investment of Rs.2,000 lakhs in plant & machinery and Rs.800 lakhs for working capital. The Plant & machinery would have a salvage value of Rs.474.61 lakhs at the end of the fifth year. Depreciation at the rate of 25% p.a. under WDV method. The other details of the project for the five-year period are as follows:

Sales	10,00,000 units p.a.
Selling price	Rs.500
Variable cost	50% of selling price
Fixed overheads (excluding depreciation)	Rs.300 lacs p.a.
Corporate tax rate	35%
Rate of interest on bank loan	12%
After tax required rate of return	15%

Required:

- Calculate NPV of the project and determine the viability of the project
- Determine the sensitivity of project's NPV under each of the following conditions:
 - Decrease in selling price by 10%
 - Increase in cost of plant and machinery by 10%

Answer:**WN 1: Initial Outflow:**

Particulars	Amount (in lacs)
Capital expenditure	(2,000.00)
Working capital	(800.00)
Initial Outflow	(2,800.00)

WN 2: In-between flows:**(in lacs)**

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5
Units sold	10.00	10.00	10.00	10.00	10.00
Contribution per unit [500-250]	250.00	250.00	250.00	250.00	250.00
Total Contribution	2,500.00	2,500.00	2,500.00	2,500.00	2,500.00
Less: Fixed cost	-300.00	-300.00	-300.00	-300.00	-300.00
PBDT	2,200.00	2,200.00	2,200.00	2,200.00	2,200.00
Less: Depreciation [Note 1]	-500.00	-375.00	-281.25	-210.94	-158.20
PBT	1,700.00	1,825.00	1,918.75	1,989.06	2,041.80
Less: Tax @ 35%	-595.00	-638.75	-671.56	-696.17	-714.63
PAT	1,105.00	1,186.25	1,247.19	1,292.89	1,327.17
Add: Depreciation	500.00	375.00	281.25	210.94	158.20
CFAT	1,605.00	1,561.25	1,528.44	1,503.83	1,485.37

Note 1: Computation of depreciation:

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5
Opening balance	2,000.00	1,500.00	1,125.00	843.75	632.81
Less: Depreciation @ 25%	-500.00	-375.00	-281.25	-210.94	-158.20
Closing balance	1,500.00	1,125.00	843.75	632.81	474.61

WN 3: Terminal flow:

Particulars	Amount (in lacs)
Salvage value	474.61
Working capital	800.00

Total terminal flow	1,274.61

WN 4: Computation of NPV:(in lacs)

Year	Cash flow	PVF @ 15%	DCF
0	-2,800.00	1.000	-2,800.00
1	1,605.00	0.869	1,394.74
2	1,561.25	0.756	1,180.31
3	1,528.44	0.657	1,004.18
4	1,503.83	0.571	858.68
5	2,759.98	0.497	1,371.71
Amount of NPV			3,009.62

The NPV of the project is positive, hence, the project is viable.

WN 2: Sensitivity Analysis with decrease in selling price by 10%:

- Initial outflow and terminal flow will not change with change in selling price
- In-between flows is computed as under:

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5
Units sold	10.00	10.00	10.00	10.00	10.00
Contribution per unit [450-250]	200.00	200.00	200.00	200.00	200.00
Total Contribution	2,000.00	2,000.00	2,000.00	2,000.00	2,000.00
Less: Fixed cost	-300.00	-300.00	-300.00	-300.00	-300.00
PBDT	1,700.00	1,700.00	1,700.00	1,700.00	1,700.00
Less: Depreciation [Note 1]	-500.00	-375.00	-281.25	-210.94	-158.20
PBT	1,200.00	1,325.00	1,418.75	1,489.06	1,541.80
Less: Tax @ 35%	-420.00	-463.75	-496.56	-521.17	-539.63
PAT	780.00	861.25	922.19	967.89	1,002.17
Add: Depreciation	500.00	375.00	281.25	210.94	158.20
CFAT	1,280.00	1,236.25	1,203.44	1,178.83	1,160.37

Computation of NPV:

Year	Cash flow	PVF @ 15%	DCF
0	-2,800.00	1	-2,800.00
1	1,280.00	0.869	1,112.32
2	1,236.25	0.756	934.61
3	1,203.44	0.657	790.66
4	1,178.83	0.571	673.11
5	2,434.98	0.497	1,210.19
Amount of NPV			1,920.89

- NPV of the project has reduced from Rs.3,009.62 lacs to Rs.1,920.89 lacs
- Fall in NPV = 3009.62 lacs – 1,920.89 lacs = 1,083.73 lacs
- % fall in NPV = $(1,083.73/3,009.62) \times 100 = 36\%$

WN 3: Sensitivity analysis with increase in plant cost by 10%:**WN 1: Initial Outflow:**

Particulars	Amount (in lacs)
Capital expenditure	(2,200.00)
Working capital	(800.00)

Initial Outflow	(3,000.00)

WN 2: In-between flows:**(in lacs)**

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5
Units sold	10.00	10.00	10.00	10.00	10.00
Contribution per unit [500-250]	250.00	250.00	250.00	250.00	250.00
Total Contribution	2,500.00	2,500.00	2,500.00	2,500.00	2,500.00
Less: Fixed cost	-300.00	-300.00	-300.00	-300.00	-300.00
PBDT	2,200.00	2,200.00	2,200.00	2,200.00	2,200.00
Less: Depreciation [Note 1]	-550.00	-412.50	-309.38	-232.04	-174.03
PBT	1,650.00	1,787.50	1,890.62	1,967.96	2,025.97
Less: Tax @ 35%	-577.50	-625.63	-661.72	-688.79	-709.09
PAT	1,072.50	1,161.87	1,228.90	1,279.17	1,316.88
Add: Depreciation	550.00	412.50	309.38	232.04	174.03
CFAT	1,622.50	1,574.37	1,538.28	1,511.21	1,490.91

Note 1: Computation of depreciation:

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5
Opening balance	2,200.00	1,650.00	1,237.50	928.12	696.09
Less: Depreciation @ 25%	-550.00	-412.50	-309.38	-232.03	-174.02
Closing balance	1,650.00	1,237.50	928.12	696.09	522.07

WN 3: Terminal flow:

Particulars	Amount (in lacs)
Net Salvage value (Note 1)	491.22
Working capital	800.00
Total terminal flow	1,291.22

Net salvage value:

Particulars	Amount (in lacs)
Sale value	474.61
Less: Book value	-522.07
Capital loss	47.46
Tax saved @ 35%	16.61
Net salvage value	491.22

WN 4: Computation of NPV:**(in lacs)**

Year	Cash flow	PVF @ 15%	DCF
0	-3,000.00	1.000	-3,000.00
1	1,622.50	0.869	1,409.95
2	1,574.37	0.756	1,190.22
3	1,538.28	0.657	1,010.65
4	1,511.21	0.571	862.90
5	2,782.13	0.497	1,382.72
Amount of NPV			2,856.44

- NPV of the project has reduced from Rs.3,009.62 lacs to Rs.2,856.44 lacs

- Fall in NPV = 3009.62 lacs – 2,856.44 lacs = 153.18 lacs
- % fall in NPV = $(153.18/3,009.62) \times 100 = 5.09\%$

60. Sensitivity Analysis:

Unnat Ltd. is considering investing Rs. 50,00,000 in a new machine. The expected life of machine is five years and has no scrap value. It is expected that 2,00,000 units will be produced and sold each year at a selling price of Rs. 30.00 per unit. It is expected that the variable costs to be Rs. 16.50 per unit and fixed costs to be Rs. 10,00,000 per year. The cost of capital of Unnat Ltd. is 12% and acceptable level of risk is 20%. You are required to measure the sensitivity of the project's net present value to a change in the following project variables:

- a) sale price;
- b) sales volume;
- c) variable cost;
- d) On further investigation it is found that there is a significant chance that the expected sales volume of 2,00,000 units per year will not be achieved. The sales manager of Unnat Ltd. suggests that sales volumes could depend on expected economic states which could be assigned the following probabilities:

State of Economy	Annual Sales (in Units)	Prob.
Poor	1,75,000	0.30
Normal	2,00,000	0.60
Good	2,25,000	0.10

Calculate expected net present value of the project and give your decision whether company should accept the project or not.

Answer:

WN 1: Computation of Base NPV:

Particulars	Calculation	Amount
PV of sales	60,00,000 x 3.605	2,16,30,000
Less: PV of variable cost	33,00,000 x 3.605	-1,18,96,500
PV of contribution		97,33,500
Less: PV of fixed cost	10,00,000 x 3.605	-36,05,000
PV of cash inflows		61,28,500
Less: Initial outlay		-50,00,000
Base NPV		11,28,500

WN 2: Sensitivity Analysis:

Selling price:

- The project will have zero NPV if the present value of sales decline by Rs.11,28,500. This is because any decrease in selling price will negatively impact the NPV

$$\text{Sensitivity \%} = \frac{\text{Change}}{\text{Base}} \times 100 = \frac{11,28,500}{2,16,30,000} \times 100 = 5.22\%$$

Sales volume:

- Any decrease in sales will also result in decrease in variable cost and hence contribution (Sales – variable cost) needs to decline by Rs.11,28,500 for the project to have zero NPV.

$$\text{Sensitivity \%} = \frac{\text{Change}}{\text{Base}} \times 100 = \frac{11,28,500}{97,33,500} \times 100 = 11.59\%$$

Variable cost:

- The project will have zero NPV if the present value of variable cost increase by Rs.11,28,500. This is because any increase in variable cost will negatively impact the NPV

$$\text{Sensitivity \%} = \frac{\text{Change}}{\text{Base}} \times 100 = \frac{11,28,500}{1,18,96,500} \times 100 = 9.49\%$$

WN 3: Computation of expected NPV:

- Expected sales volume = $(1,75,000 \times 0.30) + (2,00,000 \times 0.60) + (2,25,000 \times 0.10) = 1,95,000$ units

Particulars	Calculation	Amount
Contribution	$1,95,000 \times 13.50$	26,32,500
Less: Fixed cost		-10,00,000
Annual cash inflow		16,32,500
PVFAF (12%,5)		3.605
PV of inflows		58,85,163
Less: Initial outflow		-50,00,000
NPV		8,85,163

Further NPV in worst and best cases will be as follows:

- NPV in worst case = $[1,75,000 \times 13.50 - 10,00,000] \times 3.605 - 50,00,000 = -88,188$
- NPV in best case = $[2,25,000 \times 13.50 - 10,00,000] \times 3.605 - 50,00,000 = \text{Rs.} 23,45,188$

Conclusion: Thus, there are 30% chances that the rise will be a negative NPV and 70% chances of positive NPV. Since acceptable level of risk of Unnat Ltd. is 20% and there are 30% chances of negative NPV hence project should not be accepted.

61. Scenario Analysis [Nov 2020 MTP]

XYZ Limited is considering a Project A with an initial outlay of Rs.14,00,000 and the possible three cash flow attached with the project are as follows:

Particulars	Year 1	Year 2	Year 3
Worst case	450	400	700
Most Likely	550	450	800
Best case	650	500	900

Assuming the cost of capital as 9%, determine NPV in each scenario. If XYZ Ltd is certain about the most likely result but uncertain about the third year's cash flow, what will be the NPV expecting worst scenario in the third year.

Answer:**WN 1: Computation of NPV for worst case, most likely and best-case scenario:**

Year	Cash flow			PVF @ 9%	DCF		
	Worst	Likely	Best		Worst	Likely	Best
0	-14,00,000	-14,00,000	-14,00,000	1.000	-14,00,000	-14,00,000	-14,00,000
1	4,50,000	5,50,000	6,50,000	0.917	4,12,659	5,04,350	5,96,050
2	4,00,000	4,50,000	5,00,000	0.842	3,36,800	3,78,900	4,21,000
3	7,00,000	8,00,000	9,00,000	0.772	5,40,400	6,17,600	6,94,800
Expected NPV					-1,10,141	1,00,850	3,11,850

WN 2: Scenario Analysis:

- It is given that most likely scenario will happen. However, there is uncertainty about third year and for that year we are going to assume worst case scenario

Year	Cash flow	PVF @ 9%	DCF
0	-14,00,000	1.000	-14,00,000
1	5,50,000	0.917	5,04,350
2	4,50,000	0.842	3,78,900
3	7,00,000	0.772	5,40,400
Expected NPV			23,650

62. NPV Computation [May 2019]

Kanoria Enterprises wishes to evaluate two mutually exclusive projects X and Y. The particulars are as under:

Particulars	Project X	Project Y
Initial investment	1,20,000	1,20,000
Estimated cash inflows (per annum for 8 years)		
Pessimistic	26,000	12,000

Most likely	28,000	28,000
Optimistic	36,000	52,000

The cut-off rate is 14%. Advise management about the acceptability of projects X and Y.

Answer:

Computation of NPV of Project X and Project Y for different scenarios:

Project X:

Year	Cash flow			PVF @ 14%	DCF		
	Pessimistic	Most Likely	Optimistic		Pessimistic	Most Likely	Optimistic
0	-1,20,000	-1,20,000	-1,20,000	1.000	-1,20,000	-1,20,000	-1,20,000
1 to 8	26,000	28,000	36,000	4.639	1,20,614	1,29,892	1,67,004
Expected NPV					614	9,892	47,004

Project Y:

Year	Cash flow			PVF @ 14%	DCF		
	Pessimistic	Most Likely	Optimistic		Pessimistic	Most Likely	Optimistic
0	-1,20,000	-1,20,000	-1,20,000	1.000	-1,20,000	-1,20,000	-1,20,000
1 to 8	12,000	28,000	52,000	4.639	55,668	1,29,892	2,41,228
Expected NPV					-64,332	9,892	1,21,228

Conclusion:

In pessimistic situation project X will be better as it gives low but positive NPV whereas project Y yield highly negative NPV under this situation. In most likely situation both the project will give same result. However, in optimistic situation project Y will be better as it gives very high NPV. So project X is a risk less project as it gives positive NPV in all situations whereas project Y is a risky project as it will result into negative NPV in pessimistic situation and highly positive NPV in optimistic situation. So acceptability of project will largely depend on the risk taking capacity (risk seeking/risk aversion) of the management.

Part 10 – Decision Tree and Simulation

63. Decision Tree:

A firm has an investment proposal, requiring an outlay of Rs. 80,000. The investment proposal is expected to have two years economic life with no salvage value. In year 1, there is a 0.4 probability that cash inflow after tax will be Rs. 50,000 and 0.6 probability that cash inflow after tax will be Rs. 60,000. The probability assigned to cash inflow after tax for the year 2 is as follows:

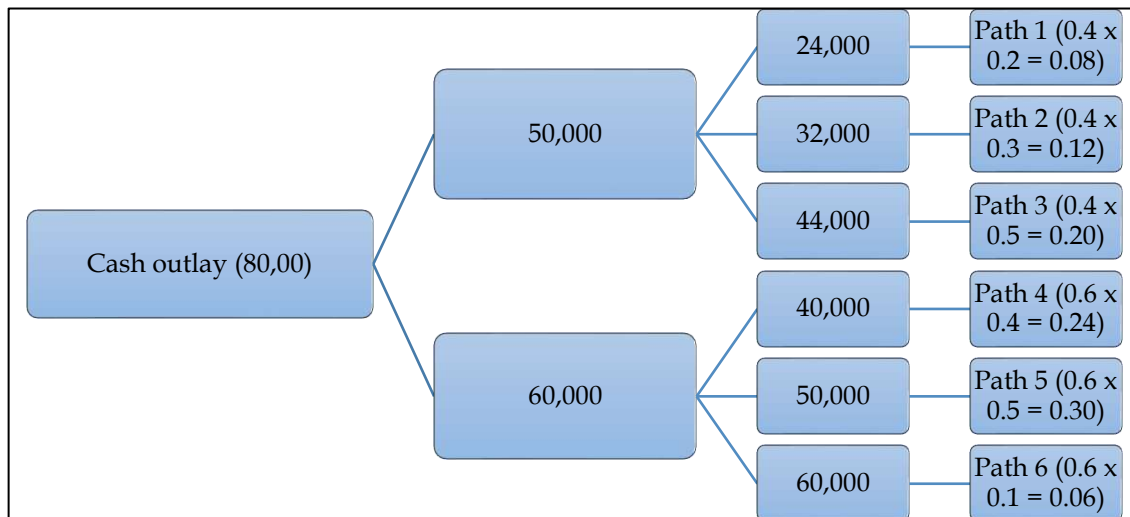
The cash inflow year 1	Rs. 50,000		Rs. 60,000	
The cash inflow year 2	Probability		Probability	
	Rs. 24,000	0.20	Rs. 40,000	0.40
	Rs. 32,000	0.30	Rs. 50,000	0.50
	Rs. 44,000	0.50	Rs. 60,000	0.10

ABC limited uses a 10% discount rate for this type of investment. Required:

- What net present value will the project yield if worst outcome is realized? What is the probability of occurrence of this NPV?
- What will be the best and the probability of that occurrence?
- Will the project be accepted?

Answer:

The decision tree diagram is presented in the chart, identifying various paths and outcomes, and the computation of various paths/outcomes and NPV of each path are presented in the following tables:

**NPV computation:**

Path	Year 1 cash flow	Year 2 cash flow	Total cash inflow	Outflow	NPV
1	$50,000 \times 0.909 = 45,450$	$24,000 \times 0.826 = 19,824$	65,274	-80,000	-14,726
2	$50,000 \times 0.909 = 45,450$	$32,000 \times 0.826 = 26,432$	71,882	-80,000	-8,118
3	$50,000 \times 0.909 = 45,450$	$44,000 \times 0.826 = 36,344$	81,794	-80,000	1,794
4	$60,000 \times 0.909 = 54,540$	$40,000 \times 0.826 = 33,040$	87,580	-80,000	7,580
5	$60,000 \times 0.909 = 54,540$	$50,000 \times 0.826 = 41,300$	95,840	-80,000	15,840
6	$60,000 \times 0.909 = 54,540$	$60,000 \times 0.826 = 49,560$	1,04,100	-80,000	24,100

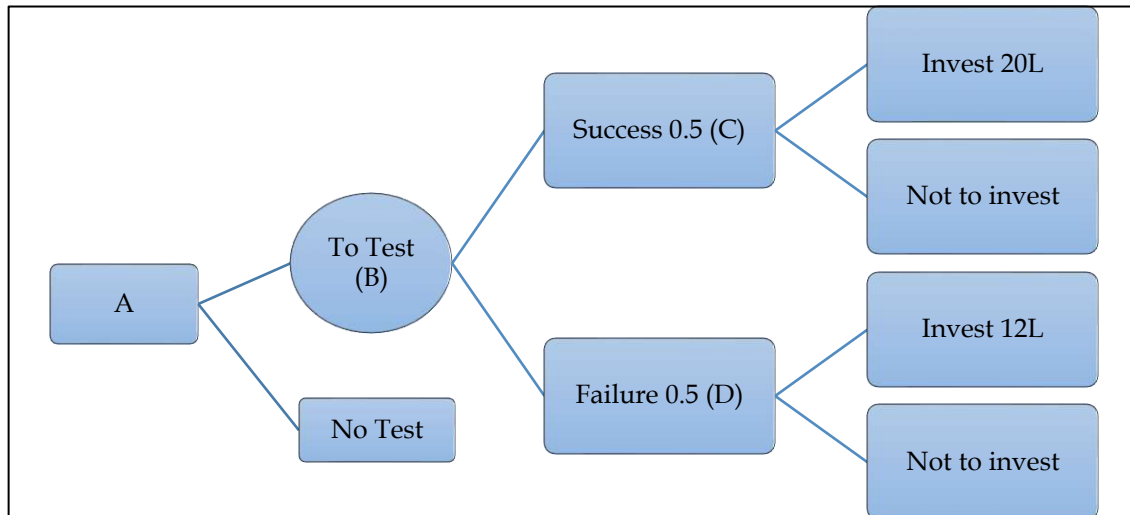
Solution:

Expected NPV	$(-14,726 \times 0.08) + (-8,118 \times 0.12) + (1,794 \times 0.20) + (7,580 \times 0.24) + (15,840 \times 0.30) + (24,100 \times 0.06) = \text{Rs.6,224}$
Worst NPV	-14,726
Probability of worst NPV	Path 1 = 8%
Best NPV	24,100
Probability of best NPV	Path 6 = 6%
Selection of project	Project should be accepted as the same has resulted in expected positive NPV of Rs.6,224

64. Decision tree (May 2016 RTP)

L&R Limited wishes to develop new virus-cleaner software. The cost of the pilot project would be Rs. 2,40,000. Presently, the chances of the product being successfully launched on a commercial scale are rated at 50%. In case it does succeed L&R can further invest a sum of Rs. 20 lacs to market the product. Such an effort can generate perpetually, an annual net after tax cash income of Rs. 4 lacs. Even if the commercial launch fails, they can make an investment of a smaller amount of Rs. 12 lacs with the hope of gaining perpetually a sum of Rs. 1 lac. Evaluate the proposal, adopting decision tree approach. The applicable discount rate is 10%.

Answer:



- There are four nodes which needs to be valued and the decision tree is valued from right to left

Value of Decision Node (C) is higher of the following

- Invest Rs.20,00,000 and get perpetual income of Rs.4,00,000. $NPV = (4,00,000/0.10) - 20,00,000 = Rs.20,00,000$
- Not to invest will lead to NPV of 0
- Hence value of Node C is Rs.20,00,000

Value of Decision Node (D) is higher of the following

- Invest Rs.12,00,000 and get perpetual income of Rs.1,00,000. $NPV = (1,00,000/0.10) - 12,00,000 = -2,00,000$
- Not to invest will lead to NPV of 0
- Hence value of Node D is 0

Value of Chance Node B is sum of expected cash flows

- Value = $(20,00,000 \times 0.50 + 0 \times 0.50) = Rs.10,00,000$

Value of Decision Node A is higher of the following

- To conduct test = $10,00,000 - 2,40,000 = Rs.7,60,000$
- Not to conduct test = 0

Conclusion: The preferred choice is, therefore, investing a sum of Rs. 2,40,000 and undertaking the test.

65. Decision Tree:

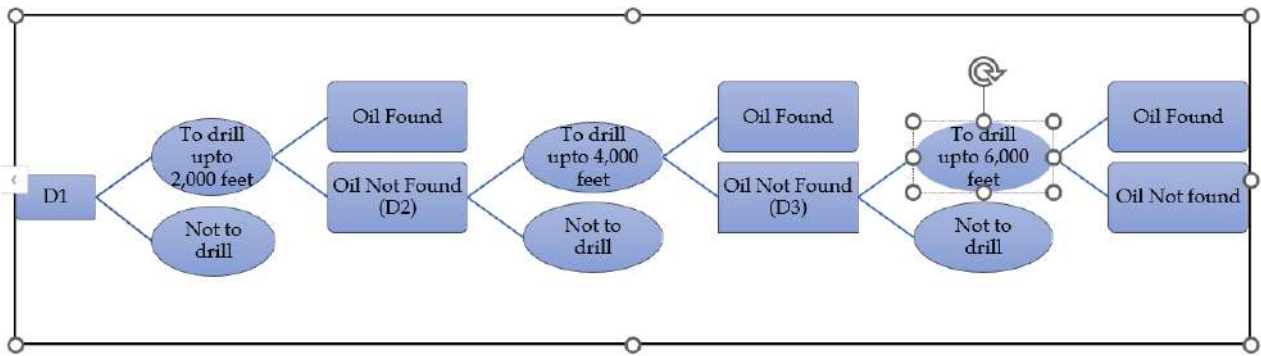
Big Oil is wondering whether to drill for oil in Westchester Country. The prospects is as follows:

Depth of well feet	Total cost millions of dollars	Cumulative probability of finding oil		PV of oil (if found) millions of dollars
		Finding Oil	Not Finding oil	
2000	4	0.50	0.50	10
4000	5	0.20	0.80	9
6000	6	0.25	0.75	8

Draw a decision tree showing the successive drilling decisions to be made by Big Oil. How deep should it be prepared to drill?

Answer:

- The company needs to decision on drilling oil and the same is being presented in the below decision tree

**Valuation of decision tree:****Statement showing evaluation at decision point D3:****Option 1: Drill upto 6,00 feet:**

- If the company decides to drill upto 6,000 feet then there is a probability of finding oil and probability of not finding oil
- Probability of finding oil at 6,000 feet = 0.25 Times
- Probability of finding oil at 6,000 feet = 0.75 Times
- Value if oil found = 8 million – 6 million = 2 million
- Value if oil not found = -6 million
- **Expected value if drilling is done = (2 million x 0.25) + (-6 million x 0.75) = -4 million**

Option 2: Not to drill

- If the company does not drill then they would have already spent Rs.5 million till now and hence the loss will be 5 million

Final decision: It is better to go ahead with drilling upto 6,000 feet and the expected value of the same is negative 4 million

Statement showing evaluation at decision point D2:**Option 1: Drill upto 4,00 feet:**

- If the company decides to drill upto 4,000 feet then there is a probability of finding oil and probability of not finding oil
- Probability of finding oil at 4,000 feet = 0.20 Times
- Probability of finding oil at 4,000 feet = 0.80 Times
- Value if oil found = 9 million – 5 million = 4 million
- Value if oil not found = -4 million (Value derived from D3)
- **Expected value if drilling is done = (4 million x 0.20) + (-4 million x 0.80) = -2.4 million**

Option 2: Not to drill

- If the company does not drill then they would have already spent Rs.4 million till now and hence the loss will be 4 million

Final decision: It is better to go ahead with drilling upto 4,000 feet and the expected value of the same is negative -2.4 million

Statement showing evaluation at decision point D1:**Option 1: Drill upto 2,00 feet:**

- If the company decides to drill upto 2,000 feet then there is a probability of finding oil and probability of not finding oil
- Probability of finding oil at 2,000 feet = 0.50 Times
- Probability of finding oil at 2,000 feet = 0.50 Times
- Value if oil found = 10 million – 4 million = 6 million
- Value if oil not found = -2.4 million (Value derived from D2)
- **Expected value if drilling is done = (6 million x 0.50) + (-2.4 million x 0.50) = 1.8 million**

Option 2: Not to drill

- If the company does not drill then there is no expenses

Final decision: The company should go for drilling upto 2,000 feet and the value for the same is Rs.1.80 million

66. Simulation:

ABC Limited is evaluating an investment opportunity that will enable them to introduce a new product. A market survey shows the following demand levels and cash flow per unit and the likely investment required and probability distribution of these uncertain variables.

Demand		Cash flow after tax per unit		Likely Investment	
Number	Probability	Rupees	Probability	Amount in lacs	Probability
37,500	0.05	3.00	0.10	8.00	0.25
45,000	0.10	5.00	0.20	16.00	0.50
52,500	0.20	7.00	0.40	24.00	0.25
60,000	0.30	9.00	0.20		
67,500	0.20	10.00	0.10		
75,000	0.10				
82,500	0.05				

Risk-free rate = 10%; Life = 8 years

Using simulation process over five trials,

- Assess the least likely cash flow and the corresponding value of investment and
- What is the maximum recommended investment level, if the least CFAT materializes
- What is the expected NPV

Use the following random number series, to be used in groups of five for each of the three uncertain variables:

28	57	60	17	6
19	07	90	02	57
18	67	16	71	43

Answer:

WN 1: Random Number Tables:

RN table for demand:

Demand			
Number	Probability	Cum prob	RN
37,500	0.05	0.05	00-04
45,000	0.1	0.15	05-14
52,500	0.2	0.35	15-34
60,000	0.3	0.65	35-64
67,500	0.2	0.85	65-84
75,000	0.1	0.95	85-94
82,500	0.05	1	95-99

RN table for CFAT:

Cash flow after tax per unit			
Rupees	Probability	Cum prob	RN
3	0.1	0.1	00-09
5	0.2	0.3	10-29
7	0.4	0.7	30-69
9	0.2	0.9	70-89
10	0.1	1	90-99

RN table for initial investment:

Likely Investment			
Amount in lacs	Probability	Cum prob	RN
8	0.25	0.25	00-24
16	0.5	0.75	25-74
24	0.25	1	75-99

WN 2: Simulation exercise:

Experiment	Demand	CFAT	Total CFAT	PVAF	DCF	Outflow	NPV
1	52,500	5	2,62,500	5.335	14,00,418	8,00,000	6,00,418
2	60,000	3	1,80,000	5.335	9,60,287	16,00,000	-6,39,713
3	60,000	10	6,00,000	5.335	32,00,956	8,00,000	24,00,956
4	52,500	3	1,57,500	5.335	8,40,251	16,00,000	-7,59,749
5	45,000	7	3,15,000	5.335	16,80,502	16,00,000	80,502
Average NPV							3,36,483

Experiment 1

- RN of 28 correspond to demand of 52,500 units, RN of 19 correspond to CFAT per unit of Rs.5 and RN of 18 correspond to initial outflow of Rs.8,00,000

Experiment 2:

- RN of 57 correspond to demand of 60,000 units, RN of 07 correspond to CFAT per unit of Rs.3 and RN of 67 correspond to initial outflow of Rs.16,00,000
- Other experiments are done in similar manner and the values are updated in above table

Solution:

- Least likely cash inflow = Rs.1,57,500 and corresponding investment = Rs.16,00,000
- Maximum recommended investment level if least cash flow materializes would be equal to present value of cash inflows and the same in this case is Rs.8,40,251
- Expected NPV over 5 experiments = Rs.3,36,483

67. Simulation:

Following are the expected Annual Cash flows and Project life:

Annual Cash Flow		Project Life	
Value	Probability	Value (year)	Probability
10,000	0.02	3	0.05
15,000	0.03	4	0.10
20,000	0.15	5	0.30
25,000	0.15	6	0.25
30,000	0.30	7	0.15
35,000	0.20	8	0.10
40,000	0.15	9	0.03
		10	0.02

Random Number

53479	81115	98036	12217	59526
97344	70328	58116	91964	26240
66023	38277	74523	71118	84892
99776	75723	03172	43112	83086
30176	48979	92153	38416	42436
81874	83339	14988	99937	13213
19839	90630	71863	95053	55532
09337	33435	53869	52769	18801
31151	58295	40823	41330	21093
67619	52515	03037	81699	17106

Risk-free rate = 10%

Required:

Using simulation process over ten trials compute the NPV?

Answer:**WN 1: Random number tables:****RN table for Cash flow:**

Value	Probability	Cum Probability	Random Number
10,000	0.02	0.02	00-01

15,000	0.03	0.05	02-04
20,000	0.15	0.20	05-19
25,000	0.15	0.35	20-34
30,000	0.30	0.65	35-64
35,000	0.20	0.85	65-84
40,000	0.15	1.00	85-99

RN table for Project life:

Value (year)	Probability	Cum Probability	Random Number
3	0.05	0.05	00-04
4	0.10	0.15	05-14
5	0.30	0.45	15-44
6	0.25	0.70	45-69
7	0.15	0.85	70-84
8	0.10	0.95	85-94
9	0.03	0.98	95-97
10	0.02	1.00	98-99

WN 2: Simulation exercise:

For random numbers, we can begin from any-where taking at random from the table and read any pair of adjacent columns, column/row wise. For the first simulation run we need two digit random numbers (1) For Annual Cash Flow (2) For Project Life. The numbers are 53 & 97 and corresponding value of Annual Cash Flow and Project Life are Rs. 30,000 and 9 years respectively.

Run	Cash flow		Project Life			NPV CF x PVAF - 1,30,000
	RN	Corresponding Cash flow	RN	Corresponding Life	PVAF @ 10%	
1	53	30,000	97	9	5.759	42,770
2	66	35,000	99	10	6.145	85,075
3	30	25,000	81	7	4.868	-8,300
4	19	20,000	09	4	3.170	-66,600
5	31	25,000	67	6	4.355	-21,125
6	81	35,000	70	7	4.868	40,380
7	38	30,000	75	7	4.868	16,040
8	48	30,000	83	7	4.868	16,040
9	90	40,000	33	5	3.791	21,640
10	58	30,000	52	6	4.355	650

Part 11 - Option in Capital Budgeting**68. Valuation of option:**

ABC Limited is considering a new drug. To develop the drug and to market it on a regional basis will cost Rs.120 lakhs over the next two years, as Rs.60 lakhs in each year. Expected cash inflows associated with the project for the next 6 years are as follows:

Year	Cash inflow in lakhs
3	10
4	20
5	40
6	40
7	30
8	10

If the project is successful, at the end of year 5 the company will have the option to invest an additional Rs.100 lakhs to secure a national market. The probability of success is 0.60. If the project is not successful then the company will not invest additional amount. If successful, the cash inflow will be better by Rs.60 lakhs per annum in each of the years through year 10. That is the project will be elongated by 2 more years than scheduled. The chance of better cash inflow by Rs.60 lakhs is 0.50 with other 0.50 for a cash inflow better only by Rs.40 lakhs. In both cases the life will be elongated by 2 years. The company's cost of capital is 14%.

- ❖ What is the NPV of the initial project lasting for 6 years after 2 years? Is it acceptable?
- ❖ What is the worth of the project if we take account of the option to expand? Is this project acceptable?

Answer:

WN 1: Computation of NPV of initial project:

Year	CF	PVF@ 14%	DCF
1	-60.00	0.877	-52.62
2	-60.00	0.769	-46.14
3	10.00	0.675	6.75
4	20.00	0.592	11.84
5	40.00	0.519	20.76
6	40.00	0.456	18.24
7	30.00	0.400	12.00
8	10.00	0.351	3.51
NPV			-25.66

- NPV of the initial project is negative 25.66 lacs and hence the project is not acceptable.

WN 2: Valuation of option to expand:

Year	CF	PVF@ 14%	DCF
5	-100.00	0.519	-51.90
6	50.00	0.456	22.80
7	50.00	0.400	20.00
8	50.00	0.351	17.55
9	50.00	0.308	15.40
10	50.00	0.270	13.50
NPV of option			37.35
Probability of option			0.60
Final value of option to expand [37.35 x 0.60]			22.41

- Value of project with option = -25.66 + 22.41 = -3.25 lacs
- Option to expand is feasible as the same has positive value. However, the project continues to have negative NPV even with expansion option and hence company cannot take up this project.

69. Valuation of option

A project with an initial cost of Rs.2,50,000 provides an annual CFAT of Rs.42,500 for 15 years. If the project proves favorable – chances for which are rated at 50% - an expansion at a cost of Rs.5,00,000 could be taken up at the end of the 4th year. The incremental CFAT will be Rs.62, 500 from years 5 to 15. Assume that the cost of capital is 8%. Advise:

- Will you invest in the initial project?
- What is the value of option?
- What is the worth of the project with the option? Is it acceptable?

Answer:

WN 1: Computation of NPV of initial project:

Year	Cash flow	PVF @ 8%	DCF
0	-2,50,000	1.000	-2,50,000
1 to 15	42,500	8.559	3,63,758
NPV of initial project			1,13,758

- We will invest in initial project as the same has positive NPV of Rs.1,13,758

WN 2: Valuation of option:

Year	Cash flow	PVF @ 8%	DCF
4	-5,00,000	0.735	-3,67,500
5 to 15	62,500	5.247	3,27,938
NPV of option to expand			-39,562
Value of option [-39,562 x 50%]			-19,781

WN 3: Worth of the project with option:

- Worth of project with option = $1,13,758 - 19,781 = \text{Rs.}93,977$
- Project continues to remain acceptable. However, the option is not feasible and hence the company should do the initial project and not exercise the expansion option

Alternate answer:

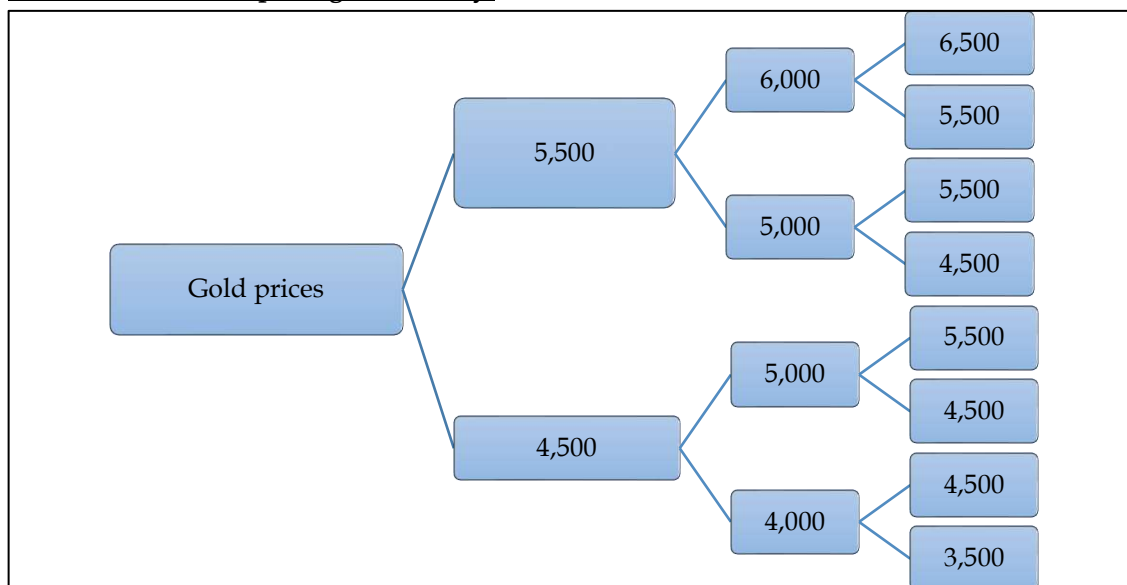
- Worth of project with option = $1,13,758$
- The value of expansion option is negative and hence we can say that the same has no value for the company. Accordingly, the NPV of the project continues to be the initial NPV of Rs.1,13,758 and the project is not to be accepted.

70. Valuation of abandonment option:

You own an unused Gold mine that will cost Rs. 10,00,000 to reopen. If you open the mine, you expect to be able to extract 1,000 ounces of Gold a year for each of three years. After that the deposit will be exhausted. The Gold price is currently Rs. 5,000 an ounce, and each year the price is equally likely to rise or fall by Rs. 500 from its level at the start of year. The extraction cost is Rs.4,600 an ounce and the discount rate is 10 per cent. Required:

(a) Should you open the mine now or delay one year in the hope of a rise in the Gold price?

(b) What difference would it make to your decision if you could costlessly (but irreversibly) shut down the mine at any stage? Show the value of abandonment option

Answer:**WN 1: Decision on opening mine today:**

- Gold prices are likely to move up or down by Rs.500 in every year and hence the expected prices of each of the year is Rs.5,000
- Expected cash flow of each year = $1,000 \times (5,000 - 4,600) = \text{Rs.}4,00,000$

Year	Cash flow	PVF @ 10%	DCF
0	-10,00,000	1.000	-10,00,000
1 to 3	4,00,000	2.487	9,94,800
NPV			-5,200

Because the NPV is negative, we should not open the mine at $t = 0$.

WN 2: Decision on opening mine in t1:

- Price of the mine can either reach 5,500 or 4,500 by end of year 1

NPV if price reaches 5,500 (50% probability):

- Investment of Rs.10,00,000 will happen in year 1
- Expected cash flow of year 2 to 4 = $1,000 \times (5,500 - 4,600) = \text{Rs.}9,00,000$

Year	Cash flow	PVF @ 10%	DCF
1	-10,00,000	0.909	-9,09,000
2 to 4	9,00,000	2.261	20,34,900
NPV if price reaches 5,500			11,25,900

NPV if price reaches 4,500 (50% probability)

- Investment will not happen as the project will have negative NPV. Price of 4,500 will translate into losses in every year
- NPV if price reaches 4,500 = 0

Expected NPV of opening the mine in year 1:

- Expected NPV = $(11,25,900 \times 0.50) = (0 \times 0.50) = \text{Rs.}5,62,950$
- Hence company can wait for one year and open the mine if the price touches Rs.5,500. This strategy would lead to an expected NPV of Rs.5,62,950

WN 3: Evaluation of abandonment option if mine is opened today:

- Abandonment option gives the flexibility to the company to close the mine at any time in case the prices are not favourable for the company.

Year 1				
Price	Probability	Profit	Expected cash flow	Overall Cash flow
5,500	0.50	900	450	4,50,000
4,500	0.50	-100	-50	-50,000
Cash flow of year 1				4,00,000

- The company will continue to run mines at both prices in year 1. This is because if the price reaches 4,500 then there is a possibility of price touching 5,000 which can lead to profits

Year 2				
Price	Probability	Profit	Expected cash flow	Overall Cash flow
6,000	0.25 [0.50 x 0.50]	1,400	350	3,50,000
5,000	0.25 [0.50 x 0.50]	400	100	1,00,000
5,000	0.25 [0.50 x 0.50]	400	100	1,00,000
4,000	0.25 [0.50 x 0.50]	-600	-150	-1,50,000
Cash flow of year 2				4,00,000

- The company will shut-down mine by end of year 2 if the price touches 4,000. This is because even with increase in price to 4,500 in year 3 the company would be making losses. Hence company will exercise abandonment in year 2 if price touches 4,000 (25% probability of it happening)

Year				
Price	Probability	Profit	Expected cash flow	Overall Cash flow
6,500	0.125 [0.50 x 0.50 x 0.50]	1,900	237.50	2,37,500
5,500	0.125 [0.50 x 0.50 x 0.50]	900	112.50	1,12,500
5,500	0.125 [0.50 x 0.50 x 0.50]	900	112.50	1,12,500
4,500	0.125 [0.50 x 0.50 x 0.50]	-100	-12.5	-12,500
5,500	0.125 [0.50 x 0.50 x 0.50]	900	112.50	1,12,500
4,500	0.125 [0.50 x 0.50 x 0.50]	-100	-12.5	-12,500
4,500	0.125 [0.50 x 0.50 x 0.50]	Mine is closed		

3,500	0.125 [0.50 x 0.50 x 0.50]	Mine is closed
Cash flow of year 3		5,50,000

- Expected cash flow of year 3 has increased from Rs.4,00,000 to Rs.5,50,000 due to abandonment option. This is because company has closed down mine in year 2 when prices are unfavorable and hence is saved from the losses.

NPV with abandonment option:

Year	Cash flow	PVF @ 10%	DCF
0	-10,00,000	1.000	-10,00,000
1	4,00,000	0.909	3,63,600
2	4,00,000	0.826	3,30,400
4	5,50,000	0.751	4,13,050
NPV with abandonment option			1,07,050
NPV without abandonment option			-5,200
Value of abandonment option [1,07,050 - (-5,200)]			1,12,250

Chapter 4 – Security Analysis**1. What is security Analysis?**

- ❖ Security Analysis involves a **systematic analysis of the risk return profiles** of various securities which is to help a rational investor **to estimate a value for a company from all the price sensitive information/data** so that he can make purchases when the market under-prices some of them and thereby earn a reasonable rate of return.
- ❖ Two approaches viz. **fundamental analysis and technical analysis** are in vogue for carrying out Security Analysis.

2. What is fundamental Analysis?

- ❖ Fundamental analysis is based on **risk-return characteristics** of securities
- ❖ Fundamental analysis is based on the assumption that the **share prices depend upon the future dividends expected by the shareholders**
- ❖ The **present value** of the future dividends can be calculated by discounting the cash flows at an **appropriate discount rate** and is known as the '**intrinsic value of the share**'.
- ❖ A share that is priced **below the intrinsic value must be bought**, while a share quoting **above the intrinsic value must be sold**
- ❖ The key variables that an investor must monitor in order to carry out his fundamental analysis are **economy wide factors, industry wide factors and company specific factors**. In other words, fundamental analysis encompasses economic, industrial and company analyses (**EIC Analysis**).

3. What is Economic Analysis and what are the factors affecting the same? [May 2020 RTP]

- ❖ Economic analysis is used to **forecast national income with its various components** that have a bearing on the concerned industry and the company in particular.
- ❖ **Macro- economic factors** e. g. historical performance of the economy in the past/ present and expectations in future, growth of different sectors of the economy in future with signs of stagnation/degradation at present to be assessed while analyzing the overall economy.
- ❖ Trends in **peoples' income and expenditure reflect** the growth of a particular industry/company in future. Consumption affects corporate profits, dividends and share prices in the market.

Factors affecting economic analysis:

Growth rates of national income and related measures	The estimated growth rate of the economy would be a pointer to the prospects for the industrial sector , and therefore to the returns investors can expect from investment in shares
Growth rates of industrial sector	This can be further broken down into growth rates of various industries or groups of industries if required. The growth rates in various industries are estimated based on the estimated demand for its products
Inflation	Inflation is measured in terms of either wholesale prices (the Wholesale Price Index or WPI) or retail prices (Consumer Price Index or CPI). The demand in some industries, particularly the consumer products industries, is significantly influenced by the inflation rate .
Monsoon	Because of the strong forward and backward linkages , monsoon is of great concern to investors in the stock market too.

4. What are the techniques used for economic analysis? [Nov 2019 MTP, May 2019 MTP]

Anticipatory surveys	❖ They help investors to form an opinion about the future state of the economy. It incorporates expert opinion on construction activities, expenditure on plant and machinery, levels of inventory – all having a definite bearing on economic activities. ❖ In spite of valuable inputs available through this method, it has certain drawbacks: (i) Survey results do not guarantee that intentions surveyed would materialize. (ii) They are not regarded as forecasts per se, as there can be a consensus approach by the investor for exercising his opinion. ❖ Continuous monitoring of this practice is called for to make this technique popular.
Barometer/ Indicator Approach	Various indicators are used to find out how the economy shall perform in the future. The indicators have been classified as under:

	❖ Leading Indicators: They lead the economic activity in terms of their outcome. They relate to the time series data of the variables that reach high/low points in advance of economic activity. ❖ Roughly Coincidental Indicators: They reach their peaks and troughs at approximately the same in the economy. ❖ Lagging Indicators: They are time series data of variables that lag behind in their consequences vis-a- vis the economy. They reach their turning points after the economy has reached its own already. All these approaches suggest direction of change in the aggregate economic activity but nothing about its magnitude. The various measures obtained from such indicators may give conflicting signals about the future direction of the economy. Money supply in the economy also affects investment decisions.
Economic Model Building Approach	A precise and clear relationship between dependent and independent variables is determined. GNP model building or sectoral analysis is used in practice through the use of national accounting framework. The steps used are as follows: ❖ Hypothesize total economic demand by measuring total income (GNP) based on political stability, rate of inflation, changes in economic levels. ❖ Forecasting the GNP by estimating levels of various components viz. consumption expenditure, gross private domestic investment, government purchases of goods/services, net exports. ❖ After forecasting individual components of GNP, add them up to obtain the forecasted GNP. ❖ Comparison is made of total GNP thus arrived at with that from an independent agency for the forecast of GNP and then the overall forecast is tested for consistency. This is carried out for ensuring that both the total forecast and the component wise forecast fit together in a reasonable manner.

5. What is Industry Analysis and what are the factors affecting the same? [May 2019 RTP]

- ❖ Industry analysis is **concerned with analysing the expected performance of the specific industry** to which the company belongs
- ❖ First of all, an assessment has to be made regarding all the conditions and factors relating to **demand of the particular product, cost structure of the industry and other economic and Government constraints on the same**. Since the basic profitability of any company depends upon the economic prospects of the industry to which it belongs, **an appraisal of the particular industry's prospects is essential**.

Factors affecting industry analysis:

Product Life-Cycle	An industry usually exhibits high profitability in the initial and growth stages , medium but steady profitability in the maturity stage and a sharp decline in profitability in the last stage of growth.
Demand Supply Gap	Excess supply reduces the profitability of the industry because of the decline in the unit price realization, while insufficient supply tends to improve the profitability because of higher unit price realization.
Barriers to Entry	Any industry with high profitability would attract fresh investments . The potential entrants to the industry, however, face different types of barriers to entry . Some of these barriers are innate to the product and the technology of production, while other barriers are created by existing firms in the industry .
Government Attitude	The attitude of the government determinant of its prospects.
State of Competition in the Industry	Factors to be noted are- firms with leadership capability and the nature of competition amongst them in foreign and domestic market, type of products manufactured viz. homogeneous or highly differentiated , demand prospects through classification viz customer-wise/area-wise, changes in demand patterns in the long/immediate/ short run, type of industry the firm is placed viz. growth, cyclical, defensive or decline.
Cost Conditions and Profitability	Factors to be considered are: ❖ Cost allocation among various heads e.g. raw material, labors and overheads and their controllability. Overhead cost for some may be higher while for

	others labour may be so. Labour cost which depends on wage level and productivity needs close scrutiny. ❖ Product price. ❖ <u>Production capacity</u> in terms of installation, idle and operating. ❖ Level of <u>capital expenditure</u> required for maintenance / increase in productive efficiency.
Technology and Research	<u>Things to be probed in this regard are:</u> ❖ <u>Nature and type</u> of technology used. ❖ Expected <u>changes in technology</u> for new products leading to increase in sales. ❖ <u>Relationship of capital expenditure</u> and sales over means increase in sales. ❖ Money spent in <u>research and development</u>. Whether this amount relates to redundancy or not? ❖ Assessment of industry in <u>terms of sales and profitability</u> in short, immediate and long run.

6. What are the techniques used in industry analysis?

Regression Analysis	❖ Investor diagnoses the factors determining the demand for output of the industry through <u>product demand analysis</u>. ❖ Factors to be considered are <u>GNP, disposable income</u>, per capita consumption / income, price elasticity of demand. ❖ For identifying factors <u>affecting demand</u>, statistical techniques like <u>regression analysis correlation</u> are used.
Input-output Analysis	❖ It reflects the <u>flow of goods and services</u> through the economy, intermediate steps in production process as goods proceed from raw material stage through final consumption. ❖ This is carried out to <u>detect changing patterns/trends</u> indicating growth/decline of industries

7. What are the factors to be analysed for company analysis?

Net worth and Book Value	❖ Net Worth is <u>sum of equity share capital, preference share capital and free reserves less intangible assets and any carry forward of losses</u>. ❖ The total net worth divided by the number of shares is the much talked about <u>book value of a share</u>. Though the book value is often seen as an indication of the intrinsic worth of the share, this may not be so for two major reasons. ❖ First, the <u>market price of the share reflects the future earnings potential</u> of the firm which may have no relationship with the value of its assets. Second, the book value is based upon the <u>historical costs</u> of the assets of the firm and these may be gross underestimates of the cost of the replacement or resale values of these assets
Sources and uses of funds	❖ The identification of sources and uses of funds is known as Funds Flow Analysis. ❖ One of the <u>major uses of funds flow analysis is to find out whether the firm has used short-term sources of funds to finance long-term investments</u>. ❖ Such methods of financing increase the <u>risk of liquidity crunch</u> for the firm, as long-term investments, because of the gestation period involved may not generate enough surpluses in time to meet the short-term liabilities incurred by the firm.
Cross-sectional and time series Analysis	❖ One of the main purposes of examining financial statements is to <u>compare two firms</u>, compare a firm against some benchmark figures for its industry and to <u>analyze the performance of a firm over time</u>. ❖ The techniques that are used to do such proper comparative analysis are: <u>common-sized statement, and financial ratio analysis</u>
Size and Ranking	❖ A rough idea regarding the <u>size and ranking of the company within the economy</u>, in general, and the industry, in particular, would help the investment manager in assessing the risk associated with the company.

	❖ In this regard the <u>net capital employed, the net profits, the return on investment and the sales</u> figures of the company under consideration may be compared with similar data of other companies in the same industry group.
Growth Record	❖ The <u>growth in sales, net income, net capital employed and earnings per share</u> of the company in the past few years should be examined. ❖ The following three growth indicators may be particularly looked into: (a) Price earnings ratio, (b) Percentage growth rate of earnings per annum, and (c) Percentage growth rate of net block.
Financial Analysis	❖ An analysis of its financial statements for the past few years would help the <u>investment manager in understanding the financial solvency and liquidity</u>, the efficiency with which the funds are used, the profitability, the operating efficiency and the financial and operating leverages of the company. ❖ For this purpose, certain fundamental ratios have to be calculated such as earnings per share, price earnings ratio, book value, intrinsic value, return on owner's investment, capital turnover ratios and cost structure ratios
Competitive advantage	❖ A company's long-term success is driven largely by its ability to maintain its competitive advantage. ❖ <u>Powerful competitive advantages</u> such as Apple's brand name and Samsung's domination of the mobile market, create a shield around a business that allows it to keep competitors at a distance.
Quality management of	❖ This is an <u>intangible factor</u> and has a very important bearing on the value of the shares. ❖ Every investment manager knows that the shares of certain business houses command a higher premium than those of similar companies managed by other business houses. This is because of the <u>quality of management, the confidence that investors have in a particular business house, its policy vis-a-vis its relationship with the investors, dividend and financial performance record of other companies in the same group, etc.</u> ❖ Quality of management has to be seen with reference to the <u>experience, skills and integrity</u> of the persons at the helm of affairs of the company. ❖ The policy of the management regarding relationship with the shareholders is an important factor since certain business houses believe in <u>very generous dividend and bonus distributions while others are rather conservative.</u>
Corporate governance	❖ Whether company is complying with all aspects of <u>clause 49</u>. ❖ How well corporate governance policies serve stakeholders? ❖ Quality and timeliness of company financial disclosures. ❖ Whether quality <u>independent directors</u> are inducted.
Regulation	❖ Regulations plays an <u>important role in maintaining the sanctity of the corporate form of organization.</u> ❖ In Indian listed companies, <u>Companies Act, Securities Contract and Regulation Act and SEBI Act</u> basically look after regulatory aspects of a company. ❖ A listed company is also <u>continuously monitored by SEBI</u> which through its guidelines and regulations protect the interest of investors.
Location and Labour-management relations	❖ The locations of the company's manufacturing facilities determine its <u>economic viability</u> which depends on the availability of crucial inputs like power, skilled labour and raw-materials, etc. Nearness to markets is also a factor considered. ❖ In the past few years, the investment manager has begun looking into <u>the state of labour-management relations in the company under consideration and the area where it is located.</u>
Pattern of existing stock holding	❖ An analysis of the pattern of existing stock holdings of the company would also be relevant. This would show the stake of various parties in the company.

Marketability of the shares	❖ Mere listing of a share on the stock exchange does not automatically mean that the share can be sold or purchased at will. ❖ There are many shares which remain inactive for long periods with no transactions being effected. ❖ In this regard, dispersal of shareholding with special reference to the extent of public holding should be seen. The other relevant factors are the <u>speculative interest in the particular scrip, the particular stock exchange where it is traded and the volume of trading.</u>

8. What are the techniques used in company analysis?

Correlation and Regression Analysis	❖ Simple regression is <u>used when inter relationship covers two variables.</u> For more than two variables, multiple regression analysis is followed. ❖ Here the inter relationship between variables belonging to economy, industry and company are found out. ❖ The main advantage in such analysis is <u>the determination of the forecasted values along with testing the reliability of the estimates.</u>
Trend Analysis	❖ The <u>relationship of one variable is tested over time using regression analysis.</u> It gives an insight to the historical behavior of the variable
Decision Tree Analysis	❖ Information relating to the <u>probability of occurrence of the forecasted value is considered useful.</u> A range of values of the variable with probabilities of occurrence of each value is taken up. The limitations are reduced through decision tree analysis and use of simulation techniques. ❖ In decision tree analysis, <u>the decision is taken sequentially with probabilities attached to each sequence.</u> To obtain the probability of final outcome, various sequential decisions given along with probabilities, <u>the probabilities of each sequence is to be multiplied and them summed up</u>

9. What is technical analysis and what are its assumptions and principles?

Meaning	❖ Technical Analysis is a method of <u>share price movements</u> based on a study of price graphs or charts on the assumption <u>that share price trends are repetitive, that since investor psychology follows a certain pattern,</u> what is seen to have happened before is likely to be repeated. ❖ A technical analyst attempts precisely that. The two basic questions that he seeks to answer are: (i) Is there a discernible trend in the prices? (ii) If there is, then are there <u>indications that the trend would reverse?</u> ❖ The methods used to answer these questions are <u>visual and statistical.</u> The visual methods are based on examination of a variety of charts to make out patterns, while the statistical procedures analyse price and return data to make trading decisions.
Assumptions	❖ The market value of stock is actually depending on the <u>supply and demand</u> for a stock ❖ The supply and demand are actually governed by <u>several factors.</u> ❖ Stock prices generally move in trends which continue for a substantial period of time. ❖ Technical analysis <u>relies upon chart analysis</u> which shows the past trends in stock prices <u>rather than the information in the financial statements</u> like balance sheet or profit and loss account
Principles	❖ <u>The Market Discounts Everything:</u> Many experts criticize technical analysis <u>because it only considers price movements and ignores fundamental factors.</u> The argument against such criticism is based on the <u>Efficient Market Hypothesis,</u> which states that a company's share price already reflects everything that has or could affect a company. So, <u>technical analysts generally have the view that a company's share price includes everything including the fundamentals</u> of a company. ❖ <u>Price moves in trends:</u> Technical analysts <u>believe that prices move in trends.</u> In other words, a stock price is more likely to continue a past trend than move in a different direction.

- ❖ **History tends to repeat itself:** Technical analysts believe that history tends to repeat itself. Technical analysis **uses chart patterns to analyze subsequent market movements to understand trends.**

10. Explain Dow Theory? [May 2018 MTP, Nov 2018 MTP]

Two indices	The Dow Theory is based upon the movements of two indices, constructed by Charles Dow, <u>Dow Jones Industrial Average (DJIA) and Dow Jones Transportation Average (DJTA)</u> . These averages reflect the aggregate impact of all kinds of information on the market.
Three classifications	The movements of the market are divided into <u>three classifications</u> , all going at the same time; the <u>primary movement, the secondary movement, and the daily fluctuations.</u>
Primary movement	The <u>primary movement</u> is the main trend of the market, which lasts from <u>one year to 36 months or longer.</u> This trend is commonly called <u>bear or bull market.</u>
Secondary Movement	The secondary movement of the market is shorter in duration than the primary movement, <u>and is opposite in direction.</u> It lasts from <u>two weeks to a month or more.</u>
Daily fluctuations	The daily fluctuations are the narrow movements from day-to-day. These fluctuations are not part of the Dow Theory interpretation of the stock market. <u>However, daily movements must be carefully studied, along with primary and secondary movements, as they go to make up the longer movement in the market.</u>
Interpretation of bull/bear market	The theory, in practice, states that if the <u>cyclical swings of the stock market averages</u> are <u>successively higher</u> and the <u>successive lows are higher,</u> then the market <u>trend is up and a bullish market exists.</u> Contrarily, if the successive highs and successive lows are lower, then the direction of the market is down and a bearish market exists.
Three moves of bull/bear market	❖ Charles Dow proposed that the primary uptrend would have <u>three moves up</u>, the <u>first one being caused by accumulation of shares by the far-sighted, knowledgeable investors,</u> the <u>second move</u> would be caused by the <u>arrival of the first reports of good earnings</u> by corporations, and the <u>last move up</u> would be caused by <u>widespread report of financial well-being of corporations.</u> ❖ The third stage would also see <u>rampant speculation in the market.</u> ❖ Towards the end of the third stage, the far-sighted investors, realizing that the <u>high earnings levels may not be sustained, would start selling, starting the first move down of a downtrend,</u> and as the non-sustainability of high earnings is confirmed, <u>the second move down would be initiated and then the third move down</u> would result from distress selling in the market.

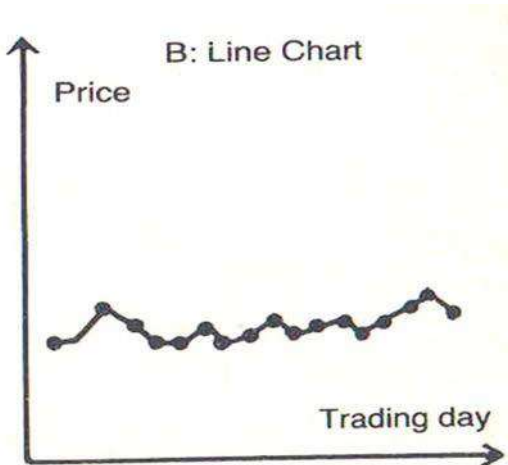
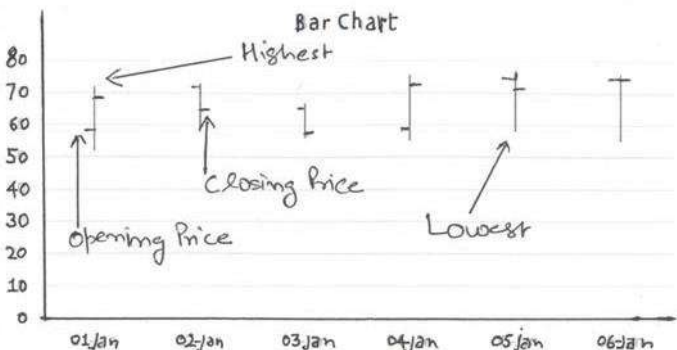
11. Explain Elliott Wave Theory?

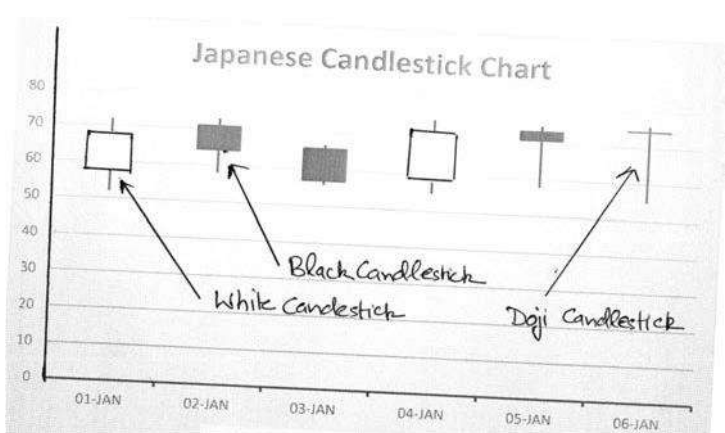
Introduction	Elliot found that the <u>markets exhibited certain repeated patterns or waves.</u> As per this theory wave <u>is a movement of the market price from one change in the direction to the next change in the same direction.</u> These waves are resulted from <u>buying and selling impulses emerging from the demand and supply pressures</u> on the market. Depending on the demand and supply pressures, waves are generated in the prices
Types of waves	Impulsive patterns and Corrective patterns
Impulsive Patterns (Basic Waves)	In this pattern there will be <u>3 or 5 waves</u> in a given direction (<u>going upward or downward</u>). These waves shall move in the direction of the <u>basic movement.</u> This movement can indicate <u>bull phase or bear phase</u>
Corrective patterns (reaction waves)	These <u>3 waves</u> are <u>against the basic direction</u> of the basic movement. <u>Correction involves correcting the earlier rise</u> in case of bull market and <u>fall</u> in case of bear market.
Conclusion	One complete cycle <u>consists of waves made up of two distinct phases,</u> bullish and bearish. On <u>completion of full one cycle</u> i.e. termination of 8 waves movement, the <u>fresh cycle starts with similar impulses</u> arising out of market trading.

12. Explain Random Walk Theory? [May 2018 MTP]

- ❖ Many investment managers and stock market analysts believe that **stock market prices can never be predicted** because they are not a result of any underlying factors but are mere statistical ups and downs. This hypothesis is known as **Random Walk hypothesis which states that the behaviour of stock market prices is unpredictable** and that there is no relationship between the present prices of the shares and their future prices.
- ❖ A British statistician, M. G. Kendall, found that **changes in security prices behave nearly as if they are generated by a suitably designed roulette wheel** for which each outcome is statistically independent of the past history. In other words, the fact that there are peaks and troughs in stock exchange prices is a mere statistical happening – successive peaks and troughs are unconnected.
- ❖ The supporters of this theory put out a simple argument. It follows that:
 - Prices of shares in stock market **can never be predicted**.
 - The reason is that the **price trends are not the result of any underlying factors**, but that they represent a statistical expression of past data.
 - There may be **periodical ups or downs in share prices**, but no connection can be established between two successive peaks (high price of stocks) and troughs (low price of stocks).

13. Explain the various charting techniques?

Line chart: In a line chart, lines are used to connect successive day's prices. The closing price for each period is plotted as a point. <u>These points are joined by a line to form the chart</u>. The period may be a day, a week or a month	
Bar Chart: In a bar chart, <u>a vertical line (Bar) represents the lowest to the highest price</u>, with a short horizontal line protruding from the bar representing both the opening and closing prices for the period	

Japanese Candlestick Chart: ❖ The bar chart displays stock opening, closing, and highs and lows, with the color of the candlestick indicating the trend. ❖ A black candlestick indicates a lower closing price, while a white candlestick indicates a higher one. A Doji candlestick indicates no change or near-no change. ❖ <u>The lowest and highest prices are indicated by vertical bars, while opening and closing prices are shown in rectangular bars.</u>																																																																									
Point and figure chart: ❖ Point and Figure charts are more complex than line or bar charts. ❖ <u>They are used to detect reversals in a trend.</u> ❖ For plotting a point and figure chart, we have to first decide the box size and the reversal criterion. The box size is the value of each box on the chart, for example each box could be 1, 2 or 0.50. ❖ <u>The smaller the box size, the more sensitive would the chart be to price change.</u> The reversal criterion is the number of boxes required to be retraced to record prices in the next column in the opposite direction	<table><tr><td>30</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>29</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>28</td><td>X</td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>27</td><td>X</td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>26</td><td>X</td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>25</td><td>X</td><td>O</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>24</td><td>X</td><td>O</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>23</td><td></td><td>O</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>22</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>	30								29								28	X							27	X							26	X							25	X	O						24	X	O						23		O						22							
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14. Write short note about various market indicators? [Nov 2020 RTP, Nov 2020 MTP]

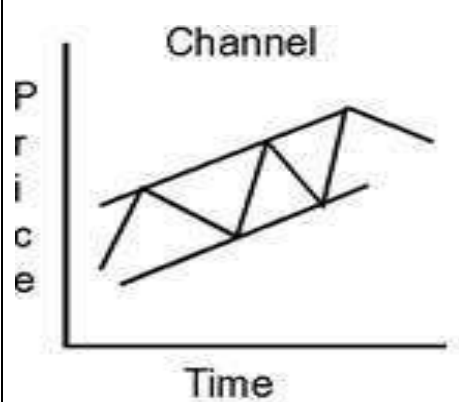
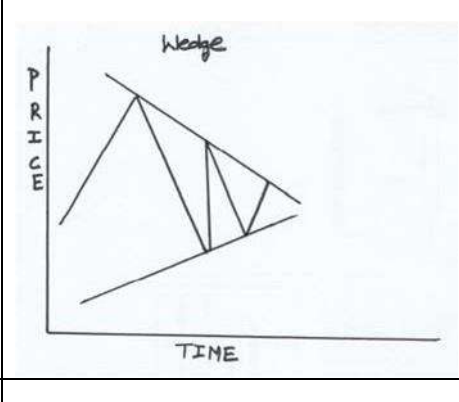
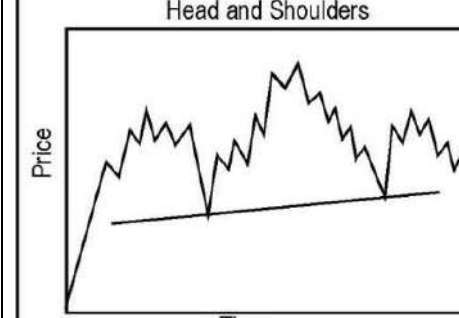
Breadth Index	❖ It is an <u>index that covers all securities traded</u>. It is computed by dividing the <u>net advances or declines in the market by the number of issues traded</u>. ❖ The breadth index either <u>supports or contradicts the movement of the Dow Jones Averages</u>. If it supports the movement of the Dow Jones Averages, this is considered sign of technical strength and if it does not support the averages, it is a sign of technical weakness i.e. a sign that the market will move in a direction opposite to the Dow Jones Averages. ❖ The breadth index is an addition to the Dow Theory and the movement of the Dow Jones Averages.
Volume of Transactions	❖ A <u>rising index/price with increasing volume</u> would signal buy behaviour because the situation reflects an unsatisfied demand in the market. Similarly, a <u>falling market with increasing volume signals a bear market</u> and the prices would be expected to fall further.
Confidence Index	❖ It is supposed to reveal how <u>willing the investors are to take a chance in the market</u>. It is the ratio of <u>high-grade bond yields to low-grade bond yields</u>. ❖ It is used by market analysts as a method of trading or timing the purchase and sale of stock, and also, as a <u>forecasting device to determine the turning points of the market</u>. ❖ A <u>rising confidence index is expected to precede a rising stock market</u>, and a fall in the index is expected to precede a drop in stock price.
Relative strength Analysis	❖ The relative strength concept suggests that the prices of some securities <u>rise relatively faster in a bull market</u> or decline more slowly in a bear market than other securities i.e. some securities exhibit relative strength.

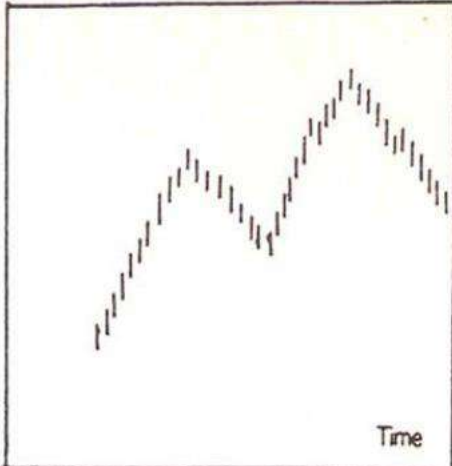
	❖ Investors will earn higher returns by investing in securities which <u>have demonstrated relative strength in the past</u> because the relative strength of a security tends to remain undiminished over time. ❖ Relative strength can be measured by calculating rates of return and classifying those securities with historically high average returns as securities with high relative strength is one of them.
Odd-Lot Theory	❖ This theory is a <u>contrary - opinion theory</u>. It assumes that the average person is usually wrong and that a wise course of action is <u>to pursue strategies contrary to popular opinion</u>. The odd-lot theory is used primarily to <u>predict tops in bull markets</u>, but also to <u>predict reversals in individual securities</u>.

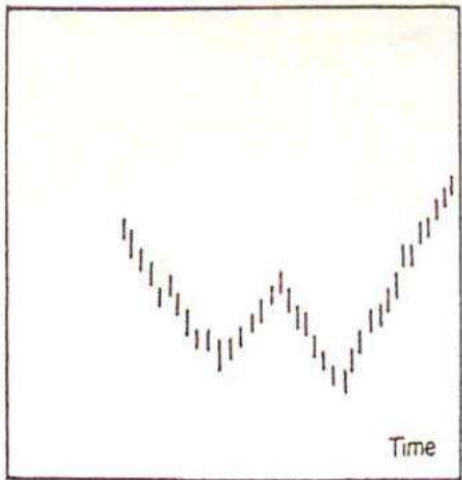
15. What is support and resistance level?

- ❖ When the index/price goes down from a peak, the peak becomes the resistance level. When the index/price rebounds after reaching a trough subsequently, the lowest value reached becomes the support level.
- ❖ The price is then expected to move between these two levels. Whenever the price approaches the resistance level, there is a selling pressure because all investors who failed to sell at the high would be keen to liquidate, while whenever the price approaches the support level, there is a buying pressure as all those investors who failed to buy at the lowest price would like to purchase the share

16. What are the tools to interpret price patterns?

Channel: A series of <u>uniformly changing tops and bottoms</u> gives rise to a channel formation. A <u>downward sloping channel</u> would indicate <u>declining prices</u> and an <u>upward sloping channel</u> would imply <u>rising prices</u>	
Wedge: A wedge is formed when the tops (resistance levels) and bottoms (support levels) <u>change in opposite direction</u> (that is, if the tops, are decreasing then the bottoms are increasing and vice versa), or when they are changing in the same direction at different rates over time.	
Head and shoulders: • It is a distorted drawing of a human form, <u>with a large lump (for head) in the middle of two smaller humps (for shoulders)</u>. This is perhaps the single most important pattern to indicate a reversal of price trend. • The neckline of the pattern is <u>formed by joining points where the head and the shoulders meet</u>. The price movement after the formation of the second shoulder is crucial. If the price goes below the neckline, then a drop in price is indicated, with	

the drop expected to be equal to the distance between the top of the head and the neckline.	
<u>Triangular or coil formation:</u> This formation represents a pattern of uncertainty and is difficult to predict which way the price will break out	 TRIANGLE OR COIL
<u>Flags and Pennants form:</u> This form signifies a phase after which the previous price trend is likely to continue	 FLAG & PENNANT
<u>Double top form:</u> This form represents a bearish development, signals that price is expected to fall.	 DOUBLE TOP

Double bottom form: This form represents bullish development signalling price is expected to rise.	 DOUBLE BOTTOM
Gap: A gap is the difference between the opening price on a trading day and the closing price of the previous trading day. The wider the gap the stronger the signal for a continuation of the observed trend. On a rising market, if the opening price is considerably higher than the previous closing price, it indicates that investors are willing to pay a much higher price to acquire the scrip. Similarly, a gap in a falling market is an indicator of extreme selling pressure.	

17. How to identify buy and sell signals provided by moving average analysis?

Buy Signal	Sell Signal
❖ Stock price line rise through the moving average line when graph of the moving average line is flattening out. ❖ Stock price line falls below moving average line which is rising. ❖ Stock price line which is above moving average line falls but begins to rise again before reaching the moving average line	❖ Stock price line falls through moving average line when graph of the moving average line is flattening out. ❖ Stock price line rises above moving average line which is falling. ❖ Stock price line which is slow moving average line rises but begins to fall again before reaching the moving average line.

18. What are the arguments in favour and against technical analysis? (OR) Describe the concept of 'Evaluation of Technical Analysis'? [OR] In an efficient market, technical analysis may not work perfectly. However, with imperfections, inefficiencies and irrationalities, which characterises the real world, technical analysis may be helpful. Critically analyse the statement [May 2019 MTP, Nov 2020]

Supporters of technical analysis	❖ Under influence of crowd psychology trend persist for some time. Tools of technical analysis help in identifying these trends early and help in investment decision making. ❖ Shift in demand and supply are gradual rather than instantaneous. Technical analysis helps in detecting this shift rather early and hence provides clues to future price movements. ❖ Fundamental information about a company is observed and assimilated by the market over a period of time. Hence price movement tends to continue more or less in same direction till the information is fully assimilated in the stock price.
Detractors of technical analysis	❖ Most technical analysts are not able to offer a convincing explanation for the tools employed by them. ❖ Empirical evidence in support of random walk hypothesis cast its shadow over the usefulness of technical analysis.

	❖ By the time an up-trend and down-trend may have been signalled by technical analysis it may already have taken place. ❖ Ultimately technical analysis must be <u>self-defeating proposition</u>. With more and more people employing it, the value of such analysis tends to decline.

19. Differentiate between Fundamental Analysis and Technical Analysis?

Basis	Fundamental Analysis	Technical Analysis
Method	Prospects are measured by analyzing economy's macro factors such as Country's GDP, Inflation Rate, Interest Rate, Growth Rate etc. and company's micro factors like its Sales, Profitability, Solvency, Asset & Liabilities and Cash position etc.	Predicts future prices and their direction using purely historical market data and information such as their Price Movements, Volume, Open Interest etc.
Rule	Prices of a share discounts everything.	Price captures everything
Usefulness	For Long-Term Investing	For short-term investing

20. Explain the efficient market theory and what are the major misconceptions about this theory?

Key conclusion	As per this theory, at any given time, <u>all available price sensitive information is fully reflected in securities' prices</u> . Thus, this theory implies that no investor can consistently outperform the market as every stock is appropriately priced based on available information
Reason why consistent outperformance cannot happen	❖ Information is <u>freely and instantaneously</u> available to all market participants. ❖ <u>Keen competition</u> among the market participants more or less ensures that market will reflect intrinsic values. This means that they will fully impound all available information. ❖ Price change <u>only response to new information</u> that is unrelated to previous information and therefore unpredictable.
Misconceptions	❖ Efficient Market Theory implies that <u>market prices factor in all available information</u> and as such it is not possible for any investor to earn consistent long term returns from market operations. ❖ Although price tends to fluctuate, they cannot reflect fair value. This is because the future is uncertain. <u>The market springs surprises continually</u> and as prices reflect the surprises they fluctuate. ❖ The random movement of stock prices suggests that stock market is irrational. Randomness and irrationality are two different things, if investors are rational and competitive, price changes are bound to be random.
Level of market efficiency	❖ <u>Weak form efficiency</u>: Price reflect all information found in the record of past prices and volumes ❖ <u>Semi-strong efficiency</u>: Price reflect not only all information found in the record of past prices and volumes but also all other publicly available information ❖ <u>Strong form efficiency</u>: Price reflect all available information public as well as private

21. What are the challenges to the efficient market theory? [Nov 2018 RTP, May 2020 MTP]

- ❖ **Limited information processing capabilities**: Human information processing capabilities are sharply limited. David Dreman maintained that under conditions of **anxiety and uncertainty**, with a vast interacting information grid, the market can become a giant.
- ❖ **Irrational Behaviour**: It is generally believed that **investors' rationality will ensure a close correspondence between market prices and intrinsic values**. But in practice this is not true. J. M. Keynes **argued that all sorts of consideration enter into the market valuation which is in no way relevant to the prospective yield**. The market seems to function largely on **hit or miss tactics rather than on the basis of informed beliefs** about the long-term prospects of individual enterprises.
- ❖ **Monopolistic Influence**: A market is **regarded as highly competitive**. No single buyer or seller is supposed to have undue influence over prices. In practice, **powerful institutions and big operators**

wield grate influence over the market. The monopolistic power enjoyed by them diminishes the competitiveness of the market.

22. What are the tools available for equity research?

- Equity Research is a finance or investment banking field that analyzes a company's financial performance to determine whether to buy, sell, or hold equity shares.
- Equity Research Analysts analyze financial performance using online tools and reports.
- Some of the available tools are:
 - Bloomberg Terminal
 - Benzinga Pro
 - Refinitiv EIKON
 - MarketXLS
 - Stockopedia
 - Koyfin
 - Finbox.io
 - GuruFocus
 - Business Quant
 - Ycharts

Theory to solve problems

Concept 1: How Exponential moving averages are calculated?

- ❖ **Step 1:** Compute the difference between current index value and previous day EMA.
- ❖ **Step 2:** EMA Adjustment = Value of exponent x Value as per step 1
- ❖ **Step 3:** EMA of current day = EMA of previous day ± EMA Adjustment

$$\text{Value of Exponent} = \frac{2}{n + 1}$$

Concept 2: How to test market efficiency?

- ❖ Capture the closing index value for all days and mention the sign of price change. Sign of price change is +(positive) if index has moved up and it will be -(negative) if index has come down
- ❖ **Compute the no. of positive changes (n1) and no. of negative changes (n2). Also compute no of times sign has changed from positive to negative(r).** For example, the sign of price change is positive, negative, negative, positive, positive, positive, negative and positive. In this example r will be taken as 5 (we started with positive and then it shifted to negative on day 2. It again got changed to positive on day 3. Then sign changed to negative on day 7 and it got changed to positive on day 8).

$$\text{Compute } \mu_r = \frac{2n_1n_2}{n_1 + n_2} + 1$$

$$\text{Compute } \sigma_r = \sqrt{\frac{2n_1n_2(2n_1n_2 - n_1 - n_2)}{(n_1 + n_2)^2(n_1 + n_2 - 1)}}$$

- ❖ Compute lower limit and upper limit for the given level of significance. We should apply t-test for n-1 degrees of freedom
 - Lower limit = $\mu_r - (\sigma_r \times t\text{-value})$
 - Upper limit = $\mu_r + (\sigma_r \times t\text{-value})$
- ❖ If the computer r lies between these limits then market exhibits weak form of efficiency

Concept 3: Auto-Correlation Test:

- This can be used to find whether market exhibits weak form of efficiency. We should first identify the two series of values which are to be compared for computing correlation co-efficient
- Process of computation of correlation co-efficient would be explained in portfolio management chapter
- If the Correlation co-efficient is between 0 to 1, then there would be a moderate degree of correlation and we can conclude that the market does not weak form of efficiency
- If the correlation is 0, it means it is difficult to predict market based on earlier trends and hence this would mean that market is exhibiting strong form of efficiency.

- If the correction is +1 or -1, it means we can predict market based on past trends and hence the same would mean market is inefficient
- In short if we can estimate market based on past trends then it is inefficient and if we cannot predict then the same becomes efficient

Practical Problems

1. Test of market efficiency [Nov 2018 MTP, Nov 2008, May 2016 MTP, May 2021 MTP]

The closing value of Sensex for the month of October, 2007 is given below

Date Closing	Sensex
1.10.07	2800
3.10.07	2780
4.10.07	2795
5.10.07	2830
8.10.07	2760
9.10.07	2790
10.10.07	2880
11.10.07	2960
12.10.07	2990
15.10.07	3200
16.10.07	3300
17.10.07	3450
19.10.07	3360
22.10.07	3290
23.10.07	3360
24.10.07	3340
25.10.07	3290
29.10.07	3240
30.10.07	3140
31.10.07	3260

You are required to test the weak form of efficient market hypothesis by applying the run test at 5% and 10% level of significance.

Following value can be used:

- Value of t at 5% is 2.101 at 18 degrees of freedom
- Value of t at 10% is 1.734 at 18 degrees of freedom
- Value of t at 5% is 2.086 at 20 degrees of freedom
- Value of t at 10% is 1.725 at 20 degrees of freedom.

Answer:

Answer:

Author's Note:

- This is an area which is different from normal questions and students normally find it difficult to remember steps. I would advise students to revise this day before exam so that they can answer in exams if it is tested

WN 1: Computation of positive changes and negative changes:

Date	Sensex	Sign of Price Change
1.10.07	2800	
3.10.07	2780	-
4.10.07	2795	+
5.10.07	2830	+
8.10.07	2760	-
9.10.07	2790	+
10.10.07	2880	+
11.10.07	2960	+
12.10.07	2990	+
15.10.07	3200	+
16.10.07	3300	+

17.10.07	3450	+
19.10.07	3360	-
22.10.07	3290	-
23.10.07	3360	+
24.10.07	3340	-
25.10.07	3290	-
29.10.07	3240	-
30.10.07	3140	-
31.10.07	3260	+

- ❖ No of positive changes(n_1) = 11
- ❖ No of negative changes(n_2) = 8
- ❖ No of times sign has changed from positive to negative (r) = 8

WN 2: Computation of upper and lower limit for test of significance:

Particulars	Formula	Calculation	Amount
μ_r	$\frac{2n_1n_2}{n_1 + n_2} + 1$	$\frac{2(11)(8)}{11 + 8} + 1$	10.26
σ_r	$\sqrt{\frac{2n_1n_2(2n_1n_2 - n_1 - n_2)}{(n_1 + n_2)^2(n_1 + n_2 - 1)}}$	$\sqrt{\frac{2(11)(8) \times (2(11)(8) - 11 - 8)}{(11 + 8)^2(11 + 8 - 1)}}$	2.06
Test of significance at 5%			
Lower Limit	$\mu_r - (\sigma_r \times t\text{-value})$	$10.26 - (2.06 \times 2.101)$ (Note 1)	5.932
Upper Limit	$\mu_r + (\sigma_r \times t\text{-value})$	$10.26 + (2.06 \times 2.101)$	14.588
Test of significance at 10%			
Lower Limit	$\mu_r - (\sigma_r \times t\text{-value})$	$10.26 - (2.06 \times 1.734)$	6.688
Upper Limit	$\mu_r + (\sigma_r \times t\text{-value})$	$10.26 + (2.06 \times 1.734)$	13.832

Conclusion:

Computed r lies between the limits and hence the market exhibits weak form of efficiency.

Note:

- Test of significance is to be checked for $n-1$ degree of freedom
- n = No of positive changes + No of negative changes = $11 + 8 = 19$. Hence $n-1$ degree of freedom would be 18

2. Exponential moving average [May 2018 MTP, May 2018, Nov 2009, Nov 2017 MTP, May 2017 RTP]

Closing values of BSE Sensex from 6th to 17th day of the month of January of the year 200X were as follows:

Day	Date	Day	Sensex
1	6	THU	14522
2	7	FRI	14925
3	8	SAT	No trading
4	9	SUN	No trading
5	10	MON	15222
6	11	TUE	16000
7	12	WED	16400
8	13	THU	17000
9	14	FRI	No Trading
10	15	SAT	No Trading
11	16	SUN	No Trading
12	17	MON	18000

Calculate Exponential Moving Average (EMA) of Sensex during the above period. The 30 days simple moving average of Sensex can be assumed as 15,000. The value of exponent for 30 days EMA is 0.062. Give detailed analysis on the basis of your calculations.

Answer:**Author's Note:**

- This is an area which is different from normal questions and students normally find it difficult to remember steps. I would advise students to revise this day before exam so that they can answer

in exams if it is tested

Computation of Exponential Moving Average:

Date	Sensex	EMA of previous day	Change (Col 2 - Col 3)	EMA Adjustment (Col 3 x 30-day exponent)	New EMA (Col 3 + Col 5)
6	14,522	15,000.00	-478	-29.64	14,970.36
7	14,925	14,970.36	-45.36	-2.81	14,967.55
10	15,222	14,967.55	254.45	15.78	14,983.33
11	16,000	14,983.33	1,016.67	63.03	15,046.36
12	16,400	15,046.36	1,353.64	83.93	15,130.29
13	17,000	15,130.29	1,869.71	115.92	15,246.21
17	18,000	15,246.21	2,753.79	170.73	15,416.94

Conclusion: The market is bullish as the value of EMA is on increasing trend. The market is likely to remain bullish for short term to medium term if other factors remain the same. On the basis of this indicator (EMA) the investors/brokers can take long position.

3. EMA:

Closing values of BSE Sensex from 3rd to 12th day of the month of January 2022 are as follows:

Day	Date	Sensex
1	3	17626
2	4	17805
3	5	17925
4	6	17746
5	7	17813
6	10	18003
7	11	18056
8	12	18212

The simple moving average of SENSEX Index for the month of December 2021 was 17174.

You are required to calculate

- The value of exponent for 15 days EMA.
- The exponential moving average (EMA) of SENSEX during the above period. (Calculations to be done up to 2 decimals only)
- Analyse the buy & sell signal on the basis of your calculations

Answer:**Part (i): Value of exponent for 15 days EMA:**

$$\text{Exponent} = \frac{2}{n+1} = \frac{2}{15+1} = 0.125$$

Computation of Exponential Moving Average:

Date	Sensex	EMA of previous day	Change (Col 2 - Col 3)	EMA Adjustment (Col 3 x 15-day exponent)	New EMA (Col 3 + Col 5)
3	17,626.00	17,174.00	452.00	56.50	17,230.50
4	17,805.00	17,230.50	574.50	71.81	17,302.31
5	17,925.00	17,302.31	622.69	77.84	17,380.15
6	17,746.00	17,380.15	365.85	45.73	17,425.88
7	17,813.00	17,425.88	387.12	48.39	17,474.27
10	18,003.00	17,474.27	528.73	66.09	17,540.36
11	18,056.00	17,540.36	515.64	64.45	17,604.81
12	18,212.00	17,604.81	607.19	75.90	17,680.71

Conclusion: A buy (bullish) signal is generated when actual price line (SENSEX in the give case) rises through the moving average, while a sell a (bearish) signal is generated when actual SENSEX level declines

through the moving averages. In the case under consideration the price line of SENSEX never breaches the 15-day EMA line. In-fact it is hovering around the 15-day EMA line only

4. Auto-Correlation Test [Jan 2021]

Mr. X is of the opinion that market has recently shown the Weak Form of Market Efficiency. In order to test the validity of his impression he has collected the following data relating to the movement of the SENSEX for the last 20 days.

Days	Open	High	Low	Close
1	33470.94	33492.44	33449.44	33453.99
2	33453.64	33476.34	33430.94	33434.83
3	33414.06	33437.96	33390.16	33431.93
4	33434.94	33460.04	33409.84	33383.41
5	33372.92	33399.22	33346.62	33370.93
6	33375.85	33403.35	33348.35	33340.75
7	33340.89	33369.59	33312.19	33330.98
8	33326.84	33356.74	33296.94	33335.08
9	33307.16	33338.26	33276.06	33301.97
10	33298.64	33330.94	33266.34	33259.03
11	33260.04	33293.54	33226.54	33251.53
12	33255.92	33290.62	33221.22	33285.89
13	33288.86	33324.76	33252.96	33329.28
14	33335.00	33372.10	33297.90	33284.17
15	33293.83	33332.13	33255.53	33298.78
16	33300.02	33339.52	33260.52	33325.38
17	33323.36	33364.06	33282.66	33329.95
18	33322.81	33364.71	33280.91	33319.67
19	33317.51	33360.61	33274.41	33302.32
20	33290.86	33335.16	33246.56	33319.61

You are required to test the Weak Form of Market Efficiency using Auto-Correlation test, taking time lag of 10 days.

Answer:

WN 1: Computation of change in values for period 1 to 10 and 11 to 20:

Period	Value	Change	Period	Value	Change
1	33453.99		11	33251.53	
2	33434.83	-19.16	12	33285.89	34.36
3	33431.93	-2.90	13	33329.28	43.39
4	33383.41	-48.52	14	33284.17	-45.11
5	33370.93	-12.48	15	33298.78	14.61
6	33340.75	-30.18	16	33325.38	26.60
7	33330.98	-9.77	17	33329.95	4.57
8	33335.08	4.10	18	33319.67	-10.28
9	33301.97	-33.11	19	33302.32	-17.35
10	33259.03	-42.94	20	33319.61	17.29

Note:

- Change of Period 2 = Value of Period 2 – Value of Period 1
- Change of Period 12 = Value of Period 12 – Value of Period 11

WN 2: Computation of Co-relation coefficient:

Prob	Period 1 to 10				Period 11 to 20				Pd ₁ d ₂
	Change	Product	Deviation	Pd ²	Change	Product	Deviation	Pd ²	
0.1111	-19.16	-2.13	2.50	0.69	34.36	3.82	26.79	79.74	7.44
0.1111	-2.90	-0.32	18.76	39.10	43.39	4.82	35.82	142.56	74.66
0.1111	-48.52	-5.39	-26.86	80.16	-45.11	-5.01	-52.68	308.35	157.22

0.1111	-12.48	-1.39	9.18	9.36	14.61	1.62	7.04	5.51	7.18
0.1111	-30.18	-3.35	-8.52	8.07	26.60	2.96	19.03	40.24	-18.02
0.1111	-9.77	-1.09	11.89	15.71	4.57	0.51	-3.00	1.00	-3.96
0.1111	4.10	0.46	25.76	73.73	-10.28	-1.14	-17.85	35.40	-51.09
0.1111	-33.11	-3.68	-11.45	14.57	-17.35	-1.93	-24.92	69.00	31.70
0.1111	-42.94	-4.77	-21.28	50.32	17.29	1.92	9.72	10.50	-22.98
Total		-21.66		291.71		7.57		692.30	182.15

Note:

- Concept of computation of correlation coefficient would be explained in detail in portfolio management chapter
- Change for period 1 to 10 and Period 11 to 20 is taken as per WN 1
- We have total of nine observations. We have taken equal probability for all years and hence probability = $1/9 = 0.1111$ Time
- Product = Change $\times$ Probability
- Deviation = Value of Change - sum of products
- Pd^2 = Probability $\times$ Deviation $\times$ Deviation
- Pd_1d_2 = Probability $\times$ Deviation of Period 1 to 10 $\times$ Deviation of Period 11 to 20

Computation of Co-relation coefficient:

Co-variance	=	182.15
SD of Period 1 to 10	=	$\sqrt{291.71} = 17.08\%$
SD of Period 11 to 20	=	$\sqrt{692.30} = 26.31\%$
Correlation co-efficient	=	$\frac{\text{Co - variance}_{12}}{\sigma_1 \sigma_2} = \frac{182.15}{17.08 \times 26.31} = 0.405 \text{ Times}$

Conclusion:

There is moderate degree of correlation between the returns of two periods hence it can be concluded that the market does not show the weak form of efficiency.

5. Moving Averages:

Compute 5-day moving averages from the following data:

Day	Price
1	74
2	62
3	77
4	46
5	40
6	59
7	49
8	38
9	50
10	74
11	76
12	72
13	45
14	58
15	73

Answer:**Computation of 5-day moving averages:**

Day	Price	5-days total	5-days average [5-days total/5]
1	74		
2	62		
3	77		

4	46		
5	40	299	59.8
6	59	284	56.8
7	49	271	54.2
8	38	232	46.4
9	50	236	47.2
10	74	270	54
11	76	287	57.4
12	72	310	62
13	45	317	63.4
14	58	325	65
15	73	324	64.8

- 5-day total = Total of prices of last 5 observations
- Day 5 total = Prices of Day 1 to Day 5
- Day 6 total = Prices of Day 2 to Day 6

6. Breadth Index:

Compute breadth index and interpret the same:

No of securities advanced	400
No of securities declined	300
No of securities unchanged	200

Answer:

Particulars	Amount
Net advances (400 – 300)	100
Total securities	900
Breadth index $(100/900) \times 100$	11.11

Interpretation:

- If the breadth index supports the movement of the Dow Jones Averages, it indicates technical strength. **This means that a significant number of securities are advancing, which aligns with the positive movement of the Dow Jones Averages.** It suggests that the market is likely to continue moving in the same direction as the Dow Jones Averages.
- If the breadth index contradicts the movement of the Dow Jones Averages, it indicates technical weakness. **This means that the breadth of the market is not supporting the movement of the Dow Jones Averages.** It suggests that the market may move in a direction opposite to the Dow Jones Averages, indicating potential weakness or a trend reversal.

7. Confidence index:

Compute Confidence index and interpret the same:

Yield on high-grade bonds	4%
Yield on low-grade bonds	6%

Answer:

Particulars	Amount
Confidence index	$\frac{\text{Yield on high grade bond}}{\text{Yield on low grade bond}} = \frac{4}{6} \times 100 = 66.67$

Interpretation:

- A rising confidence index is **expected to precede a rising stock market.** It indicates that investors are more willing to take risks in the market, **as the yields on high-grade bonds are relatively lower compared to low-grade bonds.** This suggests that investors have confidence in the overall market and are likely to invest more in stocks.
- A fall in the confidence index is **expected to precede a drop in stock prices.** It signifies that the yields on low-grade bonds **are rising faster** or falling more slowly than the yields on high-grade bonds. This indicates a decrease in investor confidence and suggests a potential shift towards safer investments, possibly leading to a decline in stock prices

8. RSI Index:

Compute RSI Index from the following information:

Day	Price
1	74
2	62
3	77
4	46
5	40
6	59
7	49
8	38
9	50
10	74
11	76
12	72
13	45
14	58
15	73

Answer:

Day	Price	Change	Gain	Loss
1	74			
2	62	-12	0	12
3	77	15	15	0
4	46	-31	0	31
5	40	-6	0	6
6	59	19	19	0
7	49	-10	0	10
8	38	-11	0	11
9	50	12	12	0
10	74	24	24	0
11	76	2	2	0
12	72	-4	0	4
13	45	-27	0	27
14	58	13	13	0
15	73	15	15	0
Average			7.14	7.21

$$\text{Relative Strength} = \frac{\text{Average gain}}{\text{Average loss}} = \frac{7.14}{7.21} = 0.99$$

$$\text{Relative Strength Index} = 100 - \left(\frac{100}{1 + \text{RS}} \right) = 100 - \left(\frac{100}{1 + 0.99} \right) = 100 - 50.25 = 49.75$$

Interpretation:

- The RSI ranges from 0 to 100, **with values above 70 typically considered overbought (indicating a potential reversal or correction)** and **values below 30 indicating oversold conditions (suggesting a potential upward price movement).**

Chapter 5 – Security Valuation**1. Differentiate between expected return and required rate of return?**

- ❖ Required rate of return is the **minimum rate of return** that the investor is expected to receive while making an investment in an asset over a specified period of time. This is also called **opportunity cost or cost of capital** because it is the highest level of expected return forgone which is available elsewhere from investment of similar risks.
- ❖ Expected return **reflects the perception of investors**. If the investors expect a return of a particular share **higher than the required return**, then the share is **undervalued**. The reason is that the share will sell for less than its intrinsic value. On the other hand, if the investors expect a return of a particular share **lower than its required rate of return**, then the share is **overvalued**. The reason is that it will sell for a higher price than its intrinsic value.
- ❖ The difference between expected return and required return is called **expected alpha**

2. What is equity risk premium?

- ❖ Equity risk premium is the **excess return that investment in equity shares** provides over a risk-free rate, such as return from tax free government bonds. This excess return compensates **investors for taking on the relatively higher risk of investing** in equity shares of a company.
- ❖ The size of the premium will change depending upon the level of risk in a particular portfolio and will also change over time as market risk fluctuates. Generally, **high-risk investments are compensated with a higher premium**.
- ❖ **Equity risk premium = Beta of security x (Market Return – Risk free rate)**

3. Explain the concept of nominal cash flow and real cash flow?

- ❖ Nominal cash flow is the **amount of future revenues** the company expects to receive and expenses it expects to pay out, **without any adjustments for inflation**.
- ❖ On the other hand, **Real cash flow** shows a company's cash flow **with adjustments for inflation**. Since inflation reduces the spending power of money over time, the real cash flow shows the effects of inflation on a company's cash flow.
- ❖ In the short term and under conditions of low inflation, the nominal and real cash flows are almost identical. However, in conditions of high inflation rates, the nominal cash flow will be higher than the real cash flow.

4. What is enterprise value and what are the multiples used in relation to enterprise value?**Enterprise value:**

- ❖ Enterprise value is the true economic value of a company. It is calculated by adding market capitalization, long term debt, minority interests minus cash and cash equivalents
- ❖ Enterprise value is of the following three types:
 - Total Enterprise value = Equity + Debt + Minority Interest – Cash and cash equivalents
 - Operating Enterprise value = Total enterprise value – market value of non-operating assets such as investments in associates
 - Core Enterprise value = Operating enterprise value – Value of non-core assets

Multiples relating to enterprise value:

- ❖ **Enterprise value to sales:** This multiple is used for the corporates who maintain negative cash flows or negative earnings. Technological firms generally use this multiple
- ❖ **Enterprise value to EBITDA:** EBITDA is the amount available to both debt and equity holders of a company. This multiple is used for valuing capital intensive companies, which generally have substantial depreciation and amortization expenses. An analyst prefers this multiple because it is not affected by depreciation policy and changes in capital structure. The inverse of this multiple is the cash return on total investment

5. Explain the concept of duration of bond?

- ❖ Duration is nothing but the **average time taken** by an investor to collect his/her investment. If an investor receives a **part of his/her investment** over the time on specific intervals before maturity, **the investment will offer him the duration which would be lesser than the maturity of the instrument**. Higher the coupon rate, lesser would be the duration.

- ❖ It measures how quickly a bond will repay its true cost. The longer the time it takes the greater exposure the bond has to changes in the interest rate environment. Following are some of factors that affect bond's duration:
 - **Time to maturity:** The shorter-maturity bond would have a lower duration and less price risk and vice versa.
 - **Coupon rate:** Coupon payment is a key factor in calculation of duration of bonds. The higher the coupon, the lower is the duration and vice versa.

6. What is immunization?

- ❖ If interest rate goes up although return on investment improves but value of bond falls and vice versa. Thus, the price of Bond is subject to following two risk: (a) Price Risk and (b) Reinvestment Rate Risk
- ❖ Further, **with change in interest rates these two risks move in opposite direction.**
- ❖ Through the process of immunization selection of bonds shall be in such manner that the effect of above two risks shall offset each other.
- ❖ **Immunization happens if the weighted duration of the portfolio is equal to the period for which investment is required to be made**

7. Explain different types of yield curve?

- The term structure of interest rates, also known as Yield Curve, shows how yield to maturity is related to term to maturity for bonds that are similar in all respects, except maturity
- Following are the different types of yield curve:
 - Upward sloping = Long-term interest rates are higher than short term
 - Downward sloping = Long-term interest rates are lower than short term
 - Flat = Long-term interest rates are equal to short term
 - Humped = Interest rates may increase with increase in duration and then may slope downwards

8. What is term structure theory?

- ❖ The term structure theories explain the relationship **between interest rates or bond yields and different terms or maturities.** The different term structures theories are as follows:
 - **Expectation Theory:** As per this theory the long-term interest rates can be used to forecast short-term interest rates in the future as long-term interest rates are assumed to be unbiased estimator of short-term interest rates in future
 - **Liquidity Preference Theory:** Investors are risk-averse and they need a premium for taking risk. Long-term instruments have higher risk need to have a premium for such risk. People prefer liquidity and if they are forced to sacrifice the same for a longer period, they need a higher compensation for the same. Positive slope may be a result of liquidity premium.
 - **Preferred Habitat Theory (Market segmentation theory):** Premiums are related to supply and demand for funds at various maturities – not the term to maturity and hence this theory can be used to explain almost any yield curve shape (can be sloping upward, falling or flat)

9. What is convexity adjustment?

- ❖ Duration is a good approximation of the percentage of price change for a small change in interest rate. However, the change cannot be estimated so accurately of convexity effect as duration base estimation assumes a linear relationship.
- ❖ This estimation can be improved by adjustment on account of 'convexity'. The formula for convexity is as follows:

Δy = Change in Yield

$$C = \frac{V_+ + V_- - 2V_0}{2V_0(\Delta^2)}$$

V_+ = Price of bond if yield increases by Δy

V_- = Price of bond if yield decreases by Δy

10. Modified Duration is a proxy not an accurate measure of change in price of a Bond due to change interest rate. Discuss. [May 2021 MTP]

- Although Modified Duration is a **measure of volatility or change in the price of a Bond** consequent upon change in the yield or interest rates as it **assumes a linear relationship** between the Modified Duration and the price of a Bond but is not accurate measure because of **Convexity**.
- Accordingly the relationship between change in the interest rate and bond value is non-linear i.e.
- Hence it is clear that the **actual effect of change in interest rate on Bond Price is different from the predicted linear relationship**

11. Risks are inherent and integral part of the market. Discuss [Jan 2021]

- Yes, **Risk is an integral part of market and this is a type of systematic risk** that affects prices of any particular share **move up or down consistently for some time periods in line with other shares in the market**.
- A general rise in share prices is referred to as a bullish trend, whereas a general fall in share prices is referred to as a bearish trend. In other words, the share market moves between the bullish phase and the bearish phase.
- **The market movements can be easily seen in the movement of share price indices such as the BSE Sensitive Index, BSE National Index, NSE Index etc.**

12. What is reverse stock split? Explain the reasons for reverse stock split? [Nov 2019 RTP, May 2019 MTP]

- ❖ **'Reverse Stock Split' is a process whereby a company decreases the number of shares outstanding by combining current shares into fewer or lesser number of shares.** For example, in a 5:1 reverse split, a company would take back 5 shares and will replace them with one share.
- ❖ Although, reverse stock split does not result in change in Market value or Market Capitalization of the company but it results in increase in price per share. Considering above mentioned ratio, if company has 100 million shares outstanding before split up, the number of shares would be equal to 20 million after the reverse split up.

Reasons

- ❖ **Avoiding delisting from stock exchange:** Sometimes as per the stock exchange regulation if the price of shares of a company goes below a limit it can be delisted. To avoid such delisting company may resort to reverse stock split up.
- ❖ **Avoiding removal from constituents of Index:** If company's share is one of the constituents of market index then to avoid their removal of scrip from this list, the company may take reverse split up route.
- ❖ **To avoid the tag of "Penny Stock":** If the price of shares of a company goes below a limit it may be called "Penny Stock". In order to improve the image of the company and avoiding this stage, the company may go for Reverse Stock Split.
- ❖ **To attract Institutional Investors and Mutual Funds:** It might be possible that institutional investors may be shying away from acquiring low value shares to attract these investors the company may adopt the route of "Reverse Stock Split" to increase the price per share.

13. Write short note on zero coupon bond?

- ❖ These bonds **do not pay interest** during the life of the bonds. Instead, zero coupon bonds are issued at discounted price to their face value, which is the amount a bond will be worth when it matures or comes due.
- ❖ When a zero-coupon bond matures, **the investor will receive one lump sum** (face value) equal to the initial investment plus interest that has been accrued on the investment made. The maturity dates on zero coupon bonds are usually long term. These maturity dates allow an investor for a long-range planning.
- ❖ Zero coupon bonds issued by banks, government and private sector companies. However, bonds issued by corporate sector carry a potentially higher degree of risk, depending on the financial strength of the issuer and longer maturity period, but they also provide an **opportunity to achieve a higher return**.

14. Explain Arbitrage Pricing Theory?

- ❖ Arbitrage pricing theory (APT) is used as an alternative to Capital Assets Pricing Model (CAPM). While the **CAPM formula helps to calculate the market's expected return, APT uses the risky asset's expected return and the risk premium of a number of macroeconomic factors**.

- ❖ In a simplistic way, if a **particular asset, say a stock**, has its major influencers as the 'interest rate fluctuations' and the 'sectoral growth rate', then the stocks' return would be calculated by using the Arbitrage Pricing Theory (APT) in the following manner:
 - Calculate the risk premium for both these two risk factors (beta for the risk factor 1 – interest rate, and beta of the risk factor 2 – sector growth rate; and,
 - Adding the risk-free rate of return.
- ❖ **Required return under APT = $R(f) + B_1(RP_1) + B_2(RP_2) + \dots B_j(RP_n)$**

15. What is money market instrument and are its characteristics? [May 2021 MTP]

- ❖ Money market instruments is used for meeting the short-term funding requirements of corporates and banks.
- ❖ Following are its characteristics:
 - Short duration
 - Large volume
 - De-regulated interest rates
 - Highly liquid
 - Safe investments owing to issuers inherent financial strength

16. Explain different money market instruments?

Call/Notice Money	❖ Call money market, or inter-bank call money market, is a segment of the money market where scheduled commercial banks lend or borrow on call (i.e., overnight) or at short notice (i.e., for periods upto 14 days) to manage the day-to-day surpluses and deficits in their cash-flows. ❖ However, under notice money market, funds are transacted for a period between two days and fourteen days.
Treasury bills	❖ Treasury bills provide a temporary outlet for short-term surplus as also provide financial instruments of varying short -term maturities to facilitate a dynamic asset-liabilities management ❖ Income on instrument = Difference between issue price and redemption value ❖ These are short-term promissory notes issued by Government of India at a discount
Commercial bills	❖ These arise out of a trade transaction wherein the seller draws a bill on the buyer for goods sold on credit ❖ The buyer accepts it immediately agreeing to pay amount mentioned therein after a certain specified date. Thus, a bill of exchange contains a written order from the creditor to the debtor, to pay a certain sum, to a certain person, after a creation period. ❖ A bill of exchange is a 'self-liquidating' paper and negotiable; it is drawn always for a short period ranging between 3 months and 6 months. ❖ Bill financing is the core component of meeting working capital needs of corporates
Certificate of Deposit (CD)	❖ The CDs are negotiable term-deposits accepted by commercial bank from bulk depositors at market related rates. ❖ CDs are usually issued in demat form or as a Usance Promissory Note. ❖ CD is a front-ended negotiable instrument, issued at a discount and the face value is payable at maturity by the issuing bank
Commercial Paper	❖ CPs are unsecured and negotiable promissory notes issued by high rated corporate entities to raise short-term funds for meeting working capital requirements directly from the market instead of borrowing from banks. ❖ Its period ranges from 7 days to 1 year. CP is issued at discount to face value ❖ The issue of CP seeks to by-pass the intermediary role of the banking system through the process of securitisation. It partly replaces the working capital limits enjoyed by companies with the commercial banks and there will be no net increase in their borrowing by issue of CP. Generally, CP has to be issued at a discount to face value. ❖ Yield on CP is freely determined by the market

Repurchase options (Repo) and Reverse Purchase Agreement (Reverse Repo)	❖ Repo and Reverse Repo refers to a type of transaction in which money <u>market participant raises funds by selling securities</u> and simultaneously agreeing to repurchase the same after a specified time generally at a specified price, which typically includes interest at an agreed upon rate. ❖ Sometimes it is also called <u>Ready Forward Contract as it involves funding by selling securities (held on Spot) and repurchasing them</u> on a forward basis.

17. What are the major differences between Repo and Reverse Repo?

- ❖ **Repo rate** is the rate at which **Reserve Bank of India (RBI) lends to Commercial Banks** for a short period of time against Government Securities. On the other hand, **Reverse Repo is the rate at which Commercial Banks lend to RBI.**
- ❖ A transaction is called a **Repo when viewed from the perspective of the seller of securities** (the party acquiring funds) and **Reverse Repo when described from the point of view of the supplier of funds.** Thus, whether a given agreement is termed a Repo or a Reverse Repo depends largely on which party initiated the transaction.
- ❖ The purpose of **Repo is to fulfill the deficiency of funds.** While the purpose of **Reverse repo is to reduce excess liquidity** in the economy.
- ❖ The Repo rate is comparatively high in comparison to Reverse Repo rate.
- ❖ The **Repo rate strives to contain inflation** in the economy. The **Reverse repo aims to control money supply** in the economy

18. What are the purposes for which valuers are now required?

- **Mergers/Acquisitions/ De-Mergers/Takeovers:** Valuation is mandated in cases of Mergers/ Acquisitions/ De-Mergers/ Takeovers by the Income Tax Act, 1961 for the purpose of determining the tax (if any) payable in such cases.
- **Slump Sale/ Asset Sale/ IPR Sale:** Valuation is required by Insolvency and Bankruptcy Code, 2016 in case of liquidation of company and sale of assets of corporate debtor for the purpose of ascertaining fair value or liquidation value
- **Conversion of Debt/ Security:** Valuation is a necessitated by RBI for Inbound Foreign Investment, Outbound Foreign Investment and other business transactions
- **Capital Reduction:** SEBI regulations such as ICDR/ LODR/ Preferential Allotment etc. also require valuations to be made for listed securities for various purposes on a period basis
- **Strategic Financial Restructuring:** Various statutes such as Companies Act, 2013, SARFAESI Act, 2002, Arbitration and Conciliation Act 1996 etc., warrant valuations to be made for meeting various statutory requirements. Valuation is also made for fulfilling IND AS purposes and may also be made on Court Orders.

19. Explain the responsibilities of valuers as per Rule 12(e) of the Companies (Registered Valuers and Valuation) Rules, 2017?

- **Integrity and Fairness:** A valuer must maintain integrity and fairness in business dealings with clients and other valuers. They should be honest, straightforward, and forthright, provide accurate information, and avoid actions that could discredit the profession
- **Professional competence and Due care:** A valuer must consistently provide high standards of service, exercise due diligence, and **exercise independent professional judgment**. They must adhere to technical and professional standards, maintain knowledge and skill, and not deny liability for their expertise in valuation reports. They must also follow client instructions with integrity, objectivity, and independence.
- **Independence and Disclosure of Interest:** A valuer must act with objectivity and avoid bias, conflict of interest, coercion, **or undue influence in their professional dealings.** They should maintain independence and conduct valuations without external influences. Valuers should disclose potential conflicts of duties and interests to clients, avoid dealing in securities of subject companies, and adhere to SEBI regulations. **They should not engage in "mandate snatching" or convenience valuations,** communicate with prior valuers, and not charge success fees. If a valuer has a prior engagement in an unconnected transaction, they must declare their past association with the company
- **Confidentiality:** Valuers must not disclose confidential information about a company without proper authority or legal duty, unless required by law.

- **Information Management:** A valuer must maintain records of decisions, reasons, and supporting evidence to ensure reasonable decision-making. They should cooperate with inspections and investigations by the Registration Authority, authorised persons, or statutory regulatory bodies. They must provide all necessary information and records. **Valuers must respect confidentiality and maintain working papers for three years for regulatory authority production or peer review.** In pending cases, the record should be maintained until the case's disposal.
- **Gifts and Hospitality:** Valuers should avoid accepting gifts or hospitality that undermine their independence or **offer financial or other advantages to public servants or others for personal gain or profession advantage.**
- **Remuneration and costs:** A valuer must provide transparent, reasonable remuneration services that reflect their work and comply with applicable rules. A valuer should not accept any fees or charges other than those which are disclosed to and approved by the persons fixing his/ its remuneration
- **Occupation, employability and restrictions:** A valuer should avoid accepting too many assignments, only engage in employment when temporarily surrendering their membership certificate, and conduct business that is inconsistent with the profession's reputation, according to the Registration Authority.

20. What precautions should a valuer take before accepting any valuation assignment?

- A good valuation does not provide a precise estimate of value. **A valuation by necessity involves many assumptions and is a professional estimate of value.** The quality and veracity of a good valuation model does not depend just on number crunching. **The quality of a valuation will be directly proportional to the time spent** in collecting the data and in understanding the firm being valued
- Valuing a company involves more **than just evaluating financial statements**; emerging businesses are valued based on narrative-driven factors like scalability, replication, growth potential, and cross-sell opportunities.
- More often than not, investors/users tend to focus on either numbers or the story without attempting to reach a middle ground. In both these cases, **investors will fail to capture opportunities that could have been unlocked had they been willing to reach some middle ground between the two concepts.**
- While it is true that a robust intrinsic value calculation using financial statements data **and an error-free model makes investing a more technical subject**, in reality, emotions play a massive role in moving stocks higher or lower. Not accounting for this fact, therefore, could become an obstacle in consistently getting the valuation right

Theory to Solve Problems

Share valuation models:

- Walter's model
- Gordon's model
- Step-up growth model (or) Dividend discount model (or) Multi-growth model
- PE Multiple approach
- Free cash flow to equity shareholders' model
- H Model

Walter's Model

$$P_0 = \left(\frac{D}{K_e} \right) + \frac{\left(\frac{r}{K_e} \right) \times (E - D)}{K_e}$$

Where:

Term	Meaning	Formula/other notes
P_0	Fair Market Price	
D	Dividend per share	$\frac{\text{Total Dividend}}{\text{Number of shares}}$ (or) $\text{EPS} \times \text{Payout ratio}$
R	Return on equity (or) Internal rate of return (or) Return on retained earnings (or) Return on investment	$\frac{\text{EAES}}{\text{Value of Equity}}$ (or) $\frac{\text{EPS}}{\text{Book value per share}}$

E	Earnings per share	EAES Number of shares EAES = PAT - Preference Dividend	(OR) Book value per share x ROE
K_e	Cost of equity	This is also called as: - Investor's required rate of return - Opportunity cost of capital - Rate of capitalization - Cost of capital (100% equity company) - Equity capitalization rate	

Important Points:

- Cost of equity will be computed as per CAPM model if data on risk-free rate, market return and beta is given. Cost of equity = $R_f + \text{Beta} \times (R_m - R_f)$
- Cost of equity can be sometimes expressed as inverse of PE Multiple ($K_e = 1/\text{PE Multiple}$).** This formula will work only when company follows 100% dividend payout. However, in few problems we will use this formula even for lower payout ratio due to lack of information to get cost of equity
- Question has asked for computing the payout ratio to achieve a target price. However, cost of equity is missing in the question.** We can do one of the following:
 - Assume cost of equity and proceed with the answer
 - Take cost of equity as inverse of PE Multiple. However, this approach will lead to payout ratio of 100%
- Cost of equity is required to be calculated in the question and PE Multiple is given in the question.** We will have all information and K_e would be computed through reverse working and forming quadratic equations.
- Cost of GDR:** Cost of GDR works in same manner as cost of equity. GDR will have underlying equity shares and we can compute the amount of dividend per GDR. Also, it can have floatation cost and hence Price (P_0) is replaced with net proceeds ($P_0 - F$) in the formula
- Multiple growth rates and cost of equity:** If there are multiple growth rates the Gordon's formula cannot be used to find cost of equity. In that scenario we need to assume discount rates and get NPV of the cash flows. Once we get one positive and one negative NPV we can calculate the IRR of the cash flows. The computed IRR would be taken as cost of equity. **We should take care of terminal cash flows while computing NPV as the terminal cash flows (perpetuity) valuation can change based on discount rate.**
- Optimum dividend payout ratio is dependent on return on equity and cost of equity. The same is summarized in the below table:

Scenario	Payout Ratio
$r > K_e$	0%
$r = K_e$	Indifferent (Any payout ratio)
$r < K_e$	100%

- Payout ratio will have impact on share price and the question can ask us to compute the payout ratio for a target share price. If the computed payout ratio is more than 100%, then the same is illogical and ICAI answer takes the payout ratio as 0%
- Limiting value is the minimum possible value of a share and same is calculated at a payout ratio which is opposite of optimum payout ratio.**

Gordon's Model:

$$P_0 = \frac{D_1}{K_e - G}$$

Where:

Term	Meaning	Formula/other notes
P_0	Fair Market Price	
D_1	Dividend of next year	- This is one important assumption as the question would not be clear whether it is nearby dividend (D_0) or Distant Dividend (D_1) - If the question is not clear, then we should write our assumption and also solve answer with both assumption (i.e. taking dividend as D_0 and D_1) Majority of ICAI answers we will have assumption of taking dividend as D_1 and hence that would be our primary answer and alternate answer would be by taking the dividend as D_0

K_e	Cost of equity	Same as per Walter's Model
G	Growth rate	This would represent the growth rate in dividends and can be computed based on the following approaches • Formula based: Growth rate = IRR/ROE x Retention Ratio • Based on past data: ○ Take the first available dividend as Present value and the latest available dividend as future value ○ Number of years gap will be taken as n ○ Use below formula and compute r as balancing figure. The computed r will be taken as growth rate ○ Future value = Present Value x $(1 + r)^n$

Important Points:

- **Price computed as per Gordon's model would be the ex-dividend price.** In case shares are quoting cum-dividend in the market then the fair cum-dividend price would be equal to ex-dividend price + Amount of dividend
- Share price will fall by the amount of dividend once the share goes ex-dividend
- Growth rate should be computed based on EPS. This is because EPS reflects real growth of company and DPS growth would mirror EPS growth unless there is a change in a payout ratio. This approach is followed in case growth is computed based on past data
- **Change in payout ratio:** In order to compute future DPS, we should first compute the EPS and based on EPS we should compute DPS. This approach will ensure correct DPS projection in case there is a change in Dividend Payout Ratio
- **Implied growth rate with current PE Multiple:** If the PE Multiple is given in the question and based on that, we can compute current market price. Current market price can be substituted in Gordon's formula to get implied growth rate.
- **Present value of Growth Opportunities [PVGO]:** PVGO basically represent extra price paid due to growth opportunities of the company. $PVGO = \text{Current market price} - \text{Price if there was no growth}$

Step-up Growth Model (or) Dividend Discount Model (or) Multi-growth model:

- This refers to a scenario where growth happens in multiple stages (initial stage, intermediate stage and final stage)
- **Step 1:** We should compute dividends till the first year of stabilization phase. Stabilization phase is reached where growth rate as well as cost of equity is stabilized and will remain same till perpetuity
- **Step 2:** We should value the perpetuity once stabilization is reached. We will use the Gordon's formula to value the growing perpetuity
- **Step 3:** Discount the above cash flows at cost of equity and arrive at fair value of the share

Important Points:

- **Linear fall in dividend growth rate:** This would mean that dividend growth rate will fall by same percentage every year. Annual fall in growth rate = $[\text{Total fall in growth rate} / \text{Number of years}]$. If the question does not specify the number of years, then we will take the same as 1 percent fall every year
- **Multiple cost of equity:** Question can give information to calculate multiple cost of equity. For instance, cost of equity can be 10% for year 1 to 4 and thereafter it can be 14%. We should use the respective discount rate for perpetuity valuation and PVF should be computed based on below rules:

$$\text{PVF of year 1} = \frac{1}{1 + \text{Discount rate of year 1 (10\%)}} = 0.909$$

$$\text{PVF of year 2} = \frac{0.909}{1 + \text{Discount rate of year 2 (10\%)}} = 0.826$$

$$\text{PVF of year 3} = \frac{0.826}{1 + \text{Discount rate of year 3 (10\%)}} = 0.751$$

$$\text{PVF of year 4} = \frac{0.751}{1 + \text{Discount rate of year 4 (10\%)}} = 0.683$$

$$\text{PVF of year 5} = \frac{0.683}{1 + \text{Discount rate of year 5 (14\%)}} = 0.599$$

- Care should be taken to take the previous year discount factor and then divide by (1 + Discount rate of next year)
- Impact of bonus issue:** Fair market price is the present value of future cash flows discounted at cost of equity. If a bonus issue is made then 1 share can get converted into 1.2 shares (or) 1.5 shares (or) any other number depending on bonus ratio. **Hence, we should consider the selling price of higher number of shares for last year cash flow.**

H Model for Three-Stage Dividend Discount Model:

- In the first stage dividend grows at high growth rate for a constant period, then in second stage it declines for some constant period and finally grow at sustainable growth rate.
- H Model is based on the assumption that before extraordinary growth rate reach to normal growth it declines lineally

$$P_0 = \frac{D_0(1 + g_n)}{r - g_n} + \frac{D_0 H_1 (g_c - g_n)}{r - g_n}$$

Where:

- Gn = Normal growth rate Long run
- Gc = Current growth rate i.e. initial short-term growth rate
- H1 = Half of duration of the transition growth period

Important points common to Walter's and Gordon's Model:

- We should ensure consistency in dividend and cost of equity.** If dividends are exempt in hands of shareholders then the cost of equity should be after tax. Conversely if dividends are taxable in hands of shareholders then the cost of equity should be before-tax
- Maintenance of Dividend Income:** An investor wants to maintain dividend income for meeting his regular expenses. However, the company may stop paying dividends due to growth opportunities. In that case, the investor can maintain the dividend income by partial sales of shares till company starts paying dividends again
- Which method to follow for valuation if the problem is silent:**
 - Most of the questions will be solved either under Walter's or Gordon's model
 - Walter's model will be followed if information on Dividend, EPS, return on equity and cost of equity is given.
 - Gordon's model can be followed if Dividend, Growth rate and Cost of equity is given
 - To conclude, if we have information for Walter's model then Gordon's approach will also be possible. This is because growth rate can be calculated with return on equity and retention ratio.**
- Total Dividends as per residual model = (Total earnings – equity needed for capex). Equity needed for capex would be computed as per the optimum debt-equity capex
- Radical approach:** A company can provide return to shareholders in form of dividends and capital gains. Company should declare dividends if tax rate on dividends is lower than tax rate on capital gain and vice versa

PE Multiple Approach:

- Fair Price of share = EPS × PE Multiple
- PE Multiple will be directly given in the question. If the same is not available, then we can compute PE Multiple as (1/ROE)**

Earning growth model:

$$P_0 = \frac{EPS_1}{K_e - G}$$

Free Cash flow Approach:

$$P_0 = \frac{FCFE_1}{K_e - G}$$

Where:

Term	Meaning	Formula/other notes
FCFE ₁	Free cash flow to equity shareholders of next year	- FCFE = PAT – Equity funding for net capex and working capital - Equity funding for net capex and working capital = Net Capex and Working Capital × (100 – Debt ratio%) - Debt ratio basically represent what percentage of capex and working capital will be funded with debt.

- This approach can be followed if the problem gives data on capital expenditure, depreciation, working capital change and debt ratio

Other important points on valuation:

- A share is said to be under-valued if current market price is lower than intrinsic value whereas a share is said to be over-valued if market price is higher than intrinsic value. Intrinsic value is basically computed as per any of the valuation models. **Investor should buy an under-valued security and sell an over-valued security**
- Inflation premium forms part of risk-free rate of return. Any increase in inflation premium will increase the risk-free rate and vice versa
- **Interest coverage ratio:** Interest coverage is normally computed using the below formula:

$$\text{Interest coverage ratio} = \frac{\text{EBIT}}{\text{Interest}}$$

- However, if the question states that PAT should cover fixed interest and fixed dividends xx times. In this case this ratio would be calculated as under:

$$\text{Interest and Dividend coverage ratio} = \frac{\text{PAT} + \text{Interest}}{\text{Interest} + \text{Preference Dividend}}$$

- **Capital gearing ratio:** Capital gearing ratio is computed using the below formula:

$$\text{Capital Gearing ratio} = \frac{\text{Debentures} + \text{Preference Capital}}{\text{Equity capital} + \text{Reserves and Surplus}}$$

- **Computation of Interest:** Question can give data on interest rates for different types of debt and also an effective interest rate for entire debt structure. If both are given, then overall interest cost = Total debt x Effective interest rate %
- **Asset Turnover ratio:** Asset turnover ratio can be used to compute the overall sales. The same is computed in the following manner:

$$\text{Asset Turnover ratio} = \frac{\text{Sales}}{\text{Total Assets}}$$

- **Operating margin:** Operating margin can be used to compute EBIT and the same can be used in the following manner:

$$\text{Operating margin} = \frac{\text{EBIT}}{\text{Total Sales}}$$

- **Operating profit and Net income:** The term operating profit is basically EBIT and net income is basically PAT
- **ROCE:** Return on capital employed can be used to compute EBIT and the same can be used in the following manner:

$$\text{ROCE} = \frac{\text{EBIT}}{\text{Capital Employed}} \times 100$$

- **Capital employed:** Capital employed = Equity capital + Reserves and Surplus + Preference capital + Debt – Fictitious assets

Rights Issue:

- ❖ A rights issue is an invitation to existing shareholders to purchase additional shares in the company
- ❖ The shares are normally issued at a discount to the fair market price
- ❖ Every shareholder will be given an option to subscribe to the rights shares. The shareholders are also allowed to sell their right. The buyer of the right will get the option to buy the shares at special price
- ❖ A rights issue will not alter the wealth of the shareholder in case he either subscribes to the issue or sells the right. However, in case the shareholder takes no action then his wealth will come down

$$\text{Theoretical ex – rights price} = \frac{(\text{Existing shares} \times \text{Existing Price}) + (\text{New shares} \times \text{Rights Price})}{\text{Existing shares} + \text{New shares}}$$

- Value of one right = Theoretical ex-rights price – Rights Issue price

Important Points:

- **If the expected post-rights price is given in the question, then the theoretical ex-rights price will be replaced with expected/actual post-rights price will be used in the above formula**
- Shareholder's wealth will not be impacted in case a shareholder subscribes to rights issue or sells the rights. However, the wealth will fall in case the shareholder ignores the rights issue
- **Information on rights issue proceeds utilization:** If the information on rights issue proceeds is available then we can compute the NPV of the project. Total NPV (positive/Negative) will have to be added to numerator to compute ex-rights price

Buyback:

- ❖ Buyback refer to repurchase of shares by companies for capital reduction
- ❖ Buyback can increase the EPS if the total earnings remain same and the number of shares reduce due to buyback of shares
- ❖ The term theoretical post buyback price means the price at which the share is expected to trade after buyback. The buyback price is fixed that it is equal to theoretical post buyback price
- ❖ Buyback can be done due to following reasons:
 - Company has surplus cash
 - Large scale change in capital structure
 - To build confidence among investors
 - To defend against hostile takeover
- ❖ **Buyback can impact the total earnings if buyback is funded with debt. Revised PAT = Existing PAT - [Interest cost x (1 - Tax rate)]**

Convertible instruments:

- Convertible instrument refers to those instruments which have an option of converting them into specified number of equity shares within specified period

Term	Formula
Conversion Value (or) Stock Value	CMP of share x Conversion ratio
Conversion premium in Rs. (Per convertible instrument)	Current market price - Conversion value
Conversion premium in Rs. (Per equity share)	$\frac{\text{Conversion Premium in Rs.}}{\text{Conversion Ratio}}$
Conversion premium in %	$\frac{\text{Conversion Premium in Rs.}}{\text{Conversion value}} \times 100$
Straight value (or) Intrinsic value	PV of future interest and principal discounted at investor's required rate of return
Downside risk in Rs.	Current market price - Straight value
Downside risk in % (% of Straight value)	$\frac{\text{Downside Risk in Rs.}}{\text{Straight value}} \times 100$
Downside risk in % (% of CMP)	$\frac{\text{Downside Risk in Rs.}}{\text{Current Market Price}} \times 100$
Premium over straight value (in %)	$\frac{\text{CMP} - \text{Straight Value.}}{\text{Straight value}} \times 100$
Conversion parity Price (or) Market Conversion Price (or) Minimum market price at which conversion is to be exercised	$\frac{\text{CMP of convertible instrument}}{\text{Conversion Ratio}}$
Favourable income differential per bond.	Interest income per bond - Dividend income for equity shares
Favourable income differential per share	$\frac{\text{Favourable income differential per bond.}}{\text{Conversion ratio}} \times 100$
Premium payback period	$\frac{\text{Conversion premium per bond}}{\text{Favourable income differential per bond}}$ (OR) $\frac{\text{Conversion premium per Share}}{\text{Favourable income differential per Share}}$

Valuation of convertible bond:

- **Normal value:** Bond is present value of future cash flows discounted at investor's required rate of return. **We need to redemption cash flow as higher of conversion value of bond on maturity and redeemable value as debt.** However, in some questions the expected conversion value on maturity will not be available and hence redeemable value will be taken as redemption cash flow.
- **Floor value or Minimum Price:** This is computed by taking the bond's cash flow as a debt instrument. **Redeemable value is taken as principal redemption value of debt and not the higher value.** This is the minimum possible value of bond and is computed based on assured cash flows of bond

- **Decision on conversion:** A bond can be converted into equity share only if the conversion value (CMP of share x conversion ratio) is higher than current market price of bond. If the value is less then we should continue the same as bond and not opt for conversion

Bond valuation:

Term	Meaning
Face value or coupon value	Value written across the face of the certificate
Coupon rate	Interest rate written on the face of the certificate
Maturity value	Value payable at the end of the life of a bond
Yield to maturity	The rate of return earned by an investor who buys the bond today and hold it until maturity
Current yield	Current yield refers to the ratio of interest to current market price

Value of bond:

- **Value in year 0:** Value of bond is present value of future cash flows of bond discounted at investor's required rate of return.
- **Value at end of year 1:** Value in year 1 = [Value in year 0 + Discount rate] - Interest of year 1
- **Value at end of year 2:** Value in year 2 = [Value in year 1 + Discount rate] - Interest of year 2

Important points:

- **Half-yearly bond:** If a bond pays interest half-yearly then we should do half-yearly discounting and the discount rate should also be half-yearly yield
- **Step-up or down discount rate:** Follow the approach given in multiple cost of equity while doing share valuation.
- **Discount rate:** Investor's required rate of return will be taken as discount rate. This can also be called as yield of comparable bond (or) going rate of interest. Sometimes the company may want to give a higher yield to investor. In this case, the issue price will be computed based on the yield proposed to be given by the company
- **Annuity Bond:** Annuity Bond is wherein annual inflow (interest + Principal) would be same every year. Annual inflow is calculated as under:

$$\text{Annual Inflow} = \frac{\text{FV of Bond}}{\text{PVAF}(r, n)}$$

- **Value of bond on a date on which interest is not paid:** Let us assume a bond pays interest in June and December. The above approach of valuation can help in valuing a bond on July 1 and January 1. However, we are required to calculate the value of bond on Sep 1. In such a scenario we will complete valuation like this:

$$\text{Value as on September 1} = \text{Value as on July 1} + \text{Accrued interest for broken period [July 1 to August 1]}$$

- **Yield of Treasury Bill:** The yield of treasury bill (short-term instrument) is computed with the below formula:

$$\text{Yield} = \frac{\text{Maturity value} - \text{investment value}}{\text{Investment value}} \times \frac{365}{\text{No of days}} \times 100$$

- **Interest rate and extension of duration:** A company can have an option of increasing the bond life as per the terms of the bond. A company will increase life of bond if the interest rate on bond is lower than prevailing interest rate in market. Similarly, the company will not increase the life and redeem the bond if the interest rate on bond is higher than prevailing interest rate in the market

Bond's yield:

- ❖ A bond will trade above face value if it gives investors a return which is higher than the yield on comparable investments. Such a bond is called premium bond
- ❖ A bond will trade at a discount if the rate of return is lower than the expected return on comparable instruments. Such a bond is called as discount bonds
- ❖ The price changes will occur unless the yield is equal to the yield on comparable instruments and then the price will stabilize

Calculation of YTM:

Method 1	Calculate IRR of the bond considering the future cash flows
Method 2 (Short-cut method)	$\frac{\text{Post tax interest income} + \text{Average other income}}{\text{Average funds employed}}$ Where: $\text{Post tax interest income} = \text{Interest income} \times (1 - \text{Tax rate})$ $\text{Average other income} = \frac{\text{Redemption value} - \text{Net investment}}{\text{Life of instrument}}$ $\text{Average funds employed} = \frac{\text{Redemption value} + \text{Net investment}}{2}$

Important Points:

- **Post-tax YTM:** In this case we should consider taxation on interest income and capital gain and consider net inflows of the investor for computing YTM
- **YTM and Interest rate:** If the bond is issued at par then YTM of the bond would be equal to interest rate of the bond
- **Increase/decrease in interest rate:** Any increase/decrease in interest rate will have to be taken as change in investor expectation (yield) and not as change in bond interest rate. This is because interest rate of a bond/debenture does not change and would remain as per original terms of debenture
- **Variable bond:** A variable bond is one whose interest rate changes with investor expectation. Interest rate on these bonds will always be equal to yield prevailing in the market
- **Computation of prevailing interest rate on similar bond:** If a question asks for computing prevailing interest rate of a similar bond, then we should compute YTM of the bond in question and the YTM of this bond will be taken as prevailing interest rate of similar bond
- **Spread of yield from comparable bond:** Spread of Bond X = YTM of Bond X - Yield of comparable bond
- Expected price of bond = Intrinsic value of bond x Beta [There is no logic for this formula. But this is frequently tested in exams and hence students are requested to remember and apply this]
- **YTM from company point of view:** Company will have inflow on day 0 and will have series of outflow over the life of the bond. Hence while calculating IRR, we should increase the discount rate if we get negative NPV and decrease the discount rate if we get positive NPV [Following an approach opposite of normal approach]

Realized yield:

- ❖ Realized yield assumes that interim cash flows from a bond will be reinvested at a realistic reinvestment rate
- ❖ Terminal value of cash flows is calculated with the reinvestment rate and the same is compared with initial outflow
- ❖ The IRR of the revised cash flows is the realized yield

Other concepts related to realized YTM:

- **Reinvested interest:** Maturity value of interest - normal interest earned
- **Intermediate cash flows are not reinvested:** If the intermediate cash flows are not re-invested then the maturity cash flows will be additional of all inflows. Hence maturity cash flows would be significantly less and based on that we should compute realized YTM.

Duration:

- ❖ Duration refers to the number of years at which the bond will have no impact due to interest rate movement
- ❖ The time period of a bond at which there is no interest rate risk (Immunization)

Steps in computing duration:

- ❖ Step 1: Compute cash flows of bond till maturity
- ❖ Step 2: Determine PVF using YTM
- ❖ Step 3: Market price is sum of present value of cash flow discounted at PVF of step 2
- ❖ Step 4: Divide each year's cash flow by market to get weights
- ❖ Step 5: Sum of (time x weights) is duration

Duration of a normal bond = $\frac{1+y}{y} - \frac{(1+y) + t(c-y)}{c((1+y)^t - 1) + y}$
Where y = Required yield (YTM); c = Coupon Rate for the period t = time to maturity
Duration of a perpetual bond = $\frac{1+y}{y}$
Duration of zero-coupon bond = Life of bond

Format for calculation of duration:

Year	Cash flow	PVF @ YTM	DCF	Weight	Year x Weight
1	Interest				
2	Interest				
3	Interest				
4	Interest				
5	Interest + Principal				
Total					Duration of bond

Important point:

- In case of half-yearly bond, we should compute the duration in terms of number of half-years and the column for year will be replaced with half-year in above table. Similarly, the YTM would be half-yearly YTM

Volatility:

- ❖ Interest rates and bond prices are inversely related
 - If interest rates go up, then bond prices will come down
 - If interest rates comes down, then bond prices will go up
- ❖ The % change in bond prices can be computed with the help of the following formula

$\text{Volatility} = \frac{\text{Duration}}{1 + \text{YTM}}$

Important points:

- Half-yearly bond:** In case of half-yearly bond, we should use half-yearly YTM in the above formula for computing volatility. **However, duration should be only in terms of years.** This will only ensure the price as per volatility formula matches with the price computed by discounting
- Duration and churning of portfolio:** If yields are expected to increase, **price of bond will fall. We should look at reducing the duration of portfolio** in this case and hence we should replace bond of higher duration with bond of lower duration. Lower duration would imply lower volatility and lower fall in price. The opposite will work if yields are expected to fall.

Immunization:

- Immunization happens if the weighted duration of the portfolio is equal to the period for which investment is required to be made. This is a level where price risk and reinvestment risk will offset each other leading to no impact to the investor
- Investor needs money after xx years:** This should be interpreted as duration of investment should be equal to xx years
- Fund an outflow after xx years:** This would be interpreted as duration of investment should be equal to xx years

Bond refunding:

- ❖ Refunding of a bond is an exercise in capital budgeting, since the cash flow structure represents investment decision as shown below

Repayment made today (Y0) = -1000 Interest saved (Y1 to Y5) = 150 Repayment saved (Y5) = 1000

- ❖ If the NPV of the above cash flow structure is positive then we should refund the bond
- ❖ If a bond is being refunded and a fresh bond is being raised then this would be similar to replacement decision
- ❖ All rules that apply to replacement decision will equally apply here

Important Points:

- **Items related to old Bond:** Floatation cost, Discount on issue of debentures, call premium etc related to old bond has to be written off on day 0 because we are looking at replacing old bond with new bond
- **Items related to new bond:** Floatation cost, discount on issue of new bond would be written off over the life of the new bond
- **In-between cash flow:** After-tax outflow of old bond – after-tax outflow of new bond. We should work as if the old bond is continuing when we analyse the cash flows of old bond
- **Overlapping interest:** This is the extra interest paid because old bond could not be redeemed on time. Overlapping interest outflow on day 0 = Extra interest paid on old bond $\times$ (1 – Tax rate)

Forward rates:

Forward rates work in the same manner as that of step-up or step-down discount rates. We will have the following two approaches to compute forward rates

Cash flows are given:

- First take one-year bond and find PVF of year 1 as balancing figure such that NPV of bond is zero. Forward rate of year 1 is computed as under:

$$\text{PVF of year 1} = \frac{1}{1 + \text{Forward rate of year 1}}$$
- Then analyse the 2-year bond and get PVF of year 2 as balancing figure such that NPV of bond is zero. Forward rate of year 2 is computed as under:

$$\text{PVF of year 2} = \frac{\text{PVF of year 1}}{1 + \text{Forward rate of year 2}}$$

Interest rates are given:

- We will use FRA formula to compute forward rates

$$\text{Forward rate for year 1 to year 2} = \frac{\text{FVF for year 2}}{\text{FVF for year 1}} - 1$$

Bond convexity:

- Duration can be used to find the new bond price when there are changes in YTM. However, duration assumes a linear relationship and assumes equal percentage change. But the change is not linear and can be adjusted using convexity adjustment
- New Price = Old Price $\pm$ % change as per duration + Convexity adjustment [Convexity adjustment will always be added even if there is an increase/decrease in Yield]

Computation of convexity:

Δy = Change in Yield

$$C = \frac{V_+ + V_- - 2V_0}{2V_0(\Delta y^2)}$$

V_+ = Price of bond if yield increases by Δy

V_- = Price of bond if yield decreases by Δy

- C = Convexity
- Convexity adjustment (in Rs.) = $C \times (\Delta y^2) \times V_0$

$$\text{Convexity Adjustment (\%)} = \frac{\text{Convexity Adjustment in Rs.}}{V_0} \times 100$$

Enterprise value:

- ❖ Enterprise value is the true economic value of a company. It is calculated by adding market capitalization, long term debt, minority interests minus cash and cash equivalents
- ❖ Enterprise value is of the following three types:
 - Total Enterprise value = Equity + Debt + Minority Interest – Cash and cash equivalents

- Operating Enterprise value = Total enterprise value – market value of non-operating assets such as investments in associates
- Core Enterprise value = Operating enterprise value – Value of non-core assets

Multiples relating to enterprise value:

- ❖ **Enterprise value to sales:** This multiple is used for the corporates who maintain negative cash flows or negative earnings. Technological firms generally use this multiple
- ❖ **Enterprise value to EBITDA:** EBITDA is the amount available to both debt and equity holders of a company. This multiple is used for valuing capital intensive companies, which generally have substantial depreciation and amortization expenses. An analyst prefers this multiple because it is not affected by depreciation policy and changes in capital structure. The inverse of this multiple is the cash return on total investment

Practical Problems**Overview:**

- Part I – Walter's and Gordon's Model
- Part II – Rights issue and buyback
- Part III – Valuation of shares
- Part IV – Valuation of convertible instruments
- Part V – Bond valuation
- Part VI – Enterprise Valuation
- Part VII – Money Market Instruments

Part I – Walter's and Gordon's Model**1. Walter's model [Nov 2009, Nov 2010, Nov 2020]**

The earnings per share of a company is Rs.10 and the rate of capitalisation applicable to it is 10 per cent. The company has three options of paying dividend i.e.(i) 50%, (ii)75% and (iii)100%. Calculate the market price of the share as per Walter's model if it can earn a return of (a) 15, (b) 10 and (c) 5 per cent on its retained earnings.

Answer:**Computation of share price under different scenarios:**

Price	=	$\left(\frac{D}{K_e}\right) + \left(\frac{\left(\frac{r}{K_e}\right) \times (E - D)}{K_e}\right)$

ROE/PR	PR = 50%	PR = 75%	PR = 100%
ROE = 15%	$\left(\frac{5}{0.10}\right) + \left(\frac{\left(\frac{0.15}{0.10}\right) \times (10 - 5)}{0.10}\right)$ = 50 + 75 = Rs.125	$\left(\frac{7.5}{0.10}\right) + \left(\frac{\left(\frac{0.15}{0.10}\right) \times (10 - 7.5)}{0.10}\right)$ = 75 + 37.50 = Rs.112.50	$\left(\frac{10}{0.10}\right) + \left(\frac{\left(\frac{0.15}{0.10}\right) \times (10 - 10)}{0.10}\right)$ = 100 + 0 = Rs.100
ROE = 10%	$\left(\frac{5}{0.10}\right) + \left(\frac{\left(\frac{0.10}{0.10}\right) \times (10 - 5)}{0.10}\right)$ = 50 + 50 = Rs.100	$\left(\frac{7.5}{0.10}\right) + \left(\frac{\left(\frac{0.10}{0.10}\right) \times (10 - 7.5)}{0.10}\right)$ = 75 + 25 = Rs.100	$\left(\frac{10}{0.10}\right) + \left(\frac{\left(\frac{0.10}{0.10}\right) \times (10 - 10)}{0.10}\right)$ = 100 + 0 = Rs.100
ROE = 5%	$\left(\frac{5}{0.10}\right) + \left(\frac{\left(\frac{0.05}{0.10}\right) \times (10 - 5)}{0.10}\right)$ = 50 + 25 = Rs.75	$\left(\frac{7.5}{0.10}\right) + \left(\frac{\left(\frac{0.05}{0.10}\right) \times (10 - 7.5)}{0.10}\right)$ = 75 + 12.50 = Rs.87.50	$\left(\frac{10}{0.10}\right) + \left(\frac{\left(\frac{0.05}{0.10}\right) \times (10 - 10)}{0.10}\right)$ = 100 + 0 = Rs.100

ROE/PR	PR = 50%	PR = 75%	PR = 100%
ROE = 15%	Rs.125	Rs.112.50	Rs.100
ROE = 10%	Rs.100	Rs.100	Rs.100
ROE = 5%	Rs.75	Rs.87.50	Rs.100

2. Target Payout Ratio – Walter's Model [May 2017]

You are requested to find out the approximate dividend payment ratio as to have the share price at Rs.56 by using Walter Model, based on following information available for a company.

Particulars	Amount
Net Profit	50 lakhs
Outstanding 10% preference shares	80 lakhs
Number of equity shares	5 lakhs
Return on investment	15%
Cost of capital after tax (Ke)	12%

Answer:

Note 1: Computation of Earnings per share:

Particulars	Amount (in lacs)
Profit after tax	50
Less: Preference Dividend	(8)
Earnings available to equity shareholders	42
No of shares	5
Earnings per share (42/5)	Rs.8.4 per share

Note 2: Computation of Dividend per share to have price of Rs.56:

$$\text{Price} = \frac{\text{Dividend}}{K_e} + \frac{\left(\frac{r}{K_e}\right) \times (E - D)}{K_e}$$

$$56 = \frac{D}{12\%} + \frac{\left(\frac{15\%}{12\%}\right) \times (8.4 - D)}{12\%}$$

$$56 = \frac{D + 1.25(8.4 - D)}{12\%}$$

- ❖ $(56 \times 12\%) = D + 10.5 - 1.25D$
- ❖ $6.72 = 10.5 - 0.25D$
- ❖ $0.25D = 3.78$
- ❖ Dividend per share = Rs.15.12

Note 3: Computation of payout ratio:

- ❖ Dividend payout ratio = $(\text{Dividends}/\text{Earnings}) \times 100$
- ❖ Dividend payout ratio = $(15.12/8.40) \times 100 = 180\%$
- ❖ Dividend pay-out ratio would be zero, as pay-out ratio more than 100% of EPS seems to be illogical [This point is based on ICAI answer and there is a possibility of writing even 100% as dividend payout ratio. However, students are advised to write this as zero payout in exam]

3. Walter's model - Target Payout Ratio [May 2005]

The following figures are collected from the annual report of XYZ Ltd.:

Particulars	Amount
Net Profit	30 lakhs
Outstanding 12% preference shares	100 lakhs
No. of equity shares	3 lakhs
Return on Investment	20%

What should be the approximate dividend pay-out ratio so as to keep the share price at Rs.42 by using Walter model?

Answer:

Computation of dividend payout ratio to get share price of Rs.42:

Note 1: Computation of EPS:

Particulars	Amount
Net Profit	30,00,000
Less: Preference Dividend (12% x 100 lacs)	(12,00,000)
Earnings available to equity shareholders	18,00,000

No of shares	3,00,000
Earnings per share (EAES/No of shares)	6

Note 2: Computation of Cost of Equity:

- ❖ Cost of equity is missing in the equation and let us take the same as 1/PE Multiple. However, this would give payout ratio as 100% as 1/PE Multiple formula works only at payout ratio of 100%
- ❖ PE Multiple = $(42/6) = 7$ Times
- ❖ Cost of equity = $(1/\text{PE Multiple}) = (1/7) \times 100 = 14.29\%$

Note 3: Computation of Dividend Payout Ratio:

Price	=	$\left(\frac{D}{K_e}\right) + \left(\frac{\left(\frac{r}{K_e}\right) \times (E - D)}{K_e}\right)$
42	=	$\left(\frac{D}{0.1429}\right) + \left(\frac{\left(\frac{0.20}{0.1429}\right) \times (6 - D)}{0.1429}\right)$
42×0.1429	=	$D + 1.40 (6 - D)$
6	=	$D + 8.40 - 1.40D$
$0.4D$	=	2.40
D	=	Rs.6 per share

Payout ratio turns out to be 100 percent for the company to have share price of Rs.42 in case Cost of equity is taken as inverse of PE Multiple.

Alternative solution (This was given as ICAI solution. Question missed giving cost of equity and same has been assumed to get payout ratio)

Cost of Equity:

- ❖ Cost of equity is missing in the question and let us assume the same as 16% (we can assume cost of equity as any number other than 16%)

Computation of Dividend Payout Ratio:

Price	=	$\left(\frac{D}{K_e}\right) + \left(\frac{\left(\frac{r}{K_e}\right) \times (E - D)}{K_e}\right)$
42	=	$\left(\frac{D}{0.16}\right) + \left(\frac{\left(\frac{0.20}{0.16}\right) \times (6 - D)}{0.16}\right)$
42×0.16	=	$D + 1.25 (6 - D)$
6.72	=	$D + 7.50 - 1.25D$
$0.25D$	=	0.78
D	=	$0.78 \div 0.25 = 3.12$ per share

- ❖ Dividend Payout Ratio = $(\text{DPS}/\text{EPS}) \times 100$;
- ❖ Dividend Payout Ratio = $(3.12/6.00) \times 100 = 52\%$

4. Walter's model - Limiting value and computation of cost of equity [May 2012]

X Ltd has an internal rate of return of 20%. It has declared dividend @ 18% on its equity shares, having face value of Rs.10 each. The payout ratio is 36% and Price Earning Ratio is 7.25. Find the cost of equity according to Walter's Model and hence determine the limiting value of its shares in case the payout ratio is varied as per the said model.

Answer:**WN 1: Computation of Cost of Equity:****Base data:**

Particulars	Calculation	Amount
Return on equity	Given	20%
Dividend per share	$\text{Rs.10} \times 18\%$	1.80
Earnings per share	$1.80/36\%$	5.00
Market price	$\text{EPS} \times \text{PE Multiple}$	36.25

	5 x 7.25	

Note:

- Cost of equity cannot be taken as inverse of PE Multiple in this question as the requirement of question is to compute cost of equity. **This approach would make the question very simple and would defeat the purpose of the question**

Computation of cost of equity:

Price	=	$\left(\frac{D}{K_e}\right) + \left(\frac{\left(\frac{r}{K_e}\right) \times (E - D)}{K_e}\right)$
36.25	=	$\left(\frac{1.80}{K_e}\right) + \left(\frac{\left(\frac{0.20}{K_e}\right) \times (5 - 1.80)}{K_e}\right)$
36.25	=	$\left(\frac{1.80}{K_e}\right) + \left(\frac{0.64}{K_e^2}\right)$
36.25	=	$\left(\frac{1.80K_e + 0.64}{K_e^2}\right)$
$36.25K_e^2$	=	$1.80K_e + 0.64$
Final equation	=	$36.25K_e^2 - 1.80K_e + 0.64 = 0$

Solving the quadratic equation:

- ❖ We will need two numbers when added become -1.80 and when multiplied becomes Rs.23.20 (36.26 x 0.64)
- ❖ Two numbers satisfying the above conditions are 4 and -5.80
- ❖ $36.25K_e^2 - 5.80K_e + 4K_e + 0.64 = 0$
- ❖ $36.25K_e(K_e - 0.16) + 4(K_e - 0.16) = 0$
- ❖ $(36.25K_e + 4)(K_e - 0.16) = 0$
- ❖ $K_e = -11.03\%$ (or) $K_e = 16\%$
- ❖ **Final cost of equity is equal to 16% as cost of equity cannot be negative**

WN 2: Computation of limiting value:

- ❖ The return on equity is 20% whereas cost of equity is 16%. The optimum payout ratio in this case is 0%
- ❖ **Limiting value will be calculated at a payout ratio which is opposite of optimum payout ratio.**
- ❖ In this question limiting value will be calculated at payout ratio of 100%

Price	=	$\left(\frac{D}{K_e}\right) + \left(\frac{\left(\frac{r}{K_e}\right) \times (E - D)}{K_e}\right)$
Price	=	$\left(\frac{5}{0.16}\right) + \left(\frac{\left(\frac{0.20}{0.16}\right) \times (5 - 5)}{0.16}\right)$
Price	=	31.25 + 0
Limiting value	=	Rs.31.25 per share

5. Gordon's model [May 2015, May 2021 RTP]

The following information is collected from the annual reports of J Limited:

Profit before tax	Rs.2.50 Crores
Tax rate	40 percent
Retention ratio	40 percent
Number of outstanding shares	50,00,000
Equity capitalization rate	12 percent
Rate of return on investment	15 percent

The market price of the share of the company in the bull market was somewhere around Rs.28 per share. Advice, whether the share of the Golden Ltd. should be purchased or not. Further, also suggest the form of Market prevalent as per EMH Theory.

Answer:

Base data

Particulars	Amount
Profit before tax	2,50,00,000
Less: Tax @ 40%	(1,00,00,000)
Profit after tax/ Earnings available to equity shareholders	1,50,00,000
No of shares	50,00,000
Earnings per share (EAES/No of shares)	3.00
Dividend per share (EPS x Payout ratio)	1.80
Growth rate (ROI x Retention ratio) = (15% x 40%)	6%

Computation of share price:

- ❖ One important assumption under Gordon's model is on Dividend per share. DPS of Rs.1.80 can either be assumed as Nearby Dividend (D0) or Distant Dividend (D1)
- ❖ Nearby dividend is also called as current year dividend and is expected to be paid within 3 months (near term). Distant dividend is also called as next year dividend and is expected to be paid over longer period (>3 months)
- ❖ Majority of ICAI answers we will have assumption of taking dividend as D1 and hence that would be our primary answer and alternate answer would be by taking the dividend as D0
- ❖ In this question we are assuming DPS of Rs.1.80 as distant Dividend (D1)

Price	=	$\left(\frac{D_1}{K_e - G} \right)$
Price	=	$\left(\frac{1.80}{12\% - 6\%} \right)$
Price	=	Rs.30.00

Alternate answer if DPS of Rs.1.80 is assumed as nearby dividend (D0):

Price	=	$\left(\frac{D_1}{K_e - G} \right)$
Price	=	$\left(\frac{1.80 + 6\%}{12\% - 6\%} \right)$
Price	=	Rs.31.80

Advice: Despite the fact that market price of share of the company during bull was around Rs.28, it is worth to purchase the same as intrinsic value of share is higher than market price even in bull phase. **The form of market is weak form of market as it is not discounting all information**

6. Walter/Gordon Model [Nov 2011, Nov 2020]

A company has a book value per share of Rs.137.80. Its return on equity is 15% and it follows a policy of retaining 60% of its earnings. If the opportunity cost of capital is 18%, what is the price of share today?

Answer:

- The problem is silent on approach to be followed for valuation.
- EPS can be computed with book value and ROE
- DPS can be computed with EPS and payout ratio (1 – Retention ratio)
- Growth rate can be computed with the help of ROE and Retention ratio
- **We therefore have the basic information for Gordon's model and Walter's model. Hence this question will be solved under both approaches.**

WN 1: Computation of share price as per Gordon's model:**Base data:**

Particulars	Calculation	Amount
Book value per share	Given	137.80
Return on equity	Given	15%
Earnings per share	Book value per share x ROE 137.80 x 15%	20.67
Dividend per share	20.67 x 40%	8.27
Growth rate	IRR/ROE x Retention ratio 15% x 60%	9%

Note:

- ❖ It is assumed that Dividend per share of Rs.8.27 as D1 (Distant dividend)

Price	=	$\left(\frac{D_1}{K_e - G} \right)$
Price	=	$\left(\frac{8.27}{18\% - 9\%} \right)$
Price	=	Rs.91.89

Alternate answer if DPS of Rs.8.27 is assumed as D0(Nearby Dividend):

Price	=	$\left(\frac{D_1}{K_e - G} \right)$
Price	=	$\left(\frac{8.27 + 9\%}{18\% - 9\%} \right)$
Price	=	Rs.100.16

WN 2: Valuation of share as per Walter's model:

Price	=	$\left(\frac{D}{K_e} \right) + \left(\frac{\left(\frac{r}{K_e} \right) \times (E - D)}{K_e} \right)$
Price	=	$\left(\frac{8.27}{0.18} \right) + \left(\frac{\left(\frac{0.15}{0.18} \right) \times (20.67 - 8.27)}{0.18} \right)$
Price	=	45.94 + 57.41
Price	=	Rs.103.35 per share

7. Cost of equity and market price computation [May 2005, Nov 2013, Nov 2018, May 2011]

Shares of Voyage Limited are being quoted at a price-earning ratio of 8 times. The company retains 45% of its earnings which are Rs.5 per share.

You are required to compute:

- The cost of equity to the company if the market expects a growth rate of 15% p.a.
- If the anticipated growth rate is 16% per annum, calculate the indicative market price with the same cost of capital
- If the company's cost of capital is 20% p.a. & the anticipated growth rate is 19% p.a., calculate the market price per share

Answer:**Part 1: Computation of cost of equity:****Note 1: Computation of Dividend (D1):**

- ❖ Retained earnings is Rs.5 per share and the same represent 45%
- ❖ Total earnings = (5/45%) = Rs.11.11 per share
- ❖ Dividend per share = Total earnings - Retained earnings = Rs.11.11 - Rs.5 = Rs.6.11 per share
- ❖ It is assumed that Rs.6.11 per share as distant dividend (D1).

Note 2: Computation of market price:

- ❖ Market price = Earnings per share x PE Multiple
- ❖ Market price = 11.11 x 8 times = Rs.88.88 per share

Note 3: Computation of cost of equity:

Rate of return (or) Cost of equity (Ke)	$\frac{D_1}{P_0} + \text{Growth rate}$	$\frac{6.11}{88.88} + 15\%$	0.0687 + 0.1500 = 0.2187 or 21.87%

Part 2: Computation of market price:

Market Price	$\frac{D_1}{(K_e - G)}$	$\frac{6.11}{(21.87\% - 16\%)}$	Rs.104.09 per share

Part 3: Computation of market price:

Market Price	$\frac{D_1}{(K_e - G)}$	$\frac{6.11}{(20\% - 19\%)}$	Rs.611 per share

Alternative solution:

- ❖ The company retains 45% of its earnings which are Rs.5 per share. This sentence can also be interpreted as total earnings being Rs.5 per share.

Part 1: Computation of cost of equity:**Note 1: Computation of Dividend (D1):**

- ❖ Dividend per share = Rs.5 per share $\times$ 55% = Rs.2.75 per share
- ❖ It is assumed that Rs.2.75 per share as distant dividend (D1).

Note 2: Computation of market price:

- ❖ Market price = Earnings per share $\times$ PE Multiple
- ❖ Market price = 5 $\times$ 8 times = Rs.40 per share

Note 3: Computation of cost of equity:

Rate of return (or) Cost of equity (Ke)	$\frac{D1}{P0} + \text{Growth rate}$	$\frac{2.75}{40} + 15\%$	$0.0687 + 0.1500 = 0.2187$ or 21.87%

Part 2: Computation of market price:

Market Price	$\frac{D1}{(Ke - G)}$	$\frac{2.75}{(21.87\% - 16\%)}$	Rs.46.85 per share

Part 3: Computation of market price:

Market Price	$\frac{D1}{(Ke - G)}$	$\frac{2.75}{(20\% - 19\%)}$	Rs.275 per share

8. Impact of new project on share price [Nov 2017]

Rahim Enterprises is a manufacturer and exporter of woolen garments to European countries. Their business is expanding day by day and in the previous financial year the company has registered a 25% growth in export business. The company is in the process of considering a new investment project. It is an all equity financed company with 10,00,000 equity shares of face value of Rs. 50 per share. The current issue price of this share is Rs. 125 ex-dividend. Annual earning are Rs. 25 per share and in the absence of new investments will remain constant in perpetuity. All earnings are distributed at present. A new investment is available which will cost Rs. 1,75,00,000 in one year's time and will produce annual cash inflows thereafter of Rs. 50,00,000. Analyse the effect of the new project on dividend payments and the share price.

Answer:**WN 1: Computation of impact of new project on Dividends:**

Year	Earnings	Investment	Dividends	DPS
1	2,50,00,000 [10,00,000 $\times$ 25]	1,75,00,000	75,00,000	7.50 [75,00,000/10,00,000]
2 to ∞	3,00,00,000 [2,50,00,000 + 50,00,000]	0	3,00,00,000	30.00 [3,00,00,000/10,00,000]

WN 2: Computation of impact on share price:**Part 1: Computation of Cost of equity:**

Cost of equity (Ke)	$\frac{D1}{P0} + \text{Growth rate}$	$\frac{25}{125} + 0\%$	$0.20 + 0.00 = 0.20$ (or) 20%

Part 2: Computation of Share Price:

Year	Cash flow	PVF @ 20%	DCF
1	7.50	0.8333	6.25
1	150 [Note 1]	0.8333	125
Expected share price			131.25

Note 1: Computation of PV of Dividends of 2 to ∞

- ❖ Dividends is expected to remain same from year 2 till infinity. We can use Gordon's formula and calculate the share price at the end of year 1

P1	$\frac{D2}{(K_e - G)}$	$\frac{30}{(20\% - 0\%)}$	Rs.150 per share

Conclusion:

Share price will increase from Rs.125 to Rs.131.25 due to the new project.

9. Maintenance of dividend income [May 2018 MTP, May 2018 RTP, May 2016]

SAM Ltd has just paid a dividend of Rs. 2 per share and it is expected to grow @ 6% p.a. After paying dividend, the Board declared to take up a project by retaining the next three annual dividends. It is expected that this project is of same risk as the existing projects. The results of this project will start coming from the 4th year onward from now. The dividends will then be Rs. 2.50 per share and will grow @ 7% p.a. An investor has 1,000 shares in SAM Ltd. and wants a receipt of atleast Rs. 2,000 p.a. from this investment. Show that the market value of the share is affected by the decision of the Board. Also show as to how the investor can maintain his target receipt from the investment for first 3 years and improved income thereafter, given that the cost of capital of the firm is 8%.

Answer:**WN 1: Impact on market price:****Before Project:**

Market Price	$\frac{D1}{(K_e - G)}$	$\frac{2 + 6\%}{(8\% - 6\%)}$	Rs.106 per share

After new project:

P3	$\frac{D4}{(K_e - G)}$	$\frac{2.50}{(8\% - 7\%)}$	Rs.250 per share
P2	$\frac{P3}{(1 + K_e)}$	$\frac{250}{(1 + 8\%)}$	Rs.231.48 per share
P1	$\frac{P2}{(1 + K_e)}$	$\frac{231.48}{(1 + 8\%)}$	Rs.214.33 per share
P0	$\frac{P1}{(1 + K_e)}$	$\frac{214.33}{(1 + 8\%)}$	Rs.198.45 per share

❖ Share price will increase from Rs.106 to Rs.198.45 due to new project

WN 2: Maintenance of Dividend Receipt:

Year	Income needed	Share price	No of shares to be sold
1	2,000	214.33	9.33 shares rounded to 10 shares
2	2,000	231.48	8.64 shares rounded to 9 shares
3	2,000	250.00	8 shares

Note: The investor needed minimum income of Rs.2,000 and hence 9.33 shares have been rounded upwards to 10 shares. 9 shares would not have provided the receipt of Rs.2,000

Dividend income of Year 4 = $2.50 \times (1,000 - 10 - 9 - 8) = \text{Rs.}2,432.50$

Conclusion:

❖ The investor can maintain target receipt of Rs.2,000 by selling shares in first three years and thereafter he can earn higher dividend income of Rs.2,432.50 growing at the rate of 7%

10. Valuation of share [May 2015 MTP]

SRK Limited is a listed company and it has just announced annual dividend for the year ending 2013-14.

Earnings per share (EPS) and Dividend per share (DPS) for 5 years is as follows:

Particulars	2013-14	2012-13	2011-12	2010-11	2009-10
EPS (Rs.)	14.00	13.60	13.10	12.70	12.20
DPS (Rs.)	8.20	8.10	7.90	7.80	7.70

In the opinion of MD of SRK Limited, if the current dividend policy is maintained annual growth in earning and dividends will be no better than the annual growth in earnings over the past years.

Since the Board of SRK Limited is reluctant to take debt to finance growth it is considering changing its dividend policy by retaining 50% of its earnings for investment in various projects having a post-tax rate of return of 15%. The beta of SRK Limited is 1.5, market risk premium is 4% and Risk-free rate of return is 6%.

You are required to calculate expected market price of share if

- SRK Limited does not announce a change in its Dividend Policy
- SRK Limited does announce a change in its Dividend Policy by retaining 50% of its earnings

Note: Growth rate is expected to remain stable

Answer:

Situation 1: SRK Limited does not announce a change in its Dividend Policy:

Note 1: Computation of Cost of Equity:

- ❖ Cost of Equity (K_e) = $R_f + \text{Beta} \times (R_m - R_f)$
- ❖ $K_e = 6\% + 1.5 (10\% - 6\%) = 12\%$

Note 2: Computation of growth rate

- ❖ Company had earnings of 12.20 in 2009-10 and the same had increased to 14.00 in 2013-14. This would mean that 12.20 has become 14.00 in 4 years
- ❖ **Growth rate has been computed based on EPS. This is because EPS reflects real growth of company and DPS growth would mirror EPS growth unless there is a change in a payout ratio**
- ❖ Earnings of Year 0 (PV) = 12.20; Earnings of year 4 (FV) = 14.00; $n = 4$ years; $r = ?$
- ❖ Future value = Present Value $\times (1 + r)^n$
- ❖ $14.00 = 12.20 \times (1 + r)^4$
- ❖ $(1 + r)^4 = \left(\frac{14.00}{12.20}\right)$
- ❖ $(1 + r)^4 = 1.1475$
- ❖ $(1 + r)^2 = 1.0712$
- ❖ $(1 + r) = 1.035$
- ❖ $r = 3.5\%$ and hence growth rate is 3.5%

Note 3: Computation of market price:

Market Price	$\frac{D_1}{(K_e - G)}$	$\frac{8.20 \times 1.035}{(12\% - 3.5\%)}$	Rs.99.85 per share

Situation 2: SRK Limited announce a change in its Dividend Policy:

Note 1: Computation of Growth Rate:

- ❖ Growth rate = ROE $\times$ Retention ratio
- ❖ Growth rate = $15\% \times 50\% = 7.5\%$

Note 2: Computation of D1:

- ❖ Earnings of next year = $14 + 7.5\% = \text{Rs.}15.05$
- ❖ Dividends of next year = $15.05 \times 50\% = \text{Rs.}7.525$

Note 3: Computation of market price:

Market Price	$\frac{D_1}{(K_e - G)}$	$\frac{7.525}{(12\% - 7.5\%)}$	Rs.167.22 per share

11. Investor's expectations and price relationship [Nov 2015 MTP, Nov 2004, May 2014 RTP]

Mr. A is contemplating purchase of 1,000 equity shares of a Company. His expectation of return is 10% before tax by way of dividend with an annual growth of 5%. The Company's last dividend was Rs. 2 per share. Even as he is contemplating, Mr. A suddenly finds, due to a Budget announcement Dividends have been exempted from Tax in the hands of the recipients. But the imposition of Dividend Distribution Tax on the Company is likely to lead to a fall in dividend of 20 paise per share. A's marginal tax rate is 30%. Calculate what should be Mr. A's estimates of the price per share before and after the Budget announcement?

Answer:

WN 1: Computation of share price before budget announcement:

- ❖ Dividends were taxable before budget announcement and the investor's required pre-tax rate of return (k_e) is 10%

- ❖ We will use Gordon's formula to solve this and both D1 and Ke will be taken as pre-tax number. This is because Dividends are taxable and hence Cost of equity should be pre-tax cost of equity

Market Price	$\frac{D1}{(Ke - G)}$	$\frac{2.10}{(10\% - 5\%)}$	Rs.42 per share

WN 2: Computation of share price post budget announcement:

- ❖ Dividends are now exempt in the hands of shareholder and hence relevant cost of equity is post-tax cost of equity. Post-tax cost of equity = $10\% \times (1 - 30\%) = 7\%$
- ❖ Dividends are expected to fall by 20 paise and hence Rs.2 per share is likely to become Rs.1.80 per share. It is assumed that Rs.1.80 is nearby dividend and hence the dividend for next year will be Rs.1.89 (Rs.1.80 + 5%) [Alternate assumptions exist for this]

Market Price	$\frac{D1}{(Ke - G)}$	$\frac{1.89}{(7\% - 5\%)}$	Rs.94.50 per share

12. Computation of cost of equity [Nov 2018 MTP, May 2012, Nov 2018 RTP]

In December, 2011 AB Co.'s share was sold for Rs. 146 per share. A long term earnings growth rate of 7.5% is anticipated. AB Co. is expected to pay dividend of Rs. 3.36 per share.

- What rate of return an investor can expect to earn assuming that dividends are expected to grow along with earnings at 7.5% per year in perpetuity?
- It is expected that AB Co. will earn about 10% on book Equity and shall retain 60% of earnings. In this case, whether, there would be any change in growth rate and cost of Equity?

Answer:**WN 1: Computation of rate of return when dividends are expected to grow at 7.5%:**

Rate of return (or) Cost of equity (Ke)	$\frac{D1}{P0} + \text{Growth rate}$	$\frac{3.36}{146} + 7.5\%$	$0.0230 + 0.0750 = 0.098$ or 9.8%

WN 2: Computation of growth rate and cost of equity if the company will earn 10% on book equity:**Note 1: Computation of growth rate:**

- ❖ Growth rate = ROE/IRR x Retention ratio
- ❖ Growth rate = $10\% \times 60\% = 6\%$

Note 2: Computation of dividends (D1):

- ❖ The company had growth rate of 7.5 percent in the past and hence retention ratio in the past would have been:
 - Retention ratio = Growth rate/IRR = $7.5\%/10\% = 75\%$
- ❖ The firm had retention rate of 75% and hence payout ratio would have been 25%.
- ❖ EPS of year 1 = (Dividend of year 1/Payout ratio) = $3.36/25\% = \text{Rs.}13.44$
- ❖ Revised dividend of year 1 = $13.44 \times 40\% = \text{Rs.}5.376$

Note 3: Computation of cost of equity:

Rate of return (or) Cost of equity (Ke)	$\frac{D1}{P0} + \text{Growth rate}$	$\frac{5.376}{146} + 6.0\%$	$0.0368 + 0.06 = 0.0968$ (or) 9.68%

Alternate answer for Part 2:**Note 1: Computation of dividends (D1):**

- ❖ The company had growth rate of 7.5 percent in the past and hence retention ratio in the past would have been:
 - Retention ratio = Growth rate/IRR = $7.5\%/10\% = 75\%$
- ❖ The firm had retention rate of 75% and hence payout ratio would have been 25%.
- ❖ EPS of year 1 = (Dividend of year 1/Payout ratio) = $3.36/25\% = \text{Rs.}13.44$
- ❖ EPS of year 0 = $(13.44/1 + 7.5\%) = \text{Rs.}12.50$
- ❖ New EPS of year 1 with growth rate of 6 percent = $12.50 + 6\% = \text{Rs.}13.25$
- ❖ Revised dividend of year 1 = $13.25 \times 40\% = \text{Rs.}5.30$

Note 3: Computation of cost of equity:

Rate of return (or) Cost of equity (Ke)	$\frac{D1}{P0} + \text{Growth rate}$	$\frac{5.30}{146} + 6.0\%$	$0.0363 + 0.06 = 0.0963$ (or) 9.63%

13. Residual dividend model:

CMC Plc has an all-common equity capital structure. It has 200,000 share of Rs.2 par value equity shares outstanding. When CMC's founder, who was also its research director and most successful inventor, retired unexpectedly to the South Pacific in late 2005, CMC was left suddenly and permanently with materially lower growth expectations and relatively few attractive investment opportunities. Unfortunately, there was no way to replace the founder's contributions to the firm. Previously, CMC found it necessary to plough back most of its earnings to finance growth, which averaged 12% per year. Future growth at 6% rate is considered realistic, but this level would call for an increase in dividend payout. Further it now appears that new investment projects with at least the 14% rate of return required by CMC's shareholders would amount to Rs.8,00,000 for 2006 in comparison to a projected Rs.20,00,000 of net income. If the existing 20% dividend payout were continued, retained earnings would be Rs.16,00,000 in 2006. The one encouraging thing is that the high earning from existing assets are expected to continue and net income of Rs.20,00,000 is still expected for 2006.

- ❖ Assume that the acceptable 2006 investment projects would be financed entirely by retained earnings during the year, calculate DPS in 2006, assuming CMC follows residual payment policy
- ❖ What payout ratio does your answer to earlier part imply for 2006
- ❖ If a 60% payout ratio is adopted and maintained for the foreseeable future, what is your estimate of the present market price of the equity share? How does this compare with the market price that should have prevailed under the assumptions existing just before the news of founder's retirement? If the two values of P_0 are different? Comment on why?
- ❖ What would happen to the price of the share if the old 20% payout were continued? Assume that if this payout is maintained, the average rate of return on the retained earnings will fall to 7.5 percent and the new growth rate will be $G = (1.0 - \text{Payout ratio}) * (\text{ROE}) = (1.0 - 0.2) * (7.5\%) = 6.0\%$

Answer:**WN 1: Computation of DPS and payout ratio for 2006:**

Particulars	Calculation	Amount
Capital expenditure of next year	Given	8,00,000
Equity needed for capex	$8,00,000 \times 100\%$	8,00,000
Net income	Given	20,00,000
Less: Amount needed for capex		(8,00,000)
Possible dividend		12,00,000
Dividend per share	$12,00,000/2,00,000$	Rs.6
Dividend payout ratio	$12,00,000/20,00,000$	60%

WN 2: Impact on share price:**Revised scenario:****Base data:**

Particulars	Calculation	Amount
Cost of equity	Given	14%
Growth rate	Given	6%
DPS	WN 1	6

Market Price	$\frac{D_1}{(K_e - G)}$	$\frac{6}{(14\% - 6\%)}$	Rs.75 per share

Existing scenario:**Base data:**

Particulars	Calculation	Amount
Cost of equity	Given	14%
Growth rate	Given	12%
Total dividends	$20,00,000 \times 20\%$	4,00,000
DPS	$4,00,000/2,00,000$	2

Market Price	$\frac{D_1}{(K_e - G)}$	$\frac{2}{(14\% - 12\%)}$	Rs.100 per share

Comments:

- ❖ Although CMC has suffered a severe setback, its existing assets will continue to provide a good income stream. More of these earnings should now be passed on to the shareholders, as the slowed internal growth has reduced the need for funds.
- ❖ However, the net result is a 25 % decrease in the value of the shares.

WN 3: Computation of share price if old 20% payout ratio is continued:**Base data:**

Particulars	Calculation	Amount
Cost of equity	Given	14%
Growth rate	Given	6%
Total dividends	20,00,000 x 20%	4,00,000
Dividend per share	4,00,000/2,00,000	2

Market Price	$\frac{D1}{(K_e - G)}$	$\frac{2}{(14\% - 6\%)}$	Rs.25 per share

14. Radical Approach:

Shares of company A and B are having the same Beta. You are planning to invest in these two companies. Data available with you indicate that price of Share A will be worth Rs.640, one year from now. A will not pay any dividend. Price of B is expected to be Rs.600 at the end of the same period with dividend payment of Rs.40. Ascertain the current market price of shares, if dividends are taxed at 15% and capital gains are taxed at 10%. Post tax return on investment in shares of A and B is 16%. Assume applicability of radical position.

Answer:**Computation of share price of Company A and Company B:**

Particulars	Company A	Company B
Current share price	X	Y
Target return (in %)	16%	16%
Target return (in Rs.)	0.16X	0.16Y
Dividend earned	0	40
Post-tax dividend	0	34 [40 x 85%]
Capital gain	640 - X	600 - Y
Post-tax capital gain	0.90[640 - X]	0.90[600 - Y]
Total return earned	0.90[640 - X]	34 + 0.90[600 - Y]

Share price of Company A:

$0.16X = 0.90[640 - X]$
$0.16X = 576 - 0.90X$
$1.06X = 576$
X = 543.40

Share price of Company B:

$0.16Y = 34 + 0.90[600 - Y]$
$0.16Y = 34 + 540 - 0.90Y$
$1.06Y = 574$
Y = 541.51

Part II - Rights Issue and Buyback**15. Rights issue [Nov 2010, May 2014 MTP, Nov 2014 RTP, Nov 2018 RTP, May 2021 RTP]**

ABC Limited has issued 75,000 equity shares of Rs.10 each. The current market price per share is Rs. 24. The company has a plan to make a rights issue of one new equity share at a price of Rs.16 for every four share held.

You are required to:

- ❖ Calculate the theoretical post-rights price per share;

- ❖ Calculate the theoretical value of the right alone;
- ❖ Show the effect of the rights issue on the wealth of a shareholder, who has 1,000 shares assuming he sells the entire rights; and
- ❖ Show the effect, if the same shareholder does not take any action and ignores the issue.

Answer:

WN 1: Computation of post-rights price:

$$\text{Ex - rights Price} = \frac{(\text{Existing shares} \times \text{existing price}) + (\text{New shares} \times \text{rights price})}{\text{Existing shares} + \text{New shares}}$$

$$\text{Ex - rights Price} = \frac{(75,000 \times 24) + (18,750 \times 16)}{75,000 + 18,750} = \text{Rs. 22.40 per share}$$

WN 2: Computation of value of right:

Particulars	Amount
Ex-rights price	22.40
Rights Price	16
Value of one right	6.40
Value of one right (per share)	1.60 [6.40/4]

WN 3: Effect on shareholder's wealth:

Particulars	Sells rights	Ignores the issue
Existing shares	1,000	1,000
Existing Price	24	24
Existing wealth	24,000	24,000
Rights acquired (1,000/4)	250	0
Sales price of right (WN 2)	6.40	0
Money earned by selling rights[A]	1,600	0
Shares held post rights issue	1,000	1,000
Ex-rights price	22.40	22.40
Value of shares post rights issue [B]	22,400	22,400
Revised Wealth [A+B]	24,000	22,400
Impact on shareholder's wealth	0	Fall by Rs.1,600

16. Rights issue [May 2012 RTP, Nov 2018 RTP, Nov 2004, May 2014 RTP]

AB Limited's shares are currently selling at Rs.130 per share. There are 10,00,000 shares outstanding. The firm is planning to raise Rs.2 Crores for finance new project.

Required:

What is ex-rights price of shares and value of a right, if:

- i. The firm offers one right share for every two shares held
- ii. The firm offers one right share for every four shares held
- iii. How does the shareholder's wealth change from (i) to (ii)? How does rights issue increase shareholder's wealth?

Answer:

WN 1: Computation of ex-rights price and value of a right for two situations:

Particulars	Offer I	Offer II
Amount to be raised	2,00,00,000	2,00,00,000
Rights ratio	1:2	1:4
No of rights shares to be issued	5,00,000 [10,00,000 x (1/2)]	2,50,000 [10,00,000 x (1/4)]
Rights Price	Rs.40 [2,00,00,000/5,00,000]	Rs.80 [2,00,00,000/2,50,000]
Existing shares	10,00,000	10,00,000
Existing Price	130	130

Ex-rights price calculation:

$$\text{Ex - rights Price} = \frac{(\text{Existing shares} \times \text{existing price}) + (\text{New shares} \times \text{rights price})}{\text{Existing shares} + \text{New shares}}$$

$$\text{Situation 1} = \frac{(10,00,000 \times 130) + (5,00,000 \times 40)}{10,00,000 + 5,00,000} = \text{Rs. 100}$$

$$\text{Situation 2} = \frac{(10,00,000 \times 130) + (2,50,000 \times 80)}{10,00,000 + 2,50,000} = \text{Rs. 120}$$

Value of right calculation:

Particulars	Offer I	Offer II
Ex-rights price	100	120
Rights Price	40	80
Value of one right	60	40
Value of one right (per share)	30 [60/2]	10 [40/4]

WN 2: Impact on shareholder's wealth:

Let us assume the shareholder owns 100 shares

Particulars	Offer I	Offer II
Existing shares	100	100
Existing Price	130	130
Existing wealth	13,000	13,000
Rights shares acquired	50	25
Rights Price	40	80
Amount paid for purchasing shares [A]	2,000	2,000
Revised shares post rights issue	150	125
Ex-rights price	100	120
Value of shares post rights issue [B]	15,000	12,500
Revised Wealth [B-A]	13,000	13,000

Shareholder's wealth remains same before and after rights issues in both offers. Hence rights issue has no impact on shareholder's wealth

17. Rights Issue:

The stock of the Soni plc is selling for Rs.50 per common stock. The company then issues rights to subscribe to one new share at Rs.40 for each five rights held.

- What is the theoretical value of a right when the stock is selling rights-on?
- What is the theoretical value of one share of stock when it goes ex-rights?
- What is the theoretical value of a right when the stock sells ex-rights at Rs.50?
- John Speculator has Rs.1,000 at the time Soni plc goes ex-rights at Rs.50 per common stock. He feels that the price of the stock will rise to Rs.60 by the time the rights expire. Compute his return on his Rs.1,000 if he (1) buys Soni plc stock at Rs.50, or (2) buys the rights as the price computed in part c, assuming his price expectations are valid.

Answer:**Part a and b**

$$\text{Ex - rights Price} = \frac{(\text{Existing shares} \times \text{existing price}) + (\text{New shares} \times \text{rights price})}{\text{Existing shares} + \text{New shares}}$$

$$\text{Ex - rights price} = \frac{(5 \times 50) + (1 \times 40)}{5 + 1} = \text{Rs. 48.33}$$

Value of right calculation:

Particulars	Amount
Ex-rights price	48.33
Rights Price	40
Value of one right	8.33
Value of one right (per share)	1.67

[8.33/5]

Part c:**Value of right calculation:**

Particulars	Amount
Ex-rights price (given in problem)	50
Rights Price	40
Value of one right	10
Value of one right (per share)	2 [10/5]

Part d:**Scenario 1: John buys the shares:**

Particulars	Amount
No of shares bought	20 [1,000/50]
Expected Ex-rights price	60
Value post rights issue	1,200 [60 × 20]
Profit	200 [1,200 – 1,000]

Scenario 2: John buys the rights:

Particulars	Amount
No of rights bought (Note 1)	500 [1,000/2]
Expected value of right post issue (Note 2)	4
Value post rights issue	2,000 [500 × 4]
Profit	1,000 [2,000 – 1,000]

Note 1: John plans to buy the rights and the same would have quoted at Rs.2 as computed in part (c) of the question. He will be able to buy 500 Rights

Note 2: Expected value of one right post issue:

Particulars	Amount
Ex-rights price (given in problem)	60
Rights Price	40
Value of one right	20
Value of one right (per share)	4 [20/5]

18. Rights issue [RTP Nov 2010]

ABC Limited has paid-up ordinary share capital of Rs.2,00,00,000 represented by 4,00,000 shares of Rs.50 each. Earnings after tax in the most recent year were Rs.75,00,000 of which Rs.25,00,000 was distributed as dividend. The current PE multiple is 8. The company is planning a major investment that will cost Rs.202.50 lacs and is expected to produce additional after tax earnings over the foreseeable future at the rate of 15% on the amount invested. It was proposed by CFO of company to raise necessary finance by a rights issue to the existing shareholders at a price 25% below the current market price of the company's shares.

You have been appointed as a management consultant and are required to calculate:

- The current market price of the shares already in issue
- The price at which the rights issue will be made
- The number of new shares that will be issued
- The price at which the shares of the entity should theoretically be quoted on completion of the rights issue assuming no incidental costs and that the market accepts the entity's forecast of incremental earnings

It has been said that, provided the required amount of money is raised and that the market is aware of the earning power of the new investment, the financial position of existing shareholders should be the same whether or not they decide to subscribe for the rights they are offered. You are required to illustrate that there will be no change in the existing shareholder's wealth.

Answer:

WN 1: Computation of current market price:

Particulars	Calculation	Amount
Total earnings	Given	75,00,000
No of shares	Given	4,00,000
Earnings per share	75,00,000/4,00,000	18.75
PE Multiple		8
Market price	18.75 x 8	Rs.150

WN 2: Computation of price at which rights issue will be made and no of shares issued:

Particulars	Calculation	Amount
Current market price	WN 1	150
Rights issue price	150 x 75%	112.50
Funds to be raised		202.50 lacs
Shares to be issued	202.50 lacs/112.50	1,80,000

WN 3: Expected price post rights issue:

Note 1: Computation of NPV of Project:

Particulars	Calculation	Amount
Cost of project	Given	202.50 lacs
Earning of project	202.50 x 15%	30.375 lacs
PE Multiple		8 Times
Value of project	30.375 lacs x 8	243 lacs
Less: Cost of project		(202.50 lacs)
NPV of Project		40.50 lacs

Note 2: Computation of ex-rights price:

$$\text{Ex - rights Price} = \frac{(\text{Existing shares} \times \text{existing price}) + (\text{New shares} \times \text{rights price}) + \text{NPV of Project}}{\text{Existing shares} + \text{New shares}}$$

$$\text{Ex - rights Price} = \frac{(4 \text{ lacs} \times 150) + (1.8 \text{ lacs} \times 112.50) + 40.50 \text{ lacs}}{4 \text{ lacs} + 1.80 \text{ lacs}} = \frac{843 \text{ lacs}}{5.80 \text{ lacs}}$$

Ex - rights Price = Rs. 145.34 per share

WN 3: Impact on shareholder's wealth:

There will be change in shareholder's wealth in this case but the change is due to positive NPV of new project and not due to rights issue.

Particulars	Buys shares	Sells rights
Existing shares (assumed)	1,000	1,000
Existing Price	150	150
Existing wealth	1,50,000	1,50,000
Rights shares purchased (1,000 x 1.80 lacs/4 lacs)	450	NA
Purchase price of share (WN 1)	112.50	NA
Money paid for buying shares (A)	50,625 [450 x 112.50]	NA
Rights sold (1,000 x 1.80 lacs/4 lacs)	NA	450
Sale value of one right (145.34 - 112.50)	NA	32.84
Money earned from selling rights (B)	NA	14,778
Shares held post rights issue	1,450	1,000
Ex-rights price	145.34	145.34
Value of shares post rights issue [C]	2,10,743	1,45,340
Revised Wealth [C+B-A]	1,60,118	1,60,118

Impact on shareholder's wealth (Revised wealth – Existing wealth)	10,118	10,118
Impact on wealth:		
Due to NPV of new project		
NPV of new project	40,50,000	40,50,000
Number of shares	4,00,000	4,00,000
NPV per share	10.125	10.125
Number of shares (pre-rights issue)	1,000	1,000
Total impact on wealth (1,000 x 10.125)	10,125	10,125
Impact due to rights issue	0	0

19. New issue versus rights issue [Nov 2015 RTP]

Telbel Limited is considering undertaking a major expansion involving outlay of Rs.150 Crores. The Board of Director of company are expecting to generate an additional profit of Rs.15.30 crore after a period of one year. Further, it is expected that this additional profit shall grow at the rate of 4% for indefinite period in future. Presently, Telbel Ltd. is completely equity financed and has 50 crore shares of Rs.10 each. The current market price of each share is Rs. 22.60 (cum dividend). The company has declared a dividend of Rs. 1.40 per share in last year. For the last few years dividend is increasing at a compound rate of 6% p.a. and it is expected to be continued in future also. This growth rate shall not be affected by expansion project in any way. Board of Directors are considering following ways of financing the possible expansion:

- ❖ A right issue on ratio of 1:5 at price of Rs.15 per share.
- ❖ A public issue of shares.

In both cases the dividend shall become payable after one year. You as a Financial Consultant required to:

- a) Determine whether it is worthwhile to undertake the project or not.
- b) Calculate ex-dividend market price of share if complete expansion is financed from the right issue.
- c) Calculate the number of new equity shares to be issued and at what price assuming that new shareholders do not suffer any loss after subscribing new shares.
- d) Calculate the total benefit from expansion to existing shareholders under each of two financing option.

Answer:

WN 1: Computation of NPV of new project:

Part 1: Computation of Cost of equity:

Cost of equity (Ke)	$\frac{D_1}{P_0} + \text{Growth rate}$	$\frac{1.40 + 6\%}{21.20} + 6\%$	0.07 + 0.06 = 0.13 (or) 13%

Note: Market price in Gordon's model is ex-dividend price. This is because share will quote at ex-dividend price once the dividends are paid out by the company

Part 2: Computation of NPV:

Particulars	Calculation	Amount
Cost of project	Given	150 crores
Value of Project	$\frac{CF_1}{K_e - \text{Growth}} = \frac{15.30 \text{ cr}}{13\% - 4\%}$	170 crores
NPV of Project		20 Crores

- ❖ The company should go ahead with project as the same generates positive NPV of Rs.20 Crores

WN 2: Computation of ex-rights price:

$$\text{Ex - rights Price} = \frac{(\text{Existing shares} \times \text{existing price}) + (\text{New shares} \times \text{rights price}) + \text{NPV of Project}}{\text{Existing shares} + \text{New shares}}$$

$$\text{Ex - rights Price} = \frac{(50 \text{ cr} \times 21.20) + (10 \text{ cr} \times 15) + 20 \text{ cr}}{50 \text{ cr} + 10 \text{ cr}} = \frac{1230 \text{ cr}}{60 \text{ Cr}} = \text{Rs. 20.50 per share}$$

WN 3: Computation of shares to be issued and issue price for new issue:

- ❖ Let us assume issue price as x
- ❖ No of shares to be issued = (150 Crores/x)
- ❖ We need to ensure that issue price and post-issue price as same. This will ensure that there is no loss for new shareholder

Particulars	Calculation	Amount
Post-issue market capitalization		1,230 crores

No of shares post issue		$50 \text{ Crores} + \frac{150 \text{ Cr}}{X}$
Post issue price (X)	=	$\frac{(1,230)}{(50 + (\frac{150}{X}))}$

$X = \frac{(1,230)}{(50 + (\frac{150}{X}))}$
$X (50 + (\frac{150}{X})) = 1,230$
$50X + 150 = 1,230$
$50X = 1,080$
X = 21.60 per share

- ❖ Issue price for public issue = Rs.21.60 per share
- ❖ No of shares to be issued = $(150 \text{ cr} / 21.60) = 6.94 \text{ Crores}$

WN 4: Computation of net benefit from expansion for existing shareholders:

Particulars	Rights issue	New issue
Existing wealth:		
No of shares	50 Crores	50 Crores
Market price	21.20	21.20
Existing wealth	1,060 Crores	1,060 Crores
Revised wealth		
No of shares held by existing shareholders	60 Crores	50 Crores
Market price	20.50	21.60
Value of shares (A)	1,230 Crores	1,080 Crores
Amount borrowed to buy rights issue shares (B)	150 Crores	
Net wealth (A - B)	1,080 Crores	1,080 Crores
Increase in wealth (New wealth - Existing wealth)	20 Crores	20 Crores

20. Rights issue [July 2021]

Aggressive Ltd., is proposing to fund its expansion plan of Rs. 12 crore by making a rights issue. The current market price (CMP) is Rs. 40. The Board is willing to offer a discount of 20% on the CMP for the rights issue. The Board is also desirous that the fall in Ex-right price of the shares be restricted to 10% of CMP. You are required to calculate:

- (i) The number of new equity shares to be offered for each rights held,
- (ii) Theoretical value of right and
- (iii) The total number of equity shares to be issued.

Answer:

WN 1: Computation of rights ratio:

Let us assume existing shares to be 1 and new share issued to be A

$$\text{Ex - rights Price} = \frac{(\text{Existing shares} \times \text{existing price}) + (\text{New shares} \times \text{rights price})}{\text{Existing shares} + \text{New shares}}$$

$$36 = \frac{(1 \times 40) + (A \times 32)}{1 + A}; 36 + 36A = 40 + 32A; 4A = 4; A = 1$$

- Hence the company would issue one share for every one existing share

WN 2: Value of right and number of shares issued:

- Value of right = Ex-rights price - Rights issue price = $36 - 32 = \text{Rs.4 per right}$
- Number of shares issued = $12 \text{ crores} / 32 = 37,50,000 \text{ shares}$

21. Buyback of shares [Nov 2017 RTP, May 2018 MTP, Nov 2010, May 2006, Nov 2016 MTP, Nov 2013 RTP]

Rahul Ltd. has surplus cash of Rs. 100 lakhs and wants to distribute 27% of it to the shareholders. The company decides to buy back shares. The Finance Manager of the company estimates that its share price after re-purchase is likely to be 10% above the buyback price-if the buyback route is taken. The number of shares outstanding at present is 10 lakhs and the current EPS is Rs. 3. You are required to determine:

1. The price at which the shares can be re-purchased, if the market capitalization of the company should be Rs. 210 lakhs after buyback,
2. The number of shares that can be re-purchased, and
3. The impact of share re-purchase on the EPS, assuming that net income is the same.

Answer:

WN 1: Computation of buyback price:

- ❖ Let us assume the buyback price to be x
- ❖ The price after buyback will be 10 percent higher and hence the post buyback price will be 1.1x

Particulars	Calculation	Amount
Surplus cash		100 lacs
Buyback size	100 lacs x 27%	27 lacs
Buyback price		X
No of shares bought back		$\frac{27 \text{ lacs}}{x}$
Post-buyback market capitalization		210 lacs
Shares post buyback		$10 \text{ lacs} - \left(\frac{27 \text{ lacs}}{x}\right)$

Post buyback price = $\frac{\text{Market capitalization}}{\text{No of shares}}$
$1.1X = \frac{210}{\left(10 - \left(\frac{27}{x}\right)\right)}$
$1.1x \left(10 - \left(\frac{27}{x}\right)\right) = 210$
$11x - 29.7 = 210$
$11x = 239.70$
X = 21.79 per share

- ❖ Hence the buyback price will be Rs.21.79 per share

WN 2: Computation of shares to be bought back:

Particulars	Calculation	Amount
Buyback size		27,00,000
Buyback price	WN 1	21.79
Shares bought back	$\frac{27,00,000}{21.79}$	1,23,910 shares

WN 3: Computation of EPS post buyback:

Particulars	Calculation	Amount
Existing EPS		3
Existing shares		10,00,000
Existing earnings	3 x 10,00,000	30,00,000
Shares post buyback	10,00,000 - 1,23,910	8,76,090
New EPS	$\frac{30,00,000}{8,76,090}$	Rs.3.42 per share

22. Computation of post-buyback EPS [Nov 2018, May 2021 MTP]

Eager Ltd. has a market capitalization of Rs. 1,500 crores and the current market price of its share is Rs. 1,500. It made a PAT of 200 crores and the Board is considering a proposal to buy back 20% of the shares at a premium of 10% to the current market price. It plans to fund this through a 16% bank loan. You are required to calculate the post buy back Earnings Per Share (EPS). The company's corporate tax rate is 30%.

Answer:

Particulars	Amount
Market capitalization	1,500 crores
Current Market Price	1,500
Existing shares (1,500 crores/1,500)	1 Crore
Shares to be bought back	20 lacs [1 crore x 20%]

Buy-back price	1,650 [1,500 + 10%]
Buy-back size	330 crores [1,650 x 20 lacs]
Interest on loan (330 crores x 16%)	52.8 crores
Post-tax interest cost (52.8 crores x 70%)	36.96 crores
Revised PAT [200 crores – 36.96 crores]	163.04 crores
Revised shares (1 crore – 0.2 crores)	0.8 crores
Post-buyback EPS [163.04/0.8]	203.8

23. Buyback Analysis [July 2021]

SM Limited has a market capitalization of Rs. 3,000 crore and the current earnings per share (EPS) is Rs. 200 with a price earnings ratio (PER) of 15. The Board of directors is considering a proposal to buy back 20% of the shares at a premium which can be supported by the financials of the company. The Board expects post buy back market price per share (MPS) of Rs. 3057. Post buy back PER will remain same. The company proposes to fund the buy back by availing 8% bank loan since available resources are committed for expansion plans. Applicable income tax rate is 30%. You are required to calculate:

- The interest amount which can be paid for availing the bank loan,
- The loan amount to be raised and
- The premium per share and percentage premium paid, over the current MPS.

Answer:

WN 1: Comparison of existing and post-buyback position:

(in crores)

Particulars	Existing	Post-buyback
PAT	200	163.04
No of shares	1.00	0.80
EPS	200	203.80
PE Multiple	15	15
MPS	3,000	3,057
No of shares	1.00	0.80
Market value of Firm	3,000	2,445.60

Note:

- Existing MPS = $200 \times 15 = 3,000$
- Existing no of shares = $3,000 \text{ crores} / 3,000 = 1 \text{ crore}$
- Existing PAT = $200 \times 1 \text{ crore} = 200 \text{ crores}$
- Revised no of shares = $1 \text{ crore} - 20\% = 0.80 \text{ crore}$
- Revised EPS = $3,057 / 15 = \text{Rs.} 203.80 \text{ per share}$
- Revised PAT = $203.80 \times 0.80 = 163.04 \text{ crores}$

Solution:

Particulars	Calculation	Amount (in cr)
Allowable post-tax interest expense	$200 \text{ cr} - 163.04 \text{ cr}$	36.96
Interest amount which can be paid (pre-tax)	$\frac{36.96}{0.70}$	52.80
Loan amount to be raised	$\frac{52.80}{8\%}$	660.00
Number of shares bought back		0.20
Buy-back price per share	$\frac{660}{0.20}$	3,300
Current market price per share		3,000
Premium paid per share		300
Percentage premium over current MPS	$\frac{300}{3,000} \times 100$	10.00%

24. Valuation of share – Beta and cost of equity [May 2005, May 2017 RTP]

A Company pays a dividend of Rs.2.00 per share with a growth rate of 7%. The risk free rate is 9% and the market rate of return is 13%. The Company has a beta factor of 1.50. However, due to a decision of the Finance Manager, beta is likely to increase to 1.75. Find out the present as well as the likely value of the share after the decision.

Answer:

Computation of share price before and after decision:

Particulars	Before	After
Risk free rate	9%	9%
Market return	13%	13%
Beta	1.50	1.75
Cost of equity [$K_e = R_f + \beta(R_m - R_f)$]	15%	16%
Current Dividend (D_0)	2	2
Dividend of next year (D_1)	2.14	2.14
Share price = $\left(\frac{D_1}{K_e - G} \right)$	$\left(\frac{2.14}{15\% - 7\%} \right)$ Rs.26.75	$\left(\frac{2.14}{16\% - 7\%} \right)$ Rs.23.78

Note:

- Dividend of Rs.2 per share can also be assumed as distant dividend (D_1) and the share price would be Rs.25 and Rs.22.22 before and after decision.

25. Decision on holding/buy/sell of shares [Nov 2014]

An investor is holding 5,000 shares of X Limited. Current year dividend rate is Rs.3/share. Market price of the share is Rs.40 each. The investor is concerned about several factors which are likely to change during the next financial year as indicated below:

Particulars	Current Year	Next Year
Dividend paid/anticipated per share	3	2.5
Risk free rate	12%	10%
Market risk premium	5%	4%
Beta value	1.3	1.4
Expected growth	9%	7%

In view of the above, advise whether the investor should buy, hold or sell the shares

Answer:

WN 1: Computation of fair price as per existing conditions:

Note 1: Computation of Cost of Equity:

- ❖ Cost of Equity (K_e) = $R_f + \text{Beta} \times (R_m - R_f)$
- ❖ $K_e = 12\% + 1.3 (5\%) = 18.50\%$

Note 2: Computation of fair market price:

Fair Market Price	$\frac{D_1}{(K_e - G)}$	$\frac{3 + 9\%}{(18.5\% - 9\%)}$	Rs.34.42 per share

WN 2: Computation of fair price as per revised conditions:

Note 1: Computation of Cost of Equity:

- ❖ Cost of Equity (K_e) = $R_f + \text{Beta} \times (R_m - R_f)$
- ❖ $K_e = 10\% + 1.4 (4\%) = 15.60\%$

Note 2: Computation of fair market price:

Fair Market Price	$\frac{D_1}{(K_e - G)}$	$\frac{2.5 + 7\%}{(15.6\% - 7\%)}$	Rs.31.10 per share

Market price of share of Rs.40 is higher in comparison to current fair market price of Rs.34.42 and revised fair market price of Rs.31.10. Hence the investor should sell the share

26. Valuation of share [Nov 2015 RTP, May 2015 MTP]

Two companies X Ltd. and Y Ltd. paid a dividend of Rs. 3.50 per share. Both are anticipating that dividend shall grow @ 8%. The beta of X Ltd. and Y Ltd. are 0.95 and 1.42 respectively. The yield on GOI Bond is 7% and it is expected that market shall increase at an annual rate of 13%.

You are required to determine:

- (i) Value of share of both companies.
- (ii) Why there is a difference in the value of shares of two companies.
- (iii) If current market price of share of A Ltd. and B Ltd. are Rs. 74 and Rs. 55 respectively. As an investor what course of action should be followed?

Answer:**WN 1: Computation of value of share of both companies:****Note 1: Computation of Cost of Equity:**

- ❖ Cost of Equity (K_e) = $R_f + \text{Beta} \times (R_m - R_f)$
- ❖ K_e of X Limited = $7\% + 0.95 (13\% - 7\%) = 12.70\%$
- ❖ K_e of Y Limited = $7\% + 1.42(13\% - 7\%) = 15.52\%$

Note 2: Computation of fair market price:

Value of A Limited	$\frac{D_1}{(K_e - G)}$	$\frac{3.5 + 8\%}{(12.7\% - 8\%)}$	Rs.80.43 per share
Value of B Limited	$\frac{D_1}{(K_e - G)}$	$\frac{3.5 + 8\%}{(15.52\% - 8\%)}$	Rs.50.27 per share

Reason for difference in value of shares of two companies:

- ❖ The valuation of share of B Ltd. is lower because of systematic risk (beta) is higher though both have same growth rate.

Decision on purchase of shares:

- ❖ If the price of share of A Ltd. is Rs. 74, the share is undervalued and it should be bought.
- ❖ If price of share of B Limited is Rs. 55, it is overvalued and should not be bought.

27. Share buy/Sell decision [May 2018 MTP, Nov 2015 MTP, May 2016]

An investor is holding 1,000 shares of Asian paints Company. Presently the rate of dividend being paid by the company is Rs.2 per share and the share is being sold at Rs.25 per share in the market. However, several factors are likely to change during the course of the year as indicated below:

	Existing	Revised
Risk free rate	12%	10%
Market risk premium	6%	4%
Beta value	1.4	1.25
Expected growth rate	5%	9%

In view of the above factors whether the investor should buy, hold or sell the shares? And why?

Answer:**Computation of fair market price:**

$$P_0 = \frac{D_1}{K_e - G}$$

Particulars	Existing scenario	Revised scenario
1. Dividend of next year (D_1)	2.10 [2 + 5%]	2.18 [2 + 9%]
2. Cost of equity ($R_f + \text{Beta} \times (R_m - R_f)$)	= 12% + (1.4 × 6%) = 20.40%	= 10% + (1.25 × 4%) = 15%
3. Growth rate	5%	9%
4. Fair market price	13.63	36.33

- Under the existing scenario the share is overvalued. However, with change in expectations fair market price increases to Rs.36.33 per share. Share will be undervalued and we should buy the share

Note:

- Existing fair price of Rs.13.63 will not impact the decision. However, ICAI solution calculates both existing and revised fair market price and the final decision would be based on revised market price. It is advised that both existing and revised fair market prices are computed in exam.

28. Valuation of share and CAPM [May 2018, May 2019 MTP, Nov 2014]

The risk free rate of return R_f is 5 percent. The expected rate of return on the market portfolio R_m is 11 percent. The expected rate of growth for the dividend of Platinum Ltd is 8 percent. The last dividend paid on the equity stock of firm A was Rs.2.00. The beta of Platinum Ltd equity Stock is 1.5.

- a) What is the equilibrium price of equity stock of Platinum Limited?
- b) What is the equilibrium price change when
 - ❖ The inflation premium increases by 3 percent?
 - ❖ The expected growth rate decreases by 3 percent?
 - ❖ The beta of Platinum Ltd's rises to 1.3?

Answer:

Computation of fair market price:

$$P_0 = \frac{D_1}{K_e - G}$$

Particulars	Existing scenario	Revised scenario
1. Dividend of next year (D1)	2.16 [2 + 8%]	2.10 [2 + 5%]
2. Cost of equity (Rf + Beta x (Rm - Rf))	= 5% + 1.5 (11% - 5%) = 14.00%	= 8% + 1.3 (11% - 8%) = 11.90%
3. Growth rate	8%	5%
4. Equilibrium price	36.00	30.43

Notes:

- It is assumed that all three changes are to happen simultaneously. Alternatively we can assume all these three changes to happen separately
- Inflation premium increases by 3 percent. Inflation forms part of risk-free rate. It is assumed that change will increase Risk free rate from 5 % to 8%. Alternatively, we can also assume risk free rate to increase from 5% to 5.15%
- Similar to inflation assumption, it is assumed that growth rate will change from 8% to 5%
- **Inflation forms part of risk-free rate and hence change in inflation has increased the risk-free rate. Any increase in risk-free rate can also increase the market return so that the risk-premium of market remains same at 6%. This is also an alternative view and answer can change based on this view.**

29. Step-up growth model [May 2017 MTP, Nov 2015, May 2019 RTP, May 2020 RTP]

X Limited is a shoes manufacturing company. It is all equity financed and has a paid-up capital of Rs.10,00,000 (Rs.10 per share). X Limited has hired swastika consultants to analyse the future earnings. The report of swastika consultants states as follows:

- ❖ The earnings and dividend will grow at 25% for the next two years
- ❖ Earnings are likely to grow at the rate of 10% from 3rd year onwards
- ❖ Further, if there is reduction in earnings growth, dividend payout ratio will increase to 50%

The other data related to the company are as follows:

Year	EPS	Net Dividend per share	Share Price
2010	6.30	2.52	63.00
2011	7.00	2.80	46.00
2012	7.70	3.08	63.75
2013	8.40	3.36	68.75
2014	9.60	3.84	93.00

You may assume that the tax rate is 30% (not expected to change in future) and post tax cost of capital is 15%. By using the dividend valuation model, calculate

- ❖ Expected market price per share
- ❖ P/E Ratio

Answer:

WN 1: Computation of Dividends till the first year of stabilization phase:

- ❖ Earnings and dividends will grow at 25% for two years. Growth will stabilize at 10% from third year. Hence, we should compute dividends till third year

Year	EPS	DPS
1	12.00 [9.60 + 25%]	4.80 [3.84 + 25%]
2	15.00 [12 + 25%]	6.00 [4.80 + 25%]
3	16.50	8.25

	[15 + 10%]	[16.50 × 50%]

WN 2: Valuation of share:

Year	Cash flow	PVF @ 15%	DCF
1	4.80	0.870	4.18
2	6.00	0.756	4.54
2	165 [Note 1]	0.756	124.74
Expected share price			133.46

Note 1: Computation of PV of Dividends of 3 to ∞

- ❖ Dividends is expected to grow at constant rate of 10 percent from year 3. We can use Gordon's formula and calculate the share price at the end of year 2

P2	$\frac{D_3}{(K_e - G)}$	$\frac{8.25}{(15\% - 10\%)}$	Rs.165 per share

WN 3: Computation of PE Multiple:

Particulars	Amount
Expected Price	133.46
EPS of current year	9.60
PE Multiple (MPS/EPS)	13.90 Times

30. Step-up growth model

ABC Limited has paid a dividend of Rs.0.40. The dividends will grow at 11.3 percent annually for next 3 years. Then the dividend growth will linearly decline in stage 2 (year 4 to year 8). Thereafter dividend will consistently grow at 2.3 percent. Calculate the value of the share if investor required rate of return is 12%

Answer:**WN 1: Computation of growth rate for different years:**

Year	1 to 3	4	5	6	7	8	9 to ∞
Growth rate	11.30%	9.80%	8.30%	6.80%	5.30%	3.80%	2.30%

Note:

- ❖ Dividends will grow at 11.30 percent for first three years. Dividend growth will consistently decline from year 4 to year 8.
- ❖ Dividend growth of year 9 is expected to be 2.3 percent [Note: Alternatively, we can also assume that growth rate of year 8 will be 2.3 percent]
- ❖ Fall in dividend growth every year = (11.30 percent - 2.30 percent)/6 years = 1.50 percent
- ❖ Dividend growth of 4th year = 11.30 percent - 1.50 percent = 9.80 percent. Dividend growth of other years is calculated in the same manner

WN 2: Computation of dividends till ninth year (first year of stabilization phase):

Year	Calculation	Dividends
1	0.40 + 11.30%	0.445
2	0.445 + 11.30%	0.496
3	0.496 + 11.30%	0.551
4	0.551 + 9.80%	0.605
5	0.605 + 8.30%	0.655
6	0.655 + 6.80%	0.709
7	0.709 + 5.30%	0.747
8	0.747 + 3.80%	0.775
9	0.775 + 2.30%	0.793

WN 3: Computation of share price:

Year	Cash flow	PVF @ 12%	DCF
1	0.445	0.893	0.397
2	0.496	0.797	0.395
3	0.551	0.712	0.392
4	0.605	0.636	0.385

5	0.655	0.567	0.371
6	0.709	0.507	0.359
7	0.747	0.452	0.338
8	0.775	0.404	0.313
8	8.18 [Note 1]	0.404	3.305
Share price			6.255

Note 1: Computation of PV of Dividends of 9 to ∞

- ❖ Dividends is expected to grow at constant rate of 2.3 percent from year 9. We can use Gordon's formula and calculate the share price at the end of year 8

P8	$\frac{D_9}{(K_e - G)}$	$\frac{0.793}{(12\% - 2.3\%)}$	Rs.8.18 per share

31. Valuation of shares as per step-up growth model [May 2019 RTP, Nov 2018 MTP]

Seawell Corporation, a manufacturer of do-it-yourself hardware and housewares, reported earnings per share of € 2.10 in 2003, on which it paid dividends per share of €0.69. Earnings are expected to grow 15% a year from 2004 to 2008, during this period the dividend payout ratio is expected to remain unchanged. After 2008, the earnings growth rate is expected to drop to a stable rate of 6%, and the payout ratio is expected to increase to 65% of earnings. The firm has a beta of 1.40 currently, and is expected to have a beta of 1.10 after 2008. The market risk premium is 5.5%. The Treasury bond rate is 6.25%.

Required:

- (a) What is the expected price of the stock at the end of 2008?
 (b) What is the value of the stock, using the two-stage dividend discount model?

Answer:**WN 1: Computation of Dividend till first year of stabilization phase:**

- ❖ Earnings are expected to grow at 15% for 2004 to 2008 and the stabilization will happen from 2009 onwards. Hence, we need to calculate dividends till 2009.

Year	Earnings	Dividend
2004	2.42	0.79
2005	2.78	0.91
2006	3.19	1.05
2007	3.67	1.21
2008	4.22	1.39
2009	4.48 [4.22 + 6%]	2.91 [4.48 x 65%]

WN 2: Computation of market price at last year before stabilization phase:

- ❖ Growth stabilizes from 2009 and hence Market price has to be calculated at end of 2008

Market Price (2008)	$\frac{\text{Dividend of 2009}}{(K_e - G)}$	$\frac{2.91}{(12.30\% - 6\%)}$	Rs.46.19 per share

- ❖ We are computing the market price at end of 2008 and hence we should dividends of 2009 and cost of equity which would prevail post 2009

Note 1: Computation of cost of equity for 2004 to 2008

- ❖ Cost of Equity (K_e) = $R_f + \text{Beta} \times (R_m - R_f)$
 ❖ $K_e = 6.25\% + (1.4 \times 5.5\%) = 13.95\%$

Note 2: Computation of cost of equity post 2008:

- ❖ Cost of Equity (K_e) = $R_f + \text{Beta} \times (R_m - R_f)$
 ❖ $K_e = 6.25\% + (1.1 \times 5.5\%) = 12.30\%$

WN 3: Computation of fair market price:

Year	Cash flow	PVF @ 13.95%	DCF
2004	0.79	0.878	0.70
2005	0.91	0.771	0.70
2006	1.05	0.677	0.70

2007	1.21	0.594	0.72
2008	1.39	0.521	0.72
2008	46.19	0.521	24.06
Fair market price			27.60

Final Solution:

- ❖ Expected price at end of 2008 = Rs.46.19 per share
- ❖ Current market price as per two-stage dividend discount model = Rs.27.60 per share

32. Valuation of share [Nov 2019, Nov 2020]

An investor is considering purchasing the equity shares of LX Limited., whose current market price (CMP) is 150. The company is proposing a dividend of Rs.6 for the next year. LX is expected to grow @ 18 percent per annum for the next four years. The growth will decline linearly to 14 percent per annum after first four years. Thereafter it will stabilize at 14 percent per annum infinitely. The required rate of return is 18 percent per annum.

You are required to determine:

- i. The intrinsic value of one share
- ii. Whether it is worth to purchase the share at this price

Answer:**WN 1: Computation of Dividend till first year of stabilization phase:**

- ❖ Dividends are expected to grow at 18% for 4 years. Then growth will linearly fall to 14%. Linear fall would indicate fall of 1 percent per year and hence it will become 14 percent in year 8
- ❖ Growth stabilizes from 8th year and hence we should calculate dividends till year 8.

Particulars	Dividend
Year 1	6
Year 2 (6 + 18%)	7.08
Year 3 (7.08 + 18%)	8.35
Year 4 (8.35 + 18%)	9.86
Year 5 (9.86 + 17%)	11.54
Year 6 (11.54 + 16%)	13.38
Year 7 (13.38 + 15%)	15.39
Year 8 (15.39 + 14%)	17.54

WN 2: Computation of market price at last year before stabilization phase:

- ❖ Growth stabilizes from eighth year and hence we should calculate market price at end of year 7

Market Price (P7)	$\frac{D8}{(K_e - G)}$	$\frac{17.54}{(18\% - 14\%)}$	Rs.438.50 per share

WN 3: Computation of fair market price:

Year	Cash flow	PVF @ 18%	DCF
1	6	0.847	5.08
2	7.08	0.718	5.08
3	8.35	0.609	5.08
4	9.86	0.516	5.09
5	11.54	0.437	5.04
6	13.38	0.370	4.96
7	453.89 [15.39 + 438.50]	0.314	142.52
Intrinsic value of share			172.85

Since the intrinsic value of share is Rs.172.85 while it is selling at Rs.150, hence it is under-priced and we should acquire it.

33. Valuation of share [Nov 2019, Jan 2021]:

The current EPS of M/s VEE Ltd. is Rs. 4. The company has shown an extraordinary growth of 40% in its earnings in the last few year This high growth rate is likely to continue for the next 5 years after which growth rate in earnings will decline from 40% to 10% during the next 5 years and remain stable at 10% thereafter. The decline in the growth rate during the five year transition period will be equal and linear. Currently, the company's pay-out ratio is 10%. It is likely to remain the same for the next five years and

from the beginning of the sixth year till the end of the 10th year, the pay-out will linearly increase and stabilize at 50% at the end of the 10th year. The post tax cost of capital is 17%. You are required to calculate the intrinsic value of the company's stock based on expected dividend. If the current market price of the stock is Rs.125, suggest if it is advisable for the investor to invest in the company's stock or not.

Answer:

WN 1: Computation of EPS and DPS till first year of stabilization phase (11th year):

Year	Growth rate	EPS	Payout Ratio	DPS
1	40%	5.60	10%	0.56
2	40%	7.84	10%	0.78
3	40%	10.98	10%	1.10
4	40%	15.37	10%	1.54
5	40%	21.51	10%	2.15
6	34%	28.82	18%	5.19
7	28%	36.89	26%	9.59
8	22%	45.00	34%	15.30
9	16%	52.20	42%	21.92
10	10%	57.42	50%	28.71
11	10%	63.16	50%	31.58

Note:

- Growth rate is 40% for year 5 and the same falls to 10% by year 10. This would mean fall of 30% for 5 years and yearly fall of 6% in growth rate
- Payout ratio is 10% for year 5 and the same increases to 50% by year 10. This would mean increase of 40% for 5 years and yearly increase of 8% in growth rate

WN 2: Valuation of share at the beginning of stabilization phase:

- Growth of company stabilized at the beginning of year 10 and hence we can compute the value of share at end of year 9

$$P_9 = \frac{D_{10}}{K_e - G}; P_9 = \frac{28.71}{17\% - 10\%} = \text{Rs. 410.14}$$

WN 3: Valuation of share:

Year	Cash flow	PVF @ 17%	DCF
1	0.56	0.855	0.48
2	0.78	0.731	0.57
3	1.10	0.625	0.69
4	1.54	0.534	0.82
5	2.15	0.456	0.98
6	5.19	0.390	2.02
7	9.59	0.333	3.19
8	15.30	0.285	4.36
9	21.92	0.244	5.35
10	410.14	0.244	100.07
Total			118.53

- Intrinsic value of share = Rs.118.53
- Current market price is Rs.125 whereas fair market price is Rs.118.53. Share is currently overvalued and hence we should not invest in share.

34. H Model:

Calculate value of equity share using H Model from the following information:

Dividend paid in last year	Rs.25
Cost of equity	8%
High-growth rate (short-term growth)	12%
Long-term growth rate	5%
Number of years for transition from high-growth to normal rate	5 years

Answer:

$$P_0 = \frac{D_0(1 + g_n)}{r - g_n} + \frac{D_0 H_1 (g_c - g_n)}{r - g_n}$$

$$P_0 = \frac{25(1 + 0.05)}{0.08 - 0.05} + \frac{25 \times 2.5 (0.12 - 0.05)}{0.08 - 0.05} = 875 + 145.83 = \text{Rs. } 1,020.33$$

35. Valuation of shares as per PE Multiple and Earnings growth model [Nov 2007, Nov 2012, May 2015 MTP, Jan 2021]

Given the following information:

Current Dividend	5.00
Discount rate	10%
Growth rate	2%

Required:

- Calculate the present value of the stock
- Is the stock overvalued if the price is Rs.40, ROE = 8% and EPS = Rs.3.00? Show your calculations under the PE Multiple approach and Earnings Growth model

Answer:

Part one:

Market Price	$\frac{D_1}{(K_e - G)}$	$\frac{5 + 2\%}{(10\% - 2\%)}$	Rs.63.75 per share

Part two:

Valuation of share as per PE Multiple Approach:

Particulars	Amount
Return on equity	8%
PE Multiple (1/ROE)	12.5
EPS	3.00
Fair market price (EPS x PE Multiple)	37.50

Actual stock price is higher than fair market price and hence share is overvalued

Valuation of share as per Earnings Growth Model:

Market Price	$\frac{E_1}{(K_e - G)}$	$\frac{3 + 2\%}{(8\% - 2\%)}$	Rs.51 per share

Note:

- ❖ For this part of the problem ROE has been taken as cost of equity. Alternatively, we could have used cost of equity as 10% as given in part one of the problem.
- ❖ Earnings Growth model works in the same manner as in Dividend growth model. However, we use numerator as Earning of year 1 and not Dividends of year 1
- ❖ **Actual stock price is lower than fair market price and hence share is undervalued**

36. Valuation of share [Nov 2018, May 2021 MTP]

A company has an EPS of Rs.2.50 for the last year and the DPS of Rs.1. The earnings are expected to grow at 2% a year in long run. Currently it is trading at 7 times its earnings. IF the required rate of return is 14%, compute the following:

- An estimate of the P/E ratio using Gordon growth model
- The Long-term growth rate implied by the current P/E ratio

Answer:

WN 1: Estimation of PE Multiple using Gordon growth model:

Market Price	$\frac{D_1}{(K_e - G)}$	$\frac{1 + 2\%}{(14\% - 2\%)}$	Rs.8.50 per share

- ❖ PE Multiple = (MPS/EPS) = 8.50/2.50 = 3.40 Times

WN 2: Computation of growth rate:

- ❖ The share is quoting at PE multiple of 7 times. Current market price on EPS of 2.50 and PE Multiple of 7 times would be Rs.17.50 per share

17.50	=	$\frac{1 + G}{(0.14 - G)}$

0.14 - G (17.50)	=	1+G
2.45 - 17.50G	=	1+G
1.45	=	18.50G
Growth rate	=	1.45/18.50
Growth rate	=	7.84%

37. Computation of growth rate and valuation of share:

The risk-free return is 10% and the risk premium is 5% with beta of a company is 1.6. The company had declared the latest dividend @ Rs.3 (2002) whereas it had declared a dividend of Rs.2.115 in the year 1996. The company's earnings and the dividend experienced constant growth. Find out the intrinsic value of the shares. Take into account the following PV factor table:

Percentage of cost of capital	PV values at the end of 6 years
5%	0.746
6%	0.705
7%	0.666

Answer:**Note 1: Computation of Cost of Equity:**

- ❖ Cost of Equity (K_e) = $R_f + \text{Beta} \times (R_m - R_f)$
- ❖ $K_e = 10\% + 1.6 (5\%) = 18\%$

Note 2: Computation of growth rate

- ❖ Company had paid dividends of Rs.3 in 2002 and the dividends of 2.115 was paid in 1996
- ❖ Dividends of Year 1996 (PV) = 2.115; Dividends of year 2002 (FV) = 3.00; $n = 6$ years; $r = ?$
- ❖ Present value = Future value $\times$ Present value factor
- ❖ $2.115 = 3 \times \text{Present value factor}$
- ❖ Present value factor = $\left(\frac{2.115}{3}\right) = 0.705$
- ❖ Present value factor of 0.705 correspond to r of 6%. Hence growth rate = 6%
- ❖ Dividends of next year = $(3 + 6\%) = 3.18$

Note 3: Computation of market price:

Market Price	$\frac{D_1}{(K_e - G)}$	$\frac{3.18}{(18\% - 6\%)}$	Rs.26.50 per share

38. Computation of maximum purchase price [May 2010, Nov 2019 RTP]

Mr. A is thinking of buying shares at Rs. 500 each having face value of Rs. 100. He is expecting a bonus at the ratio of 1:5 during the fourth year. Annual expected dividend is 20% and the same rate is expected to be maintained on the expanded capital base. He intends to sell the shares at the end of seventh year at an expected price of Rs. 900 each. Incidental expenses for purchase and sale of shares are estimated to be 5% of the market price. He expects a minimum return of 12% per annum.

Should Mr. A buy the share? If so, what maximum price should he pay for each share? Assume no tax on dividend income and capital gain

Answer:**WN 1: Decision on purchase of share:**

Year	Cash flow	PVF @ 12%	DCF
1	20	0.893	17.86
2	20	0.797	15.94
3	20	0.712	14.24
4	24	0.636	15.26
5	24	0.567	13.61
6	24	0.507	12.17
7	24	0.452	10.85
7	1026	0.452	463.75
PV of future cash inflows			563.68
Less: Purchase price (500 $\times$ 1.05)			(525)

Net gain	38.68

Note:

- ❖ Selling price at end of year 7 is Rs.900. Investor buying one share would get 1.2 shares and hence the gross sale proceeds would be Rs.1080. Selling expenses are 5% and hence net selling price is Rs.1,026
- ❖ Dividend of Rs.24 per share has been taken from year 4 as bonus issue is made in fourth year. Alternatively, higher dividend can be considered from fifth year

WN 2: Computation of maximum purchase price:

- ❖ PV of future dividends and sale proceeds = Rs.563.68; Maximum purchase outflow should therefore be Rs.563.68
- ❖ The investor needs to pay 5 percent expenses on purchase of shares
- ❖ **Maximum purchase price = (Rs.563.68/105%) = Rs.536.84**

39. Calculation of Number of GDR and Cost of GDR [May 2018 MTP, May 2018, Nov 2014, May 2017 MTP, Nov 2017 MTP, May 2021 MTP, May 2021 RTP]

Odessa Limited has proposed to expand its operations for which it requires funds of \$ 15 million, net of issue expenses which amount to 2% of the issue size. It proposed to raise the funds through a GDR issue. It considers the following factors in pricing the issue:

- ❖ The expected domestic market price of the share is Rs.300
- ❖ 3 shares underly each GDR
- ❖ Underlying shares are priced at 10% discount to the market price
- ❖ Expected exchange rate is Rs.60/\$

You are required to:

- compute the number of GDR's to be issued and cost of GDR to Odessa Limited, if 20% dividend is expected to be paid with a growth rate of 20%.
- What is your suggestion if the company receives an offer from a US Bank willing to provide an equivalent loan with an interest rate of 12%?
- How much company can save by choosing the option as recommended by you?

Answer:**WN 1: Computation of number of GDR's to be issued:**

Particulars	Calculation	\$
Money to be raised		1,50,00,000
Issue expenses		2%
Gross amount to be raised	$\frac{1,50,00,000}{98\%}$	1,53,06,122
Issue price per GDR	Note 1	13.50
Number of GDR to be issued	$\frac{1,53,06,122}{13.50}$	11,33,787

Note:

1. One GDR (Global Depository Receipt) consist of 3 shares. Current market price of a share is Rs.300. Hence issue price of one GDR is expected to be Rs.900. Company plans to price issue at 10 percent discount and hence issue price will be Rs.810. Exchange rate is 1 USD = Rs.60. Consequently, issue price of one GDR is Rs.810 (or) \$ 13.50

WN 2: Computation of cost of GDR:

- GDR is an instrument having the same characteristics as that of equity. GDR will get dividends income like equity and cost of GDR can be computed using Gordon formula

$$K_e = \frac{D_1}{P_0 - F} + \text{Growth rate}; K_e = \frac{6}{810 - 2\% \text{ of } 810} + 20\%;$$

$$K_e = 0.76\% + 20\% = 20.76\%$$

Note:

- It is assumed that face value of share is Rs.10 and hence 20% dividend would be Rs.2 per share. One GDR has 3 shares and hence dividend per GDR would be Rs.6
- Issue price is Rs.810 and floatation cost is 2% and hence net proceeds for cost of GDR computation is Rs.793.80 per GDR
- We can convert dividend as well as net proceeds in USD and do the calculations. However, answer

would remain same

Part (ii) and (iii):

- If the company receives an offer from US Bank willing to provide an equivalent amount of loan with interest rate of 12%, it should accept the offer.
- If the offer is accepted there will be net saving of 8.76% [20.76 – 12.00]

40. Calculation of cost of equity [Nov 2018 RTP]

Piyush Loonker and Associates presently pay a dividend of Re. 1.00 per share and has a share price of Rs.20.00.

- If this dividend were expected to grow at a rate of 12% per annum forever, what is the firm's expected or required return on equity using a dividend-discount model approach?
- Instead of this situation in part (i), suppose that the dividends were expected to grow at a rate of 20% per annum for 5 years and 10% per year thereafter. Now what is the firm's expected, or required, return on equity?

Answer:

WN 1: Computation of required rate of return:

- Required rate of return on equity is known as cost of equity (K_e)

K_e	$\frac{D_1}{P_0} + \text{Growth rate}$	$\frac{1.12}{20} + 0.12$	$0.056 + 0.12 = 0.176 \text{ or } 17.60\%$

WN 2: Computation of required rate of return if growth rate is 20% for 5 years and then the growth rate is 10 percent post 5 years:

- Growth rate is 20 percent for 5 years and then growth rate reduces to 10 percent. We cannot use the above formula and calculate cost of equity due to multiple growth rates
- We need to assume discount rate and calculate NPV of cash flows. If NPV is zero, then assumed discount rate is IRR of cash flows. IRR basically indicates the return earned by the investor and the same would be taken as expected or required return (Cost of equity)

Let us assume Discount rate to be 18% (Discount rate closer to earlier K_e of 17.60%):

Note 1: Computation of dividends till sixth year (first year of stabilization phase):

Year	Calculation	Dividends
1	1 + 20%	1.20
2	1.20 + 20%	1.44
3	1.44 + 20%	1.73
4	1.73 + 20%	2.08
5	2.08 + 20%	2.50
6	2.50 + 10%	2.75

Note 2: Computation of NPV if discount rate is 18%

Year	Cash flow	PVF @ 18%	DCF
0	(20)	1.000	(20.00)
1	1.20	0.847	1.02
2	1.44	0.718	1.03
3	1.73	0.609	1.05
4	2.08	0.516	1.07
5	2.50	0.437	1.09
5	34.38 [Note 3]	0.437	15.02
NPV			0.28

Note 3: Computation of PV of Dividends of 6 to ∞

- ❖ Dividends is expected to grow at constant rate of 10 percent from year 6. We can use Gordon's formula and calculate the share price at the end of year 5

P5	$\frac{D_6}{(K_e - G)}$	$\frac{2.75}{(18\% - 10\%)}$	Rs.34.38 per share

Note 4: Let us assume discount rate to be 19% (discount rate is increased as we got positive NPV at 18%):

Computation of NPV if discount rate is 19%

Year	Cash flow	PVF @ 19%	DCF
0	(20)	1.000	(20.00)
1	1.20	0.840	1.01
2	1.44	0.706	1.02
3	1.73	0.593	1.03
4	2.08	0.499	1.04
5	2.50	0.419	1.05
5	30.56 [Note 5]	0.419	12.80
NPV			-2.06

Note 5: Computation of PV of Dividends of 6 to ∞

- ❖ Dividends is expected to grow at constant rate of 10 percent from year 6. We can use Gordon's formula and calculate the share price at the end of year 5

P5	$\frac{D_6}{(K_e - G)}$	$\frac{2.75}{(19\% - 10\%)}$	Rs.30.56 per share

Note 6: Computation of IRR/Cost of equity:

- Share has positive NPV of 0.28 at discount rate of 18% and negative NPV of 2.06 at discount rate of 19%

IRR	$L_1 + \frac{\text{NPV at } L_1}{\text{NPV at } L_1 - \text{NPV at } L_2} \times (L_2 - L_1)$	$18 + \frac{0.28}{0.28 - (-2.06)} \times (19 - 18)$	18.12%

41. Valuation of share – dividend discount model [May 2013, May 2014 MTP, May 2018 MTP, Nov 2014 MTP, Nov 2018 RTP, May 2021 RTP]

X Limited, just declared a dividend of Rs.14.00 per share. Mr. B is planning to purchase the share of X Limited, anticipating increase in growth rate from 8% to 9%, which will continue for three years. He also expects the market price of this share to be Rs. 360.00 after three years. You are required to determine:

- the maximum amount Mr. B should pay for shares, if he requires a rate of return of 13% per annum.
- the maximum price Mr. B will be willing to pay for share, if he is of the opinion that the 9% growth can be maintained indefinitely and require 13% rate of return per annum.
- the price of share at the end of three years, if 9% growth rate is achieved and assuming other conditions remaining same as in (ii) above.

Answer:

WN 1: Computation of maximum amount Mr.B can pay:

Note 1: Computation of Dividends for first three years:

Year	DPS
1	15.26 [14 + 9%]
2	16.63 [15.26 + 9%]
3	18.13 [16.63 + 9%]

Note 2: Maximum price to be paid:

Year	Cash flow	PVF @ 13%	DCF
1	15.26	0.885	13.51
2	16.63	0.783	13.02
3	378.13	0.693	262.04
Expected share price			288.57

WN 2: Computation of maximum price if growth rate of 9 percent can be maintained for indefinite period:

P0	$\frac{D1}{(K_e - G)}$	$\frac{15.26}{(13\% - 9\%)}$	Rs.381.50 per share

WN 3: Computation of price at end of three years if growth rate of 9 percent can be maintained for indefinite period:

P3	$\frac{D4}{(K_e - G)}$	$\frac{19.76}{(13\% - 9\%)}$	Rs.494 per share

- Dividend of year 4 = Dividend of year 3 + 9% = Rs.19.76 per share

42. Valuation of share

In the past year, ABC paid a dividend of Rs.1.40. An analyst expects dividend to grow annually at 9.3 percent for next four years. At the end of year 4, the analyst expects the dividend to equal 40 percent of EPS and the PE multiple to be 11. If the required return on ABC Limited stock is 11.5 percent, calculate the current market price.

Answer:

WN 1: Computation of Dividends till year 4:

- ❖ Dividends will grow at 9.3 percent for four year and price at end of year 4 can be computed based on PE Multiple of 11 times

Year	DPS
1	1.53 [1.4 + 9.3%]
2	1.67 [1.53 + 9.3%]
3	1.83 [1.67 + 9.3%]
4	2.00 [1.83 + 9.3%]

WN 2: Computation of share price at end of year 4:

- DPS for year 4 is Rs.2.00 per share. Dividend is equal to 40 percent of EPS and hence EPS is Rs.5.00 per share [2/40%]
- Share is expected to quote at price earning multiple of 11 times and expected share price at end of year 4 is Rs.55 [5 x 11 times]

WN 3: Valuation of share:

Year	Cash flow	PVF @ 11.50%	DCF
1	1.53	0.897	1.37
2	1.67	0.804	1.34
3	1.83	0.721	1.32
4	57.00	0.647	36.88
Expected share price			40.91

43. Valuation of share

A company has an EPS of Rs.10 and the opportunity cost of capital for its equity shareholders is 16%. If the share is now trading at Rs.80, calculate the present value of growth opportunities.

Answer:

Value of share with no growth opportunities:

P0	$\frac{D1}{(K_e - G)}$	$\frac{10}{(16\% - 0\%)}$	Rs.62.50 per share

- Payout ratio will be 100 percent if there is no growth and hence DPS is equal to EPS

Present value of growth opportunities (PVGO):

- PVGO = Current market price - Share price with no growth
- PVGO = Rs.80 - Rs.62.50 = Rs.17.50 per share

44. Subjective assessment of cost of equity [Nov 2018 MTP, Nov 2003, May 2017 RTP]

Capital structure of Sun Ltd., as at 31.3.2003 was as under:

Particulars	Rs. (in lakhs)
Equity share capital	80
8% preference share capital	40
12% debentures	64
Reserves	32

Sun Ltd., earns a profit of Rs.32 lakhs annually on an average before deduction of income-tax, which works out to 35%, and interest on debentures. Normal return on equity shares of companies similarly placed is 9.6% provided:

- ❖ Profit after tax covers fixed interest and fixed dividends at least 3 times.
- ❖ Capital gearing ratio is 0.75.
- ❖ Yield on share is calculated at 50% of profits distributed and at 5% on undistributed profits.

Sun Ltd., has been regularly paying equity dividend of 8%. Compute the value per equity share of the company.

Answer:

WN 1: Income statement of Sun Limited:

Particulars	Amount
Profit before Interest and Taxes	32,00,000
Less: Interest on debentures (64,00,000 × 12%)	(7,68,000)
Profit before tax	24,32,000
Less: Tax @ 35% (24,32,000 × 35%)	(8,51,200)
Profit after tax	15,80,800
Less: Preference Dividend (40,00,000 × 8%)	(3,20,000)
Earnings available to equity shareholders	12,60,800
Less: Equity Dividend (80,00,000 × 8%)	(6,40,000)
Retained earnings	6,20,800

WN 2: Computation of fixed interest and fixed dividend coverage:

$$\text{Fixed interest and fixed dividend coverage} = \frac{\text{PAT} + \text{Fixed interest}}{\text{Fixed interest} + \text{Fixed Dividend}}$$

$$\text{Fixed interest and fixed dividend coverage} = \frac{15,80,800 + 7,68,000}{7,68,000 + 3,20,000} = \mathbf{2.16 \text{ Times}}$$

Note:

- PAT should cover interest and dividend atleast 3 times. We have added fixed interest to PAT while calculating the ratio as we need to find out how much cash flows are available for paying interest and dividend. PAT is already post deduction of interest and hence the same has been added back

WN 3: Computation of capital gearing ratio:

$$\text{Capital gearing ratio} = \frac{\text{Fixed charge bearing funds}}{\text{Equity shareholder funds}} = \frac{\text{Debentures} + \text{Preference capital}}{\text{Equity} + \text{Reserves}}$$

$$\text{Capital gearing ratio} = \frac{40 + 64}{80 + 32} = \mathbf{0.93 \text{ Times}}$$

WN 4: Computation of required yield (in %):

There is a scope for assumptions regarding the rates (in terms of percentage for every one time of difference between Sun Ltd. and Industry Average) of risk premium involved with respect to Interest and Fixed Dividend Coverage and Capital Gearing Ratio. The below solution has been worked out by assuming the risk premium as:

- 1% for every one time of difference for Interest and Fixed Dividend Coverage
- 2% for every one time of difference for Capital Gearing Ratio

Particulars	%
Required yield of similarly placed companies	9.6
Add: Extra yield due to weaker capital gearing [0.93 – 0.75] × 2	0.36
Add: Extra yield due to weaker interest and dividend coverage [3–2.16] × 1	0.84
Target yield for Sun Limited	10.80

WN 5: Computation of yield (in Rs.):

Particulars	Amount
50% of distributed profits [6,40,000 x 50%]	3,20,000
5% of undistributed profits [6,20,800 x 5%]	31,040
Total Yield (A)	3,51,040
No of shares (B)	80,000
Yield per share (A/B)	4.388

Note: It is assumed that face value per share is Rs.100 and hence no of shares has been calculated as 80,000 [80 lacs/10]

WN 6: Computation of value per share:

Particulars	Amount
Yield per share (in Rs.)	4.388
Yield per share (in %)	10.80%
Value per share (Yield in Rs./Yield in %)	40.63

45. Valuation of share – Free cash flow approach [May 2009, Nov 2018 MTP, May 2015 MTP, Nov 2015 MTP, Nov 2016 MTP, Nov 2014 RTP]

Calculate the value of share from the following information:

Profit of the company	Rs. 290 crores
Equity capital of company'	Rs.1,300 crores
Par value of share	Rs.40 each
Debt ratio of company	27
Long run growth rate of the company	8%
Beta 0.1; risk free interest rate	8.7%
Market return	10.3%
Capital expenditure per share	Rs. 47
Depreciation per share	Rs. 39
Change in working capital	Rs. 3.45 per share

Answer:**WN 1: Computation of Free Cash Flow per share:**

- Question has given data on depreciation, capital expenditure, working capital per share and hence we can compute Free Cash Flow per share approach to value shares

Particulars	Calculation	Amount
Total Profit		290 crores
No of shares	[1,300/40]	32.50 crores
EPS	290/32.50	8.9231
Capex per share		47
Depreciation per share		39
Net capex per share		8
WC requirement per share		3.45
Total capex and WC per share		11.45
Funded with debt (Note 1)	27% x 11.45	3.0915
Funded with equity	73% x 11.45	8.3585
Free cash flow per share	8.9231 – 8.3585	0.5646

Note:

- The term debt ratio indicates proportion of capital employed represented by debt. The company has total funding requirement of 11.45 per share. 27% of the funding will come from debt and balance 73% of funding will come from equity
- $K_e = R_f + \beta \times (R_m - R_f)$; $K_e = 8.7 + 0.1 \times (10.3 - 8.7)$; $K_e = 8.86\%$

WN 2: Valuation of equity share:

$$P_0 = \frac{FCFE_1}{K_e - \text{Growth}} = \frac{0.5646 \times 1.08}{8.86\% - 8\%} = 70.90 \text{ per share}$$

46. Valuation of share [Nov 2009, Nov 2012, May 2016 MTP, May 2016 RTP]

Following Financials are available for PQR Ltd. for the year 2008:

	Rs. In lakhs
8% Debentures	125
10% bonds (2007)	50
Equity shares (Rs.10 each)	100
Reserves and surplus	300
Total assets	600
Assets turnover ratio	1.1
Effective interest rate	8%
Effective tax rate	40%
Operating margin	10%
Dividend payout ratio	16.67%
Current market price of share	Rs.14
Required rate of return of investors	15%

You are required to:

- Draw income statement for the year
- Calculate its sustainable growth rate
- Calculate the fair price of the Company's share using dividend discount model, and
- What is your opinion on investment in the company's share at current price

Answer:

WN 1: Income statement of PQR Limited of next year:

Particulars	Calculation	Amount
Sales (Note 1)		660
Less: Operating expenses	$660 \times 90\%$	(594)
Operating profit/EBIT		66
Less: Interest (Note 2)	$175 \times 8\%$	(14)
Earnings before tax		52
Less: Tax @ 40%	$52 \times 40\%$	(20.80)
Earnings after tax/EAES		31.20
Equity dividend	$31.20 \times 16.67\%$	5.20
Retained earnings	$31.20 - 5.20$	26.00

Note:

- Assets turnover ratio is 1.1 Times. This would mean that assets are rotated 1.1 times in a year and sales will be 1.1 times of total assets. Hence sales is 660 lacs
- The company has 8% debentures and 10% bonds. Interest should have been calculated based on these percentages. However, question also provides effective rate of interest and hence calculation has been done at 8%. This is possible if some debt is issued mid of year

WN 2: Computation of growth rate:

Particulars	Calculation	Amount
Return on equity	$\frac{\text{EAES}}{\text{Amount of equity}} = \frac{31.20}{400} \times 100$	7.80%
Retention ratio	$100\% - \text{Payout ratio}; 100\% - 16.67\%$	83.33%
Growth	ROE x Retention ratio $7.80\% \times 83.33\%$	6.50%

WN 3: Computation of fair price:

Particulars	Calculation	Amount
Dividend per share	$\frac{5.20}{10}$	0.52
Cost of equity		15%
Fair price	$\frac{D_1}{K_e - G} = \frac{0.52 + 6.5\%}{15\% - 6.50\%}$	6.52

Note:

- It is assumed that Dividend of 0.52 per share as current dividend(D_0) and hence growth rate of 6.5 percent is added to compute fair price

Conclusion:

Since the current market price of share is Rs. 14, the share is overvalued. Hence the investor should not invest in the company

47. Valuation of share as per PE Multiple Approach:

Calculate the value of equity share from the following:

Particulars	Amount
Equity share capital (Rs.20 each)	Rs. 50,00,000
Reserves and surplus	Rs.5,00,000
15% secured loans	Rs.25,00,000
12.5% unsecured loans	Rs.10,00,000
Fixed Assets	Rs.30,00,000
Investments	Rs.5,00,000
Operating profit	Rs.25,00,000
Tax rate	50%
P/E Ratio (Price-Earnings)	12.5

Answer:

Particulars	Amount
Operating profit (EBIT)	25,00,000
Less: Interest on 15% secured loan	(3,75,000)
Less: Interest on 12.5% unsecured loan	(1,25,000)
Profit before tax	20,00,000
Less: Tax @ 50%	(10,00,000)
Profit after tax	10,00,000
No of shares (50,00,000/20)	2,50,000
Earnings per share	4
P/E Ratio (Price-Earnings)	12.5
Market price per share (EPS x PE Multiple)	50

48. Valuation of Share [Nov 2019, May 2021 MTP]:

You are interested in buying some equity stocks of RK Ltd. The company has 3 divisions operating in different industries. Division A captures 10% of its industries sales which is forecasted to be Rs. 50 crore for the industry. Division B and C captures 30% and 2% of their respective industry's sales, which are expected to be Rs. 20 crore and Rs. 8.5 crore respectively. Division A traditionally had a 5% net income margin, whereas divisions B and C had 8% and 10% net income margin respectively. RK Ltd. has 3,00,000 shares of equity stock outstanding, which sell at Rs. 250.

The company has not paid dividend since it started its business 10 years ago. However from the market sources you come to know that RK Ltd. will start paying dividend in 3 years time and the pay-out ratio is 30%. Expecting this dividend, you would like to hold the stock for 5 year. By analysing the past financial statements, you have determined that RK Ltd.'s required rate of return is 18% and that P/E ratio of 10 for the next year and on ending P/E ratio of 20 at the end of the fifth year are appropriate.

Required:

- Would you purchase RK Ltd. equity at this time based on your one year forecast?
- If you expect earnings to grow @ 15% continuously, how much are you willing to pay for the stock of RK Ltd?

Answer:**WN 1: Computation of EPS of RK Limited for Year 0:**

Division	Industry Sales	Market share	Company sales	Margin	Company Profit
A	50,00,00,000	10%	5,00,00,000	5%	25,00,000
B	20,00,00,000	30%	6,00,00,000	8%	48,00,000
C	8,50,00,000	2%	17,00,000	10%	1,70,000
Total Profit					74,70,000
No of shares					3,00,000
EPS (74,70,000/3,00,000)					24.90

Note: It is assumed that EPS of the company will continue to be the same in year 1 as there is no information on growth for part 1 of the question.

WN 2: Computation of price based on one-year forecast:

- Fair price at end of year 1 = EPS of Year 1 x PE Multiple of next year
- Fair price at end of year 1 = 24.90 x 10 Times = Rs.249

$$\text{PV of share price} = \frac{249}{1.18} = 211.01$$

Conclusion:

- Actual market price is Rs.250 whereas fair market price is Rs.211.01. Share is currently overvalued and hence the same is not to be bought

WN 3: Valuation of share based on growth rate of 15%:

Computation of Dividend Per share till first year of stabilization phase

Year	Growth rate	EPS	Payout Ratio	DPS
1	15%	28.64	-	0
2	15%	32.93	-	0
3	15%	37.87	30%	11.36
4	15%	43.55	30%	13.07

Note:

- Growth rate has been steady at 15 percent for all years. However, the payout has stabilized at 30% in year 4 and hence cash flows have been calculated till year 4

Valuation of share at the beginning of stabilization phase

$$P_3 = \frac{D_4}{K_e - G}; P_3 = \frac{13.07}{18\% - 15\%} = \text{Rs. } 435.67$$

Valuation of share:

Year	Cash flow	PVF @ 18%	DCF
1	0	0.847	0
2	0	0.718	0
3	447.03 [11.36 + 435.67]	0.609	272.24
Fair value of share			272.24

49. Valuation of share [Nov 2019]:

Following information is available for M/s TS Limited:

Particulars	Rs. Crores
PBIT	5.00
Less: Interest on debt (10%)	1.00
PBT	4.00
Less: Tax @ 25%	1.00
PAT	3.00
No of outstanding shares	40 lacs
EPS	7.50
Market price per share	75
PE Ratio	10 Times

TS Ltd. has an undistributed reserves of Rs. 8 crores. The company requires Rs. 3 crores for the purpose of expansion which is expected to earn the same rate of return on capital employed as present. However, if the debt to capital employed ratio is higher than 35%, then P/E ratio is expected to decline to 8 Times and rise in the cost of additional debt to 14%. Given this data which of the following options the company would prefer, and why?

Option (i) : If the required amount is raised through debt, and

Option (ii) : If the required amount is raised through equity and the new shares will be issued at a price of Rs. 25 each.

Answer:

WN 1: Computation of new EBIT:

Particulars	Existing	Revised
EBIT (A)	5.00	5.6825 (22 cr x 22.73%)
Capital Employed (B)	22.00	25.00
Share capital (40 lacs x 10)	4.00	4.00
Reserves and surplus	8.00	8.00
Borrowing (1 cr/10%)	10.00	10.00
New fund raised		3.00
ROCE (A/B) x 100	22.73%	22.73%

WN 2: Computation of debt to capital employed for both options:

Particulars	Option 1	Option 2
Debt	13	10
Capital Employed	25	25
Debt to capital employed	52%	40%
Applicable PE Multiple	8	8

WN 3: Computation of market price of both options:

Particulars	Option 1	Option 2
EBIT	5.6825	5.6825
Less: Interest	1.4200 (1.00 + 0.42)	1.0000
EBT	4.2625	4.6825
Less: Tax @ 25%	1.0656	1.1706
PAT	3.1969	3.5119
No of shares	40 lacs	52 lacs
EPS	7.99	6.75
PE Multiple	8	8
New share price	63.92	54.00

Note:

- Interest under option 1 = 1 crores + (3 crores x 14%) = Rs.1.42 Crores
- No of shares under option 2 = 40 lacs + (3 crores/25) = 52 lacs

Conclusion:

- We should go ahead with option 1 due to higher Market Price Per Share

50. Stock Lending [Jan 2021]

Mr. A is holding 1000 shares of face value of Rs.100 each of M/s. ABC Ltd. He wants to hold these shares for long term and have no intention to sell.

On 1st January 2020, M/s XYZ Ltd. Has made short sales of M/s. ABC Ltd.'s shares and approached Mr. A to lend his shares under Stock Lending Scheme with following terms:

- Shares to be borrowed for 3 months from 01-01-2020 to 31-03-2020,
- Lending Charges/Fees of 1% to be paid every month on the closing price of the stock quoted in Stock Exchange and
- Bank Guarantee will be provided as collateral for the value as on 01-01-2020.

Other Information:

- Cost of Bank Guarantee is 8% per annum,
- ABC Limited had declared dividend of Rs.25 per share in the interim period
- On 29-02-2020 M/s. ABC Ltd.'s share quoted in Stock Exchange on various dates are as follows:

Date	Share Price in Scenario -1 Bullish	Share Price in Scenario - 2 Bullish
01-01-2020	1,000	1,000
31-01-2020	1,020	980
29-02-2020	1,040	960
31-03-2020	1,050	940

You are required to find out:

(i) Earning of Mr. A through Stock Lending Scheme in both the scenarios,

(ii) Total Earnings of Mr. A during 01-01-2020 to 31-03-2020 in both the scenarios,

(iii) What is the Profit or loss to M/s. XYZ by shorting the shares using through Stock Lending Scheme in both the scenarios?

Answer:

WN 1: Computation of Earning of Mr.A through stock lending scheme:

Particulars	Scenario - 1	Scenario - 2
January Month	10,200 [1,000 shares x 1,020 x 1 %]	9,800 [1,000 shares x 980 x 1 %]
February Month	10,400 [1,000 shares x 1,040 x 1 %]	9,600 [1,000 shares x 960 x 1 %]
March Month	10,500 [1,000 shares x 1,050 x 1 %]	9,400 [1,000 shares x 940 x 1 %]
Total earning from Lending	31,100	28,800

WN 2: Computation of total earning of Mr.A:

Particulars	Scenario - 1	Scenario - 2
Earning from lending	31,100	28,800
Dividend income	25,000 [1,000 x 25]	25,000 [1,000 x 25]
Total earning of Mr.A	56,100	53,800

WN 3: Profit/loss to XYZ Limited:

Particulars	Scenario - 1	Scenario - 2
Profit/loss on short-sell	-50,000 [1,000 - 1,050] x 1,000	60,000 [1,000 - 940] x 1,000
Lending fees [WN 1]	-31,100	-28,800
Bank guarantee charges [1,000 shares x 1,000] x 8% x (3/12)	-20,000	-20,000
Profit/loss to XYZ Limited	-1,01,100	11,200

51. Computation of Dividend [July 2021]

NM Ltd. (NML) is aspiring to enter the capital market in a three years' time. The Board wants to attain the target price of Rs. 70 for its shares at the end of three years. The present value of its shares is Rs. 52.03. The dividend is expected to grow at a rate of 15% for the next three years. NML uses dividend growth model for its projections. The required rate of return is 15%.

You are required to calculate the amount of dividend to be declared by the board in the base year so as to achieve the target price.

Period (t)	1	2	3
PVIF (15%,t)	0.8696	0.7561	0.6575

Answer:

Let us assume Dividend of base year (year 0) to be A

Year	Cash flow	PVF @ 15%	DCF
1	1.15A	0.8686	A
2	1.3225A	0.7561	A
3	1.5209A	0.6575	A
3	70	0.6575	46.03
PV of Share			52.03

- Hence $3A + 46.03 = 52.03$
- $A = \text{Rs.2 per share}$
- Hence Dividend for the base year will be Rs.2 per share

Part IV - Valuation of Convertible Instruments

52. Convertible bond [Nov 2018, Nov 2018 MTP, Nov 2016 RTP]

The following data is related to 8.5% fully convertible (into equity shares) debentures issued by ABC Limited at Rs.1000.

Market Price of Debenture	Rs.900

Conversion Ratio	30
Straight value of Debenture	Rs.700
Market price of equity share	Rs.25
Expected dividend per share	Rs.1

You are required to calculate:

- ❖ Conversion value of debenture
- ❖ Market conversion price
- ❖ Conversion premium per share
- ❖ Ratio of conversion premium
- ❖ Premium over straight value of debenture
- ❖ Favorable income differential per share
- ❖ Premium pay-back period

Answer:

Particulars	Calculation	Amount
Conversion value	CMP of share x conversion ratio 25×30	750
Market conversion price (or) Conversion parity price	$\frac{\text{CMP of bond}}{\text{Conversion ratio}} = \frac{900}{30}$	30
Conversion premium		
Per debenture	$900 - 750$	Rs.150 per debenture
Per equity share	$\frac{150}{30}$	Rs.5 per equity share
Ratio of conversion premium	$\frac{150}{750} \times 100$	20% of conversion value
Premium over straight value:		
Premium over SV (in rupees)	CMP - straight value $900 - 700$	Rs.200 per debenture
Premium over SV (in %)	$\frac{200}{700} \times 100$	28.57% of straight value
Favorable income differential:		
Interest income per bond	$1,000 \times 8.5\%$	Rs.85 per debenture
Dividend income per share		Rs.1
Dividend income for 30 shares		Rs.30
Favorable income differential per bond	$\text{Rs.85} - \text{Rs.30}$	Rs.55 per bond
Favorable income differential per share	$\frac{55}{30}$	Rs.1.833 per share
Premium payback period	$\frac{\text{Conversion premium per share}}{\text{Income differential per share}}$	$\frac{5}{1.83} = 2.73 \text{ years}$

53. Convertible bond [May 2018 MTP, Nov 2018 MTP, May 2014, May 2017 RTP, May 2018]

GHI Ltd., AAA rated company has issued, fully convertible bonds on the following terms, a year ago

Face value of bond	Rs.1000
Coupon (interest rate)	8.5%
Time to maturity (remaining)	3 years
Interest payment	Annual, at the end of year
Principal repayment	At the end of bond maturity
Conversion ratio (Number of shares per bond)	25
Current market price per share	Rs.45
Market price of convertible bond	Rs.1175

AAA rated company can issue plain vanilla bonds without conversion option at an interest rate of 9.5%.

Required:

- i. Straight value of bond
- ii. Conversion value of the bond
- iii. Conversion premium
- iv. Percentage of downside risk
- v. Conversion parity price

Answer:

WN 1: Computation of straight value:

- Straight value refers to the present value of future cash flows of convertible instrument discounted at investor's required rate of return.
- In this case we should discount bond's cash flows at comparable rate of 9.5%

Year	Cash flow	PVF @ 9.5%	DCF
1	85	0.913	77.61
2	85	0.834	70.89
3	1,085	0.762	826.77
			975.27

WN 2: Computation of conversion value and conversion premium:

Particulars	Calculation	Amount
Conversion value	CMP of share x conversion ratio 45 x 25	Rs.1,125
Conversion premium		
Per debenture	1,175 - 1,125	Rs.50 per debenture
Per equity share	$\frac{50}{25}$	Rs.2 per equity share
% of conversion value	$\frac{50}{1,125} \times 100$	4.44% of conversion value

WN 3: Computation of percentage of downside risk:

Particulars	Calculation	Amount
Downside risk in Rs.	CMP - Straight value	1,175 - 975.27 = Rs.199.73
Downside risk (%)		
% of straight value	$\frac{199.73}{975.27} \times 100$	20.48% of straight value
% of CMP	$\frac{199.73}{1,175} \times 100$	17.00% of CMP

WN 4: Computation of conversion parity price:

- Conversion parity price refers to the target price per equity share at which the investor will have no loss on conversion

$$\text{Conversion parity price} = \frac{1,175}{25} = \text{Rs. 47 per share}$$

54. Issue of convertible preference shares [Nov 2009, May 2019 MTP, May 2017]

XYZ company has current earnings of Rs.3 per share with 5,00,000 shares outstanding. The company plans to issue 40,000, 7% convertible preference shares of Rs. 50 each at par. The preference shares are convertible into 2 shares for each preference shares held. The equity share has a current market price of Rs. 21 per share.

- What is preference share's conversion value?
- What is conversion premium?
- Assuming that total earnings remain the same, calculate the effect of the issue on the basic earning per share (a) before conversion (b) after conversion.
- If profits after tax increases by Rs. 1 million what will be the basic EPS (a) before conversion and (b) on a fully diluted basis?

Answer:**WN 1: Computation of conversion value and conversion premium:**

Particulars	Calculation	Amount
Conversion value	CMP of share x conversion ratio 21 x 2	Rs.42
Conversion premium		
Per preference share	50 - 42	Rs.8 per preference share
Per equity share	$\frac{8}{2}$	Rs.4 per equity share
% of conversion value	$\frac{8}{42} \times 100$	19.05% of conversion value

Note:

- Conversion premium can be expressed as per convertible instrument/per equity share/as a % of conversion value

WN 2: Computation of EPS if overall earnings remain same:

Particulars	Before conversion	After Conversion
Profit after tax (5,00,000 x 3)	15,00,000	15,00,000
Less: Preference Dividend (20,00,000 x 7%)	(1,40,000)	-
Earnings available to equity shareholders	13,60,000	15,00,000
Number of equity shares	5,00,000	5,80,000 [5,00,000 + 40,000 x 2]
Earnings per share (EAES/No of shares)	2.72	2.59

WN 3: Computation of EPS if overall earnings increase by Rs.10,00,000:

Particulars	Before conversion	After Conversion
Profit after tax [15,00,000 + 10,00,000]	25,00,000	25,00,000
Less: Preference Dividend (20,00,000 x 7%)	(1,40,000)	-
Earnings available to equity shareholders	23,60,000	25,00,000
Number of equity shares	5,00,000	5,80,000 [5,00,000 + 40,000 x 2]
Earnings per share (EAES/No of shares)	4.72	4.31

55. Conversion parity price and conversion premium: [Nov 2008, Nov 2015 MTP, Nov 2019 RTP]

The data given below relates to a convertible bond:

Face value	Rs.250
Coupon rate	12%
No of shares per bond	20
Market price of share	Rs.12
Straight value of bond	Rs.235
Market price of convertible bond	Rs.265

Calculate:

- Stock value of bond
- The percentage of downside risk
- The conversion premium
- The conversion parity price of the stock

Answer:

Particulars	Calculation	Amount
Stock value or conversion value	20 shares x 12	Rs.240
Percentage of downside risk		
Downside risk (in Rs.)	CMP of bond – straight value	Rs.30
Downside risk (in %)		
As % of CMP of bond	$\left(\frac{30}{265} \times 100\right)$	11.32%
As % of straight value	$\left(\frac{30}{235} \times 100\right)$	12.77%
Conversion Premium		
Conversion premium (in Rs.)	CMP of bond – Conversion value	Rs.25
Conversion premium (in %)	$\left(\frac{25}{240} \times 100\right)$	10.42%
Conversion parity price	$\left(\frac{\text{CMP of bond}}{\text{Conversion ratio}}\right) = \left(\frac{265}{20}\right)$	Rs.13.25

56. Convertible instruments [May 2022 MTP]

The following data is related to 9% fully convertible (into equity shares) debentures issued by ABC Limited at Rs.1000.

Market Price of Debenture	Rs.1,000
Conversion Ratio	25

Straight value of Debenture	Rs.800
Market price of equity share on the date of conversion	Rs.30
Expected dividend per share	Rs.1

ANALYSE the value of Debenture both from cost and payback period angle for an investor who is considering to adopt the route of conversion to acquire the shares of the company

Answer:

Particulars	Calculation	Amount
Conversion value of debentures	25 shares x 30	Rs.750
Conversion premium		
Per debenture	1,000 – 750	Rs.250 per debenture
Per equity share	$\frac{250}{25}$	Rs.10 per equity share
Favorable income differential:		
Interest income per bond	1,000 x 9.0%	Rs.90 per debenture
Dividend income per share		Rs.1
Dividend income for 25 shares		Rs.25
Favorable income differential per bond	Rs.90 – Rs.25	Rs.65 per bond
Favorable income differential per share	$\frac{65}{25}$	Rs.2.60 per share
Premium payback period	$\frac{\text{Conversion premium per share}}{\text{Income differential per share}}$	$\frac{10}{2.60} = 3.85 \text{ years}$

Analysis:

Thus from above it can be analysed that:

- The Conversion Value of Debenture is less than the Market Value of Debenture because the Coupon Interest Rate is higher than Yield as Straight Value is somewhat near about the conversion value.
- If the investor adopts the route of Convertible Debenture for acquiring shares he/ she will have to pay premium over the market price.
- So far as the recovery of the premium paid for acquiring one share is concerned approximate it will take about 4 years.
- However, in case if the market price of the share is increased then of course the premium will be reduced and hence the payback period. Reverse will happen in case if the prices of the share goes below Rs. 30 per share.

57. Computation of conversion premium:

Phototech plc has in issue 9% bonds which are redeemable at their par value of GBP 100 in five years' time. Alternatively, each bond may be converted on that date into 20 ordinary shares of the company. The current ordinary share price of Phototech plc is GBP 4.45 and this is expected to grow at a rate of 6.5% per year for the foreseeable future. Phototech plc has a cost of debt of 7% per year.

Required:

Calculate the following current values for each GBP 100 convertible bond:

- Market value
- Floor value
- Conversion premium

Answer:

WN 1: Computation of market value:

- ❖ Market value is the present value of future cash flows discounted at cost of debt

Year	Cash flow	PVF @ 7%	DCF
1 to 5	9	4.100	36.9
5	122(Note 1)	0.713	86.99
Market value			123.89

Note 1: Computation of redemption value:

- ❖ Redemption value of convertible bond on maturity date would be higher of the following:
- **Conversion value of bond:** The current share price is GBP 4.45. The share price is expected to grow at rate of 6.5% and hence the share price is expected to become GBP 6.10 at end of year 5. The bond will be converted into 20 shares and the bond holder will receive GBP 122.
 - **Redemption as bond:** The bond can be redeemed on maturity date at par value of GBP 100

- ❖ Redemption value in this case would be GBP 122 as the bond holder would prefer conversion of shares on maturity date

WN 2: Computation of floor value:

Year	Cash flow	PVF @ 7%	DCF
1 to 5	9	4.100	36.9
5	100	0.713	71.30
Floor value			108.20

Floor value is the minimum possible value for the bond and the same would be calculated based on assured cash flows of redemption of bond at par value of GBP 100

WN 3: Computation of conversion premium:

Particulars	Calculation	Amount
Conversion value	4.45×20	GBP 89
Conversion Premium		
Conversion premium (in Rs.)	$(\text{CMP of bond} - \text{Conversion value}) = 123.89 - 89$	GBP 34.89
Conversion premium (per share)	$\left(\frac{34.89}{20}\right)$	GBP 1.75
Conversion premium (in %)	$\left(\frac{34.89}{89} \times 100\right)$	39.20%

58. Calculation of Minimum Price [May 2015 RTP]

Suppose Mr. A is offered a 10% Convertible Bond (par value Rs. 1,000) which either can be redeemed after 4 years at a premium of 5% or get converted into 25 equity shares currently trading at Rs. 33.50 and expected to grow by 5% each year. You are required to determine the minimum price Mr. A shall be ready to pay for bond if his expected rate of return is 11%.

Answer:**Computation of minimum price:**

- Minimum price refers to the present value of bond computed using certain cash flows. Redemption value under certain cash flow is computed by taking principal as redemption value.
- In case of convertible bond, redemption value will be taken as higher of principal value and expected value of shares. However, for minimum price we should only take principal value as redemption value

Year	Cash flow	PVF @ 11%	DCF
1 to 4	100	3.103	310.30
4	1,050	0.659	691.95
Minimum price of bond			1,002.25

59. Decision on conversion [May 2018, Nov 2009]

Sabanam Limited has issued convertible debentures with coupon rate of 11%. Each debenture has an option to convert to 16 equity shares at any time until the date of maturity. Debentures will be redeemed at Rs.100 on maturity of 5 years. An investor generally requires a rate of return of 8% p.a. on a 5-year security. As an advisor, when will you advise the investor to exercise conversion for given market prices of the equity share of (i) Rs.5, (ii) Rs.6 and (iii) Rs.7.10.

Answer:**WN 1: Computation of current market price of bond**

Year	Cash flow	PVF@8%	DCF
1 to 5	11	3.993	43.923
5	100	0.681	68.100
Value of bond			112.023

Note 1: Computation of redemption value:

- ❖ Redemption value of convertible bond on maturity date would be higher of the following:
 - **Conversion value of bond:** The details on share price on maturity date is not available and hence this cannot be computed
 - **Redemption as bond:** The bond can be redeemed on maturity date at par value of Rs.100
- ❖ Redemption value in this case would be taken as Rs.100 due to absence of information on conversion value of bond on maturity date.

WN 2: Decision on conversion of bond:

Market Price	Conversion ratio	Conversion value
Rs.5	16:1	Rs.80
Rs.6	16	Rs.96
Rs.7.10	16	Rs.113.60

Hence, unless the market price is Rs.7.10 conversion should not be exercised.

60. Computation of break-even price (Nov 2021):

B International Ltd. (BIL) has purchased 5 years 15.28% convertible debentures on 1.04.2021. The convertible debentures will mature on 31.03.2026. Each debenture can be converted into 20 equity shares of face value of Rs. 1 at any point of time but before maturity. Debentures will be redeemed at Rs. 100 on maturity. The required rate of return of BIL is 10% per annum on a 5-year security. The Reputed, a consultant has projected the following price behaviour of the shares:

Period		Price Range		
From	To	Passive	Most Likely	Optimistic
1.04.2021	31.12.2022	4.00	4.50	5.00
1.01.2023	30.06.2025	4.50	6.50	7.00
1.07.2025	31.03.2026	3.50	5.00	5.50

BIL, as a matter of policy, rounds up the amount.

You are required to calculate.

- (a) The break-even price at which the debentures can be converted
 (b) The ideal period in which BIL shall convert and dispose of the shares

Note: Use four decimals for present value factors

Answer:**WN 1: Computation of fair value of debentures:**

Year	Cash flow	PVF @ 10%	DCF
1 to 5	15.28	3.7908	57.92
5	100.00	0.6209	62.09
Fair value of debentures			120.01

Note: Maturity value would be higher of the following:

- Redemption as debt = Rs.100
- Conversion into equity = 20 shares x Rs.5 (most likely price) = Rs.100

$$\text{Break even price} = \frac{\text{Fair price}}{\text{Conversion Ratio}} = \frac{120.01}{20} = \text{Rs. 6 per share}$$

- Hence the debentures can be converted into equity shares if the value of equity share is Rs.6 per share

Part (ii):

The ideal period in which BIL should convert and dispose of share will be 01.01.23 to 30.06.25 as during this period the market price of share is most likely to exceed its Break-even price.

Part V – Bond Valuation**61. Bond valuation [May 2014 MTP, Nov 2019]**

Nominal value of 10% bonds issued by a company is Rs.100. The bonds are redeemable at Rs.110 at the end of year 5. Determine the value of the bond if required yield is

- a) 5%
 b) 10%

What will be the price of the bond at the end of each of the next five years in case the required yield is 5%?

Answer:**WN 1: Valuation of bond if required yield is 5%:**

- Price of bond is present value of future cash flows (Interest + Principal) discounted at investor's required rate of return of 5%

Year	Cash flow	PVF @ 5%	DCF
1 to 5	10	4.330	43.30

5	110	0.784	86.24
Value of bond			129.54

WN 2: Valuation of bond if required yield is 10%:

Year	Cash flow	PVF @ 10%	DCF
1 to 5	10	3.790	37.90
5	110	0.621	68.31
Value of bond			106.21

WN 3: Valuation of bond at end of each of next five years in case required return is 5%:

Particulars	Calculation	Amount
Price on day 0 (P0)		129.54
Price in year 1:		
Day 0 price		129.54
Add: Required return of 5%	$129.54 \times 5\%$	6.48
Target price in year 1		136.02
Less: Interest earned in year 1		(10)
Expected price in year 1		126.02
Price in year 2:		
Year 1 Price		126.02
Add: Required return of 5%	$126.02 \times 5\%$	6.30
Target price in year 2		132.32
Less: Interest earned in year 2		(10)
Expected price in year 2		122.32
Price in year 3:		
Year 2 Price		122.32
Add: Required return of 5%	$122.32 \times 5\%$	6.11
Target price in year 3		128.43
Less: Interest earned in year 3		(10)
Expected price in year 3		118.43
Price in year 4:		
Year 3 Price		118.43
Add: Required return of 5%	$118.43 \times 5\%$	5.92
Target price in year 4		124.35
Less: Interest earned in year 4		(10)
Expected price in year 4		114.35
Price in year 5:		
Year 4 Price		114.35
Add: Required return of 5%	$114.35 \times 5\%$	5.72
Target price in year 5		120.07
Less: Interest earned in year 4		(10)
Redemption value of year 5		110.07#

Redemption value for year 5 should be Rs.110. However, difference of Rs.0.07 is due to rounding-off issues.

62. Determination of price for multiple years:

A 7% Bond was issued several years ago when the market interest rate was also 7%. Now the bond has a remaining life of 3 years when it would be redeemed at par value of Rs.1,000. The market rate of interest has increased to 8%. Find out the current market price, price after 1 year and price after 2 years from today.

Answer:

WN 1: Computation of current market price:

Year	Cash flow	PVF@8%	DCF
1 to 3	70	2.577	180.39
3	1,000	0.794	794.00
Value of bond			974.39

WN 2: Computation of price after 1 year

Year	Cash flow	PVF@8%	DCF
1 to 2	70	1.783	180.39
2	1,000	0.857	857.00
Value of bond			981.81

WN 3: Computation of price after 2 year2

Year	Cash flow	PVF@8%	DCF
1	1,070	0.926	990.82
Value of bond			990.82

Note:

- This is an alternative approach for valuing bond at end of year 1 and year 2. We can follow the same approach used in previous question for valuing bond at end of year 1 and year 2

63. Bond Valuation [Nov 2022 SA]

Mr. X wants to invest Rs. 1,00,000 in the 7 years 8% bonds in the market (Face Value Rs. 100) which were issued 2 years ago.

- You are requested to advise him what is the maximum price for bonds to be paid in the following scenarios:
 - If Mr. X is expecting minimum 9% return on the bonds
 - If Mr. X is expecting minimum 7% return on the bonds
 - If the present rate of similar bonds issued is 8.25%
 - If the present rate of similar bonds issued is 7.75%
- If the bonds are available at par and 1% is the transaction cost, what is the effective yield?
- Find the number of days required to breakeven transaction cost if the bonds are available at par and 2% is the transaction cost.

Answer:**WN 1: Computation of maximum price if Mr.X is expecting minimum 9% return on the bonds:**

Year	Cash flow	PVF @ 9%	DCF
1 to 5	8	3.890	31.12
5	100	0.650	65.00
Total			96.12

WN 2: Computation of maximum price if Mr.X is expecting minimum 7% return on the bonds:

Year	Cash flow	PVF @ 7%	DCF
1 to 5	8	4.100	32.80
5	100	0.713	71.30
Total			104.10

WN 3: Computation of maximum price if return on similar bonds is 8.25%

Year	Cash flow	PVF @ 8.25%	DCF
1 to 5	8	3.967	31.74
5	100	0.673	67.30
Total			99.04

WN 4: Computation of maximum price if return on similar bonds is 7.75%

Year	Cash flow	PVF @ 7.75%	DCF
1 to 5	8	4.019	32.15
5	100	0.689	68.90
Total			101.05

WN 5: Effective yield if 1% is the transaction cost:

- If bonds are trading at par, then yield on bond is equal to coupon rate. Hence Yield of the bond is expected to be 8%
- Yield post transaction cost = $8 \times (1 - 0.01) = 7.92\%$

WN 6: Number of days to breakeven if the transaction cost is 2%:

- If bonds are trading at par, then yield on bond is equal to coupon rate. Hence Yield of the bond is expected to be 8%

$$\text{No of days to break – even} = \left(\frac{2}{8}\right) \times 365 \text{ days} = 91 \text{ days}$$

64. Bond valuation [Nov 2009, Nov 2016 MTP]

An investor is considering the purchase of the following Bond:

Face value	Rs.100
Coupon rate	11%
Maturity	3 years

- If he wants a yield of 13% what is the maximum price he should be ready to pay for?
- If the bond is selling for Rs.97.60, what would be his yield?

Answer:

WN 1: Computation of maximum price if investor needs yield of 13%:

Year	Cash flow	PVR @ 13%	DCF
1	11	0.885	9.74
2	11	0.783	8.61
3	111	0.693	76.92
Maximum purchase price			95.27

WN 2: Computation of yield if the bond is currently selling for Rs.97.60:

- Yield refers to the return earned by the investor and the same would be equal to IRR of investment

Yield under short-cut method:

Yield = $\frac{\text{Interest} + \text{Average other income}}{\text{Average funds employed}}$
Interest = Rs.11
Average other income = $\frac{100 - 97.60}{3} = 0.80$
Average funds employed = $\frac{100 + 97.60}{2} = 98.80$
Yield = $\frac{11 + 0.80}{98.80} \times 100 = 11.94\%$

- Final IRR is expected to be closer to 11.94% and hence we will take initial guess rate of 12 percent to compute NPV and then compute IRR

Computation of NPV at initial guess rate of 12%:

Year	Cash flow	PVR @ 12%	DCF
0	(97.60)	1	(97.60)
1	11	0.893	9.82
2	11	0.797	8.77
3	111	0.712	79.03
NPV			0.02

Conclusion:

- NPV of above cash flows is equal to 0 (0.02 is due to rounding-off) and hence IRR of the above cash flows is 12%. **This would mean that investor is earning return of 12%.**

65. Bond valuation [Nov 2010]

Calculate the market price of:

- 10% Government of India Security currently quoted at Rs.110, but yield is expected to go up by 1%
- A bond with 7.5% coupon interest, Face Value of Rs.10,000 & term to maturity of 2 years presently yielding 6%. Interest payable half yearly

Answer:

Part (a):

Computation of market price:

Current yield	$\frac{\text{Interest}}{\text{Current market price}} \times 100$	$\frac{10}{110} \times 100 = 9.09\%$
Yield is expected to increase by 1% and hence the revised yield will be 10.09%		
Market price	$\frac{\text{Interest}}{\text{Revised Yield}}$	$\frac{10}{10.09\%} = \text{Rs. 99.11}$

Note:

- It is assumed that face value is Rs.100 and hence interest @ 10% amounts to Rs.10

Part (b):**Computation of market price:**

- Bond is paying interest half-yearly and hence we should do half-yearly discounting. **We should ensure that discounting frequency is same as interest payment frequency. The answer to this question will change if we do annual discounting at 6%**
- Yield to maturity is 6%. The given YTM is for a year and half-yearly yield to maturity is 3% per half year

Period	Cash flow	PVF @ 3%	DCF
1 to 4	375	3.717	1,393.88
4	10,000	0.888	8,800.00
Value of bond			10,273.88

66. Valuation of bond:

If a Rs.100 par value bond carries a coupon rate of 12 percent and a maturity period of 8 years and interest payable semi-annually then the value of the bond with required rate of return of 14 percent will be what?

Answer:

Period	Cash flow	PVF @ 7%	DCF
1 to 16	6	9.447	56.68
16	100	0.339	33.90
Value of bond			90.58

Note: We need to ensure that bond paying half-yearly interest should be discounted using half-yearly rate.

67. Bond valuation

What is the value of 5 year 11.6% coupon bond if the appropriate discount rate for discounting each cash flow is as follows:

Year	1	2	3	4	5
Discount rate	11.8	12.8	13.2	13.8	14.6

Answer:

Let us assume the face value of the bond is Rs.100

Year	Cash flow	PVF	DCF
1	11.6	0.894	10.37
2	11.6	0.793	9.20
3	11.6	0.701	8.13
4	11.6	0.616	7.15
5	111.6	0.538	60.04
Value of bond			94.89

Note:

- Discount rate varies for every year and the computation of DCF will be done in the following manner

$$\text{DCF of year 1} = \frac{1}{1 + 11.8\%} = 0.894$$

$$\text{DCF of year 2} = \frac{\text{DCF of year 1}}{1 + 12.8\%} = 0.793$$

$$\text{DCF of year 3} = \frac{\text{DCF of year 2}}{1 + 13.2\%} = 0.701$$

- DCF of year 4 and 5 will be calculated in the above manner

Possible mistake:

- Student should take care when they work with differential discount rate. PVF for year 2 should not be calculated in this manner:

$$\text{PVF of year 2} = \frac{1}{(1 + 12.8\%)^2} = 0.786$$

68. Bond Valuation [May 2021 MTP]

ABC Ltd. wants to issue 9% Bonds redeemable in 5 years at its face value of Rs. 1,000 each. The annual spot yield curve for similar risk class of Bond is as follows:

Year	Interest Rate
1	12%
2	11.62%
3	11.33%
4	11.06%
5	10.80%

(i) Evaluate the expected market price of the Bond if it has a Beta value of 1.10 due to its popularity because of lesser risk.

(ii) Interpret the nature of the above yield curve and reasons for the same.

Note: Use PV Factors upto 4 decimal points and value in Rs. upto 2 decimal points.

Answer:

WN 1: Computation of intrinsic value of bond:

Year	Cash flow	PVF	DCF
1	90.00	0.8929	80.36
2	90.00	0.8026	72.23
3	90.00	0.7247	65.22
4	90.00	0.6573	59.16
5	1,090.00	0.5988	652.69
Intrinsic Value			929.66

Note:

PVF is computed in the following manner:

$$\text{PVF of Year 1} = \frac{1}{1 + 12\%}$$

$$\text{PVF of Year 2} = \frac{1}{(1 + 11.62\%)^2}$$

$$\text{PVF of Year 3} = \frac{1}{(1 + 11.33\%)^3}$$

- The given interest rates are direct yield for two years/three years/four years/five years. This should not be confused with forward future rates. In case of forward rates, we will use step-down discount rate concept and PVF is computed differently
- Here we directly apply the yield for respective years and compute PVF

Expected Price:

Expected Price of Bond = Intrinsic value of Bond x Beta Value

Expected Price of Bond = 929.66 x 1.10 = Rs.1,022.63

Nature of Yield curve:

The given yield curve is inverted yield curve. The main reason for this shape of curve is expectation for forthcoming recession **when investors are more interested in Short-term rates over the long term**

69. Bond valuation [Nov 2003, May 2016]

M/s Agfa Industries is planning to issue a debenture series on the following terms

Face value	Rs.100
Term of maturity	10 years
Yearly coupon rate	
Years	
1-4	9%
5-8	10%
9-10	14%

The current market rate on similar debentures is 15 percent per annum. The company proposes to price the issue in such a manner that it can yield 16 percent compounded rate of return to the investors. The company

also proposes to redeem the debentures at 5 percent premium on maturity. Determine the issue price of the debentures.

Answer:

Computation of issue price of debentures:

- Interest rate on similar debentures is 15%. However, the company proposes to issue the price in such a manner the investor can earn 16 percent return. Hence, we should discount the cash flows at 16 percent to compute the issue price of debentures

Year	Cash flow	PVF@16%	DCF
1	9	0.862	7.76
2	9	0.743	6.69
3	9	0.641	5.77
4	9	0.552	4.97
5	10	0.476	4.76
6	10	0.410	4.10
7	10	0.354	3.54
8	10	0.305	3.05
9	14	0.263	3.68
10	119	0.227	27.01
Issue price of debentures			71.33

70. Calculation of YTM [May 2014 MTP]

If the market price of the bond is Rs.95; years to maturity = 6 years; coupon rate = 13% p.a. (paid annually) and issue price is Rs.100. What is the yield to maturity?

Answer:

Yield under short-cut method:

$$\text{Yield} = \frac{\text{Interest} + \text{Average other income}}{\text{Average funds employed}}$$

Interest = Rs.13

$$\text{Average other income} = \frac{100 - 95}{6} = 0.83$$

$$\text{Average funds employed} = \frac{100 + 95}{2} = 97.50$$

$$\text{Yield} = \frac{13 + 0.83}{97.50} \times 100 = 14.18\%$$

- Final IRR is expected to be closer to 14.18% and hence we will take initial guess rate of 14 percent to compute NPV and then compute IRR

Computation of NPV:

Year	Cash flow	PVF @14%	DCF	PVF @15%	DCF
0	(95)	1.000	(95.00)	1.000	(95.00)
1 to 6	13	3.888	50.54	3.785	49.21
6	100	0.456	45.60	0.432	43.20
			1.14		(2.59)

- We initially started with discount rate of 14% and got positive NPV of Rs.1.14. We need to increase the rate as there is positive NPV
- NPV has been re-computed at 15 percent and NPV is negative 2.59.
- We can now compute IRR as we have one positive and one negative NPV

$$\text{IRR} = L_1 + \frac{\text{NPV at } L_1}{\text{NPV at } L_1 - \text{NPV at } L_2} \times (L_2 - L_1)$$

L1 = Lower rate of 14%; NPV at L1 = 1.16

L2 = Higher rate of 15%; NPV at L2 = -2.59

$$\text{IRR} = 14 + \frac{1.14}{1.14 - (-2.59)} \times (15 - 14); \text{IRR} = 14 + \frac{1.14}{3.73} \times (1); \text{IRR} = 14 + 0.31 = 14.31\%$$

71. Calculation of YTM [May 2004, Nov 2015 MTP]

There is a 9% 5-year bond issue in the market. The issue price is Rs.90 and the redemption price is Rs.105. For an investor with marginal income tax rate of 30% and capital gains tax rate of 10% (assuming no indexation), what is the post-tax yield to maturity?

Answer:

Yield under short-cut method:

$$\text{Yield} = \frac{\text{Interest} + \text{Average other income}}{\text{Average funds employed}}$$

- Post-tax Interest = $(9 \times 70\%) = \text{Rs.}6.30$ per year
- Redemption value = Rs.105; Capital gain = $105 - 90 = \text{Rs.}15$;
- Tax on capital gain = $15 \times 10\% = \text{Rs.}1.50$;
- Post-tax redemption value = $105 - 1.50 = \text{Rs.}103.50$

$$\text{Average other income} = \frac{103.50 - 90}{5} = 2.70$$

$$\text{Average funds employed} = \frac{103.50 + 90}{2} = 96.75$$

$$\text{Yield} = \frac{6.30 + 2.70}{96.75} \times 100 = 9.30\%$$

- Final IRR is expected to be closer to 9.30% and hence we will take initial guess rate of 9 percent to compute NPV and then compute IRR

Computation of NPV:

Year	Cash flow	PVF@9%	DCF	PVF@10%	DCF
0	(90)	1.000	(90.00)	1.000	(90.00)
1 to 5	6.3	3.889	24.50	3.790	23.88
5	103.50	0.650	67.28	0.621	64.27
NPV			1.78		(1.85)

$$\text{IRR} = L_1 + \frac{\text{NPV at } L_1}{\text{NPV at } L_1 - \text{NPV at } L_2} \times (L_2 - L_1)$$

$$\text{IRR} = 9 + \frac{1.78}{1.78 - (-1.85)} \times (10 - 9); \text{IRR} = 9 + \frac{1.78}{3.63} \times (1); \text{IRR} = 9 + 0.49 = 9.49\%$$

- Post-tax yield to maturity is 9.49%

72. Calculation of YTM and market price [Nov 2007]

MP Ltd issued a new series of bonds on Jan 1, 2010. The bonds were sold at par (Rs.1000), having a coupon rate of 10% per annum and maturing on 31st December 2025. Coupon payments are made semi-annually on June 30 and Dec 31st each year. Assume that you purchased an outstanding MP Ltd bond on 1st March 2018 when the going interest rate was 12%.

- What was the YTM of MP Ltd Bonds as on Jan 1, 2010
- What amount you should pay to complete the transaction?
- Of that amount how much should be accrued interest and how much would represent bond's basic value?

Answer:

WN 1: Computation of YTM:

- Bonds are issued at par and hence the interest rate on bond would be equal to YTM of bond
- YTM of bond would therefore be equal to 10 percent per annum

WN 2: Computation of amount to be paid on March 1, 2018:

- Interest is paid half-yearly in the month of June and December. We can compute present value of future cash flows and calculate the value of bond
- We can compute the price as on Jan 1, 2018 using the technique of discounting of future cash flows

Period	Cash flow	PVF @ 6%	DCF
1 to 16	50	10.106	505.30
16	1,000	0.394	394.00
Value of bond as on Jan 1, 2018			899.30

- Accrued interest for Jan and Feb = $1,000 \times 5\% \times (2/6) = 16.67$

- Value of bond as on March 1, 2018 = $899.30 + 16.67 = \text{Rs.}915.97$
- Accrued interest part of purchase price = Rs.16.67
- Basic price of bond = Rs.899.30

73. Calculation of realized YTM

Rs.1000 par value bond carries a coupon rate of 10% payable annually and has a remaining maturity of 4 years. The bond is presently selling for Rs.1020. The reinvestment rate applicable for the future cash flow of the bond is 9% per annum. What is the realized YTM?

Answer:

WN 1: Computation of maturity cash flow:

- In case of realized YTM, we are required to compute the maturity cash flow assuming reinvestment rate. In this question reinvestment rate is given as 9%

Year	Cash flow	Reinvestment period	FVF @ 9%	FCF
1	100	3	1.295	129.5
2	100	2	1.188	118.8
3	100	1	1.09	109.0
4	1,100	0	1	1,100
Maturity cash flow in year 4				1,457.3

WN 2: Computation of realized YTM (realized IRR):

- The current market price of bond is Rs.1,020. This is invested on day 0 and same matures to Rs.1,457.30 in year 4
- Realized YTM refers to the rate at which 1,020 grows to 1,457.30 in 4 years

$$FV = PV \times (1 + r)^n; 1,457.30 = 1,020 \times (1 + r)^4$$

$$\frac{1,457.30}{1,020} = (1 + r)^4; 1.4287 = (1 + r)^4$$

$$1.1953 = (1 + r)^2; (1 + r) = 1.0933$$

$$r = 0.0933 \text{ or } 9.33\%$$

Therefore, realized YTM is 9.33%

74. Calculation of realized YTM

A Rs.1,00,000 par five year maturity bond with a 9% coupon rate currently sells at a YTM of 8%. A portfolio manager wants to forecast the total return on the bond over the coming two years, as his horizon is two years. He believes that two years from now, three year maturity bonds will sell at a yield of 7% and the coupon income can be reinvested in short term securities over the next two years at a rate of 6%. What is the expected annualized rate of return over the two year period?

Answer:

WN 1: Computation of cash flows:

Note 1: Computation of investment price:

- Investment is made in a 5-year bond which is currently selling at YTM of 8%
- Investment price would be present value of 5-year bond discounted at YTM of 8%

Year	Cash flow	PVF @ 8%	DCF
1 to 5	9,000	3.993	35,937
5	1,00,000	0.681	68,100
Investment value on day 0			1,04,037

Note 2: Computation of sale value at end of year 2:

- Post two years, three-year bond will quote at yield of 7% and the investor would sell the bond after 2 years. Value of bond after 2 years is calculated by discounting the future cash flows

Year	Cash flow	PVF @ 7%	DCF
1 to 3	9,000	2.624	23,616
3	1,00,000	0.816	81,600
Investment value on day 0			1,05,216

Note 3: Cash flows of bond investment:

Year	Cash flow

0	(1,04,037)
1	9,000
2	1,14,216 [9,000 + 1,05,216]

WN 2: Computation of maturity cash flows:

Year	Cash flow	Reinvestment Period	FVF	Maturity value
1	9,000	1	1.06	9,540
2	1,14,216	0	1	1,14,216
Maturity value at end of year 2				1,23,756

WN 3: Computation of realized YTM:

- Question wants us to calculate the expected annualized yield for next two months. The same can be computed by calculating realized YTM or normal YTM
- Realized YTM is used in this scenario as there is reinvestment rate given in problem

$$\begin{aligned}
 &FV = PV \times (1 + r)^n; 1,23,756 = 1,04,037 \times (1 + r)^2 \\
 &\frac{1,23,756}{1,04,037} = (1 + r)^2; 1.1895 = (1 + r)^2 \\
 &(1 + r) = 1.0907 \\
 &r = 0.0907 \text{ or } 9.07\% \\
 &\text{Therefore, realized YTM is } 9.07\%
 \end{aligned}$$

75. Computation of reinvested interest [May 2015 MTP]

Mr. X purchases a 5 years 8.5% coupon bond for a price of Rs.907.60 (Face Value of Rs.1,000) that has a YTM of 11%. You are required to compute reinvested interest amount on this bond.

Answer:

Year	Interest	Reinvestment period	FVF @ 11%	Future Value	Reinvested interest
1	85	4	1.518	129.03	44.03
2	85	3	1.368	116.28	31.28
3	85	2	1.232	104.72	19.72
4	85	1	1.11	94.35	9.35
5	85	0	1	85	0
Total				529.38	104.38

Note:

- ❖ Reinvestment is assumed to happen at YTM.
- ❖ Reinvestment period = Maturity period of 5 years – year of interest receipt
- ❖ Future value = Interest x Future value factor
- ❖ Reinvested interest = Future value – Interest

76. Computation of realized YTM [Nov 2014 MTP]

XYZ Limited's bond (Face value of Rs.1000) with 4 years maturity is currently trading at Rs.900 carrying a coupon rate of 15%. Assuming that the reinvestment rate is 16%, you are required to calculate realized yield to maturity of the bond.

Answer:**Working Note 1: Computation of maturity cash flow with reinvestment at 16%:**

Year	Interest	Reinvestment period	FVF @ 16%	Future Value
1	150	3	1.561	234.15
2	150	2	1.346	201.9
3	150	1	1.16	174
4	1150	0	1	1150
Total maturity cash flow				1,760.05

WN 2: Computation of realized YTM:

Future value	=	(Present value x (1 + r) ⁿ)
1,760.05	=	(900 x (1 + r) ⁴)

$\left(\frac{1,760.05}{900}\right)$	=	$(1 + r)^4$
1.9556	=	$(1 + r)^4$
1.3984	=	$(1 + r)^2$
1.1826	=	$(1 + r)$
r	=	0.1826 or 18.26%

77. Calculation of current yield, YTM & Intrinsic value [May 2019 RTP, Nov 2008, Nov 2011]

Based on the credit rating, Mr. Bond has decided to apply the following discount rates for valuing bonds:

Credit Rating	Discount Rate
AAA	364 day T bill rate + 3% spread
AA	AAA + 2% spread
A	AAA + 3% spread

He is considering investing in AA rated, Rs.1, 000 face value bond currently selling at Rs.1, 025.86. The bond has five years to maturity and the coupon rate on the bond is 15% p.a. payable annually. The next interest payment is due one year from today and the bond is redeemable at par. (The 364 day T-bill rate to be 9%). You are required to calculate the intrinsic value of the bond for Mr. Bond should he invest in the bond? Also calculate the current yield and the Yield to Maturity (YTM) of the bond.

Answer:

WN 1: Computation of intrinsic value:

- Mr. Bond is investing in AA rated bond. Required return for AA rated bond is AAA rated + 2% spread
- Required return for AAA rated bond is 9% + 3% = 12%
- Required return for AA rated bond is 12% + 2% = 14%

Year	Cash flow	PVF @ 14%	DCF
1 to 5	150	3.433	514.95
5	1,000	0.519	519.00
Fair value of bond			1,033.95

Conclusion:

- CMP of bond is Rs.1,025.86 whereas fair value of bond is Rs.1,033.95. Bond is currently undervalued and we should invest in bond

WN 2: Computation of Yield to Maturity:

Year	Cash flow	PVF @ 14%	DCF	PVF@ 15%	DCF
0	-1,025.86	1	-1,025.86	1	-1,025.86
1	150.00	3.433	514.95	3.352	502.80
5	1,000.00	0.519	519.00	0.497	497.00
NPV			8.09		-26.06

$IRR = L_1 + \frac{NPV \text{ at } L_1}{NPV \text{ at } L_1 - NPV \text{ at } L_2} \times (L_2 - L_1)$	
$IRR = 14 + \frac{8.09}{8.09 - (-26.06)} \times (15 - 14); IRR = 14 + \frac{8.09}{34.15} \times (1); IRR = 14 + 0.24 = 14.24\%$	

- Yield to maturity = 14.24%**

WN 3: Computation of current yield:

$$\text{Current yield} = \frac{\text{Interest}}{\text{Current Market Price}} = \frac{150}{1,025.86} \times 100 = 14.62\%$$

78. Bond valuation [May 2011 RTP]

ABC Limited has the following outstanding bonds:

Bond	Coupon	Maturity
Series X	8%	10 years
Series Y	Variable changes annually comparable to prevailing rate	10 years

Initially these bonds were issued at face value of Rs.10,000 with yield to maturity of 8%. Assuming that:

- (i) After 2 years from the date of issue, interest on comparable bonds is 10%, then what should be the price of each bond?
- (ii) If after two additional years, the interest rate on comparable bond is 7%, then what should be the price of each bond?
- (iii) What conclusions you can draw from the prices of Bonds, computed above

Answer:**WN 1: Valuation of bonds if interest rate increases to 10%****Series X Bond:**

Year	Cash flow	PVF@10%	DCF
1 to 8	800	5.335	4,268
8	10,000	0.467	4,670
Value of Bond			8,938

Series Y Bond:

Since Bond-series Y has a variable interest rates, so the interest amount will increase and decrease with the movement of interest rates. As given presently rate of interest is 10%, the value of Bond will be:

Year	Cash flow	PVF@10%	DCF
1 to 8	1,000	5.335	5,335
8	10,000	0.467	4,670
Value of Bond			10,005

WN 2: Valuation of bonds if interest rate decreases to 7%**Series X Bond:**

Year	Cash flow	PVF@7%	DCF
1 to 6	800	4.767	3,814
6	10,000	0.666	6,660
Value of Bond			10,474

Series Y Bond:

Since Bond-series Y has a variable interest rates, so the interest amount will increase and decrease with the movement of interest rates. As given presently rate of interest is 7%, the value of Bond will be:

Year	Cash flow	PVF@7%	DCF
1 to 6	700	4.767	3,337
6	10,000	0.666	6,660
Value of Bond			9,997

Conclusion:

From above prices, it can be concluded that price of Bond-Series X moves inversely with change in interest rate. Whereas, the price of Bond Series Y does not fluctuate, reason being its interest (coupon) adjusted according to change in interest rates.

79. Computation of Yield to Maturity (Nov 2020 RTP):

Today being 1st January 2019, Ram is considering to purchase an outstanding Corporate Bond having a face value of Rs. 1,000 that was issued on 1st January 2008 which has 9.5% Annual Coupon and 20 years of original maturity (i.e. maturing on 31st December 2027). Since the bond was issued, the interest rates have been on downside and it is now selling at a premium of Rs. 125.75 per bond.

Determine the prevailing interest on the similar type of Bonds if it is held till the maturity which shall be at Par. PV factors of 6% and 8% is to be used for computing prevailing interest rate

Answer:**WN 1: Computation of NPV at 6% and 8%:**

Year	Cash flow	PVF @ 6%	DCF	PVF@ 8%	DCF
0	-1,125.75	1	-1,125.75	1	-1,125.75
1 to 9	95.00	6.801	646.10	6.246	593.37
9	1,000.00	0.592	592.00	0.500	500.00
NPV			112.35		-32.38

$IRR = L_1 + \frac{NPV \text{ at } L_1}{NPV \text{ at } L_1 - NPV \text{ at } L_2} \times (L_2 - L_1)$
$IRR = 6 + \frac{112.35}{112.35 - (-32.38)} \times (8 - 6); IRR = 6 + \frac{112.35}{144.73} \times (2); IRR = 6 + 1.55 = 7.55\%$

YTM = 7.55% and thus, prevailing interest rate on similar type of Bonds shall be approx. 7.55%

80. Computation of spread of yield from comparable bond [Nov 2019 RTP, May 2018 MTP]

A hypothetical company ABC Limited issued a 10% debenture (Face value of Rs.1,000) of the duration of 10 years is currently trading at Rs.850 per debenture. The bond is convertible into 50 equity shares being currently quoted at Rs.17 per share. Calculate the spread of yield of the above bond from this comparable bond, if equivalent yield of the same is 11.80%

Answer:

Computation of NPV at 11% and 13%:

Year	Cash flow	PVF@11%	DCF	PVF@13%	DCF
0	(850)	1	(850)	1	(850)
1 to 10	100	5.889	588.90	5.426	542.60
10	1,000	0.352	352.00	0.295	295.00
NPV of Bond			90.90		-12.40

Computation of YTM:

YTM (IRR)	=	$L1 + \left(\frac{NPV \text{ at } L1}{NPV \text{ at } L1 - NPV \text{ at } L2} \right) \times (L2 - L1)$
YTM	=	$11 + \frac{90.90}{90.90 - (-12.40)} \times (13 - 11)$
YTM	=	11 + 1.76
YTM	=	12.76%

Spread from comparable bond:

- ❖ Spread from comparable bond = Spread of this bond - yield of comparable bond
- ❖ Spread from comparable bond = 12.76% - 11.80% = 0.96%

81. Bond valuation [May 2018 MTP, Nov 2013]

ABC Ltd. issued 9%, 5 year bonds of Rs. 1,000/- each having a maturity of 3 years. The present rate of interest is 12% for one year tenure. It is expected that Forward rate of interest for one year tenure is going to fall by 75 basis points and further by 50 basis points for every next year in further for the same tenure. This bond has a beta value of 1.02 and is more popular in the market due to less credit risk. Calculate the intrinsic value of bond and expected price of bond?

Answer:

Computation of intrinsic value:

Year	Cash flow	PVF	DCF
1	90	0.893	80.37
2	90	0.803	72.27
3	1,090	0.725	790.25
Intrinsic value of bond			942.89

Note:

$$PVF \text{ of year 1} = \left(\frac{1}{1.12} \right) = 0.893$$

$$PVF \text{ of year 2} = \left(\frac{PVF \text{ of year 1}}{1.1125} \right) = 0.803$$

$$PVF \text{ of year 3} = \left(\frac{PVF \text{ of year 2}}{1.1075} \right) = 0.725$$

Expected price of Bond:

Expected price of bond = Intrinsic value of bond x Beta = 942.89 x 1.02 = Rs.961.74

Note:

- There is no logic of applying the above formula to compute expected price of bond. In-fact high beta bond carries more risk and logically will have lower price. However this question has been

tested multiple times and hence we can follow above formula if asked in exam.

82. Duration [May 2007]

Find the current market price of a bond having face value Rs.1,00,000 redeemable after 6 year maturity with YTM at 16% payable annually and duration 4.3202 years?

Answer:

WN 1: Computation of interest rate on bond:

Let us assume the annual interest inflow to be X

Year	Cash flow	PVF @ 16%	DCF	Weight	Product
1	X	0.862	0.862X	0.862X	0.862X
				<u>3.684X + 41,000</u>	<u>3.684X + 41,000</u>
2	X	0.743	0.743X	0.743X	1.486X
				<u>3.684X + 41,000</u>	<u>3.684X + 41,000</u>
3	X	0.641	0.641X	0.641X	1.923X
				<u>3.684X + 41,000</u>	<u>3.684X + 41,000</u>
4	X	0.552	0.552X	0.552X	2.208X
				<u>3.684X + 41,000</u>	<u>3.684X + 41,000</u>
5	X	0.476	0.476X	0.476X	2.380X
				<u>3.684X + 41,000</u>	<u>3.684X + 41,000</u>
6	1,00,000 + X	0.410	0.41X + 41,000	0.41X + 41,000	2.46X + 2,46,000
				<u>3.684X + 41,000</u>	<u>3.684X + 41,000</u>
Total			3.684X + 41,000		11.319X + 2,46,000
					3.684X + 41,000

Computation of interest rate:

Duration = Sum of products
 $4.3202 \text{ years} = \frac{11.319X + 2,46,000}{3.684X + 41,000}$
 $11.319X + 2,46,000 = 15.916X + 1,77,128$
 $4.597X = 68,872$
 $X = 14,981.90$ rounded off to Rs.15,000
Interest rate = $15,000/1,00,000 = 15\%$

WN 2: Computation of current market price:

Current market price = $3.684X + 41,000$
Current market price = $3.684(15,000) + 41,000$
Current market price = Rs.96,260

83. Duration and volatility [Nov 2005, Nov 2015, Jan 2021]

The following data is available for a bond:

Face value	Rs.1,000
Coupon Rate	11%
Years to maturity	6
Redemption value	Rs.1,000
Yield to Maturity	15%

Calculate the following in respect of the bond:

- Current market price
- Duration of the bond
- Volatility of the bond
- Expected market price if increase in required yield is by 100 basis points
- Expected market price if decrease in required yield is by 75 basis points

Answer:

WN 1: Computation of Current Market Price and Duration:

Year	Cash flow	PVF @ 15%	DCF	Weight	Product
1	110	0.870	95.70	0.1128	0.1128
2	110	0.756	83.16	0.0980	0.1960
3	110	0.658	72.38	0.0853	0.2559

4	110	0.572	62.92	0.0742	0.2968
5	110	0.497	54.67	0.0644	0.3220
6	1,110	0.432	479.52	0.5652	3.3912
			848.35		4.5747

- Current market price = Rs.848.35
- Duration = 4.5747 years

WN 2: Computation of volatility:

$$\text{Volatility} = \frac{\text{Duration}}{1 + \text{YTM}} = \frac{4.5747}{1 + 15\%} = 3.97$$

WN 3: Computation of expected price if the yield increases by 100 bps:

- Volatility of 3.97 would mean that bond price will change by 3.97% for 1% change in yield
- Yield has increase by 1 percent and hence bond price will fall by 3.97%
- New price = 848.35 - 3.97% = Rs.814.67

WN 4: Computation of expected price if the yield decreases by 75 bps:

- Yield has fallen by 0.75% and hence price will increase by 2.98% (3.97 x 0.75)
- New price = 848.35 + 2.98% = Rs.873.63

84. YTM of Bond [July 2021]

An investor has recently purchased substantial number of 7 year 6.75% Rs. 1,000 bond with 5% premium payable on maturity at a required Yield to Maturity (YTM) of 9%. However, due to a financial crunch he is looking to sell these bonds and has got a proposal from another investor, who is willing to purchase these bonds by shelling out a maximum amount of Rs. 897 per bond. Investors follow intrinsic value method for valuation of bonds.

- You are required to determine
 - The Market price, Duration and Volatility of the Bond and
 - Required YTM of the new investor
- What is the relationship between the price of the bond and YTM?

Answer:**WN 1: Computation of market price, Duration and Volatility of the Bond:**

Year	Cash flow	PVF @ 9%	DCF	Weight	Product
1	67.500	0.917	61.898	0.0677	0.0677
2	67.500	0.842	56.835	0.0622	0.1244
3	67.500	0.772	52.110	0.0570	0.1710
4	67.500	0.708	47.790	0.0523	0.2092
5	67.500	0.650	43.875	0.0480	0.2400
6	67.500	0.596	40.230	0.0440	0.2640
7	1,117.500	0.547	611.273	0.6688	4.6816
Total			914.011		5.7579

- Market price = Rs.914.011
- Duration of Bond = 5.7579 years
- Volatility of Bond = 5.7579/(1+9%) = 5.28

WN 2: Computation of YTM of new investor:

Year	Cash flow	PVF @ 9%	DCF	PVF @ 12%	DCF
0	-897.000	1.000	-897.000	1.000	-897.000
1 to 7	67.500	5.032	339.660	4.564	308.070
7	1,050.000	0.547	574.350	0.452	474.600
			17.010		-114.330

$$\text{YTM(or)IRR} = 9 + \left(\frac{17.010}{17.010 - (-114.330)} \times (12 - 9) \right) = 9 + 0.39 = 9.39\%$$

Relationship:

Relationship between the price of the bond & YTM is opposite or inverse

85. Valuation of zero coupon and semi-annual bond:

On 1 June 2003 the financial manager of Gadgets Corporation's Pension Fund Trust is reviewing strategy regarding the fund. Over 60% of the fund is invested in fixed rate long-term bonds. Interest rates are expected to be quite volatile for the next few years. Among the pension fund's current investments are two AAA rated bonds:

1) Zero coupon June 2018

2) 12% Gilt June 2018 (interest is payable semi-annually)

The current annual redemption yield (yield to maturity) on both bonds is 6%. The semi-annual yield may be assumed to be 3%. Both bonds have a par value and redemption value of Rs.100.

Required:

Estimate the market price of each of the bonds if interest rates (yields):

(i) increase by 1%;

(ii) decrease by 1%.

Answer:**WN 1: Analysis of zero-coupon bond:****Valuation of bond with YTM of 6%**

Year	Cash flow	PVF@6%	DCF
15	100	0.4173	41.73
Value of bond			41.73

Valuation of bond with YTM of 7% (increase in yield by 1%)

Year	Cash flow	PVF@7%	DCF
15	100	0.3625	36.25
Value of bond			36.25

Valuation of bond with YTM of 5% (decrease in yield by 1%)

Year	Cash flow	PVF@5%	DCF
15	100	0.4810	48.10
Value of bond			48.10

WN 2: Valuation of semi-annual bond:**Valuation of bond with YTM of 6% (Half-yearly YTM of 3%)**

Period	Cash flow	PVF@3%	DCF
1 to 30	6	19.6004	117.60
30	100	0.4120	41.20
Value of bond			158.80

Valuation of bond with YTM of 7% (Half-yearly YTM of 3.5%)

Period	Cash flow	PVF@3.5%	DCF
1 to 30	6	18.3920	110.35
30	100	0.3563	35.63
Value of bond			145.98

Valuation of bond with YTM of 5% (Half-yearly YTM of 2.5%)

Period	Cash flow	PVF@2.5%	DCF
1 to 30	6	20.9303	125.58
30	100	0.4767	47.67
Value of bond			173.25

Note:

- Revised price can also be computed using the concept of duration and volatility

86. Duration:

A 12% coupon bond has a maturity of 5 years. It pays interest semi-annually. Its yield to maturity is 5% per half-year period. What is its duration?

Answer:

Let us assume the face value of bond to be Rs.1,000

Period	Cash flow	PVF	DCF	Weight	Product
1	60	0.952	57.12	0.0530	0.0530
2	60	0.907	54.42	0.0505	0.1010
3	60	0.864	51.84	0.0481	0.1443
4	60	0.823	49.38	0.0458	0.1832
5	60	0.784	47.04	0.0437	0.2185
6	60	0.746	44.76	0.0415	0.2490
7	60	0.711	42.66	0.0396	0.2772
8	60	0.677	40.62	0.0377	0.3016
9	60	0.645	38.70	0.0359	0.3231
10	1060	0.614	650.84	0.6041	6.0410
Total			1077.38		7.8919

- **Duration = 7.8919 half-years (or) 3.946 years**

87. Duration:

- A 3 year annuity has a yield of 10 percent. What is its duration?
- A perpetual bond has an YTM of 10 percent. What is its duration?

Answer:

Part (a): Duration of annuity bond:

Let us assume face value of bond to be Rs.1,000

$$\text{Annual cash flow} = \frac{\text{FV of bond}}{\text{PVAF}(10\%, 3)} = \frac{1,000}{2.487} = 402.09$$

Year	Cash flow	PVF @ 10%	DCF	Weight	Product
1	402.09	0.909	365.45	0.3656	0.3656
2	402.09	0.826	332.13	0.3322	0.6644
3	402.09	0.751	301.97	0.3021	0.9053
Total			999.60		1.9365

Duration of bond = 1.9365 years

Part (b)

$$\text{Duration of perpetual bond} = \frac{1 + \text{YTM}}{\text{YTM}} = \frac{1 + 0.10}{0.10} = \mathbf{11 \text{ years}}$$

88. Zero-coupon Bond:

A zero coupon bond of Rs.10, 000 has a term to maturity of 8 years and a market yield of 10% at the time of issue.

- ❖ What is the issue price of the bond?
- ❖ YTM of the bond if today's price is Rs.4, 000?
- ❖ What is the duration of the bond?
- ❖ What is the modified duration of the bond?
- ❖ What will be the percentage change in price of the bond if the yield declines by 0.5 percentage?

Answer:

WN 1: Computation of issue price of bond:

Year	Cash flow	PVF @ 10%	DCF
8	10,000	0.467	4,670
Issue price			4,670

WN 2: Computation of YTM of bond if issue price is Rs.4,000:

$$\text{FV} = \text{PV} \times (1 + r)^n; 10,000 = 4,000 \times (1 + r)^8$$

$$\frac{10,000}{4,000} = (1 + r)^8; 2.50 = (1 + r)^8$$

$$(1 + r)^4 = 1.5811; (1 + r)^2 = 1.2574; (1 + r) = 1.1213$$

$$r = 0.1213 \text{ (or) } 12.13\%$$

Therefore, YTM is 12.13%

WN 3: Duration of bond:

- Duration of zero-coupon bond is equal to life of bond
- Hence duration is equal to 8 years

WN 4: Modified duration:

$$\text{Modified Duration} = \frac{\text{Duration}}{1 + \text{YTM}} = \frac{8}{1 + 12.13\%} = 7.13$$

WN 5: Computation of percentage change in price of bond if the yield declines by 0.5 percentage:

- Modified duration (volatility) of 7.13 indicates that for every 1% change in yield, price of bond will change by 7.13%
- In this case, yield declines by 0.5 percent and hence the price of the bond will increase by 3.57% (7.13 x 0.5)

89. Duration [May 2018 RTP, Nov 2008, May 2012 RTP]

ABC Ltd. has made an issue of 14 % non-convertible debentures on January 1, 2007. These debentures have a face value of Rs.100 and are currently traded in the market at a price of Rs. 90. Interest on these NCDs will be paid through post-dated cheque dated June 30 and December 31. Interest payments for the first 3 years will be paid in advance through post-dated cheque while for the last 2 years post-dated cheque will be issued at the third year. The bond is redeemable at par on December 31, 2011 at the end of 5 years.

Required:

- Estimate the current yield & the YTM of the bond.
- Calculate the duration of the NCD.
- Assuming that intermediate coupon payments are, not available for reinvestment. Calculate the realized yield on the NCD.

Answer:**WN 1: Computation of current yield:**

$$\text{Current Yield} = \frac{\text{Interest}}{\text{Current Market Price}} = \frac{7}{90} \times 100 = 7.78\% \text{ per half year (or) } 15.56\% \text{ per year}$$

WN 2: Computation of Yield to Maturity:

Period	Cash flow	PVF @ 8%	DCF	PVF @ 9%	DCF
0	(90)	1.000	(90.00)	1.000	(90.00)
1 to 10	7	6.710	46.97	6.417	44.92
10	100	0.463	46.30	0.422	42.20
NPV			3.27		-2.88

$$\text{IRR} = L_1 + \frac{\text{NPV at } L_1}{\text{NPV at } L_1 - \text{NPV at } L_2} \times (L_2 - L_1)$$

$$\text{IRR} = 8 + \frac{3.27}{3.27 - (-2.88)} \times (9 - 8); \text{IRR} = 8 + \frac{3.27}{6.15} \times (1); \text{IRR} = 8 + 0.53 = 8.53\%$$

- YTM = 8.53 percent per half year (or) 17.06 percent per year

WN 3: Computation of duration:

Period	Cash flow	PVF @ 8.53%	DCF	Weight	Product
1	7	0.921	6.45	0.0717	0.0717
2	7	0.849	5.94	0.066	0.132
3	7	0.782	5.47	0.0608	0.1824
4	7	0.721	5.05	0.0561	0.2244
5	7	0.664	4.65	0.0517	0.2585

6	7	0.612	4.28	0.0476	0.2856
7	7	0.564	3.95	0.0439	0.3073
8	7	0.52	3.64	0.0405	0.324
9	7	0.479	3.35	0.0372	0.3348
10	107	0.441	47.19	0.5245	5.245
Total			89.97		7.3657

- Duration = 7.3657 half-years (or) 3.6829 years

WN 4: Computation of realized YTM if intermediate cash flows are not available for reinvestment:

- The bond will earn interest of Rs.14 per year and will earn Rs.70 for 5 years. These amounts are not available for reinvestment and hence the value at the end of five years is Rs.70
- We would receive principal of Rs.100 and hence the maturity value at end of five years is Rs.170
- Investment made today is Rs.70
- The life of instrument is five years and hence we cannot take square root and find realized YTM. We will have to do it in the same manner as that of IRR calculation

Period	Cash flow	PVF @ 6%	DCF	PVF @ 7%	Product
0	(90)	1.000	(90.00)	1.000	(90.00)
10	170	0.558	94.86	0.508	86.36
NPV			4.86		(3.64)

$$IRR = L_1 + \frac{NPV \text{ at } L_1}{NPV \text{ at } L_1 - NPV \text{ at } L_2} \times (L_2 - L_1)$$

$$IRR = 6 + \frac{4.86}{4.86 - (-3.64)} \times (7 - 6); IRR = 6 + \frac{4.86}{8.50} \times (1); IRR = 6 + 0.57 = 6.57\%$$

- Realized YTM will be 6.57 percent per half year (or) 13.14 percent per year

90. YTM of a convertible bond

ABC Limited issues partly convertible debentures of Rs.600, carrying an interest rate of 10%. Rs.200 will get compulsorily converted into two equity shares of ABC Limited, an year from now. The expected price per share of the company's equity an year from now would be Rs.150. The non-convertible portion will be redeemed into two equal installments of Rs.200 each at the end of year 5 and 6 respectively.

- What is the pretax rate of return earned by the debenture holders?
- What is the post tax cost of convertible debentures to the company?

Assume that tax rate of the company is 30% and the net price per share of the company would realize for the equity after an year would be Rs.120

Answer:

WN 1: Computation of pre-tax rate of return by the debenture holders:

Year	CF	PVF @ 14%	DCF	PVF @ 16%	DCF
0	-600	1.000	-600.00	1.000	-600.00
1	360	0.877	315.72	0.862	310.32
2	40	0.769	30.76	0.743	29.72
3	40	0.675	27.00	0.641	25.64
4	40	0.592	23.68	0.552	22.08
5	240	0.519	124.56	0.476	114.24
6	220	0.456	100.32	0.410	90.20
NPV			22.04		-7.80

Note:

- Cash flow for year 1 = 2 equity shares of Rs.150 each + Interest of Rs.60
- Cash flow for year 2 to 4 = 400 x 10% = Rs.40
- Cash flow for year 5 = Principal redemption of Rs.200 + Interest of Rs.40
- Cash flow for year 6 = Principal redemption of Rs.200 + Interest of Rs.20
- Rate of 14 percent has been taken as initial guess rate. This has been taken closer to 10 percent and possibility of receiving equity shares at higher value of Rs.150 per share

$IRR = L_1 + \frac{NPV \text{ at } L_1}{NPV \text{ at } L_1 - NPV \text{ at } L_2} \times (L_2 - L_1)$
$IRR = 14 + \frac{22.04}{22.04 - (-7.80)} \times (16 - 14); IRR = 14 + \frac{22.04}{29.84} \times (2); IRR = 14 + 1.48 = 15.48\%$

WN 2: Computation of post-tax cost of convertible debentures:

Year	Cash flow	PVF @ 8%	DCF	PVF @ 9%	DCF
0	600	1.000	600.00	1.000	600.00
1	-282	0.926	-261.13	0.917	-258.59
2	-28	0.857	-24.00	0.842	-23.58
3	-28	0.794	-22.23	0.772	-21.62
4	-28	0.735	-20.58	0.708	-19.82
5	-228	0.681	-155.27	0.650	-148.20
6	-214	0.630	-134.82	0.596	-127.54
NPV			-18.03		0.65

Note:

- Cash flow in year 1 = 2 shares of Rs.120 each + Post-tax interest of Rs.42 (60 x 70%)
- Cash flow in year 2 to 4 = 400 x 10% x 70% = Rs.28
- Cash flow in year 5 = Principal redemption of Rs.200 + Interest of Rs.28
- Cash flow in year 6 = Principal redemption of Rs.200 + Interest of Rs.14
- This is a cash flow where inflow happens on day 0 and outflow happens throughout the life of the instrument. In such cases, we should use the logic opposite of the normal logic
- We got negative NPV when rate was 8% and we should increase the rate so that we get positive NPV

$IRR = L_1 + \frac{NPV \text{ at } L_1}{NPV \text{ at } L_1 - NPV \text{ at } L_2} \times (L_2 - L_1)$
$IRR = 8 + \frac{-18.03}{-18.03 - (0.65)} \times (9 - 8); IRR = 8 + \frac{-18.03}{-18.68} \times (1); IRR = 8 + 0.97 = 8.97\%$

91. Portfolio creation based on duration [Nov 2018 MTP, Nov 2015]

Mr. A will need Rs.1,00,000 after two years for which he wants to make one time necessary investment now. He has a choice of two types of bonds. Their details are as below:

	Bond X	Bond Y
Face value	Rs.1000	Rs.1000
Coupon	7% payable annually	8% payable annually
Years to maturity	1	4
Current price	Rs.972.73	Rs.936.52
Current yield	10%	10%

Advice Mr. A whether he should invest all his money in one type of bond or he should buy both the bonds and, if so, in what quantity? Assume that there will not be any call risk or default risk.

Answer:**WN 1: Computation of Duration of Bond X and Bond Y:**

- Investor wants money after two years and hence his investment horizon is for two years. We can immunize his portfolio if the weighted duration of Mr.A's portfolio is of 2 years

Duration of Bond X:

- Life of Bond X is of 1 year and hence it will have single cash flow. Consequently, duration of Bond X will be equal to 1 year

Duration of Bond Y:

Year	Cash flow	PVF @ 10%	DCF	Weight	Product
1	80	0.909	72.72	0.078	0.078
2	80	0.826	66.08	0.071	0.142

3	80	0.751	60.08	0.064	0.192
4	1,080	0.683	737.64	0.788	3.152
Total			936.52		3.564

- Current yield given in the question is basically yield to maturity. There looks to be a typing error in exam question.

WN 2: Computation of investment in Bond X and Bond Y:

- Let us assume W1 to be the proportion of investment in Bond X and (1-W1) to be the proportion of investment in Bond Y

Bond	Weight	Duration	Product
X	W1	1	W1
Y	1-W1	3.564	3.564 - 3.564W1
Total	1		W1 + 3.564 - 3.564W1 = 2

W1 + 3.564 - 3.564W1 = 2
-2.564W1 = -1.564
$W_1 = \frac{1.564}{2.564} = 0.6099 \sim 0.61$
Proportion of investment in Security 1 = 0.61
Proportion of investment in Security 2 = 0.39

WN 3: Computation of number of bonds to be purchased:

Particulars	Calculation	Amount
1. Money required after two years		1,00,000
2. Money to be invested today	$\frac{1,00,000}{1.10^2}$	82,600
3. Amount to be invested in Bond X	82,600 × 61%	50,386
4. Amount to be invested in Bond Y	82,600 × 39%	32,214
5. Number of bonds of X to be purchased	$\frac{50,386}{972.73}$	52
6. Number of bonds of Y to be purchased	$\frac{32,214}{936.52}$	34

92. Immunizing portfolio [Nov 2018, May 2021 MTP]

The following data are available for three bonds A, B and C. These bonds are used by a bond portfolio manager to fund an outflow scheduled in 6 years. Current yield is 9%. All bonds have face value of Rs.100 each and will be redeemed at par. Interest is payable annually.

Bond	Maturity (Years)	Coupon Rate
A	10	10%
B	8	11%
C	5	9%

- Calculate the duration of each bond
- The bond portfolio manager has been asked to keep 45% of the portfolio money in Bond A. Calculate the percentage amount to be invested in bonds B and C that need to be purchased to immunize the portfolio
- After the portfolio has been formulated, an interest rate change occurs, increasing the yield to 11%. The new duration of these bonds are: Bond A = 7.15 years, Bond B = 6.03 years and Bond C = 4.27 years. Is the portfolio still immunized? Why or why not?
- Determine the new percentage of B and C bonds that are needed to immunize the portfolio. Bond A remains at 45% of the portfolio.

Answer:**WN 1: Computation of duration of bond:****Computation of Duration of Bond A:**

Year	Cash flow	PVF @ 9%	DCF	Weight	Product
1	10	0.917	9.17	0.086	0.086
2	10	0.842	8.42	0.079	0.158
3	10	0.772	7.72	0.073	0.219

4	10	0.708	7.08	0.067	0.268
5	10	0.65	6.5	0.061	0.305
6	10	0.596	5.96	0.056	0.336
7	10	0.547	5.47	0.051	0.357
8	10	0.502	5.02	0.047	0.376
9	10	0.46	4.6	0.043	0.387
10	110	0.422	46.42	0.436	4.36
Total			106.36		6.852

- Duration of Bond A = 6.85 years

Computation of Duration of Bond B:

Year	Cash flow	PVF @ 9%	DCF	Weight	Product
1	11	0.917	10.09	0.091	0.091
2	11	0.842	9.26	0.083	0.166
3	11	0.772	8.49	0.076	0.228
4	11	0.708	7.79	0.07	0.28
5	11	0.65	7.15	0.064	0.32
6	11	0.596	6.56	0.059	0.354
7	11	0.547	6.02	0.054	0.378
8	111	0.502	55.72	0.502	4.016
Total			111.08		5.833

- Duration of Bond B = 5.83 years

Computation of Duration of Bond C:

Year	Cash flow	PVF @ 9%	DCF	Weight	Product
1	9	0.917	8.25	0.083	0.083
2	9	0.842	7.58	0.076	0.152
3	9	0.772	6.95	0.07	0.21
4	9	0.708	6.37	0.064	0.256
5	109	0.65	70.85	0.709	3.545
Total			100		4.246

- Duration of Bond C = 4.25 years

WN 2: Computation of percentage amount to be invested in Bond B and C to immunize the portfolio:

- The portfolio manager has scheduled outflow after 6 years and hence his investment horizon will be of 6 years. We should ensure the weighted duration of portfolio is of 6 years
- Let us assume b to be the proportion of investment in Bond B
- Proportion of investment in Bond C = 1 - 0.45 - b

Bond	Weight	Duration	Product
A	0.45	6.85	3.0825
B	b	5.83	5.83b
C	1 - 0.45 - b	4.25	4.25 - 1.9125 - 4.25b
Total			5.42 + 1.58b = 6

Investment in Bond B:

$$5.42 + 1.58b = 6; 1.58b = 0.58; b = \frac{0.58}{1.58} = 0.3671$$

- Hence 36.71 percent of investment is to be made in Bond B

Investment in Bond C:

- Investment in Bond C = 100 - 45% - 36.71% = 18.29%
- Hence 18.29 percent of investment is to be made in Bond C

WN 3: Checking on immunization with revised duration:

Bond	Weight	Duration	Product
A	0.45	7.15	3.2175
B	0.3671	6.03	2.2136

C	0.1829	4.27	0.7810
Total			6.2121

- Portfolio is not immunized as the duration of the portfolio has increased from 6 years to 6.21 years

WN 4: Computation of percentage investment to immunize the portfolio with revised duration of bonds:

- Let us assume b to be the proportion of investment in Bond B
- Proportion of investment in Bond C = 1 - 0.45 - b

Bond	Weight	Duration	Product
A	0.45	7.15	3.2175
B	b	6.03	6.03b
C	1 - 0.45 - b	4.27	4.27 - 1.9215 - 4.27b
Total			5.566 + 1.76b = 6

Investment in Bond B:

$$5.566 + 1.76b = 6; 1.76b = 0.434; b = \frac{0.434}{1.76} = 0.2466$$

- Hence 24.66 percent of investment is to be made in Bond B

Investment in Bond C:

- Investment in Bond C = 100 - 45% - 24.66% = 30.34%
- Hence 30.34 percent of investment is to be made in Bond C

93. Bond refunding [Nov 2005, Nov 2018, Nov 2009, Nov 2016 RTP]

ABC Ltd. is contemplating calling Rs. 3 crores of 30 year Rs. 1,000 bond issued 5 years ago with a coupon interest rate of 14 %. The bonds have a call price of Rs. 1,140 and had initially collected proceeds of Rs. 2.91 crores due to a discount of Rs. 30 per bond. The initial floating cost was Rs. 3, 60,000. The Company intends to sell Rs. 3 crores of 12% coupon rate, 25 years bonds to raise funds for retiring the old bonds. It proposes to sell the new bonds at their par value of Rs. 1,000. The estimated floatation cost is Rs. 4, 00,000. The company is paying 40% tax and it's after cost of debt is 8 %. As the new bonds must first be sold and their proceeds, then used to retire old bonds, the company expects a two months period of overlapping interest during which interest must be paid on both the old and new bonds. What is the feasibility of refunding bonds?

Answer:**WN 1: Initial Outflow:**

Particulars	Calculation	Amount (in lacs)
Redemption value of old bond	$\left(\frac{300}{1,000}\right) \times 1,140$	(342)
Tax premium on redemption of old bonds	42 x 40%	16.80
Tax benefit on write-off of discount on old bond	$\frac{9}{30} \times 25 \times 40\%$	3.00
Tax benefit on write-off of floatation cost of old bond	$\frac{3.60}{30} \times 25 \times 40\%$	1.20
Inflow from new bonds	300 - 4	296
Overlapping interest (Note 1)	$300 \times 14\% \times \frac{2}{12} \times 60\%$	(4.2)
Initial Outflow		(29.20)

Note:

- Overlapping interest is the extra interest to be paid due to delay in redemption of old bond. During this period, interest would be paid for both old and new bonds. Under bond refunding, the assumption is that we have redeemed the old bond and replaced with new bond. Hence any interest paid on old bond will be called as overlapping interest

WN 2: In-between flows:

(in lacs)

Particulars	Old Bond	New Bond
Interest cost	42 [300 x 14%]	36 [300 x 12%]
Tax on interest	(16.80)	(14.40)

	[42 x 40%]	[36 x 40%]
Tax on floatation cost	(0.048) [3.6/30 x 40%]	(0.064) [4/25 x 40%]
Tax on discount	(0.12) [9/30 x 40%]	-
Net cash flow	25.032	21.536

- Annual cash flow savings = 25.032 - 21.536 = 3.496 lacs

WN 3: Terminal flow:

(in lacs)

Particulars	Old Bond	New Bond
Redemption value	(300)	(300)

- Net incremental cash flow = 0

WN 4: Computation of NPV:

(in lacs)

Year	Cash flow	PVF @ 8%	DCF
0	(29.20)	1.000	(29.20)
1 to 25	3.496	10.675	37.32
NPV			8.12

- The company should go ahead with bond refunding as it results in positive NPV of Rs.8.12 lacs

94. Bond refunding [May 2013, May 2018 MTP]

M/s. Earth Limited has 11% bond worth of Rs. 2 crores outstanding with 10 years remaining to maturity. The company is contemplating the issue of a Rs. 2 crores 10 year bond carrying the coupon rate of 9% and use the proceeds to liquidate the old bonds. The unamortized portion of issue cost on the old bonds is Rs. 3 lakhs which can be written off no sooner the old bonds are called. The company is paying 30% tax and it's after tax cost of debt is 7%. Should Earth Limited liquidate the old bonds? You may assume that the issue cost of the new bonds will be Rs. 2.5 lakhs and the call premium is 5%

Answer:**WN 1: Computation of initial outflow:**

Particulars	Calculation	Amount (in lacs)
Cash flows relating to old bond:		
Value of old bonds redeemed		(200)
Call premium on old bonds	200 x 5%	(10)
Tax benefit on write off of call premium of old bonds	10 x 30%	3
Tax benefit on write off of issue cost of old bonds	3 x 30%	0.9
Cash flows relating to new bond:		
Value of issue of new bond		200
Issue cost of new bond		(2.5)
Net initial outflow		8.6

Note:

- ❖ All items associated with old bond will be written off on day 0 and the company would get tax benefit on the same. Items to be written off are floatation cost and call premium on old bond

WN 2: Computation of in-between cash flows:

Particulars	Old bond	New bond
Interest outflow	22 (200 x 11%)	18 (200 x 9%)
Less: Tax saving on interest	(6.6)	(5.4)
Less: Tax benefit on w/o off floatation cost	0.09 [3 lacs/10 years x 30%]	0.075 [2.5 lacs/10 years x 30%]
Net outflow	15.31	12.525

- ❖ Net annual savings = 15.31 lacs - 12.525 lacs = 2.785 lacs

WN 3: Computation of NPV of refunding decision:

(in lacs)

Year	Cash flow	PVF @ 7%	DCF
0	(8.6)	1	(8.6)
1 to 10	2.785	7.024	19.56
NPV of refunding decision			10.96

Decision: The bond should be refunded as the same generates positive NPV of 10.96 lacs

95. Sensitivity of bond price to change in interest rates [May 2009]

Consider two bonds, one with 5 years to maturity and the other with 20 years to maturity. Both the bonds have a face value of Rs. 1,000 and coupon rate of 8% (with annual interest payments) and both are selling at par. Assume that the yields of both the bonds fall to 6%, whether the price of bond will increase or decrease? What percentage of this increase/decrease comes from a change in the present value of bond's principal amount and what percentage of this increase/decrease comes from a change in the present value of bond's interest payments?

Answer:

WN 1: Analysis of 5-year bond:

Year	Cash flow	PVF @ 8%	DCF	PVF @ 6%	DCF
1 to 5	80	3.993	319.44	4.212	336.96
5	1,000	0.681	681.00	0.747	747.00
Total			1,000.44		1,083.96

Change in price analysis:

Particulars	Value at 8%	Value at 6%	Change	Proportion of Change
Interest	319.44	336.96	17.52	$\frac{17.52}{83.52} \times 100 = 20.98\%$
Principal	681.00	747.00	66.00	$\frac{66.00}{83.52} \times 100 = 79.02\%$
Total	1,000.44	1,083.96	83.52	

WN 2: Analysis of 20-year bond:

Year	Cash flow	PVF @ 8%	DCF	PVF @ 6%	DCF
1 to 20	80	9.82	785.60	11.47	917.60
5	1,000	0.214	214.00	0.312	312.00
Total			999.60		1,229.60

Change in price analysis:

Particulars	Value at 8%	Value at 6%	Change	Proportion of Change
Interest	785.60	917.60	132.00	$\frac{132}{230} \times 100 = 57.39\%$
Principal	214.00	312.00	98.00	$\frac{98}{230} \times 100 = 42.61\%$
Total	999.60	1,229.60	230.00	

96. Bond valuation [Nov 2017 MTP, May 2015]

On 31st March 2013, the following information about Bonds is available:

Name of Security	Face Value	Maturity Date	Coupon Rate	Coupon Dates
Zero coupon	10,000	31 st March, 2023	N.A.	N.A.
T-Bill	1,00,000	20 th June, 2013	N.A.	N.A.
10.71% GOI 2023	100	31 st March, 2023	10.71	31 st March
10% GOI 2018	100	31 st March, 2018	10.00	31 st March and 31 st October

Calculate:

- If 10 years yield is 7.5 percent p.a. what price the zero coupon bond would fetch on 31st March, 2013?
- What will be the annualized yield if the T-Bill is traded @98500?
- If 10.71% GOI 2023 Bond having yield to maturity is 8%, what price would it fetch on April 1, 2013 (after coupon payment on 31st March)?
- If 10% GOI 2018 Bond having yield to maturity is 8%, what price would it fetch on April 1, 2013 (after coupon payment on 31st March)?

Answer:

WN 1: Valuation of Zero-Coupon Bond:

Year	Cash flow	PVF @ 7.5%	DCF
10	10,000	0.4852	4,852
Value of Bond			4,852

WN 2: Computation of annualized yield of treasury bill:

- Investment of Rs.98,500 today will become Rs.1,00,000 in 81 days

$$\text{Return} = \frac{1,00,000 - 98,500}{98,500} \times \frac{365}{81} \times 100 = 6.86\%$$

WN 3: Valuation of 10.71% GOI 2023 Bond:

Year	Cash flow	PVF @ 8%	DCF
1 to 10	10.71	6.710	71.86
10	100	0.463	46.30
Value of bond			118.16

WN 4: Valuation of 10% GOI 2018 Bond:

Period	Cash flow	PVF @ 4%	DCF
1 to 10	5	8.110	40.55
10	100	0.676	67.60
Value of bond			108.15

Note:

- Bond pays half-yearly interest and hence we should half-yearly discounting. Discount rate is 8% per annum and same would be equal to 4% per half-year

97. Valuation of debt [Nov 2017 MTP, Nov 2017 RTP]

Based on the following data, estimate the Net Asset Value (NAV) on 1st July 2016 on per unit basis of a Debt Fund:

Name of security	Face Value	Purchase Price	Maturity Date	No of securities	Coupon Dates	Duration of bonds
10.71% GOI 2028	100	104.78	31 st March 2028	1,00,000	31 st March	7.3494
10% GOI 2023	100	100.00	31 st March, 2023	50,000	31 st March & 30 th September	5.086
9.5% GOI 2021	100	97.93	31 st December 2021	40,000	30 th June & 31 st December	4.3949
8.5% SGL 2025	100	91.36	30 th June 2025	20,000	30 th June	6.5205

Number of units (Rs.10 face value each): 1,00,000

All securities were purchased at a time when applicable yield to maturity (YTM) was 10%. On NAV date, the required yield increased by 75 basis point and cash in hand and accrued expenses were Rs.6,72,800 and Rs.2,37,400 respectively.

Answer:**WN 1: Computation of accrued interest:**

- ❖ 10.71% GOI 2028 and 10% GOI 2023 would have last paid interest on March 31, 2016 and hence interest for the period April 1, 2016 to June 30, 2016 (3 months) would be accrued interest on NAV valuation date

Bond	Calculation	Amount
10.71% GOI 2028	$1,00,000 \times 100 \times 10.71\% \times (3/12)$	2,67,750
10% GOI 2023	$50,000 \times 100 \times 10\% \times (3/12)$	1,25,000
Total accrued interest		3,92,750

WN 2: Valuation of securities:

Name of security	Purchase Amount	Duration	Volatility (Duration/(1 + YTM%))	% change (Volatility x 0.75%)	Amount of change	Revised value

10.71% GOI 2028	1,04,78,000	7.3494	6.6813 [7.3494/1.10]	-5.0110	-5,25,053	99,52,947
10% GOI 2023	50,00,000	5.086	4.8438 [5.086/1.05]	-3.6329	-1,81,645	48,18,355
9.5% GOI 2021	39,17,200	4.3949	4.1856 [4.3949/1.05]	-3.1392	-1,22,969	37,94,231
8.5% SGL 2025	18,27,200	6.5205	5.9277 [6.5205/1.10]	4.4456	-81,230	17,45,970
Total value of all securities						2,03,11,503

Note:

- Numerator for duration will be always as duration in terms of years. However the denominator for half-yearly bond will be half-yearly YTM and for a quarterly bond will be quarterly YTM

WN 3: Computation of NAV:

Particulars	Amount
Value of securities (WN 2)	2,03,11,503
Accrued interest (WN 1)	3,92,750
Cash in hand	6,72,800
Total Assets (A)	2,13,77,050
Less: Expenditure accrued	(2,37,400)
Net Assets	2,11,39,650
No of units	1,00,000
NAV per unit (2,11,39,650/1,00,000)	Rs.211.40

98. Valuation of debt and preference portfolio [Nov 2014 MTP, May 2017 RTP]

John inherited the following securities on his uncle's death:

Types of security	Nos.	Annual Coupon %	Maturity Years	Yield %
Bond A (Rs.1,000)	10	9	3	12
Bond B (Rs.1,000)	10	10	5	12
Preference shares C (Rs.100)	100	11	*	13*
Preference shares D (Rs.100)	100	12	*	13*

* likelihood of being called at a premium over par.

Compute the current value of his uncle's portfolio.

Answer:

Types of security	Note	Value
Bond A (Rs.1,000)	1	9,282
Bond B (Rs.1,000)	2	9,275
Preference shares C (Rs.100)	3	8,462
Preference shares D (Rs.100)	4	9,231
Total value		36,250

Note 1: Valuation of Bond A:

Year	Cash flow	PVF @ 12%	DCF
1 to 3	90	2.402	216.20
3	1,000	0.712	712.00
Expected price of 1 bond			928.2
Expected price of 10 bonds			9,282

Note 2: Valuation of Bond B:

Year	Cash flow	PVF @ 12%	DCF
1 to 5	100	3.605	360.50
5	1,000	0.567	567.00
Expected price of 1 bond			927.5
Expected price of 10 bonds			9,275

Note 3: Valuation of Preference Shares C:

- ❖ Details on life of preference shares is not given and hence preference shares would be treated like a perpetuity.
- ❖ PV of perpetuity = $\left(\frac{\text{Perpetuity Amount}}{\text{Investor Expectation}} \right) = \frac{11}{13\%} = 84.62$ per share
- ❖ Value of 100 shares = Rs.8,462

Note 4: Valuation of Preference Shares D:

- ❖ PV of perpetuity = $\left(\frac{\text{Perpetuity Amount}}{\text{Investor Expectation}} \right) = \frac{12}{13\%} = 92.31$ per share
- ❖ Value of 100 shares = Rs.9,231

99. Computation of forward rates [May 2010, Nov 2007, Nov 2018 MTP, Nov 2015 RTP]

Consider the following data for Government Securities:

Face Value	Interest Rate (%)	Maturity (years)	Current Price
1,00,000	0	1	91,000
1,00,000	10.5	2	99,000
1,00,000	11.0	3	99,500
1,00,000	11.5	4	99,900

Calculate the forward interest rates

Answer:**WN 1: Computation of forward rate of year 1(r1):****Analysis of 1-year bond**

Year	Cash flow	PVF	DCF
0	(91,000)	1.000	(91,000)
1	1,00,000	0.91	91,000
			0

Note:

- Current market price of 1-year bond is Rs.91,000. The bond does not pay any interest and hence on maturity we will receive 1,00,000
- r_1 will be the forward rate for year 1 and should be the discount rate at which the PV of 1,00,000 is Rs.91,000 (Today's value)
- From above calculation we can find that PVF for year 1 is 0.91

$$\frac{1}{1 + r_1} = 0.91; 1 + r_1 = \frac{1}{0.91}; 1 + r_1 = 1.0989; r_1 = \mathbf{0.0989 \text{ or } 9.89\%}$$
- From above calculations we can conclude that forward rate for year 1 is 9.89%

WN 2: Computation of forward rate of year 2(r2):**Analysis of 2-year bond**

Year	Cash flow	PVF	DCF
0	(99,000)	1.000	(99,000)
1	10,500	0.91	9,555
2	1,10,500	0.8095	89,445
Total			0

Note:

- We need to first populate the cash flows of the bond. Year 0 is current market price, year 1 would be interest income & year 2 would be interest + principal redemption
- PVF for year 1 would be 0.91 based on forward rate of 9.89%
- PVF for year 2 is taken as balancing figure. PVF of year 2 = $89,445 / 1,10,500 = 0.8095$; 89,445 is taken as balancing figure to make the total of DCF as 0
- We can now compute r_2 using the below calculation

$$\frac{\text{PVF of year 1}}{1 + r_2} = 0.8095; 1 + r_2 = \frac{0.91}{0.8095}; 1 + r_2 = 1.1242; r_2 = \mathbf{0.1242 \text{ (or) } 12.42\%}$$
- From above calculations we can conclude that forward rate of year 2 is 12.42%

WN 3: Computation of forward rate of year 3 (r3):**Analysis of 3-year bond:**

Year	Cash flow	PVF	DCF
0	(99,500)	1.000	(99,500)

1	11,000	0.91	10,010
2	11,000	0.8095	8,905
3	1,11,000	0.7260	80,585
Total			0

Note:

- PVF for year 1 and year 2 is taken as per WN 2
- PVF for year 3 is taken as balancing figure. PVF of year 3 = $80,585 / 1,11,000 = 0.7256$; 80,585 is taken as balancing figure to make the total of DCF as 0
- We can now compute r_3 using the below calculation

$$\frac{\text{PVF of year 2}}{1 + r_3} = 0.7256; 1 + r_3 = \frac{0.8095}{0.7260}; 1 + r_3 = 1.1150; r_3 = \mathbf{0.1150 \text{ or } 11.50\%}$$
- From above calculations we can conclude that forward rate of year 3 is 11.50%

WN 4: Computation of forward rate of year 4(r_4):**Analysis of 4-year bond:**

Year	Cash flow	PVF	DCF
0	(99,900)	1.000	(99,900)
1	11,500	0.91	10,465
2	11,500	0.8095	9,309
3	11,500	0.7260	8,349
4	1,11,500	0.6437	71,777
Total			0

Note:

- We can now compute r_4 using the below calculation

$$\frac{\text{PVF of year 3}}{1 + r_4} = 0.6437; 1 + r_4 = \frac{0.7260}{0.6437}; 1 + r_4 = 1.1279; r_4 = \mathbf{0.1279 \text{ (or) } 12.79\%}$$
- From above calculations we can conclude that forward rate of year 4 is 12.79%

100. Calculation of forward rates [Nov 2008]

The following is the yield structure of AAA rated debenture:

❖ 3 Months	:	8.5%
❖ 6 months	:	9.25%
❖ 1 year	:	10.50%
❖ 2 years	:	11.25%
❖ 3 years and above	:	12.00%

Required:

- Based on the expectation theory calculate the implicit one-year forward rates in year 2 and year 3
- If the interest rate increases by 50 basis points, what will be the percentage change in the price of the bond having a maturity of 5 years? Assume that the bond is fairly priced at the moment at Rs. 1,000

Answer:**WN 1: Computation of implicit one-year forward rate in year 2 and year 3:****Forward rate in year 2:**

$$\text{Forward rate in year 2} = \frac{\text{FVF for year 2}}{\text{FVF for year 1}} - 1$$

$$\text{Forward rate in year 2} = \frac{(1 + 11.25\%)^2}{(1 + 10.50\%)} - 1 = 1.1200 - 1 = 12.00\%$$

Forward rate in year 3:

$$\text{Forward rate in year 3} = \frac{\text{FVF for year 3}}{\text{FVF for year 2}} - 1$$

$$\text{Forward rate in year 3} = \frac{(1 + 12.00\%)^3}{(1 + 11.25\%)^2} - 1 = 1.1352 - 1 = 13.52\%$$

WN 2: Computation of percentage change in bond prices if interest rate increases by 0.50%:

- 5-year bond has required yield of 12 percent. The bond is fairly priced at Rs.1,000. Bond is quoted at par and hence interest rate on bond should be equal to yield of bond. The required yield of bond increases by 0.50% and the revised yield of bond would be 12.50%

New price of bond:

Year	Cash flow	PVF @ 12.50%	DCF

1 to 5	120	3.561	427.32
5	1,000	0.555	555.00
Revised Price			982.32

$$\% \text{ fall in price} = \frac{1,000 - 982.32}{1,000} \times 100 = 1.77\%$$

Note: The change in price can also be computed with the help of duration and volatility.

Alternative solution: (This has been presented as ICAI solution)

$$\text{Bond price} = \frac{1,000 \times 1.12^5}{1.125^5} = \text{Rs. } 978$$

$$\% \text{ fall in price} = \frac{1,000 - 978}{1,000} \times 100 = 2.20\%$$

Comments:

- The above solution is also logical but it assumes that all our intermediate cash flows will be reinvested at the rate of 12% and based on the maturity cash flow, we have computed the fair price of the bond. This approach is similar to realized YTM of Bond.

101. Forward rate computation [Jan 2021]

Following are the yields on zero coupon bonds having a face value of Rs.1,000

Maturity	Yield to Maturity (YTM)
1	10%
2	11%
3	12%

Assume that the term structure of interest rate will remain the same. You are required to

(i) Calculate the implied one year forward rates

(ii) Expected Yield to Maturity and prices of one year and two-year Zero Coupon Bonds at the end of the first year

Answer:

WN 1: Computation of implied one year forward rates:

$$\text{Forward rate for year 1 to year 2} = \frac{\text{FVF for year 2}}{\text{FVF for year 1}} - 1$$

$$\text{Forward rate for year 1 to year 2} = \frac{(1 + 11\%)^2}{(1 + 10\%)} - 1 = \frac{1.2321}{1.10} - 1 = 0.1201 \text{ (or) } 12.01\%$$

$$\text{Forward rate for year 2 to year 3} = \frac{\text{FVF for year 3}}{\text{FVF for year 2}} - 1$$

$$\text{Forward rate for year 2 to year 3} = \frac{(1 + 12\%)^3}{(1 + 11\%)^2} - 1 = \frac{1.404928}{1.2321} - 1 = 0.1403 \text{ (or) } 14.03\%$$

WN 2: Computation of expected yield to maturity and prices of one year and two-year ZCB:

One-year bond:

- Yield of one-year ZCB would be equal to forward rate of year 1 to 2 of 12.01%
- Price of one-year bond = $1,000 / (1 + 12.01\%) = \text{Rs. } 892.78$

Two-year bond:

- Bond has two-year life at the end of one year. This would basically earn returns in year 2 to year 3 (if we compare from today's date)

$$\text{FVF for Year 1 to Year 3} = \frac{\text{FVF for year 3}}{\text{FVF for year 1}} = \frac{1.404928}{1.10} = 1.2772$$

$$\text{Annualized YTM} = \sqrt[2]{1.2772} - 1 = 1.1301 - 1 = 0.1301 \text{ (or) } 13.01\%$$

$$\text{Price of bond} = \frac{1,000}{(1.1301) \times (1.1403)} = \text{Rs. } 782.93$$

102. Impact on interest coverage [May 2009, Nov 2012]

Tiger Limited is presently working with an EBIT of Rs.90 lacs. Its present borrowings are as follows:

Particulars	Amount in lacs

12% term loan	300
Working capital borrowings	
From bank at 15%	200
Public deposit at 11%	100

The sales of the company are growing and to support this, the company proposes to obtain additional borrowing of Rs.100 lacs expected to cost 16%. The increase in EBIT is expected to be 15%.

Calculate the change in interest coverage ratio after the additional borrowing is effected and comment on the arrangement made.

Answer:

Particulars	Existing	Revised
EBIT (A)	90.00	103.50 [90 + 15%]
Interest expenditure		
12% term loan	36.00	36.00
15% WC borrowing	30.00	30.00
Public deposit	11.00	11.00
16% new borrowing	0.00	16.00
Total interest cost (B)	77.00	93.00
Interest coverage (A/B)	1.169	1.113

Comment:

With the proposed increase in the sales the burden of interest on additional borrowings of Rs.100 lacs will adversely affect the interest coverage ratio which has been reduced from 1.169 times to 1.113 times

103. Convertible bond [Nov 2016]

A Limited has issued convertible bonds, which carries a coupon rate of 14%. Each bond is convertible into 20 equity shares of the company A Limited. The prevailing interest rate for similar credit rating bond is 8%. The convertible bond has 5 years maturity. It is redeemable at par at Rs.100.

You are required to estimate:

- Current market price of the bond, assuming it being equal to its fundamental value
- Minimum market price of equity share at which bond holder should exercise conversion option and
- Duration of the bond

Answer:

WN 1: Computation of current market price and duration

Year	Cash flow	PVF @ 8%	DCF	Weight	Product
1	14	0.926	12.96	0.105	0.105
2	14	0.857	12	0.097	0.194
3	14	0.794	11.12	0.09	0.27
4	14	0.735	10.29	0.083	0.332
5	114	0.681	77.63	0.626	3.13
Market value			124	Duration	4.03 years

Note 1: Computation of redemption value:

- ❖ Redemption value of convertible bond on maturity date would be higher of the following:
 - **Conversion value of bond:** The details on share price is not available and hence this cannot be computed
 - **Redemption as bond:** The bond can be redeemed on maturity date at par value of Rs.100
- ❖ Redemption value in this case would be taken as Rs.100 due to absence of information on conversion value of bond on maturity date.

Minimum market price at which the bond holder should exercise conversion option:

- ❖ Minimum market price is basically the conversion parity price
- ❖ Minimum price = (CMP of bond / Conversion ratio) = (124 / 20) = Rs.6.20 per share

104. Decision on buyback of debentures [Nov 2005]

Following information is available in respect of dividend, market price and market condition after one year

Market condition	Probability	Market Price	Dividend per share
Good	0.25	115	9

Normal	0.50	107	5
Bad	0.25	97	3

The existing market price of an equity share is Rs.106 (Face value of Rs.1), which is cum 10% debentures of Rs.6 each, per share. M/s. X Finance company Limited had offered the buy-back of debentures at face value. Find out the expected return and variability of returns of the equity shares. And also advise-whether to accept buyback offer?

Answer:

Author's Note:

Students are advised to refer to this question post completion of basics of portfolio management (computation of risk and return)

Computation of expected return and standard deviation:

Market condition	Capital appreciation	Dividend	Return (in Rs.)	Return in %	Prob	Product	Deviation	Pd ²
Good	15	9	24	24	0.25	6	12	36
Normal	7	5	12	12	0.50	6	0	0
Bad	-3	3	0	0	0.25	0	-12	36
Total						12		72

Note:

- ❖ Capital appreciation = Expected market price - current market price. Current market price is taken as Rs.100 as CMP of Rs.106 include debentures of Rs.6
- ❖ Return in % = Return in Rs./CMP of 100
- ❖ Expected return = Sum of product = 12%
- ❖ Standard deviation = $\sqrt{Pd^2} = \sqrt{72} = 8.49\%$

Decision on buyback offer:

- M/s X Finance company has offered the buyback of debenture at face value. There is reasonable 10% rate of interest compared to expected return 12% from the market.
- **Considering the dividend rate and market price the creditworthiness of the company seems to be very good.** The decision regarding buy-back should be taken considering the maturity period and opportunity in the market.
- **Normally, if the maturity period is low say up to 1 year better to wait otherwise to opt buy back option**

Author's Note:

- The above answer has been given as per ICAI Solution
- Decision on buyback is normally done based on alternative opportunity in the market. If there is alternative opportunity in market then we should go ahead with buyback and vice-versa.

105.Valuation of bond [Nov 2018 RTP]

Pet feed plc has outstanding, a high yield Bond with following features:

Face value	Rs.10,000
Coupon	10%
Maturity period	6 years
Special feature	Company can extend the life of Bond to 12 years

Presently the interest rate on equivalent Bond is 8%.

- If an investor expects that interest will be 8%, six years from now then how much he should pay for this bond now
- Now suppose, on the basis of that expectation, he invests in the Bond, but interest rate turns out to be 12%, six years from now, then what will be his potential loss/gain.

Answer:

Part 1:

- ❖ The interest rate in the market is expected to be 8% after six years. The bond is paying interest of 10% and hence the company will not extend the duration. This is because the company can issue new bonds at 8%

Year	Cash flow	PVF @ 8%	DCF
1 to 6	1,000	4.623	4,623

6	10,000	0.630	6,300
Expected price today			10,923

Part 2:

- ❖ The interest rate in the market turns out to be 12% after six years. The bond is paying interest of 10% and hence the company will extend the duration. This is because the company would like to continue with the bond having lower interest rate

Year	Cash flow	PVF @ 12%	DCF
1 to 6	1,000	4.111	4,111
6	10,000	0.507	5,070
Expected price at end of year 6			9,181

Note:

- ❖ The price has been calculated at end of year 6. This is because the company will get to know the interest rate only after 6 years. The bond value has been calculated as present value of future cash flows (**Year 7 to 12**) discounted back to year 6.
- ❖ Potential loss = 10,923 – 9,181 = Rs.1,742

Author's note:

- Loss has been computed by comparing the Day 1 price with price of year 6. This is because we will get to know about changes in interest rate at end of year 6. This is not a logical answer but there is no other way of answering this question and hence students are advised to compare year 0 and year 6 price to compute the potential loss

106. Raising of debt with covenants [Nov 2017 MTP]

The HLL has Rs. 8.00 crore of 10% mortgage bonds outstanding under an indenture. The indenture allows additional bonds to be issued as long as all of the following conditions are met:

- (1) Pre-tax interest coverage $\left(\frac{\text{Income before tax} + \text{Bond interest}}{\text{Bond Interest}} \right)$ remains greater than 4
- (2) Net depreciated value of mortgage assets remains twice the amount of the mortgage debt.
- (3) Debt-to-equity ratio remains below 0.50.

The HLL has net income after taxes of Rs. 2 crores and a 40% tax-rate, Rs. 40 crores in equity and Rs. 30 crores in depreciated assets, covered by the mortgage.

Assuming that 50% of the proceeds of a new issue would be added to the base of mortgaged assets and that the company has no Sinking Fund payments until next year, how much more 10% debt could be sold under each of the three conditions? Which protective covenant is binding?

Answer:**WN 1: Computation of debt that can be raised based on condition 1:**

Let us assume that maximum interest outflow to be x to get a interest coverage of 4 times

Pre-tax interest coverage	=	4
$\left(\frac{\text{Income before tax} + \text{Bond interest}}{\text{Bond Interest}} \right)$	=	4
$\left(\frac{3.33 + X}{X} \right)$	=	4
3.33 + X	=	4X
3.33	=	3X
X	=	1.11

- ❖ Profit before tax = (Profit after tax / (1-Tax)) = 2 Crores / 0.60 = Rs.3.33 Crores
- ❖ The company can have maximum interest outflow of Rs.1.11 crores. It is currently paying interest of Rs.0.80 crores and the additional interest on new debt can be Rs.0.31 Crores
- ❖ New debt that can be raised = (0.31 crores / 10%) = Rs.3.10 Crores

WN 2: Computation of debt that can be raised based on condition 2:

- ❖ Let us assume the new debt to be raised as X. The company will use 50% of the new proceeds for purchasing mortgaged assets

$\left(\frac{\text{Value of mortgage assets}}{\text{Value of debt}} \right)$	=	2
$\left(\frac{30 + 0.5X}{8 + X} \right)$	=	2
30 + 0.5X	=	16 + 2X

14	=	1.5X
X	=	9.33

Thus, the company can raise maximum of Rs.9.33 Crores as per condition 2

WN 3: Computation of debt that can be raised based on condition 3:

❖ Let us assume the new debt to be raised as X.

$\left(\frac{\text{Debt}}{\text{Equity}}\right)$	=	0.5
$\left(\frac{8+X}{40}\right)$	=	0.5
8+X	=	20
X	=	12

Thus, the company can raise maximum of Rs.12 Crores as per condition 3

Conclusion:

Since all the conditions are to be met, the least i.e. Rs. 3.10 crores (as per condition – 1) can be borrowed by issuing additional bonds. Thus, binding conditions are met and it limits the amount of new debt to 3.10 crore

107.Computation of revised duration [Nov 2005]

The investment portfolio of a bank is as follows:

Government Bond	Coupon Rate	Purchase Rate (Face value of Rs.100)	Duration (Years)
GOI 2006	11.68	106.50	3.50
GOI 2010	7.55	105.00	6.50
GOI 2015	7.38	105.00	7.50
GOI 2022	8.35	110.00	8.75
GOI 2032	7.95	101.00	13.00

Face value of total investment is Rs.5 Crores in each Government Bond. Calculate actual investment in portfolio. What is a suitable action to churn out investment portfolio in the following scenario?

- ❖ Interest rates are expected to lower by 25 basis points
- ❖ Interest rate are expected to raise by 75 basis points.

Also calculate the revised duration of investment portfolio in each scenario.

Answer:

WN 1: Computation of actual investment in portfolio and average duration

Government Bond	Purchase Rate (Face value of Rs.100)	Investment (in lacs) [Amount invested x Purchase price/Face value]	Duration (Years)
GOI 2006	106.50	532.50	3.50
GOI 2010	105.00	525.00	6.50
GOI 2015	105.00	525.00	7.50
GOI 2022	110.00	550.00	8.75
GOI 2032	101.00	505.00	13.00
Total investment		2,637.50	Average duration = 7.85 years

Note: Average duration can also be computed on the basis of weighted average of average

WN 2: Action to be taken in case of decrease in interest rate by 25 basis points:

- ❖ Interest rates is expected to decrease and this will lead to increase in value of investment. The investor would like to increase the duration of the portfolio as higher duration would lead to higher volatility.
- ❖ Higher volatility would lead to higher percentage increase in value of investment
- ❖ Duration can be increased by replacing GOI 2006 (small duration) with GOI 2032 (higher duration).
- ❖ Revised duration of the portfolio would be as under:

Government Bond	Duration (Years)
GOI 2032	13.00
GOI 2010	6.50
GOI 2015	7.50
GOI 2022	8.75
GOI 2032	13.00

Average duration	48.75/5 = 9.75 years

WN 3: Action to be taken in case of increase in interest rate by 75 basis points:

- ❖ Interest rates is expected to increase and this will lead to decrease in value of investment. The investor would like to decrease the duration of the portfolio as lower duration would lead to lower volatility.
- ❖ Lower volatility would lead to lower percentage decrease in value of investment
- ❖ **Duration can be decreased by replacing GOI 2032 (higher duration) with GOI 2006 (lower duration).**
- ❖ Revised duration of the portfolio would be as under:

Government Bond	Duration (Years)
GOI 2006	3.50
GOI 2010	6.50
GOI 2015	7.50
GOI 2022	8.75
GOI 2006	3.50
Average duration	29.75/5 = 5.95 years

108. Convexity:

Compute convexity, convexity adjustment and new price if the yield is increased by 1%

Particulars	Amount
Face value	100
Rate of interest	10%
YTM	10%
Life	5 years

Answer:**WN 1: Computation of Duration and Current Market price of Bond:**

Year	Cash flow	PVF @ 10%	DCF	Weight	Product
1	10	0.9091	9.091	0.0909	0.0909
2	10	0.8264	8.264	0.0826	0.1652
3	10	0.7513	7.513	0.0751	0.2253
4	10	0.6830	6.83	0.0683	0.2732
5	110	0.6209	68.299	0.683	3.415
			99.997		4.1696

Duration = 4.1696 Years

$$\text{Volatility} = \frac{4.1696}{1 + 10\%} = 3.7905$$

WN 2: Computation of Convexity and Convexity Adjustment:**Note 1: Computation of MPS with 1% increase and decrease in yield**

Year	Cash flow	PVF @ 11%	DCF	PVF @ 9%	DCF
1 to 5	10	3.6959	36.959	3.8897	38.897
5	100	0.5935	59.350	0.6499	64.990
Total			96.309		103.887

$$\text{Convexity} = \frac{V_+ + V_- - 2V_0}{2V_0(\Delta y^2)} = \frac{96.309 + 103.887 - 2(99.997)}{2(99.997)(0.01)(0.01)} = 10.1003$$

$$\text{Convexity Adjustment (in Rs.)} = \text{Convexity} \times V_0 \times (\Delta y^2) = 10.1003 \times 99.997 \times 0.01 \times 0.01 = 0.1010$$

$$\text{Convexity Adjustment (in \%)} = \frac{0.1010}{99.997} \times 100 = 0.1010\%$$

WN 3: Computation of new price if yield increases to 11%

New Price = Current price – Change due to yield increase + Convexity adjustment

$$\text{New Price} = 99.997 - 3.7904 + 0.1010 = \text{Rs. } 96.3076$$

Change due to price increase:

- Duration of the bond is 4.1696. Volatility of the bond will be 3.7905. This would mean that bond price will fall by 3.7905% for 1% increase in yield
- Change due to yield increase = $99.997 \times 3.7905\% = 3.7904$

Note: Convexity adjustment will always be added even if there is a fall/rise in yield.

109. Bond Valuation:

The following data are available for a bond:

Face Value Rs. 10,000 to be redeemed at par on maturity

Coupon rate 8.5 per cent per annum

Years to Maturity 5 years

Yield to Maturity (YTM) 10 per cent

You are required to calculate:

- Current market price of the Bond,
- Macaulay's Duration,
- Volatility of the Bond,
- Convexity of the Bond,
- Expected market price, if there is a decrease in the YTM by 200 basis points
 - By Macaulay's Duration based estimate
 - By Intrinsic Value Method.

Answer:

Base computation:

Year	Cash flow	PVF @ 10%	DCF	Weight	Product
1	850	0.909	772.65	0.0819	0.0819
2	850	0.826	702.10	0.0744	0.1488
3	850	0.751	638.35	0.0677	0.2031
4	850	0.683	580.55	0.0616	0.2464
5	10,850	0.621	6,737.85	0.7144	3.572
			9,431.50		4.2522

Solution:

Current market price		Rs.9,431.50
Macaulay duration		4.2522 years
Volatility	$\frac{\text{Duration}}{1 + \text{YTM}} = \frac{4.2522}{1 + 10\%}$	3.8656%
Convexity	Note 1	9.9799
Convexity adjustment	Note 1	37.65
Convexity adjustment (%)	Note 1	0.3992%

Note 1: Computation of Convexity:

- In order to compute Convexity, we need to compute bond price with increase/decrease in yield. Question has mentioned about 200 bps change and hence we shall compute intrinsic value of bond at 12% and 8% YTM

Year	Cash flow	PVF @ 12%	DCF	PVF @ 8%	DCF
1 to 5	850	3.605	3,064.25	3.993	3,394.05
5	10,000	0.567	5,670.00	0.681	6,810.00
			8,734.25		10,204.05

$$\text{Convexity} = \frac{V_+ + V_- - 2V_0}{2V_0(\Delta y^2)} = \frac{8734.25 + 10204.05 - 2(9,431.50)}{2(9,431.50)(0.02)(0.02)} = 9.9799$$

$$\text{Convexity Adjustment (in Rs.)} = \text{Convexity} \times V_0 \times (\Delta y^2) = 9.9799 \times 9,431.50 \times 0.02 \times 0.02 = \text{Rs. } 37.65$$

$$\text{Convexity Adjustment (in \%)} = \frac{37.65}{9,431.50} \times 100 = 0.3992\%$$

Computation of new price through duration estimate:

Decrease in yield by 200 bps:

- Volatility of 3.8656 would mean that bond price will change by 3.8656% for 2% change in yield

- Yield has decreased by 2 percent and hence bond price will increase by 7.7312%
- New price = $9,431.50 + 7.7312\% = \text{Rs.}10,160.67$

Note: New price can also be calculated by taking convexity adjustment into consideration and same is computed as under:

New Price = Current price + Change due to yield fall + Convexity adjustment

New Price = 9,431.50 + 7.7312% + 37.65 = 10,198.32

New price under intrinsic value method = 10,204.05

Part VI - Enterprise Value

110. Computation of Enterprise Value:

Calculate Enterprise value from the following information:

Non-current assets	1000
Trade receivables	500
Cash and cash equivalents	500
Total assets	2000
Shareholders' funds	800
Long-term debt	200
Current liabilities and provisions	1000
Total liabilities	2000

The shares are actively traded and the current market price is Rs.12 per share. Shareholder funds represent 70 shares of 10 each and the rest is retained earnings.

Answer:

Computation of enterprise value:

Particulars	Calculation	Amount
Market value of equity	70 shares x 12	840
Market value of debt		200
Less: Cash and cash equivalents		(500)
Enterprise Value		540

111. Computation of EV/EBITDA multiple:

An analyst gathered the following data of ABC Limited

Recent share price	Rs.22.50
Shares outstanding	40 million
Market value of debt	Rs.137 million
Cash and marketable securities	Rs.62.3 million
Investments	Rs.327 million
Net income	Rs.137.5 million
Interest expense	Rs.6.9 million
Depreciation and amortization	Rs.10.4 million
Taxes	Rs.95.9 million

Based on this information calculate EV/EBITDA ratio for ABC Limited.

Answer:

WN 1: Computation of Enterprise Value:

Particulars	Calculation	Amount
Market value of equity	40 million x 22.50	900
Market value of debt		137
Less: Cash and cash equivalents		(62.30)
Less: Investments		(327)
Enterprise Value		647.70

WN 2: Computation of EBITDA:

Particulars	Amount
Net income (PAT)	137.50
Add: Tax	95.90
Profit before tax	233.40
Add: Depreciation	10.40

Add: Interest	6.90
EBITDA	250.70
EV/EBITDA Multiple [647.70/250.70]	2.58

Part VII – Money Market Instruments

112. Calculation of issue price

RBI sold a 91 day T-bill of face value of Rs.100 at an yield of 6%. What was the issue price?

Answer:

- Let us assume the issue price to be X
- X will become Rs.100 in 91 days with annual yield being 6%

$$\frac{100 - X}{X} \times \frac{365}{91} \times 100 = 6$$

$$\frac{36,500 - 365X}{91X} = \frac{6}{100}; 36,500 - 365X = 0.06(91X)$$

$$36,500 - 365X = 5.46X; 36,500 = 370.46X$$

$$X = \frac{36,500}{370.46} = \text{Rs. } 98.53$$

- Hence the issue price of treasury bill would be Rs.98.53

113. Calculation of net receipt

Z Co. Ltd issues commercial paper worth Rs.10 Crores as per the following details:

Date of issue	16 th January 2009
Date of maturity	17 th April 2009
No. of days	91
Interest rate	12.04% p.a.

What was the net amount received by the company on issue of CP? (Charges of intermediary may be ignored)

Answer:

- Let us assume the net amount received to be X
- X will become Rs.1,000 lacs in 91 days with annual yield being 12.04%

$$\frac{1,000 - X}{X} \times \frac{365}{91} \times 100 = 12.04$$

$$\frac{3,65,000 - 365X}{91X} = \frac{12.04}{100}; 3,65,000 - 365X = 0.1204(91X)$$

$$3,65,000 - 365X = 10.9564X; 3,65,000 = 375.9564X$$

$$X = \frac{3,65,000}{375.9564} = \text{Rs. } 970.8573 \text{ lacs}$$

Hence the net amount received on commercial paper is Rs.9.708573 Crores

114. Calculation of net investment

ABC Limited has to make payments of Rs.20 lacs on 16th April. It has surplus money today (January 15, 2018) and the company has decided to invest in certificate of deposits (CD) of a leading nationalized bank at 8 percent. What money is required to be invested now?

Answer:

- Let us assume the amount invested to be X
- X will become Rs.20 lacs in 91 days [16 days of January + 28 days of February + 31 days of March + 16 days of April] with annual yield being 8.00%

$$\frac{20 - X}{X} \times \frac{365}{91} \times 100 = 8.00$$

$$\frac{7,300 - 365X}{91X} = \frac{8.00}{100}; 7,300 - 365X = 0.08(91X)$$

$$7,300 - 365X = 7.28X; 7,300 = 372.28X$$

$$X = \frac{7,300}{372.28} = \text{Rs. } 19.60890 \text{ lacs}$$

- Hence amount to be invested today is Rs.19,60,890

115. Effective rate of interest of a CP issue [Nov 2020]

From the following particulars, calculate the effective rate of interest p.a. as well as the total cost of funds to Bhaskar Ltd., which is planning a CP issue:

Issue Price of CP	Rs.97,550
Face Value	Rs.1,00,000
Maturity Period	3 Months
Issue expenses:	
Brokerage	0.15% for 3 months
Rating charges	0.50% p.a.
Stamp Duty	0.175% for 3 months

Answer:**WN 1: Computation of interest cost on commercial paper:**

- Rs.97,550 has become Rs.1,00,000 in 3 months

$$\text{Nominal Interest} = \frac{1,00,000 - 97,550}{97,550} \times \frac{12}{3} \times 100 = 10.05\%$$

$$\text{Effective interest} = \left(1 + \frac{0.1005}{4}\right)^4 - 1 = 10.435\%$$

WN 2: Computation of total cost of funds:

Particulars	Amount
Effective interest cost	10.435%
Brokerage cost (0.15 x 4)	0.60%
Rating charges	0.50%
Stamp duty (0.175 x 4)	0.70%
Total cost of funds	12.235%

116. Commercial paper

ABC Limited is considering raising Rs.15 crores by issuing commercial paper for 120 days. Commercial paper will be sold at a discount of 11.25 percent. Stamp duty charges will be 0.5 percent of the size of the issue. The issuing and other charges will amount to Rs.3.75 lacs and rating charges are 0.40 percent of the issue size. Calculate the effective cost of CP?

Answer:**WN 1: Computation of amount raised:**

- Let us assume the amount raised to be X
- X will become Rs.15 crores in 120 days with annual yield being 11.25%

$$\frac{15 - X}{X} \times \frac{365}{120} \times 100 = 11.25$$

$$\frac{5,475 - 365X}{120X} = \frac{11.25}{100}; 5,475 - 365X = 0.1125(120X)$$

$$5,475 - 365X = 13.50X; 5,475 = 378.50X$$

$$X = \frac{5,475}{378.50} = \text{Rs. } 14.46499 \text{ crores}$$

- Hence amount raised today will be Rs.14.46499 Crores

WN 2: Computation of effective cost of Commercial Paper:

Particulars	Amount (in cr)
Interest [15.00 - 14.46499]	0.53501
Stamp duty [15 x 0.50%]	0.07500
Issuing and other charges	0.03750
Rating charges [15 x 0.40%]	0.06000
Total cost (in Crores)	0.70751
Amount raised	
Amount raised	14.46499
Less: Stamp duty, rating and other charges	0.17250

Effective amount raised	14.29249

$$\text{Effective cost of CP} = \frac{0.70751}{14.29249} \times \frac{365}{120} \times 100 = 15.06\%$$

117. Commercial paper

ABC Limited is able to issue commercial paper of Rs.50,00,000 every 4 months at a rate of 12.5 percent per annum. The cost of placement of commercial paper issue is Rs.2,500 per issue. ABC Limited is required to maintain line of credit of Rs.1,50,000 in bank balance. The tax rate is 30%. What is the cost of funds (after taxes) to ABC Limited for commercial paper issue? The maturity of the commercial paper was 4 months

Answer:**WN 1: Computation of amount raised:**

- Let us assume the amount raised to be X
- X will become Rs.50 lacs in 4 months with annual yield being 12.50%

$$\frac{50 - X}{X} \times \frac{12}{4} \times 100 = 12.50$$

$$\frac{600 - 12x}{4x} = \frac{12.50}{100}; 600 - 12x = 0.1250(4X)$$

$$600 - 12X = 0.50X; 600 = 12.50X$$

$$X = \frac{600}{12.50} = \text{Rs. 48 lacs}$$

- Hence amount raised today will be Rs.48 lacs

WN 2: Computation of effective cost of Commercial Paper:

Particulars	Amount (in lacs)
Interest [50.00 - 48.00]	2.000
Cost of placement	0.025
Total cost (in lacs)	2.025
Net amount raised through CP	
Amount raised	48.000
Less: Line of credit to be maintained	(1.500)
Less: Cost of placement	(0.025)
Effective amount raised	46.475

$$\text{Effective cost of CP (pre - tax)} = \frac{2.025}{46.475} \times \frac{12}{4} \times 100 = 13.07\%$$

$$\text{Effective cost of CP (post - tax)} = 13.07 \times 70\% = 9.15\%$$

118. Calculation of break-even period

Wonderland Limited has excess cash of Rs.20 lakhs, which it wants to invest in short term marketable securities. Expenses relating to investment will be Rs. 50,000. The securities invested will have an annual yield of 9 %. The company seeks your advice.

- As to the period of investment so as to earn a pre-tax income of 5 %.
- The minimum period for the company to break even its investment expenditure over Time value of money.

Answer:**WN 1: Computation of period of investment to earn pre-tax income of 5%:**

Particulars	Amount
Net return to be earned [20 lacs x 5%]	1,00,000
Expenses relating to investment	50,000
Gross return to be earned	1,50,000
% return to be earned [1,50,000/20,00,000]	7.50%
Return for a year	9%
Period of investment to earn return of 5%	10 months

$\frac{7.50\%}{9\%} \times 12 \text{ months}$	

WN 2: Computation of break-even period:

Particulars	Amount
Net return to be earned	0
Expenses relating to investment	50,000
Gross return to be earned	50,000
% return to be earned $[50,000/20,00,000]$	2.50%
Return for a year	9%
Period of investment to break-even	3.33 months
$\frac{2.50\%}{9\%} \times 12 \text{ months}$	

119. Calculation of Dirty Price [Jan 2021, May 2021 MTP]

Bank A enters into a Repo for 14 days with Bank B in 10% GOI Bonds 2017 at a rate of 5.65% for Rs.8 Crores. Assuming that the clean price will be Rs.99.42, initial margin be 2% and days of accrued interest be 262, you are required to determine:

- ❖ Dirty Price
- ❖ Start Proceeds (First Leg)
- ❖ Repayment at maturity (Second Leg)

Assume number of days be 360

Answer:**WN 1: Computation of Dirty Price:**

Dirty Price = Clean Price + Accrued Interest
Accrued interest = $100 \times 10\% \times \frac{262}{360} = 7.28$
Dirty price = $99.42 + 7.28 = \text{Rs.}106.70$

Note: Accrued interest is computed as per the base security. In this case the base security is GOI bonds which has an interest rate of 10%

WN 2: Computation of start proceeds and repayment at maturity:

Start Proceeds = $8,00,00,000 \times \frac{106.70}{100} \times 98\% = \text{Rs.} 8,36,52,800$
Interest on repo = $8,36,52,800 \times 5.65\% \times \frac{14}{360} = \text{Rs.} 1,83,804$
Repayment at maturity = $8,36,52,800 + 1,83,804 = 8,38,36,604$

Note: Interest on repo is charged based on repo interest rate of 5.65%

120. Clean price and Dirty price (reverse working) – July 2021

The Bank BK enters into a Repo for 9 days with Bank NE in 6% Government bonds 2022 for an amount of Rs. 2 crore. The other relevant details are as follows:

First Leg Payment (Start Proceeds)	Rs.2,00,06,750
Second Leg Payment (Repayment proceeds)	Rs.2,00,31,759
Initial margin	1.25%
Days of accrued interest	240

Assume 360 days in a year.

You are required to calculate:

- (i) Repo Rate
- (ii) Dirty Price and
- (iii) Clean Price

Answer:**WN 1: Computation of Repo Rate:**

Particulars	Amount
Start proceeds	2,00,06,750
End proceeds	2,00,31,759
Interest for repo period (9 days)	25,009

$$\text{Interest on repo} = 2,00,06,750 \times \text{Rate} \times \frac{9}{360}$$

$$25,009 \times 40 = 2,00,06,750 \times \text{Rate}$$

$$\text{Rate} = \frac{25,009 \times 40}{2,00,06,750} = 0.0500 \text{ (or) } 5.00\%$$

- Hence Repo Rate = 5.00%

WN 2: Computation of Dirty Price:

$$\text{Start Proceeds} = 2,00,00,000 \times \frac{\text{Dirty Price}}{100} \times 98.75\%$$

$$2,00,06,750 = 1,97,50,000 \times \frac{\text{Dirty Price}}{100}$$

$$\text{Dirty Price} = \frac{2,00,06,750}{1,97,50,000} \times 100 = \text{Rs. } 101.30$$

WN 3: Computation of Clean Price:

Dirty Price = Clean Price + Accrued Interest
Accrued interest = $100 \times 6\% \times \frac{240}{360} = 4.00$
Clean Price = $101.30 - 4.00 = \text{Rs. } 97.30$

Chapter 6 - Portfolio Management**1. What are the activities carried out in portfolio management?**

- Selection of securities
- Construction of all Feasible Portfolios with the help of the selected securities
- Deciding the weights/proportions of the different constituent securities in the portfolio so that it is an Optimal Portfolio for the concerned investor

2. What are the objectives of portfolio management?

- ❖ **Security/Safety of Principal:** Security not only involves keeping the principal sum intact but also its purchasing power.
- ❖ **Stability of Income:** To facilitate planning more accurately and systematically reinvestment or consumption of income.
- ❖ **Capital Growth:** It can be attained by reinvesting in growth securities or through purchase of growth securities.
- ❖ **Marketability i.e. the case with which a security can be bought or sold:** This is essential for providing flexibility to investment portfolio.
- ❖ **Liquidity i.e. nearness to money:** It is desirable for the investor so as to take advantage of attractive opportunities upcoming in the market.
- ❖ **Diversification:** The basic objective of building a portfolio is to reduce the risk of loss of capital and/or income by investing in various types of securities and over a wide range of industries.
- ❖ **Favourable Tax Status:** The effective yield an investor gets from his investment depends on tax to which it is subjected to. By minimising the tax burden, yield can be effectively improved.

3. What are the phases of portfolio management?

- ❖ Portfolio management is a process and broadly it involves following five phases and each phase is an integral part of the whole process and the success of portfolio management depends upon the efficiency in carrying out each of these phases.
 - **Security Analysis:** Security analysis constitutes the initial phase of the portfolio formation process and consists in examining the risk-return characteristics of individual securities and also the correlation among them.
 - **Portfolio Analysis:** From any chosen set of securities, an indefinitely large number of portfolios can be constructed by varying the fractions of the total investable resources allocated to each one of them.
 - **Portfolio selection:** The goal of a rational investor is to identify the Efficient Portfolios out of the whole set of Feasible Portfolios mentioned above and then to zero in on the Optimal Portfolio suiting his risk appetite
 - **Portfolio revision:** Once an optimal portfolio has been constructed, it becomes necessary for the investor to constantly monitor the portfolio to ensure that it does not lose its optimality.
 - **Portfolio evaluation:** This process is concerned with assessing the performance of the portfolio over a selected period of time in terms of return and risk and it involves quantitative measurement of actual return realized and the risk borne by the portfolio over the period of investment

4. Explain the traditional approach of portfolio management?

Process of investment as per traditional approach is detailed below:

- ❖ **Investor's study includes an insight into his** – (a) age, health, responsibilities, other assets, portfolio needs; (b) need for income, capital maintenance, liquidity; (c) attitude towards risk; and (d) taxation status;
- ❖ **Portfolio objectives** are defined with reference to maximising the investors' wealth which is subject to risk. The higher the level of risk borne, the more the expected returns
- ❖ **Investment strategy** covers examining a number of aspects including:
 - Balancing fixed interest securities against equities;
 - Balancing high dividend pay-out companies against high earning growth companies as required by investor
 - Finding the income of the growth portfolio;
 - Balancing income tax payable against capital gains tax;
 - Balancing transaction cost against capital gains from rapid switching; and

- Retaining some liquidity to seize upon bargains.
- ❖ **Diversification** reduces volatility of returns and risks and thus adequate equity diversification is sought. Balancing of equities against fixed interest-bearing securities is also sought.
- ❖ **Selection of individual investments** is made on the basis of the following principles:
 - Methods for selecting sound investments by calculating the true or intrinsic value of a share and comparing that value with the current market value (i.e. by following the fundamental analysis) or trying to predict future share prices from past price movements (i.e., following the technical analysis);
 - Expert advice is sought besides study of published accounts to predict intrinsic value;
 - Inside information is sought and relied upon to move to diversified growth companies, switch quickly to winners than loser companies;
 - Newspaper tipsters about good track record of companies are followed closely;
 - Companies with good asset backing, dividend growth, good earning record, high quality management with appropriate dividend paying policies and leverage policies are traced out constantly for making selection of portfolio holdings.

5. What are the elements of risk in investment? [Jan 2021]

- ❖ Total risk of a security is the **sum of systematic risk and unsystematic risk**

Systematic Risk:

- ❖ Systematic risk comprises factors that are **external to a company** (macro in nature) and affect a large number of securities simultaneously. These are mostly uncontrollable in nature
- ❖ Systematic risk can be further subdivided into interest rate risk, market risk and purchasing power risk
 - **Interest rate risk:** This arises due to variability in the interest rates from time to time and particularly affects debts securities like bonds and debentures as they carry fixed coupon rate of interest.
 - **Purchasing power risk:** It is also known as **inflation risk**, as it also emanates from the very fact that inflation affects the purchasing power adversely. Nominal return contains both the real return component and an inflation premium in a transaction involving risk of the above type to compensate for inflation over an investment holding period. **Inflation rates vary over time and investors are caught unaware when rate of inflation changes unexpectedly causing erosion in the value of realised rate of return and expected return.**
 - **Market risk:** This is a type of systematic risk that affects **prices of any particular share move up or down consistently for some time periods in line** with other shares in the market. A general rise in share prices is referred to as a bullish trend, whereas a general fall in share prices is referred to as bearish trend

Unsystematic Risk:

- ❖ Unsystematic risk includes those factors which are **internal to companies** (micro in nature) and affect only those particular companies. These are **controllable** to a great extent
- ❖ Unsystematic risk can be further subdivided into business risk and financial risk.
 - **Business Risk:** Business risk emanates from sale and purchase of securities affected by business cycles, technological changes etc. **Business cycles affect all types of securities** viz. there is cheerful movement in boom due to bullish trend in stock prices whereas bearish trend in depression brings down fall in the prices of all types of securities
 - **Financial Risk:** It arises due to **changes in the capital structure** of the company. It is also known as leveraged risk and expressed in terms of debt-equity ratio. Excess of debt vis-à-vis equity in the capital structure indicates that the company is highly geared

6. What are the assumptions of Markowitz Model?

- ❖ The return on an investment **adequately summarises the outcome** of the investment.
- ❖ The investors can **visualise a probability distribution** of rates of return.
- ❖ The investors' risk estimates are **proportional to the variance of return** they perceive for a security or portfolio.
- ❖ Investors base their investment decisions on **two criteria** i.e. expected return and variance of return.
- ❖ All investors are **risk averse**. For a given expected return he prefers to take minimum risk, for a given level of risk the investor prefers to get maximum expected return.

- ❖ Investors **are assumed to be rational** in so far as they would prefer greater returns to lesser ones given equal or smaller risk and are risk averse. Risk aversion in this context means merely that, as between two investments with equal expected returns, the investment with the smaller risk would be preferred.
- ❖ **'Return' could be any suitable measure of monetary inflows like NPV** but yield has been the most commonly used measure of return, so that where the standard deviation of returns is referred to it is meant the standard deviation of yield about its expected value.

7. Interpret the Capital Asset Pricing Model and its relevant assumptions? [May 2018 (exam)]

Meaning:

- **The model explains the relationship between the expected return, non-diversifiable risk and the valuation of securities. It considers the required rate of return of a security on the basis of its contribution to the total risk.**
- It is based on the premises that the diversifiable risk of a security is eliminated when more and more securities are added to the portfolio. **However, the systematic risk cannot be diversified and is or related with that of the market portfolio.**
- All securities do not have same level of systematic risk. The systematic risk can be measured by beta, β under CAPM, the expected return from a security can be expressed as:
- **Expected return on security = $R_f + \text{Beta} (R_m - R_f)$**
- The model shows that the expected return of a security consists of the risk -free rate of interest and the risk premium. **The CAPM, when plotted on the graph paper is known as the Security Market Line (SML). A major implication of CAPM is that not only every security but all portfolios too must plot on SML.**
- This implies that in an efficient market, all securities are having expected returns commensurate with their riskiness, measured by Beta

Assumptions:

1. **Efficient market:** It is the first assumption of CAPM. Efficient market refers to the **existence of competitive market** where financial securities and capital assets are bought and sold with full information of risk and return available to all participants
2. **Rational investment goals:** Investors desire **higher return for any acceptable level** of risk or the **lowest risk for any desired level of return**. Such a rational choice is made on logical and consistent ranking of proposals
3. **Risk aversion** in efficient market is adhered to although at times risk seeking behaviour is adopted for gains.
4. CAPM assumes that all assets are divisible and liquid assets
5. Investors are able to **borrow freely at a risk less rate of interest** i.e. borrowings can fetch equal return by investing in safe Government securities
6. Securities can be exchanged without payment of brokerage, commissions or taxes and **without any transaction cost**
7. Securities or capital assets face **no bankruptcy or insolvency**
8. CAPM assumes that the Capital Market is in equilibrium.

8. What are advantages and limitation of CAPM?

Advantages:

- ❖ **Risk Adjusted Return:** It provides a reasonable basis for estimating the required return on an investment which has risk built into it. Hence it can be used as Risk Adjusted Discount Rate in Capital Budgeting.
- ❖ **No Dividend Company:** It is useful in computing the cost of equity of a company which does not declare dividend.

Limitations

- ❖ **Reliability of Beta:** Statistically reliable Beta might not exist for shares of many firms. It may not be possible to determine the cost of equity of all firms using CAPM. All shortcomings that apply to Beta value applies to CAPM too.
- ❖ **Other Risks:** By emphasizing on systematic risk only, unsystematic risks are of importance to shareholders who do not possess a diversified portfolio.

- ❖ **Information Available:** It is extremely difficult to obtain important information on risk free interest rate and expected return on market portfolio as there is multiple risk-free rates for one while for another, markets being volatile it varies over time period.

9. Write short note on Active portfolio strategy?

An APS is followed by most investment professionals and aggressive investors who strive to **earn superior return after adjustment for risk**. The vast majority of funds (or schemes) available in India follow an “active” investment approach, **wherein fund managers of “active” funds spend a great deal of time on researching individual companies, gathering extensive data** about financial performance, business strategies and management characteristics. Following are the principles of APS:

- ❖ **Market Timing:** This involves departing from the normal i.e. **strategy for long run asset mix to reflect assessment of the prospect of various assets in the near future**. Market timing is based on an explicit or implicit forecast of general market movement. A **variety of tools are employed for market timing analysis** namely business cycle analysis, moving average analysis, advance-decline analysis, Econometric models
- ❖ **Sector Rotation:** Sector or group rotation **may apply to both stock and bond component of the portfolio**. It is used **more compulsorily with respect to strategy**. The components of the portfolio are used **when it involves shifting**. The weighting for various industry sectors is based on their asset outlook.
- ❖ **Security Selection:** Security selection involves a search for **under-price security**. If one has to resort to active stock selection, he may employ fundamental / technical analysis to identify stocks which seems to promise superior return and concentrate the stock components of portfolio on them.
- ❖ **Use of specialized investment concept:** To achieve superior return, one has to employ a **specialised concept/philosophy particularly** with respect to investment in stocks. The concept which have been exploited successfully are **growth stock, neglected or out of favour stocks, asset stocks, technology stocks and cyclical stocks**

10. Explain Passive portfolio strategy?

Passive strategy rests on the tenet that the **capital market is fairly efficient** with respect to the available information. Hence, they search for superior return. Basically, passive strategy involves adhering to two guidelines. They are:

- ❖ Create a well-diversified portfolio at a predetermined level of risk.
- ❖ Hold the portfolio relatively unchanged over time unless it became adequately diversified or inconsistent with the investor risk return preference.

Example: A fund which is passively managed are called index funds. An Index fund is a mutual fund scheme that invests in the securities of the target Index in the same proportion or weightage

11. What are the criteria for bond selection?

Bonds are fixed income avenues. The following factors have to be evaluated in selecting fixed income avenues:

- ❖ **Yield to maturity:** The yield to maturity for a fixed-income avenue represent the rate of return earned by the investor, if he invests in the fixed income avenues and holds it till its maturity.
- ❖ **Risk of Default:** To assess such risk on a bond, one has to look at the credit rating of the bond. If no credit rating is available relevant financial ratios of the firm have to be examined such as debt equity, interest coverage, earning power etc and the general prospect of the industry to which the firm belongs have to be assessed.
- ❖ **Tax Shield:** In the past, several fixed income avenues offer tax shields but at present only a few of them do so.
- ❖ **Liquidity:** If the fixed income avenues can be converted wholly or substantially into cash at a fairly short notice it possesses a liquidity of a high order.

12. What are the three approaches for selection of stock?

- ❖ **Technical analysis** looks at price behaviours and volume data to determine whether the share will move up or down or remain trend less.
- ❖ **Fundamental analysis** focuses on fundamental factors like earning level, growth prospects and risk exposure to establish intrinsic value of a share. The recommendation to buy hold or sell is based on comparison of intrinsic value and prevailing market price.

- ❖ **Random selection analysis** is based on the premise that the market is efficient and security is properly priced.
- ❖ Approach followed would depend on level of market efficiency and the same is summarized in the below table:

Level of Efficiency/Approach	Technical Analysis	Fundamental Analysis	Random selection
Inefficiency	Best	Poor	Poor
Weak form efficiency	Poor	Best	Poor
Semi-strong efficiency	Poor	Good	Fair
Strong form efficiency	Poor	Fair	Best

13. Explain various Portfolio revision and rebalancing strategies?

- **Buy and Hold Policy:** This is also called as '**do nothing policy**' as under this strategy no balancing is required. They set a floor value and invest equal to the floor value in non-fluctuating assets and the balance is invested in equity
- **Constant mix policy:** Constant Mix Policy is a '**Do Something Policy**' that maintains stock exposure at a constant percentage of the total portfolio. This strategy involves periodic rebalancing by purchasing and selling stocks when prices go down or up, holding the value of aggressive and conservative portfolios constant at a predetermined ratio.
- **Constant Proportion Portfolio Insurance:** The Constant Proportion Insurance Policy involves setting a floor value for an asset's value, **investing in non-fluctuating assets like Treasury Bills and Bonds**. This strategy is effective in bull markets, where shares purchased as cushion increases, and bearish markets, where losses are avoided by selling shares. **However, it performs poorly in markets affected by sharp reversals.**

Comparative evaluation:

Basis	Buy and Hold Policy	Constant Mix Policy	Constant Proportion Portfolio Insurance
Pay-off line	Straight	Concave (rate of additional payoff reduces with increase in prices – basically it exhibits diminishing marginal returns)	Convex (rate of additional payoff increases with increase in prices – basically it exhibits increasing marginal returns)
Protection in down/up markets	Poor in down market	Not much in Down market but relatively poor in Up market	Good in Down market and performs well in Up market
Performance in flat market	Performs between Constant and CPPI	Tends to do well in flat markets	Performs poorly

14. What are the various types of asset allocation strategies? [Nov 2018 MTP, Nov 2020 MTP]

- ❖ **Integrated Asset Allocation:** Under this strategy, capital market conditions and investor objectives and constraints are examined and **the allocation that best serves the investor's needs while incorporating the capital market** forecast is determined.
- ❖ **Strategic Asset Allocation:** Under this strategy, **optimal portfolio mixes based on returns, risk, and co-variances is generated** using historical information and adjusted periodically to restore target allocation within the context of the investor's objectives and constraints.
- ❖ **Tactical Asset Allocation:** Under this strategy, **investor's risk tolerance is assumed constant** and the asset allocation is changed based on expectations about capital market conditions.
- ❖ **Insured Asset Allocation:** Under this strategy, risk exposure for changing portfolio values (wealth) is adjusted; more value means more ability to take risk.

15. Explain process, return computation and strategies relating to fixed income portfolio process?

Fixed Income Portfolio Process	• Setting up objective • Drafting guideline for investment policy • Selection of Portfolio Strategy - Active and Passive • Selection of securities and other assets • Evaluation of performance with benchmark

Return computation	• Arithmetic Average Rate of Return • Time Weighted Rate of Return • Rupee Weighted Rate of Return • Annualized Return
Passive Strategies	Passive strategy: Passive Strategy is based on the premise that securities are fairly priced commensurate with the level of risk. Following are the passive strategies: • Buy and Hold strategy • Indexation strategy: Replication of a benchmark such as bond index • Immunization: Avoiding interest rate risk through immunized portfolio. More popular among pension funds as they are required to pay fixed amount to retiring people • Matching cash flows: This approach involves buying of Zero-Coupon Bonds to meet the promised payment out of the proceeds realized. This approach would also immunize the portfolio
Active Strategies	Active Strategy: Adopted to outperform the market. Following are the active strategies: • Forecasting Returns and Interest Rates: Forecast interest rates and create strategy based on that. If interest rates are likely to fall, then portfolio manager will buy long-term bonds and if interest rates are likely to increase then he would sell longer term bonds. Following strategies can be implemented: ❖ Bullet strategy: Concentration of investment in a single bond ❖ Barbell strategy: Equal amount in short-term and long-term bonds ❖ Ladder strategy: Investment of equal amount in bonds with different maturity periods • Bond Swaps: Regular monitoring of bonds to identify mispricing. Some of the popular techniques are: ❖ Pure Yield Pickup Swap: Switching from a lower yield bond to higher yield bonds of identical quantity and maturity. However, this can also lead to capital loss due to higher interest rate risk ❖ Substitution Swap: Swapping with similar type of bonds and risk class but at different prices. This opportunity can arise due to temporary imbalance in the market ❖ International spread swap: Swapping a domestic bond for a foreign bond. This is done to exploit the yield differential between domestic and foreign markets. However, this is exposed to exchange risk, credit risk and geopolitical risk ❖ Tax Swap: Taking tax advantage by selling existing bond whose price decreased at capital loss and set it off against capital gain in other securities and buying another security which has features like that of disposed one • Interest Rate Swaps: Helps in swapping a fixed bond to a floating bond and vice versa

16. What are the features of alternative investments?

- ❖ **High Fees** – Being a specific nature product the transaction fees are quite on higher side.
- ❖ **Limited Historical Data** – The data for historic return and risk is very limited where data for equity market for more than 100 years is available.
- ❖ **Illiquidity** – The liquidity of Alternative Investment is not good as next buyer not be easily available due to limited market.
- ❖ **Less Transparency** – The level of transparency is not adequate due to limited public information available.
- ❖ **Extensive Research Required** – Due to limited availability of market information the extensive analysis is required by the Portfolio Managers.
- ❖ **Leveraged Buying** – Generally investment in alternative investments is highly leveraged.

17. What are the characteristics of real estate which makes valuation of them complex?

- **Inefficient market:** Information may not be freely available as in case of financial securities.

- **Illiquidity:** Real Estates are not as liquid as financial instruments.
- **Comparison:** Real estates are only approximately comparable to other properties
- **High Transaction cost:** In comparison to management cost of Real Estate is quite high.
- **No Organized market:** There is no such organized exchange or market as for equity shares and bond

18. What are the four approaches to value Real Estate?

- ❖ **Sales Comparison Approach** – It is like Price Earning Multiplier as in case of equity shares. Benchmark value of similar type of property can be used to value Real Estate.
- ❖ **Income Approach** – This approach like value of Perpetual Debenture or unredeemable Preference Shares. In this approach the perpetual cash flow of potential net income (after deducting expense) is discounted at market required rate of return.
- ❖ **Cost Approach** – In this approach, the cost is estimated to replace the building in its present form plus estimated value of land. However, adjustment of other factors such as good location, neighbourhood is also made in it.
- ❖ **Discounted After Tax Cash Flow Approach** – In comparison to NPV technique, PV of expected inflows at required rate of return is reduced by amount of investment

19. Explain Gold as an alternative investment?

- Gold is a popular investment option, particularly among Indians, with jewelry being the most common way to invest. However, this method faces limitations due to jeweller charges during selling and buying back

Other modes of Gold Investment:

- **Gold Bars:** Investors can buy Gold Coins/bars of different denominations. However, this has the limitation of physical storage.
- **Sovereign Gold Bonds (SGB):** SGBs are government securities **denominated in grams of gold**, offering a superior alternative to holding physical gold. Issued by the Reserve Bank, **investors pay the issue price in cash, and the bonds are redeemed in cash upon maturity**. They protect the quantity of gold paid, **eliminate storage risks, and offer assurance of market value and interest**. **SGBs are free from issues like charges and purity**, and are held in RBI books or demat form, reducing risk of loss.
- **Gold Exchange Traded Funds (ETFs):** Gold ETFs are a hybrid investment approach **combining flexibility of stock investments with simplicity of gold investments**. They can be bought and sold on Stock Exchanges, with prices based on gold prices. ETFs offer **transparency, lower expenses, and direct gold pricing**, making them a more accessible and transparent investment option.
- **E-Gold:** E-gold, introduced in 2010, is offered by the National Spot Exchange Ltd in India. It is equivalent to one gram of physical gold **and held in a Demat account, with lower storage costs compared to physical gold**. E-gold units can be traded on the exchange.

20. What are distressed securities?

- ❖ It is a kind of **purchasing the securities of companies that are in or near bankruptcy**. Since these securities are available at very low price, the main purpose of buying such securities is to make efforts to revive the sick company. Further, these securities are suitable **for those investors who cannot participate in the market** and those who want to avoid due diligence.
- ❖ We can see by taking long position in debt and short position in equity, how investor **can earn arbitrage profit**
- ❖ In case company's condition improves because of priority, the investor will get his **interest payment which shall be more than the dividend on his short position in equity shares**. If company is in condition further deteriorates the value of both share and debenture goes down. He will make good profit from his short position.
- ❖ **Risks Analysis of Investment in Distressed Securities:** On the face, investment in distressed securities appears to be a good proposition but following types of risks are need to be analyzed.
 - **Liquidity Risk:** These securities may be saleable in the market.
 - **Event Risk:** Any event that particularly effect the company not economy as a whole
 - **Market Risk:** This is another type of risk though it is not important.
 - **Human Risk:** The judge's decision on the company in distress also play a big role.

21. Explain the strategy of Portfolio rebalancing under which the value of a portfolio shall not below a specified value in normal market conditions. [May 2021 MTP]
- Under **Constant Proportion Portfolio Insurance (CPPI) strategy** investor sets a floor below which he does not wish his asset to fall called floor, which is invested in some non-fluctuating assets such as Treasury Bills, Bonds etc.
 - The value of portfolio under this strategy **shall not fall below this specified floor** under normal market conditions.
 - This strategy performs well especially in bull market as the value of shares purchased as cushion increases. **In contrast in bearish market losses are avoided by sale of shares.** It should however be noted that this strategy performs very poorly in the market hurt by sharp reversals.
 - The following equation is used to determine equity allocation: Target Investment in Shares = multiplier (Portfolio Value – Floor Value) Multiplier is a fixed constant whose value shall be more than 1.

Theory for solving problems

Notion of Return:

- ❖ Expected return is weighted average of possible returns with probability being the assigned weight
- ❖ It can also be calculated as simple mean of past returns if probability is not given
- ❖ Expected return ignores the concept of time value of money. Hence IRR of compounded annual rate of growth is most appropriate indicator of return
- ❖ Despite its limitations, simple mean is used as indicator of return because of following:
 - It is assumed that each year has equal probability of occurrence
 - Arithmetic mean is used to compute standard deviation which is a measure of risk

How to compute return?

- ❖ Return is a function of dividend and capital appreciation. The one year holding period return is calculated as under:

Return = $\frac{D_1 + (P_1 - P_0)}{P_0}$
D1 = Dividend of next year
P1 = Price of next year
P0 = Current year price

- ❖ If each year's return has a certain probability of occurrence, the expected return will be the weighted average of return with probability of occurrence being the assigned weight
- ❖ Other things (risk) remaining the same, the investment with higher return will be selected

Notion of Risk:

- ❖ Risk refers to volatility of returns and is measured with the help of standard deviation
- ❖ Standard deviation is a measure of risk and is compute with the help of following formula:

$$\text{Standard Deviation} = \sqrt{pd^2}$$

- ❖ Standard deviation can be measured in rupees or in percentages
- ❖ Other things (return) remaining the same, the stock with lower SD will be selected

Note: If probabilities are not given in the question then equal probability is to be assumed for every year.

Format for computing risk and return:

Probability	Return	Product	Deviation	Pd ²

Note:

- Expected return and standard deviation can be computed in Rupees or in %. Preferable approach is to compute in %. In the above format, the return used is in %. Risk and Return in % can be converted into Risk and Return in Rupees using the below formulae:
- Expected return in (Rs.) = Price x Expected Return in %**
- Risk (in Rs.) = Price x Risk in %**

- Dividend rate is to be applied on face value and Dividend yield is to be applied on market price to get the Dividend Amount
- Different probabilities for Dividend and Capital Gain:** A question can have a different probability for dividend and different probability for price. Let us assume there are 3 possible dividends and 3 possible prices. This scenario will lead to nine different combinations and joint probability for each combination is to be calculated. **Joint Probability = Probability for Dividend x Probability for Capital Gain**

Notion of diversification:

- ❖ Diversification means investing in more than one stock. Investing in more than one stock is called building a portfolio
- ❖ Diversification reduces risk if an “economic factor” affects the company in one way and another company in opposite way
- ❖ **Example:** Summer is good for ice-cream and bad for coffee and investing in both ice-cream and coffee business lead to risk reduction.
- ❖ **Example:** Investing in ice-cream and soft drink business may not lead to risk reduction because summer is good for both businesses and winter is bad for both businesses

Portfolio:

- ❖ The return of a portfolio is the weighted average return of securities which constitute the portfolio
- ❖ The risk of a portfolio is **NOT** the weighted average risk of securities which constitute the portfolio. This is because the risk of a portfolio does not depend only on the securities but also on how the securities **correlate** to each other.

Portfolio Risk = $\sqrt{(\sigma_a w_a)^2 + (\sigma_b w_b)^2 + 2\sigma_a \sigma_b \text{COR}_{ab}}$
COR_{ab} = Correlation between A and B

- ❖ Risk-reduction is set to take place if the risk of a portfolio is less than the weighted average risk of securities which constitute the portfolio
- ❖ The extent of risk reduction can be as under:

Correlation co-efficient	Extent of risk reduction
-1	↓ even to zero
-1 to +1	↓ but not up-to zero
+1	Cannot be reduced

Format for computing Portfolio Return and Risk:

Prob	Security A				Security B				$Pd_a d_b$
	Return	Product	Deviation	Pd^2	Return	Product	Deviation	Pd^2	

Note:

- Correlation between a risk-free asset and risky asset is zero
- Portfolio of risky-asset and risk-free asset with maximum risk:** An investor can create a portfolio with a restriction on maximum risk. In this case, weight of risky asset would be as under:

$$\text{Weight of risky asset} = \frac{\text{Maximum risk}}{\text{SD of risky asset}}$$

$$\text{Weight of risk-free asset} = 1 - \text{weight of risky asset}$$
- Finding out how well the fund has been compensated for risk undertaken:** We are required to find out Sharpe Ratio for finding this. Any increase in Sharpe Ratio will indicate better returns for risk undertaken by the investor

$$\text{Sharpe Ratio} = \frac{\text{Expected return} - \text{Risk free return}}{\text{Standard Deviation}}$$
- Portfolio invested with margin of 40%:** This would mean that we have borrowed money to extent of 40% and hence the investment would be equal to 140% of portfolio value.

$$\text{Portfolio return} = [140\% \times \text{Portfolio return}] - [40\% \times \text{cost of borrowing}]$$

$$\text{Portfolio risk} = 140\% \text{ of portfolio risk}$$

- **Co-variance between A and A:** Some question can give data on co-variance between security A and Security A. This basically would mean variance of A itself.

Portfolio with minimum risk:

- ❖ Portfolio risk does not depend only on the standard deviation of individual securities but also on how securities are correlated to each other

Optimum weights with 2 securities:

$$\text{Weight of Security 1} = \frac{\text{Variance of Security 2} - \text{Covariance of 1 and 2}}{\text{Variance of security 1} + \text{Variance of Security 2} - 2\text{Covariance of 1 and 2}}$$

$$\text{Weight of security 2} = 1 - \text{weight of security 1}$$

Optimum weights with 3 Securities (Critical line approach):

- ❖ Critical line is calculated to get the weights of the individual securities in the minimum variance portfolio
- ❖ We would need combination of two minimum variance portfolio in order to arrive at the critical line

Weight of security 1 = a + b (weight of security 2)

Form two equations and get values of a and b

The critical line will then be written as Weight of security 1 = a + b (weight of security 2)

Example:

Portfolio 1 = Security A = 50%, Security B = 25% and Security C = 25%

Portfolio 2 = Security A = 70%, Security B = 20% and Security C = 10%

Critical line between A and B:

Weight of Security A = a + b(weight of Security B)

$$0.50 = a + 0.25b \dots\dots\dots (\text{Equation 1})$$

$$0.70 = a + 0.20b \dots\dots\dots (\text{Equation 2})$$

Solving equations, we get b = -4 and a = 1.5

Critical line: Weight of Security A = 1.50 - 4(Weight of Security B)

Creation of portfolio with Security A, B and C:

- ❖ Weight of security A = 0.70
- ❖ Desired weight of security B = 0.2
- ❖ Balance weight of Security C = 0.1

Critical line between B and C:

Weight of Security B = a + b(weight of Security C)

$$0.25 = a + 0.25b \dots\dots\dots (\text{Equation 1})$$

$$0.20 = a + 0.10b \dots\dots\dots (\text{Equation 2})$$

Solving equations, we get b = 0.3333 and a = 0.1667

Critical line: Weight of Security B = 0.1667 - 0.3333(Weight of Security C)

Creation of portfolio with Security A, B and C:

- ❖ Weight of security B = 0.20
- ❖ Desired weight of security C = 0.1
- ❖ Balance weight of Security A = 0.7

Critical line between A and C:

Weight of Security A = a + b(weight of Security C)

$$0.50 = a + 0.25b \dots\dots\dots (\text{Equation 1})$$

$$0.70 = a + 0.10b \dots\dots\dots (\text{Equation 2})$$

Solving equations, we get b = -1.3333 and a = 0.8333

Critical line: Weight of Security A = 0.8333 - 1.3333(Weight of Security C)

Creation of portfolio with Security A, B and C:

- ❖ Weight of security A = 0.70
- ❖ Desired weight of security C = 0.1
- ❖ Balance weight of Security B = 0.2

Optimum weight with more than 3 securities (Sharpe's optimal portfolio):

- ❖ **Step 1:** Calculate excess return to Beta (Treynor Ratio) for all securities

$$\text{Treynor Ratio} = \frac{\text{Expected return} - \text{riskfree return}}{\text{Beta of security}}$$

- ❖ **Step 2:** Arrange the securities in the descending order of the variable computed in step 1
- ❖ **Step 3:** Calculate [(Excess return * Beta) / σ_{ci}] for all securities

Variable for step 3 = $\frac{\text{Excess return} \times \text{Beta}}{\sigma^2_{ci}}$	
❖ Step 4:	Calculate cumulative values for the variable identified in step 3
❖ Step 5:	Calculate $[\text{Beta}^2 / \sigma^2_{ci}]$ for all securities
Variable for step 5 = $\frac{\text{Beta}^2}{\sigma^2_{ci}}$	
❖ Step 6:	Calculate cumulative values for the variable identified in step 5
❖ Step 7:	Calculate cut-off point for all securities: (Market variance x Step 4 value)
Cutoff point = $\frac{\text{Market variance} \times \text{Step 4 value}}{1 + (\text{Market variance} \times \text{Step 6 value})}$	
❖ Step 8:	Identify the maximum cut-off point. Securities till the maximum cut-off point will form part of optimum portfolio
❖ Step 9:	Calculate Z-value for securities which have been selected to form part of optimum portfolio
Z value = $\frac{\text{Beta}}{\sigma^2_{ci}} \times (\text{Treynor ratio} - \text{Maximum Cutoff Point})$	
❖ Step 10:	Identify the proportion of securities in the final portfolio. The weights of the securities would be in the same proportion as their z-value

How to calculate correlation co-efficient:

- ❖ **Step 1:** Compute the deviation of each security for each observation from their respective mean
- ❖ **Step 2:** Multiply the product of these deviations with the probability of occurrence
- ❖ **Step 3:** The sum of the values of step 2 is the co-variance_{AB}. **Co-variance between two securities can also be calculated as Beta of Security 1 * Beta of Security 2 * Variance of market.**
- ❖ **Step 4:** Correlation co-efficient is computed using the below formula:

$$\text{COR}_{AB} = \frac{\text{Covariance}_{AB}}{\sigma_A \sigma_B}$$

Return and risk of three securities (Markowitz Model):

- ❖ **Return:** Weighted average of the securities which constitute the portfolio
- ❖ **Risk:**

For 3 securities the formula of $(a + b + c)^2$ is to be used
Portfolio Risk = $a^2 + b^2 + c^2 + 2ab + 2bc + 2ac$
$a = \sigma_a w_a; b = \sigma_b w_b; c = \sigma_c w_c$
With 2ab we need to add correlation of a and b; similarly for 2ac we need to add correlation of a and c; for 2bc we need to add correlation of b and c

Notion of Dominance:

- ❖ Security A dominates Security B if
 - Security A has higher return for same or lower risk
 - Security A has same return for a lower risk
- ❖ In that case Security A is said to be a dominating (or efficient) stock. Security B is said to be a dominated (or inefficient) stock
- ❖ Only efficient stocks should form part of a portfolio

Efficiency frontier:

- ❖ Efficiency frontier is a curve which connects all the efficient securities/portfolio
- ❖ The curve should start with minimum SD security/portfolio and all other efficient securities/portfolio are to be plotted on the graph
- ❖ Risk is to be considered on x-axis and return is to be plotted on y-axis

Portfolio of risk free-asset and efficient portfolio:

- ❖ Risk free-asset provides guaranteed return with zero risk. Addition of risk free asset can help in increasing the return while reducing the standard deviation of the portfolio
- ❖ Efficient frontier gives multiple efficient portfolios. However one of the portfolios will be the best and the same can be identified by following a combination of efficient portfolio and risk free asset

Steps

- ❖ **Step 1:** Identify the target standard deviation

- ❖ **Step 2:** Get the weight of the efficient portfolio and risk free asset
 - Weight of efficient portfolio = Target SD/SD of efficient portfolio
 - Weight of risk free asset = 1 - weight of efficient portfolio
- ❖ **Step 3:** Calculate the weighted average expected return and select the combination of risk free asset and efficient portfolio which gives the highest return

Notion of non-diversifiable risk:

- ❖ Adding more securities to a portfolio reduce risk but the rate of reduction slows down and after a point tapers off.
- ❖ The number of securities at which risk reduction stops is not known
- ❖ Since risk reduction is not possible beyond a point of time, total risk is broken into
 - Diversifiable risk [Non-systematic risk]
 - Non-diversifiable risk [Systematic risk]
- ❖ The portfolio manager should eliminate diversifiable risks through diversification and hold only non-diversifiable risk
- ❖ The stock market rewards only non-diversifiable risk
- ❖ Non-diversifiable risk exists because there are certain events (inflation, recession, outbreak of war) which affects all stocks alike

Systematic risk and non-systematic risk:

Particulars	Components	Standard deviation approach	Variance approach
Systematic risk	Interest rate risk, Purchasing Power risk and Market risk	$\left(\begin{array}{c} \text{SD of Security } x \\ \text{Correlation coefficient} \\ \text{(or)} \\ \text{(Beta of Security } x \times \text{SD of Market)} \end{array} \right)$	$\left(\begin{array}{c} \text{SD of Security } x \\ \text{Correlation coefficient} \\ \text{(or)} \\ \text{(Beta of Security } x \times \text{SD of Market)} \end{array} \right)^2$
Non-systematic risk ($\sigma^2_{\epsilon i}$)	Business risk and financial risk	Total risk - Systematic risk	Total risk - Systematic risk

Note:

- ❖ Co-efficient of determination gives the percentage of the variation in the security's return that is explained by the variation of the market return. Variation on account of index is called systematic risk and balance is called unsystematic risk.

Co-efficient of determination = Systematic risk / Total Risk

- ❖ Total risk (Variance) of portfolio as per Sharpe Index Model = Systematic risk of portfolio + Unsystematic risk of portfolio
 - Systematic risk of portfolio = (Beta of portfolio * SD of market)²
 - Unsystematic risk = (W_1^2 * Unsystematic risk) + (W_2^2 * Unsystematic risk) + (W_n^2 * Unsystematic risk)
- ❖ **Residual variance:** The term residual variance would mean unsystematic risk as per variance approach
- ❖ **Random error:** Random error is denoted by $\sigma_{\epsilon i}$. It will be considered as unsystematic risk as per variance approach if $\sigma^2_{\epsilon i}$ is given. Conversely it will be considered as unsystematic risk as per SD approach if $\sigma_{\epsilon i}$ is given. We can compute portfolio risk using below formula:
 Portfolio risk = Systematic Risk + Unsystematic risk
 Unsystematic risk = Weighted average of individual unsystematic risk
 Systematic risk = (Beta x SD of market)²
- ❖ **Specific SD of expected return:** Specific SD of expected return would refer to unsystematic risk

Notion of Beta:

- ❖ Beta is a measure of non-diversifiable risk. Beta measures the sensitivity of a stock to a broad-based market index.
- ❖ If the beta of a stock with respect to sensdex is 1.5, it means that if sensdex changes by 10% then the stock will change by 15%

Nature of Beta	Size	Nature of Investor
Low	<1	Conservative
Unity	=1	Neutral

High	>1	Aggressive

- ❖ Beta is the ratio of **systematic risk** to standard deviation of the market

Formula 1: Beta = $\frac{(\sum XY - n(\text{Mean of X})(\text{Mean of Y}))}{\sum Y^2 - n(\text{Mean of Y})^2}$
N = No. of observations; X = Rate of return of stock; Y = Rate of return of market
Formula 2: Beta = $\frac{\text{SD of Security}}{\text{SD of Market}} \times \text{Correlation coefficient}$
Formula 3: Beta = $\frac{\text{Covariance of Security and Market}}{\text{Variance of Market}}$

Note:

- **Computation of return:** In few questions the return may not be given directly and the same should be computed using the below formula

$$\text{Return} = \frac{D_1 + (P_1 - P_0)}{P_0}$$

- **Dividend Yield is given:** In the above formula dividend yield can be sometimes given directly and hence return would be sum of dividend % and capital appreciation %. Formula for computation is as under

$$\text{Return} = \text{Dividend}\% + \left[\frac{(P_1 - P_0)}{P_0} \right] \times 100$$

- **Observation based on Beta Computation:** We should compute the required return as per CAPM for every year and compare the same with actual return of every year. Based on this, we can advise on whether to buy or sell the security in that year
- **Use of equilibrium return:** Based on equilibrium return of security, we can compute the Beta of security. Beta of security can help us in computing variance of market (formula 3) if Co-variance is given in question. Similarly, SD of security/market can be computed (formula 2) if correlation coefficient is given in question.
- **Computation of risk-free rate:** Treasury Bond/Government Bond will be taken as risk-free security and risk-free return can be computed using the below formula:

$$\text{Risk - free rate} = \frac{\text{Interest}}{\text{Value of Bond}}$$

- **Multiple risk-free rates given in question:** If there are multiple risk-free rates given in the question then we can follow one of the below approaches:
 - Aggressive approach: Take risk-free rate as higher rate
 - Conservative approach: Take risk-free rate as lower rate
 - Moderate approach: Take average as risk-free rates. Follow this approach if problem is silent
- **Decision on fresh buying/selling of security:** We can decide on making fresh investments/liquidity of security by computing Beta of security. Beta will help us in calculating required return and same can be compared with actual return. Positive Alpha [Actual return - required return] would mean fresh purchase and vice versa
- **Negative risk premium of market:** Return of market should always be higher than risk-free rate and hence risk premium of market will always be positive. However, some questions can give a scenario of negative risk premium and we should continue with same figures for solving the question
- **Rm and Rf from expected return of two security:** If expected return and Beta of 2 securities are given in question, then we can form two CAPM equations (SML equations). We should solve those 2 equations we will be able to calculate market return and risk-free rate of return.
- **Fully diversified portfolio:** If a portfolio is fully diversified then the standard deviation of security is equal to systematic risk. Based on systematic risk (formula shared below) we can reverse work and compute Beta
- **Sensitivity of returns to market:** This would basically mean Beta of Security

Beta of portfolio:

- ❖ Beta of the portfolio is the weighted average of beta of individual securities with the amount invested in each security being the assigned weights

- ❖ An individual stock is not diversified and therefore the risk applicable is total risk or standard deviation
- ❖ A portfolio is normally fully diversified and hence the risk applicable is non-diversifiable risk computed with the help of Beta
- ❖ If a portfolio is not fully diversified then the applicable risk is total risk computed with the help of standard deviation
- ❖ **Format for calculation of Beta**

Security	Beta	Weight (Amount invested)	Product

- ❖ **Beta of portfolio = Sum of products/sum of weights**

Note:

- **Weights for target Beta:** If there is a target Beta given in question then we can use the above weighted-average format for computing the optimum weights of securities.
- **Expected return of portfolio:** Expected return of portfolio can be computed using CAPM equation. We will use portfolio Beta in CAPM equation [$R_f + \text{Beta} \times (R_m - R_f)$]
- **Replacing security with NIFTY/SENSEX:** An investor can replace a security with NIFTY/SENSEX if the beta of security is 1 time. This would ensure that overall beta would remain same
- **Risk of Portfolio relative to Market:** We are required to calculate actual beta and equilibrium beta. Equilibrium Beta is computed by substituting actual portfolio return in CAPM equation. Portfolio is more risky if actual beta is higher than equilibrium beta and vice versa
- **Change in composition of portfolio:** We should compare actual return of security with required return to decide on whether to buy/sell a security and consequently change the composition of portfolio
- **Increasing/reducing Beta through risk-free investment:** Beta can be increased or reduced through risk-free investment. We should borrow money if we have to increase Beta and invest in risk-free asset if we have to reduce risk. We should assume weight of risky portfolio as A and weight of risk-free asset to be (1-A) and get the required risk-free investment as balancing figure.
- **Hidden risk-free rate of return:** There could be a portfolio of securities given in the question and one of the securities can have a Beta of 0 times. If any security has Beta of 0 time, then the same will be taken as risk-free rate of return

Alpha:

- Alpha refers to excess/deficit return earned by security/portfolio. This is calculated by comparing the actual return with required return
- **Required return:** Required return can be computed using the following approaches:
 - **Diversified portfolio (CAPM Approach):** $R_f + \text{Beta} \times (R_m - R_f)$
 - **Undiversified portfolio (CML Approach):** Required return using the below formula

$$\text{Capital Market Line} = R_f + \frac{\text{SD of Security}}{\text{SD of Market}} \times (R_m - R_f)$$
 - **Characteristic Line Approach:** $\text{Beta} \times \text{Return of Market}$
- $\text{Alpha} = \text{Actual return} - \text{required return}$

Important Points:

- Return attributable to sheer skill of portfolio manager is basically computation of Alpha
- Return attributable to higher risk taken by portfolio manager = Required return of security as per CAPM – Required return of security if Beta is 1 time (this is basically market return). **We need to use required return as per CAPM and not the actual return in above formula.**

CAPM and Gearing:

- ❖ Based on the liabilities side, a firm can be classified either as unlevered firm or levered firm
- ❖ Based on the asset side, a firm may have single project or multiple projects
- ❖ Based on the above mentioned 2 points the following situations arise:

- Unlevered firm & single project
- Unlevered firm & multiple projects
- Levered firm & single project
- Levered firm & multiple projects

Key Principles:

- ❖ Overall beta of assets side = Overall beta of liabilities side
- ❖ If there are several assets, then Beta of assets will be weighted average of beta of various assets
- ❖ If there are several liabilities, then Beta of liabilities will be weighted average of beta of various liabilities
- ❖ The overall beta of a firm is constant irrespective of capital structure. As we introduce more debt in the capital structure the beta of equity will change in such a way that overall beta remains same
- ❖ Two firms operating under same business risk class will have same overall beta irrespective of capital structure. Example: WIPRO and INFOSYS will have same overall Beta
- ❖ The starting beta for overall beta will therefore be beta of the unlevered firm

Proxy Beta:

- ❖ Following organisation will not be able to compute equity beta:
 - Unlisted companies
 - Private companies
 - Partnership firms
- ❖ Such companies can take the overall beta of a similar company as their own beta (proxy)

$$\text{Overall Beta} = \text{Debt Beta} \times \frac{\text{Debt}}{\text{Debt} + \text{Equity}} + \text{Equity Beta} \times \frac{\text{Equity}}{\text{Debt} + \text{Equity}}$$

Note:

1. In cases taxes are involved then value of debt is replaced with debt * (1 - tax rate) and

Security Market Line:

- ❖ Security Market Line (SML) is the representation of capital asset pricing model.
- ❖ It displays the expected rate of return of an individual security as a function of systematic, non-diversifiable risk (Beta).
- ❖ It is visual of the capital asset pricing model (CAPM) where the x-axis of the chart represent risk in terms of beta, and the y-axis of the chart represents expected return.
- ❖ Return as per security Market Line = $R_f + \text{Beta} \times (R_m - R_f)$

Characteristic line:

- ❖ Security characteristic line plots performance of a particular security or portfolio against that of the market portfolio at every point of time
- ❖ It represents the amount by which an individual share price gives a greater or lower return mandated by CAPM. The excess or lower return is denoted as Alpha.
- ❖ Positive Alpha indicates that the share has outperformed the market and vice versa

$$\text{Characteristic line} = \text{Alpha} + \text{Beta} \times (R_m)$$

Where Alpha = Actual return - Required return

Capital Market Line:

- ❖ Capital market line is used to show the rates of return, which depends on risk-free rates of return and levels of risk for a specific portfolio
- ❖ **CML Versus SML:** This risk in case of CML is measured through standard deviation while the same for SML is measured through Beta
- ❖ It depicts the expected return of a security on Y-axis and the standard deviation is depicted on the X-axis
- ❖ Return as per Capital market line = $R_f + (\text{SD of security} / \text{SD of Market}) \times (R_m - R_f)$

Arbitrage Pricing Theory Model (APT Model)

- ❖ APT is an asset pricing model based on the idea that an asset's returns can be predicted using the relationship between that asset and many common risk factors.
- ❖ CAPM is a single factor model wherein expected return of a security is dependent on a single factor named Beta

- ❖ However, share price can be impacted by multiple factors such as inflation, money supply, interest rate, industrial production among others
- ❖ Expected return under APT model is calculated as under:
- ❖ Formula 1: Expected return = Risk free return + (Factor 1 Beta x Risk premium of factor 1) + (Factor 2 Beta x Risk premium of factor 2) + (Factor 3 Beta x Risk premium of factor 3) + (Factor 4 Beta x Risk premium of factor 4)
- ❖ Formula 2: Expected return = Risk free return + (Variation in factor 1 x Risk premium of factor 1) + (variation in factor 2 x Risk premium of factor 2) + (Variation in factor 3 x Risk premium of factor 3) + (variation in factor 4 x Risk premium of factor 4)

Performance evaluation measures:

- **Sharpe Ratio (or) Reward to variability ratio:** This is used for undiversified portfolio

$$\text{Sharpe Ratio} = \frac{\text{Expected return} - \text{Risk free}}{\text{Standard Deviation}}$$
- **Treynor Ratio (or) Reward to Volatility ratio:** This is used for diversified portfolio

$$\text{Treynor Ratio} = \frac{\text{Expected return} - \text{Risk free}}{\text{Beta}}$$
- Alpha = Actual return - expected return as per CAPM/CML/Characteristic line

Portfolio strategies:

- **Buy and Hold Policy:** Under this policy the investment in debt and equity remain same. There is no rebalancing of investment done
- **Constant mix policy:** Under this policy the investment in debt and equity would be maintained at constant mix. At every reset date, some portion of debt and equity purchase/sales will be done to maintain the mix
- **Constant Proportion portfolio insurance policy:**
 - Investment in equity = Multiplier x [Portfolio value - Floor value]. Investment in equity will be rebalanced based on movement in equity markets
 - Investment in debt = Total portfolio value - Investment in equity

Important Points:

- Floor value = Portfolio value - Maximum % decline in NIFTY/SENSEX

Practical Problems

Overview:

- Part I – Basics of Portfolio Theory
- Part II – Optimum weights for risk reduction
- Part III – Security and Portfolio Beta
- Part IV – Systematic and Unsystematic Risk
- Part V – Characteristic Line, CML and SML
- Part VI – Factory Sensitivity Analysis and Arbitrage Pricing Theory
- Part VII – Beta and Leverage
- Part VIII – Portfolio Strategies
- Part IX – Real Estate Valuation

Part I – Basics of Portfolio Theory

1. Calculation of expected return and standard deviation [Nov 2009, May 2017]

A stock costing Rs.120 pays no dividends. The possible prices that the stock might sell for at the end of the year with the respective probabilities are:

Price	Probability
115	0.1
120	0.1
125	0.2
130	0.3
135	0.2
140	0.1

Required:

- Calculate the expected return
- Calculate the standard deviation of returns

Answer:

Computation of expected return and standard deviation:

Price	Probability	Return (in Rs.)	Return (in %)	Product	Deviation	Pd ²
115	0.1	-5.00	-4.17	-0.42	-11.25	12.66
120	0.1	0.00	0.00	0.00	-7.08	5.01
125	0.2	5.00	4.17	0.83	-2.91	1.69
130	0.3	10.00	8.33	2.50	1.25	0.47
135	0.2	15.00	12.50	2.50	5.42	5.88
140	0.1	20.00	16.67	1.67	9.59	9.2
				7.08		34.91

Note:

- Return (in Rs.) = Expected price - 120
- Return (in %) = Return in Rs./120
- Product = Probability x Return (in %)
- Deviation = Return in % - Expected return (sum of product)
- Pd² = Probability x Deviation x Deviation

Expected return (%)	7.08%
Standard deviation (%)	$\sqrt{34.91} = 5.91\%$
Expected return (in Rs.)	= Price x Expected return in % = 120 x 7.08% = Rs.8.50
Standard deviation (in Rs.)	= Price x Standard Deviation in % = 120 x 5.91% = Rs.7.09

2. Calculation of Risk and Return [Nov 2017]

The following is the return of two securities for the past five years. Calculate the expected return and risk

Year	Security A	Security B
1	10.6	20.5
2	11.6	-10.9
3	-14	28.4
4	17.6	-2.8
5	10	5.8

Answer:

- Probability is not given in question and hence we are assuming equal probability for all years. This assumption would help us to solve all risk and return questions in same format

Security A

Year	Return	Probability	Product	Deviation	Pd ²
1	10.6	0.2	2.12	3.44	2.37
2	11.6	0.2	2.32	4.44	3.94
3	-14	0.2	-2.80	-21.16	89.55
4	17.6	0.2	3.52	10.44	21.8
5	10	0.2	2.00	2.84	1.61
Total			7.16		119.27

Expected return (%)	7.16%
Standard deviation (%)	$\sqrt{119.27} = 10.92\%$

Security B

Year	Return	Probability	Product	Deviation	Pd ²
1	20.5	0.2	4.10	12.30	30.26
2	-10.9	0.2	-2.18	-19.10	72.96
3	28.4	0.2	5.68	20.20	81.61

4	-2.8	0.2	-0.56	-11.00	24.2
5	5.8	0.2	1.16	-2.40	1.15
Total			8.20		210.18

Expected return (%)	8.20%
Standard deviation (%)	$\sqrt{210.18} = 14.50\%$

3. Calculation of portfolio return and standard deviation [May 2020 RTP, May 2018, Nov 2008, Nov 2010, Nov 2014 MTP, Jan 2021]

Consider the following information on two stocks, A and B:

Year	Return on A (%)	Return on B (%)
2006	10	12
2007	16	18

You are required to determine:

- ❖ The expected return on a portfolio containing A and B in the proportion of 40% and 60% respectively
- ❖ The standard deviation from each of these two stocks
- ❖ The co-variance of returns from the two stocks
- ❖ Co-relation co-efficient between the returns of the two stocks
- ❖ Standard deviation of the portfolio

Answer:

Base calculation:

Year	Prob	Security A				Security B				Pd _a d _b
		Return	Product	Deviation	Pd ²	Return	Product	Deviation	Pd ²	
2006	0.5	10	5	-3	4.5	12	6	-3	4.5	4.5
2007	0.5	16	8	3	4.5	18	9	3	4.5	4.5
Total			13		9		15		9	9

Portfolio return	=	Weighted average of individual security return
Portfolio return	=	$(0.4 \times 13\%) + (0.6 \times 15\%) = 14.20\%$
Standard deviation of A	=	$\sqrt{Pd^2} = \sqrt{9} = 3\%$
Standard deviation of B	=	$\sqrt{Pd^2} = \sqrt{9} = 3\%$
Co-variance of stocks	=	Sum of Pd _a d _b = 9%
Co-relation coefficient	=	$\frac{CO - variance_{AB}}{\sigma_A \sigma_B} = \frac{9}{3 \times 3} = 1$
Portfolio Variance	=	$(\sigma_a W_a)^2 + (\sigma_b W_b)^2 + 2\sigma_a W_a \sigma_b W_b COR_{ab}$
Portfolio Variance	=	$(3 \times 0.4)^2 + (3 \times 0.6)^2 + 2(3)(0.4)(3)(0.6)(1)$
Portfolio Variance	=	$1.44 + 3.24 - 4.32 = 9\%$
Portfolio SD	=	$\sqrt{9} = 3\%$

4. Calculation of portfolio return and standard deviation [May 2019 RTP, Nov 2006, May 2008, May 2014 MTP]

X Ltd. Invested on 1.4.2009 in certain equity shares as below:

Name of company	No. of shares	Cost
M Limited	1000 (Rs. 100 each)	2, 00,000
N Limited	500 (Rs. 10 each)	1, 50,000

In September 2009, 10% dividend was paid out by M Limited and in October, 2009, 30% dividend paid out by N Limited. On 31.3.2010 market quotations showed a value of Rs. 220 and Rs. 290 per share for M Limited and N Limited respectively.

On 1.4.2010, investment advisors indicate

- ❖ that the dividend from M Limited and N Limited for the year ending 31.3.2011 are likely to be 20% and 35% respectively and
- ❖ that the probabilities of the market quotations on 31.3.2011 are as below:

Probability	Price per share of M Limited	Price per share of N Limited

0.20	220	290
0.50	250	310
0.30	280	330

You are required to:

- Calculate the average return from the portfolio for the year ended 31.3.2010
- Calculate the average expected return from the portfolio for the year 2010-11
- Calculate comparative risk in the two investments by calculating the standard deviation in each case.

Answer:

WN 1: Computation of return of portfolio for 2009-10

Return of Security M	=	$\frac{(D_1) + (P_1 - P_0)}{P_0} = \frac{10 + (220 - 200)}{200} \times 100 = 15\%$
Return of Security N	=	$\frac{(D_1) + (P_1 - P_0)}{P_0} = \frac{3 + (290 - 300)}{300} \times 100 = -2.33\%$

Portfolio Return:

Security	Return	Weight	Product
M	15%	2,00,000	30,000
N	-2.33%	1,50,000	-3,500
Portfolio	7.57%	3,50,000	26,500

- Portfolio return of 2009-10 = 7.57%

WN 2: Computation of risk and return of Security M for 2010-11

Return of Security M	=	$\frac{(D_1) + (P_1 - P_0)}{P_0} \times 100$
Probability of 0.2	=	$\frac{(20) + (220 - 220)}{220} \times 100 = 9.09\%$
Probability of 0.5	=	$\frac{(20) + (250 - 220)}{220} \times 100 = 22.73\%$
Probability of 0.3	=	$\frac{(20) + (280 - 220)}{220} \times 100 = 36.36\%$

Return and risk calculation:

Return	Probability	Product	Deviation	Pd ²
9.09	0.2	1.82	-15.01	45.06
22.73	0.5	11.37	-1.37	0.94
36.36	0.3	10.91	12.26	45.09
Total		24.10		91.09

Expected return (%)	24.10%
Standard deviation (%)	$\sqrt{91.09} = 9.54\%$
Standard deviation (in Rs.)	$9.54\% \times 220 = \text{Rs.}21.00$

WN 3: Computation of risk and return of Security N for 2010-11

Return of Security N	=	$\frac{(D_1) + (P_1 - P_0)}{P_0} \times 100$
Probability of 0.2	=	$\frac{(3.5) + (290 - 290)}{290} \times 100 = 1.21\%$
Probability of 0.5	=	$\frac{(3.5) + (310 - 290)}{290} \times 100 = 8.10\%$
Probability of 0.3	=	$\frac{(3.5) + (330 - 290)}{290} \times 100 = 15\%$

Return and risk:

Return	Probability	Product	Deviation	Pd ²
1.21	0.2	0.24	-7.58	11.49

8.1	0.5	4.05	-0.69	0.24
15	0.3	4.50	6.21	11.57
		8.79		23.30

Expected return (%)	8.79%
Standard deviation (%)	$\sqrt{23.30} = 4.83\%$
Standard deviation (in Rs.)	$4.83\% \times 290 = \text{Rs.}14.00$

WN 4: Portfolio Return for 2010-11

Security	Return	Weight	Product
M	24.10%	2,20,000 [1,000 × 220]	53,020
N	8.79%	1,45,000 [500 × 290]	12,746
Portfolio	18.02%	3,65,000	65,766

- Portfolio return of 2010-11 = 18.02%

5. Security return and risk (Nov 2020 MTP):

An investor has planned to invest in X Limited. Following are the probabilities of dividends for the year ending 31.03.2016:

Probability	Dividend from X Limited (%)
0.20	10
0.30	15
0.50	20

Expected prices for the year ending 31.03.2016 are as under:

Probability	X Limited
0.20	220
0.50	250
0.30	280

- Price as on 31.03.2015 was Rs.220 for X Limited
- Face value of X Limited is Rs.100

Required:

- Compute the expected return and standard deviation of X Limited

Answer:**WN 1: Computation of different possible returns of X Limited:**

Dividend	Probability	Price	Probability	Capital appreciation	Total return	Total return %	Joint Probability
10	0.20	220	0.20	-	10	4.55	0.04
10	0.20	250	0.50	30	40	18.18	0.10
10	0.20	280	0.30	60	70	31.82	0.06
15	0.30	220	0.20	-	15	6.82	0.06
15	0.30	250	0.50	30	45	20.45	0.15
15	0.30	280	0.30	60	75	34.09	0.09
20	0.50	220	0.20	-	20	9.09	0.10
20	0.50	250	0.50	30	50	22.73	0.25
20	0.50	280	0.30	60	80	36.36	0.15

WN 2: Computation of risk and return of X Limited:

Return	Probability	Product	Deviation	Pd^2
4.55	0.04	0.18	-17.95	12.89
18.18	0.10	1.82	-4.32	1.87
31.82	0.06	1.91	9.32	5.21
6.82	0.06	0.41	-15.68	14.75
20.45	0.15	3.07	-2.05	0.63

34.09	0.09	3.07	11.59	12.09
9.09	0.10	0.91	-13.41	17.98
22.73	0.25	5.68	0.23	0.01
36.36	0.15	5.45	13.86	28.81
Total		22.50		94.24

Answer:

Particulars	Calculation	Amount
Expected return of X Limited (in %)		22.50%
Expected return of X Limited (in Rs.)	220 x 22.50%	Rs.49.50
Risk of X Limited (in %)	$\sqrt{94.24}$	9.71%
Risk of X Limited (In Rs.)	220 x 9.71%	Rs.21.36

6. Calculation of portfolio return and standard deviation [Nov 2008, Nov 2020]

Mr. A is interested to invest Rs.1, 00,000 in the securities market. He selected two securities B and D for this purpose. The risk return profile of these securities is as follows:

Security	Risk	Expected Return
B	10%	12%
D	18%	20%

Co-efficient of correlation between B and D is 0.15.

You are required to calculate the portfolio return of the following portfolios of B and D to be considered by A for his investment.

- 100 percent investment in B only;
- 50 percent of the fund in B and the rest 50 percent in D;
- 75 percent of the fund in B and the rest 25 percent in D; and
- 100 percent investment in D only.

Also indicate that which portfolio is best for him from risk as well as return point of view?

Answer:**Computation of portfolio return and risk:**

Combination	Portfolio Return	Portfolio Risk
100 % in B	12%	10%
50% in B and 50% in D	$= (0.5 \times 12) + (0.5 \times 20)$ $= 16\%$	$= (\sigma_b W_b)^2 + (\sigma_d W_d)^2 + 2\sigma_b W_b \sigma_d W_d \text{COR}_{bd}$ $= (10 \times 0.5)^2 + (18 \times 0.5)^2 + 2(10)(0.5)(18)(0.5)(0.15)$ $= 25 + 81 + 13.5 = 119.50$ Portfolio risk = $\sqrt{119.50} = 10.93\%$
75% in B and 25% in D	$(0.75 \times 12) + (0.25 \times 20)$ $= 14\%$	$= (10 \times 0.75)^2 + (18 \times 0.25)^2 +$ $2(10)(0.75)(18)(0.25)(0.15)$ $= 56.25 + 20.25 + 10.13 = 86.63$ Portfolio risk = $\sqrt{86.63} = 9.31\%$
100% in D	20%	18%

- A person looking for return would invest 100% in Security D
- A conservative investor (minimizes risk) will invest 75% in B and 25% in D

7. Efficient portfolio [Nov 2017 RTP, May 2021 MTP]

Given the following risky securities:

Particulars	A	B	C	D	E	F	G	H
Return %	10	12.5	15	16	17	18	18	20
Risk %	23	21	25	29	29	32	35	45

- ❖ Which of the following securities are efficient and which are inefficient?

Answer:**WN 1: Identification of efficient and inefficient securities**

- Security B dominates Security A as it generates higher return with lower risk. Hence Security A is inefficient.
- Security E dominates Security D as it generates higher return with same risk. Hence Security D is inefficient

- Security F dominates Security G as it generates same return with lower risk. Hence Security G is inefficient
- Security B, C, E, F and H are efficient securities

8. Calculation of co-variance and correlation co-efficient [May 2007]

The historical rates of return of two securities over the past ten years are given. Calculate the covariance and the correlation coefficient of the two securities:

Year	1	2	3	4	5
Security 1	12	8	7	14	16
Security 2	20	22	24	18	15

Answer:

Computation of co-variance and correlation coefficient:

Year	Prob	Security 1				Security 2				Pd ₁ d ₂
		Return	Product	Deviation	Pd ²	Return	Product	Deviation	Pd ²	
1	0.2	12	2.4	0.6	0.072	20	4	0.2	0.008	0.024
2	0.2	8	1.6	-3.4	2.312	22	4.4	2.2	0.968	-1.496
3	0.2	7	1.4	-4.4	3.872	24	4.8	4.2	3.528	-3.696
4	0.2	14	2.8	2.6	1.352	18	3.6	-1.8	0.648	-0.936
5	0.2	16	3.2	4.6	4.232	15	3	-4.8	4.608	-4.416
Total			11.4		11.84		19.8		9.76	-10.52

Co-variance	=	-10.52
SD of security 1	=	$\sqrt{11.84} = 3.44\%$
SD of security 2	=	$\sqrt{9.76} = 3.12\%$
Correlation co-efficient	=	$\frac{\text{Co-variance}_{12}}{\sigma_1 \sigma_2} = \frac{-10.52}{3.44 \times 3.12} = -0.98$

9. Constructing an efficient portfolio [May 2017 MTP]

If the rate of return and Standard Deviation of Market Portfolio (Index) is 8% and 6% respectively and the risk-free rate of return is 5%, you are required to:

- Construct an efficient portfolio which produces expected return of 7.5%
- Calculate the risk of above portfolio
- Suppose if Mr.X has Rs.1,00,000 of his personal funds, then how he would construct his portfolio giving expected return of 10% and what will be the risk of this portfolio

Answer:

WN 1: Computation of efficient portfolio which gives return of 7.5%

Let us assume X to be the proportion of investment in market and (1-X) to be the proportion of investment in Risk-free security

Security	Return	Weight	Product
Market	8	X	8X
Risk-free	5	1-X	5-5X
Total	7.5	1	7.5

- ❖ The investor wants overall return of 7.5% and hence overall return in above table is 7.5. Based on weight of 1 product total should add to 7.5
- ❖ Total of product = 7.5
- ❖ $8X + 5 - 5X = 7.5$
- ❖ $3X = 2.5$; $X = 83.33\%$
- ❖ Hence investor should invest 83.33% in market portfolio and 16.67% in risk-free security

WN 2: Computation of risk of above portfolio:

Risk of portfolio	=	$(W_1SD_1)^2 + (W_2SD_2)^2 + 2W_1W_2SD_1SD_2COR_{12}$
Variance of Portfolio	=	$(0.8333 \times 6)^2 + (0.1667 \times 0)^2 + (2 \times 0.8333 \times 0.1667 \times 6 \times 0 \times 0)$
Variance of Portfolio	=	25
SD of portfolio	=	5%

WN 3: Computation of efficient portfolio with expected return of 10%

Let us assume X to be the proportion of investment in market and (1-X) to be the proportion of investment in Risk-free security

Security	Return	Weight	Product
Market	8	X	8X
Risk-free	5	1-X	5-5X
Total	10	1	10

- ❖ The investor wants overall return of 10% and hence overall return in above table is 10.
- ❖ Total of product = 10
- ❖ $8X + 5 - 5X = 10$
- ❖ $3X = 5$; $X = 166.67\%$
- ❖ Hence investor should invest 166.67% in market portfolio and borrow 66.67% from risk-free security
- ❖ Investment in market security = Rs.1,66,667; Borrowing from market = Rs.66,667

WN 4: Computation of risk of above portfolio:

Risk of portfolio	=	$(W1SD1)^2 + (W2SD2)^2 + 2W1W2SD1SD2COR_{12}$
Variance of Portfolio	=	$(1.6667 \times 6)^2 + (-0.6667 \times 0)^2 + (2 \times 1.6667 \times -0.6667 \times 6 \times 0 \times 0)$
Variance of Portfolio	=	100
SD of portfolio	=	10%

10. Impact of diversification [May 2016 MTP, Nov 2012 RTP]

Suppose that economy A is growing rapidly and you are managing a global equity fund and so far, you have invested only in developed-country stocks only. Now you have decided to add stocks of economy A to your portfolio. The table below shows that expected rates of return, standard deviations, and correlation coefficients (all estimates are in aggregate stock market of developed countries and stock market of Economy A).

Particulars	Developed country stocks	Stocks of Economy A
Expected rate of return (%)	10	15
Risk (Standard deviation)	16	30
Correlation coefficient	0.30	

Assuming the risk-free interest rate to be 3%, you are required to determine:

- (a) What percentage of your portfolio should you allocate to stocks of Economy A and if you want to increase the expected rate of return on your portfolio by 0.5%?
- (b) What will be the standard deviation of your portfolio assuming that stocks of Economy A are included in the portfolio as calculated above?
- (c) Also show how well the Fund will be compensated for the risk undertaken due to inclusion of stocks of Economy A in the portfolio

Answer:

WN 1: Computation of efficient portfolio which gives return of 7.5%

Let us assume X to be the proportion of investment in developed country and (1-X) to be the proportion of investment in Economy A

Security	Return	Weight	Product
Developed Country	10	X	10X
Economy A	15	1-X	15 - 15X
Total	10.5	1	10.5

- ❖ The investor wants overall return of 10.5% and hence overall return in above table is 10.5. Based on weight of 1 product total should add to 10.5
- ❖ $10X + 15 - 15X = 10.5$
- ❖ $5X = 4.5$; $X = 90\%$
- ❖ Hence investor should invest 90% in developed country and 10% in Economy A

WN 2: Computation of risk of above portfolio:

Risk of portfolio	=	$(W1SD1)^2 + (W2SD2)^2 + 2W1W2SD1SD2COR_{12}$
Variance of Portfolio	=	$(0.90 \times 16)^2 + (0.10 \times 30)^2 + (2 \times 0.90 \times 0.10 \times 16 \times 30 \times 0.30)$
Variance of Portfolio	=	242.28
SD of portfolio	=	15.57% or 15.60%

WN 3: Computation of how well the fund have been compensated for the risk undertaken:

- ❖ We can compute Sharpe Ratio to understand how fund has been compensated for the risk undertaken

Sharpe Ratio	=	$\left(\frac{\text{Actual Return} - \text{Risk Free Return}}{\text{Standard Deviation}} \right)$
Sharpe Ratio of Developed Economy	=	$\frac{10 - 3}{16} = 0.437$
Sharpe Ratio of revised portfolio	=	$\frac{10.5 - 3}{15.60} = 0.481$

Sharpe Ratio has improved by 0.04 times due to addition of Economy A in revised portfolio.

11. Portfolio Creation [Nov 2022 SA]

Following is the information related to return on shares of three different companies:

Years	A Limited	B Limited	C Limited
2018	2%	3%	5%
2019	6%	8%	7%
2020	13%	14%	15%
2021	7%	9%	11%

Required:

- (i) Construct maximum number of portfolio and its return, if each portfolio consists of any two Company's shares in proportion of 65% and 35% and suggest which portfolio provides highest return.
(ii) Calculate portfolio return and beta (β), if Mr. X invests Rs. 65,000 in A Ltd. having beta (β) of 0.45; Rs. 20,000 in B Ltd. having beta (β) of 1.15 and Rs. 15,000 in C Ltd. having beta (β) of 1.8.

Answer:**WN 1: Computation of security return:**

$$\text{Return of A Limited} = \frac{2 + 6 + 13 + 7}{4} = 7.00\%$$

$$\text{Return of B Limited} = \frac{3 + 8 + 14 + 9}{4} = 8.50\%$$

$$\text{Return of C Limited} = \frac{5 + 7 + 15 + 11}{4} = 9.50\%$$

WN 2: Creation of multiple portfolios:

Portfolio 1	65% in A and 35% in B	$(0.65 \times 7) + (0.35 \times 8.50)$	7.525%
Portfolio 2	35% in A and 65% in B	$(0.35 \times 7) + (0.65 \times 8.50)$	7.975%
Portfolio 3	65% in A and 35% in C	$(0.65 \times 7) + (0.35 \times 9.50)$	7.875%
Portfolio 4	35% in A and 65% in C	$(0.35 \times 7) + (0.65 \times 9.50)$	8.625%
Portfolio 5	65% in B and 35% in C	$(0.65 \times 8.50) + (0.35 \times 9.50)$	8.85%
Portfolio 6	35% in B and 65% in C	$(0.35 \times 8.50) + (0.65 \times 9.50)$	9.15%

Since maximum return is under Combination - 6 i.e. 65% investment in C Ltd. and 35% in B Ltd. hence it should be opted for.

WN 3: Computation of portfolio return and Beta:

Security	Beta	Weight	Product	Return	Product
A Limited	0.45	65,000	29,250	7.00%	4,550
B Limited	1.15	20,000	23,000	8.50%	1,700
C Limited	1.80	15,000	27,000	9.50%	1,425
Overall	0.7925	1,00,000	79,250	7.675%	7,675

Part II - Optimum Weights for Risk Reduction**12. Risk reduction [Nov 2015 MTP, May 2019 RTP, Nov 2010, Nov 2016 MTP, Nov 2012 RTP]**

An investor has decided to invest Rs.1,00,000 in the shares of two companies, namely, ABC and XYZ. The returns and their probability is given below:

Probability	ABC (%)	XYZ (%)
0.20	12	16
0.25	14	10

0.25	-7	28
0.30	28	-2

- Comment on return and risk of investment in individual shares.
- Compare the risk and return of these two shares with a Portfolio of these shares in equal proportions.
- Find out the proportion of each of the above shares to formulate a minimum risk portfolio.

Answer:

WN 1: Computation of risk and return of individual securities:

Prob	Security ABC				Security XYZ				Pd _{abc} d _{xyz}
	Return	Product	Deviation	Pd ²	Return	Product	Deviation	Pd ²	
0.20	12	2.4	-0.55	0.06	16	3.2	3.9	3.04	-0.43
0.25	14	3.5	1.45	0.53	10	2.5	-2.1	1.1	-0.76
0.25	-7	-1.75	-19.55	95.55	28	7	15.9	63.2	-77.71
0.30	28	8.4	15.45	71.61	-2	-0.6	-14.1	59.64	-65.35
Total		12.55		167.75		12.1		126.98	-144.25

Return of ABC	=	12.55%
Risk of ABC	$\sqrt{167.75}$	12.95%
Return of XYZ	=	12.10%
Risk of XYZ	$\sqrt{126.98}$	11.27%

Comments:

- Security ABC provides higher return than XYZ. However, the same is offset by higher risk

WN 2: Computation of Portfolio return and Portfolio Risk:

Portfolio return	=	$(0.5 \times 12.55) + (0.5 \times 12.10) = 12.325\%$
Portfolio Variance	=	$(\sigma_a W_a)^2 + (\sigma_x W_x)^2 + 2W_a W_x \text{COV}_{ax}$
Portfolio Variance	=	$(12.95 \times 0.50)^2 + (11.27 \times 0.50)^2 + 2(0.5)(0.5)(-144.25)$
Portfolio Variance	=	$41.93 + 31.75 - 72.13 = 1.55$
Portfolio SD	=	$\sqrt{1.55} = 1.24\%$

WN 3: Computation of weights for minimum risk portfolio:

Weight of security 1	=	$\frac{\text{Variance of Security 2} - \text{Covariance of 1 \& 2}}{\text{Variance of Security 1} + \text{Variance of Security 2} - 2\text{Covariance of 1 \& 2}}$
Weight of security 1	=	$\frac{126.98 + 144.25}{167.75 + 126.98 + 2(144.25)} = \frac{271.23}{583.23} = 0.4650$
Weight of security 2	=	$\frac{\text{Variance of Security 1} - \text{Covariance of 1 \& 2}}{\text{Variance of Security 1} + \text{Variance of Security 2} - 2\text{Covariance of 1 \& 2}}$
Weight of security 2	=	$\frac{167.75 + 144.25}{167.75 + 126.98 + 2(144.25)} = \frac{312.00}{583.23} = 0.5350$

Optimum weights for risk reduction:

- Weight of ABC = 0.465 or 46.50%
- Weight of XYZ = 0.535 or 53.50%

13. Risk reduction:

ABC owns a portfolio of two securities with the following expected return, standard deviation and weights:

Security	Expected return	Standard deviation	Weight
X	12%	15%	0.40
Y	15%	20%	0.60

- ❖ What are the maximum and minimum portfolio standard deviations for varying levels of correlation between two securities [Start with correlation of -1 and increase the same by 0.25]?
- ❖ If correlation is -1, calculate the proportion of the individual securities in the portfolio to reduce the risk to zero.

Answer:

WN 1: Computation of Portfolio SD for varying levels of co-relation coefficient:

Portfolio Variance	=	$(\sigma_x W_x)^2 + (\sigma_y W_y)^2 + 2\sigma_x W_x \sigma_y W_y \text{COR}_{xy}$

Corelation coefficient	Portfolio variance	Portfolio SD
-1.00	36.00	6.00
-0.75	72.00	8.49
-0.50	108.00	10.39
-0.25	144.00	12.00
0.00	180.00	13.42
0.25	216.00	14.70
0.50	252.00	15.87
0.75	288.00	16.97
1.00	324.00	18.00

Note:

- Scenario 1 (Variance) = $(0.40 \times 15)^2 + (0.60 \times 20)^2 + 2(0.40)(15)(0.60)(20)(-1)$
- Portfolio variance = $36 + 144 - 144 = 36$
- Portfolio variance can be computed in same manner for other scenarios

WN 2: Computation of optimum weights for risk reduction:

Weight of security 1	=	$\frac{\text{Variance of Security 2} - \text{Covariance of 1 \& 2}}{\text{Variance of Security 1} + \text{Variance of Security 2} - 2\text{Covariance of 1 \& 2}}$
Weight of security 1	=	$\frac{400 + 300}{225 + 400 - 2(-300)} = \frac{700.00}{1,225} = 0.5714 \text{ Times}$
Weight of Security 2	=	$1 - \text{weight of security 1} = 1 - 0.5714 = 0.4286 \text{ Times}$

- Weight of 0.5714 Times for Security 1 and 0.4286 Times for Security 2 will make the risk as zero

14. Minimum variance portfolio [May 2009]

An investor has two portfolios known to be on minimum variance set for a population of three securities A, B and C having below mentioned weights:

	WA	WB	WC
Portfolio X	0.30	0.40	0.30
Portfolio Y	0.20	0.50	0.30

- What would be the weight for each stock for a portfolio constructed by investing Rs.5,000 in portfolio X and Rs.3000 in portfolio Y?
- Suppose the investor invests Rs.4,000 out of Rs.8,000 in security A. How he will allocate the balance between Security B and Security C to ensure that his portfolio is on minimum variance set?

Answer:**WN 1: Computation of weight of A, B and C:**

Particulars	Security A	Security B	Security C
Investment in Portfolio X [5,000]	1,500	2,000	1,500
Investment in Portfolio Y [3,000]	600	1,500	900
Total investment [8,000]	2,100	3,500	2,400
Weight of investment [Investment/8,000]	0.2625	0.4375	0.3000

WN 2: Computation of investment to be made in Security B and Security C:**Critical line between Security A and Security B:**

- Weight of Security A = a + b (Weight of Security B)
- $0.30 = a + 0.40b$ Equation 1
- $0.20 = a + 0.50b$ Equation 2
- Equation 2 - Equation 1: $-0.10 = 0.10b$; **b = -1**
- Substituting b in equation 1: $0.30 = a + 0.40(-1)$; **a = 0.70**
- **Weight of Security A = 0.70 - 1(Weight of Security B)**

Finding optimum weights:

Weight of security A	=	$\frac{4,000}{8,000} = 0.50 \text{ Times}$
Weight of Security B	=	$0.50 = 0.70 - \text{Weight of Security B}$

		Weight of Security B = 0.20 Times
Weight of Security C	=	1 – 0.50 – 0.20 = 0.30 Times

15. Building portfolio [May 2010, May 2016 MTP]

Ramesh wants to invest in stock market and has provided the following information:

Security	Expected Return	Beta	σ^2ci
A	15	1.5	40
B	12	2	20
C	10	2.5	30
D	09	1	10
E	08	1.2	20
F	14	1.5	30

Market index variance is 10 percent and the risk free rate of return is 7%. What should be the optimum portfolio assuming no short sales?

Answer:

Author's Note:

- This is an area which is different from normal questions and students normally find it difficult to remember steps. I would advise students to revise this day before exam so that they can answer in exams if it is tested

WN 1: Computation of Treynor Ratio for all securities (Step 1)

Security	Expected Return	Beta	σ^2ci	Excess return [Expected – Risk free]	Excess return Beta	Rank
A	15	1.5	40	8	5.33	1
B	12	2	20	5	2.50	3
C	10	2.5	30	3	1.20	5
D	9	1	10	2	2.00	4
E	8	1.2	20	1	0.83	6
F	14	1.5	30	7	4.67	2

$$\text{Treynor ratio} = \frac{\text{Excess return}}{\text{Beta}}$$

WN 2: Arranging the securities in the order of Treynor Ratio and computation of cumulative values (Step 2 to Step 4)

Security	Beta	σ^2ci	Excess return (ER)	$\frac{ER}{Beta}$	ER x Beta	$\frac{ER \times Beta}{\sigma^2ci}$	Cum values
A	1.5	40	8	5.33	12	0.30	0.3
F	1.5	30	7	4.67	10.5	0.35	0.65
B	2	20	5	2.50	10	0.50	1.15
D	1	10	2	2.00	2	0.20	1.35
C	2.5	30	3	1.20	7.5	0.25	1.6
E	1.2	20	1	0.83	1.2	0.06	1.66

WN 3: Computation of Cut-off Point (Step 5 to Step 8):

Security	Beta	σ^2ci	$\frac{Beta^2}{\sigma^2ci}$	Cum values	Cut-off point
A	1.5	40	0.05625	0.05625	1.920
F	1.5	30	0.07500	0.13125	2.811
B	2	20	0.20000	0.33125	2.667
D	1	10	0.10000	0.43125	2.541
C	2.5	30	0.20833	0.63958	2.163
E	1.2	20	0.07200	0.71158	2.045

$$\text{Cutoff Point} = \frac{\text{Market variance} \times \text{Cum value as per WN 2}}{1 + (\text{Market variance} \times \text{Cum value as per WN 3})}$$

$$\text{Cutoff Point for A} = \frac{10 \times 0.30}{1 + (10 \times 0.05625)} = 1.920$$

$$\text{Cutoff Point for F} = \frac{10 \times 0.65}{1 + (10 \times 0.13125)} = 2.811$$

Note: It would be computed in same manner for other securities

WN 4: Computation of Z-value and proportion of investment:

- Maximum cut-off point is 2.811 and hence securities till F (A and F) will form part of final portfolio.

Z-value computation:

$$Z - \text{value} = \left(\frac{\text{Beta}}{\sigma^2_{ci}} \right) \times (\text{Treynor ratio} - \text{Maximum cutoff point})$$

$$Z - \text{value for Security A} = \left(\frac{1.5}{40} \right) \times (5.33 - 2.811) = 0.0945$$

$$Z - \text{value for Security F} = \left(\frac{1.5}{30} \right) \times (4.67 - 2.811) = 0.0930$$

Proportion of investment:

Security	Z-value	Proportion of investment
A	0.0945	$\frac{0.0945}{0.1875} \times 100 = 50.40\%$
F	0.0930	$\frac{0.0930}{0.1875} \times 100 = 49.60\%$
Total	0.1875	

- We should invest 50.40% of investment in Security A and 49.60% investment in Security F for us to have the lowest risk

Part III - Security and Portfolio Beta

16. Calculation of Beta [Nov 2004]

Given below is information of market rates of return and data from two companies A and B:

	Year 2007	Year 2008	Year 2009
Market (%)	12.0	11.0	9.0
Company A (%)	13.0	11.5	9.8
Company B (%)	11.0	10.5	9.5

You are required to calculate Beta of company A and company B

Answer

Probability is not given in question and hence we can use formula 1 to compute Beta

WN 1: Computation of Beta of Company A:

Year	Company A return (X)	Market return (Y)	XY	Y ²
2007	13	12	156	144
2008	11.5	11	126.5	121
2009	9.8	9	88.2	81
Sum	34.3	32	370.7	346
Average	11.43	10.67		

$$\text{Beta} = \frac{(\sum XY - n(\text{Mean of X})(\text{Mean of Y}))}{\sum Y^2 - n(\text{Mean of Y})^2}$$

$$\text{Beta} = \frac{(370.7 - 3(11.43)(10.67))}{346 - 3(10.67^2)} = \frac{4.8257}{4.4533} = 1.0836 \text{ Times}$$

WN 2: Computation of Beta of Company B:

Year	Company B return (X)	Market return (Y)	XY	Y ²
2007	11	12	132	144

2008	10.5	11	115.5	121
2009	9.5	9	85.5	81
Sum	31	32	333	346
Average	10.33	10.67		

$$\text{Beta} = \frac{(\sum XY - n(\text{Mean of X})(\text{Mean of Y}))}{\sum Y^2 - n(\text{Mean of Y})^2}$$

$$\text{Beta} = \frac{(333 - 3(10.33)(10.67))}{346 - 3(10.67^2)} = \frac{2.3367}{4.4533} = 0.5247 \text{ Times}$$

17. Calculation of Beta [Nov 2011 RTP]

The following information is available for the share of X limited and market index for the past four years:

Years	X Ltd share price	X Limited Dividend Yield	Index of stock exchange	Dividend yield of market	Return from Government
Present year	197.00	10%	2182	16%	15%
1 year ago	164.20	12%	1983	15%	15%
2 year ago	155.00	8%	1665	16%	16%
3 year ago	121.00	10%	1789	10%	14%
4 year ago	95.00	10%	1490	18%	15%

With above information available please calculate:

- ❖ Expected return of X limited share
- ❖ Expected return on market index
- ❖ Risk free rate of return
- ❖ Beta of X Limited

Answer:

WN 1: Computation of return of X Limited:

- This is a tricky question and the prices have been given in the reverse order. Let us change the order and compute the return. It is assumed that present year is 2020

Year	Price	Capital appreciation	Capital appn % (Column 3/ Price of last year)	Dividend %	Return of X
2016	95	NA	NA	10	NA
2017	121	26	27.37	10	37.37
2018	155	34	28.1	8	36.1
2019	164.2	9.2	5.94	12	17.94
2020	197	32.8	19.98	10	29.98
Expected return on X Limited share (Average)					30.35%

- Capital appreciation of 2017 = $26/95 = 27.37\%$
- Capital appreciation of 2018 = $34/121 = 28.10\%$
- Return of X = Capital appreciation % + Dividend %

WN 2: Computation of return of Market Index:

Year	Price	Capital appreciation	Capital appn %	Dividend %	Return of market
2016	1490	NA	NA	18	NA
2017	1789	299	20.07	10	30.07
2018	1665	-124	-6.93	16	9.07
2019	1983	318	19.1	15	34.1
2020	2182	199	10.04	16	26.04
Expected return on Market Index (Average)					24.82%

WN 3: Computation of risk-free rate of return:

$$\text{Risk free rate of return} = \frac{15 + 15 + 16 + 14 + 15}{5} = 15\%$$

WN 4: Computation of Beta:

Year	Company X return (X)	Market return (Y)	XY	Y ²
2017	37.37	30.07	1123.72	904.2
2018	36.1	9.07	327.43	82.26
2019	17.94	34.1	611.75	1162.81
2020	29.98	26.04	780.68	678.08
Sum	121.39	99.28	2843.58	2827.35
Average	30.35	24.82		

$$\text{Beta} = \frac{(\sum XY - n(\text{Mean of X})(\text{Mean of Y}))}{\sum Y^2 - n(\text{Mean of Y})^2}$$

$$\text{Beta} = \frac{(2843.58 - 4(30.35)(24.82))}{2827.35 - 4(24.82^2)} = \frac{-169.57}{363.22} = -0.4669 \text{ Times}$$

Note:

- Answer does not match with ICAI solution. In ICAI solution Beta has been computed by substituting security return, market return and risk-free return in CAPM equation

- Beta as per ICAI solution:**

Rf + Beta x (Rm – Rf) = Return of security

$$15 + \text{Beta} \times (24.82 - 15) = 30.35$$

$$\text{a. Beta} = 15.35; \text{Beta} = \frac{15.35}{9.82} = 1.56 \text{ Times}$$

- This answer has been presented just to give ICAI solution. Beta as per me should be computed using the above formula and same would be -0.4669 Times

18. Computation of Beta [May 2017, May 2019 MTP]

The following information are available with respect of Krishna Limited:

Year	Krishna Limited Average Price	Dividend Per Share	Average Market Index	Dividend Yield	Return on Govt bonds
2012	245	20	2013	4%	7%
2013	253	22	2130	5%	6%
2014	310	25	2350	6%	6%
2015	330	30	2580	7%	6%

Compute Beta Value of the Krishna Limited at the end of 2015 and state your observation.

Answer:**WN 1: Computation of return of security 2013, 2014 and 2015:**

Year	Krishna Limited Average Price	Capital Appreciation	Dividend Per Share	Total return	Return in % [Total return/Last year price]
2012	245	NA	20	NA	NA
2013	253	8	22	30	12.24% [30/245]
2014	310	57	25	82	32.41% [82/253]
2015	330	20	30	50	16.13% [50/310]

WN 2: Computation of return of market for 2013, 2014 and 2015:

Year	Average Market Index	Capital appreciation	Capital appreciation %	Dividend Yield	Total return %
2012	2013	NA	NA	4%	NA
2013	2130	117	5.81% [117/2130]	5%	10.81%
2014	2350	220	10.33% [220/2130]	6%	16.33%
2015	2580	230	9.79%	7%	16.79%

[230/2350]

WN 3: Computation of Beta:

Year	Security return [X]	Market Index [Y]	XY	Y ²
2012-13	12.24	10.81	132.31	116.86
2013-14	32.41	16.33	529.25	266.67
2014-15	16.13	16.79	270.82	281.90
Total	60.78	43.93	932.38	665.43
Average	20.26	14.64		

$$\text{Beta} = \frac{(\sum XY - n\bar{X}\bar{Y})}{\sum Y^2 - n(\bar{Y})^2} = \frac{932.38 - 3 \times 20.26 \times 14.64}{665.43 - 3 \times 14.64^2} = 1.897$$

Observation:

Year	Expected return	Actual Return	Action
2012-13	6% + 1.897(10.81% - 6%) = 15.12%	12.24%	Sell
2013-14	6% + 1.897(16.33% - 6%) = 25.60%	32.41%	Buy
2014-15	6% + 1.897(16.79% - 6%) = 26.47%	16.13%	Sell

19. Calculation of Beta [May 2020 RTP, May 2006, Nov 2020 RTP]

The distribution of return of security 'F' and the market portfolio 'P' is given below:

Probability	Return of F (%)	Return of P (%)
0.30	30	-10
0.40	20	20
0.30	0	30

You are required to calculate the expected return of security 'F' and the market portfolio 'P', the covariance between the market portfolio and security and beta of the security

Answer:**Computation of expected return of security, market, covariance and Beta:**

Prob	Security F			Market P				Pd _i d _p
	Return	Product	Deviation	Return	Product	Deviation	Pd ²	
0.3	30	9	13	-10	-3	-24	172.8	-93.6
0.4	20	8	3	20	8	6	14.4	7.2
0.3	0	0	-17	30	9	16	76.8	-81.6
Total		17			14		264	-168

Return of Security F	=	17%
Return of Market P	=	14%
Covariance of security and market	=	-168
Beta of security	$\frac{\text{Covariance of security and Market}}{\text{Variance of Market}}$	$\frac{-168}{264} = -0.6364$

20. Standard deviation calculation [May 2019 MTP, May 2016 MTP, May 2013 RTP]

The following information is available in respect of security X

Equilibrium Return	15%
Market Return	15%
7% Treasury Bond Trading at	\$ 140
Co-variance of market return and security return	2.25%
Coefficient of correlation	0.75

You are required to determine the standard deviation of market return and security return.

Answer:

- Equilibrium return refers to the return to be earned by security as per CAPM
- Equilibrium return (15%) = $R_f + \text{Beta} \times (R_m - R_f)$

Calculating risk free rate:

- Risk free security is providing interest of 7 percent and is quoting at 140 \$

- Let us assume face value of treasury bond to be \$ 100
- Treasury bond would provide income of 7\$ on current market price of \$140

$$\text{Value of bond} = \frac{\text{Interest}}{\text{investor expectation}}; 140 = \frac{7}{\text{Investor expectation}}$$

$$\text{Investor expectation} = \frac{7}{140} = 0.05 \text{ or } 5\%; \text{Risk free rate} = 5\%$$

Computing Beta of Security:

- Equilibrium return (15%) = 5% + Beta (15% - 5%)
- 10% = 10%Beta
- Beta = 1 time

Computing standard deviation of market:

$$\text{Beta} = \frac{\text{Co - variance of security and market}}{\text{variance of market}}$$

$$1 = \frac{0.0225}{\text{Variance of market}}; \text{Variance of market} = 0.0225; \text{SD of market} = 0.15 \text{ or } 15\%$$

Computing standard deviation of security:

$$\text{Beta} = \frac{\text{SD of security}}{\text{SD of market}} \times \text{Correlation coefficient}$$

$$1 = \frac{\text{SD of security}}{0.15} \times 0.75; \text{SD of security} = \frac{1 \times 0.15}{0.75} = 0.20 \text{ or } 20\%$$

21. Computation of intrinsic value and required return [May 2016]

XYZ Limited paid a dividend of Rs.2 for the current year. The dividend is expected to grow at 40% for the next 5 years and at 15% per annum thereafter. The return on 182 days T-bills is 11% per annum and the market return is expected to be around 18% with a variance of 24%. The co-variance of XYZ's return with that of the market is 30%. You are required to calculate the required rate of return and intrinsic value of the stock.

Answer:

WN 1: Computation of required rate of return on stock (Ke):

Note 1: Computation of Beta:

Beta	=	$\frac{\text{Co - variance of security and market}}{\text{Variance of market}}$
Beta	=	$\frac{30}{24}$
Beta	=	1.25 Times

Note 2: Computation of required return:

Ke	=	Rf + Beta x (Rm - Rf)
Ke	=	11 + 1.25 x (18-11)
Ke	=	19.75%

WN 2: Computation of intrinsic value:

Note 1: Computation of Dividend till first year of stabilization phase:

- ❖ Dividends are expected to grow at 40% for 5 years. Growth will stabilize from sixth year onwards at 15%. Hence, we should calculate Dividends for first six years

Particulars	Dividend
Year 0	2
Year 1	2.80
Year 2	3.92
Year 3	5.49
Year 4	7.68
Year 5	10.76
Year 6	12.37

WN 2: Computation of market price at last year before stabilization phase:

- ❖ Growth stabilizes from sixth year and hence we should calculate market price at end of year 5

Market Price (P5)	$\frac{D_6}{(K_e - G)}$	$\frac{12.37}{(19.75\% - 15\%)}$	Rs.260.42

WN 3: Computation of fair market price:

Year	Cash flow	PVF @ 19.75%	DCF
1	2.80	0.825	2.34
2	3.92	0.697	2.73
3	5.49	0.582	3.19
4	7.68	0.486	3.73
5	271.18 [10.76+260.42]	0.406	110.10
Fair market price of share			122.09

22. Computation of Beta:

Pearl Limited expects that considering the current market prices, the equity share holders should get a return of atleast 15.50% while the current return on the market is 12%. RBI has closed the latest auction for Rs.2,500 crores of 182 days bills for the lowest bid of 4.3% although there were bidders at a higher rate of 4.6% also for lots less than Rs.10 Crores. What is Pearl Limited's Beta?

Answer:

Determining Risk free rate: Two risk free rates are given. The aggressive approach would be to consider 4.6% while the conservative approach would be to take 4.3%. If we take the moderate value then the simple average of the two (4.45%) would be considered

Computation of Beta:

Required return	=	$R_f + \text{Beta} \times (R_m - R_f)$
15.50	=	$4.45 + \text{Beta} \times (12 - 4.45)$
11.05	=	7.55 Beta
Beta	=	$\frac{11.05}{7.55} = 1.464 \text{ times}$

23. Share buy/sell decision [Nov 2009, Nov 2015 RTP]

An investor holds two stocks A and B. The probability distribution of the returns is:

Economic scenario	Probability	Conditional returns %		
		A	B	Market
Growth	0.40	25	20	18
Stagnation	0.30	10	15	13
Recession	0.30	-5	-8	-3

The risk free rate during the next year is expected to be around 11%. Determine whether the investor should liquidate his holdings in stocks A and B or on the contrary make fresh investments in them.

Answer:

- We are required to decide whether company can make fresh investments/liquidate its holdings. This can be done by computing Beta of A and B
- Beta combined with CAPM would give the required return of security. The same would be then compared with actual return to decide on fresh investments

WN 1: Computation of Beta of Company A:

Prob	Security A			Market			Pd ²	Pd _a d _m
	Return	Product	Deviation	Return	Product	Deviation		
0.4	25	10	13.5	18	7.2	7.8	24.34	42.12
0.3	10	3	-1.5	13	3.9	2.8	2.35	-1.26
0.3	-5	-1.5	-16.5	-3	-0.9	-13.2	52.27	65.34
Total		11.5			10.2		78.96	106.2

$$\text{Beta of Company A} = \frac{\text{Covariance of A and Market}}{\text{Variance of Market}} = \frac{106.20}{78.96} = 1.3450 \text{ Times}$$

WN 2: Computation of Beta of Company B:

Prob	Security B			Market				Pd _b d _m
	Return	Product	Deviation	Return	Product	Deviation	Pd ²	
0.4	20	8	9.9	18	7.2	7.8	24.34	30.89
0.3	15	4.5	4.9	13	3.9	2.8	2.35	4.12
0.3	-8	-2.4	-18.1	-3	-0.9	-13.2	52.27	71.68
Total		10.1			10.2		78.96	106.69

$$\text{Beta of Company B} = \frac{\text{Covariance of B and Market}}{\text{Variance of Market}} = \frac{106.69}{78.96} = 1.3512 \text{ Times}$$

WN 3: Decision on investment/redemption:

Particulars	Security A	Security B
1. Beta	1.3450	1.3512
2. Required return	9.9240 [11 + 1.3450 × [10.20 - 11]]	9.9190 [11 + 1.3512 × [10.20 - 11]]
3. Actual Return	11.50	10.10
4. Alpha	1.5760	0.1810

Conclusion:

- Security A and B generates higher return than expected return. This is also reflected in positive Alpha. Hence both are under-valued and we should make additional investment in company A and B

24. Mutual Funds – Performance Evaluation [Nov 2019]:

The returns of a Portfolio A and market portfolio for the last 12 months are indicated as follows:

Month	Portfolio A	Market Portfolio
January	-0.52	0.82
February	2.20	0.04
March	2.17	2.80
April	4.17	1.72
May	2.04	0.27
June	3.00	0.39
July	1.99	1.95
August	4.00	0.64
September	-1.38	1.53
October	2.67	2.70
November	3.99	2.52
December	1.86	2.09
Standard Deviation	1.6223	0.9498

- You are required to find out the monthly returns attributable to the sheer skill of the Portfolio Manager.
 - What part of the monthly return is attributable to the higher risk assumed by the Portfolio Manager?
- Assume that the risk-free rate of return is 12% per annum and the portfolio is fully diversified.

Answer:**WN 1: Computation of Average Portfolio and Market Return:**

Month	Portfolio A	Market Portfolio
Total return for 12 months	26.19	17.47
No of months	12	12
Return per month	2.1825	1.4558

WN 2: Computation of monthly return attributable to sheer skill of portfolio manager:

- Portfolio is fully diversified and hence we should compute the required return of portfolio as per CAPM
- The same should be compared with actual return and the excess return (Alpha) is considered as the return attributable to sheer skill of portfolio manager

Part 1: Beta of Portfolio:

- Portfolio is fully diversified and hence it will not carry any unsystematic risk. The standard deviation of the portfolio would be equal to its systematic risk

Systematic Risk = Beta of Security $\times$ SD of Market

1.6223 = Beta of Security $\times$ 0.9498

Beta of Security = $\frac{1.6223}{0.9498} = 1.7080$ Times

Part 2: Computation of required return as per CAPM:

CAPM return = $R_f + \text{Beta} \times (R_m - R_f)$

CAPM return = $1 + 1.7080 \times (1.4558 - 1)$

CAPM return = 1.7785%

Part 3: Excess return (Alpha) due to brilliance of portfolio Manager:

Particulars	Amount
Actual Return per month	2.1825%
CAPM required return per month	1.7785%
Excess return (Alpha) per month	0.4040%

WN 3: Computation of return attributable to higher risk of portfolio manager:

- Security A has Beta of 1.7080 Times as compared to market Beta of 1 Time. This would mean that portfolio manager is taking higher risk as compared to market
- Return of market is 1.4558% for Beta of 1 Time. Required return of Security A is 1.7785% for Beta of 1.7080 Times
- **Excess return due to higher risk** = $1.7785 - 1.4558 = 0.3227\%$ per month

25. Portfolio Beta

A Ltd has an expected return of 22% and standard deviation of 40%. B Ltd has an expected return of 24% and standard deviation of 38%. A Ltd has a beta of 0.86 and B Ltd has a beta of 1.24. The correlation between the return of A Ltd and B Ltd is 0.72. The standard deviation of the market return is 20%. Suggest

- Is investing in B Ltd better than A Ltd.
- If you invest 30% in B Ltd and 70% in A Ltd, what is your expected rate of return and how much is the portfolio standard deviation?
- What is the market portfolios rate of return and how much is the risk-free rate.
- What is the β of a portfolio if A Ltd weight is 70% and B Ltd is 30%

Answer:

WN 1: Investment decision:

- B Limited dominates A Limited because it generates higher return with lower risk. Therefore it is preferable to invest in B Limited

WN 2: Computation of portfolio return and portfolio SD:

Portfolio return	=	$(0.7 \times 22) + (0.3 \times 24) = 22.6\%$
Portfolio Variance	=	$(\sigma_a W_a)^2 + (\sigma_b W_b)^2 + 2\sigma_a W_a \sigma_b W_b \text{COR}_{ab}$ $(0.40 \times 0.7)^2 + (0.38 \times 0.3)^2 + 2 \times 0.40 \times 0.7 \times 0.38 \times 0.3 \times 0.72$ $0.0784 + 0.012996 + 0.045965 = 0.137361$
Portfolio SD	=	$\sqrt{0.137361} = 37.06\%$

WN 3: Computation of market return and risk-free rate:

CAPM return = $R_f + \text{Beta} \times (R_m - R_f)$
Return of A (22) = $R_f + 0.86 \times (R_m - R_f)$ -----equation 1
Return of B (24) = $R_f + 1.24 \times (R_m - R_f)$ -----equation 2
Subtracting equation 1 from equation 2
$2 = 0.38 (R_m - R_f); (R_m - R_f) = (2/0.38) = 5.26\%$
Substituting $(R_m - R_f)$ in equation 1
$22 = R_f + (0.86 \times 5.26)$
$R_f = 22 - 4.52; R_f = 17.48\%$
$(R_m - R_f) = 5.26$
$R_m - 17.48 = 5.26$
$R_m = 22.74\%$

WN 4: Computation of portfolio Beta:

Portfolio Beta = $(0.86 \times 0.7) + (1.24 \times 0.3) = 0.974$ Times

26. Portfolio Beta

You have Rs.10,00,000 to invest in a stock portfolio. Your choices are Stock A where you invest Rs.2,80,000, Stock B where you invest Rs.3,20,000 and stock C and risk free asset where you invest the balance. Given the beta of stock A is 0.9, stock B is 1.2 and Stock C is 1.6 and the overall beta is that of whole market, how much money you will invest in stock C and risk free asset.

Answer:

Computation of investment in Security C and Risk-free asset:

Let us assume A and B to be the investment in Security C and Risk-free asset

Security	Beta	Weight	Product
A	0.9	2,80,000	2,52,000
B	1.2	3,20,000	3,84,000
C	1.6	A	1.6A
Risk-free asset	0	B	0
Total	1	10,00,000	10,00,000 [10,00,000 x 1]

Note:

Computation of A:

- $2,52,000 + 3,84,000 + 1.6A = 10,00,000$
- $A = 3,64,000 / 1.60 = \text{Rs.}2,27,500$

Computation of B:

- $2,80,000 + 3,20,000 + 2,27,500 + B = 10,00,000$
- $B = \text{Rs.}2,72,500$

Conclusion:

- We should invest Rs.2,27,500 and Rs.2,72,500 in Security C and risk-free asset to have Beta of that of whole market (Beta of 1)

27. Portfolio Beta [May 2018 MTP, Nov 2018 RTP, Nov 2012, Nov 2015 MTP, Nov 2016 MTP]

Mr. Fed-up wants to invest an amount of Rs.520 lakhs and had approached his Portfolio Manager. The Portfolio Manager had advised Mr. Fed-up to invest in the following manner:

Security	Moderate	Better	Good	Very Good	Best
Amount (in Rs. Lakhs)	60	80	100	120	160
Beta	0.5	1	0.8	1.2	1.5

You are required to advise Mr. FedUp in regard to the following, using Capital Asset Pricing Methodology:

- Expected return on the portfolio, if the Government Secs are at 8% and NIFTY is yielding 10%.
- Advisability of replacing Security 'Better' with NIFTY.

Answer:

WN 1: Computation of Portfolio Beta and Portfolio Return:

Security	Beta	Weight	Product
Moderate	0.5	60	30
Better	1	80	80
Good	0.8	100	80
Very good	1.2	120	144
Best	1.5	160	240
Total	1.1038	520	574

- Portfolio Beta = 1.038 Times
- Portfolio Return = $8\% + 1.1038 \times (10\% - 8\%) = 8\% + 2.21\% = 10.21\%$

Advise on replacing Security 'Better' with NIFTY:

- Security Better has Beta of 1 Time. We can replace the same with NIFTY as the same will also have Beta of 1 Time

28. Portfolio Beta [May 2018 MTP, Nov 2007, May 2014 MTP, May 2014 RTP, May 2021 RTP]

XYZ Limited has substantial cash flow and until the surplus funds are utilized to meet the future capital expenditure, likely to happen after several months are invested in a portfolio of short term equity investments, details for which are given below:

Investment	No.of shares	Beta	MPS	Expected yield

A Ltd	60,000	1.16	4.29	19.5%
B Ltd	80,000	2.28	2.92	24%
C Ltd	1,00,000	0.90	2.17	17.5%
D Ltd	1,25,000	1.50	3.14	26%

The current market return is 19% and the risk free rate is 11%. Required to:

- Calculate the risk of the XYZ Ltd portfolio relative to market.
- Whether XYZ Limited should change the composition of its portfolio.

Answer:

WN 1: Computation of Actual Beta and Actual Return:

Security	Beta	Weight	Product	Return	Product
A Limited	1.16	2,57,400	2,98,584	19.50%	50,193
B Limited	2.28	2,33,600	5,32,608	24.00%	56,064
C Limited	0.90	2,17,000	1,95,300	17.50%	37,975
D Limited	1.50	3,92,500	5,88,750	26.00%	1,02,050
Total	1.4677	11,00,500	16,15,242	22.38%	2,46,282

- Overall beta = Sum of Product (Column 4)/Sum of weights
- Overall return = Sum of Product (Column 6)/Sum of weights

WN 2: Computation of equilibrium (fair) Beta:

$$\begin{aligned} \text{Return} &= R_f + \text{Beta} \times (R_m - R_f) \\ 22.38 &= 11 + \text{Beta} \times (19 - 11) \\ 11.38 &= 8\text{Beta} \\ \text{Fair Beta} &= \frac{11.38}{8} = 1.4225 \text{ Times} \end{aligned}$$

Comment on risk of portfolio:

- Actual Beta of Portfolio is 1.4677 Times whereas fair Beta is 1.4225 Times. This indicates that Portfolio carries more risk than required as actual Beta is higher than Fair Beta. Hence Portfolio is relatively more risky

WN 3: Advise on change in composition of Portfolio:

Security	Beta	CAPM Return [$R_f + \text{Beta} \times (R_m - R_f)$]	Actual Return	Decision
A Ltd	1.16	20.28	19.50	Sell as actual return is lower than CAPM return
B Ltd	2.28	29.24	24.00	Sell as actual return is lower than CAPM return
C Ltd	0.90	18.20	17.50	Sell as actual return is lower than CAPM return
D Ltd	1.50	23.00	26.00	Buy/hold as actual return is higher than CAPM return

29. Modification in portfolio Beta [Nov 2011, May 2017 MTP, Nov 2016 RTP]

A portfolio manager has the following four stocks in this portfolio:

Security	No. of shares	Market price per share	Beta
VSL	10,000	50	0.9
CSL	5,000	20	1.0
SML	8,000	25	1.5
APL	2,000	200	1.2

Compute the following:

- Portfolio β
- If the PM seeks to reduce the β to 0.8, how much risk free investment should he bring in?
- If the PM seeks to increase the β to 1.2 how much risk free investment should he bring in?

Answer:

WN 1: Computation of Portfolio Beta:

Security	Beta	Weight	Product
VSL	0.90	5,00,000	4,50,000
CSL	1.00	1,00,000	1,00,000
SML	1.50	2,00,000	3,00,000

APL	1.20	4,00,000	4,80,000
Total	1.1083	12,00,000	13,30,000

- Overall Beta = Sum of Product/Sum of weights = 1.1083 Times

WN 2: Reduction of Beta:**Option 1 – Bringing in fresh risk-free investment without selling shares:**

Let us assume B to be the amount of investment in risk-free asset

Security	Beta	Weight	Product
Risky portfolio	1.1083	12,00,000	13,30,000
Risk free asset	-	B	-
		16,62,500	
Overall	0.8000	[13,00,000/0.80]	13,30,000

- $12,00,000 + B = 16,62,500$; $B = 4,62,500$
- Portfolio manager should bring in risk-free investment of Rs.4,62,500

Option 2- Bringing in fresh risk-free investment by selling shares:

Let us assume A and B to be the amount of investment in risky portfolio and risk-free asset.

Security	Beta	Weight	Product
Risky portfolio	1.1083	A	1.1083A
Risk free asset	-	B	-
Total	0.8000	12,00,000	9,60,000

- $1.1083 A = 9,60,000$; $A = 8,66,191$
- $A + B = 12,00,000$; $8,66,191 + B = 12,00,000$; $B = 3,33,809$
- Portfolio manager should bring in risk-free investment of Rs.3,33,809 by selling shares

WN 3: Increasing the Beta:**Option 1 – Borrowing money and buying more shares:**

Let us assume A and B to be the amount of investment/borrowing in risky portfolio and risk-free asset

Security	Beta	Weight	Product
Risky portfolio	1.1083	A	1.1083A
Risk free asset	-	B	-
Total	1.2000	12,00,000	14,40,000

- $1.1083A = 14,40,000$; $A = 12,99,287$
- $A + B = 12,00,000$; $12,99,287 + B = 12,00,000$; $B = -99,287$
- Portfolio Manager should borrow Rs.99,287 and buy shares

Option 2 – Borrowing money and reducing own investment:

- Let us assume B to be the borrowing in risk-free asset
- Reducing own capital would mean that investor would borrow money but not buy new shares. Hence total of weights will become less than 12,00,000. This is because investor has reduced his own investment in the company

Security	Beta	Weight	Product
Risky portfolio	1.1083	12,00,000	13,30,000
Risk free asset	-	B	-
		11,08,333	
Total	1.2000	[13,30,000/1.20]	13,30,000

- $12,00,000 + B = 11,08,333$; $B = -91,667$
- Portfolio Manager should borrow Rs.91,667 to increase the Beta to 1.20 times

30. Portfolio Beta

You are analyzing a portfolio consisting of 4 securities. Data are:

Security	Beta	Expected return	Amount invested
A	1.4	16	3.8
B	0	6	5.2
C	0.7	10	6.1

D	1.1	13	2.9

Calculate portfolio return and beta and analyze the individual securities when market return is 10%.

Answer:

WN 1: Computation of Portfolio Return and Portfolio Beta:

Security	Beta	Weight	Product	Return	Product
A	1.40	3,80,000	5,32,000	16.00%	60,800
B	-	5,20,000	-	6.00%	31,200
C	0.70	6,10,000	4,27,000	10.00%	61,000
D	1.10	2,90,000	3,19,000	13.00%	37,700
Total	0.71	18,00,000	12,78,000	10.59%	1,90,700

- Portfolio Beta = 0.71 Times
- Portfolio Return (actual) = 10.59%
- Portfolio Return (fair) = $R_f + \text{Beta} \times (R_m - R_f) = 6\% + 0.71 \times (10\% - 6\%) = 8.84\%$

WN 2: Analysis of individual securities:

Security	Beta	CAPM Return [$R_f + \text{Beta} \times (R_m - R_f)$]	Actual Return	Decision
A Ltd	1.40	11.60	16.00	Buy/hold as actual return > CAPM return
B Ltd	0.00	6.00	6.00	Hold as actual return = CAPM return
C Ltd	0.70	8.80	10.00	Buy/hold as actual return > CAPM return
D Ltd	1.10	10.40	13.00	Buy/hold as actual return > CAPM return

31. Return for portfolio using CAPM [Nov 2005, Nov 2013, May 2015, May 2018]

Your client is holding the following securities:

Securities	Cost Rs.	Dividends/ Interest Rs.	Market price Rs.	Beta
Equity Shares:				
Gold Ltd.	10,000	1,725	9,800	0.6
Silver Ltd.	15,000	1,000	16,200	0.8
Bronze Ltd.	14,000	700	20,000	0.6
PSU Bonds	36,000	3,600	34,500	0.01

Average return on the portfolio is 15.7%. Calculate

- Expected rate of return in each, using the Capital Asset Pricing Model (CAPM)
- Risk free rate of return

Author's Note:

- This question lacks accuracy and we will be making lots of contradictory assumption. However, this is frequently tested in exam and hence students should not ignore this problem

WN 1: Computation of Return of Market:

- Let us assume market comprises of 1 share of Gold Limited, Silver Limited, Bronze Limited and 1 PSU Bonds

Security	Cost	Market price	Capital Appreciation	Dividends	Total return
Gold Ltd	10,000	9,800	-200	1,725	1,525
Silver Ltd	15,000	16,200	1,200	1,000	2,200
Bronze Ltd	14,000	20,000	6,000	700	6,700
PSU Bonds	36,000	34,500	-1,500	3,600	2,100
Total	75,000				12,525

$$\text{Return of market} = \frac{12,525}{75,000} \times 100 = 16.70\%$$

WN 2: Computation of Risk-free rate:

- Let us now consider the given portfolio as our portfolio and compute average Beta (Average is taken as simple average; weighted average can also be done)

$$\text{Beta of Portfolio} = \frac{0.6 + 0.8 + 0.6 + 0.01}{4} = 0.50 \text{ Times}$$

$$\text{Return of Portfolio} = R_f + \text{Beta} \times (R_m - R_f)$$

$$15.70 = R_f + 0.50 \times (16.70 - R_f)$$

$$15.70 = R_f + 8.35 - 0.5R_f$$

$$7.35 = 0.50R_f; R_f = \frac{7.35}{0.50} = 14.70\%$$

WN 3: Computation of expected rate of return for each security:

Particulars	Calculation	Amount
1. Gold Limited	$R_f + \text{Beta} \times (R_m - R_f)$ $14.70 + 0.6 \times (16.70 - 14.70)$	15.90%
2. Silver Limited	$14.70 + 0.8 \times (16.70 - 14.70)$	16.30%
3. Bronze Limited	$14.70 + 0.6 \times (16.70 - 14.70)$	15.90%
4. PSU Bonds	$14.70 + 0.01 \times (16.70 - 14.70)$	14.72%

32. Return for portfolio using CAPM [May 2008, May 2015 MTP]

A holds the following portfolio:

Share/Bond	Beta	Initial Price	Dividends	Market price at the end of year
Epsilon Ltd	0.8	25	2	50
Sigma Ltd	0.7	35	2	60
Omega Ltd	0.5	45	2	135
GOI Bonds	0.01	1,000	140	1,005

Calculate:

- ❖ The expected return on his portfolio using capital asset pricing method
- ❖ The average return on his portfolio

Risk free return is 14%

Answer:

Author's Note:

- This question also lacks accuracy. Again, we are doing this in ICAI manner as the same is frequently tested in exam
- I do not find any difference in expected return and average return. However both are asked and are done differently in suggested answers

WN 1: Computation of Market return/expected return of portfolio:

- Let us assume market comprises of one share of Epsilon Limited, Sigma Limited, Omega Limited and one GOI Bonds

Security	Cost	Market price	Capital appreciation	Dividends	Total return
Epsilon Limited	25	50	25	2	27
Sigma Limited	35	60	25	2	27
Omega Limited	45	135	90	2	92
GOI Bonds	1,000	1,005	5	140	145
Total	1,105				291

$$\text{Return of market} = \frac{291}{1,105} \times 100 = 26.33\%$$

$$\text{Expected return of portfolio} = 26.33\%$$

WN 2: Computation of average return of portfolio:

Particulars	Calculation	Amount
1. Epsilon Limited	$R_f + \text{Beta} \times (R_m - R_f)$ $14 + 0.80 \times (26.33 - 14.00)$	23.86%
2. Sigma Limited	$14 + 0.70 \times (26.33 - 14.00)$	22.63%
3. Omega Limited	$14 + 0.80 \times (26.33 - 14.00)$	20.17%
4. GOI Bonds	$14 + 0.01 \times (26.33 - 14.00)$	14.12%
Average return of portfolio		20.20%

33. Computation of expected return using CAPM [Nov 2013, May 2018]

Mr. Ram is holding the following securities:

Security	Cost	Dividends	Market Price	Beta
Equity shares:				
Gold Limited	11,000	1,800	12,000	0.6
Silver Limited	16,000	1,000	17,200	0.8
Bronze Limited	12,000	800	18,000	0.6
GOI Bonds	40,000	4,000	37,500	1.0

Calculate:

- Expected rate of return in each case, using the capital asset pricing model
- Average rate of return, if risk free rate of return is 14%

Answer:

WN 1: Computation of market return

Let us assume that market portfolio consists of 1 unit of Gold Limited, Silver Limited, Bronze Limited and GOI Bonds

Security	Investment	Dividends	Capital gains
Gold Limited	11,000	1,800	1,000
Silver Limited	16,000	1,000	1,200
Bronze Limited	12,000	800	6,000
GOI Bonds	40,000	4,000	-2,500
Total	79,000	7,600	5,700

$$\text{Expected return of market portfolio} = \frac{7,600 + 5,700}{79,000} = 16.84\%$$

WN 2: Computation of expected return of each security:

Return	=	Rf + beta x (Rm - Rf)	
Gold Limited	=	14 + 0.6 (16.84 - 14)	15.70%
Silver Limited	=	14 + 0.8 (16.84 - 14)	16.27%
Bronze Limited	=	14 + 0.6 (16.84 - 14)	15.70%
GOI Bonds	=	14 + 1.0 (16.84 - 14)	16.84%

WN 3: Computation of average rate of return:

Average Return	=	$\frac{15.70 + 16.27 + 15.70 + 16.84}{4}$	16.13%

34. Return based on CAPM [July 2021]

Mr. X is having 1 lakh shares of M/s. Kannyaka Ltd. The beta of the company is 1.40. Mr. Y a financial advisor has suggested having the following portfolio:

Security	Beta	% of holding
S	1.20	10
K	0.75	10
P	0.40	30
D	1.40	50

Market Return is 12% Risk free rate is 8%

You are required to calculate the following for the present investment and suggested portfolio:

- What is the expected return based on CAPM and also
 - If the market goes up by 2.5%.
 - If the market goes down by 2.5%
 - If the market gives Negative Returns of 2.5%
- If the probability of market giving negative return is more, please advise Mr. X whether to continue the holdings of M/s. Kannyaka Ltd. or to buy the portfolio as per the suggestion of Mr. Y. If so why?

Answer:

WN 1: Computation of Beta of Portfolio:

$$\text{Beta of Portfolio} = (1.20 \times 10\%) + (0.75 \times 10\%) + (0.40 \times 30\%) + (1.40 \times 50\%) = 1.015 \text{ Times}$$

WN 2: Computation of expected return of portfolio and present investment:

Situation	Rf	Rm	Present investment		Portfolio	
			Beta	Return	Beta	Return
Original	8	12	1.40	$= 8 + 1.40 \times (12 - 8)$ $= 8 + 5.60 = 13.60\%$	1.015	$= 8 + 1.015 \times (12 - 8)$ $= 8 + 4.06 = 12.06\%$
Market up by 2.5%	8	14.50	1.40	$= 8 + 1.40 \times (14.50 - 8)$ $= 8 + 9.10 = 17.10\%$	1.015	$= 8 + 1.015 \times (14.50 - 8)$ $= 8 + 6.60 = 14.60\%$
Market down by 2.5%	8	10.50	1.40	$= 8 + 1.40 \times (9.50 - 8)$ $= 8 + 2.10 = 10.10\%$	1.015	$= 8 + 1.015 \times (9.50 - 8)$ $= 8 + 1.52 = 9.52\%$
Market gives negative 2.5%	8	-2.50	1.40	$= 8 + 1.40 \times (-2.50 - 8)$ $= 8 - 14.70 = -6.70\%$	1.015	$= 8 + 1.015 \times (-2.50 - 8)$ $= 8 - 10.66 = -2.66\%$

Advise: If the probability of market giving negative return is more, it is advisable to Mr. X to buy the portfolio suggested by Mr. Y because Beta of the portfolio is less than of Kanniyaka Ltd.

35. Portfolio Beta [Nov 2022 SA]

M/s. Siri Ltd. Has a surplus amount of Rs. 3 crores to invest and has shortlisted the following equity shares:

Company	Beta
S Limited	1.60
K Limited	1.00
P Limited	-0.30
D Limited	2.00
C Limited	0.60

Required:

- If M/s. Siri Ltd. invests an equal amount in all securities, what is the beta of the portfolio?
- If M/s. Siri Ltd. invests 15% of its investment in S Ltd., 15% in P Ltd., 10% in C Ltd. and the balance in equal amount in the other two securities, what is the beta of the portfolio?
- If the expected return of market portfolio is 12% at a beta factor of 1.0, what will be the portfolios expected return in both the situations given above?
- If the Company changes its policy to invest in any 3 securities with a minimum of 20% in each of these 3 securities to diversify risk, you are requested to advise the company to have a right mix of securities to maximize the return in the following two scenarios and also calculate the expected return:
 - Bull Phase: Expected Market returns 10%
 - Bear Phase: Expected Market returns – 5%

Answer:

WN 1: Portfolio Beta with equal investment:

Security	Beta	Weight	Product
S Limited	1.60	0.20	0.32
K Limited	1.00	0.20	0.20
P Limited	-0.30	0.20	-0.06
D Limited	2.00	0.20	0.40
C Limited	0.60	0.20	0.12
Overall Beta			0.98

WN 2: Portfolio Beta with given proportion:

Security	Beta	Weight	Product
S Limited	1.60	0.15	0.24
K Limited	1.00	0.30	0.30
P Limited	-0.30	0.15	-0.045
D Limited	2.00	0.30	0.60
C Limited	0.60	0.10	0.06
Overall Beta			1.155

WN 3: Portfolio return for the above composition:

- Return for part one = Beta x Return of Market = $0.98 \times 12 = 11.76\%$
- Return for part two = Beta x Return of Market = $1.155 \times 12 = 13.86\%$

WN 4: Portfolio composition during bull phase and bear phase:

- We should invest maximum in securities having higher Beta to maximize returns in bull phase
- We are required to invest in three securities with minimum investment of 20%. Hence we can invest 60% in highest Beta Security, 20% in next security and balance 20% in third security.

Security	Beta	Weight	Product
S Limited	1.60	0.20	0.32
K Limited	1.00	0.20	0.20
P Limited	-0.30	0.00	0.00
D Limited	2.00	0.60	1.20
C Limited	0.60	0.00	0.00
Overall Beta			1.72

- Returns in bull market = $1.72 \times 10\% = 17.20\%$

Portfolio under Bear Phase:

- We should invest maximum in securities having lower Beta to minimize losses in bear phase
- We are required to invest in three securities with minimum investment of 20%. Hence, we can invest 60% in lowest Beta Security, 20% in next security and balance 20% in third security.

Security	Beta	Weight	Product
S Limited	1.60	0.00	0.00
K Limited	1.00	0.20	0.20
P Limited	-0.30	0.60	-0.18
D Limited	2.00	0.00	0.00
C Limited	0.60	0.20	0.12
Overall Beta			0.14

- Returns in bear market = $0.14 \times -5.00\% = -0.70\%$

Part IV - Systematic and Unsystematic Risk

36. Systematic and unsystematic risk [May 2019 MTP, Nov 2009, Nov 2015 RTP]

A study by a Mutual fund has revealed the following data in respect of three securities:

Security	S.D. (%)	Correlation with index
A	20	0.60
B	18	0.95
C	12	0.75

The standard deviation of market portfolio (BSE Sensex) is observed to be 15%.

- What is the sensitivity of returns of each stock with respect to the market?
- What is the covariance among the various stocks?
- What would be the risk of portfolio consisting of all the three stocks equally?
- What is the beta of the portfolio consisting of equal investment in each stock?
- What is the total, systematic and unsystematic risk of the portfolio in (d)?

Answer:

WN 1: Computation of Beta:

- Sensitivity of returns with respect to market is known as Beta

Beta of security	=	$\frac{\sigma_s}{\sigma_m} \times \text{COR}_{sm}$
Beta of A	=	$\frac{20}{15} \times 0.60 = 0.80 \text{ Times}$
Beta of B	=	$\frac{18}{15} \times 0.95 = 1.14 \text{ Times}$
Beta of C	=	$\frac{12}{15} \times 0.75 = 0.60 \text{ Times}$

WN 2: Computation of co-variance between stocks:

Co-variance between 1 and 2	=	Beta of 1 x Beta of 2 x variance of Market
Co-variance between 1 and 2	=	$0.80 \times 1.14 \times 225 = 205.20$
Co-variance between 1 and 3	=	Beta of 1 x Beta of 3 x Variance of Market

Co-variance between 1 and 3	=	$0.80 \times 0.60 \times 225 = 108$
Co-variance between 2 and 3	=	Beta of 2 $\times$ Beta of 3 $\times$ Variance of Market
Co-variance between 2 and 3	=	$1.14 \times 0.60 \times 225 = 153.90$

WN 3: Computation of Portfolio risk with equal investment in all three stocks:

Portfolio Variance	=	$(SD_a \times W_a)^2 + (SD_b \times W_b)^2 + (SD_c \times W_c)^2 + 2(W_a)(W_b)(COV_{ab}) + 2(W_a)(W_c)(COV_{ac}) + 2(W_b)(W_c)(COV_{bc})$
Portfolio variance	=	$(20 \times 0.3333)^2 + (18 \times 0.3333)^2 + (12 \times 0.3333)^2 + 2(0.3333)(0.3333)(205.20) + 2(0.3333)(0.3333)(108) + 2(0.3333)(0.3333)(153.90)$
Portfolio variance	=	$44.44 + 36 + 16 + 45.59 + 24 + 34.19 = 200.22$
Portfolio SD	=	14.15

WN 4: Computation of Beta of Portfolio consisting of all stocks equally:

$$\text{Portfolio Beta} = \frac{0.60 + 0.80 + 1.14}{3} = 0.8467 \text{ Times}$$

WN 5: Computation of total risk, systematic risk and unsystematic risk:

- Systematic and unsystematic risk can be computed under variance as well as SD approach. Variance approach is preferred if the problem is silent.

Particulars	Variance Approach	SD approach
1. Total risk	200.22	14.15
2. Systematic risk (SD of Market $\times$ Beta of Portfolio)	161.29 $(0.8467 \times 15)^2$	12.70 (0.8467×15)
3. Unsystematic risk (bal figure)	38.93	1.45

37. Systematic and unsystematic risk [May 2016 RTP]

The following details are given for X and Y companies' stocks and the Bombay Sensex for a period of one year. Calculate the systematic and unsystematic risk for the companies' stocks. What would be the portfolio risk if equal amount of money is allocated between these stocks?

	X Stock	Y Stock	Sensex
Average return	0.15	0.25	0.06
Variance of return	6.30	5.86	2.25
Beta	?	0.685	
Co-efficient of determination (r^2)	0.18	?	

Answer:**WN 1: Analysis of systematic and unsystematic risk:**

- Coefficient of determination (r^2) is given in the question. This would mean coefficient of determination under variance approach. If the same was mentioned as r then the same would be under SD approach

Particulars	Stock X	Stock Y
1. Total risk	6.30	5.86
2. Systematic risk	1.134 $[6.30 \times 0.18]$	1.056 $[0.685 \times 0.685 \times 2.25]$
3. Unsystematic risk	5.166	4.804
4. Co-efficient of determination (r^2)	0.18	0.18 $[1.056/5.86]$
5. Beta $\left(\sqrt{\frac{\text{Systematic risk}}{\text{Variance of Market}}}\right)$	0.7099 $\sqrt{\frac{1.134}{2.25}}$	0.685

WN 2: Computation of Portfolio risk:**Markowitz Approach:**

Portfolio Variance	=	$(\sigma_x W_x)^2 + (\sigma_y W_y)^2 + 2W_x W_y COV_{xy}$
Portfolio Variance	=	$(6.30 \times 0.5 \times 0.5) + (5.86 \times 0.5 \times 0.5) + 2(0.5)(0.5)(1.09)$

Portfolio variance	=	$1.58 + 1.47 + 0.55 = 3.60$
Portfolio SD	=	$\sqrt{3.60} = 1.90$

Computation of co-variance of X and Y:

Co-variance between X and Y = Beta of X x Beta of Y x Variance of Market

Co-variance between X and Y = $(0.7099) \times (0.6850) \times 2.25 = 1.09$

Sharpe Approach:

Particulars	Portfolio variance
1. Systematic risk (Note 1)	1.09
2. Unsystematic risk (Note 2)	2.49
3. Total Risk	3.58
4. Portfolio SD	1.89

Note 1: Computation of systematic risk:

Systematic risk = $(0.6975 \times 0.6975 \times 2.25) = 1.09$

Note 2: Computation of unsystematic risk:

Unsystematic risk = $(5.166 \times 0.5^2) + (4.804 \times 0.5^2) = 2.49$

38. Portfolio Beta [Nov 2018 MTP, May 2018 RTP, Nov 2017 MTP, May 2015, Jan 2021]

Following are the details of a portfolio consisting of three shares:

Share	Portfolio Weight	Beta	Expected return in %	Total Variance
A	0.20	0.40	14	0.015
B	0.50	0.50	15	0.025
C	0.30	1.10	21	0.100

Standard deviation of market portfolio returns is 10%. You are given the following additional data:

Covariance (A, B) = 0.030

Covariance (A, C) = 0.020

Covariance (B, C) = 0.040

Calculate the following:

- ❖ The Portfolio Beta
- ❖ Residual variance of each of the three shares
- ❖ Portfolio variance using Sharpe Index Model
- ❖ Portfolio variance (on the basis of modern portfolio theory given by Markowitz)

Answer:**WN 1: Computation of Portfolio Beta:**

Portfolio Beta = $(0.20 \times 0.40) + (0.50 \times 0.50) + (0.30 \times 1.10) = 0.66$

WN 2: Computation of residual variances:

Particulars	Share A	Share B	Share C
1. Total risk (variance)	0.0150	0.0250	0.1000
2. Systematic risk (Beta x Beta x variance of market)	0.0016	0.0025	0.0121
3. Unsystematic risk (Residual variance)	0.0134	0.0225	0.0879

WN 3: Computation of Portfolio variance as per Sharpe Index Model:

Particulars	Portfolio variance
1. Systematic risk (Note 1)	0.004356
2. Unsystematic risk (Note 2)	0.014072
3. Total Risk	0.018428

Note 1: Computation of systematic risk:

Systematic risk = $(0.66 \times 0.66 \times 0.1 \times 0.1) = 0.004356$

Note 2: Computation of unsystematic risk:

Unsystematic risk = $(0.0134 \times 0.2^2) + (0.0225 \times 0.5^2) + (0.0879 \times 0.3^2) = 0.014072$

WN 4: Computation of Portfolio Variance as per Markowitz approach:

Portfolio Variance	=	$(SD_a \times W_a)^2 + (SD_b \times W_b)^2 + (SD_c \times W_c)^2 + 2(W_a)(W_b)(COV_{ab}) + 2(W_a)(W_c)(COV_{ac}) + 2(W_b)(W_c)(COV_{bc})$
Portfolio variance	=	$(0.015 \times 0.20 \times 0.20) + (0.025 \times 0.50 \times 0.50) + (0.100 \times 0.30 \times 0.30) + 2(0.20)(0.50)(0.030) + 2(0.20)(0.30)(0.020) + 2(0.50)(0.30)(0.040)$
Portfolio variance	=	$0.0006 + 0.00625 + 0.009 + 0.006 + 0.0024 + 0.012$
Portfolio variance	=	0.03625

39. Portfolio standard deviation [May 2012, Nov 2018 MTP, Nov 2016 RTP]

A portfolio has been constructed with the following features:

Security	B	Random Error, $\sigma_{\epsilon i}$	Weight
A	1.50	6	.3
B	1.10	10	.2
C	1.30	4	.2
D	0.80	12	.2
E	0.90	7	.1

Find out the risk of the portfolio given that the standard deviation of the market index is 20%.

Answer:

WN 1: Computation of Portfolio Beta and Portfolio Unsystematic risk:

Security	Beta	Weight	Product	Random error (SD)	Product
A	1.5	0.3	0.45	6	3.24
B	1.1	0.2	0.22	10	4
C	1.3	0.2	0.26	4	0.64
D	0.8	0.2	0.16	12	5.76
E	0.9	0.1	0.09	7	0.49
Total			1.18		14.13

- Random error is basically unsystematic risk (SD based unsystematic risk as the value is not squared)
- Product for column 6 = Random error x Random error x Weight x weight
- Beta of Portfolio = 1.18 Times
- Unsystematic risk of portfolio = 14.13 (weighted average of individual unsystematic risk; Random error is equal to unsystematic risk)

WN 2: Computation of Portfolio risk:

Particulars	Amount
1. Systematic risk $(1.18 \times 1.18 \times 20 \times 20)$	556.96
2. Unsystematic risk (Note 2)	14.13
3. Total Risk (Portfolio Variance)	571.09
4. Portfolio SD	$\sqrt{571.09} = 23.90$

40. Portfolio return and risk [May 2011 RTP]

Following information is available regarding expected return, standard deviation and beta of 6 shares are available in the stock market:

Security	Expected Return	Beta	S.D (%)
1	5	0.70	9
2	10	1.05	14
3	11	0.95	12
4	12.5	1.10	20
5	15	1.40	17.5
6	16	1.70	25

Suppose risk free rate of return is 4% and Market return is 6% and standard deviation is 10%. You are required to compute:

- Which security is under-valued and which is over-valued?
- Assuming that funds are equally invested in these six stocks, then compute

- a. Return of portfolio
 b. Risk of portfolio
 (iii) Suppose if above portfolio is invested in with margin of 40% and cost of borrowing is 4% then what will be the position.

Answer:**WN 1: Determination of under-valued and over-valued securities:**

Using CAPM we shall calculate the expected return of security and based on the same we can find the under-valued and over-valued securities

Security	Beta	Return as per CAPM	Expected Return	Status
1	0.70	$4 + 0.70 (6 - 4) = 5.4\%$	5	Over valued
2	1.05	$4 + 1.05 (6 - 4) = 6.1\%$	10	Under valued
3	0.95	$4 + 0.95 (6 - 4) = 5.9\%$	11	Under valued
4	1.10	$4 + 1.10 (6 - 4) = 6.2\%$	12.5	Under valued
5	1.40	$4 + 1.40 (6 - 4) = 6.8\%$	15	Under valued
6	1.70	$4 + 1.70 (6 - 4) = 7.4\%$	16	Under valued

Security 2 to 6 are under-valued as the expected return is higher than required return as per CAPM. Security 1 is overvalued as expected return is lower than required return as per CAPM.

WN 2: Computation of portfolio return and portfolio Beta:

Security	Expected Return	Beta
1	5	0.70
2	10	1.05
3	11	0.95
4	12.5	1.10
5	15	1.40
6	16	1.70
Average	11.58%	1.15

WN 3: Computation of portfolio risk:

- ❖ Portfolio Risk = Systematic risk of portfolio + Unsystematic risk of portfolio
- ❖ Systematic Risk = $(\text{Beta} \times \text{SD of Market})^2 = (1.15 \times 10)^2 = 132.25$
- ❖ Unsystematic Risk of Portfolio = 24.9 (refer Note 1)
- ❖ Portfolio Risk (Variance) = $132.25 + 24.9 = 157.15$
- ❖ Portfolio SD = $\sqrt{157.75} = 12.54\%$

Note 1: Computation of unsystematic Risk:

Security	S.D (%)	Variance	Beta	Systematic Risk (Beta x SD of Market) ²	Unsystematic Risk [Total Risk - Systematic Risk]	W ² x unsys Risk
1	9	81	0.7	49	32	0.89
2	14	196	1.05	110.25	85.75	2.38
3	12	144	0.95	90.25	53.75	1.49
4	20	400	1.1	121	279	7.75
5	17.5	306.25	1.4	196	110.25	3.06
6	25	625	1.7	289	336	9.33
Total						24.9

WN 4: Position of the investor if the above portfolio has been invested with margin of 40%:

Portfolio return = $1.40 \times 11.58 + (-0.4) \times 4 = 14.612\%$
Portfolio Risk = $1.40 \times 12.54 = 17.56\%$

41. Systematic and Unsystematic Risk [Nov 2019]:

Following are risk and return estimates for two stocks

Stock	Expected Return (%)	Beta	Specific SD of Expected Return (%)
A	14	0.8	35

B	18	1.2	45

The market index has a Standard Deviation (SD) of 25% and risk-free rate on Treasury Bills is 6%.

You are required to calculate:

(i) The standard deviation of expected returns on A and B.

(ii) Suppose a portfolio is to be constructed with the proportions of 25%, 40% and 35% in stock A, B and Treasury Bills respectively, what would be the expected return, standard deviation of expected return of the portfolio?

Answer:

WN 1: Computation of standard deviation of A and B:

- Specific SD of expected return refers to Unsystematic Risk

Particulars	A	B
Systematic risk (Beta x SD of Market) ²	400 (0.8 x 25) ²	900 (1.2 x 25) ²
Unsystematic risk	1225 (35) ²	2025 (45) ²
Total Risk (Variance)	1625	2925
Standard Deviation	40.31%	54.08%

WN 2: Computation of expected return and standard deviation of portfolio:

- Expected Return of portfolio = $(14 \times 0.25) + (18 \times 0.40) + (6 \times 0.35) = 12.80\%$
- Beta of Portfolio = $(0.80 \times 0.25) + (1.20 \times 0.40) + (0 \times 0.35) = 0.68$ Times
- Systematic risk of portfolio = $(0.68 \times 25)^2 = 289$
- Unsystematic risk of portfolio = $(35 \times 0.25)^2 + (45 \times 0.40)^2 + (0 \times 0.35)^2 = 400.56$
- Total risk of portfolio = $289 + 400.56 = 689.56$
- SD of portfolio = SQRT (689.56) = 26.26%**

42. Computation of systematic/unsystematic/sharpe/treynor [Nov 2020 RTP, May 2019 MTP, Nov 2016]

Mr. Abhishek is interested in investing Rs.2,00,000 for which he is considering following three alternatives:

- Invest Rs.2,00,000 in Mutual Fund X (MFX)
- Invest Rs.2,00,000 in Mutual Fund Y (MFY)
- Invest Rs.1,20,000 in MFX and Rs.80,000 in MFY

Average annual return earned by MFX and MFY is 15% and 14% respectively. Risk free rate of return is 10% and market rate of return is 12%

Co-variance of returns of MFX, MFY and market portfolio Mix are as follow:

Particulars	MFX	MFY	MIX
MFX	4.800	4.300	3.370
MFY	4.300	4.250	2.800
MIX	3.370	2.800	3.100

You are required to calculate:

- Variance of return from MFX, MFY and market return
- Portfolio return, beta, portfolio variance and portfolio standard deviation
- Expected return, systematic risk and unsystematic risk and
- Sharpe ratio, Treynor ratio and Alpha of MFX, MFY and Portfolio Mix

Answer:

WN 1: Computation of variance of return of MFX, MFY and Market return:

Variance of MFX	=	Co-variance between MFX and MFX	4.800
Variance of MFY	=	Co-variance between MFY and MFY	4.250
Variance of Market	=	Co-variance of MIX and MIX	3.100

Note: In this question we have taken portfolio mix of 60% and 40% as market return

WN 2: Computation of portfolio return, beta, portfolio variance and portfolio standard deviation:

Weight of MFX in portfolio	=	(1,20,000/2,00,000)	60%
Weight of MFY in portfolio	=	(80,000/2,00,000)	40%

Portfolio return	=	$0.60 \times 15\% + 0.40 \times 14\%$	14.60%
Beta of MFX	=	$\frac{\text{Co - variance of MFX and market}}{\text{Variance of market}}$	$\frac{3.370}{3.100} = 1.087$
Beta of MFY	=	$\frac{\text{Co - variance of MFY and market}}{\text{Variance of market}}$	$\frac{2.800}{3.100} = 0.903$
Portfolio Beta	=	$(0.60 \times 1.087) + (0.40 \times 0.903)$	1.013
Portfolio variance	=	$(W_X \times SD_X)^2 + (W_Y \times SD_Y)^2 + 2W_X W_Y \text{COV}_{XY}$	
Portfolio variance	=	$(0.60)^2 \times 4.800 + (0.40)^2 \times (4.250) + 2(0.60)(0.40)(4.300)$	4.472
Portfolio SD	=	$\sqrt{4.472}$	2.115

WN 3: Computation of expected return, systematic risk and unsystematic risk:**Note 1: Calculation of expected return:**

Particulars	MIX	MFX	MFY
Expected return ($R_f + \text{beta} \times (R_m - R_f)$)	$10\% + 1.0134(12\% - 10\%)$ =12.03%	$10\% + 1.087(12\% - 10\%)$ =12.17%	$10\% + 0.903(12\% - 10\%)$ =11.81%

Note 2: Calculation of systematic risk and unsystematic risk:

Particulars	MIX	MFX	MFY
Total risk	4.472	4.80	4.250
Systematic risk [$\text{beta}^2 \times \text{variance of market}$]	$(1.013)^2 \times 3.10$ = 3.181	$(1.087)^2 \times 3.10$ = 3.663	$(0.903)^2 \times 3.10$ = 2.528
Unsystematic risk [Total risk - Sys risk]	1.291	1.137	1.722

WN 4: Computation of Sharpe Ratio, Treynor Ratio and Alpha:

Particulars	MIX	MFX	MFY
Sharpe Ratio $\frac{\text{Expected return} - \text{Risk free}}{\text{Standard Deviation}}$	$\frac{14.60 - 10}{2.115}$ = 2.175	$\frac{15\% - 10\%}{\sqrt{4.800}}$ = 2.282	$\frac{14\% - 10\%}{\sqrt{4.250}}$ = 1.94
Treynor Ratio $\frac{\text{Expected return} - \text{Risk free}}{\text{Beta}}$	$\frac{14.60 - 10}{1.0134}$ = 4.54	$\frac{15\% - 10\%}{1.087}$ = 4.60	$\frac{14\% - 10\%}{0.903}$ = 4.43
Alpha (Actual return - required return)	$14.60 - 12.03\%$ = 2.57%	$15\% - 12.17\%$ = 2.83%	$14\% - 11.81\%$ = 2.19%

Part V - Characteristic Line, CML and SML**43. Characteristic line [May 2009, Nov 2016]**

The returns on stock A and market portfolio for a period of 6 years are as follows:

Year	Return on A (%)	Return on market portfolio (%)
1	12	8
2	15	12
3	11	11
4	2	-4
5	10	9.5
6	-12	-2

You are required to determine:

- Characteristic line for stock A
- The systematic and unsystematic risk of stock A.

Answer:

WN 1: Characteristic line:**Computation table for Beta:**

- Probability is not given in the question and hence we are assuming equal probability. Beta can also be computed under formula 1. However we need total risk of security for solving systematic and unsystematic risk

Prob	Security A				Market				$Pd_a d_m$
	Return	Product	Deviation	Pd^2	Return	Product	Deviation	Pd^2	

0.1667	12	2.00	5.67	5.36	8	1.33	2.26	0.85	2.14
0.1667	15	2.50	8.67	12.53	12	2.00	6.26	6.53	9.05
0.1667	11	1.83	4.67	3.64	11	1.83	5.26	4.61	4.09
0.1667	2	0.33	-4.33	3.13	-4	-0.67	-9.74	15.8	7.03
0.1667	10	1.67	3.67	2.25	9.5	1.58	3.76	2.36	2.3
0.1667	-12	-2.00	-18.33	56.01	-2	-0.33	-7.74	9.99	23.65
Total		6.33		82.92		5.74		40.15	48.26

Particulars	Calculation	Amount
1. Beta of Security (Covariance of security and Market/Variance of Market)	$\frac{(48.26)}{(40.15)}$	1.20
2. Required return (Beta x Rm)	(1.20×5.74)	6.89
3. Actual return		6.33
4. Alpha (Actual return - required return)		-0.56
5. Characteristic line (Alpha + (Beta x Rm)		$-0.56 + 1.20 R_m$

WN 2: Computation of systematic risk and unsystematic risk:

Particulars	Variance Approach	SD Approach
1. Total Risk	82.92	9.11
2. Systematic risk (Beta x SD of Market)	57.82	7.60
3. Unsystematic risk (balancing figure)	25.10	1.51

44. Characteristic line [Nov 2003, May 2015 RTP]

The rates of return on the security of company X and market portfolio for 10 periods are

Year	Return on X (%)	Return on market portfolio (%)
1	20	22
2	22	20
3	25	18
4	21	16
5	18	20
6	-5	8
7	17	-6
8	19	5
9	-7	6
10	20	11

- What is the beta of security X?
- What is the characteristic line for security X?

Answer:**WN 1: Computation of Beta:**

Year	Return of X	Return of Market (Y)	XY	Y ²
1	20	22	440	484
2	22	20	440	400
3	25	18	450	324
4	21	16	336	256
5	18	20	360	400
6	-5	8	-40	64
7	17	-6	-102	36
8	19	5	95	25
9	-7	6	-42	36
10	20	11	220	121
Total/Average	15	12	2157	2146

$$\text{Beta} = \frac{\sum XY - n(\text{Mean of X})(\text{Mean of Y})}{\sum Y^2 - n(\text{Mean of Y})^2} = \frac{2157 - 10(15)(12)}{2146 - 10(12)(12)} = \frac{357}{706} = 0.5057 \text{ Times}$$

WN 2: Characteristic line:

Particulars	Calculation	Amount
1. Required return (Beta x Rm)	(0.5057×12)	6.07
2. Actual return		15
3. Alpha		8.93
4. Characteristic line (Alpha + (Beta x Rm))		$8.93 + 0.5057R_m$

45. Security market line & capital market line [May 2018 RTP, May 2007, May 2015 MTP, Nov 2018 MTP, May 2014 RTP, May 2019 RTP]

Expected return on two stocks for particular market returns are given in the following table:

Market Return	Aggressive	Defensive
7%	4%	9%
25%	40%	18%

You are required to calculate:

- The Betas of the two stocks
- Expected return of each stock, if the market return is equally likely to be 7% or 25%
- The Security Market Line (SML), if the risk free rate is 7.5% and market return is likely to be 7% or 25%
- The Alphas of the two stocks
- Capital market line

Answer:

WN 1: Computation table for Beta:

Security A:

Prob	Aggressive				Market				$Pd_a d_m$
	Return	Product	Deviation	Pd^2	Return	Product	Deviation	Pd^2	
0.5	4	2	-18	162	7	3.5	-9	40.5	81
0.5	40	20	18	162	25	12.5	9	40.5	81
Total		22		324		16		81	162

Security B:

Prob	Aggressive				Market				$Pd_b d_m$
	Return	Product	Deviation	Pd^2	Return	Product	Deviation	Pd^2	
0.5	4	2	-18	162	7	3.5	-9	40.5	20.25
0.5	40	20	18	162	25	12.5	9	40.5	20.25
Total		22		324		16		81	40.5

WN 2: Beta, Expected return and SML:

Particulars	Calculation	Amount
1. Beta of Aggressive	$(162/81)$	2 Times
2. Beta of Defensive	$(40.50/81)$	0.50 Times
3. Expected return of Aggressive	WN 1	22%
4. Expected return of defensive	WN 1	13.50%
5. Security Market Line	$R_f + \text{Beta} \times (R_m - R_f)$ $7.5 + \text{Beta} \times (16 - 7.5)$	$7.5 + 8.50 \text{ Beta}$

WN 3: Computation of Alpha:

Computation of Alpha:

Particulars	Characteristic Line Approach	CAPM Approach
Security Aggressive		
1. Required return	32% [Beta x Rm]	24.50% $R_f + \text{Beta} \times (R_m - R_f)$
2. Actual Return	22%	22%
3. Alpha	-10%	-2.50%
Security Defensive		
1. Required return	8% [0.5 x 16]	11.75% [7.5 + 0.5 x 8.5]
2. Actual Return	13.50%	13.50%

3. Alpha	5.50%	1.75%

WN 4: Capital Market Line:

$$\text{Capital Market Line} = R_f + \frac{\text{SD of Security}}{\text{SD of Market}} \times (R_m - R_f) = 7.50\% + \left(\frac{\text{SD of Security}}{9}\right) \times 8.50\%$$

46. Security market line [May 2012 RTP]

Assuming that two securities X and Y are correctly priced on SML and expected return from these securities are 9.40% (Return of X) and 13.40% (Return of Y) respectively. The Beta of these securities is 0.80 and 1.30 respectively. Mr. A, an investment manager states that the return on market index is 9%. You are required to determine:

- ❖ Whether the claim of Mr.A is right. If not then what is the correct return on market index?
- ❖ Risk Free Rate of Return

Answer:

Expected return of X = $R_f + \text{Beta} \times (R_m - R_f)$ $9.40 = R_f + 0.80 \times (R_m - R_f)$ Equation 1
Expected return of Y = $R_f + \text{Beta} \times (R_m - R_f)$ $13.40 = R_f + 1.30 \times (R_m - R_f)$ Equation 2
Subtracting 1 from equation 2: $4.00 = 0.50 \times (R_m - R_f); (R_m - R_f) = 8.00$
Substituting risk premium in equation 1 $9.40 = R_f + 0.80 \times 8; R_f = 3\%$
$(R_m - R_f) = 8\%; (R_m - 3\%) = 8\%; R_m = 11\%$

- Claim of Mr.A is not right. The correct return of market is 11%
- Risk-free rate is 3%

47. Security Market Line:

Assuming that shares of ABC Limited and XYZ Limited are correctly priced according to capital asset pricing model. The expected return from and Beta of these shares are as follows:

Share	Beta	Expected Return
ABC	1.20	19.8%
XYZ	0.9	17.10

You are required to derive Security Market Line

Computation of Risk-free rate and Market return:

Return as per CAPM= $R_f + \text{Beta} \times (R_m - R_f)$
Equation for ABC: $19.80\% = R_f + 1.20 \times (R_m - R_f)$
Equation for XYZ: $17.10\% = R_f + 0.90 \times (R_m - R_f)$
Solving two equations we will get: $R_f = 9\%; R_m = 18\%$

- ❖ SML equation = $R_f + \text{Beta} \times (R_m - R_f)$
- ❖ SML equation = $9 + \text{Beta} \times (18 - 9)$
- ❖ SML equation = $9 + (\text{Beta} \times 9)$

Part VI – Factor Sensitivity Analysis and Arbitrage Pricing Theory**48. Miscellaneous – Factor sensitivity analysis [Nov 2018, Nov 2009, May 2021 MTP]**

Mr. X own a portfolio with the following characteristics:

Particulars	Security A	Security B	Risk Free Security
Factor 1 sensitivity	0.80	1.50	0
Factor 2 sensitivity	0.60	1.20	0
Expected Return	15%	20%	10%

It is assumed that security returns are generated by a two factor model.

- a) If Mr. X has Rs. 1, 00,000 to invest and sells short Rs. 50,000 of security B and purchases Rs. 1, 50,000 of security A what 'is the sensitivity of Mr. X's portfolio to the two factors?

- b) If Mr. X borrows Rs. 1,00,000 at the risk free rate and invests the amount he borrows along with the original amount of Rs. 1,00,000 in security A and B in the same proportion as described in part (i), what is the sensitivity of the portfolio to the two factors?
- c) What is the expected return premium of part 2?

Answer:**WN 1: Computation of sensitivity of Portfolio to Factor 1 and Factor 2:**

Security	Weight	Factor 1 Beta	Product	Factor 2 Beta	Product
Security A	1,50,000	0.80	1,20,000	0.60	90,000
Security B	-50,000	1.50	-75,000	1.20	-60,000
Total	1,00,000	0.45	45,000	0.30	30,000

- Factor 1 sensitivity of Portfolio = $45,000/1,00,000 = 0.45$ Times
- Factor 2 sensitivity of Portfolio = $30,000/1,00,000 = 0.30$ Times

WN 2: Computation of sensitivity of Portfolio to Factor 1 and Factor 2:

Security	Weight	Factor 1 Beta	Product	Factor 2 Beta	Product
Security A	3,00,000	0.80	2,40,000	0.60	1,80,000
Security B	-1,00,000	1.50	-1,50,000	1.20	-1,20,000
Risk-free security	-1,00,000	0.00	0	0.00	0
Total	1,00,000	0.90	90,000	0.60	60,000

- Factor 1 sensitivity of Portfolio = $90,000/1,00,000 = 0.90$ Times
- Factor 2 sensitivity of Portfolio = $60,000/1,00,000 = 0.60$ Times

WN 3: Computation of return premium:

Return = $R_f + (\text{Beta}_1 \times \text{RP}_1) + (\text{Beta}_2 \times \text{RP}_2)$
$15 = 10 + 0.80 \text{ RP}_1 + 0.60 \text{ RP}_2$ Equation 1
$20 = 10 + 1.50 \text{ RP}_1 + 1.20 \text{ RP}_2$ Equation 2
Equation 1 x 2
$30 = 20 + 1.60 \text{ RP}_1 + 1.20 \text{ RP}_2$
Subtracting equation 2 from above equation
$10 = 10 + 0.10 \text{ RP}_1$; $\text{RP}_1 = 0$
Substituting RP 1 in equation 1
$15 = 10 + 0 + 0.60 \text{ RP}_2$
$\text{RP}_2 = 5/0.60 = 8.33\%$
Return Premium of Factor 1 = 0%
Return Premium of Factor 2 = 8.33%
Return Premium for Part 2:
Return Premium = $(0.90 \times 0) + (0.60 \times 8.33) = 5\%$

49. Factor sensitivity analysis:

Mr. S owns the portfolio with the following characteristics:

Particulars	Security A	Security B	Risk Free Security
Factor 1 sensitivity	0.50	1.50	0
Factor 2 sensitivity	0.80	1.40	0
Expected Return	15%	20%	10%

It is assumed that the security's returns are generated by two factor model:

- ❖ In what combination one should invest in A and B, that the overall portfolio is insensitive to changes in factor 2?
- ❖ In what combination we should invest in A, B and risk free asset so that the overall portfolio is insensitive to changes in factor 2 and has sensitivity of 1 to factor 1?

Answer:**WN 1: Computation of combination of A and B to have Portfolio Factor 2 Beta of 0**

Let us assume W1 to be the investment in Security A and $(1 - W1)$ to be the investment in Security B

Security	Beta	Weight	Product
Security A	0.80	W1	$0.80W1$
Security B	1.40	$1 - W1$	$1.40 - 1.40W1$
Total	0	1	0

- $0.80W_1 + 1.40 - 1.40W_1 = 0$
- $0.60W_1 = 1.40$
- $W_1 = (1.40/0.60) = 2.3333$
- Investment in Security A = 2.3333; Investment in Security B = -1.3333

WN 2: Computation of weights of Security A, Security B and Risk free asset to have Factor 1 Beta of 1 and Factor 2 Beta of 0:

Let us assume a and b to be the proportion of investment in Security A and Security B

Security	Weight	Factor 1 Beta	Product	Factor 2 Beta	Product
Security A	a	0.50	0.50a	0.80	0.80a
Security B	b	1.50	1.50b	1.40	1.40b
Risk-free security	1 - a - b	0	0	0	0
Total	1		0.50a + 1.50b = 1		0.80a + 1.40b = 0

0.50a + 1.50b = 1.....Equation 1
0.80a + 1.40b = 0.....Equation 2
Equation 1 x 1.60
0.80a + 2.40b = 1.60
Subtracting equation 2 from above equation
b = 1.60 Times
Substituting b in equation 1
0.50a + 1.50(1.60) = 1
0.50a + 2.40 = 1
0.50a = -1.40
a = -2.80 Times
Weight of security A = -2.80 Times
Weight of Security B = 1.60 Times
Weight of Risk-free asset = 2.20 Times

50. Factor sensitivity analysis:

Assume that only two macro-economic factors, factor 1 and factor 2, impact security returns. Investments A, B and C have the following sensitivities to these two factors:

Investment	Beta of factor 1	Beta of factor 2
A	1.75	0.25
B	-1.00	2.00
C	2.00	1.00

We are given the expected risk premium is 4% on factor 1 and 8% on factor 2. According to the APT, what is the risk premium on each of the three stocks? Suppose we buy Rs.2,00,000 of A, Rs.50,000 of B and sell Rs.1,50,000 of C. What is the sensitivity of the portfolio to each of the two factors? What is the expected risk premium?

Answer:

WN 1: Computation of Risk Premium:

Risk Premium of Security = (Factor 1 Beta x RP of Factor 1) + (Factor 2 Beta x RP of Factor 2)
Risk Premium of Security A = $(1.75 \times 4) + (0.25 \times 8) = 9\%$
Risk Premium of Security B = $(-1.00 \times 4) + (2 \times 8) = 12\%$
Risk Premium of Security C = $(2 \times 4) + (1 \times 8) = 16\%$

WN 2: Computation of Portfolio Sensitivity:

Security	Weight	Factor 1 Beta	Product	Factor 2 Beta	Product
Security A	2,00,000	1.75	3,50,000	0.25	50,000
Security B	50,000	-1.00	-50,000	2.00	1,00,000
Security C	-1,50,000	2.00	-3,00,000	1.00	-1,50,000
Total	1,00,000	0	0	0	0

- Factor 1 Beta = $0/1,00,000 = 0$
- Factor 2 Beta = $0/1,00,000 = 0$
- Risk premium of portfolio = 0

51. Arbitrage pricing theory [Nov 2018 MTP, May 2011, May 2013 RTP]

Mr. Tamarind intends to invest in equity shares of a company the value of which depends upon various parameters as mentioned below:

Factor	Beta	Expected Value %	Actual Value %
GNP	1.20	7.70	7.70
Inflation	1.75	5.50	7.00
Interest rate	1.30	7.75	9.00
Stock market index	1.70	10.00	12.00
Industrial production	1.00	7.00	7.50

If the risk free rate of interest be 9.25%, how much is the return of the share under Arbitrage Pricing Theory?

Answer:

- Return under APT = Risk free rate + (Factor 1 Beta x Change in Factor 1) + (Factor 2 Beta x Change in Factor 2) + (Factor 3 Beta x Change in Factor 3) + (Factor 4 Beta x Change in Factor 4) + (Factor 5 Beta x Change in Factor 5)
- Return under APT = $9.25 + (1.20 \times 0) + (1.75 \times 1.50) + (1.30 \times 1.25) + (1.70 \times 2.00) + (1 \times 0.50)$
- Return under APT = 17.40%**

52. Arbitrage pricing theory:

The estimated factor sensitivity of ABC to the five macro-economic factors are given in the below table:

Factor	Factor Sensitivity	Risk Premium (%)
A	0.25	2.59
B	0.30	-0.66
C	-0.45	-4.32
D	1.60	1.49
E	0.80	3.61

Use APT model to calculate the required rate of return for ABC Limited when risk free rate is 4.1%

Answer:

- Return under APT = Risk free return + (Factor 1 Beta x Risk Premium of Factor 1) + (Factor 2 Beta x Risk Premium of Factor 2) + (Factor 3 Beta x Risk Premium of Factor 3) + (Factor 4 Beta x Risk Premium of Factor 4) + (Factor 5 Beta x Risk Premium of Factor 5)
- Return under APT = $4.1 + (0.25 \times 2.59) + (0.30 \times -0.66) + (-0.45 \times -4.32) + (1.60 \times 1.49) + (0.80 \times 3.61)$
- Return under APT = 11.77%**

53. Arbitrage Pricing Theory [Nov 2019 RTP]

Mr. Nirmal Kumar has categorized all the available stock in the market into the following types:

- Small cap growth stocks
- Small cap value stocks
- Large cap growth stocks
- Large cap value stocks

Mr. Nirmal Kumar also estimated the weights of the above categories of stocks in the market index. Furthermore, the sensitivity of returns on these categories of stocks to the three important factor are estimated to be:

Category of stocks	Weight in the market index	Factor I (Beta)	Factor II (Price Book)	Factor III (Inflation)
Small cap growth	25%	0.80	1.39	1.35
Small cap value	10%	0.90	0.75	1.25
Large cap growth	50%	1.165	2.75	8.65
Large cap value	15%	0.85	2.05	6.75
Risk premium		6.85%	-3.5%	0.65%

The rate of return on treasury bonds is 4.5%.

Required:

- Using arbitrage pricing theory, determine the expected return on the market index
- Using CAPM, determine the expected return on the market index

- (c) Mr. Nirmal Kumar wants to construct a portfolio constituting only the 'small cap value' and 'large cap growth' stocks. If the target beta for the desired portfolio is 1, determine the composition of his portfolio.

Answer:

WN 1: Computation of Market index return using APT:

Return under APT = $R_f + (\text{Factor 1 Beta} \times \text{RP}_1) + (\text{Factor 2 Beta} \times \text{RP}_2) + (\text{Factor 3 Beta} \times \text{RP}_3)$
Small cap growth = $4.5 + (0.80 \times 6.85) + (1.39 \times -3.50) + (1.35 \times 0.65) = 5.9925\%$
Small cap value = $4.5 + (0.90 \times 6.85) + (0.75 \times -3.50) + (1.25 \times 0.65) = 8.8525\%$
Large cap growth = $4.5 + (1.165 \times 6.85) + (2.75 \times -3.50) + (8.65 \times 0.65) = 8.4778\%$
Large cap value = $4.5 + (0.85 \times 6.85) + (2.05 \times -3.50) + (6.75 \times 0.65) = 7.535\%$
Return of Market Index = $(5.9925 \times 0.25) + (8.8525 \times 0.10) + (8.4778 \times 0.50) + (7.535 \times 0.15) = 7.7525\%$

WN 2: Computation of Market Index return using CAPM:

Return under CAPM = $R_f + (\text{Beta} \times \text{RP})$
Small cap growth = $4.5 + (0.80 \times 6.85) = 9.98\%$
Small cap value = $4.5 + (0.90 \times 6.85) = 10.665\%$
Large cap growth = $4.5 + (1.165 \times 6.85) = 12.4803\%$
Large cap value = $4.5 + (0.85 \times 6.85) = 10.3225\%$
Return of Market Index = $(9.98 \times 0.25) + (10.665 \times 0.10) + (12.4803 \times 0.50) + (10.3225 \times 0.15) = 11.35\%$

WN 3: Computation of portfolio weights for Beta of 1 Time:

Let us assume W1 to be the weight of small cap value and $(1 - W1)$ to be the weight of large cap Growth

Security	Beta	Weight	Product
Small cap value	0.90	W1	$0.90W1$
Large cap Growth	1.165	$1 - W1$	$1.165 - 1.165W1$
Total		1	$1.165 - 0.265W1 = 1$

$$\text{Weight of Small cap value} = \frac{0.1.65}{0.265} = 62.26\%$$

$$\text{Weight of Large cap growth} = 100 - 62.26\% = 37.74\%$$

54. Arbitrage pricing theory:

With the help of following data, determine the return of the security X

Factor	Risk premium associated with the factor	Beta
Market	4%	1.30
Growth rate of GDP	1%	0.30
Inflation	-4%	0.20

Risk free rate of return is 8%

Answer:

- Return under APT = Risk free return + (Factor 1 Beta x Risk Premium of Factor 1) + (Factor 2 Beta x Risk Premium of Factor 2) + (Factor 3 Beta x Risk Premium of Factor 3)
- Return under APT = $8.00 + (1.30 \times 4) + (0.30 \times 1.00) + (0.20 \times -4.00)$
- Return under APT = 12.70%**

Part VII - Beta and Leverages

55. Beta calculation [May 2015 RTP]

The total market value of the equity share of O.R.E. company is Rs.60,00,000 and the total value of the debt is Rs.40,00,000. The treasurer estimate that the beta of the stock is currently 1.5 and the expected risk premium on the market is 10 percent. The treasury bill rate is 8 percent.

Required:

- ❖ What is the Beta of company's existing portfolio of assets?
- ❖ Estimate the company's cost of capital and the discount rate to be used for expansion of the company's present business?
- ❖ What discount rate to be used for diversification into new business?

Answer:

- Beta of Assets side will be equal to Beta of liabilities side

Source	Beta	Weight	Product
Equity	1.50	60,00,000	90,00,000
Debt	0.00	40,00,000	0
Overall	0.90	1,00,00,000	90,00,000

- Beta of company's existing assets = 0.90 Times
- Cost of capital = $R_f + \text{Beta} \times (R_m - R_f) = 8 + 0.90 \times 10 = 17\%$
- **Expansion:** The company should use discount rate of 17% for expansion
- **Diversification:** However, in case of diversification into new business the risk profile of new business is likely to be different. Therefore, different discount factor has to be worked out for such business

56. Computation of Equity Beta:

A firm has an equity beta of 1.30 and is currently financed by 25% debt and 75% equity. What will be the company's new equity beta if the company changes its financing policy to 33% and 67% equity? Assume corporation tax to stand at 35%.

Answer:

WN 1: Computation of existing Beta:

Security	Beta	Weight	Product
Equity	1.30	0.75	0.975
Debt	0.00	0.1625	0
Firm	1.0685	0.9125	0.975

- ❖ Beta of debt will be zero in the absence of information
- ❖ Weight of debt = $0.25 \times (1 - \text{Tax rate}) = 0.25 \times 0.65 = 0.1625$
- ❖ Beta of firm = $\frac{\text{Sum of Product}}{\text{Sum of weight}} = \frac{0.975}{0.9125} = 1.0685$

WN 2: Computation of new equity Beta:

Security	Beta	Weight	Product
Equity	1.4106	0.67	0.9451
Debt	0.00	0.2145	0
Firm	1.0685	0.8845	0.9451

- ❖ Beta of firm will continue to be 1.0685 and hence the overall product would be equal to 0.9451 (1.0685 x 0.8845)
- ❖ Product for debt is zero and hence product for equity will be 0.9451
- ❖ Equity Beta = $\frac{0.9451}{0.67} = 1.41$ Times

57. Proxy Beta

ABC Limited is considering a shipping project for which it proposes to employ a debt-equity ratio of 2:1. The tax rate is 30 percent.

There are three firms, A, B and C engaged wholly in shipping. Their tax rate is 35 percent. Their equity betas and debt-equity ratios are as follows:

	Equity Beta	Debt-equity ratio
A	1.40	2.0
B	1.20	1.8
C	1.1	1.5

The risk-free rate is 8 percent and the expected return on the market portfolio is 14 percent. What is the average asset beta of the three firms A, B and C? Compute cost of equity of ABC Limited?

Answer:

WN 1: Computation of Asset Beta:

Firm A:

Source	Beta	Weight	Product
Equity	1.40	1	1.40
Debt	0	1.3	0
Overall	0.6087	2.3	1.40

- Weight for debt = $2 \times (1 - 0.35) = 1.30$ Times
- Overall beta = Sum of product/Sum of weights

- Overall Beta = $1.40/2.30 = 0.6087$ Times

Firm B:

Source	Beta	Weight	Product
Equity	1.20	1	1.20
Debt	0	1.17	0
Overall	0.5530	2.17	1.20

Firm C:

Source	Beta	Weight	Product
Equity	1.10	1	1.10
Debt	0	0.975	0
Overall	0.5570	1.975	1.10

$$\text{Average of Asset Beta} = \frac{0.6097 + 0.5530 + 0.5570}{3} = \mathbf{0.5729 \text{ Times}}$$

WN 2: Computation of equity Beta of ABC Limited:

Let us assume equity beta of ABC Limited to be A

Source	Beta	Weight	Product
Equity	A	1	A
Debt	0	1.40	0
Overall	0.5729	2.40	1.375 [0.5729 x 2.40]

- $A + 0 = 1.375$
- Equity Beta = 1.375 Times
- Cost of equity = $8 + 1.375 \times (14 - 8) = 8 + 8.25 = 16.25\%$

58. Computation of proxy Beta:

Excellent Ltd. is a frozen food packaging company and is looking to diversify its activities into the electronics business. The project it is considering has a return of 18% and Excellent Ltd. is trying to decide whether the project should be accepted or not. To help it decide it is going to use the CAPM. Tax rate is 35%. Risk free rate of return is 10% and market return is 14%. The company has to find a proxy beta for the project and has the following information on three companies in the electronics business:

a) Superior Ltd.

Equity beta of 1.33. Financed by 50% debt and 50% equity.

b) Admirable Ltd.

Admirable Ltd. has an equity beta of 1.30, but it has just taken on a totally unrelated project, accounting for 20% of the company's value, that has an asset beta of 1.4. The company is financed by 40% and 60% equity.

c) Meritorious Ltd.

Equity beta of 1.05. Financed by 35% debt and 65% equity.

Answer:**WN 1: Computation of Beta of Superior Limited:**

Security	Beta	Weight	Product
Equity	1.33	0.50	0.665
Debt	0.00	0.325	0
Firm	0.8061	0.825	0.665

WN 2: Computation of Beta of Admirable Limited:

Security	Beta	Weight	Product
Equity	1.30	0.60	0.78
Debt	0.00	0.26	0
Firm	0.9070	0.86	0.78

Analysis of asset side beta of Admirable Limited:

Project	Beta	Weight	Product
Related project	0.784	0.80	0.6270
Unrelated project	1.40	0.2	0.2800

Firm	0.9070	1	0.9070

- ❖ Overall Beta of assets side and liabilities side would remain same. Some part of asset beta is due to unrelated project and removing the effect of that we get related project beta as 0.784 times

WN 3: Computation of Beta of Meritorius:

Security	Beta	Weight	Product
Equity	1.05	0.65	0.6825
Debt	0.00	0.2275	0
Firm	0.778	0.8775	0.6825

WN 4: Computation of average beta for the project and required return:

- ❖ Average asset beta = $(0.8061 + 0.784 + 0.778) / 3 = 0.789$ times
- ❖ Required return of project = $R_f + \text{Beta} \times (R_m - R_f) = 10 + 0.789 \times (14 - 10) = 13.16\%$
- ❖ The project is giving a return of 18% and hence we should go ahead with the project

59. Proxy Beta:

Two companies are identical in all aspects except capital structure. ABC Limited has a debt-equity ratio of 1:4 and its equity has beta of 1.1. XYZ Limited has a debt-equity ratio of 3:4. Income tax is 30%. Estimate equity beta of XYZ Limited?

Answer:**WN 1: Computation of overall Beta of ABC Limited**

Source	Beta	Weight	Product
Equity	1.10	4	4.40
Debt	0	0.7	0
Overall	0.9362	4.70	4.40

WN 2: Computation of Equity Beta of XYZ Limited

Let us assume equity beta of XYZ Limited to be A

Source	Beta	Weight	Product
Equity	A	4	4A
Debt	0	2.1	0
Overall	0.9362	6.1	5.7108 [0.9362 x 6.10]

$$4A = 5.7108; A = \frac{5.7108}{4} = 1.4277 \text{ Times}$$

Equity Beta of XYZ Limited = 1.4277 Times

60. Beta calculation through Proxy [Nov 2017 RTP, Nov 2015 MTP]

ABC Limited manufactures Car Air Conditioners (ACs), Window ACs and Split ACs constituting 60%, 25% and 15% of total market value. The stand-alone standard deviation and coefficient of correlation with market return of Car AC and Window AC is as follows:

	Standard Deviation	Coefficient of Correlation
Car AC	0.30	0.6
Window AC	0.35	0.7

No data for stand-alone SD and Coefficient of Correlation of Split AC is available. However a company who derives its half value from Split AC and half from Window AC has a SD of 0.50 and Coefficient of correlation with market return is 0.85. Index has a return of 10% and has SD of 0.20. Further the risk-free rate of return is 4%.

You are required to determine:

- ❖ Beta of ABC Limited
- ❖ Cost of Equity of ABC Limited

Assuming that ABC Limited wants to raise debt of an amount equal to half of its market value then determine equity Beta, if yield of debt is 5%.

Answer:**WN 1: Computation of Beta of Car AC, Window AC and Proxy Company:**

Beta	=	$\frac{\sigma_s}{\sigma_m} \times \text{COR}_{sm}$

Beta of car AC	=	$\frac{0.30}{0.20} \times 0.60 = 0.90$ Times
Beta of window AC	=	$\frac{0.35}{0.20} \times 0.70 = 1.225$ Times
Beta of Proxy company	=	$\frac{0.50}{0.20} \times 0.85 = 2.125$ Times

WN 2: Computation of Beta of Split AC Business:

Let us assume Beta of Split AC business to be A

Source	Beta	Weight	Product
Split AC	A	0.50	0.50A
Window AC	1.225	0.50	0.6125
Overall	2.125	1.00	2.125

- $0.50A + 0.6125 = 2.125$
- $0.50A = 1.5125$
- $A = 1.5125/0.50 = 3.025$ Times
- **Beta of Split AC business = 3.025 Times**

WN 3: Computation of Beta of ABC Limited (Assets side):

Source	Beta	Weight	Product
Car AC	0.90	0.60	0.5400
Split AC	3.025	0.15	0.45375
Window AC	1.225	0.25	0.30625
Overall	1.30	1	1.30

- Beta of ABC Limited = 1.30 Times

WN 4: Computation of equity Beta of ABC Limited:

Let us assume equity beta of ABC Limited to be A

Source	Beta	Weight	Product
Equity	A	0.50	0.50A
Debt	0.1667	0.50	0.0833
Total	1.30	1.00	1.30

- $0.50A + 0.0833 = 1.30$
- $A = 1.2167/0.50 = 2.4333$
- **Equity Beta of ABC Limited = 2.4333 Times**

Note 1: Computation of Debt Beta:

$$\text{Return} = R_f + B \times (R_m - R_f)$$

$$5 = 4 + \text{Beta} \times (10 - 4)$$

$$1 = 6 \text{ Beta}$$

$$\text{Debt Beta} = \frac{1}{6} = 0.1667 \text{ Times}$$

WN 5: Computation of cost of equity:

$$\text{Cost of equity} = R_f + \text{Beta} \times (R_m - R_f)$$

$$\text{Cost of equity} = 4 + 2.4333 \times (10 - 4)$$

$$\text{Cost of equity} = 4 + 14.60 = 18.60\%$$

61. Computation of Beta [May 2020 MTP, Nov 2019, May 2021 RTP]

Equity of KGF Limited (KGFL) is Rs.410 crores, its debt, is worth Rs.170 Crores. Printer Division segments value is attributable to 74%, which has an Asset Beta of 1.45, balance value is applied to spares and consumables Division, which has an Asset beta of 1.20. KGFL Debt beta is 0.24.

You are required to calculate:

- Equity beta
- Ascertain Equity Beta, if KGF Limited decides to change its Debt Equity position by raising further debt and buying back of equity to have its Debt Equity Ratio at 1.90. Assume that the present Debt Beta is 0.35 and any further funds raised by way of Debt will have a Beta of 0.40
- Whether the new Equity Beta justifies increase in the value of equity on account of leverage?

Answer:**WN 1: Computation of Asset Beta of KGF Limited**

Source	Beta	Weight	Product
Printer	1.45	0.74	1.073
Spares	1.20	0.26	0.312
Total	1.385	1.00	1.385

- Asset Beta of KGF Limited = 1.385 Times

WN 2: Computation of equity Beta of KGF Limited

Let us assume equity Beta of KGF Limited to be A

Source	Beta	Weight	Product
Equity	A	410	410A
Debt	0.24	170	40.80
Total	1.385	580	803.30

- $410A + 40.80 = 803.30$
- $410A = 762.50$
- Equity Beta = 1.8596 Times (762.50/410)

WN 3: Computation of equity Beta post buy-back:

Let us assume equity Beta to be A

Source	Beta	Weight	Product
Equity	A	200	200A
Old Debt	0.35	170	59.50
New Debt	0.40	210	84.00
Total	1.385	580	803.30

- $200A + 59.50 + 84.00 = 803.30$
- $200A = 659.80$
- Equity Beta = 3.299 Times (659.80/200)

Note: Computation of debt raised

- Total capital of company (existing) = $410 + 170 = 580$ Crores
- Target debt equity ratio = 1.90 Times
- Debt = 1.90 Equity
- Debt + Equity = 580; $1.90\text{Equity} + \text{Equity} = 580$; $2.90\text{Equity} = 580$; Equity = 200 Crores
- Debt = 380 crores
 - Old debt = 170 Crores
 - New debt = 210 Crores

Conclusion:

- Increase in equity Beta is justified due to higher leverage. Equity Beta has increased from 1.8596 Times to 3.299 Times

Part VIII - Portfolio Strategies**62. SIP mode of investing:**

Two funds are available for investment. Fund A is being launched today (January 1, 2017) and available for investment at Rs.10 per unit. A similar fund B (same risk profile like Fund A) is also available for investment at Rs.19.45 per unit. The information of quarterly NAV for the next three quarters are available as given below. Assuming that investor X prefers fund A and investor Y prefers Fund B for investment through SIP with installment entailing Rs.2000 for the four quarters including the initial investment. Which investor (X or Y) would clock a higher return on investment on September 30, 2017 (Ignore time value of money)? Is the difference in return because of one investor chosen to invest at Rs.10 and other at Rs.19.45?

Closing NAV	Fund A	Fund B
December 31, 2016	10	19.45
March 31, 2017	11.1567	21.50
June 30, 2017	14.768	27.15
September 30, 2017	12.8554	23.69

Answer:**WN 1: Computation of units allotted to X and Y:**

Particulars	Fund A	Fund B
January 1	200.00	102.83
April 1	179.26	93.02
July 1	135.43	73.66
September 30	155.58	84.42
Total units	670.27	353.93

Note:

- Units allotted = Rs.2,000/NAV on investment date

WN 2: Computation of return of Mr.X and Mr.Y:

Particulars	Mr.X	Mr.Y
Total units	670.27	353.93
NAV as on Sep 30	12.8554	23.69
Value of units	8,616.59	8,384.60
Amount invested	8,000.00	8,000.00
Return (in Rs.)	616.59	384.60
Return (in %)	$\frac{616.59}{8,000} \times 100$ 7.71%	$\frac{384.60}{8,000} \times 100$ 4.81%

Conclusion:

- Mr.X is generating higher return of 7.71 percent as compared to 4.81 percent return of Mr.Y
- Higher return is not due to initial investment at Rs.10 for Fund A compared to Rs.19.45 for Fund B. Higher return is due to relatively higher increase in NAV of fund A.

63. Constant ratio plan [Nov 2016 MTP]

Mr. A is working with an MNC at Mumbai. She wants to invest in a fund which consist of equities only and the ending NAV's for the last 10 months are given below:

Month	Ending NAV	Month	Ending NAV
December 2015	40.00	May 2016	37.00
January 2016	25.00	June 2016	42.00
February 2016	36.00	July 2016	43.00
March 2016	32.00	August 2016	50.00
April 2016	38.00	September 2016	52.00

Assume Mr. A has invested a notional amount of Rs.2 lakhs equally in the equity fund and a conservative portfolio (of bonds) in the beginning of December 2015 and the total portfolio was being rebalanced each time the NAV of the fund increased or decreased by 15%. You are required to determine the value of the portfolio for each level of NAV following the constant ratio plan.

Answer:**Computation of value of portfolio for each level of NAV:**

Month	NAV	% change	Rebalance	Units	Equity	Bond	Total value
Dec	40.00	NA	NA	2,500.00	1,00,000	1,00,000	2,00,000
Jan before	25.00	-37.50	Yes	2,500.00	62,500	1,00,000	1,62,500
Jan after	25.00	-37.50	NA	3,250.00	81,250	81,250	1,62,500
Feb before	36.00	44.00	Yes	3,250.00	1,17,000	81,250	1,98,250
Feb after	36.00	44.00	NA	2,753.47	99,125	99,125	1,98,250
March	32.00	-11.11	No	2,753.47	88,111.11	99,125	1,87,236
Apr before	38.00	18.75	Yes	2,753.47	1,04,632	99,125	2,03,757
Apr after	38.00	18.75	NA	2,681.01	1,01,879	1,01,878	2,03,757
May	37.00	-2.63	No	2,681.01	99,198	1,01,878	2,01,076
June	42.00	13.51	No	2,681.01	1,12,603	1,01,878	2,14,481
July	43.00	2.38	No	2,681.01	1,15,284	1,01,878	2,17,162

Aug before	50.00	16.28	No	2,681.01	1,34,051	1,01,878	2,35,929
Aug after	50.00	16.28	NA	2,359.29	1,17,965	1,17,964	2,35,929
Sep	52.00	4.00	No	2,359.29	1,22,683	1,17,964	2,40,647

Explanation of different columns:

Column	Explanation
1	Month
2	NAV of the month
3	Change in NAV/Opening NAV
4	Rebalance will be yes if the change is more than 15%
5	Opening units + Purchase - Redemption as per action table
6	Value of equity = Units x NAV
7	Value of bond
8	Total value = Value of equity + Value of bond

Action in different months:

Month	Action
December	We will buy 2,500 units of MF to start with 50:50 mix
January	- NAV has changed by 37.50 percent and hence we should opt for rebalancing. The value of portfolio before re-balancing is Rs.1,62,500. Post re-balancing value of equity and bond will become Rs.81,250 - Number of units = $(81,250/25.00) = 3,250$ - We should buy 750 units to make the number of units as 3,250
February	- NAV has changed by 44 percent and hence we should opt for rebalancing. The value of portfolio before re-balancing is Rs.1,98,250. Post re-balancing value of equity and bond will become Rs.99,125 - Number of units = $(99,125/36.00) = 2,753.47$ - We should sell 496.53 units to make the number of units as 2,753.47
March	NAV has changed by 11.11 percent and hence there is no need for rebalancing
April	- NAV has changed by 18.75 percent and hence we should opt for rebalancing. The value of portfolio before re-balancing is Rs.2,03,757. Post re-balancing value of equity and bond will become Rs.1,01,878 - Number of units = $(1,01,878/38.00) = 2,681.01$ - We should sell 72.46 units to make the number of units as 2,681.01
May	NAV has changed by 2.63 percent and hence there is no need for rebalancing
June	NAV has changed by 13.51 percent and hence there is no need for rebalancing
July	NAV has changed by 2.38 percent and hence there is no need for rebalancing
August	- NAV has changed by 16.28 percent and hence we should opt for rebalancing. The value of portfolio before re-balancing is Rs.2,35,929. Post re-balancing value of equity and bond will become Rs.1,17,965 - Number of units = $(1,17,965/50.00) = 2,359.29$ - We should sell 321.72 units to make the number of units as 2,359.29
September	NAV has changed by 4.00 percent and hence there is no need for rebalancing

64. Constant ratio plan vs buy and hold strategy [Nov 2022 SA]

Mr. A is working with an MNC at Mumbai. She wants to invest in a fund which consist of equities only and the ending NAV's for the last 10 months are given below:

Month	Ending NAV	Month	Ending NAV
December 2015	40.00	May 2016	37.00
January 2016	25.00	June 2016	42.00
February 2016	36.00	July 2016	43.00
March 2016	32.00	August 2016	50.00
April 2016	38.00	September 2016	52.00

Assume Mr. A has invested a notional amount of Rs.2 lakhs equally in the equity fund and a conservative portfolio (of bonds) in the beginning of December 2015 and the total portfolio was being rebalanced each time the NAV of the fund increased or decreased by 15%. You are required to

- determine the value of the portfolio for each level of NAV following the constant ratio plan.
- Compare the value of the portfolio with buy and hold policy and state whether there are any errors in the technique developed by Mr.A? If so briefly explain.

Answer:**Computation of value of portfolio for each level of NAV:**

Month	NAV	% change	Rebalance	Units	Equity	Bond	Total value
Dec	40.00	NA	NA	2,500.00	1,00,000	1,00,000	2,00,000
Jan before	25.00	-37.50	Yes	2,500.00	62,500	1,00,000	1,62,500
Jan after	25.00	-37.50	NA	3,250.00	81,250	81,250	1,62,500
Feb before	36.00	44.00	Yes	3,250.00	1,17,000	81,250	1,98,250
Feb after	36.00	44.00	NA	2,753.47	99,125	99,125	1,98,250
March	32.00	-11.11	No	2,753.47	88,111.11	99,125	1,87,236
Apr before	38.00	18.75	Yes	2,753.47	1,04,632	99,125	2,03,757
Apr after	38.00	18.75	NA	2,681.01	1,01,879	1,01,878	2,03,757
May	37.00	-2.63	No	2,681.01	99,198	1,01,878	2,01,076
June	42.00	13.51	No	2,681.01	1,12,603	1,01,878	2,14,481
July	43.00	2.38	No	2,681.01	1,15,284	1,01,878	2,17,162
Aug before	50.00	16.28	No	2,681.01	1,34,051	1,01,878	2,35,929
Aug after	50.00	16.28	NA	2,359.29	1,17,965	1,17,964	2,35,929
Sep	52.00	4.00	No	2,359.29	1,22,683	1,17,964	2,40,647

Explanation of different columns:

Column	Explanation
1	Month
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4	Rebalance will be yes if the change is more than 15%
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6	Value of equity = Units x NAV
7	Value of bond
8	Total value = Value of equity + Value of bond

Action in different months:

Month	Action
December	We will buy 2,500 units of MF to start with 50:50 mix
January	• NAV has changed by 37.50 percent and hence we should opt for rebalancing. The value of portfolio before re-balancing is Rs.1,62,500. Post re-balancing value of equity and bond will become Rs.81,250 • Number of units = $(81,250/25.00) = 3,250$ • We should buy 750 units to make the number of units as 3,250
February	• NAV has changed by 44 percent and hence we should opt for rebalancing. The value of portfolio before re-balancing is Rs.1,98,250. Post re-balancing value of equity and bond will become Rs.99,125 • Number of units = $(99,125/36.00) = 2,753.47$ • We should sell 496.53 units to make the number of units as 2,753.47
March	• NAV has changed by 11.11 percent and hence there is no need for rebalancing
April	• NAV has changed by 18.75 percent and hence we should opt for rebalancing. The value of portfolio before re-balancing is Rs.2,03,757. Post re-balancing value of equity and bond will become Rs.1,01,878 • Number of units = $(1,01,878/38.00) = 2,681.01$ • We should sell 72.46 units to make the number of units as 2,681.01
May	• NAV has changed by 2.63 percent and hence there is no need for rebalancing
June	• NAV has changed by 13.51 percent and hence there is no need for rebalancing
July	• NAV has changed by 2.38 percent and hence there is no need for rebalancing

August	- NAV has changed by 16.28 percent and hence we should opt for rebalancing. The value of portfolio before re-balancing is Rs.2,35,929. Post re-balancing value of equity and bond will become Rs.1,17,965 - Number of units = $(1,17,965/50.00) = 2,359.29$ - We should sell 321.72 units to make the number of units as 2,359.29
September	NAV has changed by 4.00 percent and hence there is no need for rebalancing

Part two:

- Value under buy and hold policy = $[1,00,000 + [1,00,000 \times 52/40]] = \text{Rs.}2,30,000$
- Value of portfolio as per technique is higher than Buy & Hold Strategy
- Even if the value under the strategy was lesser then also there is no error. This is because if the market has been bearish then the value would be lesser than Buy & Hold Strategy

65. Portfolio re-balancing:

Calculate the payoff from an initial investment of Rs.1,00,000 when the market moves from 100 to 80 and back to 100 under the following three policies:

- Buy and hold policy with the initial stock and bond mix as 50:50
- Constant mix policy under which the stock bond mix is 50:50
- A constant proportion portfolio insurance policy with investment in stock = $2\{\text{Portfolio value} - 70,000\}$ (floor value)

Answer:**WN 1: Computation of payoff under buy and hold policy:**

Particulars	Day 1	Fall	Maturity
Equity	50,000	40,000	50,000
Bond	50,000	50,000	50,000
Total Value	1,00,000	90,000	1,00,000

Note:

- Value of equity on fall to 80 = $50,000 \times (80/100) = 40,000$
- Value of equity on rise to 100 = $40,000 \times (100/80) = 50,000$

WN 2: Computation of payoff under constant mix policy:

Particulars	Day 1	Fall before	Fall after	Maturity
Equity	50,000	40,000	45,000	56,250
Bond	50,000	50,000	45,000	45,000
Total Value	1,00,000	90,000	90,000	1,01,250

Note:

- Value of equity on fall to 80 = $50,000 \times (80/100) = 40,000$. Overall portfolio value will be Rs.90,000. This would be rebalanced as 45,000 of equity and 45,000 of bonds
- Value of equity on rise to 100 = $45,000 \times (100/80) = 56,250$

WN 3: Computation of payoff under constant proportion portfolio insurance policy:

Particulars	Day 1	Fall before	Fall after	Maturity
Equity	60,000	48,000	36,000	45,000
Bond	40,000	40,000	52,000	52,000
Total Value	1,00,000	88,000	88,000	97,000

Note:

- Investment in equity = $2 [\text{Portfolio value} - 70,000] = 2[1,00,000 - 70,000] = \text{Rs.}60,000$
- Value of equity on fall to 80 = $60,000 \times (80/100) = 48,000$. Overall portfolio value will be Rs.88,000. This would be rebalanced based on investment in equity
- Investment in equity = $2[88,000 - 70,000] = \text{Rs.}36,000$
- Value of equity on rise to 100 = $36,000 \times (100/80) = 45,000$

66. Portfolio re-balancing [May 2019 RTP, May 2012]

Indira has a fund of Rs.3 lacs which she wants to invest in share market with rebalancing target after every 10 days to start with for a period of one month from now. The present NIFTY is 5326. The

minimum NIFTY within a month can at most be 4793.4. She wants to know as to how she should rebalance her portfolio under the following situations, according to the theory of Constant Proportion Portfolio Insurance Policy, using "2" as the multiplier:

- ❖ Immediately to start with.
- ❖ 10 days later-being the 1st day of rebalancing if NIFTY falls to 5122.96.
- ❖ 10 days further from the above date if the NIFTY touches 5539.04.

For the sake of simplicity, assume that the value of her equity component will change in tandem with that of the NIFTY and the risk free securities in which she is going to invest will have no Beta.

Answer:

WN 1: Computation of investment in equity on day 0

Particulars	Calculation	Amount
Maximum decline in NIFTY	$\frac{5,326 - 4,793.40}{5,326}$	10%
Floor value	$3,00,00 - 10\%$	2,70,000
Investment in equity	$2 \times [3,00,000 - 2,70,000]$	60,000

WN 2: Rebalancing of portfolio:

Particulars	Equity	Bond	Total
Day 0	60,000	2,40,000	3,00,000
Day 10:			
Before rebalancing	57,713	2,40,000	2,97,713
After rebalancing	55,426	2,42,287	2,97,713
Day 20:			
Before rebalancing	59,927	2,42,287	3,02,214
After rebalancing	64,428	2,37,786	3,02,214

Note:

Day 10:

- Value of equity on day 10 = $60,000 \times \frac{5,122.96}{5,326} = 57,713$
- Value of portfolio will be Rs.2,97,713. We need to rebalance the same as per CPPI
- Investment in equity = $2 \times [2,97,713 - 2,70,000] = 55,426$

Day 20:

- Value of equity on day 20 = $55,426 \times \frac{5,539.04}{5,122.96} = 59,927$
- Value of portfolio will be Rs.3,02,214. We need to rebalance the same as per CPPI
- Investment in equity = $2 \times [3,02,214 - 2,70,000] = 64,428$

67. Rebalancing of portfolio [May 2018 MTP]

Ms. Kiran had a surplus fund of Rs.2,00,000 on 31.03.2016. She is interested in constructing a portfolio of shares of the core sectors to be weighted equally in rupee value terms. Her friend Shaila based on research advised her to purchase following shares:

Company	No of shares	Price per share
O Limited	100	400
H Limited	1000	40
A Limited	320	125
R Limited	400	100
T Limited	200	200

On April 1, 2016, the prices of these stocks were as follows:

Company	Price per share
O Limited	300
H Limited	60
A Limited	120
R Limited	150
T Limited	125

You are required to exhibit how Kiran can rebalance her portfolio on 1.4.2016 so that here exposure to individual stock is maintained at original level in terms of rupee value

Answer:**WN 1: Rebalancing action:**

Company	Price per share	No of shares	Revised portfolio	Target value [2,13,400/5]	Target shares [Target value/Price]	Shares to be bought/sold
O Limited	300	100	30,000	42,680	142.27	Buy 42.27
H Limited	60	1000	60,000	42,680	711.33	Sell 288.67
A Limited	120	320	38,400	42,680	355.67	Buy 35.67
R Limited	150	400	60,000	42,680	284.53	Sell 115.47
T Limited	125	200	25,000	42,680	341.44	Buy 141.44
Total			2,13,400	2,13,400		

- Initially we had made equal investment of Rs.40,000 in all shares and hence plan is to make equal investment of Rs.42,680 on rebalancing date

Part IX – Real estate valuation

68. Discounted cash flow after tax approach:

A real estate investment is likely to generate cash flows of Rs.70,000, Rs.50,000 and Rs.65,000 over next three years. The terminal value of property at end of year 3 is estimated as Rs.3,00,000. Assuming a required rate of return of 8 percent, determine the fair value of property?

Answer:

Year	Cash flow	PVF @ 8%	DCF
1	70,000	0.926	64,820
2	50,000	0.857	42,850
3	3,65,000	0.794	2,89,810
Fair value of property			3,97,480

69. Income approach:

Assume that a property has an estimated net operating income (NOI) equal to Rs.150,000. Further assume that comparable properties have a capitalization rate of 11%. Compute the fair value of this property?

Answer:

$$\text{Fair value of property} = \frac{\text{Income}}{\text{Capitalization rate}} = \frac{1,50,000}{11\%} = \text{Rs. } 13,63,636$$

70. Real estate valuation:

ABC Limited is a private real estate company that buys, develops, manages and sells commercial real estate properties for its clients. ABC Limited is considering buying the XYZ building of Chennai City. Adams, Jefferson and Madison are other office buildings that are similar properties also located in Chennai. The following information was gathered by ABC Limited analysts.

Chennai City Economic Outlook: The economy is expected to rebound after a recent recessionary period. Economic expansion is expected to last at least the next five years. Projected economic factors for next five years:

Job Growth	Moderate to high
Population Growth	Moderate
Inflation	Low

The job growth is expected to lead to an influx of young professionals to Chennai. This will increase demand for residential rental properties. Other commercial developments are under consideration by the city government. Construction time for new buildings is three years after city approval.

Few sales of office buildings have occurred recently. The last three sales of comparable buildings are listed below. Supply of office space is limited because no commercial buildings of any kind have been built in Chennai over the last seven years mostly due to the economic slowdown.

XYZ Building	Estimate	XYZ Building	Cost Estimate
Square feet	5,00,000	Effective age of building	10 years
Monthly rent	Rs.4 per square feet	Total Economic life	50 years
Expected vacancy	5.00%	Estimated value of land	4,50,00,000
Operating expenses	42.5% of effective gross income	Replacement cost	Rs.250 per square feet
Property management fees	7.5% of effective gross income	Developer's profit	Rs.15 per square feet
Other income	Rs.30,00,000		
Location	Prime		
Net operating income starting year 8	1,50,00,000		

Recent transactions of office buildings in Chennai City:

Particulars	Adams	Jefferson	Madison
Size in square feet	4,00,000	3,00,000	6,00,000
Age in years	7	10	13
Location	Prime	Secondary	Secondary
Age of transaction (in months)	12	36	24
Sales price	11,00,00,000	6,75,00,000	16,50,00,000
Projected Net operating income	99,00,000	57,37,500	1,32,00,000

Additional information:

- Depreciation is 2.5% per year
- Location can be: Prime, Secondary or Tertiary. Prime locations are the most sought and 10.0% is the adjustment needed per classification
- Market prices have been increasing at a rate of 0.25% per month

Required:

- Valuation of XYZ Building using income approach
- Valuation of property using sales comparison approach

Answer:

WN 1: Valuation of property using income capitalization method:

Note 1: Computation of net-operating income:

Particulars	Calculation	Amount
Rental income	$5,00,000 \times 4 \times 12$	2,40,00,000
Other income		30,00,000
Total Income		2,70,00,000
Less: Vacancy	$2,70,00,000 \times 5\%$	-13,50,000
Effective gross income		2,56,50,000
Less: Expenses	$2,56,50,000 \times 50\%$	-1,28,25,000
Net operating income		1,28,25,000

Note 2: Computation of capitalization rate:

Particulars	Calculation	Amount
Capitalization rate of Adams	$\frac{99,00,000}{11,00,00,000} \times 100$	9.00%
Capitalization rate of Jefferson	$\frac{57,37,500}{6,75,00,000} \times 100$	8.50%

Capitalization rate of Madison	$\frac{1,32,00,000}{16,50,00,000} \times 100$	8.00%
Average of capitalization rates		8.50%

- We can use average capitalization rates of comparable companies as the capitalization rate of XYZ Building.

Note 3: Valuation of building:

Particulars	Calculation	Amount
Value of building	$\frac{1,28,25,000}{8\%}$	15,08,82,353

WN 2: Valuation of property as per sales comparison approach:

Particulars	Adams	Jefferson	Madison
Sale value	11,00,00,000	6,75,00,000	16,50,00,000
Area in square feet	4,00,000	3,00,000	6,00,000
Sale price per square feet	275.00	225.00	275.00
Adjustments:			
Age adjustment (2.5% depreciation per year)	-7.50%	0.00%	+7.50%
Location adjustment	0.00%	+10.00%	+10.00%
Date of sale adjustment	+3.00%	+9.00%	+6.00%
Total adjustments	-4.50%	+19.00%	+23.50%
Adjusted sales price per square feet	262.63 [275 - 4.50%]	267.75 [225 + 19%]	339.63 [275 + 23.50%]

- Average adjusted sales price = Rs.290
- Value of property as per sales comparison approach = 5,00,000 x 290 = Rs.14,50,00,000

71. Cost based valuation:

ABC Limited analyzes investment opportunities for Central Europe Securities. XYZ is considering proposals by several of the firm's junior analysts.

Ram, one of the junior analysts, proposes a real estate project in Stuttgart and has put together a comprehensive packet on the project. Klein is optimistic about the potential apartment buildings because it is located in an area densely populated with high-income residents. XYZ finds the proposal intriguing, but is worried about the equity needed to make the deal work. Most Central European properties' loan-to-values (LTV) are usually below 80% and Klein's project would require borrowing 60% of the value.

XYZ calls Ram in for a conference and asks him some questions about the real estate proposal, including the different ways to value the properties. During the meeting, XYZ takes notes based on Ram's findings:

- The market value of the land using comparables is Rs.125 crores
- The total area is 2.5 million square feet. Replacement cost and developer's profit is Rs.630.00 per square foot
- Estimated obsolescence cost of building is Rs.5 crores

Required:

Estimate the value of property using cost comparison approach

Answer:

Particulars	Calculation	Amount (in crores)
Value of land		125.00
Value of building	0.25 crores x 630	157.50
Less: Obsolescence		-5.00
Value of property		277.50

Chapter 7 – Securitization

1. Explain the concept and features of Securitization? [Nov 2018 MTP, Jan 2021, May 2021 RTP]

- ❖ **Concept:** The process of securitization typically involves the creation of pool of assets from the illiquid financial assets, such as receivables or loans which are marketable. These assets can be automobile loans, credit card receivables, residential mortgages or any other form of future receivables.

Features of Securitization:

- ❖ **Creation of Financial Instruments:** The process of securities can be viewed as process of creation of additional financial product of securities in market backed by collaterals.
- ❖ **Bundling and Unbundling:** When all the assets are combined in one pool it is bundling and when these are broken into instruments of fixed denomination it is unbundling.
- ❖ **Tool of Risk Management:** In case of assets are securitized on non-recourse basis, then securitization process acts as risk management as the risk of default is shifted.
- ❖ **Structured Finance:** In the process of securitization, financial instruments are tailor structured to meet the risk return trade of profile of investor, and hence, these securitized instruments are considered as best examples of structured finance.
- ❖ **Trenching:** Portfolio of different receivable or loan or asset are split into several parts based on risk and return they carry called 'Trenche'. Each Trench carries a different level of risk and return.
- ❖ **Homogeneity:** Under each trenche the securities are issued of homogenous nature and even meant for small investors the who can afford to invest in small amounts.

2. Explain Securitization in India? [Nov 2018 MTP]

- ❖ **Citi Bank had pioneered the concept of securitization in India** by bundling of auto loans in securitized instruments. Thereafter many organizations securitized their receivables. Although started with securitization of auto loans it moved to other types of receivables such as sales tax deferrals, aircraft receivable etc.
- ❖ In order to encourage securitization, the Government has come out with Securitization and Reconstruction of Financial Assets and Enforcement of Security Interest (SARFAESI) Act, 2002, to tackle menace of Non-Performing Assets (NPAs) without approaching to Court. With growing sophistication of financial products in Indian Capital Market, securitization has occupied an important place.
- ❖ As mentioned above, though, initially started with auto loan receivables, it has become an important source of funding for micro finance companies and NBFCs and even now a days commercial mortgage backed securities are also emerging. The important highlight of the scenario of securitization in Indian Market is that it is dominated by a few players e.g. ICICI Bank, HDFC Bank, NHB etc.
- ❖ As per a report of CRISIL, securitization transactions in India scored to the highest level of approximately Rs. 1.9 trillion, in Financial Year 2019 and 2020.
- ❖ In order to further enhance the investor base in securitized debts, SEBI allowed FPIs to invest in securitized debt of unlisted companies upto a certain limit.

3. What are the benefits of Securitization? (OR) Explain the benefits of Securitization from the point of view of originator [Nov 2019 RTP, May 2018 (exam), Nov 2019 (exam)]

The benefits of securitization can be viewed from the angle of various parties involved as follows:

From the angle of originator	❖ Off – Balance Sheet Financing: When loan/receivables are securitized it release a portion of capital tied up in these assets resulting in off Balance Sheet financing leading to improved liquidity position which helps expanding the business of the company. ❖ More specialization in main business: By transferring the assets the entity could concentrate more on core business as servicing of loan is transferred to SPV. Further, in case of non- recourse arrangement even the burden of default is shifted. ❖ Helps to improve financial ratios: Especially in case of Financial Institutions and Banks, it helps to manage Capital -To-Weighted Asset Ratio effectively. ❖ Reduced borrowing Cost: Since securitized papers are rated due to credit enhancement even they can also be issued at reduced rate as of debts and hence the originator earns a spread, resulting in reduced cost of borrowings.

From the angle of investor	❖ Diversification of Risk: Purchase of securities backed by different types of assets provides the diversification of portfolio resulting in reduction of risk. ❖ Regulatory requirement: Acquisition of asset backed belonging to a particular industry say micro industry helps banks to meet regulatory requirement of investment of fund in industry specific. ❖ Protection against default: In case of recourse arrangement if there is any default by any third party then originator shall make good the least amount. Moreover, there can be insurance arrangement for compensation for any such default.

4. Who are the participants in Securitization? (OR) Distinguish between Primary Participants and Secondary Participants in Securitization? [May 2018 RTP, Nov 2018, Nov 2018 MTP, Jan 2021, May 2021 MTP, May 2021 RTP]

Types of Participants	Primary Participants and Secondary Participants
Primary Participants (Main Parties)	❖ Originator: It is the initiator of deal or can be termed as <u>securitizer</u>. It is an entity which sells the assets lying in its books and receives the funds generated through the sale of such assets. The originator transfers both legal as well as beneficial interest to the Special Purpose Vehicle ❖ Special Purpose Vehicle: SPV is created for the purpose of executing the deal. Since issuer originator transfers all rights in assets to SPV, it holds the legal title of these assets. It is created especially for the purpose of securitization only and normally could be in form of a company, a firm, a society or a trust. The main objective of creating SPV to remove the asset from the Balance Sheet of Originator. Since, SPV makes an upfront payment to the originator, it holds the key position in the overall process of securitization ❖ Investors: Investors are the buyers of securitized papers which may be an individual, an institutional investor such as mutual funds, provident funds, insurance companies, mutual funds, Financial Institutions etc
Secondary Participants	❖ Obligors: Actually, they are the main source of the whole securitization process. <u>They are the parties who owe money to the firm and are assets in the Balance Sheet of Originator.</u> The amount due from the obligor is transferred to SPV and they form the basis of securitization process and their credit standing is of paramount importance in the whole process ❖ Rating Agency: Since the securitization is based on the pools of assets rather than the originators, the assets have to be assessed in terms of its credit quality and credit support available ❖ Receiving and Paying agent (RPA): Also, called Servicer or Administrator, it collects the payment due from obligor(s) and passes it to SPV. It also follow-up with defaulting borrower and if required initiate appropriate legal action against them. Generally, an originator or its affiliates acts as servicer ❖ Agent or Trustee: Trustees are appointed to oversee that all parties to the deal perform in the true spirit of terms of agreement. Normally, it takes care of interest of investors who acquires the securities ❖ Credit Enhancer: Since investors in securitized instruments are directly exposed to performance of the underlying and sometime may have limited or no recourse to the originator, <u>they seek additional comfort in the form of credit enhancement.</u> Originator itself or a third party say a bank may provide this additional context called Credit Enhancer ❖ Structurer: It brings together the <u>originator, investors, credit enhancers and other parties to the deal of securitization.</u> Normally, these are <u>investment bankers</u> also called arranger of the deal. It ensures that deal meets all legal, regulatory, accounting and tax laws requirements

5. Explain the mechanism of Securitization? (OR) Discuss briefly the steps in Securitization Mechanism [May 2020 RTP, May 2018 (exam), May 2019 (exam), May 2019 MTP]

- ❖ **Creation of Pool of Assets:** The process of securitization begins with creation of pool of assets by segregation of assets backed by similar type of mortgages in terms of interest rate, risk, maturity and concentration units.
 - ❖ **Transfer to SPV:** Once assets have been pooled, they are transferred to Special Purpose Vehicle (SPV) especially created for this purpose.
 - ❖ **Sale of Securitized Papers:** SPV designs the instruments based on nature of interest, risk, tenure etc. based on pool of assets. These instruments can be Pass Through Security or Pay Through Certificates
 - ❖ **Administration of assets:** The administration of assets is subcontracted back to originator which collects principal and interest from underlying assets and transfer it to SPV, which works as a conduct.
 - ❖ **Recourse to Originator:** Performance of securitized papers depends on the performance of underlying assets and unless specified in case of default they go back to originator from SPV.
 - ❖ **Repayment of funds:** SPV will repay the funds in form of interest and principal that arises from the assets pooled.
 - ❖ **Credit Rating to Instruments:** Sometime before the sale of securitized instruments credit rating can be done to assess the risk of the issuer.
6. Explain the problems in Securitization? [Nov 2020 RTP, Nov 2019 (exam), May 2018 MTP, May 2020 MTP, Nov 2019 MTP, Nov 2020 MTP]
- ❖ **Stamp Duty:** Under Transfer of Property Act, 1882, a mortgage debt stamp duty which even goes upto 12% in some states of India and this impeded the growth of securitization in India. It should be noted that since pass through certificate are exempted from stamp duty. Moreover, in India, recognizing the special nature of securitized instruments in some states has reduced the stamp duty on them
 - ❖ **Taxation:** Taxation is another area of concern in India. In the absence of any specific provision relating to securitized instruments in Income Tax Act experts' opinion differ a lot
 - ❖ **Accounting:** Accounting and reporting of securitized assets in the books of originator is another area of concern. Although securitization is slated to an off-balance sheet instrument but in true sense receivables are removed from originator's balance sheet. Problem arises especially when assets are transferred without recourse
 - ❖ **Lack of Standardization:** Every originator follows own format for documentation and administration have lack of standardization is another obstacle in growth of securitization
 - ❖ **Inadequate debt market:** Lack of existence of a well-developed debt market in India is another obstacle that hinders the growth of secondary market of securitized or asset backed securities
 - ❖ **Ineffective foreclosure laws:** For last many years there are efforts are going on for effective foreclosure but still foreclosure laws are not supportive to lending institutions and this makes securitized instruments especially mortgaged backed securities less attractive as lenders face difficulty in transfer of property in event of default by the borrower
7. What are the various securitization instruments? [May 2018 MTP, May 2019 MTP, Nov 2018 MTP, Nov 2020]
- ❖ **Pass Through Certificates (PTCs):** Originator transfers the entire receipt of cash in form of interest or principal repayment from the assets sold. Thus, these securities represent direct claim of the investors on all the assets that has been securitized through SPV. Since all cash flows are transferred the investors carry proportional beneficial interest in the asset held in the trust by SPV. It should be noted that since it is a direct route any prepayment of principal is also proportionately distributed among the securities holders. Further, due to these characteristics on completion of securitization by the final payment of assets, all the securities are terminated simultaneously. Skewness of cash flows occurs in early stage if principals are repaid before the scheduled time
 - ❖ **Pay Through Security (PTS):** In contrast to PTC in PTS, SPV debt securities backed by the assets and hence it can restructure different tranches from varying maturities of receivables. This structure permits desynchronization of servicing of securities issued from cash flow generating from the asset. Further, this structure also permits the SPV to reinvest surplus funds for short term as per their requirement. Since, in Pass Through, all cash flow immediately in PTS in case of early retirement of receivables plus cash can be used for short term yield. This structure also provides the freedom to issue several debt tranch with varying maturities
 - ❖ **Stripped Securities:** Stripped Securities are created by dividing the cash flows associated with underlying securities into two or more new securities. Those two securities are as follows: (i) Interest

Only (IO) Securities and (ii) Principle Only (PO) Securities. The holder of IO securities receives only interest while PO security holder receives only principal. **Being highly volatile in nature these securities are less preferred by investors**

8. How is the pricing of securitized instruments done? [May 2019 MTP]

While pricing the instruments, it is important that it should be acceptable to both originators as well as to the investors. On the same basis pricing of securities can be divided into following two categories:

From Originator's Angle	From originator's point of view, the instruments can be priced at a rate at which originator has to incur an outflow and <u>if that outflow can be amortized over a period of time by investing the amount</u> raised through securitization
From Investor's Angle	From an investor's angle security price <u>can be determined by discounting best estimate of expected future cash flows using rate of yield to maturity of a security</u> of comparable security with respect to credit quality and average life of the securities. This yield can also be estimated by referring the yield curve available for marketable securities, though some adjustments is needed on account of spread points, because of credit quality of the securitized instruments

9. What are the various risks in Securitization process?

Credit risk or counterparty risk	It is the prime risk wherein investors are prone to <u>the risk of bankruptcy</u> and non-performance of the servicer.
Legal risks	Securitization is an evolving area in India and any dispute in legal ownership of assets will cause uncertainty regarding investor pay-outs
Markets risk	• <u>Macroeconomic risks:</u> Performance of the underlying loan contracts depend on macroeconomic factors and any industry downturns can lead to default of loan portfolio • <u>Prepayment risk:</u> Any prepayment made on the underlying assets will increase the re-investment risk and investors may not be able to reinvest the amount at the same yield • <u>Interest rate risks:</u> This is applicable where the loans in a pool are based on floating rate and investor pay-outs are based on a fixed rate or vice versa. Even with 100% pool collection, the pool may not be able to meet the investor payouts

10. What is blockchain technology, and how is it applied in various industries?

- Blockchain is a decentralized open ledger of transactions without trusted third parties, with **permanent entries and irreversible changes**. It operates on a decentralized network without banks, corporations, or governments. A blockchain uses a chain of blocks representing digital information stored in a public database.
- **Example:** A simple analogy for understanding blockchain technology is a **Google Doc**. When we create a document and share it with a group of people, the document is distributed instead of copied or transferred. This creates a decentralized distribution chain that gives everyone access to the document at the same time. No one is locked out awaiting changes from another party, while all modifications to the document are being recorded in real-time, making changes completely transparent.

Working of Blockchain transaction:

- A transaction like sending money to someone is initiated.
- Transaction is broadcasted via the network.
- The network validates the transaction using cryptography
- The transaction is represented online as a block
- Block is added to the existing block chain
- Transaction is complete

Applications of Blockchain:

- **Financial services:** Blockchain automates trade lifecycle for financial services, enabling automated transactions of physical and digital assets and properties

- **Healthcare:** Blockchain provides secure sharing of data in healthcare industry by increasing the privacy, security, and interoperability of the data by eliminating the interference of third party and avoiding the overhead costs.
- **Government:** At the government front, there are instances where the technical decentralization is necessary but politically should be governed by governments like land registration, vehicle registration and management, e-voting etc. Blockchain improves the transparency and provides a better way to monitor and audit the transactions in these systems
- **Travel Industry:** Blockchain revolutionizes travel industry by enabling secure transactions, document storage, reservation management, insurance, loyalty, and rewards
- **Economic Forecasts:** Blockchain makes possible the financial and economic forecasts based on decentralized prediction markets, decentralized voting, and stock trading, thus enabling the organizations to plan and shape their businesses

11. What are the risks in a blockchain technology?

- With the use of blockchain, organizations need to consider risks with a wider perspective as different members of a particular blockchain may have different risk appetite/risk tolerances that may further lead to conflict when monitoring controls are designed for a blockchain. There may be questions about who is responsible for managing risks if no one party is in-charge, and how proper accountability is to be achieved in a blockchain.
- The reliability of financial transactions is dependent on the underlying technology and if this underlying consensus mechanism has been tampered with, it could render the financial information stored in the ledger to be inaccurate and unreliable.
- In the absence of any central authority to administer and enforce protocol amendments, there could be a challenge in the development and maintenance of process control activities and in such case, users of public blockchains find difficult to obtain an understanding of the general IT controls implemented and the effectiveness of these controls.
- As blockchain involves humongous data getting updated frequently, risk related to information overload could potentially challenge the level of monitoring required. Furthermore, to find competent people to design and perform effective monitoring controls may again prove to be difficult

12. What is Tokenization and compare the same with securitization?

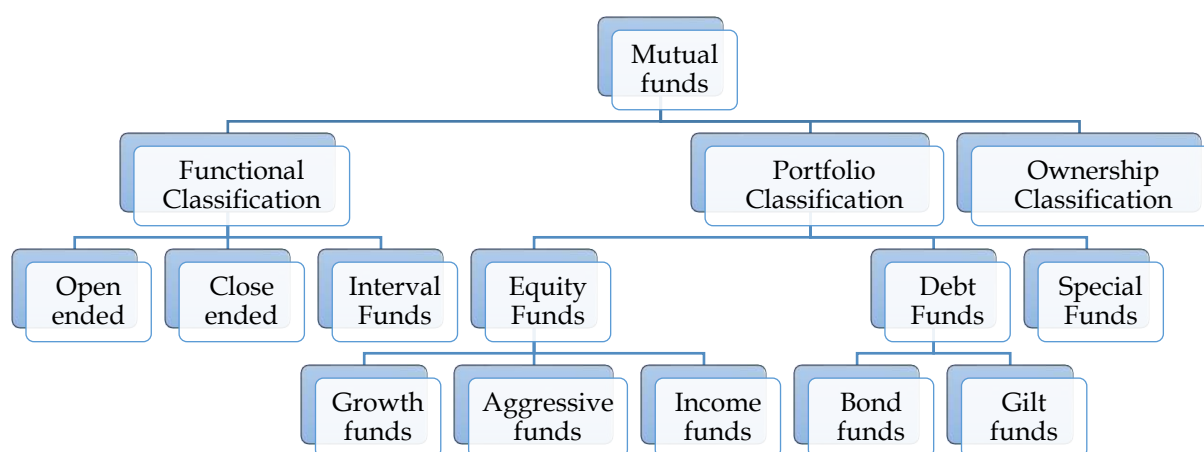
- Tokenization is a process of converting tangible and intangible assets into blockchain tokens. It can be effective in conventional industries like real estate, artwork etc.

Similarities between Tokenization and Securitization:

- **Liquidity:** Both Securitization and Tokenization inject liquidity in the market for the assets which are otherwise illiquid assets.
- **Diversification:** Both help investors to diversify their portfolio thus managing risk and optimizing returns.
- **Trading:** Both are tradable hence helps to generate wealth.
- **New Opportunities:** Both provide opportunities for financial institutions and related agencies to earn income through collection of fees.

Chapter 8 – Mutual Funds**1. What is a mutual fund?**

- ❖ Mutual fund is a trust that pools together the resources of investors to make a foray into investments in the capital market, thereby making the investor to be part owner of the assets of mutual fund. It is trust **that pools the resources of investors who share a common financial goal.**
- ❖ The fund is **managed by a professional money manager** who makes investment in various stocks, bonds or other securities according to the investment objectives established by the Fund.
- ❖ Anybody with investible surplus can invest in the funds. The income earned through these investments and the capital appreciation realized by the scheme is shared by the unit holders in proportion to their investment.

2. What are the various classification of mutual funds?

Functional Classification	
Open Ended Funds	In an open-ended scheme, the investor can make entry and exit at any time. Also, the capital of the fund is unlimited and the redemption period is indefinite
Close ended funds	In a close ended scheme, the investor can buy into the scheme during Initial Public offering or from the stock market after the units have been listed. The scheme has a limited life at the end of which the corpus is liquidated
Interval funds	Interval schemes are a combination of an Open-Ended and a Close-Ended structure. These schemes are open for both purchase and redemption during pre-specified intervals (viz. monthly, quarterly, annually etc.) at prevailing NAV based prices
Portfolio Classification	
Equity Funds	Equity funds invest primarily in stocks. Equity funds are of the following types: ❖ Growth Funds: They seek to provide long term capital appreciation to the investor and are best to long term investors. ❖ Aggressive Funds: They look for super normal returns for which investment is made in start-ups, IPOs and speculative shares. They are best to investors willing to take risks. ❖ Income Funds: They seek to maximize present income of investors by investing in safe stocks paying high cash dividends and in high yield money market instruments. They are best to investors seeking current income
Debt funds	Debt funds are of two types: ❖ Bond Funds: They invest in fixed income securities e.g. government bonds, corporate debentures, convertible debentures, money market. Investors seeking tax free income go in for government bonds while those looking for safe, steady income buy government bonds or high-grade corporate bonds. Although there have been past exceptions, bond funds tend to be less volatile than stock funds and often produce regular income. They are exposed to risks such as interest rate risk, credit risk, prepayment risk and re-investment risk

Special funds	❖ Gilt Funds: They are mainly invested in Government securities. ❖ Index Funds: Every stock market has a stock index which measures the upward and downward sentiment of the stock market. Index Funds are low cost funds and influence the stock market. ❖ International Funds: A mutual fund located in India to raise money in India for investing globally. ❖ Offshore Funds: A mutual fund located outside India to raise money globally for investing in India. ❖ Sector Funds: They invest their entire fund in a particular industry e.g. utility fund for utility industry like power, gas, public works. ❖ Money Market Funds: These are predominantly debt-oriented schemes, whose main objective is preservation of capital, easy liquidity and moderate income. To achieve this objective, liquid funds invest predominantly in safer short-term instruments like Commercial Papers, Certificate of Deposits, Treasury Bills, G-Secs etc. ❖ Fund of Funds: Fund of Funds (FoF) as the name suggests are schemes which invest in other mutual fund schemes. ❖ Capital Protection Oriented Fund: The term 'capital protection-oriented scheme' means a mutual fund scheme which is designated as such and which endeavours to protect the capital invested therein through suitable orientation of its portfolio structure. <u>A typical portfolio structure could be to set aside major portion of the assets for capital safety and could be invested in highly rated debt instruments.</u> The remaining portion would be invested in equity or equity related instruments to provide capital appreciation. Capital Protection Oriented schemes are a recent entrant in the Indian capital markets and should not be confused with 'capital guaranteed' schemes. ❖ Gold Funds: The objective of these funds is to track the performance of Gold. The units represent the value of gold or gold related instruments held in the scheme. ❖ Quant Funds: Quant Fund <u>works on a data-driven approach for stock selection and investment decisions</u> based on pre-determined rules or parameters using statistics or mathematics-based models. Quant Funds <u>rely on automated programs for investment decisions, timings, and actions.</u> However, human intervention is minimal, as fund managers focus on robust models and continuously monitor performance. Modifications may be made as needed. It <u>eliminates the human biasness and subjectivity and by using model-based approach also ensures consistency in strategy across the market conditions.</u>
Ownership classification	
Funds are classified into Public Sector Mutual Funds, Private Sector Mutual Funds and Foreign Mutual Funds . Public Sector Mutual Funds are sponsored by a company of the public sector. Private Sector Mutual Fund is sponsored by a company of the private sector. Foreign Mutual Funds are sponsored by companies for raising funds in India, operate from India and invest in India	

3. Explain about Direct Plan in Mutual Fund? [May 2019 MTP]

- ❖ Asset management companies (AMC) have been permitted to make direct investments in mutual fund schemes even before 2011. But, there were no separate plans for these investments. These investments were made in distributor plan itself and were tracked with single NAV - one of the distributor plans. Therefore, an investor was forced to buy mutual funds based on the NAV of the distributor plans. However, things changed with introduction of direct plans by SEBI on January 1, 2013.
- ❖ Mutual fund direct plans are those plan where Asset Management Companies or mutual fund Houses do not charge distributor expenses, trail fees and transaction charges. NAV of the direct plan are generally higher in comparison to a regular plan. Studies have shown that the 'Direct Plans' have performed better than the 'Regular Plans' for almost all the mutual fund schemes.

4. What are the various types of schemes in mutual funds? [OR] Explain the concept of Exchange Traded Funds? [Nov 2019 RTP]

- ❖ **Balanced Fund:** It consists of both debt and equity. It works on the principle that debt portfolio provides stability and the equity provides growth. The returns of the fund will be moderate.

- ❖ **Equity Diversified Funds:** This type of fund ensures high level of diversification and ensures reduction of risk involved in the fund. The following are the types of diversified funds:
 - Flexi cap / Multicap fund
 - Contra fund
 - Index fund
 - Dividend yield fund (Dividend Payout option & Dividend Re investment option)
- ❖ **Equity tax linked savings scheme:** It is used as a tax saver under Sec 80C of the Income tax Act, 1961. It also has benefit to give potential returns.
- ❖ **Sector funds:** These funds are focussed on a particular industry to take the advantage of industry cycles. They are much riskier than the equity diversified funds. These funds are suitable only for those who already have a portfolio.
- ❖ **Thematic funds:** These funds could vary from multi sector, international exposure etc. They have a broader outlook than the sector funds.
- ❖ **Arbitrage funds:** The fund seeks to provide better return than debt instruments and lower volatility than equity funds. Arbitrage funds seek to capitalize on the price differentials between the spot and the futures market. This is suitable for conservative investor.
- ❖ **Hedge fund:** This is a sort of private investment vehicle which is free from most of the regulations. The fund does not reveal anything about its operations publicly. Hedge funds are aggressively managed portfolio of investments with a goal of generating high returns.
- ❖ **Cash fund:** Cash fund is an open-ended liquid scheme that aims to provide returns with low risk and ensure better liquidity. The fund has retail and super institutional plans. There is no entry or exit load.
- ❖ **Exchange Traded Fund (ETF):** These funds are listed on the stock exchanges and their prices are linked to the underlying securities. An ETF can be bought by placing an order with the Broker and traded during the market hours at prices closer to its NAV. Following are the types of ETF Products available in the market: (i) Index EFTs (ii) Commodity ETFs (iii) Bond ETFs (iv) Currency ETFs
- ❖ **Fixed Maturity Plans:** Fixed Maturity Plans (FMPs) are closely ended mutual funds that investors can invest in during New Fund Offers (NFOs). **These funds typically invest in CDs, Commercial Papers, Money Market Instruments, and Non-Convertible Debentures over a fixed investment period.** FMPs are not liquid instruments and have lower trading volume. They are free from interest rate risk but carry credit risk due to potential default by the debt issuing company. **Most FMPs have a three-year tenure, but they struggle to provide good interest returns if they invest in higher-rated instruments and hence some FMPs also invest in lower rated instruments.**

5. What are the advantages and limitations of mutual funds?

Advantages of mutual funds:

- ❖ **Professional Management:** The funds are managed by skilled and professionally experienced managers with a back-up of a Research team.
- ❖ **Diversification:** Mutual Funds offer diversification in portfolio which reduces the risk.
- ❖ **Convenient Administration:** There are no administrative risks of share transfer, as many of the Mutual Funds offer services in a demat form which save investor's time and delay.
- ❖ **Higher Returns:** Over a medium to long-term investment, investors always get higher returns in Mutual Funds as compared to other avenues of investment.
- ❖ **Low Cost of Management:** No Mutual Fund can increase the cost beyond prescribed limits of 2.5% maximum and any extra cost of management is to be borne by the AMC.
- ❖ **Liquidity:** In all the open-ended funds, liquidity is provided by direct sales / repurchase by the Mutual Fund and in case of close ended funds, the liquidity is provided by listing the units on the Stock Exchange.
- ❖ **Transparency:** The SEBI Regulations now compel all the Mutual Funds to disclose their portfolios on a half-yearly basis. However, many Mutual Funds disclose this on a quarterly or monthly basis to their investors.
- ❖ **Other Benefits:** Mutual Funds provide regular withdrawal and systematic investment plans according to the need of the investors. The investors can also switch from one scheme to another without any load.
- ❖ **Highly Regulated:** Mutual Funds all over the world are highly regulated and in India all Mutual Funds are registered with SEBI and are strictly regulated as per the Mutual Fund Regulations which provide excellent investor protection.

- ❖ **Economies of scale:** The “pooled” money from a number of investors ensures that mutual funds enjoy economies of scale; it is cheaper compared to investing directly in the capital markets which involves higher charges.
- ❖ **Flexibility:** There are a lot of features in a regular mutual fund scheme, which imparts flexibility to the scheme. An investor can opt for Systematic Investment Plan (SIP), Systematic Withdrawal Plan etc. to plan his cash flow requirements as per his convenience.
- ❖ **Convenience:** It is very convenient & easy to invest & disinvest from Mutual Fund Schemes specially through digital transaction portals

Drawbacks of mutual funds:

- ❖ **No guarantee of Return** – There are three issues involved:
 - All Mutual Funds cannot be winners.
 - A mutual fund may perform better than the stock market but this does not necessarily lead to a gain for the investor.
 - Investors may forgive if the return is not adequate. But they will not do so if the principal is eroded. Mutual Fund investment may depreciate in value.
- ❖ **Diversification:** A mutual fund helps to create a diversified portfolio. Though diversification minimizes risk, it does not ensure maximizing returns.
- ❖ **Selection of Proper Fund:** It may be easier to select the right share rather than the right fund. For stocks, one can base his selection on the parameters of economic, industry and company analysis.
- ❖ **Cost Factor:** Mutual Funds carry a price tag. Fund Managers are the highest paid executives.

6. What is trail commission in relation to a mutual fund?

- It is the amount **that a mutual fund investor pays to his advisor each year**. The purpose of charging this commission from the investor is to **provide incentive to the advisor to review their customer's holdings** and to give advice from time to time
- This is calculated as a **percentage of the daily average assets under management** of the distributor and is paid monthly

7. What is expense ratio?

- The expense ratio is the percentage of assets **spent on mutual fund operations**, including management, advisory, travel, audit, custodian, registrar, and consultancy fees.
- It is crucial to monitor as it can be as high as 2-3%, **potentially affecting a mutual fund scheme's performance**.

8. Explain the concept of Side pocketing in mutual funds? [May 2019 RTP]

- ❖ Side Pocketing leads to separation of risky assets from other investments and cash holdings.
- ❖ The purpose is to make sure that money invested in a mutual fund, which is linked to stressed assets, gets locked, until the fund recovers the money from the company or could avoid distress selling of illiquid securities.
- ❖ A debt mutual fund invests in securities which normally enjoy high credit rating. Whenever the rating of a mutual fund decreases, the fund shifts the illiquid assets into a side pocket so that current unitholders can be benefitted from liquid assets. Hence the NAV of the fund will reflect the actual value of liquid assets
- ❖ Side Pocketing is beneficial for those investors who wish to hold on to the units of the main funds for long term. Therefore, the process of Side Pocketing ensures that liquidity is not the problem even in the circumstances of frequent allotments and redemptions.
- ❖ Side Pocketing is quite common internationally. However, Side Pocketing has also been resorted to impact the genuine returns of investors.

9. EXPLAIN how to measure divergence or deviation of return of a Mutual Fund Scheme that replicates any benchmark Index [May 2022 MTP]

- Tracking error can be used to measure the divergence or deviation of a fund's return from the benchmarks return it is following.
- The passive fund managers **closely follow or track the benchmark index**. Although they design their investment strategy on the same index but often it may not exactly replicate the index return. In such situation, there is possibility of deviation between the returns.

- The tracking error can be calculated on the basis of corresponding benchmark return vis a vis quarterly or monthly average NAVs. **Higher the tracking error higher is the risk profile of the fund. Whether the funds outperform or underperform their benchmark indices; it clearly indicates that of fund managers are not following the benchmark indices properly.**
- In addition to the same, other reason for tracking error are as follows:
 - Transaction cost
 - Fees charged by AMCs
 - Fund expenses
 - Cash holdings
 - Sampling biasness
- **Thus, from above it can be said that to replicate the return to any benchmark index the tracking error should be near to zero.**

10. How can we evaluate the performance of a mutual fund?

Quantitative Parameters	
Risk-Adjusted Returns	• Return of a Mutual Fund relative to the risk it assumed as benchmarked against the market and industry risk
Benchmark Returns	• Benchmark can be defined as the <u>quality or set of standards</u> against which performance of Mutual Fund can be measured • A good Mutual Fund performs over and above its benchmark during all phases of market, <u>this excess return is known as 'Alpha'</u>
Comparison to peers	• Comparing mutual fund performance with peers is a quantitative method, as it is fair to compare apples with apples rather than oranges. • <u>A good mutual fund should consistently outperform its peers for its worth.</u>
Comparison of Returns across different economic and market cycles	• Mutual Fund performance involves considering not only time frames but also economic and market cycles, as special conditions may cause short-term outperformance or underperformance, potentially lasting for future periods
Financial Measures	• Expense Ratio • Sharpe Ratio • Treynor Ratio • Sortino Ratio
Qualitative Parameters	
Quality of Portfolio	• Mutual Funds' portfolio quality is <u>crucial for superior returns</u> • Equity Mutual Funds allocate funds to <u>top blue-chip companies</u> and are diversified, with styles like growth, value, or blend. • Debt Funds measure portfolio quality based on <u>credit quality, average maturity, and modified duration</u> of fixed asset securities. • Good quality stocks and securities are essential, and investments should align with the fund's objectives
Track Record and Competence of Fund Manager	• Fund Manager's competence and conviction are crucial in selecting securities and making investment decisions.
Credibility of Fund House Team	• Team of Fund House also plays a big role towards the investors' interest. In addition to investment decisions, there are some other administrative tasks also such as <u>redemption of units, crediting of dividend, providing adequate information etc. which play a crucial role</u> in qualitative assessment of any mutual fund house

11. What is the role of a fund manager in the context of mutual funds?

- Main responsibility is to ensure **good performance of the fund he/she is managing**, but there are other roles as well
- Nature of Fund manager's role also depends on the fact that whether Fund is an Actively Managed Fund or a Passively Managed Fund
- **Actively Managed funds:** Fund manager plays a crucial role as right stock selection is critical to generate positive Alpha.

- **Passively Managed Funds:** Fund Manager's role is to match the return of the underlying index with the minimum Tracking Error

Other key roles of fund manager:

- **Compliances:** Fund Manager must ensure compliance of various Guidelines as laid down by SEBI, AMFI etc. They should also ensure proper reporting and furnish required documents on time
- **Constant Monitoring the Performance of the Fund:** Fund Managers must continuously monitor and evaluate securities and investments to maximize wealth for unit holders. **Their performance is evaluated not only on return but also on growth above inflation and interest rates.**
- **Creation of wealth and protection:** Fund Managers play a crucial role in wealth creation and protection, avoiding reckless risk assumptions and **conducting thorough research using Fundamental and Technical Analysis techniques.**
- **Control over works outsourced to third parties:** Fund Manager must exercise control over third party works to ensure error-free operations in outsourced works, ensuring proper functioning and oversight.

12. Write about role of Foreign Institutional Investors in Mutual Funds?

- Foreign Institutional Investors (FIIs) are large foreign groups with **substantial investible funds, registered abroad** to invest in equity markets, hedge funds, pension funds, and mutual funds.
- **They have a strong research team and can buy domestic mutual funds directly from issuers or through registered stock brokers on recognized stock exchanges in India.**
- **Role of FII in Indian Economy through MF investment:** FIIs play a crucial role in the Indian economy through their investment in mutual funds, as they **enhance corporate governance, improve market competition, and improve capital inflow.** This not only generates employment but also improves the position of foreign exchanges

Theory to solve problems

MF Return Vs Individual Return:

$$\text{MF return} = \frac{\text{Own return}}{1 - \text{Initial expense ratio}} + \text{Annual expense ratio}$$

Important points:

- A person is required to spend time while investing on his own. However, investing through mutual fund will save this time and hence the same can give extra income to investor. If a question gives data on this, then we should prepare a cost-benefit analysis of own investing vs MF investing [Formula based calculation will not be possible]

MF Return:

$$\text{Holding period return} = \frac{(\text{NAV}_1 - \text{NAV}_0) + D_1 + \text{CG}_1}{\text{NAV}_0} \times 100$$

$$\text{Annual return} = \frac{(\text{NAV}_1 - \text{NAV}_0) + D_1 + \text{CG}_1}{\text{NAV}_0} \times \frac{12}{m} \times 100$$

Note:

- Opening and closing NAV will have to be adjusted for premium and discount in case of close ended fund. This is because NAV of close-ended fund can quote at premium/discount to normal NAV
- **Date of investment given in question:** If the date of investment is given in question, then we can compute the no of days of investment and use 365 in numerator for computing annual return. Date of investment may or may not be considered as part of number of days of holding depending on assumption
- **Total Yield:** An MF investor can invest in different schemes and returns for each investment can be computed using the above formula. For total yield we should consider the below formula:

$$\text{Total Yield} = \frac{\text{Capital Gain} + \text{Dividend}}{\text{Total Amount invested}} \times 100$$
- **Period of holding:** Period of holding can be computed using annual return and holding period return

$$\text{Period of Holding} = \frac{\text{Holding Period Return}}{\text{Annual Return}} \times 365 \text{ days (or) 12 months}$$

Dividend Payout vs Dividend reinvestment:

- In a dividend payout plan, the investor will get dividend in Rupees and in case of dividend reinvestment plan dividend will get reinvested and we will get additional units
- Return for dividend payout plan would be computed as per the above formula
- Return for dividend re-investment plan would be computed as per the below formula:

$$\text{Holding Period Return} = \frac{\text{Closing value} - \text{Opening investment}}{\text{Opening investment}} \times 100$$

$$\text{Annual Return} = \frac{\text{Closing value} - \text{Opening investment}}{\text{Opening investment}} \times \frac{12}{m} \times 100$$

Note:

- Dividend rate is to be applied on face value of unit to calculate dividend earned by the investor. This will also help in computing the number of units re-invested in dividend reinvestment plan

Taxation impact:

- Cost of acquisition of bonus units will be taken as zero
- Securities Transaction Tax is not allowed as tax deductible expense while computing long-term capital gain and short-term capital gain

Effective yield:

- Effective yield is normally computed using the below formula:

$$\text{Annual Return} = \frac{\text{Closing value} - \text{Opening investment}}{\text{Opening investment}} \times \frac{12}{m} \times 100$$

However, the same can also be computed using IRR method if there is a single inflow and single outflow scenario and number of years map to a whole number.

Front-end load and back-end load:**Formula for calculating front-end load:**

$$\text{Front - end Load} = \frac{\text{Public offer price} - \text{NAV}}{\text{NAV}}$$

Formula for calculating back-end load:

$$\text{Back - end Load} = \frac{\text{NAV} - \text{Redemption Price}}{\text{NAV}}$$

Note:

- Front-end load is otherwise called as entry load and is added to opening NAV
- Back-end load is otherwise called as exit load and is deducted from closing NAV

Computation of NAV:

$$\text{Closing NAV} = \frac{\text{Market value of assets} - \text{Value of liabilities}}{\text{Number of units}}$$

Note:

- **Opening net assets details are given and detailed break-up of assets and liabilities are not available:** In some question, we will not have information on assets and liabilities but details on opening net assets will be available. Net assets will increase by items like portfolio appreciation, dividend received, income earned, fresh inflow etc. Similarly, net assets will decrease by items like portfolio depreciation, expenses incurred, redemption. NAV will be computed in this manner:

$$\text{Closing NAV} = \frac{\text{Opening Network} + \text{Items increasing network} - \text{Items reducing network}}{\text{Opening units} + \text{New inflows} - \text{Redemptions}}$$

- **Impact of inflows/redemption on NAV:** NAV of mutual fund does not change due to fresh inflow/redemption. This is because units change proportionately with change in Network. NAV will change if there is a change in value of underlying assets of Mutual Fund
- **Declaration of dividend:** NAV will fall by the amount of dividend once the same is declared by Mutual Fund
- **Tracking of inflows and outflows:** If it is possible to track inflows and outflows of a mutual fund then we are required to compute closing cash balance by adding inflows and deducting outflows from opening cash balance. Closing cash balance will form part of assets for computing NAV
- **Valuation of equity shares:** Closing value of equity investments can be computed based on index value. It is computed using below formula:

$$\text{Closing value of equity} = \text{Amount invested} \times \frac{\text{Closing index value}}{\text{Index value on date of investment}}$$

- **Payment of dividends:** MF declares 80 percent of realized earnings as dividends. Realized earnings = Interest earned + Dividends earned + Realized capital gain. This amount will be deducted from cash balance

- **Net asset value of Fund vs NAV per unit:** Net asset value of fund represents overall value of fund. The same will be divided by number of units to get NAV per unit
- **Valuation of bonds:** We can use the formula of current yield to value the bond if the interest rate on bond and investor expectation (yield) is given in question

$$\text{Current yield} = \frac{\text{Interest of bond}}{\text{Value of bond}}$$
- **Cash and equity component of MF:** Cash component of MF will decline by expense per unit whereas equity component will change based on movement of market. Beta can be used to find the percentage change in equity component when NIFTY change is given.

$$\% \text{ change in equity} = \text{Beta} \times \% \text{ change in market}$$

Dividend equalization:

- **Adjustment in issue price:** An investor entering into a mutual fund has to pay a higher price if additional income has been earned by mutual fund and the NAV is not computed periodically.

$$\text{Issue price} = \text{Opening NAV} + \text{Dividend equalization adjustment} + \text{Entry load}$$
- **Adjustment in re-purchase Price:** Re-purchase price = Opening NAV + Dividend equalization - Exit Load.

Expense ratio:

$$\text{Expense ratio (based on closing NAV)} = \frac{\text{Annual expense per unit}}{\text{Closing NAV}} \times 100$$

$$\text{Expense ratio (based on opening NAV)} = \frac{\text{Annual expense per unit}}{\text{Opening NAV}} \times 100$$

$$\text{Expense ratio (based on average NAV)} = \frac{\text{Annual expense per unit}}{\text{Average NAV}} \times 100$$

Performance evaluation measures:

- **Sharpe Ratio (or) Reward to variability ratio:** This is used for undiversified portfolio. Higher Sharpe Ratio is better.

$$\text{Sharpe Ratio} = \frac{\text{Expected return} - \text{Risk free}}{\text{Standard Deviation}}$$
- **Treynor Ratio (or) Reward to Volatility ratio:** This is used for diversified portfolio. Higher Treynor Ratio is better.

$$\text{Treynor Ratio} = \frac{\text{Expected return} - \text{Risk free}}{\text{Beta}}$$
- Alpha = Actual return - required return. Higher Positive Alpha is better

Practical Problems**Overview:**

- Part I - MF Return
- Part II - Calculation of NAV
- Part III - Mutual Funds - Performance Evaluation

Part I - MF Return**1. Calculation of return [Nov 2003, May 2013 RTP]**

Mr. A can earn a return of 16 percent by investing in equity shares on his own. Now he is considering a recently announced equity based mutual fund scheme in which initial expenses are 5.5 percent and annual recurring expense are 1.5 percent.

- ❖ How much should the fund earn to provide Mr. A return of 16 percent?
- ❖ Ascertain the target expense ratio in case the Mutual Fund earn 18%?
- ❖ Ascertain the initial expense ratio in case the MF can earn 19%?

Answer:**WN 1: Computation of MF return to earn individual return of 16 percent:**

$$\text{MF return} = \frac{\text{Own return}}{1 - \text{Initial expense ratio}} + \text{Annual expense ratio}$$

$$\text{MF return} = \frac{16\%}{1 - 0.055} + 1.5\% = 16.93\% + 1.5\% = 18.43\%$$

WN 2: Computation of target expense ratio if MF can earn 18%:

$$\text{MF return} = \frac{\text{Own return}}{1 - \text{Initial expense ratio}} + \text{Annual expense ratio}$$

$$18\% = \frac{16\%}{1 - 0.055} + \text{Annual expense ratio}$$

$$18\% = 16.93\% + \text{Annual expense ratio}$$

Target Annual expense ratio = 1.07%

WN 3: Computation of initial expense ratio if MF can earn 19%:

$$\text{MF return} = \frac{\text{Own return}}{1 - \text{Initial expense ratio}} + \text{Annual expense ratio}$$

$$19\% = \frac{16\%}{1 - \text{Initial expense ratio}} + 1.5\%$$

$$17.5\% = \frac{16\%}{1 - \text{Initial expense ratio}}$$

$$1 - \text{Initial expense ratio} = \frac{16\%}{17.5\%} = 0.9143$$

$$\text{Initial expense ratio} = 1 - 0.9143 = 0.0857 \text{ (or) } 8.57\%$$

2. Calculation of return [May 2009]

Mr. X earns 10% on his investments in equity shares. He is considering a recently floated scheme of a mutual fund where the initial expenses are 6% and annual recurring expense are expected to be 2%. How much should the MF earn to provide a return of 10% to X?

Answer:

$$\text{MF return} = \frac{\text{Own return}}{1 - \text{Initial expense ratio}} + \text{Annual expense ratio}$$

$$\text{MF return} = \frac{10\%}{1 - 0.06} + 2\% = 10.64\% + 2.0\% = 12.64\%$$

3. MF Return Versus Own Return [Nov 2019]:

Mr. Alex, a practicing Chartered Accountant, can earn a return of 15 percent by investing in equity shares on his own. He is considering a recently announced equity based mutual fund scheme in which initial expenses are 6 percent and annual recurring expenses are 2 percent.

- (i) How much should the mutual fund earn to provide Mr. Alex a return of 15 percent per annum?
- (ii) Mr. Alex's current Annual Professional Income is Rs. 40 Lakhs. His portfolio value is Rs. 50 Lakhs and now he is spending 10% of his time to manage his portfolio. If he spends this time on profession, his professional income will go up in same proportion. He is thinking to invest his entire portfolio into a Multicap Fund, assuming the fund's NAV will grow at 13% per annum (including dividend). You are requested to advise Mr. Alex, whether he can invest the portfolio into Multicap Funds ? If so, what is the net financial benefit?

Answer:

WN 1: Computation of MF return to earn individual return of 15 percent:

$$\text{MF return} = \frac{\text{Own return}}{1 - \text{Initial expense ratio}} + \text{Annual expense ratio}$$

$$\text{MF return} = \frac{15\%}{1 - 0.06} + 2\% = 15.96\% + 2.0\% = 17.96\%$$

WN 2: Computation of net financial benefit of investing in Multicap Fund:

Particulars	Calculation	Amount
Benefits:		
Income from Mutual Fund	50,00,000 x 13%	6,50,000
Additional income due to usage of 10% time in profession	$\frac{40,00,000}{90\%} \times 10\%$	4,44,444
Total Benefits		10,94,444
Opportunity cost:		
Loss of 15 percent income due to shifting to MF	50,00,000 x 15%	7,50,000
Net financial benefit of investing in Multicap Fund	10,94,444 - 7,50,000	3,44,444

Note:

- ICAI solution to this question takes additional income due to usage of 10% time in profession as Rs.4,00,000 [40,00,000 x 10%]. However logical solution would be to take the same as Rs.4,44,444. This is because we have earned Rs.40,00,000 with 90% of time and hence extra 10% time would give additional income of Rs.4,44,444

4. Calculation of return [May 2010, May 2009, May 2014 MTP, Nov 2016 MTP]

A mutual fund, that had a net asset value of Rs.20 at the beginning of the month, made income and capital gain distribution of Rs.0.0375 and Rs.0.03 per unit respectively during the month and then ended the month with a net asset value of Rs.20.06. Compute the monthly return?

Answer:

$$\text{Monthly return} = \frac{(\text{NAV}_1 - \text{NAV}_0) + D_1 + \text{CG}_1}{\text{NAV}_0} \times 100$$

$$\text{Monthly return} = \frac{(20.06 - 20) + 0.0375 + 0.03}{20} \times 100 = \mathbf{0.6375\% \text{ per month}}$$

5. Calculation of return [May 2011, Nov 2011, May 2018 MTP, May 2019 MTP, Nov 2018, May 2006, Nov 2018 MTP, May 2016 MTP, Nov 2014 MTP, Nov 2017 MTP, May 2016 RTP]

Mr. X, an investor purchased 300 units of ABC Mutual Fund at rate of Rs.12.25 per unit, one year ago. Over the year Mr.X received Rs.1.25 as dividend and had received a capital gains distribution of Rs.1.00 per unit. You are required to find out:

- Mr.X's holding period return assuming that this no load fund has a NAV of Rs.13.00 as on today
- Mr.X's holding period return, assuming all the dividends and capital gains distributions are reinvested into additional units as at average price of Rs.12.50 per unit.

Answer:

WN 1: Computation of return with dividend payout option:

$$\text{Return} = \frac{(\text{NAV}_1 - \text{NAV}_0) + D_1 + \text{CG}_1}{\text{NAV}_0} \times 100$$

$$\text{Return} = \frac{(13.00 - 12.25) + 1.25 + 1.00}{12.25} \times 100 = \mathbf{24.49\% \text{ per annum}}$$

Note:

- Return can be computed using the above formula for a single unit. Return percentage would remain same irrespective of the number of units purchased by the investor

WN 2: Computation of return with dividend re-investment option:

Particulars	Calculation	Amount
Dividend per unit		2.25
No of opening units		300
Dividend in rupees	300 x 2.25	675
Re-investment NAV		12.50
Units received due to dividend reinvestment	$\frac{675}{12.50}$	54
Closing units	300 + 54	354
Closing NAV		13.00
Closing value	354 x 13	Rs.4,602

$$\text{Return} = \frac{\text{Closing value} - \text{Opening investment}}{\text{Opening investment}} \times 100$$

$$\text{Return} = \frac{4,602 - (300 \times 12.25)}{(300 \times 12.25)} \times 100 = \frac{927}{3,675} \times 100 = \mathbf{25.22\%}$$

6. Calculation of return [Nov 2015 MTP]

The NAV of per unit of XYZ Mutual Fund (a Close Ended Funds) on 1.1.2014 was Rs. 28. The value on 31.12.2014 comes to Rs. 28.80. On the same date unit was trading in market at a premium of 3% though on 1.1.2014 same was trading at a discount at 5%. On 31.12.2014, XYZ distributed a sum of Rs. 2.80 as incomes and capital gains. You are required to compute rate of return to the investor during the year.

Answer:

$$\text{Return} = \frac{(\text{NAV}_1 - \text{NAV}_0) + D_1 + \text{CG}_1}{\text{NAV}_0} \times 100$$

$$\text{Return} = \frac{(29.664 - 26.60) + 2.80}{26.60} \times 100 = 22.05\%$$

Note:

- Closing NAV = 28.80 + 3% premium = Rs.29.664
- Opening NAV = 28.00 – 5% discount = Rs.26.60

7. Calculation of return [May 2018 RTP, Nov 2005, Nov 2008]

Sun Moon Mutual Fund sponsored open-ended equity oriented scheme “Chanakya Opportunity Fund”. There were three plans viz. ‘A’ – Dividend Re-investment Plan, ‘B’ – Bonus Plan & ‘C’ – Growth Plan. At the time of initial public offer on 1.4.1999, Mr. Anand, Mr. Bacchan & Mrs. Charu, three investors invested Rs.1,00,000 each & chosen ‘B’, ‘C’ & ‘A’ Plan respectively. The history of the fund is as follows:

Date	Dividend %	Bonus Ratio	Net Asset Value per unit (FV of Rs.10)		
			Plan A	Plan B	Plan C
28.07.2003	20		30.70	31.40	33.42
31.03.2004	70	5:4	58.42	31.05	70.05
31.10.2007	40		42.18	25.02	56.15
15.03.2008	25		46.45	29.10	64.28
31.03.2008		1:3	42.18	20.05	60.12
24.03.2009	40	1:4	48.10	19.95	72.40
31.07.2009			53.75	22.98	82.07

On 31st July all three investors redeemed all balance units. Calculate annual rate of return to each of the investors.

Consider:

- ❖ Long-term capital gain is exempt from Income tax
- ❖ Short-term capital gain is subject to 10% Income tax
- ❖ Security Transaction Tax 0.2 percent only on sale/redemption of units
- ❖ Ignore education cess

Answer:**WN 1: Computation of return of Mr. Anand (Plan B):****Calculation of units on maturity:**

Particulars	Opening Balance	Bonus Allotment	Closing units
Bonus on 31.03.2004	10,000	12,500	22,500
Bonus on 31.03.2008	22,500	7,500	30,000
Bonus on 24.03.2009	30,000	7,500	37,500

Calculation of Annual Return:

Particulars	Calculation	Amount
Value of units sold	(37,500 * 22.98)	8,61,750
Less: STT	(value of units sold * 0.2%)	1,724
Less: Cost of acquisition		1,00,000
Less: Tax on STCG	(7,500 * {(22.98 – 0) x 10%}	17,235
Net returns from investment		7,42,791
Holding Period		124 months
Annual Return	$\left(\frac{7,42,791}{1,00,000} \right) \times \left(\frac{12}{124} \right) \times 100$	71.88%

Note:

- Cost of acquisition for bonus units has been taken as zero

WN 2: Computation of returns of Mr. Bachhan (Growth Plan):

Particulars	Calculation	Amount
Value of units sold	(10,000 * 82.07)	8,20,700
Less: STT	(value of units sold * 0.2%)	(1641)

Less: Cost of acquisition		(1,00,000)
Net returns from investment		7,19,059
Holding Period		124 months
Annual Return	$\left(\frac{7,19,059}{1,00,000}\right) \times \left(\frac{12}{124}\right) \times 100$	69.59%

WN 3: Computation of return of Mrs. Charu (Dividend Reinvestment Plan):**Calculation of units on maturity:**

Date	Opening Balance	Amount of dividend	Units allotted	Closing Balance
01.04.1999	10,000.00	-	0	10000
28.07.2003	10,000.00	20,000	651.47	10651.47
31.03.2004	10,651.47	74,560	1,276.28	11927.75
31.10.2007	11,927.75	47,711	1,131.13	13058.88
15.03.2008	13,058.88	32,647	702.85	13761.73
24.03.2009	13,761.72	55,047	1,144.43	14906.16

Note:

- Amount of dividend = Opening balance x Dividend % x Face value (Rs.10)
- Units allotted = Amount of dividend/NAV on dividend date
- Closing balance = Opening balance + Units allotted

Computation of return:

Particulars	Calculation	Amount
Value of units sold	(14,906.16 x 53.75)	8,01,206
Less: STT	(8,01,206 x 0.2%)	(1,602)
Less: Cost of acquisition		(1,00,000)
Less: Tax on STCG	(1,144.43 x 53.75 - 48.10) x 10%	(647)
Net returns from investment		6,98,958
Holding Period		124 months
Annual Return	$\left(\frac{6,98,958}{1,00,000}\right) \times \left(\frac{12}{124}\right) \times 100$	67.64%

8. MF Return [Nov 2010, May 2019]

A mutual fund company introduces two schemes i.e. Dividend Plan (Plan-D) and Bonus Plan (Plan-B). The face value of the unit is Rs.10. On 1-4-2005 Mr.K invested Rs.2,00,000 each in Plan-D and Plan-B when the NAV was Rs.38.20 and Rs.35.60. Both the plans matured on 31-3-2010.

Particulars of dividend and bonus declared over the period are as follows:

Date	Dividend %	Bonus Ratio	NAV of Plan D	NAV of Plan B
30-09-2005	10		39.10	35.60
30-06-2006		1:5	41.15	36.25
31-03-2007	15		44.20	33.10
15-09-2008	13		45.05	37.25
30-10-2008		1:8	42.70	38.30
27-03-2009	16		44.80	39.10
11-04-2009		1:10	40.25	38.90
31-03-2010			40.40	39.70

What is the effective yield per annum in respect of the above two plans?

Answer:**WN 1: Computation of return of Plan-D:****Note 1: Computation of units on maturity:**

Date	Unit held	Dividend		Reinvestment rate	New units	Total units
		%	Amount			

01.04.2005	5235.60					5235.60
30.09.2005	5235.60	10	5235.6	39.1	133.90	5369.50
31.03.2007	5369.50	15	8054.25	44.2	182.22	5551.72
15.09.2008	5551.72	13	7217.24	45.05	160.21	5711.93
27.03.2009	5711.93	16	9139.09	44.8	204.00	5915.93

Note 2: Computation of return:

Particulars	Calculation	Amount
Amount received on maturity	5,915.93 x 40.40	2,39,003
Less: Amount invested		(2,00,000)
Return in Rs. for 5 years		39,003
Return per year	39,003/5	7,800.60
Return in %	$\left(\frac{7800.60}{2,00,000} \times 100 \right)$	3.90%

Note 3: Computation of effective yield using IRR method:

Year	Cash flow	PVF@3%	DCF	PVF@4%	DCF
0	-2,00,000	1	(2,00,000)	1	(2,00,000)
5	2,39,003	0.863	2,06,260	0.822	1,96,461
NPV			6,260		(3,539)

IRR	=	$L1 + \left(\frac{NPV \text{ at } L1}{NPV \text{ at } L1 - NPV \text{ at } L2} \right) \times (L2 - L1)$
IRR	=	$3 + \frac{6,260}{6,260 - (-3,539)} \times (4 - 3)$
IRR	=	3 + 0.64
IRR	=	3.64%

WN 2: Computation of return of Plan-B:**Note 1: Computation of units on maturity:**

Date	Unit held	Bonus ratio	Bonus units	Total units
01.04.2005	5617.98			5617.98
30.06.2006	5617.98	1:5	1123.60	6741.58
30.10.2008	6741.58	1:8	842.70	7584.28
11.04.2009	7584.28	1:10	758.43	8342.71

Note 2: Computation of return:

Particulars	Calculation	Amount
Amount received on maturity	8,342.71 x 39.70	3,31,206
Less: Amount invested		(2,00,000)
Return in Rs. for 5 years		1,31,206
Return per year	1,31,206/5	26,241.20
Return in %	$\left(\frac{26,241.20}{2,00,000} \times 100 \right)$	13.12%

Note 3: Computation of effective yield using IRR method:

Year	Cash flow	PVF@10%	DCF	PVF@13%	DCF
0	-2,00,000	1	(2,00,000)	1	(2,00,000)
5	3,31,206	0.621	2,05,679	0.543	1,79,845
NPV			5,679		(20,155)

IRR	=	$L1 + \left(\frac{NPV \text{ at } L1}{NPV \text{ at } L1 - NPV \text{ at } L2} \right) \times (L2 - L1)$
IRR	=	$10 + \frac{5,679}{5,679 - (-20,155)} \times (13 - 10)$

IRR	=	10 + 0.66
IRR	=	10.66%

9. Reverse-working: [Nov 2020 Exam]

M/S. Corpus an AMC, on 1.04.2015 has floated two schemes viz. Dividend Plan and Bonus Plan. Mr. X, an investor has invested in both the schemes. The following details (except the issue price) are available

Date	Dividend (%)	Bonus ratio	NAV	
			Dividend Plan	Bonus Plan
1.04.2015			?	?
31.12.2016		1:4 (One unit on 4 units held)	47	40
31.03.2017	12		48	42
31.03.2018	10		50	39
31.12.2018		1:5 (one unit on 5 units held)	46	43
31.03.2019	15		45	42
31.03.2020	-	-	49	44

Additional details:

Investment	9,20,000	10,00,000
Average profit	27,748.60	
Average yield (%)		6.40

You are required to calculate the issue price of both the schemes as on 1.04.2015.

Answer:**WN 1: Analysis of Dividend plan:**

- It is assumed that the given plan is dividend reinvestment plan

Note 1: Computation of maturity value and maturity units:

Particulars	Calculation	Amount
Average profit (assumed annual profit)		27,748.60
Investment period		5 years
Total profit	27,748.60 x 5	1,38,743
Investment made		9,20,000
Maturity value	9,20,000 + 1,38,743	10,58,743
NAV on 31.03.2020		49
Units on maturity		21,607

Note 2: Analysis of dividend as on 31.03.2019:

Particulars	Calculation	Amount
Units before re-investment	Assumed	A
Dividend in rupees	Face value assumed as 10 A x 10 x 15%	1.5A
Dividend in units		$\frac{1.5A}{45}$
Closing units		$A + \frac{1.5A}{45} = 21,607$

$$A + \frac{1.5A}{45} = 21,607$$

$$46.5A = 21,607 \times 45$$

$$A = \frac{21,607 \times 45}{46.5} = 20,910 \text{ units}$$

- Hence, we can find that no of units before re-investment on 31.03.2019 is 20,910 units

Note 3: Analysis of dividend as on 31.03.2018

Particulars	Calculation	Amount
Units before re-investment	Assumed	A
Dividend in rupees	Face value assumed as 10 A x 10 x 10%	1A

Dividend in units		$\frac{1A}{50}$
Closing units		$1A + \frac{1A}{50} = 20,910$

$$A + \frac{A}{50} = 20,910$$

$$51A = 20,910 \times 50$$

$$A = \frac{20,910 \times 50}{51.00} = 20,500 \text{ units}$$

- Hence, we can find that no of units before re-investment on 31.03.2018 is 20,500 units

Note 4: Analysis of dividend as on 31.03.2017

Particulars	Calculation	Amount
Units before re-investment	Assumed	A
Dividend in rupees	Face value assumed as 10 $A \times 10 \times 12\%$	1.2A
Dividend in units		$\frac{1.2A}{48}$
Closing units		$1A + \frac{1.2A}{48} = 20,500$

$$A + \frac{1.2A}{48} = 20,500$$

$$49.2A = 20,500 \times 48$$

$$A = \frac{20,500 \times 48}{49.2} = 20,000 \text{ units}$$

- Hence, we can find that no of units before re-investment on 31.03.2017 is 20,000 units

Calculation of entry price:

Particulars	Amount
Amount invested	9,20,000
No of units purchased	20,000
Issue price on entry date [9,20,000/20,000]	46.00

WN 2: Analysis of Bonus Plan:

Note 1: Computation of units on maturity:

Particulars	Calculation	Amount
Average yield		6.40%
Investment period		5 years
Total yield	$6.40\% \times 5$	32.00%
Investment made		10,00,000
Total profit	$10,00,000 \times 32\%$	3,20,000
Maturity value	$10,00,000 + 3,20,000$	13,20,000
NAV on 31.03.2020		44
Units on maturity		30,000

Note 2: Computation of units on entry date:

Analysis of bonus as on 31.12.2018:

Particulars	Calculation	Amount
Units before bonus	Assumed	A
Bonus units		0.2A
Closing units		$1.2A = 30,000$
Units before bonus issue	$\frac{30,000}{1.20}$	25,000 units

Analysis of bonus as on 31.12.2016:

Particulars	Calculation	Amount
Units before bonus	Assumed	A
Bonus units		0.25A

Closing units		1.25A = 25,000
Units before bonus issue	$\frac{25,000}{1.25}$	20,000 units

Computation of issue price:

Particulars	Amount
Amount invested	10,00,000
No of units purchased	20,000
Issue price on entry date [10,00,000/20,000]	50.00

10. Reverse working [July 2021]

The Asset Management Company of the mutual fund (MF) has declared a dividend of 9.98% on the units under the dividend reinvestment plan for the year ended 31st March, 2021. The investors are issued additional units for the dividend at the rate of closing Net Asset Value (NAV) for the year as per the conditions of the scheme. The closing NAV was Rs. 24.95 as on 31st March, 2021. An investor Mr. X who is having 20,800 units at the year-end has made an investment in the units before the declaration of the dividend and at the rate of opening NAV plus an entry load of Rs. 0.04. The NAV has appreciated by 25% during the year. Assume the face value of the unit as Rs. 10.00.

You are required to calculate:

- Opening NAV,
- Number of the units purchased,
- Original amount of the investment

Answer:**Computation of units purchased:**

Particulars	Calculation	Amount
Units before re-investment	Assumed	A
Dividend in rupees	$A \times 10 \times 9.98\%$	0.998A
Dividend in units		$\frac{0.998A}{24.95}$
Closing units		$A + \frac{0.998A}{24.95} = 20,800$

$$A + \frac{0.998A}{24.95} = 20,800$$

$$25.948A = 20,800 \times 24.95$$

$$A = \frac{20,800 \times 24.95}{25.948} = 20,000 \text{ units}$$

Solution:

Particulars	Calculation	Amount
Opening NAV	$\frac{24.95}{1 + 25\%}$	19.96
Number of units purchased		20,000
Original amount of investment	$20,000 \times [19.96 + 0.04]$	4,00,000

11. Missing NAV [July 2021]

M/s. Strong an AMC has floated a dividend bonus plan on 1st April, 2016 at a certain net asset value (NAV). The fund has a robust growth and has declared a bonus of 1:5 (1 bonus unit for 5 right units held) on 30th September, 2017 and a second bonus of 1:4 (1 bonus unit for 4 right units held) on 30th September 2019. The fund, as on 31st March 2021, has generated an average yield of 17.5%

Mr. Optimistic has made an investment of Rs. 16 lakhs in the plan before the declaration of the first bonus and remain invested thereafter.

The following information is also available:

Date	01.04.2016	30.09.2017	30.09.2019	31.03.2021
NAV	?	85	92	100

You are required to advise to Mr. Optimistic the opening NAV, which is required by him to calculate the capital appreciation.

Answer:**Note 1: Computation of units on maturity:**

Particulars	Calculation	Amount
Average yield		17.50%
Investment period		5 years
Total yield	$17.50\% \times 5$	82.50%
Investment made		16,00,000
Total profit	$16,00,000 \times 82.50\%$	14,00,000
Maturity value	$16,00,000 + 14,00,000$	30,00,000
NAV on 31.03.2021		100
Units on maturity		30,000

Note 2: Computation of units on entry date:**Analysis of bonus as on 30.09.2019:**

Particulars	Calculation	Amount
Units before bonus	Assumed	A
Bonus units		0.25A
Closing units		$1.25A = 30,000$
Units before bonus issue	$\frac{30,000}{1.25}$	24,000 units

Analysis of bonus as on 30.09.2017:

Particulars	Calculation	Amount
Units before bonus	Assumed	A
Bonus units		0.2A
Closing units		$1.20A = 24,000$
Units before bonus issue	$\frac{24,000}{1.20}$	20,000 units

Computation of opening NAV:

Particulars	Amount
Amount invested	16,00,000
No of units purchased	20,000
Issue price on entry date $[16,00,000/20,000]$	80.00

12. MF charges [Nov 2019 RTP]

ANP Plan, a hedge fund currently has assets of Rs. 20 crore. CA. X, the manager of fund charges fee of 0.10% of portfolio asset. In addition to it he charges incentive fee of 2%. The incentive will be linked to gross return each year in excess of the portfolio maximum value since the inception of fund. The maximum value the fund achieved so far since inception of fund about one and half year ago was Rs. 21 crores. You are required to compute the fee payable to CA. X, if return on the fund this year turns out to be

- (a) 29%
- (b) 4.5%
- (c) -1.8%

Answer:**WN 1: Calculation of fee payable if return is 29%**

Particulars	Amount
Opening hedge fund	20 Cr
Add: Return earned $(20 \text{ cr} \times 29\%)$	5.8 Cr
Closing value	25.8 Cr
Return in excess of 21 Cr	4.8 Cr
Variable incentive fee $(2\% \times 4.8 \text{ Cr})$	9,60,000
Fixed incentive fee $(0.1\% \times 20 \text{ Cr})$	2,00,000
Total incentive	11,60,000

WN 2: Calculation of fee payable if return is 4.5%

Particulars	Amount
Opening hedge fund	20 Cr
Add: Return earned $(20 \text{ cr} \times 4.5\%)$	0.9 cr

Closing value	20.9 Cr
Return in excess of 21 Cr	0
Variable incentive fee	-
Fixed incentive fee (0.1% x 20 Cr)	2,00,000
Total incentive	2,00,000

WN 3: Calculation of fee payable if return is -1.8%

Return is negative and only fixed incentive fee of Rs.2,00,000 will be paid.

13. Front-end loan and back-end load [May 2018]

The unit price of Equity Linked Savings Scheme (ELSS) of a mutual fund is Rs.10. The public offer price (POP) of the unit is Rs.10.204 and the redemption price is Rs.9.80.

Calculate:

- (i) Front-end Load
- (ii) Back-end Load

Answer:

Computation of front-end load:

$$\text{Public offer price} = \frac{\text{NAV}}{1 - \text{Front end Load}}$$

$$10.204 = \frac{10}{1 - \text{Front end Load}}; \text{Front end Load} = 0.0199 \text{ or } 2\%$$

Computation of Back-end Load:

$$\text{Redemption price} = \frac{\text{NAV}}{1 - \text{Back end Load}}$$

$$9.80 = \frac{10}{1 - \text{Back end Load}}; \text{Back end Load} = 0.0204 \text{ or } 2.04\%$$

Alternative answer:

$$\text{Front End load} = \frac{10.204 - 10.00}{10.00} = 0.0204 \text{ or } 2.04\%$$

$$\text{Back End load} = \frac{10.00 - 9.80}{10.00} = 0.02 \text{ or } 2.00\%$$

14. Computation of amount of investment [Nov 2018]

During the year 2017 an investor invested in a mutual fund. The capital gain and dividend for the year was Rs. 3.00 per unit, which were re-invested at the year end NAV of Rs. 23.75. The investor had total units of 26,750 as at the end of the year. The NAV had appreciated by 18.75% during the year and there was an entry load of Rs. 0.05 at the time when the investment was made.

The investor lost his records and wants to find out the amount of investment made and the entry load in the mutual fund.

Answer:

Opening NAV	$\frac{23.75}{118.75\%}$	Rs.20
No of units at beginning		X
Amount of dividend		3X
Dividend in units		$\frac{3X}{23.75}$
Closing units	Opening units + Dividend	26,750
Computation of opening units:	$X + \frac{3X}{23.75} = 26,750$ $\frac{23.75X + 3X}{23.75} = 26,750$ $\frac{26.75X}{23.75} = 26,750$ $X = \frac{26,750 \times 23.75}{26.75}$	23,750 units
Opening investment	$23,750 \times (20 + 0.05)$	Rs.4,76,187.50
Amount of entry load	$23,750 \times 0.05$	Rs.1,187.50

Part II – Calculation of NAV

15. Calculation of NAV

Calculate the today's NAV of ABC Fund if the following details are given:

- ❖ Yesterday's NAV = Rs.12.8700
- ❖ Total number of outstanding units = 1.25 Crores
- ❖ Face value = Rs.10
- ❖ Expenses = Rs.1 lakh [Assume sales NAV and repurchase NAV to be Rs.12.87]

Appreciation of portfolio today	Rs.12 lakhs
Units – Fresh subscription	2 lakhs
Units – Redemption	0.75 lakhs
Dividends received	Rs.1 lakhs

Answer:

Computation of NAV:

Particulars	Calculation	Amount (in lacs)
Opening Net assets of fund	12.87 × 125 lacs	1,608.75
Less: Expenses		(1)
Add: Dividends received		1
Add: Portfolio appreciation		12
Add: Fresh subscription	12.87 × 2 lacs	25.74
Less: Redemption	12.87 × 0.75	(9.6525)
Closing net assets of Fund		1,636.8375
Closing units	125 + 2 – 0.75	126.25
NAV/unit	<u>1,636.8375</u> 126.25	12.9651

Note:

- Net assets of mutual fund will increase in case of incomes (portfolio appreciation/dividends) and fresh inflow from unit holders
- Net assets of mutual fund will decrease in case of expenses and redemption by unit holders

16. NAV calculation [Nov 2019 RTP, May 2018, May 2012, May 2016 MTP, May 2018 MTP, Nov 2013 RTP, May 2021 MTP, Nov 2020]

On 1st April 2009, ABC MF has the following assets and prices at 4:00 PM

Shares	No of shares	Market Price Per share
A Limited	10000	19.70
B Limited	50000	482.60
C Limited	10000	264.40
D Limited	100000	674.90
E Limited	30000	25.90
No of units of fund		8,00,000

Calculate the following:

- a) NAV of the Fund
- b) Assuming Mr.X, send a cheque of Rs.50,00,000 to the fund and Fund manager purchases 18000 shares of C Limited and the balance is held in bank. Then what will be the position of the fund
- c) Calculate the New NAV if on 2nd April 2009 at 4:00 PM, the market price of share is as follows:
 - a. A Limited Rs.20.30
 - b. B Limited Rs.513.70
 - c. C Limited Rs.290.80
 - d. D Limited Rs.671.90
 - e. E Limited Rs.44.20

Answer:

WN 1: Computation of NAV of the Fund:

Shares	No of shares	Market Price Per share	Market value of shares (in lacs)
A Limited	10,000	19.70	1.97
B Limited	50,000	482.60	241.30

C Limited	10,000	264.40	26.44
D Limited	1,00,000	674.90	674.90
E Limited	30,000	25.90	7.77
Total value of assets			952.38
No of units			8.00
NAV/unit (952.38/8.00)			119.0475

WN 2: Position of fund post purchase by Mr.X:

- Mr. X gives a cheque for Rs.50 lacs. It is assumed that the fund manager buys 18,000 shares of C Limited at closing price of Rs.264.40. This will involve investment of Rs.47,59,200 (18,000 x 264.40) and the balance Rs.2,40,800 (50,00,000 – 47,59,200) is held in the bank account
- Mr. X will get fresh units allotted at NAV of RS.119.0475 and he would get 42,000 units [50,00,000/119.0475]

Shares	No of shares	Market Price Per share	Market value of shares (in lacs)
A Limited	10,000	19.70	1.9700
B Limited	50,000	482.60	241.3000
C Limited	28,000	264.40	74.0320
D Limited	1,00,000	674.90	674.9000
E Limited	30,000	25.90	7.7700
Cash (50 lacs - value of C purchased)			2.4080
Total value of assets			1,002.3800
No of units (8 lacs + (50 lacs/119.05))			8.4200
NAV/unit			119.0475

WN 3: Computation of New NAV as on April 2, 2019:

Shares	No of shares	Market Price Per share	Market value of shares (in lacs)
A Limited	10,000	20.30	2.0300
B Limited	50,000	513.70	256.8500
C Limited	28,000	290.80	81.4240
D Limited	1,00,000	671.90	671.9000
E Limited	30,000	44.20	13.2600
Cash (50 lacs - value of C purchased)			2.4080
Total value of assets			1,027.8720
No of units (8 lacs + (50 lacs/119.05))			8.4200
NAV/unit			122.0751

17. Return calculation [Nov 2009, Nov 2004, May 2013, Nov 2012 RTP]

Mr. Sinha has invested in three mutual fund schemes as per details below:

Particulars	Scheme X	Scheme Y	Scheme Z
Date of investment	01.12.2011	01.01.2012	01.03.2012
Amount of investment	Rs.5,00,000	Rs.1,00,000	Rs.50,000
NAV at entry date	Rs.10.50	Rs.10.00	Rs.10.00
Dividend received upto 31.03.2012	Rs.9,500	Rs.1,500	Nil
NAV at 31.03.2012	Rs.10.40	Rs.10.10	Rs.9.80

You are required to calculate the effective yield on per annum basis in respect of each of the three schemes to Mr. Sinha upto 31.03.2012?

Answer:

Computation of effective yield:

Particulars	Scheme X	Scheme Y	Scheme Z

1. Amount invested	5,00,000	1,00,000	50,000
2. NAV at entry date	10.50	10.00	10.00
3. No of units purchased (1/2)	47,619.05	10,000.00	5,000.00
4. Closing NAV	10.40	10.10	9.80
5. Value as on 31.03.2012 (3 x 4)	4,95,238.12	1,01,000	49,000
6. Capital appreciation (5 - 1)	(4,761.88)	1,000	(1,000)
7. Dividend income	9,500	1,500	-
8. Return (in rupees) (6 + 7)	4,738.12	2,500.00	-1,000.00
9. Holding Period Return (8/1) x 100	0.95%	2.50%	-2.00%
10. No of days of investment	122	91	31
11. Annual Yield (HPR x 366/No of days)	2.84%	10.05%	(23.61%)

Note:

- Holding period return does not consider the time period of investment and it just calculates return as income earned/amount invested
- For Annualized yield, we need to consider the time period of investment and then calculate the return. For computing no. of days of investment, we have considered February to have 29 days and the overall days to be 366.
- It is assumed that investment is made in morning and hence date of investment will be considered in number of days of investment.
- Annualized yield can also be calculated by multiplying holding period return with 12/no. of months of investment. ICAI has calculated return with no. of days in this question

18. Effective yield – reverse working [May 2018, May 2022]

Mr. Y has invested in the three mutual funds (MF) as per the following details:

Particulars	MF 'X'	MF 'Y'	MF 'Z'
Amount of investment	2,00,000	5,00,000	4,00,000
NAV at the time of purchase	10.00	25.00	20.00
Dividend Yield upto 31.03.2022	3%	5%	4%
NAV as on 31.03.2022	10.50	22.80	20.80
Annualized Yield as on 31.03.2022	9.733%	-11.185%	15%

Assume 1 Year = 365 days

Mr. Y has misplaced the documents of his investment. Held him in finding the date of his original investment after ascertaining the following:

- Number of units in each scheme
- Value of his investments as on 31.03.2022
- Holding period of his investments in number of days as on 31.03.2022
- Dates of original investments
- Total Return on investments,
- Assuming past performance of all three schemes will continue for next one year, what action the investor should take? What will be the expected return for the next one year after the above action?
- Will your answer as above point no. (vi) changes if the Mutual fund charges exit load of 5% if the investment is redeemed within one year? If so, advise the investor what and when the action to be taken to optimize the returns

Answer:**WN 1: Computation of number of units and value of investments as on 31.03.2022**

Particulars	Calculation	No of units	NAV as on 31.03.2022	Value as on 31.03.2022 [No of units x NAV]
MF 'X'	$\frac{2,00,000}{10.00}$	20,000.00	10.50	2,10,000
MF 'Y'	$\frac{5,00,000}{25.00}$	20,000.00	22.80	4,56,000
MF 'Z'	$\frac{4,00,000}{20.00}$	20,000.00	20.80	4,16,000
Total				10,82,000

WN 2: Calculation of Yield of each fund, total yield, period of holding and date of original investment:

Particulars	MF 'X'	MF 'Y'	MF 'Z'	Total
Initial investment	2,00,000	5,00,000	4,00,000	11,00,000
Capital gain	10,000	-44,000	16,000	-18,000
Dividends [Investment x Dividend Yield%]	6,000	25,000	16,000	47,000
Total return	16,000	-19,000	32,000	29,000
Holding period return (%) [Total return/investment] x 100	8.00	-3.80	8.00	2.64
Annual Yield	9.733	-11.185	15.00	
Period of holding (days)	$\left(\frac{8.00}{9.733}\right) \times 365$ = 300 Days	$\left(\frac{-3.80}{-11.185}\right) \times 365$ = 124 Days	$\left(\frac{8.00}{15.00}\right) \times 365$ = 195 Days	
Date of original investment	04.06.21	27.11.21	17.09.21	

Note: It is assumed that investment is made in evening and hence date of original investment is not considered in period of holding

Part (vi):

If past returns of all three schemes will continue for next one year, the investor should redeem the units of MFs 'X' and 'Y' and invest the proceeds in MF 'Z'. The expected return next will be 15%.

Part (vii):

If the Mutual funds are charging exit load of 5%, if investment is redeemed within one year, then investor should get redeemed units of MF 'Y' now and units of MF 'X' after 65 days.

19. Missing NAV [Nov 2006, Nov 2013, May 2017 MTP, Nov 2015, May 2019 RTP]

Mr. X on 1.7.2007, during the initial offer of some mutual fund invested in 10,000 units having face value of Rs.10 for each unit. On 31.03.2008, the dividend operated by the MF was 10% and Mr.X found that his annualized yield was 153.33%. On 31.12.2009 20% dividend was given. On 31.03.2010, Mr.X redeemed all his balance of 11,296.11 units when his annualized yield was 73.52%. What are the NAVs as on 31.03.2008, 31.12.2009 and 31.3.2010?

Answer:**WN 1: Computation of NAV as on 31.03.2008**

- The investor has earned an annualized yield of 153.33% for 1.7.2007 to 31.3.2008
- He has invested for a period of 9 months. The holding period return for 9 months is calculated below:

$$\text{Holding Period Return} = \text{Annual Return} \times \left(\frac{9}{12}\right)$$

$$\text{Holding Period Return} = 153.33\% \times \left(\frac{9}{12}\right) = 115\%$$

Particulars	Calculation	Amount
1. Amount of investment		1,00,000
2. Holding period return (in %)		115%
3. Holding period return (in Rs.)	$1,00,000 \times 115\%$	1,15,000
4. Value of investment as on 31.03.2008		2,15,000
5. No of units	$\frac{1,00,000}{10}$	10,000
6. NAV per unit before dividend payment	$\frac{2,15,000}{10}$	21.50
7. Less: Dividend	$10 \times 10\%$	1.00
8. NAV per unit post dividend payment	$21.50 - 1.00$	20.50

WN 2: Calculation of NAV as on 31.12.2009:

Particulars	Calculation	Amount
1. Dividend paid on 31.03.2008	$10,000 \times 1$	10,000
2. Units allotted	$\left(\frac{10,000}{20.50}\right)$	487.80
3. Total units post dividend re-investment		10,487.80
4. Dividend as on 31.12.2009	$10,487.80 \times 10 \times 20\%$	20,975.60

5. Units allotted as on 31.12.2009 (Note 1)	11,296.11 – 10,487.80	808.31
6. NAV/unit as on 31.12.2009	$\left(\frac{20,975.60}{808.31}\right)$	25.95

Note 1:

- The company has redeemed 11,296.11 units as on 31.03.2010. However, it had 10,487.80 units as on 31.03.2008. Hence extra units would have been allotted on 31.12.2009 due to dividend re-investment

WN 3: Computation of NAV as on 31.03.2010:

- Mr. X has earned an annualized yield of 73.52%. He has invested from 1.7.2007 to 31.3.2010 and the investment period is 33 months
- Holding period return for 33 months is calculated below:

$$\text{Holding Period Return} = \text{Annual Return} \times \left(\frac{9}{12}\right)$$

$$\text{Holding Period Return} = 73.52\% \times \left(\frac{33}{12}\right) = 202.18\%$$

Particulars	Calculation	Amount
1. Amount of investment		1,00,000
2. Holding period return (in %)		202.18%
3. Holding period return (in Rs.)	1,00,000 x 202.18%	2,02,180
4. Value of investment as on 31.03.2010		3,02,180
5. No of units		11,296.11
6. NAV as on 31.03.2010	$\frac{3,02,180}{11,296.11}$	26.75

20. Calculation of NAV [Nov 2009, May 2014 MTP, May 2015 MTP, May 2017 RTP]

A mutual fund made and issue of 10,00,000 units of Rs.10 each on January 01, 2021. No entry load was charged. It made the following investments:

Particulars	Amount
25,000 equity shares of Rs.100 each @ 320	80,00,000
5% Government securities	4,00,000
10% Debentures (unlisted)	5,00,000
8% Debentures (Listed)	10,00,000

During the year, dividends of Rs.8,00,000 were received on equity shares. Interest on all types of debt securities was received as and when due. On 31st December 2021 equity shares were appreciated by 15% while listed debentures were quoted at 20% premium. XYZ Ltd., on 15th December 2021 in its AGM declared the interim dividend of 10% and bonus shares at 1:10 with the record date of 28th December 2021.

- Find out the NAV per unit as on 31st December given that the operating expenses paid during the year amounting to Rs. 3,00,000.
- Find out the NAV, if the MF had distributed a dividend of, Rs. 0.50 per unit during the year to the investors.
- If you are the investor, find out what is the annualised return you have got.

Answer:**WN 1: Calculation of cash balance as on December 31, 2008:**

Particulars	Calculation	Amount (in lacs)
1. Inflow from unit holders	10,00,000 x 10	100.00
2. Purchase of investments		(99.00)
3. Dividends received		8.00
4. Interest on 5% security	4 lacs x 5%	0.20
5. Interest on 10% debt	5 lacs x 10%	0.50
6. Interest on 8% debt	10 lacs x 8%	0.80
7. Interim dividend	25,000 x 10	2.50
8. Operating expenses		(3.00)
9. Closing cash balance		10.00

Note: Interim dividend will be received only on original shares as the bonus shares are allotted post dividend declaration.

WN 2: Computation of NAV as on 31.12.2008:

Particulars	Calculation	Amount (in lacs)
Assets:		
Equity shares	$27,500 \times 320 \times 115\%$	101.20
5% Securities		4.00
10% debentures		5.00
8% debentures	$10.00 \times 120\%$	12.00
Cash balance		10.00
Total Assets (A)		132.20
Liabilities (B)		0
Net assets (A - B)		132.20
No of units		10
NAV/unit	$\left(\frac{132.20}{10}\right)$	11.551

- NAV/unit before declaration of dividend = Rs.13.22
- NAV/units after declaration of dividend = $13.22 - 0.50 = \text{Rs.}12.72$

WN 3: Annualized return:

$$\text{Return} = \frac{(\text{NAV}_1 - \text{NAV}_0) + D_1 + \text{CG}_1}{\text{NAV}_0} \times 100$$

$$\text{Return} = \frac{(12.72 - 10.00) + 0.50}{10.00} \times 100 = \mathbf{32.20\% \text{ per annum}}$$

21. Calculation of NAV [Nov 2018 RTP, May 2010, May 2014, Nov 2015 MTP, Nov 2018 MTP, Nov 2016 RTP]

Based on the following data, estimate the Net Asset Value (NAV) on per unit basis of a Regular Income Scheme of a mutual fund on 31.03.2016

Particulars	Amount (in lakhs)
Listed equity shares at cost (ex-dividend)	40.00
Cash in hand	2.76
Bonds & debentures at cost	8.96
Of these, Bonds not listed and not quoted	2.50
Other fixed interest securities at cost	9.75
Dividend accrued	1.95
Amount payable on shares	13.54
Expenditure accrued	1.76

Current realizable value of fixed income securities of face value Rs.100 is Rs.96.50. Number of units (Rs.10 face value) = 2,75,000

All the listed equity shares were purchased at a time when the market portfolio index was 12,500. On the NAV date market portfolio index was 19,975. There has been a diminution of 15% in unlisted bonds and debentures valuation. Listed bonds and debentures carry a market value of Rs.7.5 lakhs, on NAV date. Operating expenses paid during the year amounted to Rs.2.24 lakhs.

Answer:**Computation of NAV:**

Particulars	Calculation	Amount
Assets:		
Listed equity shares	$40 \times \left(\frac{19,975}{12,500}\right)$	63,92,000
Cash in hand	Given	2,76,000
Listed bonds and debentures		7,50,000
Unlisted bonds and debentures	$2,50,000 - 15\%$	2,12,500
Other fixed interest securities	$9,75,000 \times \left(\frac{96.5}{100}\right)$	9,40,875
Accrued dividends (assumed to be receivable)		1,95,000
Total Assets (A)		87,66,375
Liabilities:		

Amount payable on shares		13,54,000
Expenditure accrued		1,76,000
Total Liabilities (B)		15,30,000
Net Assets (A – B)		72,36,375
No of units		2,75,000
NAV/unit	72,36,375 2,75,000	26.3141

22. Calculation of NAV and repurchase price [Nov 2018 MTP, Nov 2015, Nov 2018 RTP, Jan 2021]

On 1st April an open ended scheme of mutual fund had 300 Lakh units outstanding with Net Assets Value (NAV) of Rs.18.75. At the end of April, it issued 6 lakhs units at opening NAV plus 2% load adjusted for dividend equalization. At the end of May, 3 Lakh units were repurchased at opening NAV less 2 % exit load adjusted for dividend equalization. At the end of June, 70 % of its available income was disturbed. In respect of April-June quarter, the following additional information are available.

	Rs (In lakhs)
Portfolio value appreciation	425.47
Income of April	22.950
Income of May	34.425
Income for June	45.450

You are required to calculate

- Income available for distribution;
- Issue price at the end of April;
- Repurchase price at the end May; and
- Net asset value (NAV) as on 30th June.

Answer:**WN 1: Computation of income available for distribution:**

Particulars	No of units (lacs)	Per unit	Amount (in lacs)
Income of April	300	0.0765 [22.95/300]	22.95
Add: Inflow from April MF buyers	6	0.0765	0.459
Total income till April	306	0.0765	23.409
Income of May	306	0.1125 [34.425/306]	34.425
Total income till May	306	0.189	57.834
Less: Redemption in May	3	0.189	0.567
Revised income till May	303	0.189	57.267
Income of June	303	0.15 [45.45/303]	45.45
Income available for distribution	303	0.339	102.717

Note:

- MF is earning income every month. In practice, NAV is calculated every day. However here we are not doing it.
- Hence NAV will get adjusted by dividend equalization. New unit holders will have to pay extra amount towards dividend equalization.
- In case of unit redemptions, unit holders will get extra amount as part of dividend equalization

WN 2: Computation of issue price for April:

- Issue price = (Opening NAV + 2%) + Dividend equalization of April
- Issue price = (18.75 + 2%) + 0.0765 = Rs. 19.2015

WN 3: Computation of Repurchase price at end of May:

- Repurchase price = (Opening NAV – 2%) + Dividend equalization for April and May
- Repurchase price = (18.75 – 2%) + 0.1890 = Rs.18.564

WN 4: Computation of NAV as on June 30:

Particulars	Calculation	Amount (in lacs)
Net assets on April 1	300 x 18.75	5,625.000
Add: Income of April	Given	22.950
Add: Inflow from unit buyers	6 x 19.2015	115.209
Add: Income of May	Given	34.425
Less: Payment to unit sellers	3 x 18.564	(55.692)
Add: Income of June	Given	45.450
Add: Portfolio appreciation	Given	425.470
Less: Dividends paid	70% x 102.717	(71.902)
Net Assets as on June 30		6,140.91
No of units		303
NAV per unit	$\left(\frac{6,140.91}{303} \right)$	20.2670

23. Calculation of NAV [May 2018 RTP, May 2013, May 2019 MTP, Nov 2014 RTP, May 2021 MTP]

On 1-4-2012 ABC Mutual Fund issued 20 lakh units at Rs.10 per unit. Relevant initial expenses involved were Rs.12 lakhs. It invested the fund so raised in capital market instruments to build a portfolio of Rs.185 lakhs. During the month of April, 2012 it disposed of some of the instruments costing Rs.60 lakhs for Rs.63 lakhs and used the proceeds in purchasing securities for Rs.56 lakhs. Fund management expenses for the month of April, 2012 was Rs.8 lakhs of which 10% in arrears. In April, 2012 the fund earned dividends amounting to Rs.2 lakhs and it distributed 80% of the realized earnings. On 30-04-2012 the market value of the portfolio was Rs.198 lakhs. Mr.Akash, an investor, subscribed to 100 units on 1-4-2012 and disposed of the same at closing NAV on 30-04-2012. What was his annual rate of earning?

Answer:

WN 1: Computation of closing cash balance:

Particulars	Calculation	Amount (in lacs)
Inflow from unit holders	20 lacs x 10	200
Less: Initial expenses		(12)
Less: Purchase of investments		(185)
Add: sale of shares		63
Less: Purchase of investments		(56)
Less: Fund management expenses		(7.2)
Add: Receipt of dividends		2
Less: Payment of dividends	Note 1	(4)
Closing cash balance		0.80

Note 1:

- The company has paid 80% of realized earnings as dividends. Realized earnings = Capital gain of Rs.3 lacs + Dividends of Rs.2 lacs. Dividends paid = 80% x 5 lacs = Rs.4 lacs

WN 2: Computation of NAV:

Particulars	Calculation	Amount (in lacs)
Assets:		
Market value of portfolio		198
Cash balance	WN 1	0.80
Total Assets (A)		198.80
Less: Liabilities		(0.80)
Net Assets		198
No of units		20
NAV per unit	198/20	9.90

WN 3: Computation of annual rate of earning:

$$\text{Annual rate of earning} = \frac{(\text{NAV}_1 - \text{NAV}_0) + D_1 + \text{CG}_1}{\text{NAV}_0} \times \frac{12}{m} \times 100$$

$$\text{Annual rate of earning} = \frac{(9.90 - 10.00) + \left(\frac{4}{20}\right)}{10.00} \times \frac{12}{1} \times 100$$

$$\text{Annual rate of earning} = \frac{0.10}{10.00} \times \frac{12}{1} \times 100 = 12\% \text{ per annum}$$

24. NAV computation and expense ratio [May 2019, May 2021 RTP]

The following particulars relating to Vishnu Fund Schemes:

Particulars	Value in Crores
Investment in shares (at cost)	
Pharmaceutical companies	79
Construction industries	31
Service sector companies	56
IT Companies	34
Real Estate Companies	10
Investment in Bonds (Fixed Income)	
Listed Bonds (8000, 14% Bonds of Rs.15,000 each)	12
Unlisted Bonds	7
No of units outstanding (crores)	4.2
Expenses payable	3.5
Cash and Cash equivalents	1.5
Market expectations on listed Bonds	8.842%

Particulars relating to each sector are as follows:

Sector	Index on purchase date	Index on valuation date
Pharmaceutical companies	260	465
Construction Industries	210	450
Service sector companies	275	480
IT Companies	240	495
Real Estate Companies	255	410

The funds has incurred the following expenses:

- Consultancy and management fees Rs.480 lacs
- Office expenses Rs.150 lacs
- Advertisement expenses Rs.38 lacs

You are required to calculate the following:

- Net Asset Value of the fund
- Net Asset Value per unit
- If the period of consideration is 2 years, and the fund has distributed Rs.3 per unit per year as cash dividend, ascertain the net return (annualized)
- Ascertain the expense ratio

Answer:

WN 1: Computation of Net Asset value of the fund and Net Asset Value per unit:

Particulars	Calculation	Amount (in Cr)
Assets:		
Pharma Companies	$79 \times \left(\frac{465}{260}\right)$	141.2885
Construction	$31 \times \left(\frac{450}{210}\right)$	66.4286
Service sector	$56 \times \left(\frac{480}{275}\right)$	97.7455
IT Companies	$34 \times \left(\frac{495}{240}\right)$	70.1250
Real estate	$10 \times \left(\frac{410}{255}\right)$	16.0784
Listed bonds	$8,000 \times \left(\frac{15,000 \times 14\%}{8.842\%}\right)$	19.0002
Unlisted bonds		7.0000
Cash		1.5000
Total Assets (A)		419.1662
Less: Liabilities		
Expenses payable		(3.5000)
Net Asset Value of Fund		415.6662

No of units		4.2000
NAV per unit	$\frac{415.6662}{4.2000}$	98.9681

WN 2: Computation of Return:

$$\text{Annual rate of earning} = \frac{(\text{NAV}_1 - \text{NAV}_0) + D_1 + \text{CG}_1}{\text{NAV}_0} \times \frac{12}{m} \times 100$$

$$\text{Annual rate of earning} = \frac{(98.9681 - 54.5238) + 6}{54.5238} \times \frac{12}{24} \times 100$$

$$\text{Annual rate of earning} = \frac{50.4443}{54.5238} \times \frac{12}{24} \times 100 = 46.26\% \text{ per annum}$$

Note:**Computation of opening NAV:**

Particulars	Calculation	Amount (in Cr)
Assets:		
Pharma Companies		79.00
Construction		31.00
Service sector		56.00
IT Companies		34.00
Real estate		10.00
Listed bonds		12.00
Unlisted bonds		7.00
Cash		-
Total Assets (A)		229.00
Less: Liabilities		
Expenses payable		-
Net Asset Value of Fund		229.00
No of units		4.2000
NAV per unit	$\frac{229.00}{4.2000}$	54.5238

WN 3: Computation of expense ratio:

Particulars	Calculation	Amount
1. Expenses for two years (assumed) (in crores)	4.80 + 1.50 + 0.38	6.68
2. Expenses for one year (in crores)	$\frac{6.68}{2}$	3.34
3. No of units (in crores)		4.2
4. Annual expense per unit	$\frac{3.34}{4.2}$	0.7952
5. Annual expense ratio (on closing NAV)	$\frac{0.7952}{98.9681} \times 100$	0.80%
6. Annual expense ratio (on opening NAV)	$\frac{0.7952}{54.5238} \times 100$	1.46%
7. Annual expense ratio (on average NAV)	$\frac{0.7952}{76.7460} \times 100$	1.04%

Part III – Mutual Funds – Performance Evaluation**25. Sharpe & Treynor ratio [Nov 2018 RTP, May 2016, Nov 2018 RTP, May 2019 RTP]**

The following are the data on five mutual funds

Fund	Return	Standard Deviation	Beta
A	15	7	1.25
B	18	10	0.75
C	14	5	1.40
D	12	6	0.98

E	16	9	1.50

You are required to compute reward to variability and reward to volatility ratio and rank the portfolio. Assume risk free rate as 6%

Answer:

WN 1: Computation of reward to variability (Sharpe Ratio) and ranking:

$$\text{Sharpe Ratio} = \frac{\text{Return of security} - \text{Risk-free return}}{\text{SD of security}}$$

Fund	Return	Excess return (Return - Risk free)	SD	Reward to variability (Col 3/Col 4)	Rank
A	15	9	7	1.29	2
B	18	12	10	1.2	3
C	14	8	5	1.6	1
D	12	6	6	1	5
E	16	10	9	1.11	4

WN 2: Computation of reward to volatility (Treynor Ratio) and ranking:

$$\text{Treynor Ratio} = \frac{\text{Return of security} - \text{Risk-free return}}{\text{Beta of security}}$$

Fund	Return	Excess return (Return - Risk free)	Beta	Reward to Volatility (Col 3/Col 4)	Rank
A	15	9	1.25	7.2	2
B	18	12	0.75	16	1
C	14	8	1.4	5.71	5
D	12	6	0.98	6.12	4
E	16	10	1.5	6.67	3

26. Calculation of Expected NAV [May 2019 RTP, May 2018 MTP, May 2015]

There are two Mutual Funds, D Mutual Fund Limited and K Mutual Fund Limited, each having close ended equity schemes. NAV as on 31-12-2014 of equity schemes of D Mutual Fund Limited is Rs.70.71 (consisting 99% equity and remaining cash balance) and that of K Mutual Fund Limited is Rs.62.50 (consisting 96% equity and balance in cash).

Following is the other information:

Particulars	Equity Schemes	
	D Mutual Fund Limited	K Mutual Fund Limited
Sharpe Ratio	2	3.3
Treynor Ratio	15	15
Standard deviation	11.25	5

There is no change in portfolios during the next month and annual average cost is Rs.3 per unit for the schemes of both the mutual funds. If share market goes down by 5 percent within a month, calculate expected NAV after a month for the schemes of both the mutual funds. For calculation, consider 12 months in a year and ignore number of days for particular month.

Answer:

WN 1: Computation of Beta of D Mutual Fund and K Mutual Fund:

Particulars	D Mutual Fund	K Mutual Fund
1. Sharpe Ratio	2	3.3
2. Standard deviation	11.25	5
3. Excess return (Return - Risk free) [1 x 2]	22.50	16.50
4. Treynor Ratio	15	15
5. Beta (3/4)	1.50	1.10

- Beta of 1.50 times would mean that if market falls by 1%, mf will fall by 1.50%. In this question, the market has fallen by 5%
- Equity component of D Mutual Fund and K Mutual Fund will fall by 7.5% (5 x 1.5) & 5.5% (5 x 1.1) respectively

WN 2: Computation of NAV:

Particulars	D Mutual Fund	K Mutual Fund
1. Opening NAV	70.71	62.50
Represented by equity	70.00 [70.71 x 99%]	60.00 [62.50 x 96%]
Represented by cash	0.71 [70.71 x 1%]	2.50 [62.50 x 4%]
2. Closing NAV	65.21 [64.75 + 0.46]	58.95 [56.70 + 2.25]
Represented by equity	64.75 [70 - 7.5%]	56.70 [60 - 5.5%]
Represented by cash	0.46 [0.71 - 0.25]	2.25 [2.5 - 0.25]

- Equity component of NAV has been reduced by 7.5% and 5.5%
- Annual expense is Rs.3 per unit. Monthly expense will be Rs.0.25 per unit and hence cash component has been reduced by Rs.0.25 per unit

27. Computation of Jensen's Alpha [May 2017]

The five portfolios of a mutual fund experienced following result during last 10 years:

Portfolio	Average Annual Return %	Standard Deviation	Correlation with the market return
A	20.0	2.3	0.8869
B	17.0	1.8	0.6667
C	18.0	1.6	0.600
D	16.0	1.8	0.867
E	13.5	1.9	0.5437

- ❖ Market risk : 1.2
- ❖ Market rate of return : 14.3%
- ❖ Risk free rate : 10.1%

Beta may be calculated only upto two decimal. Rank the portfolio using JENSEN's ALPHA Method.

Answer:

WN 1: Computation of Beta:

$$\text{Beta} = \frac{\text{Standard deviation of portfolio}}{\text{Standard deviation of market}} \times \text{Correlation coefficient}$$

Portfolio	Standard Deviation	Correlation with the market return	Beta
A	2.3	0.8869	1.70
B	1.8	0.6667	1.00
C	1.6	0.600	0.80
D	1.8	0.867	1.30
E	1.9	0.5437	0.86

WN 2: Computation of Jensen's Alpha:

Portfolio	Beta	Expected return $R_f + \text{beta} \times (R_m - R_f)$	Actual Return	Jensen's Alpha	Rank
A	1.70	17.24	20.0	2.76	II
B	1.00	14.30	17.0	2.70	III
C	0.80	13.46	18.0	4.54	I
D	1.30	15.56	16.0	0.44	IV
E	0.86	13.71	13.5	-0.21	V

28. MF - Performance Evaluation [Nov 2020 Exam]

The following are the details of three mutual funds of MFL:

	Growth Fund	Balanced Fund	Regular Fund	Market
Average return (%)	7	6	5	9
Variance	92.16	54.76	40.96	57.76
Co-efficient of determination	0.3025	0.6561	0.9604	

The yield on 182 days Treasury Bill is 9 per cent per annum.

You are required to:

- (i) Rank the funds as per Sharpe's measure.
(ii) Rank the funds as per Treynor's measure.
(iii) Compare the performance with the market

Answer:

WN 1: Evaluation as per Sharpe Ratio:

$$\text{Sharpe Ratio} = \frac{\text{Return of security} - \text{Risk-free return}}{\text{SD of security}}$$

Fund	Return	Excess return (Return - Risk free)	Variance	SD	Sharpe Ratio	Rank
Growth	7.00	-2.00	92.16	9.60	-0.2083	1
Balanced	6.00	-3.00	54.76	7.40	-0.4054	2
Regular	5.00	-4.00	40.96	6.40	-0.6250	3
Market	9.00	0.00	57.76	7.60	-0.0000	NA

Note:

- There seems to be some inaccuracy with the question as the risk-free rate of return is higher than MF return. This leads to negative excess return and negative Sharpe Ratio
- Lower negative Sharpe ratio has been ranked 1 and so on. Alternatively, we need not do any ranking as the same is of not much use

WN 2: Computation of Beta of different funds:

Particulars	Growth	Balanced	Regular
Variance	92.16	54.76	40.96
Coefficient of determination (assumed to be r^2)	0.3025	0.6561	0.9604
Systematic risk [Variance x coefficient of determination]	27.8784	35.9280	39.3380
Variance of market	57.76	57.76	57.76
Beta ² $\frac{\text{[Systematic risk]}}{\text{[Variance of market]}}$	0.4827	0.6220	0.6811
Beta	0.6948	0.7887	0.8253

WN 3: Evaluation as per Treynor Ratio:

$$\text{Treynor Ratio} = \frac{\text{Return of security} - \text{Risk-free return}}{\text{Beta of security}}$$

Fund	Return	Excess return (Return - Risk free)	Beta	Treynor Ratio	Rank
Growth	7.00	-2.00	0.6948	-2.8785	1
Balanced	6.00	-3.00	0.7887	-3.8037	2
Regular	5.00	-4.00	0.8253	-4.8467	3
Market	9.00	0.00	1.0000	-0.0000	NA

WN 4: Comparison of performance with market:

- Market has Sharpe and Treynor ratio of 0 times. However, the ratio for other mutual funds is negative. Hence, we can conclude that funds have performed weaker than the market

29. Tracking error:

XYZ Nifty index fund aims to replicate the performance of Nifty 50 as its benchmark. Following are the returns over last 5 months. Compute tracking error from this information.

Month	XYZ Nifty Index Fund Return	Nifty 50 return
1	4%	3.7%
2	2%	2.5%
3	-4%	-3.2%
4	1%	1.8%
5	6%	7.2%

Answer:**Computation of tracking error:**

Month	XYZ Nifty Index Fund Return	Nifty 50 return	Differential return	Deviation	Deviation ²
1	4	3.7	0.3	0.9	0.81
2	2	2.5	-0.5	0.1	0.01
3	-4	-3.2	-0.8	-0.2	0.04
4	1	1.8	-0.8	-0.2	0.04
5	6	7.2	-1.2	-0.6	0.36
Average			-0.6		1.26
Variance					0.315
SD					0.5612

Note:

- Differential return = Index fund return – benchmark return
- Deviation = Differential return – average differential return
- Variance = Total of deviation column / (n-1) = 1.26 / (5-1) = 0.315
- **Standard deviation (Tracking error) = 0.5612%**

Chapter 9 – Derivatives Analysis and Valuation**1. What is a derivative instrument and how does it derive its value?**

- ❖ **Meaning:** Derivative is a product whose value is to be derived from the value of one or more basic variables called bases (underlying assets, index or reference rate). The underlying assets can be Equity, Forex, and Commodity
- ❖ The importance of underlying asset in derivative instrument is as follows:
 - All derivative instruments are dependent on an underlying to have value.
 - The change in value in a forward contract is broadly equal to the change in value in the underlying.
 - In the absence of a valuable underlying asset the derivative instrument will have no value.
 - On maturity, the position of profit/loss is determined by the price of underlying instruments. If the price of the underlying is higher than the contract price the buyer makes a profit. If the price is lower, the buyer suffers a loss.

2. Who are the main users of derivatives?

Users	Purpose
Corporation	To hedge currency risk and inventory risk
Individual investors	For speculation, hedging and yield enhancement
Institutional investor	For hedging asset allocation, yield enhancement and to avail arbitrage opportunities
Dealers	For hedging position taking, exploiting inefficiencies and earning dealer spreads.

3. Differentiate between Cash market and Derivatives market?

- ❖ In cash market tangible assets are traded whereas in derivative market contracts based on tangible or intangibles assets like index or rates are traded.
- ❖ In cash market, we can purchase even one share whereas in Futures and Options minimum lots are fixed.
- ❖ Cash market is more-risky than Futures and Options segment because in “Futures and Options” risk is limited upto 20%.
- ❖ Cash assets may be meant for consumption or investment. Derivative contracts are for hedging, arbitrage or speculation.
- ❖ The value of derivative contract is always based on and linked to the underlying security. However, this linkage may not be on point-to-point basis.
- ❖ In the cash market, a customer must open securities trading account with a securities depository whereas to trade futures a customer must open a future trading account with a derivative broker.
- ❖ Buying securities in cash market involves putting up all the money upfront whereas buying futures simply involves putting up the margin money.
- ❖ With the purchase of shares of the company in cash market, the holder becomes part owner of the company. While in future it does not happen.

4. Distinguish between forward and futures contract? [Nov 2020 RTP]

Features	Forward Contract	Futures Contract
Trading	Forward contracts are traded on personal basis or on telephone or otherwise	Futures Contracts are traded in a competitive arena.
Size of contract	Forward contracts are individually tailored and have no standardized size	Futures contracts are standardized in terms of quantity or amount as the case may be
Organized exchanges	Forward contracts are traded in an over the counter market.	Futures contracts are traded on organized exchanges with a designated physical location.
Settlement	Forward contracts settlement takes place on the date agreed upon between the parties.	Futures contracts settlements are made daily via. Exchange's clearing house.
Delivery date	Forward contracts may be delivered on the dates agreed upon and in terms of actual delivery.	Futures contracts delivery dates are fixed on cyclical basis and hardly takes place.

		However, it does not mean that there is no actual delivery.
Transaction costs	Cost of forward contracts is based on bid – ask spread.	Futures contracts entail brokerage fees for buy and sell order
Marking to Market	Forward contracts are not subject to marking to market	Futures contracts are subject to marking to market in which the loss on profit is debited or credited in the margin account on daily basis due to change in price.
Margins	Margins are not required in forward contract.	In futures contracts every participants is subject to maintain margin as decided by the exchange authorities
Credit risk	In forward contract, credit risk is born by each party and, therefore, every party has to bother for the creditworthiness.	In futures contracts the transaction is a two way transaction, hence the parties need not to bother for the risk.

5. What is Marking to market?

It implies the process of recording the investments in traded securities (shares, debt-instruments, etc.) at a value, which reflects the market value of securities on the reporting date. In the context of derivatives trading, the futures contracts are marked to market on periodic (or daily) basis. Marking to market essentially means that at the end of a trading session, all outstanding contracts are repriced at the settlement price of that session. Unlike the forward contracts, the future contracts are repriced every day. Any loss or profit resulting from repricing would be debited or credited to the margin account of the broker. It, therefore, provides an opportunity to calculate the extent of liability on the basis of repricing. Thus, the futures contracts provide better risk management measure as compared to forward contracts.

6. What are the advantages of stock index futures over stock futures?

- ❖ It adds flexibility to one's investment portfolio. Institutional investors and other large equity holders prefer the most this instrument in terms of portfolio hedging purpose. The stock systems do not provide this flexibility and hedging.
- ❖ It creates the possibility of speculative gains using leverage. Because a relatively small amount of margin money controls a large amount of capital represented in a stock index contract, a small change in the index level might produce a profitable return on one's investment if one is right about the direction of the market. Speculative gains in stock futures are limited but liabilities are greater.
- ❖ Stock index futures are the most cost-efficient hedging device whereas hedging through individual stock futures is costlier.
- ❖ Stock index futures cannot be easily manipulated whereas individual stock price can be exploited more easily.
- ❖ Since, stock index futures consists of many securities, so being an average stock, is much less volatile than individual stock price. Further, it implies much lower capital adequacy and margin requirements in comparison of individual stock futures. Risk diversification is possible under stock index future than in stock futures.
- ❖ One can sell contracts as readily as one buys them and the amount of margin required is the same.
- ❖ In case of individual stocks, the outstanding positions are settled normally against physical delivery of shares. In case of stock index futures, they are settled in cash all over the world on the premise that index value is safely accepted as the settlement price.
- ❖ It is also seen that regulatory complexity is much less in the case of stock index futures in comparison to stock futures.
- ❖ It provides hedging or insurance protection for a stock portfolio in a falling market.

7. What are the uses/advantages of stock index futures?

- Investors commonly use stock index futures to change the weights or risk exposures of their investment portfolios. Investors can buy index futures of a particular index to increase weights and sell index futures of another index to reduce weights
- Stock index futures also allow investors to separate market timing from market selection decisions. For instance, investors may want to take advantage of perceived immediate increases in an equity market but are not certain which securities to buy; they can do this by purchasing stock index futures

- Investors can also make money **from stock index futures through index arbitrage**, also referred to as program trading as it is carried out through use of computers. Investors taking part in stock index arbitrage seek to gain profits whenever a futures contract is trading out of line with the fair price of the securities underlying it.
- Investors often use **stock index futures to hedge the value of their portfolios**. Provide hedging or insurance protection for a stock portfolio in a falling market.
- Stock index futures add flexibility to his or her portfolio as a hedging and trading instrument
- Create the possibility of **speculative gains using leverage**. Because a relatively small amount of margin money controls a large amount of capital represented in a stock index contract, a small change in the index level might produce a profitable return on one's investment if he or she is right about the market's direction.
- Maintain one's stock portfolio **during stock market corrections**. One may not need "insurance" for all the time, but there are certain times **when one would like less exposure to stocks**
- One can sell contracts as readily as he or she can buy them and the amount of margin required is the same. Mutual funds do not specialize in bear market approaches by short selling stocks but, and also it is **not possible for individuals to short sell stocks in a falling market** to make money.
- Transfer risk quickly and efficiently. Whether one is speculating, looking for insurance protection (hedging), or temporarily substituting futures for a later cash transaction, **most stock index futures trades can be accomplished quickly and efficiently**

8. Distinguish between options and futures?

- ❖ **Nature:** In options, the buyer of the options has the right but not the obligation to purchase or sell the stock. However, while going in for a long futures position, the investor is obligated to square off his position at or before the expiry date of the futures contract.
- ❖ **Movement of the Market:** Options traders use a mathematical factor, the delta that measures the relationship between the options premium and the price of the underlying stock. At times, an options contract's value may fluctuate independently of the stock price. By contrast, the future contract will much more closely follow the movement of the underlying stock.
- ❖ **The Price of Investing:** When an options investor takes a long position, he or she pays a premium for the contract. The premium is often called a sunk cost. At expiration, unless the options contract is in the money, the contract is worthless and the investor has lost the entire premium. Stock future contracts require an initial margin deposit and a specific maintenance level of cash for mark to market margin

9. What are the factors affecting value of an option?

- ❖ **Price Movement of the Underlying:** The value of calls and puts are affected by changes in the underlying stock price in a relatively straightforward manner. When the stock price goes up, calls should gain in value and puts should decrease. Put options should increase in value and calls should drop as the stock price falls.
- ❖ **Time till expiry:** The option's future expiry, at which time it may become worthless, is an important and key factor of every option strategy. Ultimately, time can determine whether your option trading decisions are profitable. To make money in options over the long term, you need to understand the impact of time on stock and option positions.
- ❖ **Volatility in Stock Prices:** Volatility can be understood via a measure called statistical (sometimes called historical) volatility, or SV for short. SV is a statistical measure of the past price movements of the stock; it tells you how volatile the stock has actually been over a given period of time
- ❖ **Interest Rate:** Another feature which affects the value of an Option is the time value of money. The greater the interest rates, the present value of the future exercise price are less

10. Write short note on various Greeks (Delta, Gamma, Theta, Rho and Vega)?

Delta	It is the degree to which an option price will move given a small change in the underlying stock price. For example, an option with a delta of 0.5 will move half a rupee for every full rupee movement in the underlying stock.
Gamma	It measures how fast the delta changes for small changes in the underlying stock price. i.e. the delta of the delta. If you are hedging a portfolio using the delta-hedge technique described under "Delta", then you will want to keep gamma as small as possible, the smaller it is the less often you will have to adjust the hedge to maintain a delta neutral position

Theta	The change in option price given a one day decrease in time to expiration. Basically it is a measure of time decay
Rho	The change in option price given a one percentage point change in the risk-free interest rate. It is sensitivity of option value to change in interest rate. Rho indicates the absolute change in option value for a one percent change in the interest rate.
Vega	Sensitivity of option value to change in volatility. Vega indicates an absolute change in option value for a one percent change in volatility

11. What is an exotic option and what are the different types of exotic options?

- Exotic options are the classes of option contracts with **structure and features different from plain vanilla options** (American and European style options).
- Exotic options are different from these vanilla options in their expiration dates also. Exotic option is some type of hybrid of American and European options **and hence falls somewhere in between these options.**
- **Exotic vs traditional options:** An exotic option can vary in terms of pay off and time of exercise. These options are more complex than vanilla options and they are mostly traded in OTC market.

Types of Exotic Options:

- **Chooser Options:** This option provides a right to the buyer of option after a specified period of time to decide **whether purchased option is a call option or put option**. It is to be noted that the decision can be made within a specified period prior to the expiration of contracts
- **Compound Options:** Also called split fee option or '**option on option**'. As the name suggests this option provides a right or choice not an obligation **to buy another option at specific price on the expiry of first maturity date**. Thus, it can be said in this option the underlying is an option. Further the payoff depends on the strike price of second option.
- **Barrier options:** Though it is similar to plain vanilla call and put options, but unique feature of this option is **that contract will become activated only if the price of the underlying reaches a certain price** during a predetermined period
- **Binary Options:** Also known as 'Digital Option', this option contract guarantees the pay-off **based on the happening of a specific event**. If the event has occurred, the pay-off shall be pre-decided amount and if event it has not occurred then there will be no pay-off
- **Asian Options:** These are the option contracts whose pay off are determined by the **average of the prices of the underlying over a predetermined period** during the lifetime of the option.
- **Bermuda Option:** It is somewhat a compromise between a European and American options. Contrary to American option where it can be exercised at any point of time, **the exercise of this option is restricted to certain dates** or on expiration like European option.
- **Basket Options:** In this type of contracts the value of option instead of one underlying depends on **the value of a portfolio i.e., a basket**. Generally, this value is computed based on the weighted average of underlying constituting the basket.
- **Spread Options:** As the name suggests the payoff of these type of options depend on **difference between prices of two underlying**.
- **Look back options:** Unlike other type of options whose exercise prices are pre-decided, in this option on maturity date the **holder of the option is given a choice to choose a most favourable strike price depending on the minimum and maximum price of an underlying** achieved during the life time of option.

12. What are the two types of risks which are impacting financial products?

Financial products are subject to following two types of risks:

- **Market Risk:** Due to adverse movement of the stock market, interest rates and foreign exchange rates. Financial derivatives can be used to hedge the market risk.
- **Credit Risk:** Also called as counter party or default risk, this risk involves non-fulfilment of obligation by the counter party. Credit derivatives can be used to mitigate this risk.

13. Explain the working of Credit Default Swaps (CDS)?

- CDS can be defined as an **insurance (not in stricter sense) against the risk of default** on a debt which may be debentures, bonds etc

- Under this arrangement, one party (called buyer) needing protection against the default **pays a periodic premium to another party (called seller), who in turn assumes the default risk**. Hence, in case default takes place then there will be settlement and in case **no default takes place no cash flow will accrue to the buyer alike option contract and agreement is terminated**. Although it resembles the options but since element of choice is not there it more resembles the swap arrangements. **Amount of premium mainly depends on the price of underlying and especially when the credit risk is more.**

Features:

- CDS is a non-standardized private contract between the buyer and seller. Therefore, it is covered in the category of **Forward Contracts**
- They are normally not traded on any exchange and hence **remains free from the regulations** of Governing Body.
- The International Swap and Derivative Association (ISAD) publishes the guidelines and general rules used normally to carry out CDS contracts.
- CDS can be purchased **from third party to protect itself from default of borrowers**.
- Similarly, an individual investor who is buying bonds from a company can purchase CDS to protect his investment from insolvency of that company. Thus, this increases the level of confidence of investor in Bonds purchased.
- The cost or premium of CDS **has a positive relationship with risk attached with loans**. Therefore, higher the risk attached to Bonds or loans, higher will be premium or cost of CDS.
- If an investor buys a CDS without being exposed to credit risk of the underlying bond issuer, **it is called "naked CDS"**.

14. What are the primary applications of Credit Default Swaps (CDS), and who are the participants involved in CDS transactions?"

Applications of CDS:

- Hedging:** Main purpose of using CDS is to **neutralize or reduce a risk** to which CDS is exposed to. Thus, by buying CDS, risk can be passed on to CDS seller or writer.
- Arbitrage:** It involves buying a CDS and entering into an asset swap. For example, a fixed coupon payment of a bond is swapped against a floating interest stream. Arbitrage will lead to profit if the cost of CDS is lower than the net benefit received from asset swap
- Speculation:** CDS can also be used to make profit by exploiting price changes. For example, a CDS writer assumed risk of default, will gain from contract if credit risk does not materialize during the tenure of contract or if compensation received exceeds potential payout

Parties to CDS:

- The initial borrowers:** It is also called a 'reference entity', which are owing a loan or bond obligation.
- Buyer:** It is also called 'investor' i.e. the **buyer of protection**. The buyer will make regular payment to the seller for the protection from default or credit event of reference entity.
- Seller:** It is also called 'writer' of the CDS and makes payment to buyer in the event of credit event of reference entity. It receives a regular pay off from the buyer of CDS.

15. Explain the settlement process of CDS?

- CDS Transaction example:** Suppose BB Corp. buys CDS from SS Bank for the Bonds amounting \$ 10 million of Danger Corp. In such case, the BB Corp. will become the buyer, SS Bank becomes seller and Danger Corp. becomes the reference entity. BB Corp. will make regular payment to SS Bank of the premium and if Danger Corp. defaults on its debts, the BB Corp. will receive one time payment and CDS contract is terminated.

Settlement types:

- Physical Settlement:** This is the traditional method of settlement. It involves the delivery of Bonds or debts of the reference entity by the buyer to the seller and seller pays the buyer the par value. For example, as mentioned above suppose Danger Corp. defaults then SS Bank **will pay \$ 10 Million to BB Corp. and BB Corp will deliver \$10 Million face value of Bonds to SS Bank**
- Cash Settlement:** Under this arrangement seller pays the buyer the **difference between par value and the market price of a debt (whatever may be the market value) of the reference entity**.

Continuing the above example suppose, the market value of Bonds is 30%, as market is of belief that bond holder will receive 30% of the money owed in case company goes into liquidation. Thus, the SS Bank shall pay BB Corp. \$ 10 Million - \$3 million (100% - 30%) = \$ 7 Million.

16. What is Collateralized Debt Obligations (CDOs) and explain its types?

- CDOs typically **pool together various debt instruments**, such as bonds, loans, and other fixed-income assets, to create a diversified portfolio of assets. The cash flows generated from these assets are used to pay **interest and principal to the investors** of different tranches.

Types of CDOs:

- Cash Flow Collateralized Debt Obligations (Cash CDOs):** Cash CDO is CDO which is backed by cash market debt or securities which normally **have low risk weight**. This structure mainly relies on the collateral's risk weight and collateral's ability to generate sufficient cash to pay off the securities issued by SPV
- Synthetic Collateralized Debt Obligations:** Synthetic CDOs **do not typically hold actual debt instruments as collateral**. Instead, they use credit derivatives, **such as credit default swaps (CDS)**, to replicate the performance of a portfolio of reference assets. Accordingly, this structure is mainly **used to hedge the risk rather than balance sheet funding**. Further, for banks, this structure also allows **the customer's relations to be unaffected**. This was started mainly by banks who want to **hedge the credit risk but not interested in taking administrative burden of sale of** assets through securitization. Synthetic CDOs can also be categorized as follows:
 - Unfunded:** It will be comprised only CDs.
 - Fully Funded:** It will be through issue of Credit Linked Notes (CLN)
 - Partially Funded:** It will be partially through issue of CLN and partially through CDs
- Arbitrage CDOs:** Basically, in Arbitrage CDOs, the issuer **captures the spread between the return realized collateral underlying the CDO and cost of borrowing to purchase these collaterals**. In addition to this issuer also collects the fee for the management of CDOs. This arbitrage arises due to acquisition of relatively high yielding securities with large spread from open market.

17. What are the various risks involved in CDOs?

Default Risk	Also called as 'credit risk', it emanates from the default of underlying party to the instruments. The prime sufferers of these types of risks are equity or junior tranche in the waterfall
Interest rate risk	- Also called as Basis risk and mainly arises due to different basis of interest rates. For example, asset may be based on floating interest rate but the liability may be based on fixed interest rates. - Though this type of risk is quite difficult to manage fully but commonly used techniques such as swaps, caps, floors, collars etc. can be used to mitigate the interest rate risk
Liquidity risk	Another major type of risk by which CDOs are affected is liquidity risks as there may be mismatch in coupon receipts and payments
Prepayment risk	This risk results from unscheduled or unexpected repayment of principal amount underlying the security.
Reinvestment risk	This risk is generic in nature as the CDO manager may not find adequate opportunity to reinvest the proceeds when allowed for substitutions
Foreign Exchange Risk	Sometimes CDOs are comprised of debts and loans from countries other than the country of issue. In such a case, in addition to above mentioned risks, CDOs are also subject to the foreign exchange rate risk

18. Distinguish between Financial Option and Real option?

Basis	Financial Option	Real Option
Underlying	Have underlying assets that are normally traded in the market i.e. shares, stocks, bonds, commodity etc.	Have underlying the projects that are not traded in the market.
Pay-off	In most of the cases it is specified in the contracts and hence is fixed.	It is estimated from the project cash flows and hence can be varied.

Exercise period	Mostly the period of these options is short and can go maximum upto 1 year.	The period of these options mostly starts from the end of 1st year and higher than the Financial Options.
Approach	Since these options are normally traded in the market they are "Priced".	Since these options are used to make decisions, they are "Valued"

19. What are the key criteria that a commodity must meet in order to be considered suitable for commodity derivatives trading?

- **Standardization:** The commodity should have a standardized quality and quantity. This means that there should be consistent specifications regarding the composition, grade, size, and other relevant characteristics of the commodity. Standardization ensures that the commodity can be easily exchanged and traded in the derivatives market
- **Deliverability:** The commodity must be deliverable, meaning it should be physically available for delivery upon the expiration of the derivative contract. The ability to deliver the underlying commodity is essential for settlement purposes, especially in futures contracts where physical delivery may occur.
- **Liquidity:** Sufficient liquidity is crucial for commodity derivatives. There should be active trading in the commodity and corresponding derivative contracts, with a reasonable number of buyers and sellers in the market. Adequate liquidity ensures smooth trading, efficient price discovery, and the ability to enter and exit positions without significant price impact
- **Price volatility:** Commodities considered for derivatives should exhibit a certain level of price volatility
- **Market demand:** There should be a significant market demand for the commodity, either for consumption or as an investment.

20. What are the needs of the users of commodity derivatives?

- Instrumental needs are the **hedgers' needs for price risk reduction**. Hedgers wish to reduce, or, if possible, eliminate portfolio risks at low cost. The instrumental needs are related to the core service of the commodity derivatives market, which consists of reducing price variability to the customer.
- Not only do hedgers wish to reduce price risk, **they also desire flexibility in doing business, easy access to the market, and an efficient clearing system. These needs are called convenience needs.** They deal with the customer's need to be able to use the core service provided by the exchange with relative ease. The extent to which the commodity derivatives exchange is able to satisfy convenience needs determines the process quality.
- The service offering is not restricted to the core service, but has to be complemented by so-called peripheral services.

21. What are the advantages of Commodity Market? Also explain the benefits of commodity futures?

Advantages of Commodity Market:

- Most money managers prefer derivatives to tangible commodities
- Less hassle (delivery, etc);
- Allows indirect investment in real assets that could provide an **additional hedge against inflation risk.**

Advantages of Commodity Futures:

- Easiest and cheapest way to invest in commodities
- 3 Major Categories like **Agricultural products** (soft commodities) –fibers, grains, food, livestock; **Energy** – crude oil, heating oil, natural gas; and **Metals** – copper, aluminium, gold, silver, platinum

22. Discuss the types of Commodity Swaps? [Nov 2018 MTP]

There are two types of commodity swaps: fixed-floating or commodity-for-interest.

- ❖ **Fixed-Floating Swaps:** They are just like the fixed-floating swaps in the interest rate swap market with the exception that both indices are commodity-based indices. **General market indices in the international commodities market with which many people would be familiar include the S&P Goldman Sachs Commodities Index (S&PGSCI) and the Commodities Research Board Index (CRB).** These two indices place different weights on the various commodities so they will be used according to the swap agent's requirements.

- ❖ **Commodity-for-Interest Swaps:** They are similar to the equity swap in which a total return on the commodity in question is exchanged for some money market rate (plus or minus a spread)
23. What are the peculiar characteristics of commodity swaps which have a bearing on their valuation?
- ❖ The cost of hedging;
 - ❖ The institutional structure of the particular commodity market in question;
 - ❖ The liquidity of the underlying commodity market;
 - ❖ Seasonality and its effects on the underlying commodity market;
 - ❖ The variability of the futures bid/offer spread;
 - ❖ Brokerage fees; and
 - ❖ Credit risk, capital costs and administrative costs.

Unique nature of the commodity markets refers to the limited number of participants in these markets (naturally begging questions of liquidity and market information), the unique factors driving these markets, the inter-relations with cognate markets (*agricultural commodities can be influenced by other markets such as energy markets*) and the individual participants in these markets.

24. Write short note on Embedded derivatives? [Nov 2018 (exam)]

- ❖ An embedded derivative is a **derivative instrument that is embedded in another contract - the host contract**. The host contract might be a debt or equity instrument, a lease, an insurance contract or a sale or purchase contract.
- ❖ Derivatives require to be **marked-to-market through the income statement**, other than qualifying hedging instruments. This requirement on embedded derivatives are designed to ensure that mark-to-market through the income statement cannot be avoided by including - embedding - a derivative in another contract or financial instrument that is not marked to market through the income statement.
- ❖ **Example:** A coal purchase contract may **include a clause that links the price of the coal to a pricing formula** based on the prevailing electricity price or a related index at the date of delivery. The coal purchase contract, which qualifies for the executory contract exemption, is described as the host contract, and the pricing formula is the embedded derivative. **The pricing formula is an embedded derivative because it changes the price risk from the coal price to the electricity price**
- ❖ An embedded derivative that modifies an instrument's inherent risk (such as a fixed to floating interest rate swap) would be considered closely related. Conversely, an embedded derivative that changes the nature of the risks of a contract is not closely related

25. What are weather derivatives and how is it different from traditional insurance contract?

- Weather Derivatives have **emerged as a new class of financial instruments to manage volumetric risk resulting from unfavorable weather patterns**. These derivatives have an underlying weather measure, which influences the trading volume of goods. **The primary objective of weather derivatives is to hedge volume risk, rather than price risk, due to changes in demand for goods due to weather-related changes**. This class of instruments is essential for companies like airline and juice manufacturing companies, particularly farmers.
- **Underlying asset:** Underlying asset is weather which has several dimensions such as rainfall, temperature, humidity, wind speed, etc.
- **Weather derivatives vs Insurance:** Weather derivatives offer an alternative to insurance contracts, providing protection against unforeseen weather events. The main difference is due to the type of coverage provided by the two instruments. **Insurance provides protection to extreme, low probability weather events, such as earthquakes, hurricanes and floods, etc. Instead, derivatives can also be used to protect the holder from all types of risks, including uncertainty in normal conditions that are much more likely to occur.**
- **Weather derivative pricing is challenging** due to **data reliability, forecasting difficulties, and temperature modelling challenges**. Data availability varies across countries and agencies, making it difficult to predict future weather behaviour. Forecasts typically focus on seasonal levels, but daily temperature levels are not universally accurate.

26. Explain the need for Electricity Derivatives and what are the various types?

- India's power purchase and sale involve state-owned distribution companies entering Power Purchase Agreements (PPAs) with power generators. These long-term contracts, typically 20-25 years, are necessary due to high capital and operational expenditure requirements.
- Volatile electricity spot prices in India require hedging instruments to reduce price risk exposures for generators, buyers, and load-serving entities.
- Derivative instruments can help market participants hedge from price risk variations, ensuring buyers pay a fixed price despite fluctuations.
- Following are the forms of Electricity Derivatives:
 - Forwards
 - Futures and
 - Swaps

27. What is Electricity Locational Basis Swap?

- Electricity Locational Basis Swaps wherein a holder of an electricity swap agrees to either pay or receive the difference between a specified futures contract price and another locational spot price of interest for a fixed constant cash flow at the time of the transaction.
- These swaps are used to lock-in a fixed price at a geographic location that is different from the delivery point of a futures contract and hence are effective financial instruments for hedging the risk-based on the price difference between power prices at two different physical locations

28. What are the key lessons from derivatives mishaps?

- Don't buy any derivative product that you don't understand: The best way to avoid this is to analyse the instrument being purchased in house because outside persons can misguide the corporation about the potential dangers.
- Due diligence before making Treasury Department as a Profit Centre: Though the main objective of establishing a Treasury Department is to reduce financing costs and manage risk optimally. But it has been seen that though initially Treasury Department made limited profits from treasury activities later started taking more risks in anticipation of higher profit. The best way to avoid this situation is to avoid linking the treasurer's salary with the profit he made for the organization
- Specify the Risk Limits: Proper monitoring is prerequisite for the trader to ensure that he/she should switch from arbitrageur to speculator. The best way to avoid the situation of overtrading is to limit the sizes positions that can be taken by a trader, and it should be accurately reported from risk perspective
- Separation of Front, Middle and Back Offices: The three offices though are interlinked but they discharge separate functions. Accordingly, there should be a firewall in the functioning of these offices i.e. person of one office should not have the access to the functioning of other office.
- Ensure that a hedger should not become a speculator: To avoid this situation, it is essential that clear cut risk limits should be defined. Further before entering into any trading strategy proper risk analysis should be carried out and if proposed strategy is crossing the limits of Risk Appetite of the company it should be avoided.
- Carry out Stress Test, Scenario Analysis etc: To counter this type of unpredictable situation it is necessary that VAR analysis should always be followed by Scenario Analysis because as tendency a human being normally can anticipate two to three scenarios. It will be better to refer the data of at least 10 to 20 years to anticipate a Black Swan event. Further even Simulation Test can be applied to analyze the results in various possible situations

Theory to Solve Problems

Basics of derivatives:

- ❖ A derivative contract is a financial instrument whose payoff structure is derived from the value of the underlying asset

Example: Ticket Price of IPL match is Rs.1,000 but the same is fully sold out. A reference letter is given to buy 3 tickets by paying the price of the ticket

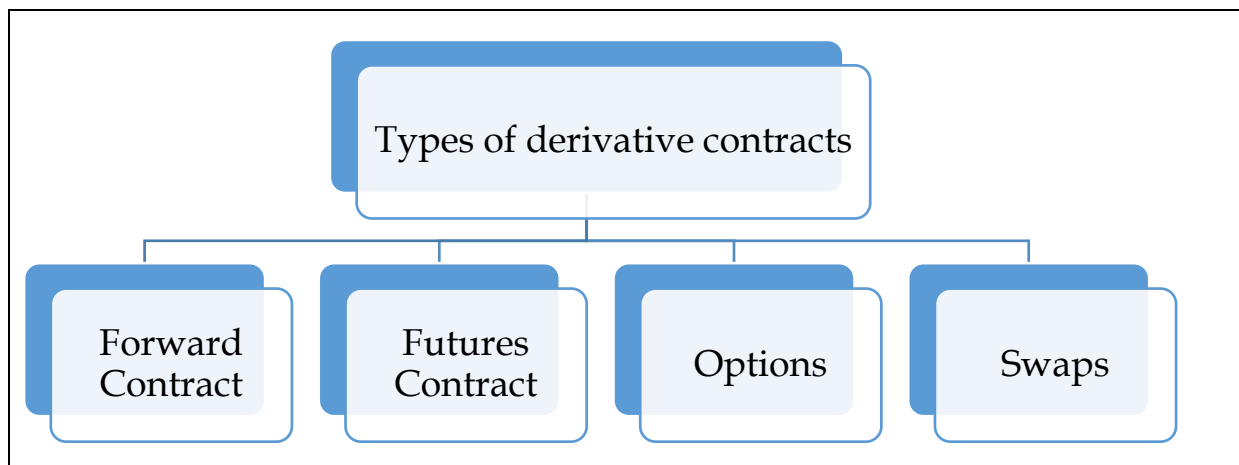
- ❖ The letter is a derivative instrument. It gives you the right to buy the tickets
- ❖ The underlying asset is the ticket
- ❖ The letter does not constitute ownership
- ❖ It is a promise to convey ownership

- ❖ The value of the letter changes with the value of the ticket

What can be an underlying asset?

- ❖ Stock (Equity)
- ❖ Commodity (Cotton)
- ❖ Precious metals (Gold)
- ❖ Foreign currency (\$)
- ❖ Interest rate
- ❖ Market index (Sensex/Nifty)

Types of derivative contracts:



Forward contract:

<u>Meaning:</u> A forward contract is an agreement entered today under which one party agrees to buy and the other party agrees to sell an asset on a specified future date at an agreed price	<u>Features:</u> ❖ Unique – No transfer can be made ❖ Performance obligation – Both parties obliged to perform ❖ Price risk is eliminated ❖ No margins ❖ Default risk ~ There is no guarantee of performance ❖ Illiquid – FC cannot be traded

Futures contract:

<u>Meaning:</u> A futures contract is a standardized contract between two parties <u>where one of the parties commits to sell and the other permits to buy</u> a specified quantity of a specified asset at an agreed price on a given date in the future	<u>Features:</u> ❖ Standardized quantity ❖ Deal with clearing house ❖ Market to Market

Options Contract:

<u>Meaning:</u> A contract between two parties under which the “buyer of the option” buys on payment of a price (premium) <u>the right and not the obligation to sell (put option)</u> , a standardized quantity (contract size) of a financial instrument (underlying asset) at or before a pre-determined date (expiry date) at a predetermined price (exercise price or strike price).	<u>Features:</u> ❖ Standardized quantity ❖ Deal with clearing house ❖ Market to market

Why derivative instruments:

- ❖ A derivative market is a market for derivative instruments. We need a derivative market because they perform three useful economic functions.

1. Different Players and different objectives: Each player in the market has different objectives. Following are the objectives of the different players: ❖ Hedger – To protect against the adverse price changes ❖ Arbitrageur – Looks for prospects in 2 different markets for riskless gains ❖ Speculator – Take risk in order to make profit during adverse market movement	2. Price Discovery: ❖ Low transaction cost ❖ High return ❖ Price changes are first reflected in this market	3. Risk transfer: ❖ Like an insurance company ❖ Redistributes the risk to market players ❖ Premium is the protection against adverse price movement

Futures:**Key concepts:**

1. Continuous compounding:

- ❖ 12% rate of interest has a different effective annual rate if it is compounded at different frequencies as show below:

Compounding frequency	Effective rate
Annually	12.00%
Half-yearly	12.36%
Quarterly	12.55%
Monthly	12.68%
Continuous compounding	12.75%

- ❖ As the frequency of compounding increases the effective annual rate goes up
- ❖ The effective rate is maximum when compounding is continuous
- ❖ The future value of continuous compounding is got from e^x table and the present value of continuous discounting is got from e^{-x} table
- ❖ Future value of X can also be computed using the below formula

$$e^x = 1 + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots + \frac{x^n}{n!}$$

2. Arbitrage through futures:

- ❖ Compute fair futures price
- ❖ Compare fair futures price with actual futures price to take decision

Relationship	Valuation	Futures	Spot
AFP > FFP	Over-valued	Sell	Buy
FFP < AFP	Under-valued	Buy	Sell

Computation of fair futures price:**Situation 1: Non-dividend paying stock:**

- ❖ The underlying asset (stock) does not generate any income for the investor.

Fair futures price = Spot rate $\times e^x$

Where $X = r \times t$; r = rate per annum; t = time in years

Situation 2: Dividend in rupees:

- ❖ This refer to assets (stock) which generate income or dividend during the period of the futures contract
- ❖ In this case the spot price should be adjusted with the present value of the income

Fair futures price = Adjusted Spot rate $\times e^x$

Where Adjusted spot rate = Spot rate – PV of dividend income

Situation 3: Dividend in percentage

- ❖ At times the income is expressed as a % of spot price. This is called yield
- ❖ Since this is a %, it must be deducted from r

Fair futures price = Spot rate $\times e^{(r-y)t}$
 Where r = risk free rate; y = known yield ; t = time in years

Situation 4: Storage costs in rupees

- ❖ In respect of physical assets like Gold there is no intervening income. There are only intervening costs namely storage costs

Fair futures price = Adjusted Spot rate $\times e^x$
 Where Adjusted spot rate = Spot rate + PV of storage costs

Situation 5: Storage cost in percentage:

- ❖ At times the cost is expressed as a % of spot price.
- ❖ Since this is a %, it must be added to r

Fair futures price = Spot rate $\times e^{(r+s)t}$
 Where r = risk free rate; s = storage cost; t = time in years

Convenience yield:

- ❖ It is an implied return on holding inventories. It is an adjustment to the cost of carry in the non-arbitrage pricing formula for forward prices.
- ❖ This is the amount of benefit that is associated with physically owning a particular good
- ❖ **Fair Futures Price = Spot Price + Cost to Carry – Convenience yield**
- ❖ **Cost to carry = FFP as per formula – Spot price**
- ❖ **Convenience yield will be computed in case actual futures price and fair futures price (as per formula) does not match. However, question says that given actual futures prices is fair and then we need to use above formula to compute convenience yield**

Contango/Backwardation:

- Contango and backwardation are terms used to define the structure of the forward curve.
- When a market is in contango, the forward price of a futures contract is higher than the spot price.
- Conversely, when a market is in backwardation, the forward price of the futures contract is lower than the spot price
- Contango and backwardation is determined with the help of basis
- Basis = Spot price – futures prices
- If Basis is negative the market is said to be in Contango and when it is positive the market is said to be Backwardation.

Hedging with futures:

- ❖ To hedge (protect against price risk) we must take a position in the futures market, which is opposite of the position taken in the spot market
 - If we are long in the spot market, we must go short in the futures market
 - If we are short in the spot market, we must go long in the futures market
- ❖ If we seek only partial protection, the value of the position to be taken in the futures market is as under:

Value of futures position = Spot position $\times$ Protection needed (%)
- ❖ If the stock for which hedging is required is not traded in the futures market, we can create a cross hedge by taking a position in index futures. Position to be taken is as under:

Value of futures position = Spot position $\times$ Protection needed (%) $\times$ Beta

Impact of hedging:

- ❖ If we are long in one market and price goes up we gain
- ❖ If we are short in one market and price goes up we lose
- ❖ If we are long in one market and price falls we lose
- ❖ If we are short in one market and price falls we gain

Position	Price	Impact
Long	Up	Gain
Long	Down	Lose
Short	Up	Lose
Short	Down	Gain

How to compute Hedge ratio (Beta)

- ❖ Beta measures the sensitivity of a stock to a broad-based index. Beta of 2 times would indicate that a 1 percent change in index will lead to a 2 percent change in stock price (concept of Beta is explained in detail in portfolio management)

$$\text{Beta} = \frac{\text{Change in spot prices}}{\text{Change in future prices}} \times \text{Correlation coefficient}$$

How to alter risk in portfolio:

Situation 1: Reducing risk Method 1: Sell portfolio and buy risk free investment ❖ Step 1: Let weight of the stock in the new portfolio is W1. So weight of risk free investment is 1 - W1 ❖ Step 2: Compute weighted average of step 1 and equate the same to the new desired beta ❖ Step 3: The proportion of (1-W1) of old portfolio will be sold and be replaced with risk free investment ❖ Step 4: All stocks in the portfolio will be sold for the value identified in step 3 in the proportion in which they were held in the original portfolio Method 2: Keep portfolio intact, sell stock index futures • Use weighted average format of computation and assume X to be the amount of index futures • Solve X and find the number of contracts to be taken up for hedging $\text{Number of contracts} = \frac{\text{Amount to be hedged}}{\text{Value of one contract}}$	Situation 2: Increasing risk Method 1: Borrow money and buy securities ❖ Step 1: Let weight of the stock in the new portfolio is W1. So weight of borrowings is 1 - W1 ❖ Step 2: Compute weighted average of step 1 and equate the same to the new desired beta ❖ Step 3: The proportion of (1-W1) of old portfolio will be borrowed to buy additional stocks ❖ Step 4: The same old stocks will be bought in the proportion in which they were originally held Method 2: Keep portfolio intact, buy stock index futures • Use weighted average format of computation and assume X to be the amount of index futures • Solve X and find the number of contracts to be taken up for hedging $\text{Number of contracts} = \frac{\text{Amount to be hedged}}{\text{Value of one contract}}$

Concept of Mark to Market and margin account:

- ❖ The stock exchange wants the derivative players to maintain the margin accounts to safeguard against the risk of default
- ❖ **The initial margin to be maintained is equal to average daily absolute change + 3 (Standard deviation)**
- ❖ The margin balance will change with daily profits/losses being credited/recovered from the margin account. This concept is also known as mark to market wherein the company's derivatives are valued daily at the closing price
- ❖ The margin balance cannot fall below a specified limit which is also known as maintenance margin. In case the margin account drops below the maintenance margin then the derivative player is required to replenish the account to the level of initial margin
- ❖ The derivative player can withdraw the balance from the margin account in case the balance is above initial margin. However the maximum withdrawal will be upto to the point of initial margin

Open Interest:

- ❖ Open interest is the total number of open or outstanding (not closed or delivered) options and/or futures contract that exist on a given day
- ❖ Open interest is commonly associated with futures and options markets, where the number of existing contracts changes from day to day unlike the stock market wherein the number of shares remain constant unless new issues are made

- ❖ Open interest is a measure of flow of money into a futures or options market. Increasing open interest represents new or additional money coming into the market, while decreasing open interest indicates money flowing out of the market
- ❖ An increase in open interest is typically interpreted as a bullish signal while decreasing open interest is interpreted as a bearish signal

Basics of option contract:

Term	Meaning
Holder	Buyer of the "Right to buy" or "Right to sell"
Writer	Person who sells the "Right to buy" or "Right to sell"
Exercise price / strike price	Price at which the underlying asset will be bought or sold
Expiry date	The date by which the option has to be exercised
Call option	This gives the buyer the right to buy
Put option	This gives the buyer the right to sell
Underlying asset	Asset against which the derivative instrument option is traded
American option	Right can be exercised at any time before the expiry date
European option	Right can be exercised only at the expiry date

When to exercise an option:

Relationship	Call option	Put option
Exercise price > Market price	Lapse	Exercise
Exercise price = Market price	Lapse	Lapse
Exercise price < Market price	Exercise	Lapse

Note:

- ❖ Only buyer can exercise an option
- ❖ Option premium is irrelevant because the same is a sunk cost

In the money (ITM) / Out the money (OTM) and At the money (ATM):

- ❖ An option is in the money if exercising the option at that point would give a gain
- ❖ An option is out the money if exercising the option at that point would lead to a loss
- ❖ An option is at the money if exercising the option at that point would lead to neither profits nor losses
- ❖ In all the above cases, the option premium being a sunk cost is irrelevant

Relationship	Status for call	Status for Put
Exercise price > Market price	OTM	ITM
Exercise price = Market price	ATM	ATM
Exercise price < Market price	ITM	OTM

- ❖ The phrase ITM, OTM and ATM are used in relation to the buyer. Therefore while in the money is good for the buyer, it is bad for the writer
- ❖ Similarly OTM is bad for the buyer it is good for the writer

Taking stance:

- ❖ Whether a derivative player want to be a buyer (holder) or a writer would depend on his ability to take risk
 - Maximum risk = Writer
 - Minimum risk = Holder
- ❖ A buyer would prefer that option which lead to him an exercise on the maturity date
- ❖ A writer would prefer that option which would lead to lapse on the maturity date
- ❖ In order to take a stance we need to compare the exercise price with expected market price

Bullish and Bearish Market:

- ❖ A bullish market is one where the expected MP is greater than the exercise price
- ❖ A bearish market is one where the expected MP is lesser than the exercise price

Party	EMP > EP	EMP < EP
Call Buyer	Favourable	Adverse
Call Writer	Adverse	Favourable
Put Buyer	Adverse	Favourable

Put Writer	Favourable	Adverse

Note:

- ❖ Favourable means making money and adverse means losing money. For a buyer the position is favourable if it is exercisable and for a writer the position is favourable if it lapses

Intrinsic value and time value:

- ❖ Intrinsic value is the extent to which the option is in the money if it ITM
- ❖ Time value is the difference between option premium and intrinsic value

Payoff table and Payoff graph:

- ❖ The payoff table captures the net profit at various expected MP on expiry date
- ❖ Such tables are drawn for call buyer, call writer, put buyer and put writer
- ❖ When an option is exercised, the buyer gains and the writer lose at gross payoff level
- ❖ Gain or loss at the net payoff level will depend on the extent of premium
- ❖ When an option in lapsed, neither the holder nor the writer gain or lose at the gross payoff level
- ❖ A payoff graph is a graphical representation of the payoff table with market price on X-axis and net payoff on Y-axis

Which option what premium?

- ❖ The option with the lowest exercise price is called E_1 . The one with the higher EP is called E_2
- ❖ Example: EP of 90, 110 & 98. Then $E_1 = 90$, $E_2 = 98$ & $E_3 = 110$
- ❖ The call with a lower EP has a greater probability of being exercised and therefore command a higher premium
- ❖ A put with a higher exercise price has a greater probability of being exercised and therefore command a higher premium

Steps in Payoff Table and Payoff Graph:**Step 1: Prepare relationship table**

- ❖ If there are "n" options then there will be "n+1" relationships
- ❖ The various columns in table and their computation is as follows

Column reference	Column Name	Explanation
1	Relationship	Refer point above
2	E_1	Identify action on expiry date and calculation gross payoff
3	E_2	Same as above
4	GPO	Column 2 + Column 3
5	Premium	Income (+) for writer and expense (-) for buyer
6	NPO	$GPO \pm \text{Premium}$
7	BEP	Equate NPO to zero

Step 2: Breakeven table:

The breakeven table summarizes the outcome of the relationship table with reference to the net pay off column

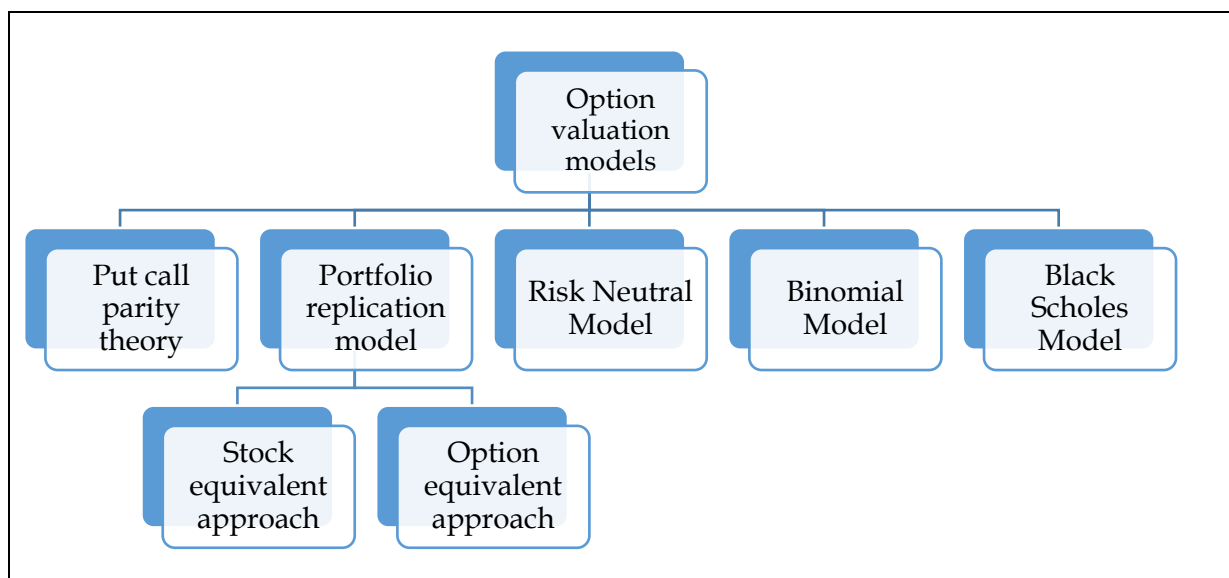
- ❖ If a relationship has no BEP then it will have only one class interval
- ❖ If a relationship has BEP then it will have 3 columns. One before, one at and one after BEP

Step 3: Draw Payoff graph:

- ❖ Payoff graph convert the BEP table into graph. Draw break even table on a graph with expected MP on x-axis and net payoff on y-axis

Pricing options:

- ❖ Valuation of options means finding out the fair option price



Model 1: Put call parity theory (PCPT)

Share + Put = Call + Present value of exercise price
The formula indicate that the payoff from the following two strategies will always be identical
❖ Buying a share and buying a put ❖ Buying a call & making an investment equal to present value of exercise price
The above formula can be spun around as follows:
❖ Put = Call + Present value of exercise price – Share ❖ Call = Share + Put – Present value of exercise price ❖ Share = Call + Present value of exercise price – Put
Note: (+) would indicate buy/invest & (-) would indicate sell/borrow

Note:

- ❖ For all option valuation models the share price will get replaced with adjusted share price in case dividends are expected to be paid during tenor of option.
- ❖ Adjusted spot price = Spot Price – PV of dividend income

Model 2: Portfolio Replication Model

Assumptions:

- ❖ The investor can make only two judgements of market prices on expiry date
- ❖ He cannot make judgements of “MP before expiry date”
- ❖ That only 2 judgements of MP are made doesn’t mean that their probabilities are 50/50

<u>Stock equivalent approach:</u>	<u>Option equivalent approach:</u>
❖ Compute intrinsic value at two judgement prices ❖ Compute no. of calls to be bought using $\text{No of calls} = \frac{\text{Spread in Stock Price}}{\text{Spread in IV}}$ ❖ Compute risk free investment = Present value of (Lower JP – IV at JP 1) ❖ Compute value of calls using ○ $S_0 = C_0 * \text{No of calls} + R_f \text{ investment}$ ❖ Compute value of put using PCPT	❖ Compute intrinsic value at two judgement prices ❖ Compute the no. of shares to be bought using $\text{No of Shares} = \frac{\text{Spread in IV}}{\text{Spread in Stock Price}}$ ❖ Compute amount of borrowing using the following formula ○ Borrowing = PV of [(No. of shares * Lower JP) – IV at JP₁] ❖ Compute value of call using ○ Call = share value bought – borrowing ❖ Compute value of put using PCPT

Model 3: Risk Neutral Model:

Assumptions:

- ❖ Investors are indifferent to risk

- ❖ Investors can make only two judgement prices “MP of stock on expiry date”
- ❖ It is possible to make an estimate of probabilities of upside price & downside price

Steps:

- ❖ **Step 1:** Compute the intrinsic value at 2 judgement prices
- ❖ **Step 2:** Compute upside probability and downside probability by equating the weighted average return with the return from the risk-free asset
- ❖ **Step 3:** Expected value of call on expiry date is the weighted average of the values in step 1 with probability computed in step 2 being the assigned weights
- ❖ **Step 4:** Compute the PV of expected value of step 3 by discounting at risk free rate. This gives the value of call
- ❖ **Step 5:** Use PCPT model to value the put

Formula to calculate Probability:

$$\text{Upside Probability} = \frac{e^{rt} - d}{u - d}$$

Where

r = rate of interest per annum; t = time period in years

$$d = \frac{JP_1}{\text{Current Price}}$$

$$u = \frac{JP_2}{\text{Current Price}}$$

Model 4: Binomial model:

- ❖ **Step 1:** Draw decision diagram
- ❖ **Step 2:** Identify market price on expiry dates
- ❖ **Step 3:** Write intrinsic value at various judgement price on expiry date
- ❖ **Step 4:** Taking into account the previous probabilities roll back the IV to the base. This is the fair value of the option
- ❖ **Step 5:** Discount the value of step 4 to identify the fair value of option on day 0

Binomial model and American Option:

- ❖ **Step 1:** Draw decision diagram
- ❖ **Step 2:** Identify market price on expiry dates
- ❖ **Step 3:** Write intrinsic value at various judgement price on expiry date
- ❖ **Step 4:** The value of each previous node is higher of the following
 - Value of immediate exercise
 - Value of later exercise
- ❖ **Step 5:** Roll back to get the option value at base node
- ❖ **Step 6:** Discount the value of step 4 to identify the fair value of option on day 0

Model 5: Black – Scholes Model:**Assumptions:**

- ❖ Applicable only for European options
- ❖ Risk free rate of return is known and is constant over the life of the option
- ❖ The volatility of the underlying asset is known and is constant over the life of the option
- ❖ The underlying asset's CCRFI is known and follows normal distribution pattern
- ❖ The prices of underlying assets cannot be negative
- ❖ No transaction charges & tax

$$\text{Value of Call} = (S_0 \times N(d_1)) - (PV_{EP} \times N(d_2))$$

$$d_1 = \frac{\left(\text{Naturallog} \left(\frac{S_0}{E} \right) + (r + 0.5\sigma^2)t \right)}{\sigma\sqrt{t}}$$

$$d_2 = \frac{\left(\text{Naturallog} \left(\frac{S_0}{E} \right) + (r - 0.5\sigma^2)t \right)}{\sigma\sqrt{t}}$$

(or)

$$d_2 = d_1 - \sigma\sqrt{t}$$

S₀=CMP; r=risk free rate per year; t=time in years and E=Exercise Price

Value of Put can be calculated using Put Call Parity Theory

Delta of an option:

- ❖ Delta is a ratio comparing the change in the price of an asset to the corresponding change in the price of the derivative instrument.
- ❖ It is similar to beta of a stock which measures the percentage change in share price for a corresponding change in market
- ❖ **Example:** A stock option having beta of 0.7 would mean that if price of share increased by 1 rupee then the price of the option will increase by Rs.0.7
- ❖ Delta values can be positive or negative depending on the type of option. Call option will have positive delta values as the increase in share price will lead to increase in call value. However put option will have negative delta values as the increase in share price will lead to decrease in put value
- ❖ Call option can have delta closer to 1 for deep in the money options whereas it will have delta value closer to 0 for deep out of the money options

$$\text{Delta} = \frac{\text{Change in option Price}}{\text{Change in stock price}}$$

$$\text{(or)}$$

$$\text{Delta of call option} = N(D_1) \text{ of Black Scholes Model}$$

$$\text{Delta of put option} = \text{Call delta} - 1$$

Delta values with dividend:

- ❖ In case the dividend is given in rupees then the current market price of the share is to be replaced with CMP – PV of dividend income
- ❖ In case the dividend is given as % then delta is as under
 - Call delta = $N(d_1) * e^{-yt}$
 - Put delta = Call delta - 1

Where y = Annualized dividend yield in %; Also additionally r is to be replaced with r-y while calculating d1

Delta Hedging:

- ❖ Creating a riskless hedge using options and underlying stock is called as Delta Hedging
- ❖ The investor should aim to make the delta adjusted value of the portfolio as zero to have a delta neutral portfolio

Credit Default Swaps:

- ❖ Premium = Notional Amount x CDS spread. This is the amount to be paid by protection buyer to protection seller. Any increase in CDS spread would indicate deterioration in credit quality of underlying bonds
- ❖ Cash settlement on default = Notional Amount x (1 – Recovery rate%)
- ❖ **Index CDS:** Index CDS consist of multiple securities and the notional amount of the swap would decline in case of default made by the constituents of index CDS
- ❖ Profit/loss of credit protection buyer = Notional Amount x Change in spread x Duration
- ❖ CDS spread = Probability of default x (1 – Recovery rate)
- ❖ Probability of survival = 1 – Probability of default (hazard rate)
- ❖ Upfront premium = [Coupon – CDS spread] x Duration x Notional Amount. If this amount is positive then there will be receipt for protection buyer and vice versa

Practical Problems**Overview:**

- Part I – Valuation of Futures
- Part II – Hedging with Futures
- Part III – Maintenance Margin and Open Interest
- Part IV – Basics of Option
- Part V – Payoff table and Payoff graph
- Part VI – Option Valuation
- Part VII – Delta Hedging
- Part VIII – Credit Derivatives

Part I – Valuation of Futures**1. Pricing future – Non-dividend paying stock**

The stock of Y Limited, a non-dividend paying stock, is today selling at Rs.72. You wish to enter into a futures contract on this stock maturing in 6 months' time.

- If the risk-free rate of return is 12 percent per annum continuously compounded what would be the futures price to be?
- If the price of futures contract is Rs.75, what action would you take?
- In case it is priced at Rs.77 will your decision change?

Answer:

WN 1: Computation of Fair Futures Price:

Base information:

Spot price	72
Time period	6 months (or) 2 quarters (or) 1 half year (or) 0.5 years
Rate of interest	12% pa. (or) 6% per half year (or) 3 percent per quarter (or) 1% per month
Dividend	0
Storage cost	0
Type of compounding	Continuous

Computation of Fair Futures Price:

$$\text{Fair Futures Price} = \text{Spot Price} \times e^{rt}$$

$$\text{Fair Futures Price} = 72 \times e^{(0.12)(0.5)} = 72 \times e^{0.06} = 72 \times 1.061836 = \text{Rs. 76.45}$$

Note:

- We should ensure that r and t is for the same time period. In the above calculation we have taken r as 12% per annum and hence t has been taken as 0.5 years. We can also take r as 6% per half-year and t as 1 half-year
- $e^{0.06}$ can be taken from e^x tables. If the tables are not given then the same can be computed using the below calculation.

$$e^{0.06} = 1 + \frac{0.06}{1} + \frac{0.06^2}{2!} + \frac{0.06^3}{3!} = 1 + 0.06 + 0.0018 + 0.000036 = 1.061836$$

WN 2: Strategy if Actual Futures Price is Rs.75

- Fair futures price is Rs.76.45 whereas actual futures price is Rs.75. This would mean that futures are under-valued
- We should buy in the futures market and sell in the spot market to exploit arbitrage opportunity
- Arbitrage gain = Difference between FFP and AFP = Rs.1.45**

Arbitrage steps:

Particulars	Amount
Day 0:	
• Do a short-sell of share in spot market and receive Rs.72	72.00
• Create a risk-free deposit of 6 months @ CCRFI of 12% with sale proceeds	72.00
• Enter into futures contract to buy share at Rs.75 after 6 months	75.00
Month 6:	
• Redeem fixed deposit along with interest (72 will become 76.45 @ 12% CCRFI)	76.45
• Buy share in futures market at Rs.75 and provide delivery of share to buyer in spot market	(75.00)
• Arbitrage gain	1.45

WN 3: Strategy if Actual Futures Price is Rs.77:

- Fair futures price is Rs.76.45 whereas actual futures price is Rs.77. This would mean that futures are over-valued
- We should sell in the futures market and buy in the spot market to exploit arbitrage opportunity
- Arbitrage gain = Difference between FFP and AFP = Rs.0.55**

Arbitrage steps:

Particulars	Amount
Day 0:	

• Take a loan for 6 months @ 12% CCRFI	72.00
• Buy share in spot market with proceeds from loan	72.00
• Enter into futures contract to sell share at Rs.77 after 6 months	75.00
Month 6:	
• Sell share in futures market at agreed price of Rs.77	77.00
• Repay loan along with interest (72 + Interest of 12% @ CCRFI)	(76.45)
• Arbitrage gain	0.55

2. Calculation of today's price [Nov 2006, Nov 2011]

The 6-months forward price of a security is Rs.208.18. The borrowing rate is 8% per annum payable with monthly rests. What should be the spot price? Rework if the borrowing rate has quarterly compounding, half-yearly compounding and continuous compounding?

Answer:

WN 1: Computation of spot price with monthly compounding:

Base data:

Spot price	?
Time period	6 months
Rate of interest	8% per annum (or) 0.6667% per month
Dividend	0
Storage cost	0
Type of compounding	Monthly

- Compounding frequency should always be continuous for futures valuation. However, question specifically has mentioned monthly rest and hence we are considering monthly compounding

Spot price computation:

$$\begin{aligned}\text{Futures Price} &= \text{Spot Price} \times (1 + r)^n \\ 208.18 &= \text{Spot Price} \times (1 + 0.6667\%)^6 \\ 208.18 &= \text{Spot Price} \times 1.040675 \\ \text{Spot Price} &= \frac{208.18}{1.040675} = \text{Rs. } 200.04\end{aligned}$$

- Spot price will be Rs.200.04 in case compounding frequency is monthly

WN 2: Computation of spot price with quarterly compounding:

Base data:

Spot price	?
Time period	6 months (or) 2 quarters
Rate of interest	8% per annum (or) 2% per quarter
Dividend	0
Storage cost	0
Type of compounding	Quarterly

Spot price computation:

$$\begin{aligned}\text{Futures Price} &= \text{Spot Price} \times (1 + r)^n \\ 208.18 &= \text{Spot Price} \times (1 + 2\%)^2 \\ 208.18 &= \text{Spot Price} \times 1.0404 \\ \text{Spot Price} &= \frac{208.18}{1.0404} = \text{Rs. } 200.10\end{aligned}$$

- Spot price will be Rs.200.10 in case compounding frequency is quarterly

WN 3: Computation of spot price with half-yearly compounding:

Base data:

Spot price	?
Time period	6 months (or) 1 half year
Rate of interest	8% per annum (or) 4% per half year

Dividend	0
Storage cost	0
Type of compounding	Half-yearly

Spot price computation:

$$\begin{aligned}\text{Futures Price} &= \text{Spot Price} \times (1 + r)^n \\ 208.18 &= \text{Spot Price} \times (1 + 4\%)^1 \\ 208.18 &= \text{Spot Price} \times 1.04 \\ \text{Spot Price} &= \frac{208.18}{1.04} = \text{Rs. } 200.17\end{aligned}$$

- Spot price will be Rs.200.17 in case compounding frequency is half-yearly

WN 4: Computation of spot price with continuous compounding:**Base data:**

Spot price	?
Time period	6 months (or) 0.50 year
Rate of interest	8% per annum
Dividend	0
Storage cost	0
Type of compounding	Continuous

Spot price computation:

$$\begin{aligned}\text{Futures Price} &= \text{Spot Price} \times e^{rt} \\ 208.18 &= \text{Spot Price} \times e^{(0.08)(0.5)} \\ 208.18 &= \text{Spot Price} \times 1.040811 \\ \text{Spot Price} &= \frac{208.18}{1.040811} = \text{Rs. } 200.02\end{aligned}$$

- Spot price will be Rs.200.02 in case compounding frequency is continuous

Conclusion:

Compounding Frequency	Spot Price
Monthly	200.04
Quarterly	200.10
Half-yearly	200.17
Continuous	200.02

3. Pricing future -Dividend paying stock

Calculate the price of a 6 months futures contract on a share that is currently priced at Rs.75. The share is expected to pay a Rs.2 dividend four months from today. The continuously compounded risk-free rate is 12 percent per annum. The contract size is 100. If the contract value is Rs.7400 what action would follow? In case it is Rs.7800 what would you do?

Answer:**Computation of fair futures price:****Base data:**

Spot price	Rs.75
Time period	6 months (or) 0.5 year
Rate of interest	12% per annum
Dividend	Rs.2 in Month 4
Storage cost	0
Type of compounding	Continuous

Computation of PV of Dividend Income:

Amount of Dividend	Rs.2
Time period	4 months (or) 0.3333 years

Rate of interest	12% per annum
Type of compounding	Continuous

$$\text{Present value} = \frac{\text{Future value}}{e^{rt}}$$

$$\text{Present value} = \frac{2}{e^{(0.12)(0.3333)}} = \frac{2}{e^{0.04}} = \frac{2}{1.040811} = 1.92$$

Fair Futures Price:

$$\text{Fair Futures Price} = \text{Adjusted Spot Price} \times e^{rt}$$

$$\text{Fair Futures Price} = 73.08 \times e^{(0.12)(0.5)} = 73.08 \times e^{0.06} = 73.08 \times 1.061836 = \text{Rs. 77.60}$$

Note:

- Adjusted spot price = Spot Price - PV of Dividend Income
- Adjusted spot price = 75 - 1.92 = Rs.73.08

WN 2: Strategy if actual futures price is Rs.7,400:

- Fair futures price is Rs.7,760 (77.60 x 100) whereas actual futures price is Rs.7,400. This would mean that futures are under-valued
- We should buy in the futures market and sell in the spot market to exploit arbitrage opportunity
- Arbitrage gain = Difference between FFP and AFP = Rs.360**

Arbitrage steps:

Particulars	Amount
Day 0	
1. Short-sell 100 shares in spot market for Rs.7500	7,500
2. Create fixed deposit of 192 for 4 months @ 12% CCRFI (this is created so that we can pay dividend of Rs.200 after 4 months – this is basically present value of dividend income)	192
3. Create fixed deposit for balance Rs.7,308 for 6 months @ 12% CCRFI	7,308
4. Enter into futures contract to buy 100 shares for Rs.7,400	7,400
Day 120	
5. Company declared dividend, we redeem FD and pay dividend to buyer of the share (this is because we do not own share and we did short-sell and hence we need to pay dividend to buyer of share)	200
Day 180	
6. Redeem fixed deposit of Rs.7,308 and get Rs.7760	7,760
7. Buy 100 shares through futures contract and deliver shares to the buyer of shares	7,400
8. Arbitrage gain	360

WN 3: Strategy if actual futures price is Rs.7,800:

- Fair futures price is Rs.7,760 (77.60 x 100) whereas actual futures price is Rs.7,800. This would mean that futures are over-valued
- We should sell in the futures market and buy in the spot market to exploit arbitrage opportunity
- Arbitrage gain = Difference between FFP and AFP = Rs.360**

Arbitrage steps:

Particulars	Amount
Day 0	
1. Take loan of Rs.192 for 4 months (this loan will be repaid with dividend income and hence we are taking this loan only for four months – we are buyer of share and hence we would get dividend income)	192
2. Take loan of Rs.7,308 for 6 months @ 12% CCRFI	7,308
3. Buy 100 shares in spot market	7,500
4. Enter into futures contract to sell 100 shares for Rs.7800	7,800
Day 120	

5. Receive dividend of Rs.200 and repay loan of 192 with interest	200
Day 180	
6. Sell 100 shares in futures market	7,800
7. Repay loan of Rs.7,308 along with interest	7,760
8. Arbitrage gain	40

4. Price future – Dividend paying stock

Consider a 3-months futures contract on New Gen Bank Ltd. quoting at Rs.1100. The continuously compounded risk-free rate of return is 12 percent per annum and the continuously yield on the share is 4 percent per annum.

- Find the value of the futures contract?
- What action would follow if futures are available at 1110?
- Will your position change if futures are available at 1150?

Answer:

WN 1: Computation of fair futures price:

Base data:

Spot price	Rs.1,100
Time period	3 months (or) 0.25 years
Rate of interest	12% per annum
Dividend	4 % per annum
Storage cost	0
Type of compounding	Continuous

Fair Futures Price:

$$\begin{aligned}\text{Fair Futures Price} &= \text{Spot Price} \times e^{(r-y)t} \\ \text{Fair Futures Price} &= 1,100 \times e^{(0.12-0.04)(0.25)} \\ \text{Fair Futures Price} &= 1,100 \times e^{0.02} \\ \text{Fair Futures Price} &= 1,100 \times 1.0202 \\ \text{Fair Futures Price} &= \text{Rs.1,122.22}\end{aligned}$$

WN 2: Strategy if actual futures price is Rs.1,110:

- Fair futures price is Rs.1,122.22 whereas actual futures price is Rs.1,110. This would mean that futures are under-valued
- We should buy in the futures market and sell in the spot market to exploit arbitrage opportunity
- Arbitrage gain = Difference between FFP and AFP = Rs.12.22**

Arbitrage steps:

Particulars	Amount
Day 0	
1. Sell 1 share in spot market for Rs.1100	1,100
2. Create fixed deposit for 3 months @ 12% CCRFI	1,100
3. Enter into futures contract to buy share @ 1,110 in 3 months	1,110
Day 1 to Day 90	
4. Company will declare dividend, we will pay dividend out of interest on fixed deposit, and hence net interest on FD will be 8 percent	
Day 90	
5. Redeem fixed deposit along with interest of 8 percent	1,122.22
6. Buy share @ 1110 in futures market	1,110.00
7. Arbitrage gain	12.22

WN 3: Strategy if actual futures price is Rs.1,150:

- Fair futures price is Rs.1,122.22 whereas actual futures price is Rs.1,150. This would mean that futures are over-valued

- We should sell in the futures market and buy in the spot market to exploit arbitrage opportunity
- Arbitrage gain = Difference between FFP and AFP = Rs.27.78

Arbitrage steps:

Particulars	Amount
Day 0	
1. Take a bank loan for Rs.1,100 @ 12% CCRFI for 3 months	1,100
2. Buy share in spot market	1,100
3. Enter into contract to sell share @ 1150 after 3 months	1,150
Day 1 to Day 90	
4. Company declared dividend, use the same to pay interest of 4 percent and hence net interest cost will be 8 percent	
Day 90	
5. Sell share for Rs.1,150	1,150.00
6. Repay loan along with net interest of 8 percent	1122.22
7. Arbitrage gain	27.78

5. Pricing future – Storage costs

Gold futures have been opened up in India recently. A 3-month gold futures is available at Rs.800 per gram. Suppose the current price of gold is Rs.775 per gram and that it costs Rs.5 per gram in arrears for the 3-monthly period to store gold.

- What is the fair price if the CCRFI is 8% per annum?
- If the rental is 4 percent per annum instead of Rs.5 per gram and the CCRFI is 8% per annum, what is the fair price of gold futures?
- If the futures price of Rs.770 per gram is to be considered as fair then what is the implicit convenience yield

Answer:**WN 1: Computation of fair futures price if rental is Rs.5 per gram****Base data:**

Spot price	Rs.775
Time period	3 months (or) 0.25 years
Rate of interest	8% per annum
Dividend	0
Storage cost	Rs.5 in Month 3
Type of compounding	Continuous

Computation of PV of Storage Costs:

Amount of storage cost	Rs.5
Time period	3 months (or) 0.25 year
Rate of interest	8% per annum
Type of compounding	Continuous

$$\text{Present value} = \frac{\text{Future value}}{e^{rt}}$$

$$\text{Present value} = \frac{5}{e^{(0.08)(0.25)}} = \frac{5}{e^{0.02}} = \frac{5}{1.0202} = 4.90$$

Adjusted spot price:

$$\text{Adjusted Spot Price} = \text{Spot Price} + \text{PV of storage costs} = 775 + 4.90 = \text{Rs.779.90}$$

Fair Futures Price:

Fair Futures Price = Adjusted Spot Price $\times e^{rt}$
Fair Futures Price = $779.90 \times e^{0.08 \times 0.25}$
Fair Futures Price = $779.90 \times e^{0.02}$
Fair Futures Price = 779.90×1.0202

Fair Futures Price = Rs.795.65

WN 2: Computation of fair futures price if rental is 4 percent per annum:**Base data:**

Spot price	Rs.775
Time period	3 months (or) 0.25 years
Rate of interest	8% per annum
Dividend	0
Storage cost	4% per annum
Type of compounding	Continuous

Fair Futures Price:

Fair Futures Price = Adjusted Spot Price $\times e^{(r+s)t}$ Fair Futures Price = $775 \times e^{(0.08+0.04)0.25}$ Fair Futures Price = $775 \times e^{0.03}$ Fair Futures Price = 775×1.030455 Fair Futures Price = Rs.798.60

WN 3: Computation of convenience yield if fair futures price is Rs.770:

- Let us assume convenience yield is calculated in continuation with Scenario 2 of the question
- Cost to Carry = Fair Futures price as per formula – Spot Price
- Cost to Carry = $798.60 - 775.00 = \text{Rs.}23.60$

Convenience yield:

Fair Futures Price (given in question) = Spot Price + Cost to carry – Convenience yield $770 = 775 + 23.60 - \text{Convenience Yield}$ Convenience Yield = Rs.28.60

6. Convenience Yield (May 2011 RTP):

The following information is available about standard gold.

- Spot Price (SP) = Rs.15,600 per 10 Grams
- Future Price (FP) = Rs.17,100 for one-year future contract
- Risk free interest Rate (Rf) = 8.5%
- Present Value of Storage Cost = Rs. 900 per year

From the above information you are requested to calculate the Present Value of Convenience yield (PVC) of the standard gold.

Answer:**WN 1: Computation of Fair Futures Price:****Base data:**

Spot price	Rs.15,600
Time period	1 year
Rate of interest	8.5% per annum
Dividend	0
Storage cost	Rs.900 in day 0
Type of compounding	Once in a year

Adjusted spot price:

Adjusted Spot Price = Spot Price + PV of storage costs = $15,600 + 900 = \text{Rs.}16,500$

Fair Futures Price:

Fair Futures Price = Adjusted Spot Price $\times (1 + r)^n$ Fair Futures Price = $16,500 \times (1 + 8.5\%)^1$ Fair Futures Price = Rs. 17,902.50

WN 2: Computation of convenience yield if futures price is Rs.17,100:

- Cost to Carry = Fair Futures price as per formula – Spot Price
- Cost to Carry = 17,902.50 – 15,600 = Rs.2,302.50

Convenience yield:

Fair Futures Price (given in question) = Spot Price + Cost to carry – Convenience yield
 17,100 = 15,600 + 2,302.50 – Convenience Yield
Convenience Yield = Rs.802.50

PV of convenience Yield:

$$\text{PV of Convenience Yield} = \frac{\text{Convenience Yield}}{(1 + r)^n} = \frac{802.50}{(1 + 8.5\%)^1} = \text{Rs. 739.63}$$

7. Arbitrage opportunity:

Spot price of Gold	:	Rs.30,000
Interest rate	:	6%/10%
Transaction cost on buy or sell	:	3%

- ❖ Define the no arbitrage boundary for a futures contract expiring in one year
- ❖ Rework the no arbitrage boundary if on short sell the trader can receive a fraction amount of 80% from the broker

Answer:**WN 1: Identification of no arbitrage boundary with no restriction on short-sell:**

- Fair futures price cannot be computed with the formula due to two reasons namely
 - Transaction costs
 - Presence of differential interest rates for investment and borrowing

Option 1 – Arbitrage strategy of buying in spot market and selling in futures market:

Let us assume the futures price to be X

Particulars	Amount
Day 0:	
• Take a loan for 12 months @ 10% (30,000 + 3%)	30,900
• Buy Gold in spot market with proceeds from loan	30,900
• Enter into futures contract to sell Gold at X after 12 months	X
Month 12:	
• Sell Gold in futures market at agreed price of X	X
• Repay loan along with interest (30,900 + Interest of 10%)	33,990
• Arbitrage gain	X – 33,990 = 0

Arbitrage gain will be zero if the futures price of Gold is Rs.33,990

Option 2 – Arbitrage strategy of selling Gold in spot market and buying in futures market:

Let us assume the futures price to be X

Particulars	Amount
Day 0:	
• Do a short-sell of Gold in spot market and receive Rs.29,100 (30,000 – 3%)	29,100
• Create a risk-free deposit for 12 months @ 6%	29,100
• Enter into futures contract to buy Gold at X after 12 months	X
Month 12:	
• Redeem fixed deposit along with interest (29,100 + 6%)	30,846
• Buy Gold in futures market at X and provide delivery of share to buyer in spot market	X
• Arbitrage gain	30,846 – X = 0

Arbitrage gain will be zero if the futures price of Gold is Rs.30,846

Conclusion:

- No arbitrage boundary for futures price of Gold = Rs.30,846 to Rs.33,990

WN 2: Computation of arbitrage boundary if there are restriction on short-sell:

Option 1 – Arbitrage strategy of buying in spot market and selling in futures market:

- No change in this and hence arbitrage gain will be zero if the futures price of Gold is Rs.33,990

Option 2 – Arbitrage strategy of selling Gold in spot market and buying in futures market:

Let us assume the futures price to be X

Particulars	Amount
Day 0:	
• Do a short-sell of Gold in spot market and receive Rs.23,280 $(30,000 - 3\%) \times 80\%$	23,280
• Create a risk-free deposit for 12 months @ 6%	23,280
• Enter into futures contract to buy Gold at X after 12 months	X
Month 12:	
• Redeem fixed deposit along with interest $(23,280 + 6\%)$	24,676.80
• Receive balance 20 percent money of short-sell $(29,100 \times 20\%)$	5,820
• Buy Gold in futures market at X and provide delivery of share to buyer in spot market	X
• Arbitrage gain	30,496.80 - X = 0

Arbitrage gain will be zero if the futures price of Gold is Rs.30,496.80

Conclusion:

- No arbitrage boundary for futures price of Gold = Rs.30,496.80 to Rs.33,990

8. Pricing future [Nov 2018 RTP, May 2004, Nov 2009, May 2015 MTP, Nov 2014 MTP, May 2021 RTP]

The following data relate to Anand Ltd.'s share price:

Current price per share Rs.1800

6 months future's price/share Rs.1950

Assuming it is possible to borrow money in the market for transactions in securities at 12% per annum, you are expected:

- ❖ To calculate the theoretical minimum price of a 6-months forward purchase and
- ❖ To explain arbitrage opportunity

Answer:**WN 1: Computation of Fair Futures Price:****Base data:**

Spot price	Rs.1,800
Time period	6 months (or) 1 half year (or) 0.5 year
Rate of interest	12% per annum (or) 6% per half year
Dividend	0
Storage cost	0
Type of compounding	Half-yearly (Note)

Note:

- Compounding frequency is normally continuous. However, in case e^x values /CCRFI is not mentioned in the question then we can follow normal compounding. Normal compounding frequency would be equal to period of the contract (half-year) and hence frequency is half-yearly

Fair Futures Price:

Futures Price = Spot Price $\times (1 + r)^n$
Futures Price = $1,800 \times (1 + 6\%)^1$
Futures Price = 1,908

- Theoretical minimum price for 6-months forward contract = Rs.1,908

WN 2: Arbitrage mechanism:

- Fair futures price is Rs.1,908 whereas actual futures price is Rs.1,950. This would mean that futures are over-valued
- We should sell in the futures market and buy in the spot market to exploit arbitrage opportunity
- Arbitrage gain = Difference between FFP and AFP = Rs.42**

Arbitrage steps:

Particulars	Amount
Day 0:	
• Take a loan for 6 months @ 12% per annum	1,800
• Buy share in spot market with proceeds from loan	1,800
• Enter into futures contract to sell share at Rs.1,950 after 6 months	1,950
Month 6:	
• Sell share in futures market at agreed price of Rs.1,950	1,950
• Repay loan along with interest (1,800 + Interest of 6%)	(1,908)
• Arbitrage gain	42

9. Pricing future [May 2012, May 2012 RTP]

On 31-8-2011, the value of stock index was Rs.2,200. The risk-free rate of return has been 8% per annum. The dividend yield on this stock index is as under:

Month	Dividend Paid p.a.
January	3%
February	4%
March	3%
April	3%
May	4%
June	3%
July	3%
August	4%
September	3%
October	4%
November	3%
December	3%

Assuming that interest is compounded daily, find out the future price of contract deliverable on 31-12-2011. Given $e^{0.01583} = 1.01593$

Answer:**Computation of Fair Futures Price:****Base data:**

Spot price	Rs.2,200
Time period	4 months (or) 0.33 years
Rate of interest	8% per annum
Dividend	$3.25\% \frac{[3\% + 4\% + 3\% + 3\%]}{4}$
Storage cost	0
Type of compounding	Daily or continuous

Note:

- Dividend yield has been considered for four months of September to December. It has been taken as average of 3.25% per annum which is average of these four months

Fair Futures Price:

$$\begin{aligned} \text{Fair Futures Price} &= \text{Spot Price} \times e^{(r-y)t} \\ \text{Fair Futures Price} &= 2,200 \times e^{(0.08-0.0325) \times 0.3333} \\ \text{Fair Futures Price} &= 2,200 \times e^{0.01583} \\ \text{Fair Futures Price} &= 2,200 \times 1.01593 \\ \text{Fair Futures Price} &= \text{Rs.2,235.05} \end{aligned}$$

10. Futures and arbitrage opportunity [Nov 2014 MTP]

The BSE's Market Index is currently trading at 27,000 whose 6 months future's value is trading at 27,810. The Current price of Anand Ltd.'s share listed on BSE is Rs. 1,800. The beta of share is 1.80.

Assuming it is possible to borrow money in the market for transactions in securities at 10% per annum, you are required:

(i) To calculate 6 months future's value and the theoretical minimum price of a 6months forward purchase of Anand Ltd.'s share; and

(ii) To find arbitrage opportunity, if any possible.

Answer:

WN 1: Computation of 6 months futures value:

Particulars	Calculation	Amount
Spot price of share	Given	1,800
Change in Market for 6-month period	$\frac{27,810 - 27,000}{27,000} \times 100$	3.00%
Beta of Share		1.80
Expected change in share price	$1.80 \times 3\%$	5.40%
6 months futures value of Anand Ltd	$1,800 + 5.40\%$	1,897.20

Note: The above computed price has been taken as actual futures price.

WN 2: Computation of theoretical minimum price of 6-month contract:

Base data:

Spot price	Rs.1,800
Time period	6 months (or) 1 half year (or) 0.5 year
Rate of interest	10% per annum (or) 5% per half year
Dividend	0
Storage cost	0
Type of compounding	Half-yearly (equal to time period of contract)

Forward Price:

Forward Price = Spot Price $\times (1 + r)^n$
Forward Price = $1,800 \times (1 + 5\%)^1$
Forward Price = 1,890

- **Theoretical minimum price for 6-months forward contract = Rs.1,908**

Note: The above price as per futures formula is taken as fair futures price.

WN 3: Arbitrage strategy:

- Fair futures price is Rs.1,890 whereas actual futures price is Rs.1,897.20. This would mean that futures are over-valued
- We should sell in the futures market and buy in the spot market to exploit arbitrage opportunity
- **Arbitrage gain = Difference between FFP and AFP = Rs.7.20**

Arbitrage steps:

Particulars	Amount
Day 0:	
• Take a loan for 6 months @ 10% per annum	1,800.00
• Buy share in spot market with proceeds from loan	1,800.00
• Enter into futures contract to sell share at Rs.1,897.20 after 6 months	1,897.20
Month 6:	
• Sell share in futures market at agreed price of Rs.1,897.20	1,897.20
• Repay loan along with interest (1,800 + Interest of 5%)	(1,890.00)
• Arbitrage gain	7.20

11. Calculation of fair futures price [Nov 2012 RTP]

Suppose that there is a future contract on a share presently trading at Rs.1000. The life of future contract is 90 days and during this time the company will pay dividends of Rs.7.50 in 30 days, Rs.8.50 in 60 days and Rs.9.00 in 90 days. Assuming that the CCRFI is 12%, you are required to find out:

- ❖ Fair value of the contract if no arbitrage opportunity exists
- ❖ Value of cost to carry

Answer:

WN 1: Computation of fair futures price:

Base data:

Spot price	Rs.1,000
Time period	90 days (or) 0.25 years
Rate of interest	12% per annum
Dividend	Rs.7.50 in M1 Rs.8.50 in M2 Rs.9.00 in M3
Storage cost	0
Type of compounding	Daily or continuous

Computation of PV of Dividend Income:

Amount of Dividend	Rs.7.50	Rs.8.50	Rs.9.00
Time period	1 month (or) 0.0833 years	2 month (or) 0.1667 year	3 month (or) 0.25 year
Rate of interest	12% per annum	12% per annum	12% per annum
Type of compounding	Continuous	Continuous	Continuous
PV of Dividend	$\frac{7.50}{e^{(0.12)(0.0833)}} = \frac{7.50}{e^{0.01}} = 7.43$	$\frac{8.50}{e^{(0.12)(0.1667)}} = \frac{7.50}{e^{0.02}} = 8.33$	$\frac{9.00}{e^{(0.12)(0.25)}} = \frac{7.50}{e^{0.03}} = 8.73$

PV of dividend income = 7.43 + 8.33 + 8.73 = 24.49

Adjusted spot price:

Adjusted spot price = Spot Price - PV of dividend income = 1,000 - 24.49 = Rs.975.51

Fair Futures Price:

Fair Futures Price = Adjusted Spot Price $\times e^{rt}$
Fair Futures Price = 975.51 $\times e^{(0.12) \times 0.25}$
Fair Futures Price = 975.51 $\times e^{0.03}$
Fair Futures Price = 975.51 $\times 1.030455$
Fair Futures Price = Rs.1,005.22

WN 2: Computation of cost to carry:

- Cost to Carry = Fair Futures Price - Spot Price
- Cost to Carry = 1,005.22 - 1,000 = Rs.5.22

12. Calculation of interest rate [Nov 2013 RTP]

Suppose current price of an index is Rs.13,800 and yield on index is 4.8% (p.a.). A 6-month future contract on index is trading at Rs.14,340. Assuming that Risk Free Rate of Interest is 12%, show how Mr. X (an arbitrageur) can earn an abnormal rate of return irrespective of outcome after 6 months. You can assume that after 6 months index closes at Rs. 10,200 and Rs. 15,600 and 50% of stock included in index shall pay dividend in next 6 months. Also calculate implied risk free rate.

Answer**WN 1: Computation of fair futures price:**

Particulars	Amount
Spot price	13,800
Rate of interest (r)	12% per annum (or) 6% per half year
Dividend (y)	4.8% per annum (or) 2.4% per half year
N	6 months or 1 half year
Compounding frequency	Half-yearly

$$FFP = \text{Spot Price} \times (1 + (r - y))^n$$

$$FFP = 13,800 \times (1 + (6\% - 2.4\%))^1 = \text{Rs. 14,296.80}$$

WN 2: Computation of return earned if index turns out to be 10,200 and 15,600:

- ❖ Fair futures price is Rs.14,296.80 whereas actual futures price is Rs.14,340. Futures are overvalued and hence we should sell futures and buy spot market

Arbitrage steps:

Particulars	Index turns out to be 10,200	Index turns out to be 15,600
Day 0		
1. Buy shares in spot market	Rs.13,800	Rs.13,800
2. Enter into futures contract to sell share @ 14,340	Rs.14,340	Rs.14,340
Day 0 to Day 180		
3. Dividend earned on shares	331.20 [13,800 × 2.4%]	331.20 [13,800 × 2.4%]
Day 180		
4. Profit/loss from futures position	4,140 [14,340 – 10,200]	-1,260 [14,340 – 15,600]
5. Profit/loss from cash position	-3,600 [10,200 – 13,800]	1,800 [15,600 – 13,800]
Total Profit [3+4+5]	871.20	871.20
Implied risk free rate	12.63% $\frac{871.20}{13,800} \times \left(\frac{12}{6}\right) \times 100$	12.63% $\frac{871.20}{13,800} \times \left(\frac{12}{6}\right) \times 100$

Note:

- Profit/loss = Selling price – Purchase price
- Futures position = Selling price is 14,340 and purchase price is either 10,200 or 15,600. This is because we sold futures at Rs.14,340 and now we will buy it back at 10,200 or 15,600
- Cash position = Purchase price is 13,800 and selling price is either 10,200 or 15,600. This is because we bought in cash market at Rs.13,800 and now we will sell it either 10,200 or 15,600

13. Calculation of profit/loss:

Mr. X bought NIFTY futures of Rs.10,00,000 on January 1, 2017 for delivery on March 31, 2017. The nifty lot size is 200. Calculate the profit/loss if NIFTY future on maturity date is:

- ❖ 6,000
- ❖ 4,500

Answer:**WN 1: Computation of Profit/Loss if NIFTY on maturity date is 6,000:**

Date	Position	Action	Reference Date	Rate
Jan 1, 2017	Original Position	Buy	Mar 31, 2017	(5,000) [10,00,000/200]
Mar 31, 2017	Opposition Position	Sell	Mar 31, 2017	6,000
Gain per unit of NIFTY				1,000
Gain per lot (1,000 × 200)				2,00,000

WN 2: Computation of Profit/Loss if NIFTY on maturity date is 4,500:

Date	Position	Action	Reference Date	Rate
Jan 1, 2017	Original Position	Buy	Mar 31, 2017	(5,000) [10,00,000/200]
Mar 31, 2017	Opposition Position	Sell	Mar 31, 2017	4,500
Loss per unit of NIFTY				500
Loss per lot (500 × 200)				1,00,000

14. Computation of profit/loss:

A sold one January Nifty futures contract for Rs. 3,40,000 on January 15, For this he had paid an initial margin of Rs. 34,000 to his broker. Each Nifty futures contract is for the delivery of 200 Nifties. On January 25, the index was closed on 1850. How much profit/loss A has made?

Answer:

Date	Position	Action	Reference Date	Rate
Jan 15	Original Position	Sell	XX date	1,700 [3,40,000/200]
Jan 25	Opposition Position	Buy	XX date	(1,850)

Loss per unit of NIFTY		150
Loss per lot (150 x 200)		30,000

15. Valuation and arbitrage with futures [Nov 2019]:

The NSE-50 Index futures are traded with rupee value being Rs. 100 per index point. On 15th September, the index closed at 1195, and December futures (last trading day December 15) were trading at 1225. The historical dividend yield on the index has been 3% per annum and the borrowing rate was 9.5% per annum.

- Determine whether on September 15, the December futures were underpriced or overpriced?
- What arbitrage transaction is possible to gain out this mispricing?
- Calculate the gains and losses if the index on 15th December closes at
 - 1260
 - 1175.

Assume 365 days in a year for your calculations.

Answer:**WN 1: Computation of Fair Futures Price:****Base information:**

Spot price	1195
Time period	15 days + 31 days + 30 days + 15 days = 91 days
Rate of interest	9.5% per annum (or) 2.3685% per 91 days
Dividend	3% per annum (or) 0.7479% per 91 days
Storage cost	0
Type of compounding	Once in 91 days

$$FFP = \text{Spot Price} \times (1 + (r - y))$$

$$FFP = 1195 \times (1 + (2.3685\% - 0.7479\%))$$

$$FFP = 1195 \times (1 + 1.6206\%) = 1,214.37$$

- Fair futures price is Rs.1,214.37 whereas actual futures price is Rs.1,225. Actual futures price is higher than fair futures price and hence futures are overpriced

WN 2: Arbitrage strategy:

- Fair futures price is Rs.1,214.37 (1,214.37 x 100) whereas actual futures price is Rs.1,22,500 (1,225 x 100). This would mean that futures are over-valued
- We should sell in the futures market and buy in the spot market to exploit arbitrage opportunity
- Arbitrage gain = Difference between FFP and AFP = 1,22,500 - 1,21,437 = Rs.1063

Arbitrage steps:

Particulars	Amount
Day 0	
1. Take a bank loan for Rs.1,19,500 @ 9.5% for 91 days	1,19,500
2. Buy shares worth of index in spot market	1,19,500
3. Enter into contract to sell index @ 1,22,500 after 91 days	
Day 1 to Day 91	
4. Company declared dividend, use the same to pay interest of 3 percent and hence net interest cost will be 6.50 percent	
Day 91	
5. Sell index for Rs.1,22,500	1,22,500
6. Repay loan along with net interest of 6.5 percent (1,19,500 + (1,19,500 x 6.5% x (91/365)))	1,21,437
7. Arbitrage gain	1,063

WN 3: Computation of arbitrage gain if index closes at 1,260 and 1,175:**Index closes at Rs.1,260:**

Particulars	Amount
Day 0	
1. Take a bank loan for Rs.1,19,500 @ 9.5% for 91 days	1,19,500
2. Buy shares worth of index in spot market	1,19,500

3. Enter into contract to sell index @ 1,22,500 after 91 days	
Day 1 to Day 91	
4. Company declared dividend, use the same to pay interest of 3 percent and hence net interest cost will be 6.50 percent	
Day 91	
5. Sell index for Rs.1,26,000 (1,260 x 100)	1,26,000
6. Loss in futures contract (Selling price was Rs.1,225; Opposite purchase price is Rs.1,260) Loss (100 x (1,225 - 1,260))	(3,500)
7. Repay loan along with net interest of 6.5 percent (1,19,500 + (1,19,500 x 6.5% x (91/365)))	1,21,437
8. Arbitrage gain	1,063

Index closes at Rs.1,175:

Particulars	Amount
Day 0	
1. Take a bank loan for Rs.1,19,500 @ 9.5% for 91 days	1,19,500
2. Buy shares worth of index in spot market	1,19,500
3. Enter into contract to sell index @ 1,22,500 after 91 days	
Day 1 to Day 91	
4. Company declared dividend, use the same to pay interest of 3 percent and hence net interest cost will be 6.50 percent	
Day 91	
5. Sell index for Rs.1,17,500 (1,175 x 100)	1,17,500
6. Gain in futures contract (Selling price was Rs.1,225; Opposite purchase price is Rs.1,175) Loss (100 x (1,225 - 1,175))	5,000
7. Repay loan along with net interest of 6.5 percent (1,19,500 + (1,19,500 x 6.5% x (91/365)))	1,21,437
8. Arbitrage gain	1,063

16. Valuation of futures [Nov 2019, May 2021 MTP]:

A future contract is available on R Ltd. that pays an annual dividend of Rs. 4 and whose stock is currently priced at Rs. 125. Each future contract calls for delivery of 1,000 shares to stock in one year, daily marking to market. The corporate treasury bill rate is 8%.

Required:

- Given the above information, what should the price of one future contract be ?
 - If the company stock price decreases by 6%, what will be the price of one futures contract ?
 - As a result of the company stock price decrease, will an investor that has a long position in one futures contract of R Ltd. realizes a gain or loss ? What will be the amount of his gain or loss ?
- (Ignore margin and taxation, if any)

Answer:

WN 1: Computation of fair futures price:**Base data:**

Spot price	Rs.125
Time period	1 year
Rate of interest	8% per annum
Dividend	Rs.4 in year 1
Storage cost	0
Type of compounding	Yearly

Note: It is assumed that dividend will be paid at the end of year 1

Computation of PV of Dividend Income:

Amount of Dividend	Rs.4
Time period	1 year
Rate of interest	8% per annum

Type of compounding	Yearly

$$\text{Present value} = \frac{4}{1.08} = 3.70$$

Fair Futures Price:

$$\text{Fair Futures Price} = \text{Adjusted Spot Price} \times (1 + r)^n$$

$$\text{Fair Futures Price} = 121.30 \times (1.08)^1 = \text{Rs. 131}$$

$$\text{Price of one contract} = 131 \times 1,000 = \text{Rs. 1,31,000}$$

Note:

- Adjusted spot price = Spot Price – PV of Dividend Income
- Adjusted spot price = 125 – 3.70 = Rs.121.30

WN 2: Computation of fair futures price if stock price decreases by 6%**Base data:**

Spot price	Rs.125 x 94% = Rs.117.50
Time period	1 year
Rate of interest	8% per annum
Dividend	Rs.4 in year 1
Storage cost	0
Type of compounding	Yearly

Fair Futures Price:

$$\text{Fair Futures Price} = \text{Adjusted Spot Price} \times (1 + r)^n$$

$$\text{Fair Futures Price} = 113.80 \times (1.08)^1 = \text{Rs. 122.90}$$

$$\text{Price of one contract} = 122.90 \times 1,000 = \text{Rs. 1,22,900}$$

Note:

- Adjusted spot price = Spot Price – PV of Dividend Income
- Adjusted spot price = 117.50 – 3.70 = Rs.113.80

WN 3: Computation of gain or loss:

- If the investor has taken a long position, decrease in price will result in loss for the investor.
- Amount of loss will be: Rs. 1, 31,000 – Rs. 1,22,900 = Rs. 8,100

17. Arbitrage through futures [May 2015 RTP]

Mr. X, is a Senior Portfolio Manager at ABC Asset Management Company. He expects to purchase a portfolio of shares in 90 days. However he is worried about the expected price increase in shares in coming day and to hedge against this potential price increase he decides to take a position on a 90-day forward contract on the Index. The index is currently trading at 2290. Assuming that the continuously compounded dividend yield is 1.75% and risk free rate of interest is 4.16%, you are required to determine:

- ❖ Calculate the justified forward price on this contract.
- ❖ Suppose after 28 days of the purchase of the contract the index value stands at 2450 then determine gain/ loss on the above long position.
- ❖ If at expiration of 90 days the Index Value is 2470 then what will be gain on long position.

Note: Take 365 days in a year and value of $e^{0.005942} = 1.005960$ & $e^{0.001849} = 1.001851$

Answer:**WN 1: Computation of fair futures price:****Base data:**

Spot price	Rs.2,290
Time period	90 days (or) 90/365 year
Rate of interest	4.16% per annum
Dividend (Note 1)	1.75% per annum
Storage cost	0
Type of compounding	Continuous

Fair Futures Price:

$$\begin{aligned} \text{Fair Futures Price} &= \text{Spot Price} \times e^{(r-y)t} \\ \text{Fair Futures Price} &= 2,290 \times e^{(4.16-1.75)\left(\frac{90}{365}\right)} \\ \text{Fair Futures Price} &= 2,290 \times e^{0.005942} \\ \text{Fair Futures Price} &= 2,290 \times 1.005960 \\ \text{Fair Futures Price} &= \text{Rs. 2,303.65} \end{aligned}$$

WN 2: Computation of gain/loss after 28 days if index stands at 2,450:

Date	Position	Action	Reference Date	Rate
Day 1	Original Position	Buy	Day 90	(2,303.65)
Day 28	Opposition Position	Sell	Day 90	2,460.05 (Note 1)
Profit				156.40

Note 1: Computation of futures price on day 28:

Spot price	Rs.2,450
Time period	62 days (or) 62/365 year
Rate of interest	4.16% per annum
Dividend (Note 1)	1.75% per annum
Storage cost	0
Type of compounding	Continuous

Fair Futures Price:

$$\begin{aligned} \text{Fair Futures Price} &= \text{Spot Price} \times e^{(r-y)t} \\ \text{Fair Futures Price} &= 2,290 \times e^{(4.16-1.75)\left(\frac{62}{365}\right)} \\ \text{Fair Futures Price} &= 2,290 \times e^{0.00409} \\ \text{Fair Futures Price} &= 2,290 \times 1.00410 \\ \text{Fair Futures Price} &= \text{Rs. 2,460.05} \end{aligned}$$

WN 3: Computation of gain/loss if index expires at 2,470:

Date	Position	Action	Reference Date	Rate
Day 1	Original Position	Buy	Day 90	(2,303.65)
Day 90	Opposition Position	Sell	Day 90	2,470.00
Profit				166.35

18. Pricing future and arbitrage opportunity [May 2018 RTP, Nov 2008, Nov 2019 RTP]

Calculate the price of 3 months PQR futures, if PQR (FV Rs.10) quotes Rs.220 on NSE and the three months future price quotes at Rs.230 and the one month borrowing rate is given as 15 percent and the expected annual dividend yield is 25 percent per annum payable before expiry. Also examine arbitrage opportunities.

Answer:**WN 1: Computation of fair futures price:****Base data:**

Spot price	Rs.220
Time period	3 months (or) 0.25 year
Rate of interest	15 percent per annum (or) 1.25% per month
Dividend	Rs.2.50 in Month 3 (Note 1)
Storage cost	0
Type of compounding	Monthly

Note 1: Dividend Income:

- Dividend yield of 25 percent is given in the question and the same is payable before expiry. Dividend yield is normally computed on market value. However, the same will not be logical in this question as the interest rate is 15 percent and normally dividend yield is lower than interest rate

- ICAI in this question has considered dividend yield as dividend rate and computed the same on face value. It is possible that there is a typing mistake in question and the question should have mentioned dividend rate
- Dividend = 25% × 10 = Rs.2.50

Computation of PV of Dividend Income:

Amount of Dividend	Rs.2.50
Time period	3 months (or) 0.25 year
Rate of interest	15% per annum (or) 1.25% per month
Type of compounding	Monthly

$$\text{Present value} = \frac{\text{Future value}}{(1 + r)^t}$$

$$\text{Present value} = \frac{2.50}{(1 + 1.25\%)^3} = \frac{2.50}{1.0380} = 2.41$$

Fair Futures Price:

$$\text{Fair Futures Price} = \text{Adjusted Spot Price} \times (1 + r)^t$$

$$\text{Fair Futures Price} = 217.59 \times (1 + 1.25\%)^3 = 217.59 \times 1.0380 = \text{Rs. 225.86}$$

Note:

- Adjusted spot price = Spot Price – PV of Dividend Income
- Adjusted spot price = 220 – 2.41 = Rs.217.59

WN 2: Strategy if actual futures price is Rs230:

- Fair futures price is Rs.225.86 whereas actual futures price is Rs.230. This would mean that futures are over-valued
- We should sell in the futures market and buy in the spot market to exploit arbitrage opportunity
- Arbitrage gain = Difference between FFP and AFP = 4.14

Arbitrage steps:

Particulars	Amount
Day 0	
1. Take loan of Rs.2.41 for 3 months @ 1.25% per month. This would be repaid out of dividend income	2.41
2. Take loan of Rs.217.59 for 3 months @1.25% per month. This would be repaid out of sell proceeds of share	217.59
3. Buy 1 share in spot market	220.00
4. Enter into futures contract to sell share at Rs.230	230.00
Day 90	
5. Receive dividend of Rs.2.50 and repay loan of Rs.2.41	2.50
6. Sell share in futures market and receive Rs.230	230.00
7. Repay loan of Rs.217.59 along with interest	225.86
8. Arbitrage gain (230 – 225.86)	4.14

19. Pricing future and arbitrage opportunity [Nov 2017 RTP, May 2009]

The share of X Ltd. is currently selling for Rs.300. Risk free interest rate is 0.8% per month. A three months futures contract is selling for Rs.312. Develop an arbitrage strategy and show what your riskless profit will be 3 month hence assuming that X Ltd. will not pay any dividend in the next three months.

Answer:**WN 1: Computation of fair futures price:****Base data:**

Spot price	Rs.300
Time period	3 months (or) 0.25 year

Rate of interest	0.8% per month (or) 9.6% per annum
Dividend	0
Storage cost	0
Type of compounding	Monthly

Fair Futures Price:

Fair Futures Price = Adjusted Spot Price $\times (1 + r)^t$

Fair Futures Price = $300 \times (1 + 0.80\%)^3 = 300.00 \times 1.0242 = \text{Rs. } 307.26$

WN 2: Strategy if actual futures price is Rs.312:

- Fair futures price is Rs.307.26 whereas actual futures price is Rs.312. This would mean that futures are over-valued
- We should sell in the futures market and buy in the spot market to exploit arbitrage opportunity
- Arbitrage gain = Difference between FFP and AFP = 4.74

Arbitrage steps:

Particulars	Amount
Day 0	
1. Take loan of Rs300.00 for 3 months @0.80% per month. This would be repaid out of sell proceeds of share	300.00
2. Buy 1 share in spot market	300.00
3. Enter into futures contract to sell share at Rs.312	312.00
Day 90	
4. Sell share in futures market and receive Rs.312	312.00
5. Repay loan of Rs.300.00 along with interest	307.26
6. Arbitrage gain (312 - 307.26)	4.74

20. Concept of Contango and Backwardation [Nov 2020 RTP]

Mr. SG sold five 4-Month Nifty Futures on 1st February 2020 for Rs. 9,00,000. At the time of closing of trading on the last Thursday of May 2020 (expiry), Index turned out to be 2100. The contract multiplier is 75.

Based on the above information calculate:

- The price of one Future Contract on 1st February 2020.
- Approximate Nifty Sensex on 1st February 2020 if the Price of Future Contract on same date was theoretically correct. On the same day Risk Free Rate of Interest and Dividend Yield on Index was 9% and 6% p.a. respectively.
- The maximum Contango/ Backwardation.
- The pay-off of the transaction.

Note: Carry out calculation on month basis.

Answer:

Particulars	Calculation	Amount
Price of one contract	$\frac{9,00,000}{5}$	Rs.1,80,000
Nifty on Feb 1, 2020:		
Fair futures price	$\frac{1,80,000}{75}$	2,400
Spot price calculation	$SP \times (1 + (r - y)^t) = 2,400$ $SP \times (1 + \left(\left(\frac{0.09}{3}\right) - \left(\frac{0.06}{3}\right)\right)^1) = 2,400$ $SP \times (1 + 0.01) = 2,400$ $SP = \frac{2,400}{1.01}$	Rs.2,376.24
Contango/backwardation:		
Basis	Spot price - futures price $2,376.24 - 2,400$	-23.76

Contango	Note 1	23.76
Pay-off (profit)	Note 2	Rs.1,12,500

Note 1:

If Basis is negative the market is said to be in Contango and when it is positive the market is said to be Backwardation. Since current Spot Price is 2400 and Nifty Index is 2376.24, the Basis is negative and hence there is Contango Market and maximum Contango shall be 23.76

Note 2:

Date	Position	Action	Reference Date	Rate
Feb 1	Original Position	Sell	May 2020	2,400
May 2020	Opposition Position	Buy	May 2020	(2,100)
Profit				300
Total Profit [300 x 75 x 5]				1,12,500

Part II - Hedging with Futures

21. Hedging with futures [Nov 2007, May 2018 MTP, Nov 2014 MTP, Nov 2017 MTP, May 2016 RTP, May 2019 RTP, Nov 2020]

BSE	5,000
Value of portfolio	10,10,000
Risk free interest rate	9% per annum
Dividend yield on index	6% per annum
Beta of portfolio	1.5

We assume that a future contract on the BSE index with four months maturity is used to hedge the value of portfolio over next three months. One future contract is for delivery of 50 times the index. Based on the above information calculate:

- ❖ Price of future contract.
- ❖ The gain on short futures position if index turns out to be 4,500 in three months.

Answer:**WN 1: Computation of fair futures price:****Base data:**

Spot price	Rs.5,000
Time period	4 months (or) 0.33 year
Rate of interest	9% per annum (or) 3% per 4 months
Dividend	6% per annum (or) 2% per 4 months
Storage cost	0
Type of compounding	Once in four months

Fair Futures Price:

Fair Futures Price = Adjusted Spot Price $\times (1 + (r - y))^t$

Fair Futures Price = 5,000 $\times (1 + (0.03 - 0.02))^1$ = 5,000 $\times 1.01$ = Rs. 5,050

WN 2: Computation of no of contracts taken for hedging:

- The investor wants to hedge the portfolio for another three months. He plans to use four months BSE index futures for hedging the portfolio. This is an acceptable strategy as the four months futures contract would remain active till the hedging period of three months
- We are planning for hedging the portfolio and that would make the beta of portfolio to 0 from current 1.5 times

Security	Beta	Weight	Product
Portfolio	1.50	10,10,000	15,15,000
BSE futures	1.00	(15,15,000)	(15,15,000)
Total	0.00	10,10,000	0

Note:

- Investor currently has invested Rs.10,10,000. Portfolio has beta of 1.5 times and hence risk-adjusted portfolio value is Rs.15,15,000

- We need Beta of 0 times and hence sum of product will be zero. This would make the product of BSE futures as balancing figure and same would be -15,15,000. Beta of BSE futures is 1 (market beta) and hence weight is -15,15,000
- We will not be adding BSE futures weight while adding the overall weights. This is because money of Rs.15,15,000 will not be blocked in BSE futures and only the margin for the same would be blocked
- We need to take position of -15,15,000 in BSE futures. Negative would indicate that we need to sell BSE futures

$$\text{No of contracts to be sold} = \frac{15,15,000}{50 \times 5,050} = 6 \text{ Contracts}$$

WN 3: Computation of profit/loss:

Date	Position	Action	Reference Date	Rate
Day 1	Original position	Sell	Day 120	5,050.00
Day 90	Opposite position	Buy	Day 120	(4,511.25)
Profit per BSE				538.75
Profit per contract (538.75 x 60)				26,937.50
Profit for 6 contracts (26,937.50 x 6)				1,61,625

Note: Computation of futures price on day 90 for day 120:**Base data:**

Spot price	Rs.4,500
Time period	1 month
Rate of interest	9% per annum (or) 0.75% per month
Dividend	6% per annum (or) 0.50% per month
Storage cost	0
Type of compounding	Monthly

Fair Futures Price:

$$\text{Fair Futures Price} = \text{Adjusted Spot Price} \times (1 + (r - y))^t$$

$$\text{Fair Futures Price} = 4,500 \times (1 + (0.0075 - 0.0050))^1 = 4,500 \times 1.0025 = \text{Rs. } 4,511.25$$

22. Hedging with futures [Nov 2018 MTP, May 2019 MTP, May 2011, May 2015 MTP, Nov 2018 MTP, Nov 2014 RTP]

A Mutual Fund is holding the following assets

Investments in diversified equity shares	Rs.90 Crores
Cash and Bank Balances	Rs.10 Crores

The Beta of the portfolio is 1.1. The index future is selling at 4300 level. The Fund Manager apprehends that the index will fall at the most by 10%. How many index futures he should short for perfect hedging? One index future consists of 50 units. Substantiate your answer assuming the Fund Manager's apprehension will materialize.

Answer:**WN 1: Computation of number of contracts for hedging:**

Security	Beta	Weight	Product
Equity shares	1.10	90,00,00,000	99,00,00,000
Cash	0.00	10,00,00,000	-
Index futures	1.00	(99,00,00,000)	(99,00,00,000)
Total	0	100,00,00,000	0

Note:

- It is assumed that beta of 1.1 times is for equity shares of Rs.90 crores. Alternatively, it can be assumed that beta of overall portfolio is 1.1 times.

$$\text{No of contracts for hedging} = \frac{99,00,00,000}{4,300 \times 50} = 4,605 \text{ Contracts}$$

WN 2: Impact of hedging if the index falls by 10 percent:

- Beta of equity shares is 1.1 times. This would mean that if index falls by 10 percent, equity shares will fall by 11 percent
- We have purchased equity shares of Rs.90 crores and fall in share price will lead to loss. Loss in equity portfolio = 90 crores x 11% = Rs.9.9 crores
- Index has fallen by 10 percent. We have sold equity shares and this will lead to profit for the company. Gain in futures = (4,605 contracts x 4,300 x 50) x 10% = Rs.9.9 Crores
- Net gain/loss = 0. This proves that hedge has enabled the fund manger to save from loss despite 10 percent fall in index

23. Hedging with futures [Nov 2013, Nov 2019 MTP, Nov 2016 RTP]

A trader is having in its portfolio shares worth Rs.85 lakhs at current price and cash Rs.15 lakhs. The beta of share portfolio is 1.6. After 3 months the price of shares dropped by 3.2%. Determine:

- ❖ Current portfolio beta
- ❖ Portfolio beta after 3 months if the trader on current date goes for long position on Rs. 100 lakhs Nifty futures.

Answer:

WN 1: Computation of portfolio Beta:

Security	Beta	Weight	Product
Shares	1.60	85,00,000	1,36,00,000
Cash	0.00	15,00,000	-
Total	1.36	1,00,00,000	1,36,00,000

$$\text{Portfolio Beta} = \frac{\text{Sum of product}}{\text{Sum of weights}} = \frac{1,36,00,000}{1,00,00,000} = 1.36 \text{ Times}$$

WN 2: Computation of portfolio Beta if the trader goes on long position on Rs.100 lacs Nifty futures:

Security	Beta	Weight	Product
Shares	1.60	85,00,000	1,36,00,000
Cash	0.00	15,00,000	-
Nifty futures	1.00	1,00,00,000	1,00,00,000
Total	2.36	1,00,00,000	2,36,00,000

$$\text{Portfolio Beta} = \frac{2,36,00,000}{1,00,00,000} = 2.36 \text{ Times}$$

Alternative answer:

- Market has fallen by 2%. We have gone long on Rs.100 lacs of index futures and hence loss would be Rs.2 lacs from futures
- Beta of stock is 1.6 and hence shares would have fallen by 3.2%. Loss in shares = 85,00,000 x 3.2% = Rs.2,72,000
- Total loss = Rs.2,00,000 + Rs.2,72,000 = Rs.4,72,000
- % loss = (4,72,000/100,00,000) x 100 = 4.72%

$$\text{Beta} = \frac{\% \text{ loss in portfolio}}{\% \text{ change in market}} = \frac{4.72\%}{2\%} = 2.36 \text{ Times}$$

24. Computation of portfolio Beta [May 2017, Nov 2020 RTP]

A is an investor and having in its portfolio shares worth Rs.1,20,00,000 at current price and Cash of Rs.10,00,000. The Beta of share portfolio is 1.4. After four months the price of shares dropped by 1.8%. You are required to determine:

- Current Portfolio Beta
- Portfolio Beta after four months-if A on current date goes for long position on Rs.1,30,00,000 Nifty Futures

Show calculations in lacs with four decimal points

Answer:

WN 1: Computation of Portfolio Beta:

Particulars	Beta	Weight	Product
Equity portfolio	1.40	120	168
Cash	0.00	10	0
Total	1.2923	130	168

WN 2: Computation of Beta if shares change by 1.8%:

- ❖ The share portfolio will fall by 1.8%. Loss on share portfolio is equal to Rs.2.16 lacs (120 lacs x 1.8%)
- ❖ The share portfolio has fallen by 1.8%. Beta of shares is 1.40 and hence Nifty will fall by 1.2857% (1.8/1.4). Nifty futures will have a loss of 1.2857 percent as the investor has entered into long position. Loss on Nifty Futures is equal to Rs.1.6714 lacs (130 lacs x 1.2857%)
- ❖ **Overall loss = Rs.2.16 lacs + Rs.1.6714 lacs = Rs.3.8314 lacs**
- ❖ **Overall loss in percentage = (3.8314 lacs/130 lacs) = 2.9472%**

$$\text{Beta} = \frac{\text{change in portfolio}}{\text{Change in market}} = \frac{2.9472}{1.2857} = 2.2923 \text{ Times}$$

25. Hedging with futures

Identify the action to be taken in respect of the following situations?

Stock beta	Stock Position	Stock value (Rs. lakh)	Hedge needed
0.8	Long	2	Full
1.2	Long	5	Full
0.9	Short	1	Full
1.0	Long	2	50%
1.3	Short	4	110%

Answer:**Part 1:**

- Investor has taken a long position in stock and hence he has to take short position to hedge the position
- Amount of hedge to be taken = (Investment in spot market x stock beta x hedge needed %)
- Amount of hedge = (2,00,000 x 0.80 x 100%) = Rs.1,60,000
- We should take short position of Rs.1,60,000 in index futures

Part 2:

- Investor has taken a long position in stock and hence he has to take short position to hedge the position
- Amount of hedge = (5,00,000 x 1.20 x 100%) = Rs.6,00,000

Part 3:

- Investor has taken a short position in stock and hence he has to take long position to hedge the position
- Amount of hedge = (1,00,000 x 0.90 x 100%) = Rs.90,000

Part 4:

- Investor has taken a long position in stock and hence he has to take short position to hedge the position
- Amount of hedge = (2,00,000 x 1.00 x 50%) = Rs.1,00,000

Part 5:

- Investor has taken a short position in stock and hence he has to take long position to hedge the position
- Amount of hedge = (4,00,000 x 1.30 x 110%) = Rs.5,72,000

26. Hedge ratio [May 2012, May 2018 MTP, Nov 2014 MTP, May 2017 RTP]

A company is long on 10 MT of copper @ Rs. 534 per kg (spot) and intends to remain so for the ensuing quarter. The variance of change in its spot and future prices are 16% and 36% respectively, having correlation coefficient of 0.75. The contract size of one contract is 1,000 kgs.

Calculate:

- (i) Calculate the Optimal Hedge Ratio for perfect hedging in Future Market.
- (ii) Advice the position to be taken in Future Market for perfect hedging.
- (iii) Determine the number and the amount of the copper futures to achieve a perfect hedge.

Answer:

WN 1: Computation of Beta (optimal hedge ratio):

$$\text{Beta} = \frac{\text{SD of changes in spot market}}{\text{SD of changes in in futures market}} \times \text{Correlation coefficient}$$

$$\text{Beta} = \frac{\sqrt{16}}{\sqrt{36}} \times 0.75 = 0.50$$

WN 2: Position to be taken:

Since the company is long position in Spot (Cash) Market it shall take Short Position in Future Market

WN 3: Computation of futures position for perfect hedge:

Security	Beta	Weight	Product
Spot market	0.50	53,40,000 (534 × 10,000)	26,70,000
Futures	1.00	(26,70,000)	(26,70,000)
Total	0.00	53,40,000	0

- We have to short futures worth Rs.26,70,000 for perfect hedge
- Size of one contract = 1,000 kgs × 534 = Rs.5,34,000
- No of contracts for perfect hedge = (26,70,000/5,34,000) = 5 Contracts

27. Hedging with futures [May 2020 RTP, May 2019 MTP, May 2013, May 2015 MTP]

On January 1, 2013 an investor has a portfolio of 5 shares as given below:

Security	Price	No.of Shares	β
A	349.30	5,000	1.15
B	480.50	7,000	0.40
C	593.52	8,000	0.90
D	734.70	10,000	0.95
E	824.85	2,000	0.85

The cost of capital to the investor is 10.5% per annum. You are required to calculate.

- The beta of his portfolio.
- The theoretical value of the NIFTY futures for February 2013.
- The number of contracts of NIFTY the investors needs to sell to get a full hedge until February for his portfolio if the current value of NIFTY is 5900 and NIFTY futures are trading lot requirement of 200 units. Assume that the futures are trading at their fair value.
- The number of future contracts the investor should trade if he desire to reduce the beta of his portfolios to 0.6

(No. of days in a year be treated as 365. Given: $\ln(1.105) = 0.0998$ e $(0.015858) = 1.01598$)

Answer:**WN 1: Computation of Beta of portfolio:**

Security	Beta	Weight	Product
A	1.15	17,46,500	20,08,475
B	0.40	33,63,500	13,45,400
C	0.90	47,48,160	42,73,344
D	0.95	73,47,000	69,79,650
E	0.85	16,49,700	14,02,245
Total	0.8491	1,88,54,860	1,60,09,114

$$\text{Portfolio Beta} = \frac{\text{Sum of product}}{\text{Sum of weights}} = \frac{1,60,09,114}{1,88,54,860} = 0.8491 \text{ Times}$$

WN 2: Computation of fair futures price:**Base data:**

Spot price	Rs.5,900
Time period	58 days (or) 58/365 years
Rate of interest	10.50% normal rate (or) 9.98% continuous compounded rate per annum (Note 1)
Dividend	0
Storage cost	0

Type of compounding	Continuous

Note 1:

- Cost of capital of the company is 10.50 percent per annum. This can be converted into CCRFI rate using natural log values (ln)
- $\ln(1.105) = 0.0998$. This would mean that normal cost of capital of 10.50 per annum can be converted into continuous compounded rate of 9.98 percent per annum

Fair Futures Price:

Fair Futures Price = Spot Price $\times e^{rt}$
Fair Futures Price = $5,900 \times e^{(0.0998)(\frac{58}{365})}$
Fair Futures Price = $5,900 \times e^{0.015858}$
Fair Futures Price = $5,900 \times 1.01598$
Fair Futures Price = Rs. 5,994.28

WN 3: Calculation of number of contracts for perfect hedging:

Security	Beta	Weight	Product
Portfolio	0.8491	1,88,54,860	1,60,09,114
Futures	1.00	(1,60,09,114)	(1,60,09,114)
Total	0	1,88,54,860	0

- We should sell NIFTY futures worth Rs.1,60,09,114 for perfect hedge

$$\text{No of contracts to be sold} = \frac{1,60,09,114}{200 \times 5,994.28} = 13.35 \text{ rounded off to 13 contracts}$$

WN 4: Calculation of number of contracts to reduce beta to 0.6 Times:

Security	Beta	Weight	Product
Portfolio	0.8491	1,88,54,860	1,60,09,114
Futures	1.00	(46,96,198)	(46,96,198)
Total	0.60	1,88,54,860	1,13,12,916

- We should sell NIFTY futures worth Rs.46,96,198 to reduce Beta to 0.6 Times

$$\text{No of contracts to be sold} = \frac{46,96,198}{200 \times 5,994.28} = 3.917 \text{ rounded off to 4 contracts}$$

28. Hedging with futures [Nov 2018 MTP, May 2018 MTP, Nov 2015]

On April 1, 2015, an investor has portfolio consisting of eight securities as shown below:

Security	Price	No. of shares	β
A	29.40	400	0.59
B	318.70	800	1.32
C	660.20	150	0.87
D	5.20	300	0.35
E	281.90	400	1.16
F	275.40	750	1.24
G	514.60	300	1.05
H	170.50	900	0.76

The cost of capital for the investor is given to be 20% per annum. The investor fears a fall in the prices of the shares in the near future. Accordingly, he approaches you for advice. You can make use of the following information/assumptions:

- ❖ The current S&P CNX Nifty value is 8500.
- ❖ S&P CNX Nifty futures can be traded in units of 25 only.
- ❖ The May futures are currently quoted at 8700 and the June Futures are being quoted at 8850.

You are required to:

- Calculate the beta of his portfolio.
- Calculate the theoretical value of the futures contracts according the investor for contracts expiring in (1) May, (2) June. [Given $e^{0.03} = 1.03045$; $e^{0.04} = 1.04081$; $e^{0.05} = 1.05127$]
- Calculate the number of units of S&P CNX Nifty that he would have to sell if he desires to hedge until June (1) his total portfolio, (2) 90% of his portfolio and (3) 120% of his portfolio.

Answer:

WN 1: Computation of Beta of portfolio:

Security	Beta	Weight	Product
A	0.59	11,760	6,938
B	1.32	2,54,960	3,36,547
C	0.87	99,030	86,156
D	0.35	1,560	546
E	1.16	1,12,760	1,30,802
F	1.24	2,06,550	2,56,122
G	1.05	1,54,380	1,62,099
H	0.76	1,53,450	1,16,622
Total	1.1019	9,94,450	10,95,832

$$\text{Beta} = \frac{\text{Sum of Product}}{\text{Sum of weights}} = \frac{10,95,832}{9,94,450} = 1.1019 \text{ Times}$$

WN 2: Computation of Fair Futures Price:**Contract expiring in May:****Base data:**

Spot price	8,500
Time period	2 months (or) 0.16667 year
Rate of interest	20%
Dividend	0
Storage cost	0
Type of compounding	Continuous

Fair Futures Price:

$$\begin{aligned} \text{Fair Futures Price} &= \text{Spot Price} \times e^{rt} \\ \text{Fair Futures Price} &= 8,500 \times e^{(0.20)(0.16667)} \\ \text{Fair Futures Price} &= 8,500 \times e^{0.03333} \\ \text{Fair Futures Price} &= 8,500 \times 1.03387 \\ \text{Fair Futures Price} &= \text{Rs. 8,788} \end{aligned}$$

Note: Computation of $e^{0.03333}$.

$e^{0.03333}$ shall be computed using interpolation formula as follows

$e^{0.03}$	=	1.03045
$e^{0.04}$	=	1.04081
$e^{0.01}$	=	0.01036
$e^{0.0033}$	=	0.00342 (0.01036 × 33/100)
$e^{0.0067}$	=	0.00694 (0.01036 × 67/100)
$e^{0.0333}$	=	1.03045 + 0.00342 = 1.03387
(or)		
$e^{0.0333}$	=	1.04081 - 0.00694 = 1.03387

Contract expiring in June:**Base data:**

Spot price	8,500
Time period	3 months (or) 0.25 year
Rate of interest	20%
Dividend	0
Storage cost	0
Type of compounding	Continuous

Fair Futures Price:

$$\begin{aligned} \text{Fair Futures Price} &= \text{Spot Price} \times e^{rt} \\ \text{Fair Futures Price} &= 8,500 \times e^{(0.20)(0.25)} \\ \text{Fair Futures Price} &= 8,500 \times e^{0.05} \end{aligned}$$

Fair Futures Price = $8,500 \times 1.05127$
Fair Futures Price = Rs. 8,935.80

WN 3: Computation of number of contracts for hedging portfolio till June:**Scenario 1: Hedging full portfolio:**

- Investor wants to hedge full portfolio and hence the Beta will come down to zero

Security	Beta	Weight	Product
Security	1.1019	9,94,450	10,95,832
Nifty futures	1	(10,95,832)	(10,95,832)
Total	0	9,94,450	0

$$\text{No of contracts to sell} = \frac{10,95,832}{25 \times 8,850} = 4.95 \sim 5 \text{ contracts}$$

Scenario 2: Hedging 50% portfolio:

$$\text{No of contracts to sell} = 4.95 \times 0.50 = 2.475 \sim 2 \text{ or } 3 \text{ contracts}$$

Scenario 3: Hedging 120% portfolio:

$$\text{No of contracts to sell} = 4.95 \times 1.20 = 5.94 \sim 6 \text{ contracts}$$

29. Futures hedging [Dec 2021]

A future contract on BSE Index with 4 months maturity is used to hedge the value of the portfolio over the next 3 months. One future contract for delivery is 50 times of the index. The following information is available:

Value of Portfolio	1,16,00,000
BSE sensx on 1 st Jan 2022 [Anticipated on 1 st Sep 2021]	58,580
BSE sensx on 1 st Jan 2022 [Anticipated on 1 st Dec 2021]	56,641.25
Dividend yield of index	6% p.a.
181 days treasury bill rate	9% p.a.
Beta of the portfolio	1.5

You are required to calculate:

- The present value of the Sensex as on 1st September 2021
- Turned out value of the Sensex as on 1st December 2021
- The number of contracts to hedge the portfolio

Answer:**WN 1: Computation of present value of sensx on 1st Sep 2021 [Spot Price]**

Spot price	?
Time period	4 months (or) 0.33 year
Rate of interest	9% per annum (or) 3% per 4 months
Dividend	6% per annum (or) 2% per 4 months
Storage cost	0
Type of compounding	Once in four months
Futures price	58,580

Computation of Spot price:

$$\text{Fair Futures Price} = \text{Spot Price} \times (1 + (r - y))^t$$

$$58,580 = \text{Spot price} \times (1 + (0.03 - 0.02))^1$$

$$\text{Spot price} = \frac{58,580}{1.01} = 58,000$$

WN 2: Computation of present value of sensx on 1st Dec 2021 [Spot Price]

Spot price	?
Time period	1 month
Rate of interest	9% per annum (or) 0.75% per month

Dividend	6% per annum (or) 0.50% per month
Storage cost	0
Type of compounding	Monthly
Futures price	56,641.25

Computation of Spot price:

Fair Futures Price = Adjusted Spot Price $\times (1 + (r - y))^t$

$$56,641.25 = \text{Spot price} \times (1 + (0.0075 - 0.0050))^1$$

$$\text{Spot Price} = \frac{56,641.25}{1.0025} = \text{Rs. } 56,500$$

WN 3: Computation of number of contracts for hedging:

Security	Beta	Weight	Product
Portfolio	1.50	1,16,00,000	1,74,00,000
BSE futures	1.00	(1,74,00,000)	(1,74,00,000)
Total	0.00	1,16,00,000	0

$$\text{Number of contracts to be sold} = \frac{1,74,00,000}{50 \times 58,580} = 5.94 \text{ Contracts} \sim 6 \text{ Contracts}$$

30. Hedging of stock position [Dec 2021]

On 1st July 2021 Mr. P has made the following investment:

Name of Company	No of equity shares	Beta	Purchase Price per Equity Share
ML Limited	1,000	1.25	Rs.700

He wants to hold the investment till end of September 2021 with an expectation of huge dividends to be announced in the AGM. On the date of investment, September Nifty Futures are quoting at 17500 and tradeable with lot size of 50 for each contract.

You are the Investment advisor to Mr. P,

- Please advise Mr. P how to hedge his market exposure using the available data.
- Calculate the profit or loss of Mr. P during the expiry of September 2021 futures in following situation:
 - Nifty Future rise by 10% (b) ML Ltd. falls by 5%
- Is it possible stock as well as nifty to raise or fall at the same percentage? Please state the reason.

Answer:**WN 1: Creation of hedge:**

Security	Beta	Weight	Product
ML Limited	1.25	7,00,000	8,75,000
Nifty futures	1.00	-8,75,000	-8,75,000
Total	0.00	7,00,000	0

$$\text{Number of contracts to be sold} = \frac{8,75,000}{17,500 \times 50} = 1 \text{ Contracts}$$

WN 2: Computation of profit/loss:**Nifty raises by 10 percent:**

- If Nifty has increased by 10 percent, then ML Limited will increase by 12.50 percent

Particulars	Calculation	Amount
Profit on ML Limited shares	7,00,000 $\times$ 12.50%	87,500
Loss on Nifty futures	8,75,000 $\times$ 10%	-87,500
Net profit/loss		0

ML Limited falls by 5 percent:

ML Limited has fallen by 5 percent and hence Nifty will fall by 4 percent [5/1.25]

Particulars	Calculation	Amount
Loss on ML Limited shares	7,00,000 $\times$ 5%	-35,000
Profit on Nifty futures	8,75,000 $\times$ 4%	35,000
Net profit/loss		0

Part (iii):

Normally it is not possible that Nifty to rise or fall by same percentage because of systematic risk i.e. Beta may not be the same as of market. It can change by same percentage only if the Beta of the security is 1 time.

31. Hedging with futures [Nov 2016, May 2021 RTP]

Details about portfolio of shares of an investor is as below:

Shares	No of shares (lakh)	Price per share	Beta
A Limited	3.00	500	1.40
B Limited	4.00	750	1.20
C Limited	2.00	250	1.60

The investor thinks that the portfolio is carrying a very high risk as compared to the market risk and hence interested to reduce the portfolio's systematic risk to 0.91. He is considering two below mentioned alternative strategies:

- Dispose off a part of his existing portfolio to acquire risk free securities, or
- Take appropriate position on Nifty Futures which are currently traded at Rs.8,125 and each Nifty points is worth Rs.200

You are required to determine:

- Interpret the opinion of investor, whether it is correct or not.
- Calculate the existing systematic risk of the portfolio
- The value of risk free securities to be acquired
- The number of shares of each company to be disposed off
- The number of Nifty contracts to be bought/sold and
- The value of portfolio beta for 2% rise in Nifty

Answer:

Yes, the apprehension of investor is correct as the current portfolio is more riskier than market as the beta (Systematic Risk) of market portfolio is as computed as follows

Shares	Beta	Weight	Product
A Limited	1.40	1,500	2,100
B Limited	1.20	3,000	3,600
C Limited	1.60	500	800
Overall	1.30	5,000	6,500

- Overall Beta (systematic risk) of Portfolio = 1.3 Times

WN 2: Computation of risk-free securities to be acquired to get target Beta of 0.91 times:

Particulars	Beta	Weight	Product
Equity portfolio	1.30	3,500	4,550
Risk-free securities	0	1,500	0
Overall	0.91	5,000	4,550

- ❖ The company needs target beta of 0.91 times and we first update that. Based on target Beta of 0.91 times and weight of 5,000 we should get overall product of 4,550
- ❖ Product for risk-free security will be zero irrespective of weight and hence product for equity portfolio will be 4,550
- ❖ Weight for equity portfolio = $4,550 / 1.30 = 3,500$
- ❖ Weight for risk-free security = $5,000 - 3,500 = 1,500$
- ❖ Hence, we should buy risk-free securities of 1,500 lacs

WN 3: Computation of number of shares to be disposed-off:

- ❖ The company currently has a share portfolio of 5,000 lacs and the revised portfolio is 3,500 lacs. Hence, we should dispose 30 percent of share portfolio to reduce Beta.

Shares	Existing shares (in lacs)	Shares to be disposed-off (in lacs)
A Limited	3.00	0.90
B Limited	4.00	1.20
C Limited	2.00	0.60

WN 4: Adjustment of Beta through Nifty Futures:

Particulars	Beta	Weight	Product
Equity portfolio	1.30	5,000	6,500

Nifty Futures	1.00	-1,950	-1,950
Overall	0.91	5,000	4,550

- ❖ The company currently has portfolio of 5,000 lacs and the risk adjusted value (product) for the same is 6,500 lacs
- ❖ The company can reduce the risk through Nifty Futures. The overall Beta has to be 0.91 and the product will be 4,550 lacs
- ❖ **Nifty futures will have Beta of 1 time and weight for the same will not appear in total of weights. This is because the portfolio value will continue to be 5,000 lacs despite entering into long/short Nifty Futures**
- ❖ Value of Nifty Futures = 4,550 – 6,500 = -1,950 lacs; Answer is negative and hence we should go for short position

$$\text{No of contracts to be short} = \frac{1,950 \text{ lacs}}{8,125 \times 200} = 120 \text{ contracts}$$

WN 5: Computation of Beta for 2% rise in Nifty:

- ❖ The share portfolio will improve by 2.6% (2% x 1.3 times) for a 2% rise in Nifty. Profit on portfolio is equal to Rs.130 lacs (5,000 x 2.6%)
- ❖ Nifty futures will have a loss of 2 percent as the investor has entered into short position. Loss on Nifty Futures is equal to Rs.39 lacs (1,950 x 2%)
- ❖ **Overall profit = Rs.91 lacs or 1.82% of portfolio**

$$\text{Beta} = \frac{\text{change in portfolio}}{\text{Change in market}} = \frac{1.82}{2.00} = 0.91 \text{ Times}$$

32. Hedging with futures [May 2018 MTP]

On 1 April 2015, Sunidhi was holding a portfolio of 10 securities whose value was Rs. 9,94,450, the weighted average of beta of 9 securities was 1.10.

Since she was expecting a fall in the prices of the shares in near future to hedge her portfolio she sold 5 contract of NIFTY Futures (Multiplier of 25) expiring in May 2015, which was trading at 8767.07 on 1 April.

(a) Calculate the beta of the 10th security.

(b) Reconcile the reasons in spite of 2% fall in the market as per Sunidhi's apprehension if she would have earned some profit on her cash position.

Answer:

WN 1: Computation of overall beta of 10 securities:

Security	Beta	Weight	Product
10 securities	1.102	9,94,450	10,95,881
Nifty futures	1.00	(10,95,881)	(10,95,881)
Total	0	9,94,450	0

Note:

- Beta for Nifty futures will be 1 time
- Weight for Nifty futures = -5 x 25 x 8,767.07 = Rs.10,95,881
- We have fully hedged the portfolio and hence total of product will be zero. Hence weight for 10 securities will be balancing figure of Rs.10,95,881

$$\text{Overall Beta} = \frac{10,95,881}{9,94,450} = 1.102 \text{ Times}$$

WN 2: Computation of Beta of 10th Security:

- ❖ It is assumed that there is equal investment in all securities and hence weight of 9 securities will be 0.9 and weight of 10th security will be 0.1

Security	Beta	Weight	Product
9 Security	1.1	0.9	0.99
10 th Security	1.12	0.1	0.112
Total	1.102	1.0	1.102

Note:

- Overall product is 1.102 Times
- Product for 10th security = 1.102 – 0.99 = 0.112
- Beta of 10th security = 0.112/0.1 = 1.12 Times

WN 3: Reason for earning some profit despite hedging:

The main reason for the profit in cash position might be due to reason that contrary to her expectation of fall in the value of cash position there may be increase in value of cash position.

33. Stock hedging – long position

You have bought 2045 shares of LP Limited. LP has a beta of 1.1 with the sensex. Each sensex contract is equal to 50 units. LP now quotes at Rs.100 and the sensex futures is available at 4500 index points. Required:

- How many futures contracts will you have to take?
- If the price of the spot market drops by 12 percent how are you protected?
- If the price in the spot market jumps up by 5 percent, what happens?
- Calculate the profit if LP limited falls to 97 and sensex falls to 4410

Answer:

WN 1: Computation of no of contracts for hedging:

Security	Beta	Weight	Product
LP Limited	1.10	2,04,500	2,24,950
Sensex futures	1	(2,24,950)	(2,24,950)
Total	0	2,04,500	0

$$\text{No of contracts to sell} = \frac{2,24,950}{50 \times 4,500} = 0.9997 \sim 1 \text{ contract}$$

WN 2: Working of hedging mechanism with change in price:

Price in spot market drops by 12 percent:

- Price in spot market drops by 12 percent. This would mean that shares of LP limited falls by 12 percent
- Fall in sensex futures = (12 percent/1.1) = 10.909%

Particulars	Calculation	Amount
Loss on LP Limited shares	$2,045 \times 100 \times 12\%$	(24,540)
Gain on short futures	$50 \times 4,500 \times 10.909\%$	24,545
Net loss/gain		5

Price in spot market increases by 5 percent:

- Price in spot market increases by 5 percent. This would mean that shares of LP limited gain by 5 percent
- Gain in sensex futures = (5 percent/1.1) = 4.545%

Particulars	Calculation	Amount
Gain on LP Limited shares	$2,045 \times 100 \times 5\%$	10,225
Loss on short futures	$50 \times 4,500 \times 4.545\%$	(10,226)
Net loss/gain		1

- Above calculations validates that investor is not impacted by price increase/fall due to perfect hedging

WN 3: Profit/loss LP limited falls to 97 and sensex falls to 4410

Particulars	Calculation	Amount
Loss on LP Limited shares	$2,045 \times 100 \times (100 - 97)$	(6,135)
Gain on short futures	$50 \times (4,500 - 4,100)$	4,500
Net loss/gain		(1,635)

34. Stock hedging – short position

Consider the following data relating to KM stock. KM has a beta of 0.7 with NIFTY. Each Nifty contract is equal to 200 units. KM now quotes at Rs.150 and the Nifty futures is 1400 Index points. You expect prices to fall and have gone short on 8000 shares of KM in the spot market.

- How many futures contracts will you have to take?
- Suppose the price in the spot market drops by 10 percent, how are you protected?
- Suppose the price in the spot market jumps up by 5 percent, what happens?
- Calculate the profit if KM stock increases to 160 and nifty increases to 1600.

Answer:

WN 1: Computation of no of contracts for hedging:

Security	Beta	Weight	Product
KM Limited	0.70	12,00,000	(8,40,000)
Nifty futures	1	8,40,000	8,40,000
Total	0	12,00,000	0

No of contracts to buy = $\frac{8,40,000}{200 \times 1,400} = 3$ contracts

WN 2: Working of hedging mechanism with change in price:

Price in spot market drops by 10 percent:

- Price fall of KM Limited = 10 percent
- Fall in sensex futures = (10 percent/0.7) = 14.286%

Particulars	Calculation	Amount
Gain on KM Limited shares	12,00,000 x 10%	1,20,000
Loss on futures	8,40,000 x 14.286%	(1,20,002)
Net loss/gain		(2)

Price in spot market increases by 5 percent:

- Price gain of KM Limited = 5 percent
- Gain in sensex futures = (5 percent/0.7) = 7.143%

Particulars	Calculation	Amount
Loss on KM Limited shares	12,00,000 x 5%	(60,000)
Gain on futures	8,40,000 x 7.143%	60,001
Net loss/gain		1

- Above calculations validates that investor is not impacted by price increase/fall due to perfect hedging

WN 3: Profit/loss if KM limited increases to 160 and nifty increase to 1,600

Particulars	Calculation	Amount
Loss on LP Limited shares	8,000 x 10	(80,000)
Gain on futures	600 x 200	1,20,000
Net loss/gain		40,000

35. Impact of hedging [May 2017 RTP]

Miss K holds 10,000 shares of IBS Bank @ 2,738.70 when 1 month Index Future was trading @ 6,086 The share has a Beta (β) of 1.2. How many Index Futures should she short to perfectly hedge his position. A single Index Future is a lot of 50 indices. Justify your result in the following cases:

- when the Index zooms by 1%
- when the Index plummets by 2%.

Answer:

WN 1: Computation of index futures to hedge the position:

Security	Beta	Weight (in lacs)	Product (in lacs)
IBS Bank	1.20	273.87	328.644
Index Futures	1.00	(328.644)	(328.644)
Total	0	273.87	0

Amount of index futures to be short = Rs.328.644 lacs
No of contracts = $\frac{328.644 \text{ lacs}}{6,086 \times 50} = 108$ contracts

WN 2: Position of the investor if index zoomed by 1%

Particulars	Calculation	Amount
Profit on purchase of shares	273.87 lacs x 1.20%	3.28644 lacs
Loss on Nifty Futures	328.644 lacs x 1.00%	(3.28644 lacs)
Net profit/loss		0

- ❖ Market has increased by 1% and hence share will increase by 1.2% due to Beta of 1.2 times

WN 3: Position of the investor if index plummets by 2%

Particulars	Calculation	Amount
Loss on purchase of shares	273.87 lacs x 2.40%	(6.57288 lacs)
Profit on Nifty Futures	328.644 lacs x 2.00%	6.57288 lacs
Net profit/loss		0

❖ Market has fallen by 2% and hence share will fall by 2.4% due to Beta of 1.2 times

36. Hedging with futures [May 2021 MTP]

A portfolio manager has the following five stocks in his portfolio

Security	No of shares	Price/share	Beta
A	10000	50	1.2
B	5000	20	2.0
C	8000	25	0.7
D	1000	100	1.0
E	500	200	1.3

- Compute portfolio beta?
- If the manager wants to reduce the beta to 0.8, how much risk free investment would he bring in? What will be the new portfolio?
- If the manager wants to increase the beta to 1.4, how much of risk free investment should he sell? What will be the new portfolio?
- Suppose Nifty spot is 1200 points and Nifty futures is 1250 points and futures have a contract multiplier of 200, how can he obtain the same position as in (ii) by dealing in Nifty futures?
- How can he obtain the same position as in (iii) by dealing in Nifty futures?

Answer:

WN 1: Computation of portfolio Beta:

Security	Beta	Weight	Product
A	1.20	5,00,000	6,00,000
B	2.00	1,00,000	2,00,000
C	0.70	2,00,000	1,40,000
D	1.00	1,00,000	1,00,000
E	1.30	1,00,000	1,30,000
Total	1.17	10,00,000	11,70,000

- Portfolio Beta = 1.17 Times

WN 2: Reducing Beta to 0.8 Times:

It is assumed that investment in shares would continue to be Rs.10,00,000 and the investor would bring in additional money for risk-free investment

Security	Beta	Weight	Product
Portfolio	1.17	10,00,000	11,70,000
Risk-free	0.00	4,62,500	0
Total	0.80	14,62,500	11,70,000

Note:

- Beta of risk-free asset is zero and hence product of risk-free asset will be zero
- Total of product = 11,70,000 + 0 = 11,70,000
- Overall beta = 0.8 Times
- Total of weights = 11,70,000/0.80 = Rs.14,62,500
- Weight of risk-free asset = 14,62,500 – 10,00,000 = Rs.4,62,500
- Investor needs to bring risk-free investment of Rs.4,62,500 to reduce beta to 0.8 times

WN 3: Increasing Beta to 1.4 Times:

Security	Beta	Weight	Product
Portfolio	1.17	10,00,000	11,70,000
Risk-free	0.00	(1,64,286)	0
Total	1.40	8,35,714	11,70,000

- Investor should borrow Rs.1,64,286 to increase beta to 1.4 times

WN 4: Changing beta through futures:**Reducing beta to 0.8 times:**

Security	Beta	Weight	Product
Portfolio	1.17	10,00,000	11,70,000
Futures	1.00	(3,70,000)	(3,70,000)
Total	0.80	10,00,000	8,00,000

$$\text{No of contracts to be sold} = \frac{3,70,000}{200 \times 1,250} = 1.48 \sim 1 \text{ or } 2 \text{ contracts}$$

Increasing beta to 1.4 times:

Security	Beta	Weight	Product
Portfolio	1.17	10,00,000	11,70,000
Futures	1.00	2,30,000	2,30,000
Total	1.40	10,00,000	14,00,000

$$\text{No of contracts to be bought} = \frac{2,30,000}{200 \times 1,250} = 0.92 \sim 1 \text{ contract}$$

37. Change in beta through risk free asset and futures [Nov 2014 RTP]

Mr. A has a portfolio of Rs. 5 crore consisting of equity shares of X Ltd. and Y Ltd. with beta of 1.15. Other information is as follows:

- ❖ Spot Value of Index Future = 21000
- ❖ Multiplier = 150

You are requested to reduce beta of portfolio to 0.85 and increase beta to 1.45 by using:

- (a) Change in composition through Risk Free securities
- (b) Index futures

Answer:**WN 1: Reduction of Beta to 0.85 Times:****Approach 1 – Using Risk-free Securities:**

Security	Beta	Weight (in lacs)	Product
Equity portfolio	1.15	369.5652	425
Risk-free security	0.00	130.4348	0
Total	0.85	500	425

- ❖ Investor should buy sell shares and buy risk-free securities worth Rs.130.4348 lacs to reduce Beta to 0.85 times

Note:

- It is assumed that investor will sell equity shares and invest in risk-free security. Hence the total of portfolio is taken as Rs.500 lacs in above table
- Product for risk-free security will be zero irrespective of the weight amount
- Product for equity portfolio will be Rs.425 lacs through reverse working
- **Weight for equity portfolio = 425 lacs/1.15 = Rs.369.5652 lacs**
- **Hence weight for risk-free security would be Rs.130.4348 lacs [500 lacs – 369.5652 lacs]**

Approach 2- Using Index Futures:

Security	Beta	Weight (in lacs)	Product
Equity portfolio	1.15	500	575
Index Futures	1.00	-150	-150
Total	0.85	500	425

- ❖ Investor should sell Nifty Futures worth Rs.150 lacs to reduce Beta to 0.85 Times

$$\text{No of contracts to be short} = \frac{150 \text{ lacs}}{21000 \times 150} = 4.76 \text{ contracts (or) } 5 \text{ Contracts}$$

WN 2: Increase of Beta to 1.45 Times:**Approach 1 – Using Risk-free Securities:**

Security	Beta	Weight (in lacs)	Product
Equity portfolio	1.15	630.4348	725
Risk-free security	0.00	-130.4348	0
Total	1.45	500	725

- ❖ Investor should borrow money of Rs.130.4348 lacs and invest the same in equity portfolio. This will increase Beta to 1.45 times

Approach 2- Using Index Futures:

Security	Beta	Weight (in lacs)	Product
Equity portfolio	1.15	500	575
Index Futures	1.00	150	150
Total	1.45	500	725

- ❖ Investor should buy Nifty Futures worth Rs.150 lacs to increase Beta to 1.45 Times

$$\text{No of contracts to be bought} = \frac{150 \text{ lacs}}{21000 \times 150} = 4.76 \text{ contracts (or) 5 Contracts}$$

38. Hedging with futures [Nov 2004]

Which position on the index future gives a speculator, a complete hedge against the following transactions:

- ❖ The share of Right Limited is going to rise. He has a long position on the cash market of Rs. 50 lakhs on the Right Limited. The beta of the Right Limited is 1.25.
- ❖ The share of Wrong Limited is going to depreciate. He has a short position on the cash market of Rs. 25 lakhs on the Wrong Limited. The beta of the Wrong Limited is 0.90.
- ❖ The share of Fair Limited is going to stagnant. He has a short position on the cash market of Rs. 20 lakhs of the Fair Limited. The beta of the Fair Limited is 0.75.

Answer:**Computation of index futures to get complete hedge:**

Security	Beta	Weight	Product
Right Limited	1.25	50,00,000	62,50,000
Wrong Limited	0.90	-25,00,000	-22,50,000
Fair Limited	0.75	-20,00,000	-15,00,000
Index futures	1.00	-25,00,000	-25,00,000
Total	0	5,00,000	0

The speculator needs to sell index futures worth Rs.25,00,000 to have a complete hedge for all transactions

39. Hedging with futures [Nov 2013, Nov 2018 RTP, Jan 2021]

Ram buys 10,000 shares of X Ltd. at a price of Rs. 22 per share whose beta value is 1.5 and sells 5,000 shares of A Ltd. at a price of Rs. 40 per share. He obtains a complete hedge by Nifty futures at Rs. 1,000 each. He closes out his position at the closing price of the next day when the share of X Ltd. dropped by 2%, share of A Ltd. appreciated by 3% and Nifty futures dropped by 1.5%. What is the Beta of A Limited if the overall loss of the investor is Rs.11,450?

Answer:**Computation of Beta of A Limited:**

Security	Beta	Weight	Product
X Limited	1.50	2,20,000	3,30,000
A Limited	2.00	-2,00,000	-4,00,000
Nifty Futures	1.00	70,000	70,000
Total	0	20,000	0

Note:

- We need a perfect hedge and hence total of product would be zero.
- Product for X Limited is Rs.3,30,000 and for nifty futures is Rs.70,000 (refer computation below). This would mean that product for A Limited will be -4,00,000
- **Beta of A Limited = -4,00,000/-2,00,000 = 2 times**

Analysis of loss of Rs.11,450:

- Ram has purchased shares of X Limited of Rs.2,20,000. Price of X Limited has dropped by 2% and hence loss of X Limited shares would be Rs.4,400 (2,20,000 × 2%)
- Ram has sold shares of A Limited of Rs.2,00,000. Price of A Limited has appreciated by 3 percent. Ram has sold shares and price has appreciated. This would lead to loss for the investor of Rs.6,000 (2,00,000 × 3%)

- Net loss from Nifty futures = 11,450 – 4,400 – 6,000 = Rs.1,050
- Nifty futures have dropped by 1.5%. Investor has made loss of Rs.1,050. This is possible when we have purchased Nifty futures.
- Amount of futures bought = (1,050/1.5%) = Rs.70,000

40. Beta calculation – reverse working [May 2015 RTP]

Mr. Careless was employed with ABC Portfolio Consultants. The work profile of Mr. Careless involves advising the clients about taking position in Future Market to obtain hedge in the position they are holding. Mr. ZZZ, their regular client purchased 100,000 shares of X Inc. at a price of \$22 and sold 50,000 shares of A plc for \$40 each having beta 2. Mr. Careless advised Mr. ZZZ to take short position in Index Future trading at \$1,000 each contract. Though Mr. Careless noted the name of A plc along with its beta value during discussion with Mr. ZZZ but forgot to record the beta value of X Inc.

On next day Mr. ZZZ closed out his position when:

- ❖ Share price of X Inc. dropped by 2%
- ❖ Share price of A plc appreciated by 3%
- ❖ Index Future dropped by 1.5%

Mr. ZZZ, informed Mr. Careless that he has made a loss of \$114,500 due to the position taken. Since record of Mr. Careless was incomplete he approached you to help him to find the number of contract of Future contract he advised Mr. ZZZ to be short to obtain a complete hedge and beta value of X Inc. You are required to find these values.

Answer:

WN 1: Analysis of loss of \$ 1,14,500:

Security	Amount bought/sold	% change	Profit/loss
X Inc	22,00,000	(2%)	(44,000) [22,00,000 x -2%]
A Inc	(20,00,000)	3%	(60,000) [-20,00,000 x 3%]
Index Futures	7,00,000 [-10,500/-1.5%]	(1.5%)	(10,500) [1,14,500 – 44,000 – 60,000]
Total			(1,14,500)

- ❖ The investor has made loss of \$ 1,14,500. He has made loss of 44,000 in X Inc and 60,000 in A Inc. Hence the balance loss of 10,500 would be in index futures
- ❖ Index futures have fallen by 1.5% and hence amount of index futures dealt was 7,00,000 [-10,500/-1.5%]

$$\text{No of contracts to be bought} = \frac{7,00,000}{1,000} = 700 \text{ Contracts}$$

Note: There is an error in question, and it should have been no of contracts to be bought

WN 2: Computation of Beta of A Inc:

Security	Beta	Weight	Product
X Inc	1.5 [33,00,000/22,00,000]	22,00,000	33,00,000
A Inc	2	(20,00,000)	(40,00,000)
Nifty Futures	1	7,00,000	7,00,000
Total	0	2,00,000	0

- ❖ The investor has obtained a perfect hedge and hence overall Beta and total of products will be zero.
- ❖ Reverse working we will get total of X Inc to be 33,00,000
- ❖ Beta of X Inc = 33,00,000/22,00,000 = 1.5 Times

41. Computation of net realization [May 2013 RTP]

A wheat trader has planned to sell 440000 kgs of wheat after 6 months from now. The spot price of wheat is Rs. 19 per kg and 6 months future on same is trading at Rs. 18.50 per kg (Contract Size= 2000 kg). The price is expected to fall to as low as Rs. 17.00 per kg 6 month hence. What trader can do to mitigate its risk of reduced profit? If he decides to make use of future market what would be effective realized price for its sale when after 6 months is spot price is Rs. 17.50 per kg and future contract price for 6 months is Rs. 17.55.

Answer:

WN 1: Computation of futures profit/loss:

Date	Position	Action	Reference Date	Rate
Day 0	Original Position	Sell	Day 180	18.50
Day 180	Opposite Position	Buy	Day 180	(17.55)
Net profit per Kg in futures market				0.95

- ❖ Investor originally entered into contract to sell wheat at the rate of Rs.18.50 in futures market. The same would be cancelled on Day 180 to get the net profit/loss
- ❖ The contract would be cancelled on Day 180 at the futures rate of Rs.17.55 and hence the net profit per Kg of Wheat is Rs.0.95

WN 2: Computation of effective realized price:

Particulars	Amount
Realization in the spot market	17.50
Futures Profit	0.95
Effective realization	18.45

42. Computation of net realization [Nov 2020 RTP]:

A Rice Trader has planned to sell 22000 kg of Rice after 3 months from now. The spot price of the Rice is Rs. 60 per kg and 3 months Future on the same is trading at Rs. 59 per kg. Size of the contract is 1000 kg. The price is expected to fall as low as Rs. 56 per kg, 3 months hence.

Required:

- to interpret the position of trader in the Cash Market.
- to advise the trader the trader should take in Future Market to mitigate its risk of reduced profit.
- to demonstrate effective realized price for its sale if he decides to make use of future market and after 3 months, spot price is Rs. 57 per kg and future contract price for closing the contract is Rs. 58 per kg.

Answer:**Part 1:**

- Since trader has planned to sell after 3 months now it implies, he is in Long Position in Cash or Spot Market.

Part 2:

- Since the trader is in Long Position in Cash Market, he can mitigate its risk of reduced profit by hedging his position by selling Rice Futures i.e. Short Position in Future Market.

Part 3:**Computation of futures profit/loss:**

Date	Position	Action	Reference Date	Rate
Day 0	Original Position	Sell	3 months	59.00
3 months	Opposite Position	Buy	3 months	(58.00)
Net profit per Kg in futures market				1.00

- ❖ Investor originally entered into contract to sell rice at the rate of Rs.59.00 in futures market. The same would be cancelled in month 3 to get the net profit/loss
- ❖ The contract would be cancelled in month 3 at the futures rate of Rs.58.00 and hence the net profit per Kg of rice is Rs.1.00

Computation of effective realized price:

Particulars	Amount
Realization in the spot market	57.00
Futures Profit	1.00
Effective realization	58.00

43. Benefit of hedging:

ABC Technologies is expecting to receive a sum of USD 4,00,000 after 3 months. The company decided to go for future contract to hedge against the risk. The standard size of future contract available in the market is USD 1,000. As on date spot and futures contract are quoting at Rs.44.00 and Rs.45.00 respectively. Suppose after 3 months the company closes out its position futures are quoting at Rs.44.50 and spot rate is also quoting at Rs.44.50. You are required to calculate effective realization for the company while selling the receivable. Also calculate how company has been benefitted by using the future option.

Answer:**WN 1: Computation of number of contracts:**

The company can hedge position by selling future contracts as it will receive amount from outside.

$$\text{No of contracts} = \frac{4,00,000}{1,000} = 400 \text{ contracts}$$

WN 2: Computation of Profit/loss on futures:

Date	Position	Action	Reference Date	Rate
Day 0	Original Position	Sell	Day 90	45.00
Day 90	Opposite Position	Buy	Day 90	(44.50)
Net profit per USD in futures market				0.50
Overall Profit (0.50 x 400 contracts x 1,000)				2,00,000

WN 3: Computation of effective realized price:

Particulars	Calculation	Amount
Realization in the spot market	4,00,000 x 44.50	1,78,00,000
Futures Profit		2,00,000
Total realization		1,80,00,000
No of dollars		4,00,000
Realization per USD	1,80,00,000/4,00,000	45.00

44. Computation of return on investment [Nov 2011 RTP]

Mr. V decides to sell short 10000 shares of ABC plc, when it was selling at yearly high of £5.60. His broker requested him to deposit a margin requirement of 45% and commission of £1550 while Mr. V was short the share, the ABC paid a dividend of £0.25 per share. At the end of one year Mr. V buys 1000 shares of ABC plc at £4.50 to close out position and was charged a commission of £1450. You are required to calculate the return on investment of Mr. V.

Answer:

WN 1: Computation of investment made:

Particulars	Calculation	Amount
Margin deposited	10,000 x 5.60 x 45%	25,200
Commission		1,550
Total investment made		26,750

WN 2: Computation of profit made:

Particulars	Calculation	Amount
Profit on short position	10,000 x (5.60 - 4.50)	11,000
Loss in dividends	10,000 x 0.25	(2,500)
Commission on entry position		(1,550)
Commission on exit position		(1,450)
Profit earned		5,500
Investment made		26,750
Return on investment	$\frac{5,500}{26,750} \times 100$	20.56%

45. Swap agreement [May 2018 RTP, May 2017 MTP, Nov 2017 MTP]

TMC Holding Ltd. has a portfolio of shares of diversified companies valued at Rs. 400 crore enters into a swap arrangement with None Bank on the terms that it will get 1.15% quarterly on notional principal of Rs. 400 crore in exchange of return on portfolio which is exactly tracking the Sensex which is presently 21,600. You are required to determine the net payment to be received/ paid if Sensex turns out to be 21,860, 21,780, 22,080 and 21,960 at the end of each quarter.

Answer:

WN 1: Computation of net-payment to be received/paid for every quarter:

Quarter	Sensex	Sensex Return %	Amount payable (Rs. Crore)	Fixed return receivable (Rs. Crore)	Net payment(-) /receipt(+)
0	21,600	-	-	-	-
1	21,860	1.2037	4.8148	4.6000 [400 cr x 1.15%]	-0.2148

			[400 cr x 1.2037%]		
2	21,780	-0.3660	-1.4640	4.6000	+6.0640
3	22,080	1.3774	5.5096	4.6000	-0.9096
4	21,960	-0.5435	-2.1740	4.6000	6.7740

Part III - Maintenance Margin and Open Interest

46. Maintenance of margin - Mark to Market

On November 15 when the spot price of Telco is Rs.473/share, Mr. X buys 15 contracts of July Telco Futures at 491. Assume that the initial margin for Telco Futures is Rs.800 per contract, and the maintenance margin is Rs.600 per contract. Given that each contract is for 50 shares. Daily settlement prices for the next few days are as follows:

- ❖ November 15 - Rs.496
- ❖ November 16 - Rs.503
- ❖ November 17 - Rs.488
- ❖ November 18 - Rs.485
- ❖ November 19 - Rs.491

Assume that Mr. X withdraws profits from his margin account only once on November 16th when he withdraws half the maximum amount allowed. Compute the balance in the account at the end of each of these 5 days

Answer:

- Initial margin = $800 \times 15 \text{ contracts} = \text{Rs.}12,000$
- Maintenance margin = $600 \times 15 \text{ contracts} = \text{Rs.}9,000$

Answer:

Date	Price	Profit/Loss	Margin balance	Deposit/ withdrawal	Revised balance
Nov 15	491	0	12,000	0	12,000
Nov 15	496	3,750	15,750	0	15,750
Nov 16	503	5,250	21,000	4,500 (withdraw)	16,500
Nov 17	488	-11,250	5,250	6,750 (deposit)	12,000
Nov 18	485	-2,250	9,750	0	9,750
Nov 19	491	4,500	14,250	0	14,250

Note:

- Profit/loss = Price change $\times$ 15 contracts $\times$ 50 shares
- Withdrawal on November 16 = $(21,000 - 12,000)/2 = \text{Rs.}4,500$
- Margin balance needs to be replenished back to initial margin if it falls below maintenance margin. On Nov 17 the margin balance has reached 5,250 and hence it was replenished back to 12,000
- Investor faced a loss on Nov 18. However, the margin balance did not go below maintenance margin and hence there was no replenishment

47. Maintenance of margin - Mark to Market [Nov 2010, May 2015 RTP, Nov 2018 RTP]

Sensex futures are traded at a multiple of 50. Consider the following quotations of sensex futures in the 10 trading days during February, 2017:

Day	High	Low	Closing
4-2-09	3306.4	3290.0	3296.50
5-2-09	3298.00	3262.50	3294.40
6-2-09	3256.20	3227.00	3230.40
7-2-09	3233.00	3201.50	3212.30
10-2-09	3281.50	3256.00	3267.50
11-2-09	3283.50	3260.00	3263.80
12-2-09	3315.00	3286.30	3292.00
14-2-09	3315.00	3257.10	3309.30
17-2-09	3278.00	3249.50	3257.80
18-2-09	3118.00	3091.40	3102.60

You have bought one sensex futures contract on February 04. The average daily absolute change in the value of the contract is Rs.10,000 and standard deviation of these changes is Rs.2,000. The maintenance margin is

75% of initial margin. You are required to determine the daily balances in the margin account and payment of margin calls, if any.

Answer:

- Initial margin = Daily absolute change + (3 x standard deviation)
- Initial margin = 10,000 + (3 x 2,000) = Rs.16,000
- Maintenance margin = 16,000 x 75% = Rs.12,000

Date	Price	Profit/Loss	Margin balance	Deposit/ withdrawal	Revised balance
Feb 4	3296.50	0	16,000	0	16,000
Feb 5	3294.40	-105	15,895	0	15,895
Feb 6	3230.40	-3,200	12,695	0	12,695
Feb 7	3212.30	-905	11,790	4,210	16,000
Feb 10	3267.50	2,760	18,760	0	18,760
Feb 11	3263.80	-185	18,575	0	18,575
Feb 12	3292.00	1,410	19,985	0	19,985
Feb 14	3309.30	865	20,850	0	20,850
Feb 17	3257.80	-2,575	18,275	0	18,275
Feb 18	3,102.60	-7,760	-10,515	5,485	16,000

Note:

- Feb 5 and Feb 6 balance has reduced from 16,000 but the same was maintained above maintenance margin. Hence this was not replenished back to 16,000
- On Feb 7, the balance fell below Rs.12,000 and hence the same was replenished back to Rs.16,000 (initial margin)

48. MTM Profits/losses on futures [Jan 2021]

The price of March Nifty Futures Contract on a particular day was 9170. The minimum trading lot on Nifty Futures is 50. The initial margin is 8% and the maintenance margin is 6%. The index closed at the following levels on next five days:

Day	1	2	3	4	5
Settlement Price	9380	9520	9100	8960	9140

- (i) Mark to market cash flows and daily closing balances on account of
- An investor who has taken a long position at 9170
 - An investor who has taken a short position at 9170
- (ii) Net profit/ loss on each of the contracts

Answer:**WN 1: Computation of initial margin and maintenance margin:**

- Initial Margin = Value of one contract x 8% = 9,170 x 50 x 8% = Rs.36,680
- Maintenance margin = Value of one contract x 6% = 9,170 x 50 x 6% = Rs.27,510

WN 2: Mark to market cash flows for investor taking long position:

Day	Price	Profit/loss	Margin balance	Deposit/withdrawal	Revised balance
1	9380	10,500 [210 x 50]	47,180 [36,680 + 10,500]		47,180
2	9520	7,000 [140 x 50]	54,180 [47,180 + 7,000]		54,180
3	9100	-21,000 [420 x 50]	33,180 [54,180 - 21,000]		33,180
4	8960	-7,000 [140 x 50]	26,180 [33,180 - 7,000]	10,500 [36,680 - 26,180]	36,680
5	9140	9,000 [180 x 50]	45,680 [36,680 + 9,000]	-	45,680

- Margin balance should not fall below maintenance margin. It has fallen below maintenance margin on Day 4, and hence a margin call was made and the amount was replenished back to initial margin
- Overall profit/loss = 10,500 + 7,000 - 21,000 - 7,000 + 9,000 = -1,500
- Hence the investor will make loss of Rs.1,500

WN 3: Mark to market cash flows for investor taking short position:

Day	Price	Profit/loss	Margin balance	Deposit/withdrawal	Revised balance
1	9380	-10,500 [210 × 50]	26,180 [36,680 - 10,500]	10,500	36,680
2	9520	-7,000 [140 × 50]	29,680 [36,680 - 7,000]	-	29,680
3	9100	21,000 [420 × 50]	50,680 [29,680 + 21,000]	-	50,680
4	8960	7,000 [140 × 50]	57,680 [50,680 + 7,000]	-	57,680
5	9140	-9,000 [180 × 50]	48,680 [57,680 - 9,000]	-	48,680

- Overall profit/loss = -10,500 - 7,000 + 21,000 + 7,000 - 9,000 = Rs.1,500

Hence the investor will make profit of Rs.1,500

49. Initial and maintenance margin [Dec 2021]

On 31/08/2021 Mr. R has taken a Long position of Two lots of Nifty Futures at 17300. One lot of Nifty future is 50 units. Initial Margin required is 10% of Contract Value. Maintenance Margin required is 80% of Initial Margin. The closing price of 5 days are given below-

Date	Closing price of NIFTY Futures
01/09/2021	17340
02/09/2021	17180
03/09/2021	16990
06/09/2021	16900
07/09/2021	17120

You are required to

- Prepare a statement showing the daily balances in the margin account & payment on margin calls, if any.
- Compute the Gain or Loss of Mr. R, if contract squared off on 07/09/2021.
- What would be the Gain or Loss if Mr. R, had taken the short position?

Answer:

WN 1: Computation of initial margin and maintenance margin:

- Value of two contracts = 17,300 × 50 × 2 = Rs.17,30,000
- Initial margin = 10% of 17,30,000 = Rs.1,73,000
- Maintenance Margin = Rs.1,73,000 × 80% = Rs.1,38,400

WN 2: Margin Account:

Date	Price	Profit/Loss	Margin balance	Deposit/ withdrawal	Revised balance
Sep-01	17,340	4,000	1,77,000	0	1,77,000
Sep-02	17,180	-16,000	1,61,000	0	1,61,000
Sep-03	16,990	-19,000	1,42,000	0	1,42,000
Sep-06	16,900	-9,000	1,33,000	40,000 (Deposit)	1,73,000
Sep-07	17,120	22,000	1,95,000	0	1,95,000

- Gain/loss = 100 × [Selling Price - Purchase Price]
- Gain/loss = 100 × [17,120 - 17,300] = Loss of Rs.18,000

WN 3: Gain/loss if Mr. R had taken short position:

- Gain/loss = 100 × [Selling Price - Purchase Price]
- Gain/loss = 100 × [17,300 - 17,120] = Profit of Rs.18,000

50. Concept of open interest

Day	Transaction	No of contracts
1	A (long) with B (short) X (long) with Y (short)	100 contracts 50 contracts
2	A (short) with X (long) B (short) with Y (long)	50 contracts 100 contracts

Answer:

Day	A	B	X	Y	Open interest
1	+100	-100	+50	-50	150
2	-50	-100	+50	+100	
Cumulative day 2	50	-200	100	50	200

Part IV – Basics of Option

51. Spot the option terms

The Infosys stock is selling at Rs.5,000. Mr.X has a negative view about the stock. He decides to go through the option route to take advantage of the situation. He buys an option from Mr.A which will entitle him to sell 100 shares on or before 30th December at Rs.4,500 per share for which has to pay Rs.20 per share today. Identify:

- Type of option
- Exercise price
- Expiry date
- Option premium
- Buyer of the option
- Writer of the option
- Underlying asset and
- Current market price

Answer:

Type of option	American put option
Exercise price	Rs.4,500 per share
Expiry date	December 30
Option premium	Rs.20 per share (or) Rs.2,000 per contract
Buyer of option	Mr. X
Writer of option	Mr. A
Underlying asset	Stock of Infosys
Current market price	Rs.5,000

52. Spot the option terms

The WIPRO stock is selling at Rs.700. Mr.Z thinks that the stock price will rise. He decides to go through the option route to take advantage of the situation. He buys an option from Mr.K which will entitle him to buy 100 shares on or before 30th December at Rs.725 per share for which has to pay Rs.10 per share today. Identify type of option, exercise price, expiry date, option premium, buyer of the option, writer of the option, underlying asset and the current market price?

Answer:

Type of option	American call option
Exercise price	Rs.725 per share
Expiry date	December 30
Option premium	Rs.10 per share (or) Rs.1,000 per contract
Buyer of option	Mr. Z
Writer of option	Mr. K
Underlying asset	Stock of Wipro
Current market price	Rs.700

53. Option status

State whether each one of the following is in the money, at the money or out of the money

Option	Exercise Price	Stock Price	Status
Call	60	55	
Call	50	50	
Call	110	105	
Call	30	35	
Put	110	100	
Put	105	105	
Put	12	15	
Put	25	20	

Answer:

Option	Exercise Price	Stock Price	Status
Call	60	55	Out the money
Call	50	50	At the money
Call	110	105	Out the money
Call	30	35	In the money
Put	110	100	In the money
Put	105	105	At the money
Put	12	15	Out the money
Put	25	20	In the money

54. Taking position

The strike price and the expected price on expiry are given in columns 1 and 2 respectively. The option expires 3 months down the road. What position would you take? The actual price on the expiry date is given in column 3. What action will be taken on maturity date?

Exercise Price	Expected price on expiry	Actual price on expiry
180	160	180
125	125	130
160	175	155
170	155	160
150	160	150
110	110	100
150	155	165
170	160	180
95	95	95

Answer:

It is assumed that investor wants to take low risk and hence would opt only to be holder of option. Writing an option would lead to high risk.

Exercise Price	Expected price on expiry	Position taken	Actual price on expiry	Action on maturity date
180	160	Price expected to be lower than exercise price. We should go for put option	180	Option will lapse as Actual price of Rs.180 is equal to exercise price
125	125	No action to be taken	130	Not applicable
160	175	Price expected to be higher than exercise price. We should go for call option	155	Call option will lapse as actual price is lower than exercise price
170	155	Price expected to be lower than exercise price. We should go for put option	160	Put option will be exercised
150	160	Price expected to be higher than exercise price. We should go for call option	150	Lapse
110	110	No action to be taken	100	Not applicable
150	155	Price expected to be higher than exercise price. We should go for call option	165	Call option will be exercised
170	160	Price expected to be lower than exercise price. We should go for put option	180	Lapse
95	95	No action to be taken	95	Not applicable

55. Intrinsic value

Consider the data relating to a stock contained in the following table. Determine both the intrinsic value and the time value in each of the cases.

Option	Exercise	Asset Price	Option Price	Intrinsic value	Time value

Call	90	100	5		
Call	110	100	2		
Put	200	100	65		
Put	90	100	4		
Put	150	125	30		
Call	150	125	30		

Answer:

Option	Exercise	Asset Price	Option Price	Intrinsic value	Time value
Call	90	100	5	10	0
Call	110	100	2	0	2
Put	200	100	65	100	0
Put	90	100	4	0	4
Put	150	125	30	25	5
Call	150	125	30	0	30

- Intrinsic value = Gross payoff of option if it is exercised
- Time value = Option price – Intrinsic value. Time value cannot be negative

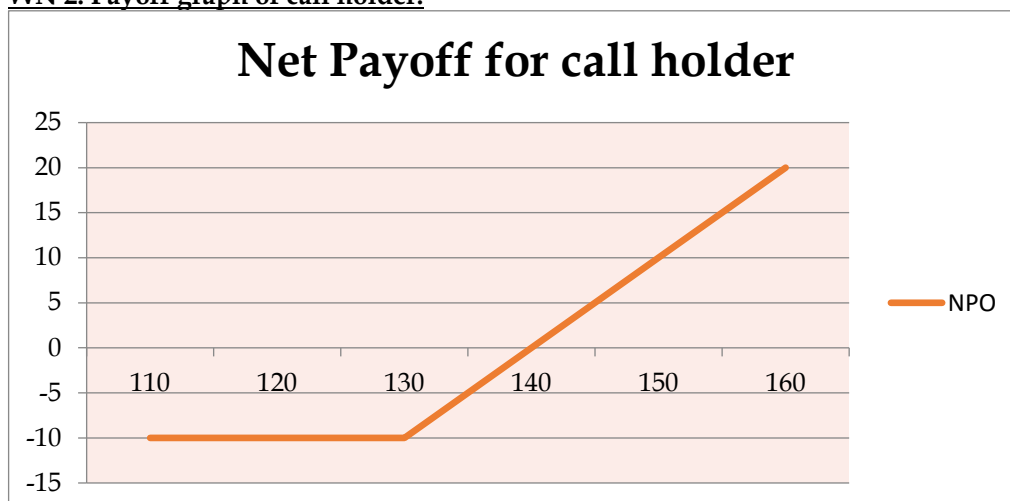
Part V –Payoff table and Payoff graph**56. Payoff for call option**

The September option on AB corp stock at a strike price of Rs.130 is available at a call option price of Rs.10. The contract size is 100 shares. The price of the stock today in 15 June is Rs.140. A range of prices beginning from 110 and ending with 160 with intervals of 10 is possible as at the expiry date.

- What is the payoff for the call holder on expiration?
- Draw the payoff graph
- What is the call writer's payoff on expiration
- Draw the payoff table and the payoff graph

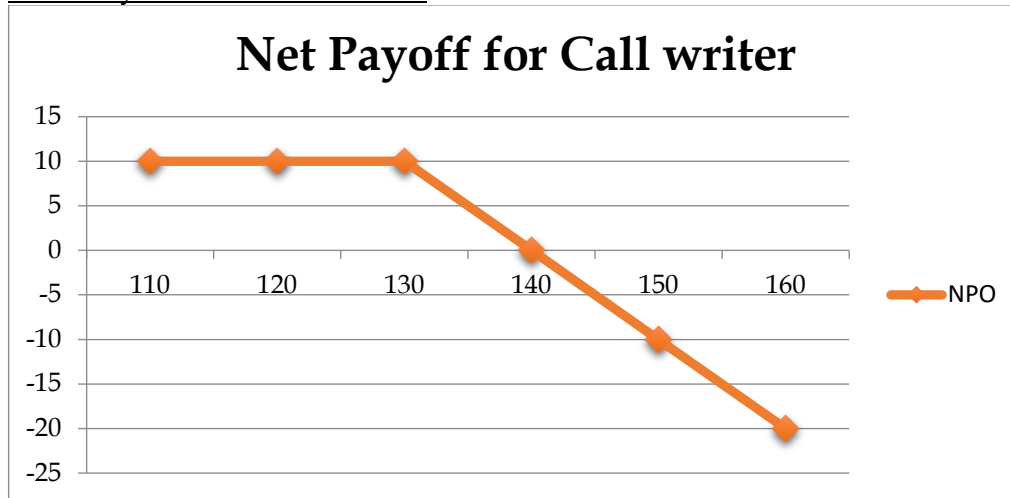
Answer:**WN 1: Pay-off table for call holder:**

Price	110	120	130	140	150	160
Exercise price	130	130	130	130	130	130
Action	Lapse	Lapse	Lapse	Exercise	Exercise	Exercise
GPO	0	0	0	10	20	30
Premium	-10	-10	-10	-10	-10	-10
NPO	-10	-10	-10	0	10	20

WN 2: Payoff graph of call holder:**WN 3: Pay-off table for call writer:**

Price	110	120	130	140	150	160

Exercise price	130	130	130	130	130	130
Action	Lapse	Lapse	Lapse	Exercise	Exercise	Exercise
GPO	0	0	0	-10	-20	-30
Premium	10	10	10	10	10	10
NPO	10	10	10	0	-10	-20

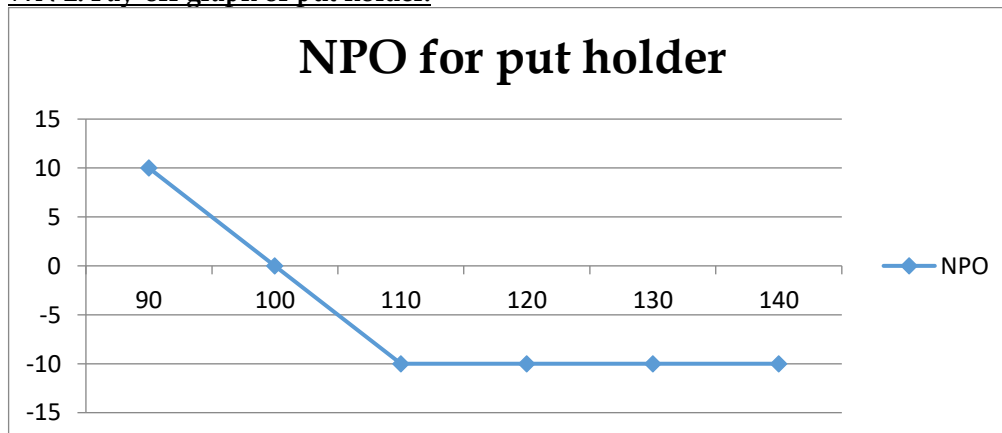
WN 4: Pay-off table for call writer:**57. Payoff for put option**

The September put option on JB Ltd stock at a strike price of Rs.110 is available at a price of Rs.10. The contract size is 100 shares. The price of the stock today on 15 June is Rs.115. A range of prices beginning from 90 and ending with 140 with intervals of 10 is possible as at the expiry date.

- What is the payoff for the put holder on expiration?
- Draw the payoff graph
- What is the put writer's payoff on expiration?
- Draw the payoff table and the payoff graph

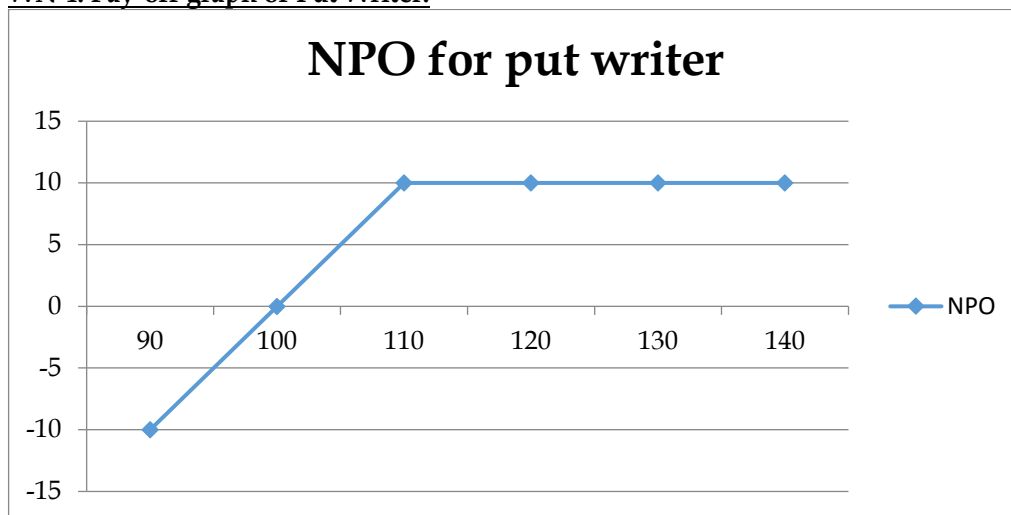
Answer:**WN 1: Pay-off table for put holder:**

Price	90	100	110	120	130	140
EP	110	110	110	110	110	110
Action	Exercise	Exercise	Lapse	Lapse	Lapse	Lapse
GPO	20	10	0	0	0	0
Premium	-10	-10	-10	-10	-10	-10
NPO	10	0	-10	-10	-10	-10

WN 2: Pay-off graph of put holder:

WN 3: Pay-off table for put writer:

Price	90	100	110	120	130	140
EP	110	110	110	110	110	110
Action	Exercise	Exercise	Lapse	Lapse	Lapse	Lapse
GPO	-20	-10	0	0	0	0
Premium	10	10	10	10	10	10
NPO	-10	0	10	10	10	10

WN 4: Pay-off graph of Put Writer:**58. Application of option strategy:**

Mr. A is considering writing a 30-day option on ABC Limited which is currently trading at Rs.60 per share. The exercise price of the share is also Rs.60 and the premium received on the option will be Rs.3.75. At what share prices will he make money, at what price will he start to lose money and at what prices will he lose Rs.5 and Rs.10 on each option that is written?

Answer:

- Type of option is not mentioned in the question. It is assumed that it is a call option

Particulars	Make money	Lose money	Loss of Rs.5	Loss of Rs.10
Actual price	63.74	63.76	68.75	73.75
Exercise price	60.00	60.00	60.00	60.00
Gross payoff	-3.74	-3.76	-8.75	-13.75
Premium	3.75	3.75	3.75	3.75
Net payoff	0.01	-0.01	-5.00	-10.00

Note:

- We have first filled net payoff. Making money (0.01), starting to lose money (-0.01) and loss of Rs.5 and Rs.10.
- GPO is negative for writer. Option will be exercised if actual market price is higher than exercise price
- Price at which profit would be earned = Price below 63.75 (63.75 is break-even price at which profit/loss would be zero)
- Price at which loss would be incurred = Price above 63.75
- Price at which loss will be Rs.5 = Rs.68.75
- Price at which loss will be Rs.10 = Rs.73.75

59. Payoff for option strategy [Nov 2018, May 2009, Nov 2019 RTP]

The equity share of VCC Ltd. is quoted at Rs. 210. A 3-month call option is available at a premium of Rs. 6 per share and a 3-month put option is available at a premium of Rs. 5 per share. Ascertain the net payoffs to the optionholder of a call option and a put option.

- ❖ the strike price in both cases in Rs. 220; and
- ❖ the share price on the exercise day is Rs. 200,210,220,230,240.

Also indicate the price range at which the call and the put options may be gainfully exercised.

Answer:**WN 1: Pay-off table for call holder:**

Price	200	210	220	230	240
Exercise price	220	220	220	220	220
Action	Lapse	Lapse	Lapse	Exercise	Exercise
GPO	0	0	0	10	20
Premium	-6	-6	-6	-6	-6
NPO	-6	-6	-6	4	14

- Break-even price = Exercise price + Premium = $220 + 6 = \text{Rs.}226$
- Option can be gainfully exercised if the price is greater than Rs.226

WN 2: Pay-off table for put holder:

Price	200	210	220	230	240
Exercise price	220	220	220	220	220
Action	Exercise	Exercise	Lapse	Lapse	Lapse
Gross payoff	20	10	0	0	0
Premium	-5	-5	-5	-5	-5
Net payoff	15	5	-5	-5	-5

- Break-even price = Exercise price - Premium = $\text{Rs.}220 - 5 = \text{Rs.}215$
- Option can be gainfully exercise if the price is lower than Rs.215

60. Payoff for option strategy [May 2010, Nov 2012 RTP]

A call and put exist on the same stock each of which is exercisable at Rs. 60. They now trade for:

Market price of Stock or stock index Rs.55

Market price of call Rs.9

Market price of put Rs.1

Calculate the expiration date cash flow, investment value, and net profit from:

- Buy 1.0 call
- Write 1.0 call
- Buy 1.0 put
- Write 1.0 put

for expiration date stock prices of Rs. 50, Rs. 55, Rs. 60, Rs. 65, Rs. 70.

Answer:**WN 1: Computation of expiration date cash flow, investment value and net profit from buying one call:**

Expected market price	50	55	60	65	70
Action	Lapse	Lapse	Lapse	Exercise	Exercise
Expiration date cash flow	0	0	0	-60	-60
Gross pay-off (investment value)	0	0	0	5	10
Premium	9	9	9	9	9
Net profit	-9	-9	-9	-4	1

- Expiration date cash flow will occur if the option is exercised. It would be an outflow if the share is purchased and an inflow if the share is sold

WN 2: Computation of expiration date cash flow, investment value and net profit from writing one call:

Expected market price	50	55	60	65	70
Action	Lapse	Lapse	Lapse	Exercise	Exercise
Expiration date cash flow	0	0	0	60	60
Gross pay-off (investment value)	0	0	0	-5	-10
Premium	9	9	9	9	9
Net profit	9	9	9	4	-1

WN 3: Computation of expiration date cash flow, investment value and net profit from buying one put:

Expected market price	50	55	60	65	70
Action	Exercise	Exercise	Lapse	Lapse	Lapse
Expiration date cash flow	60	60	0	0	0
Gross pay-off (investment value)	10	5	0	0	0
Premium	1	1	1	1	1
Net profit	9	4	-1	-1	-1

WN 4: Computation of expiration date cash flow, investment value and net profit from writing one put:

Expected market price	50	55	60	65	70
Action	Exercise	Exercise	Lapse	Lapse	Lapse
Expiration date cash flow	-60	-60	0	0	0
Gross pay-off (investment value)	-10	-5	0	0	0
Premium	1	1	1	1	1
Net profit	-9	-4	1	1	1

61. Option strategies:

Consider a call and put option on the same underlying stock. Both options have an exercise price of Rs.75. The call costs Rs.5 and the put costs Rs.4. The stock price is expected to be in the range of Rs.50 to Rs.90. Prepare a payoff table and payoff graph for:

- ❖ Buy 1 call of exercise price of 75 and Buy 1 put of exercise price of 75
- ❖ Sell 1 call of exercise price of 75 and Sell 1 put of exercise price of 75

Answer:**Buy 1 call and put of exercise price of Rs.75:****Step 1: Payoff table:**

Relationship	E1 (call)	E2 (Put)	GPO	Premium	NPO	BEP
$P < 75$	0	$75 - P$	$75 - P$	-9	$66 - P$	66
$P > 75$	$P - 75$	0	$P - 75$	-9	$P - 84$	84

Note:

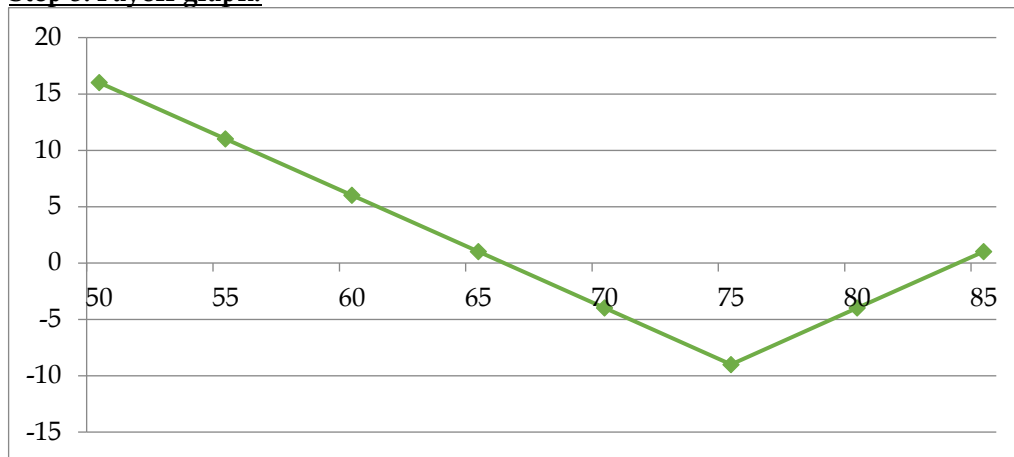
- E1 refers to GPO of call option. If the price is below Rs.75, call option will not be exercised and hence GPO is zero. If the price is above Rs.75, call option will be exercised and hence the same is taken as Price - 75. For instance, price is Rs.80 then GPO will be $80 - 75 = \text{Rs.}5$
- Similar analysis is done for Put option
- We are holder and hence both these items are written as positive. If we are writer then we will write GPO as negative
- Premium is negative as we are holder. If we are writer, premium is income and will come as positive
- $\text{NPO} = \text{GPO} \pm \text{Premium}$.
- We will equate NPO to zero and this would give us break-even price. In some cases we may not have break-even price and it will be NA.

Step 2: Break-even table:

Price	Payoff
50 to 66	Decreasing profits (16 to 0)
66	BEP
66 to 75	Increasing loss (0 to -9)
75 to 84	Decreasing loss (-9 to 0)
84	BEP
84 to 90	Increasing profits (0 to 6)

Note:

- If we have a break-even price for a relationship, then we will have 3 class intervals. Price below break-even price, at break-even price and price above break-even price are three different situations
- We need to substitute the prices in NPO as per step 1 and that can help in getting the NPO number. First class interval is 50 to 66. The relevant NPO for this is $66 - P$. We substitute this in equation and get profits as 16 to 0. This is called decreasing profits. Same analysis is repeated for other class interval

Step 3: Payoff graph:**Sell 1 call and put of exercise price of Rs.75:****Step 1: Relationship table:**

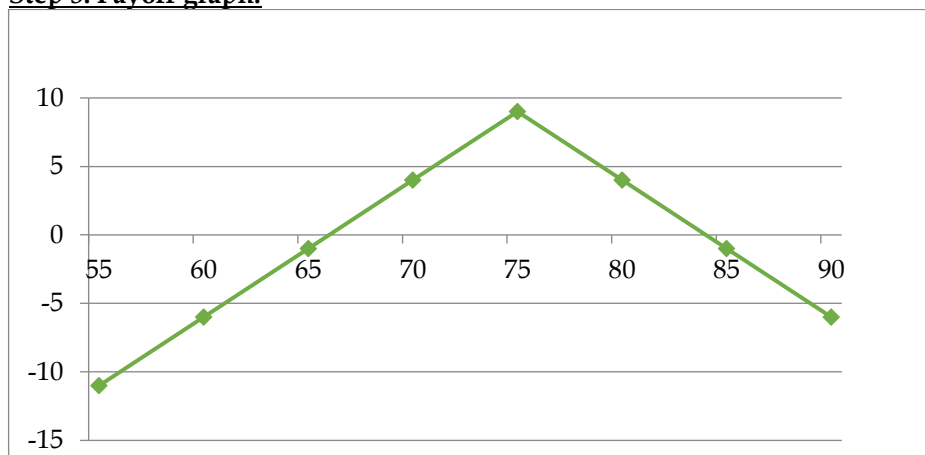
Relationship	E1 (Call)	E2 (Put)	GPO	Premium	NPO	BEP
$P < 75$	0	$P-75$	$P-75$	9	$P-66$	66
$P > 75$	$75-P$	0	$75-P$	9	$84-P$	84

Note:

- GPO of call option if price is below Rs.75 is zero and if price is above Rs.75 then GPO will be Price - 75. However, we are writer of option then the same will become negative and GPO becomes $75 - P$
- Premium is an income for writer of option

Step 2: Break-even table:

Price	Payoff
50 to 66	Decreasing loss (-16 to 0)
66	BEP
66 to 75	Increasing profits (0 to 9)
75 to 84	Decreasing profits (9 to 0)
84	BEP
84 to 90	Increasing losses (0 to -6)

Step 3: Payoff graph:**62. Option strategies:**

Consider a call and put option on the same underlying stock. The call has an exercise price of Rs.100 and put has an exercise price of Rs.90. The call costs Rs.20 and the put costs Rs.12. The stock price is expected to be in the range of Rs.50 to Rs.150. Prepare a payoff table and payoff graph for:

- ❖ Buy 1 call of exercise price of 100 and buy 1 put of exercise price of 90

- ❖ Sell 1 call of exercise price of 100 and Sell 1 put of exercise price of 90

Answer:

Buy 1 call of exercise price of Rs.100 and buy 1 put of exercise price of Rs.90:

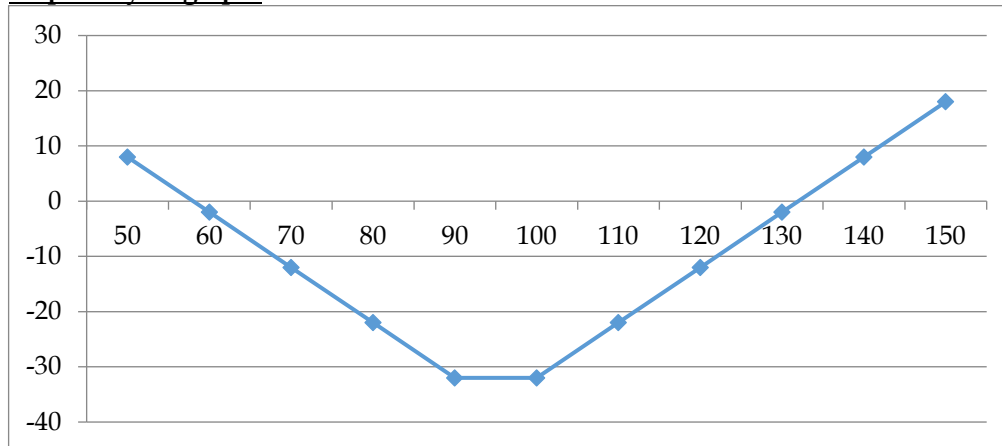
Step 1: Relationship table:

Relationship	E1 (call) (100)	E2 (Put) (90)	GPO	Premium	NPO	BEP
$P < 90$	0	$90 - P$	$90 - P$	-32	$58 - P$	58
$90 < P < 100$	0	0	0	-32	-32	Fixed loss
$P > 100$	$P - 100$	0	$P - 100$	-32	$P - 132$	132

Step 2: Break-even table:

Price	Payoff
50 to 58	Decreasing profits (8 to 0)
58	BEP
58 to 90	Increasing loss (0 to -32)
90 to 100	Constant loss (-32)
100 to 132	Decreasing loss (-32 to 0)
132	BEP
132 to 150	Increasing profits (0 to 18)

Step 3: Payoff graph:



Sell 1 call of exercise price of Rs.100 and buy 1 put of exercise price of Rs.90:

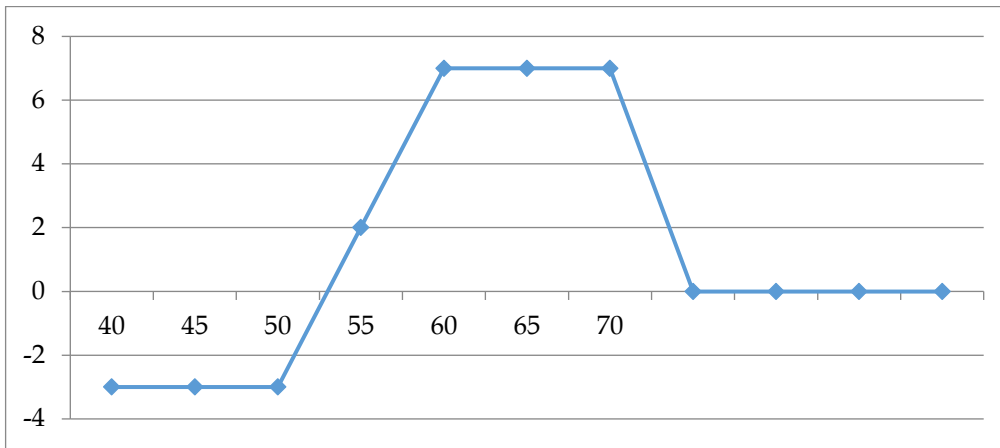
Step 1: Relationship table:

Relationship	E1 (call) (100)	E2 (Put) (90)	GPO	Premium	NPO	BEP
$P < 90$	0	$P - 90$	$P - 90$	32	$P - 58$	58
$90 < P < 100$	0	0	0	32	32	Fixed profit
$P > 100$	$100 - P$	0	$100 - P$	32	$132 - P$	132

Step 2: Break-even table:

Price	Payoff
50 to 58	Decreasing loss (-8 to 0)
58	BEP
58 to 90	Increasing profits (0 to 32)
90 to 100	Constant Profits (32)
100 to 132	Decreasing Profits (32 to 0)
132	BEP
132 to 150	Increasing losses (0 to -18)

Step 3: Payoff graph:

**63. Bull and bear spread**

For each of the following cases, calculate the profit/loss of different price range of the stock. Also compute the break-even price. Draw the payoff table and the payoff graph.

Type of option	Exercise price of option bought	Exercise price of option sold	Premium on option bought	Premium on option sold
Call	60	70	9	4
Call	80	75	2	6
Put	70	65	9	5
Put	50	60	4	11

Answer:

Situation 1 - Purchase call option of Rs.60 and sell call option of Rs.70

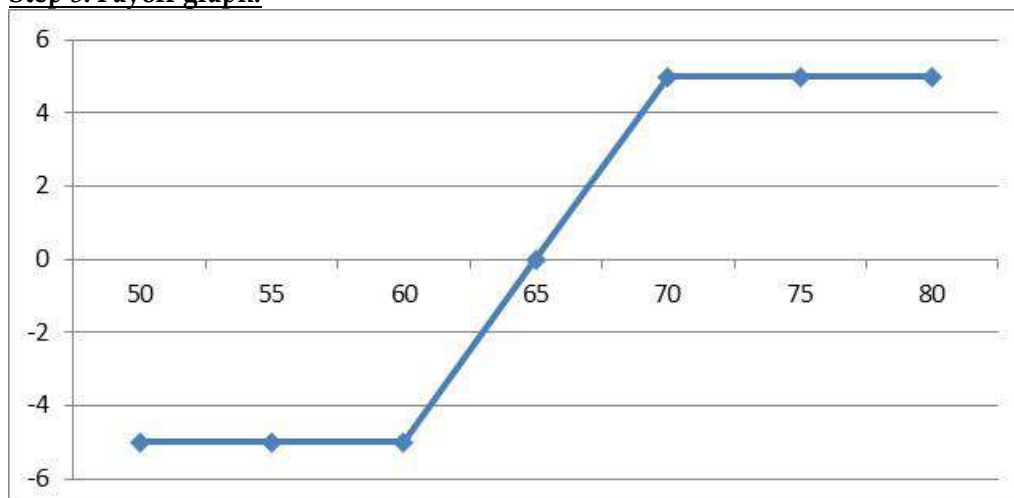
Step 1: Relationship table:

Relationship	E1 (call) 60)	E2 Call (70)	GPO	Premium	NPO	BEP
$P < 60$	0	0	0	-5	-5	Fixed loss
$60 < P < 70$	$P-60$	0	$P-60$	-5	$P-65$	65
$P > 70$	$P-60$	$70-P$	10	-5	5	Fixed profit

Step 2: Break-even table:

Price	Payoff
$P < 60$	Fixed loss (-5)
60 to 65	Decreasing loss (-5 to 0)
65	BEP
65 to 70	Increasing profits (0 to 5)
$P > 70$	Constant profits (5)

Step 3: Payoff graph:

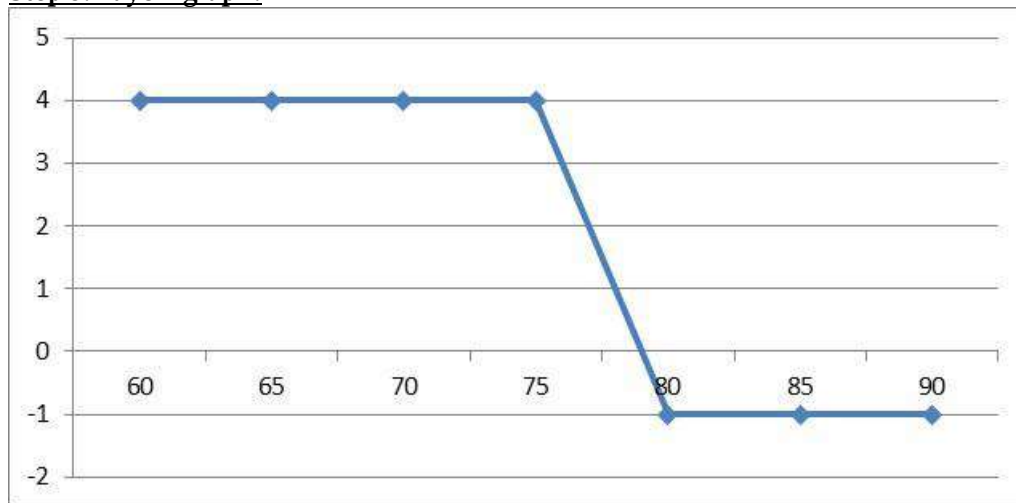


Situation 2 – Purchase call option of Rs.80 and sell call option of Rs.75:**Step 1: Relationship table:**

Relationship	E1 (call) 75)	E2 Call (80)	GPO	Premium	NPO	BEP
$P < 75$	0	0	0	4	4	Fixed profit
$75 < P < 80$	$75 - P$	0	$75 - P$	4	$79 - P$	79
$P > 80$	$75 - P$	$P - 80$	-5	4	-1	Fixed loss

Step 2: Break-even table:

Price	Payoff
$P < 75$	Fixed profit (4)
75 to 79	Decreasing profit (4 to 0)
79	BEP
79 to 80	Increasing loss (0 to -1)
$P > 80$	Fixed loss (-1)

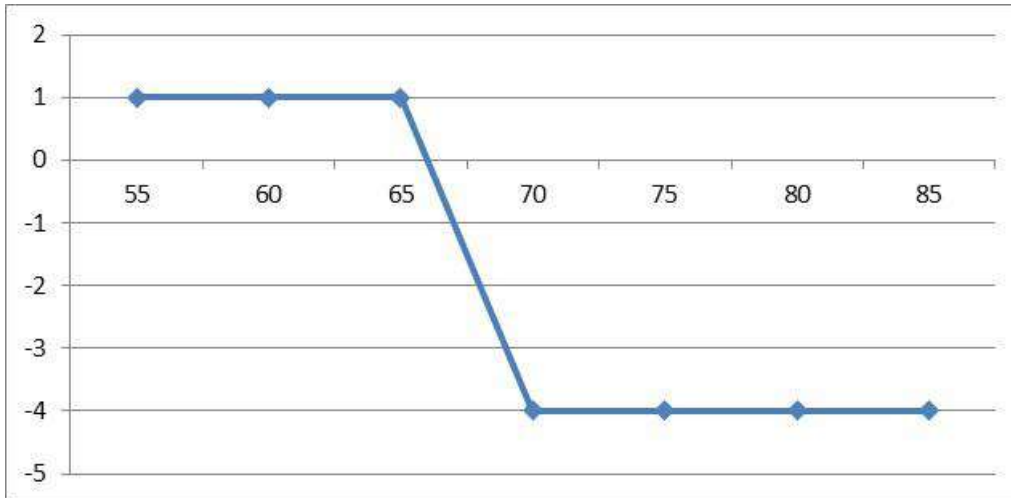
Step 3: Payoff graph:**Situation 3 – Purchase put option of Rs.70 and sell put option of Rs.65****Step 1: Relationship table:**

Relationship	E1 (put) 70)	E2 Put (65)	GPO	Premium	NPO	BEP
$P < 65$	$70 - P$	$P - 65$	5	-4	1	Fixed profit
$65 < P < 70$	$70 - P$	0	$70 - P$	-4	$66 - P$	66
$P > 70$	0	0	0	-4	-4	Fixed loss

Step 2: Break-even table:

Price	Payoff
$P < 65$	Fixed profit (1)
65 to 66	Decreasing profit (1 to 0)
66	BEP
66 to 70	Increasing loss (0 to -4)
$P > 70$	Fixed loss (-4)

Step 3: Payoff graph:



Situation 4 - Purchase put option of Rs.50 and sell put option of Rs.60:

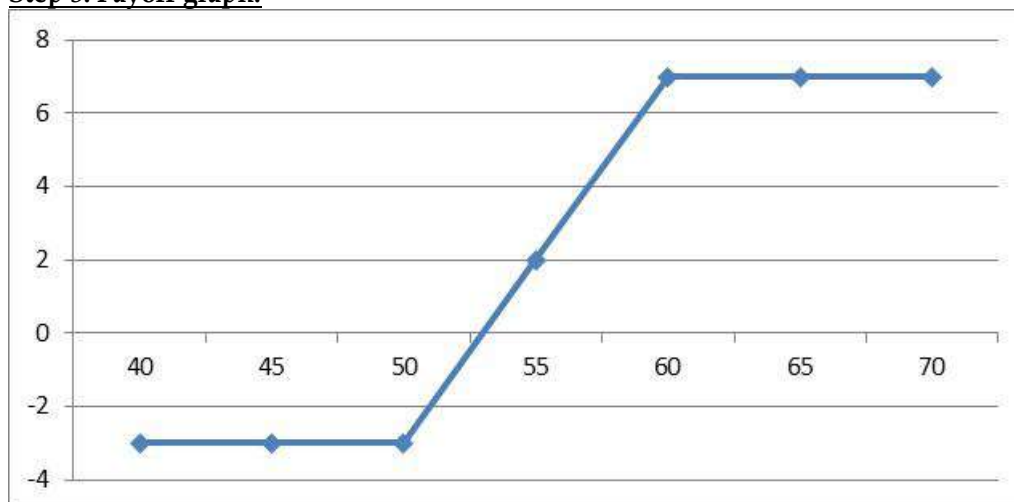
Step 1: Relationship table:

Relationship	E1 Put (50)	E2 Put (60)	GPO	Premium	NPO	BEP
$P < 50$	$50 - P$	$P - 60$	-10	7	-3	Fixed loss
$50 < P < 60$	0	$P - 60$	$P - 60$	7	$P - 53$	53
$P > 60$	0	0	0	7	7	Fixed profit

Step 2: Break-even table:

Price	Payoff
$P < 50$	Fixed loss (-3)
50 to 53	Decreasing loss (-3 to 0)
53	BEP
53 to 60	Increasing profits (0 to 7)
$P > 60$	Constant profits (7)

Step 3: Payoff graph:



64. Payoff table and Payoff Graph:

A stock is selling at 62. An investor observes the market price of 3-month calls and notes the following:

Exercise Price	Call Price
55	10
60	7
65	5

The investor chooses to go long on two calls (55 and 65) and writes two calls with an exercise price of Rs.60. Determine his payoff function for different levels of stock prices. Also, find his profit or loss when the stock price at maturity is

- ❖ 52
- ❖ 57
- ❖ 64 and
- ❖ 70

Answer:

Step 1: Relationship table:

Relationship	Call of 55	Call of 60	Call of 65	GPO	Premium	NPO	BEP
$P < 55$	0	0	0	0	-1	-1	Fixed loss
$55 < P < 60$	$P - 55$	0	0	$P - 55$	-1	$P - 56$	56
$60 < P < 65$	$P - 55$	$2(60 - P)$	0	$65 - P$	-1	$64 - P$	64
$P > 65$	$P - 55$	$2(60 - P)$	$P - 65$	0	-1	-1	Fixed loss

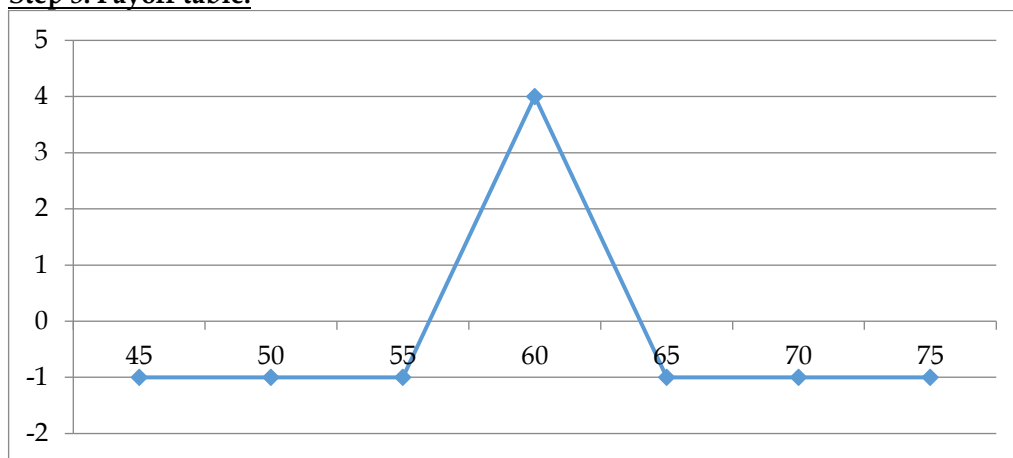
Note:

- Premium = $(2 \times 7) - 10 - 5 = -1$

Step 2: Break-even table:

Price	Payoff
$P < 55$	Fixed loss (-1)
55 to 56	Decreasing loss (-1 to 0)
56	BEP
56 to 60	Increasing profits (0 to 4)
60 to 64	Decreasing profits (4 to 0)
64	BEP
64 to 65	Increasing loss (0 to -1)
65	Fixed Loss (-1)

Step 3: Payoff table:



Profit or loss at different price levels:

Price	Relevant NPO	Calculation	Profit or Loss
52	-1	NA	-1
57	$P - 56$	$57 - 56$	1
64	$64 - P$	$64 - 64$	0
70	-1	NA	-1

65. Payoff for option [Nov 2014 MTP, May 2019 RTP, May 2006]

The market received rumour about ABC corporation's tie-up with a multinational company. This has induced the market price to move up. If the rumour is false, the ABC corporation stock price will probably fall dramatically. To protect from this an investor has bought the call and put options. He purchased one 3 months call with a striking price of Rs.42 for Rs.2 premium, and paid Re.1 per share premium for a 3 months put with a striking price of Rs.40.

- ❖ Determine the Investor's position if the tie up offer bids the price of ABC Corporation's stock up to Rs.43 in 3 months.

- ❖ Determine the Investor's ending position, if the tie up programme fails and the price of the stocks falls to Rs. 36 in 3 months.

Answer:

Let us assume 1 lot of option contract is for 100 shares

Particulars	Price of 43	Price of 36
GPO of call option	100	0
GPO of put option	0	400
Total GPO	100	400
Premium	-300	-300
Net profit/loss	-200	100

66. Payoff table and Payoff graph:

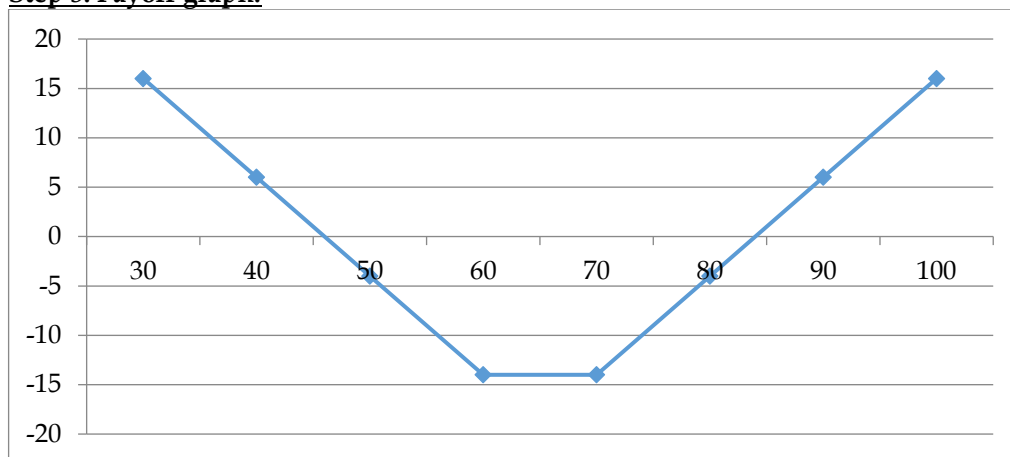
A call option on a stock with an exercise price of Rs.70 is available for Rs.6 while a put option on the same stock with the same expiration date with an exercise price of Rs.60 is selling for Rs.8. Draw the payoff table and the payoff graph if we Buy 1 call of exercise price of 70 and buy 1 put of exercise price of 60

Answer:**Step 1: Relationship table:**

Relationship	E1 (call) (70)	E2 (Put) (60)	GPO	Premium	NPO	BEP
$P < 60$	0	$60 - P$	$60 - P$	-14	$46 - P$	46
$60 < P < 70$	0	0	0	-14	-14	Fixed loss
$P > 70$	$P - 70$	0	$P - 70$	-14	$P - 84$	84

Step 2: Break-even table:

Price	Payoff
<46	Decreasing profits
46	BEP
46 to 60	Increasing loss (0 to -14)
60 to 70	Constant loss (-14)
70 to 84	Decreasing loss (-14 to 0)
84	BEP
> 84	Increasing profits

Step 3: Payoff graph:**67. Option strategy [Nov 2018 MTP, May 2018, May 2010, Nov 2008, Nov 2009, Nov 2011, May 2018 RTP, Nov 2020]**

Mr. X established the following spread on the Delta Corporation's stock :

Purchased one 3-month call option with a premium of Rs. 30 and an exercise price of Rs. 550. Purchased one 3-month put option with a premium of Rs. 5 and an exercise price of Rs. 450. Corporation's stock is currently selling at Rs. 500. Determine profit or loss, if the price of Delta Corporation's :

- ❖ remains at Rs.500 after 3 months.
- ❖ falls at Rs.350 after 3 months.

- ❖ rises to Rs.600.

Assume the size option is 100 shares of Delta Corporation.

Answer:

Particulars	Price of 500	Price of 350	Price of 600
GPO of call option	-	-	5,000
GPO of put option	-	10,000	-
Total GPO	-	10,000	5,000
Premium	-3,500	-3,500	-3,500
Net profit/loss	-3,500	6,500	1,500

68. Decision making [Nov 2018 RTP]

Ram holding shares of Reliance Industries Limited which is currently selling at Rs.1,000. He is expecting that this price will further fall due to lower than expected level of profits to be announced after one month. As on following option contract are available in Reliance share.

Strike Price	Option	Premium
1030	Call	40
1010	Call	35
1000	Call	30
990	Put	35
970	Put	20
950	Put	8
930	Put	5

Ram is interested in selling his stock holding as he cannot afford to lose more than 5% of its value. Recommend a hedging strategy with option and show how his position will be protected.

Answer:

Instead of selling the stock of Reliance Limited, Ram must cover his risk by buying or long position in Put option with appropriate strike price. Since Ram's risk appetite is 5%, the most suitable strike price in put option shall be Rs.950 (Rs.1,000 - 5% of Rs.1,000). Impact of hedging will be as under:

- ❖ If the price is less than Rs.950, then investor can sell the stock for Rs.950. He would be paying premium of Rs.8 and hence net realization will be. Rs.942
- ❖ If the price is more than Rs.950, then investor can sell the stock for market price. He would be paying premium of Rs.8 and hence net realization will be Market price - Premium
- ❖ Thus, from the above, it can be seen that the value of holding of Ram shall never be less than Rs.942 as put option will compensate for loss below price of Rs.950. However, this strategy will involve a cost of Rs.8

69. Payoff table and Payoff graph:

You are given three call options on a stock at exercise price of Rs. 30, Rs. 35 and Rs. 40 with expiration date in three months and the premium of Rs. 4, Rs. 2 and Re. 1 respectively. The investor buys call option of Rs.30 and Rs.40 whereas he writes 2 call options of Rs.35. Construct a table with different market prices and show how profit changes with stock prices ranging from Rs. 20 to 50.

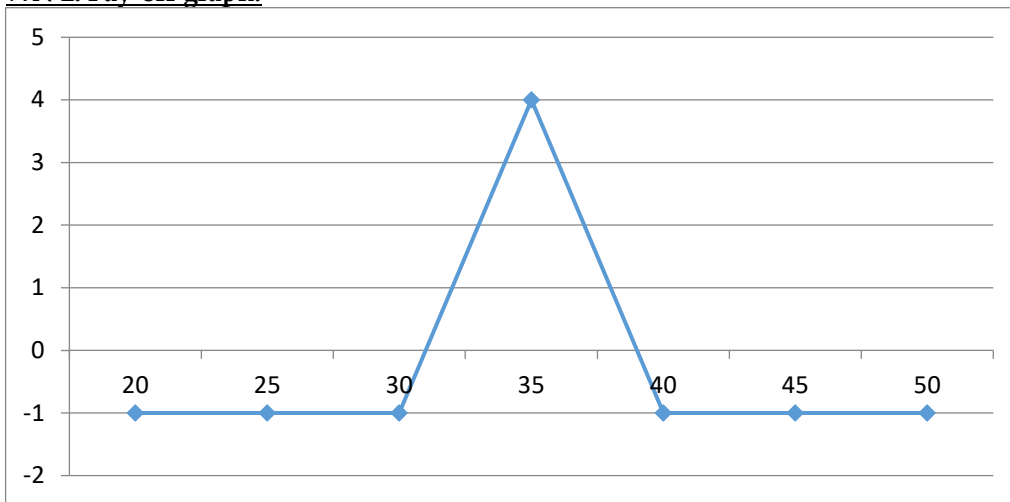
Answer:

WN 1: Computation of profit at different price levels:

Price	20	25	30	35	40	45	50
EP of call 1	30	30	30	30	30	30	30
GPO of call 1	0	0	0	5	10	15	20
EP of call 2	35	35	35	35	35	35	35
GPO of call 2 [2 options]	0	0	0	0	-10	-20	-30
EP of call 3	40	40	40	40	40	40	40
GPO of call 3	0	0	0	0	0	5	10
Total GPO [Call 1+ Call 2+ Call 3]	0	0	0	5	0	0	0
Premium [2 x 2]- 4 - 1	-1	-1	-1	-1	-1	-1	-1
NPO	-1	-1	-1	4	-1	-1	-1

Note:

- Premium = (2 x 2) - 4 - 1 = -1

WN 2: Pay-off graph:

From the above graph we can conclude that break-even point is at market price of Rs.31 and Rs.39.

Part VI - Option Valuation
70. Setting up Put

X Limited is quoting at Rs.85. A three-month call can be written at Rs.7. The exercise price is Rs.90. CCRFI is 10 percent per annum. Required:

- If puts on X Limited are not traded but you want to create the same, how would you do it? In case the market is not favorable, how are you protected?
- If puts are traded, what would it quote?

Answer:**WN 1: Creation of Put:****As per Put Call Parity Theory (PCPT):**

Share + Put = Call + Present value of exercise price

Put = Call + Present value of exercise price – Share

- Note:** + means buy/invest & - means short-sell/borrow

Hence a Put can be created using following approach:

- Buy a call of Rs.7
- Invest money equivalent to present value of exercise price (Rs.87.78) for three month @ 10% CCRFI
- Short-sell share for Rs.85

PV of exercise price:

PV of exercise price = Exercise price $\times e^{-rt}$

PV of exercise price = $90 \times e^{-(0.10)(0.25)}$

PV of exercise price = $\frac{90}{e^{0.025}} = \frac{90}{1.02535} = \text{Rs. } 87.78$

WN 2: Protection from market fluctuations with above strategy:

- The above strategy should provide payoff which is similar to buying a put. Put will help in case the market price falls in the market
- Let us assume expected share price in the market is Rs.60, Rs.90 and Rs.120

Particulars	Price of Rs.60	Price of Rs.90	Price of Rs.120
Direct purchase of put:			
GPO of put option	30	0	0
Put creation through above strategy:			
GPO of call option	0	0	30
Maturity proceeds of risk-free investment	90	90	90
Short-sell share (delivery to be given today by buying in the market)	-60	-90	-120

Net cash flow	30	0	0

- Hence above calculations validate that either we can either go for direct put purchase and if put is not traded, then the same can be created using above rout

WN 3: Valuation of Put:

Share + Put = Call + Present value of exercise price

$$85 + \text{Put} = 7 + 87.78$$

Put = Rs. 9.78

71. Put call parity

Three-month call and three-month put are available on Multan Ltd's stock. The exercise price is Rs.100. The CCRFI is 12% p.a.

- If the put rules at Rs.5, and the share is worth Rs.95, Compute the value of the call.
- If the put quotes Rs.3 and the call is worth Rs.4 what is the share worth?
- If the market price of the call is Rs.8 and the market price of the share is Rs.102, what is the value of the put?
- Rework the above three scenarios in case dividend of Rs.1 is to be paid at the end of first month.

Answer:**WN 1: Valuation of call option:**

Share + Put = Call + Present value of exercise price

$$95 + 5 = \text{Call} + \frac{100}{e^{rt}}$$

$$95 + 5 = \text{Call} + \frac{100}{e^{(0.12)(0.25)}}; 100 = \text{Call} + \frac{100}{1.03045}$$

$$100 = \text{Call} + 97.04$$

Call = Rs. 2.96

WN 2: Valuation of share:

Share + Put = Call + Present value of exercise price

$$\text{Share} + 3 = 4 + 97.04$$

Share = Rs. 98.04

WN 3: Valuation of put option:

Share + Put = Call + Present value of exercise price

$$102 + \text{Put} = 8 + 97.04$$

Put = Rs. 3.04

WN 4: Rework of three scenarios if dividend of Rs.1 is to be paid at the end of first month:

- Dividend of Rs.1 will be paid at the end of first month. In such a scenario we need to replace stock with price with adjusted stock price in the formula
- Adjusted stock price = Share price - Present value of dividend income

$$\text{PV of Dividend Income} = \frac{1}{e^{(0.12)(\frac{1}{12})}} = \frac{1}{e^{0.01}} = \frac{1}{1.01005} = \text{Rs. 0.99}$$

Valuation of call option of Part 1:

Adjusted stock price = 95 - 0.99 = Rs.94.01

Share + Put = Call + Present value of exercise price

$$94.01 + 5 = \text{Call} + 97.04$$

Call = Rs. 1.97

Valuation of share of Part 2:

- Adjusted share price = Rs.98.04
- Adjusted share price = Share price - PV of dividend income
- 98.04 = Share price - 0.99
- Share price = Rs.99.03**

Valuation of put option of Part 3:

- Share price = Rs.102
- Adjusted share price = 102 - 0.99 = Rs.101.01

Share + Put = Call + Present value of exercise price

101.01 + Put = 8 + 97.04

Put = Rs. 4.05

72. Put call parity theory – arbitrage opportunity:

Consider the following data:

Exercise price of option : Rs.50

Share price : Rs.60

Call option price : Rs.16

Put option price : Rs.2

Time to expiration of both options is 3 months and the CCRFI is 12%.

- ❖ Determine if the put-call parity is working?
- ❖ Is there any arbitrage opportunity existing? If so how an investor could gain from it
- ❖ Rework if the put option was quoting at Rs.8.
- ❖ Rework part 2 if dividend of Rs.2 per share is expected at the end of month 2.

Answer:

WN 1: Verification of PCPT:

Share + Put = Call + Present value of exercise price

$$60 + 2 = 16 + \frac{50}{e^{rt}}$$

$$62 = 16 + \frac{50}{e^{(0.12)(0.25)}}; 62 = 16 + \frac{50}{e^{0.03}}$$

$$62 = 16 + \frac{50}{1.03045}; 62 = 16 + 48.52$$

$$62 \neq 64.52$$

- PCPT is not working as the values are not equal

WN 2: Arbitrage mechanism:

- Let us assume portfolio 1 to be share + Put & portfolio 2 to be call + PV of exercise price
- Portfolio 1 is undervalued and portfolio 2 is overvalued. We will buy the undervalued portfolio and sell the overvalued portfolio

Cash flow on day 0:

Particulars	Amount
Buy share	(62)
Buy Put	(2)
Write call	16
Borrow money equivalent to PV of exercise price	48.52
Net cash flow (arbitrage gain on day 0)	2.52

Verification of arbitrage mechanism:

Particulars	Price of Rs.40	Price of Rs.50	Price of Rs.60
Sell share	40	50	60
GPO of Put (Exercise price of Rs.50)	10	0	0
GPO of call (Exercise price of Rs.50)	0	0	(10)
Repayment of loan with interest	(50)	(50)	(50)
Net cash flow	0	0	0

- Above calculations indicate that on maturity investor will not have any cash flow irrespective of the future price. Hence initial gain of Rs.2.52 will hold good as the same will not be impacted on maturity date
- Arbitrage gain at end of month 3 = $2.52 \times 1.03045 = \text{Rs.}2.60$

WN 3: Rework if the put option quotes at Rs.8:

Part 1: Check on arbitrage opportunity:

Share + Put = Call + Present value of exercise price

$$60 + 8 = 16 + 48.52$$

$$68 \neq 64.52$$

Part 2: Arbitrage mechanism:

- Let us assume portfolio 1 to be share + Put & portfolio 2 to be call + PV of exercise price
- Portfolio 1 is overvalued and portfolio 2 is undervalued. We will buy the undervalued portfolio and sell the overvalued portfolio

Cash flow on day 0:

Particulars	Amount
Sell share	60
Write Put	8
Buy call	(6)
Invest money equivalent to PV of exercise price	(48.52)
Net cash flow (arbitrage gain on day 0)	3.48

Verification of arbitrage mechanism:

Particulars	Price of Rs.40	Price of Rs.50	Price of Rs.60
Buy share and deliver it	(40)	(50)	(60)
GPO of Put (Exercise price of Rs.50)	(10)	0	0
GPO of call (Exercise price of Rs.50)	0	0	10
Investment proceeds	50	50	50
Net cash flow	0	0	0

- Above calculations indicate that on maturity investor will not have any cash flow irrespective of the future price. Hence initial gain of Rs.3.48 will hold good as the same will not be impacted on maturity date
- Arbitrage gain at end of month 3 = $3.48 \times 1.03045 = \text{Rs.}3.59$**

WN 4: Rework if dividend of Rs.2 is to be paid at the end of month 2:**Part 1: Computation of PV of dividend income:**

$$\text{PV of dividend income} = \frac{2}{e^{(0.12)(\frac{2}{12})}} = \frac{2}{e^{0.02}} = \frac{2}{1.02020} = \text{Rs. } 1.96$$

$$\text{Adjusted share price} = \text{Stock price} - \text{PV of dividend income} = 60 - 1.96 = \text{Rs. } 58.04$$

Part 2: Verification of PCPT:

Share + Put = Call + Present value of exercise price

$$58.04 + 2 = 16 + 48.52$$

$$60.04 \neq 64.52$$

- PCPT is not working as the values are not equal

Part 3: Arbitrage mechanism:

- Let us assume portfolio 1 to be share + Put & portfolio 2 to be call + PV of exercise price
- Portfolio 1 is undervalued and portfolio 2 is overvalued. We will buy the undervalued portfolio and sell the overvalued portfolio

Cash flow on day 0:

Particulars	Amount
Buy share	(60)
Buy Put	(2)
Write call	16
Borrow money equivalent to PV of exercise price	48.52
Borrow money equal to PV of dividend income (this will be repaid out of dividend in month 2)	1.96
Net cash flow (arbitrage gain on day 0)	4.48

- Arbitrage mechanism will work as per WN 2
- Arbitrage gain at end of month 3 = $4.48 \times 1.03045 = \text{Rs.}4.62$**

73. Portfolio replication model

From the following data compute the value of the call option using replicating model. First use the stock equivalent approach and then the option equivalent approach. Are the results different? Also find value of put.

Upper price	90
Lower price	70
Time	1 year
CMP	75
Exercise price	65
CCRFI	4%

Answer:**WN 1: Valuation of call and put option using stock equivalent approach:****Step 1: Computation of intrinsic values at two judgement prices:**

Judgement price	Intrinsic value
70	5
90	25

Step 2: Computation of no of calls to be bought:

$$\text{No of calls} = \frac{\text{Spread in stock price}}{\text{Spread in Intrinsic value}} = \frac{90 - 70}{25 - 5} = 1$$

Step 3: Computation of risk-free investment:

$$\text{Risk - free investment} = \text{PV of } (JP_1 - IV \text{ at } JP_1)$$

$$\text{Risk - free investment} = \text{PV of } (70 - 5) = \text{PV of } 65 = \frac{65}{e^{0.04(1)}} = \frac{65}{1.040811} = \text{Rs. 62.45}$$

Step 4: Valuation of call option:

$$S_0 = (C_0 \times \text{No of calls}) + \text{Risk - free investment}$$

$$75 = (C_0 \times 1) + 62.45;$$

$$\text{Value of call} = \text{Rs. 12.55}$$

Step 5: Valuation of Put option using PCPT:

$$\text{Share} + \text{Put} = \text{Call} + \text{Present value of exercise price}$$

$$75 + \text{Put} = 12.55 + 62.45$$

$$\text{Value of put} = 0$$

WN 2: Valuation of call and put option using option equivalent approach:**Step 1: Computation of intrinsic values at two judgement prices:**

Judgement price	Intrinsic value
70	5
90	25

Step 2: Computation of no of calls to be bought:

$$\text{No of shares} = \frac{\text{Spread in Intrinsic value}}{\text{Spread in stock price}} = \frac{25 - 5}{90 - 70} = 1$$

Step 3: Computation of amount of borrowing:

$$\text{Borrowing} = \text{PV of } (\text{No of shares} \times JP_1 - IV \text{ at } JP_1)$$

$$\text{Borrowing} = \text{PV of } (1 \times 70 - 5) = \text{PV of } 65 = \frac{65}{e^{0.04(1)}} = \frac{65}{1.040811} = \text{Rs. 62.45}$$

Step 4: Valuation of call option:

$$\text{Call} = \text{Share value bought} - \text{Borrowings}$$

$$\text{Call} = (1 \times 75) - 62.45$$

$$\text{Value of call} = \text{Rs. 12.55}$$

Step 5: Valuation of Put option using PCPT:

$$\text{Share} + \text{Put} = \text{Call} + \text{Present value of exercise price}$$

$$75 + \text{Put} = 12.55 + 62.45$$

$$\text{Value of put} = 0$$

74. Portfolio replication model

In one year's time R Ltd's stock will either halve in value to Rs.50 or it will rise to Rs.200. CCRFI is 10%. Assume exercise price as Rs.100.

- Use the stock equivalent approach to value this call
- Use the option equivalent approach to value this call
- Are the results different?
- Find the value of put?

Answer:

WN 1: Valuation of call and put option using stock equivalent approach:

Step 1: Computation of intrinsic values at two judgement prices:

Judgement price	Intrinsic value
200	100
50	0

Step 2: Computation of no of calls to be bought:

$$\text{No of calls} = \frac{\text{Spread in stock price}}{\text{Spread in Intrinsic value}} = \frac{200 - 50}{100 - 0} = 1.5 \text{ calls}$$

Step 3: Computation of risk-free investment:

Risk – free investment = PV of (JP₁ – IV at JP₁)

$$\text{Risk – free investment} = \text{PV of } (50 - 0) = \text{PV of } 50 = \frac{50}{e^{0.10(1)}} = \frac{50}{1.10517} = \text{Rs. 45.24}$$

Step 4: Valuation of call option:

$S_0 = (C_0 \times \text{No of calls}) + \text{Risk – free investment}$

$$100 = (C_0 \times 1.5) + 45.24; 1.5C_0 = 54.76$$

Value of call = Rs. 36.51

Note:

- It is mentioned that share price can halve in value to Rs.50. This would mean that current share price is Rs.100 and half of that is JP₁ of Rs.50

Step 5: Valuation of Put option using PCPT:

Share + Put = Call + Present value of exercise price

$$100 + \text{Put} = 36.51 + 45.24$$

Value of put = 26.99

WN 2: Valuation of call and put option using option equivalent approach:

Step 1: Computation of intrinsic values at two judgement prices:

Judgement price	Intrinsic value
50	0
200	100

Step 2: Computation of no of calls to be bought:

$$\text{No of shares} = \frac{\text{Spread in Intrinsic value}}{\text{Spread in stock price}} = \frac{100 - 0}{200 - 50} = 0.6667 \text{ shares}$$

Step 3: Computation of amount of borrowing:

Borrowing = PV of (No of shares x JP₁ – IV at JP₁)

$$\text{Borrowing} = \text{PV of } (0.6667 \times 50 - 0) = \text{PV of } 33.3333 = \frac{33.3333}{e^{0.10(1)}} = \frac{33.3333}{1.10517} = \text{Rs. 30.16}$$

Step 4: Valuation of call option:

Call = Share value bought – Borrowings

$$\text{Call} = (0.6667 \times 100) - 30.16$$

Value of call = Rs. 36.51

Step 5: Valuation of Put option using PCPT:

Share + Put = Call + Present value of exercise price

$$100 + \text{Put} = 36.51 + 45.24$$

Value of put = 26.99

75. Option valuation [Nov 2015, May 2018 MTP, Nov 2018 MTP, May 2021 MTP]

Mr. Dayal is interested in purchasing equity shares of ABC Ltd. which are currently selling at Rs. 600 each. He expects that price of share may go upto Rs. 780 or may go down to Rs. 480 in three months. The chances of occurring such variations are 60% and 40% respectively. A call option on the shares of ABC Ltd. can be exercised at the end of three months with a strike price of Rs. 630.

- ❖ What combination of share and option should Mr. Dayal select if he wants a perfect hedge?
- ❖ Explain how the investor will be able to maintain identical position regardless of the share price
- ❖ What should be the value of option today (the risk free rate is 10% p.a.)?
- ❖ What is the expected rate of return on the option?

Answer:**WN 1: Valuation of option:**

- Call option can be valued either using risk neutral model or portfolio replication model
- Any option valued under risk neutral model will give expected rate of return as equal to risk-free rate. Hence third part of the question will be redundant if option is valued as per risk neutral method
- Hence, we are going ahead with valuation of option as per portfolio replication model

Step 1: Computation of intrinsic values at two judgement prices:

Judgement price	Intrinsic value
780	150
480	0

Step 2: Computation of no of calls to be bought:

$$\text{No of calls} = \frac{\text{Spread in stock price}}{\text{Spread in Intrinsic value}} = \frac{780 - 480}{150 - 0} = 2 \text{ calls}$$

Step 3: Computation of risk-free investment:

Risk – free investment = PV of $(JP_1 - IV \text{ at } JP_1)$

$$\text{Risk – free investment} = \text{PV of } (480 - 0) = \text{PV of } 480 = \frac{480}{(1 + 2.5\%)} = \frac{480}{1.025} = \text{Rs. 468.29}$$

Step 4: Valuation of call option:

$$S_0 = (C_0 \times \text{No of calls}) + \text{Risk – free investment}$$

$$600 = (C_0 \times 2) + 468.29; 2C_0 = 131.71$$

Value of call = Rs. 65.86

WN 2: Combination of share and option should Mr. Dayal select if he wants a perfect hedge

- No of calls to be bought as per the above computation is 2 calls
- Hence combination of 2 calls and 1 share will lead to perfect hedge. Alternatively, we can say that we should purchase 0.50 shares for every 1 call option

Maintenance of same position irrespective of price touching Rs.480 and Rs.780:

Particulars	Price of Rs.480	Price of Rs.780
Cash flow from 0.5 shares	240 [480 x 0.5]	390 [780 x 0.5]
GPO of 1 call option	0	150 [780 – 630]
Net cash flow	240	240

- Perfect hedge would involve taking opposite position. Hence, we can assume that we are buying 0.50 shares and selling 1 option
- **Price of Rs.480:** Net cash flow = 240 – 0 = Rs.240
- **Price of Rs.780:** Net cash flow = 390 – 150 = Rs.240
- The above analysis validates that investor will be able to maintain same position irrespective of the price touching Rs.480 or Rs.780.

WN 3: Expected return on option:

- Expected value of call option at end of M3 = $(150 \times 0.40) + (0 \times 0.60) = \text{Rs.90}$

$$\text{Return on call option} = \frac{90 - 65.86}{65.86} \times 100 = 36.65\% \text{ per 3 months (or) } 146.60\% \text{ p. a.}$$

76. Risk Neutral model [Nov 2018 MTP, May 2011, May 2013 RTP]

The current market price of an equity share of Penchant Ltd is Rs.420. Within a period of 3 months, the maximum and minimum price of it is expected to be Rs. 500 and Rs. 400 respectively. If the risk free rate of interest be 8% p.a., what should be the value of a 3 months Call option under the "Risk Neutral" method at the strike rate of Rs. 450 ? Given $e^{0.02} = 1.0202$

Answer:

WN 1: Computation of upside and downside probability:

$$\text{Expected share price} = PV \times e^{rt}$$

$$\text{Expected share price} = 420 \times e^{(0.08)(0.25)} = 420 \times e^{0.02} = 420 \times 1.0202 = \text{Rs. } 428.48$$

Let us assume p to be the probability of price reaching Rs.400 and 1-p to be the probability of price reaching Rs.500

Price	Probability	Product
400	P	400P
500	1-P	500 - 500P
Total		400P+500-500P = 428.48

$$400P + 500 - 500P = 428.48; -100P = -71.52; P = \frac{71.52}{100} = 0.7152$$

- Hence 0.7152 is the probability of price reaching Rs.400 and 0.2848 (1 - 0.7152) is the probability of price reaching Rs.500

WN 2: Valuation of call option:

Price	IV	Probability	Product
400	0	0.7152	0
500	50	0.2848	14.24
Value of call at end of M3			14.24

- Value of call on maturity date = Rs.14.24
- Today's value of call option = $(14.24/1.0202) = \text{Rs. } 13.96$

77. Option valuation [Nov 2017]

A call option on gold with exercise price of Rs.26,000 per ten gram and three months to expire is being traded at a premium of Rs.1,010 per ten gram. It is expected that in three months' time the spot price might change to Rs.27,300 or Rs.24,700 per ten gram. At present this option is at-the-money and the rate of interest with simple compounding is 12% per annum. Is the current premium for the option justified? Evaluate the option and comments.

Answer:

WN 1: Computation of probability:

Let us assume p to be the probability of price touching Rs.27,300 and 1-p to be the probability of price touching Rs.24,700

PV	Probability	Product
27,300	P	27,300P
24,700	1-P	24,700 - 24,700P
Expected Price		26,780

- The exercise price of Gold is Rs.26,000. The option is at the money and hence exercise price is equal to current market price.
- Interest rate is 12% per annum and hence the same for three months will be 3%
- Expected price at end of 3 months = Rs.26,780 (26,000 + 3%)
- $27,300P - 24,700 - 24,700P = 26,780$
- $2,600P = 2,080$
- $P = 2,080/2,600 = 0.80$
- Probability of price touching Rs.27,300 is 0.80 and probability of price touching 24,700 is 0.20

WN 2: Computation of value of call option:

PV	EP	GPO	Probability	Product [GPO x Prob]
27,300	26,000	1,300	0.80	1,040
24,700	26,000	0	0.20	0
Future value of Call				1,040
Present value of Put = $\frac{1,040}{1.03}$				1,010

Hence the current premium of Rs.1,010 is justified as fair option price is Rs.1,010

78. Calculation of probability of price rise [Nov 2017 RTP, Nov 2018 MTP, May 2012]

Sumana wanted to buy shares of EIL which has a range of Rs.411 to Rs.592 a month later. The present price per share is Rs.421. Her broker informs her that the price of this share can sore up to Rs. 522 within a month or so, so that she should buy a one month CALL of EIL. In order to be prudent in buying the call, the share price should be more than or at least Rs. 522 the assurance of which could not be given by her broker. Though she understands the uncertainty of the market, she wants to know the probability of attaining the share price Rs. 592 so that buying of a one month CALL of EIL at the execution price of Rs. 522 is justified. Advice her. Take the one-month risk free interest to be 3.60% and $e^{0.036} = 1.037$

Answer:

Computation of upside and downside probability:

Expected share price = $PV \times e^{rt}$

Expected share price = $421 \times e^{(0.036)(1)} = 420 \times e^{0.036} = 420 \times 1.037 = \text{Rs. } 436.58$

Note: It is assumed that risk-free interest rate of 3.60% is the per month

Let us assume p to be the probability of price reaching Rs.411 and 1-p to be the probability of price reaching Rs.592

Price	Probability	Product
411	P	411P
592	1-P	592 - 592P
Total		411P+592-592P = 436.58

$$411P + 592 - 592P = 436.58; -181P = -155.42; P = \frac{155.42}{181} = 0.8587$$

- Hence 0.8587 is the probability of price reaching Rs.411 and 0.1413 (1 - 0.8587) is the probability of price reaching Rs.592
- Probability of price reaching Rs.592 = 14.13%**

79. Binomial model

The current share price is Rs.20 and share price volatility has been estimated to be either 10% up or down. The risk-free interest rate is 12% p.a. Using two period binomial, estimated the fair price of 6 months call option with a strike price of Rs.21.

Answer:

WN 1: Computation of upside and downside probability:

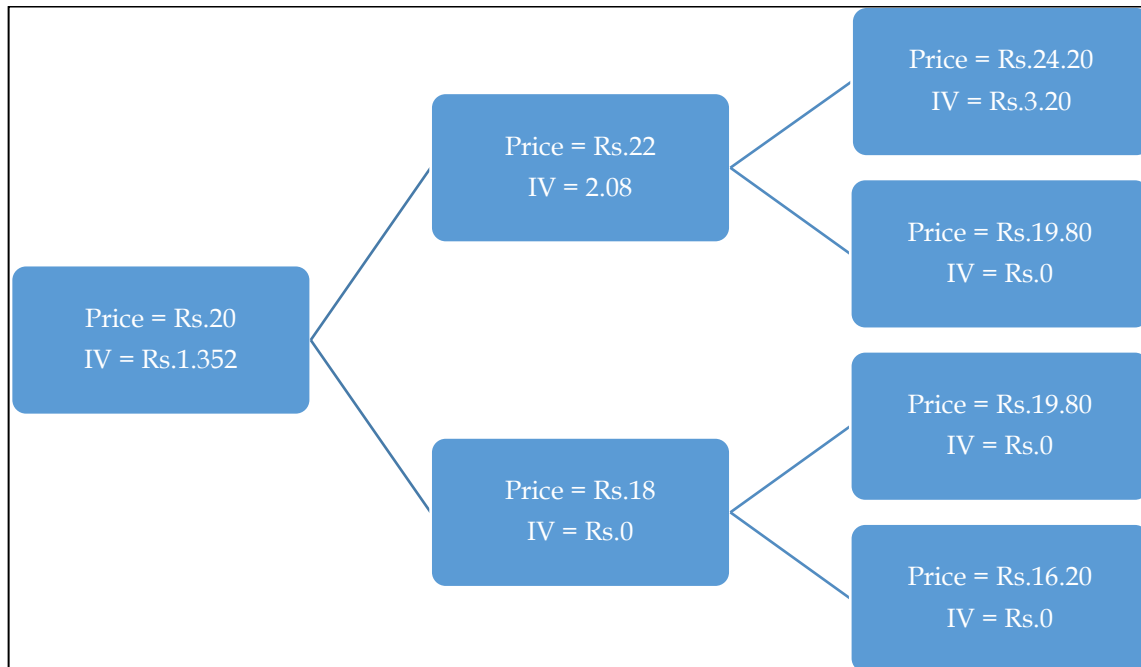
- Let us assume P to be the probability of price increase by 10% and 1-P to be the probability of price fall by 10%
- Risk-free rate of interest is 12% per annum. 6 month period has two binomial of three months. Proportionate risk-free rate of return for 3 months is 3%
- Expected price at end of month 3 = $20 + 3\% = \text{Rs. } 20.60$

Price	Probability	Product
22	P	22P
18	1-P	18-18P
Total		22P+18-18P=20.60

$$22P + 18 - 18P = 20.60; 4P = 2.60; P = \frac{2.60}{4}; P = 0.65$$

- Hence probability of price raise is 65% and probability of price fall is 35%

WN 2: Valuation of option:

**Note:**

- Share price is expected to either go up by 10% or fall by 10% over the next three months and then the same would be repeated from M3 to M6
- Intrinsic values in M6 is equal to Gross payoff of call option
- Value in month 3:
 - When price is Rs.22 = $(3.20 \times 65\%) + (0 \times 35\%) = \text{Rs.}2.08$
 - When price is Rs.18 = $(0 \times 65\%) + (0 \times 35\%) = \text{Rs.}0$
- Valuation in Month 0 = $(2.08 \times 65\%) + (0 \times 35\%) = \text{Rs.}1.352$

Final value of call:

- The above-computed value does not consider time value of money while rolling backwards and doing the valuation of option. We need to give effect of time value of money to find the value of option in Month 0

$$\text{Value of call option} = \frac{1.352}{(1.03)(1.03)} = \text{Rs. } 1.27$$

80. Binomial model

A stock is currently priced at Rs.50. It is known that in the first 6 months of current year from now prices will either rise by 20% or go down by 20%, further in the later half of the year prices may again up by 20% or go down by 20%. Suppose risk free rate is 5% continuous compounded and strike rate is Rs.52. Calculate value of European Put option? Also calculate the value of European call option

Answer:**WN 1: Computation of upside and downside probability:**

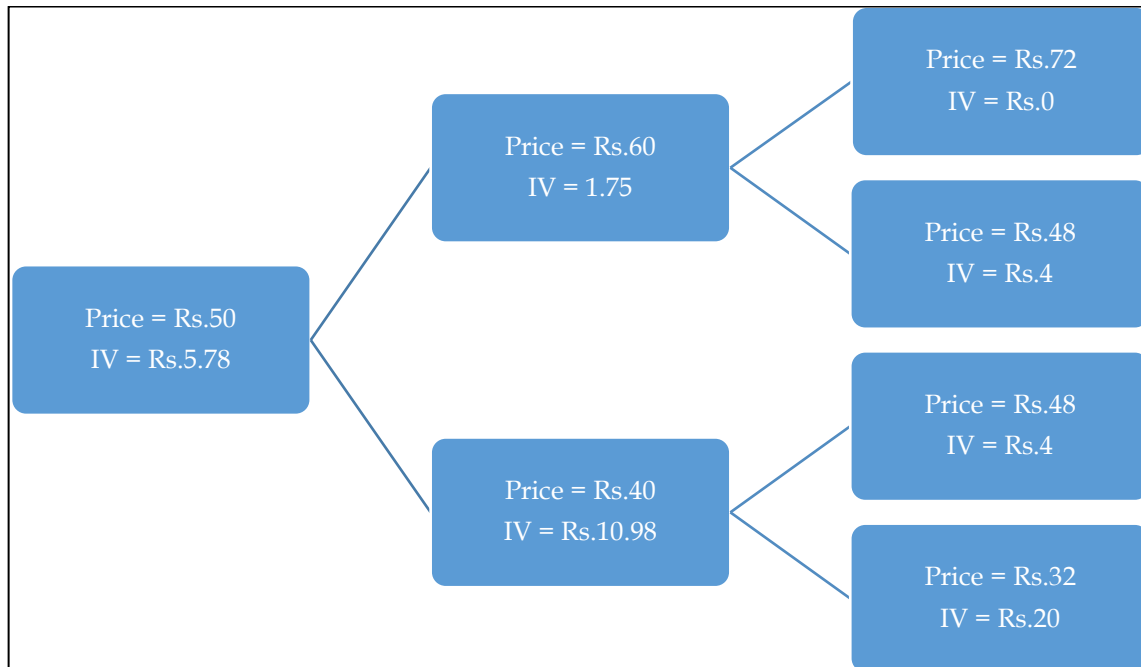
- Let us assume P to be the probability of price increase by 20% and 1-P to be the probability of price fall by 20%
- Risk-free rate of interest is 5% per annum CCRFI
- Expected price at end of month 6 = $50 \times e^{(0.05)(0.5)} = 50 \times e^{0.025} = 50 \times 1.0253 = 51.27$

Price	Probability	Product
60	P	60P
40	1-P	40-40P
Total		60P+40-40P=51.27

$$60P + 40 - 40P = 51.27; 20P = 11.27; P = \frac{11.27}{20} = 0.5635$$

- Hence probability of price raise is 56.35% and probability of price fall is 43.65%

WN 2: Valuation of option:

**Note:**

- Share price is expected to either go up by 20% or fall by 20% over the next six months and then the same would be repeated from M6 to M12
- Intrinsic values in M12 is equal to Gross payoff of put option
- Value in month 6:
 - When price is Rs.60 = $(0 \times 56.35\%) + (4 \times 43.65\%) = \text{Rs.}1.75$
 - When price is Rs.40 = $(4 \times 56.35\%) + (20 \times 43.65\%) = \text{Rs.}10.98$
- Valuation in Month 0 = $(1.75 \times 56.35\%) + (10.98 \times 43.65\%) = \text{Rs.}5.78$

Final value of Put:

- The above-computed value does not consider time value of money while rolling backwards and doing the valuation of option. We need to give effect of time value of money to find the value of option in Month 0

$$\text{Value of put option} = \frac{5.78}{e^{0.05}} = \frac{5.78}{1.05127} = \text{Rs. } 5.50$$

WN 3: Valuation of call option using PCPT:

Share + Put = Call + Present value of exercise price

$$50 + 5.50 = \text{Call} + \frac{52}{e^{rt}}$$

$$50 + 5.50 = \text{Call} + \frac{52}{e^{0.05}}; 55.51 = \text{Call} + 49.46$$

Call = Rs. 6.04

81. Binomial model

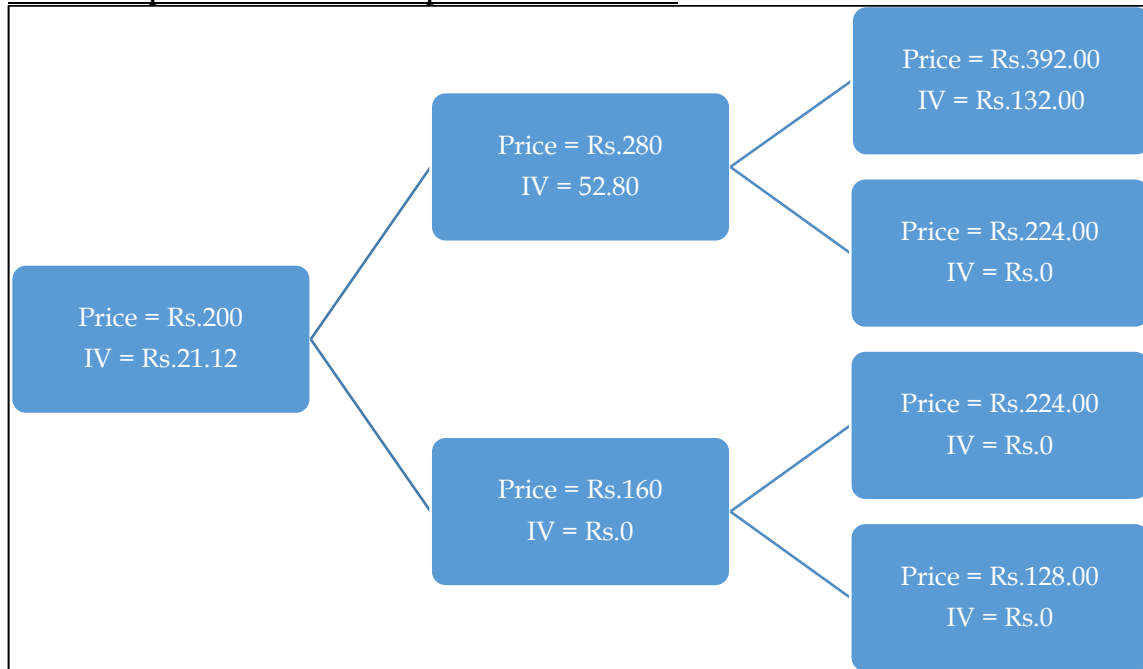
ABC Limited is a newly listed company and its price today is Rs.200. Analysts expect the price of ABC Limited to either rise by 40% every half year or fall by 20% every half year, for the next one year, weightage being 40% for every increase and 60% for every fall. If a one-year option carries an exercise price of Rs.260, you are required to compute the following under binomial model

- ❖ Risk free rate of return
- ❖ Future and Present Value of call
- ❖ Future and Present Value of Put

Answer:**WN 1: Computation of risk-free rate of return:**

Price	Probability	Product
40	40%	16
-20	60%	-12
Return for half year		4

- Risk-free rate = 4% per half-year (or) 8% per annum

WN 2: Computation of future and present value of call:**Note:**

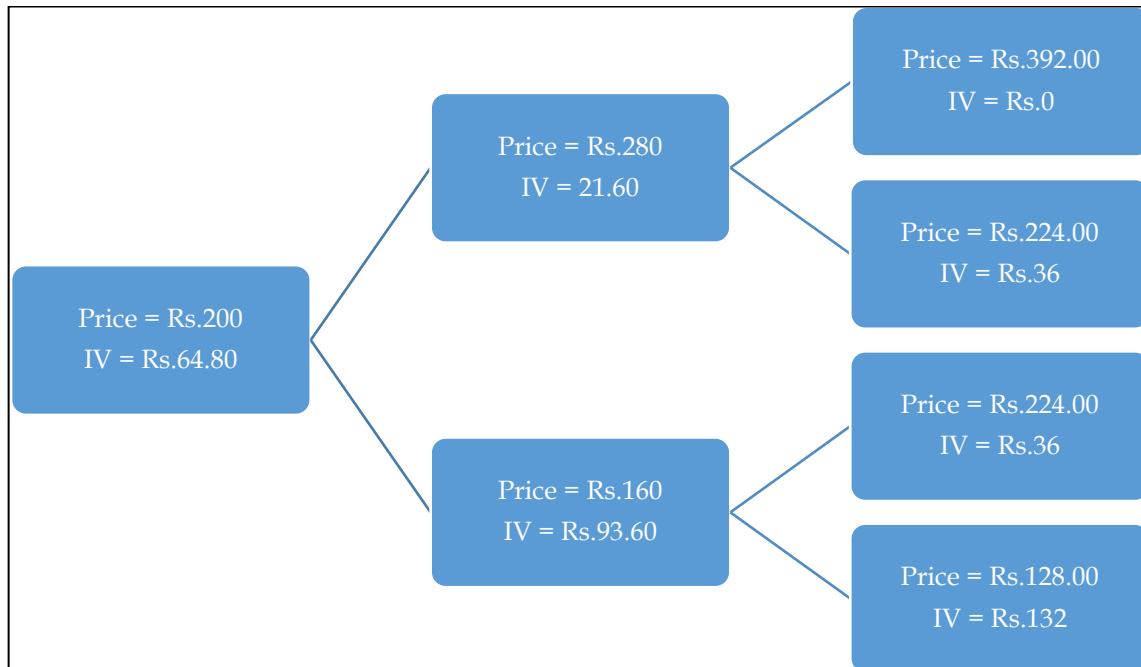
- Share price is expected to either go up by 40% or fall by 20% over the next six months and then the same would be repeated from M6 to M12
- Intrinsic values in M12 is equal to Gross payoff of call option
- Value in month 6:
 - When price is Rs.280 = $(132 \times 40\%) + (0 \times 60\%) = \text{Rs.}52.80$
 - When price is Rs.160 = $(0 \times 40\%) + (0 \times 60\%) = \text{Rs.}0$
- Valuation in Month 0 = $(52.80 \times 40\%) + (0 \times 60\%) = \text{Rs.}21.12$
- Future value of call option = Rs.21.12

Present value of call:

- The above-computed value does not consider time value of money while rolling backwards to value the option. We need to give effect of time value of money to find the present value of option

$$\text{Present Value of call option} = \frac{21.12}{(1.04)(1.04)} = \text{Rs. } 19.53$$

WN 3: Computation of future and present value of Put:

**Note:**

- Share price is expected to either go up by 40% or fall by 20% over the next six months and then the same would be repeated from M6 to M12
- Intrinsic values in M12 is equal to Gross payoff of call option
- Value in month 6:
 - When price is Rs.280 = $(0 \times 40\%) + (36 \times 60\%) = \text{Rs.}21.60$
 - When price is Rs.160 = $(36 \times 40\%) + (132 \times 60\%) = \text{Rs.}93.60$
- Valuation in Month 0 = $(21.60 \times 40\%) + (93.60 \times 60\%) = \text{Rs.}64.80$
- Future value of put option = Rs.64.80

Present value of Put:

- The above-computed value does not consider time value of money while rolling backwards to value the option. We need to give effect of time value of money to find the present value of option

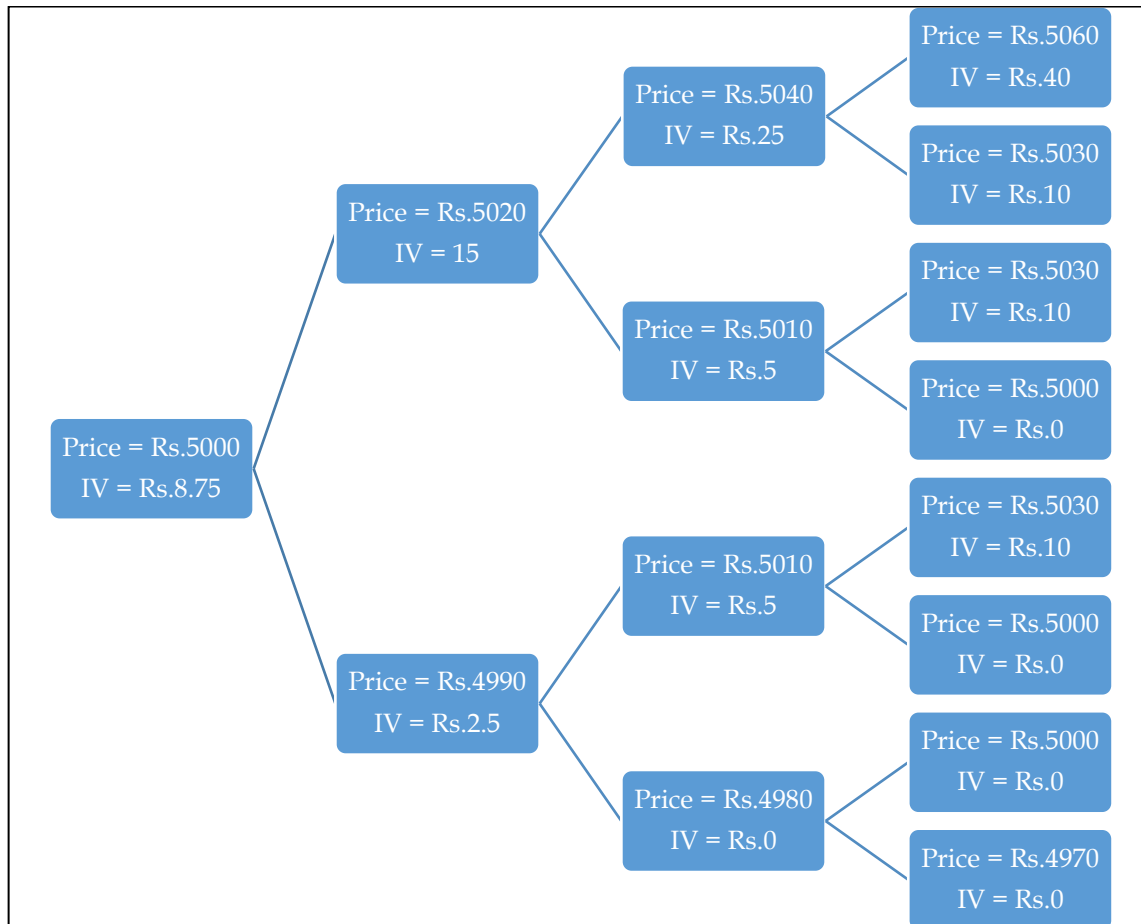
$$\text{Present Value of Put option} = \frac{64.80}{(1.04)(1.04)} = \text{Rs. } 59.91$$

82. Binomial model

A stock index is at 5000 points. There is a 50% probability that it will change either up by 20 points or down by 10 points in each month. Consider an American call option on this index with an exercise price of 5020, which will expire in three months.

- Find the value of the American call if risk free rate is 8%?
- If the actual price of the call were Rs.12, what strategy would you adopt?
- If the actual price of the call were Rs.8, what strategy would you adopt?

Answer:**WN 1: Valuation of American call option:**



- In an American option, we have a choice to exercise the option immediately or on expiry.
- Value of any node will be higher of immediate exercise (GPO on that day) or later exercise (weighted average of its branches)
- Valuation of Rs.5,040 in Month 2 will be higher of the following:
 - Immediate exercise: $GPO = 5,040 - 5,020 = \text{Rs.}20$
 - **Later exercise: $(40 \times 0.5) + (10 \times 0.5) = \text{Rs.}25$**
- Valuation of Rs.5,010 in Month 2 will be higher of the following:
 - Immediate exercise: $GPO = 0$
 - **Later exercise: $(10 \times 0.5) + (0 \times 0.5) = \text{Rs.}5$**
- Valuation of Rs.4,980 in Month 2 will be higher of the following:
 - Immediate exercise: $GPO = 0$
 - **Later exercise: $(0 \times 0.5) + (0 \times 0.5) = \text{Rs.}0$**
- Valuation of Rs.5,020 in Month 1 will be higher of the following:
 - Immediate exercise: $GPO = 0$
 - **Later exercise = $(25 \times 0.5) + (5 \times 0.5) = \text{Rs.}15$**
- Valuation of Rs.4,990 in Month 1 will be higher of the following:
 - Immediate exercise: $GPO = 0$
 - **Later exercise = $(5 \times 0.5) + (0 \times 0.5) = \text{Rs.}2.5$**
- Valuation of Rs.5,000 in Month 0 will be higher of the following:
 - Immediate exercise: $GPO = 0$
 - **Later exercise = $(15 \times 0.5) + (2.5 \times 0.5) = \text{Rs.}8.75$**

Final value of Call:

- The above-computed value does not consider time value of money while rolling backwards and doing the valuation of option. We need to give effect of time value of money to find the value of option in Month 0

$$\text{Value of call option} = \frac{8.75}{(1 + 2\%)} = \text{Rs. } 8.58$$

WN 2: Strategy of the investor:

Actual call price of Rs.12	- Fair value of call is Rs.8.58 whereas actual value of call is Rs.12. This would mean that call is currently over-valued - We should sell over-valued securities and hence call option will be written
Actual call price of Rs.8	- Fair value of call is Rs.8.58 whereas actual value of call is Rs.8. This would mean that call is currently under-valued - We should buy under-valued securities and hence call option will be bought

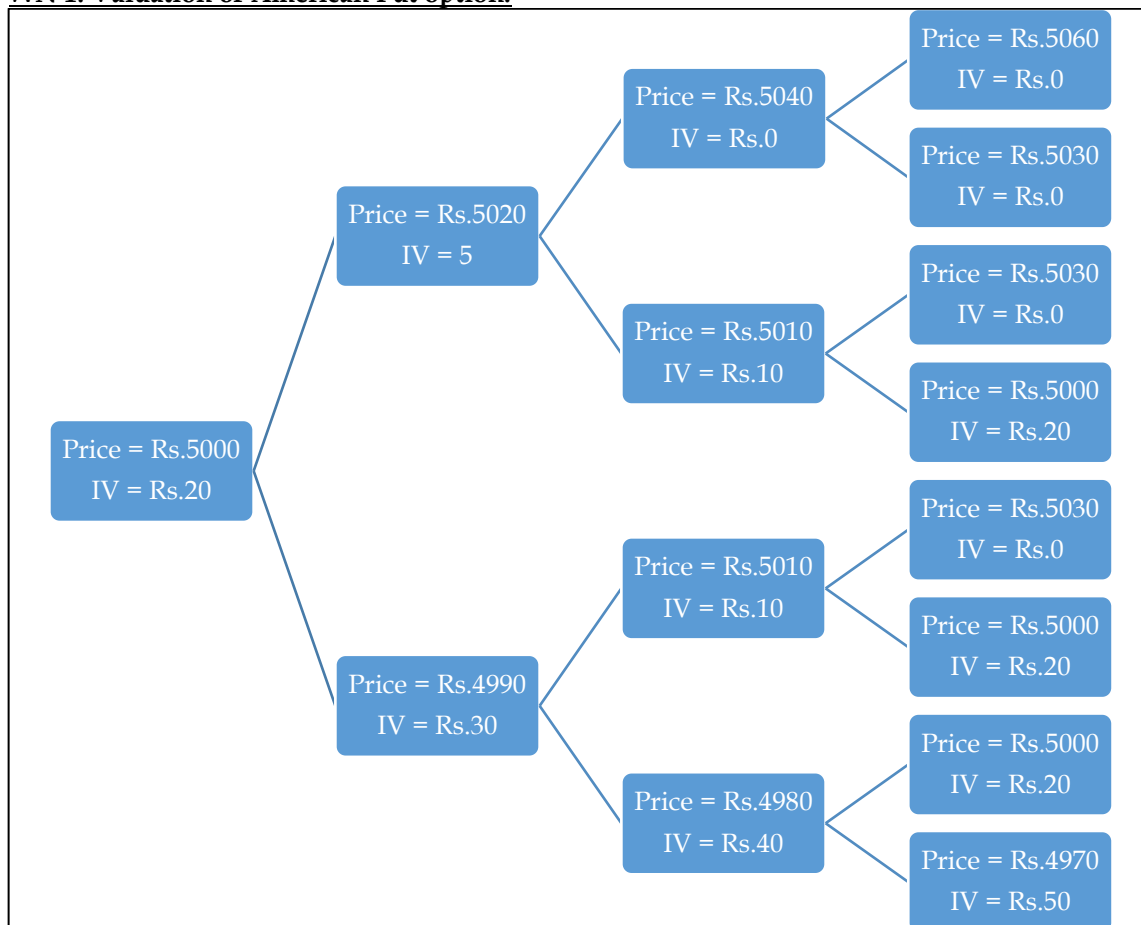
83. Binomial model

A stock index is at 5000 points. There is a 50% probability that it will change either up by 20 points or down by 10 points in each month. Consider an American put option on this index with an exercise price of 5020, which will expire in three months.

- Find the value of the American put?
- If the actual price of the put were Rs.12, what strategy would you adopt?
- If the actual price of the put were Rs.28, what strategy would you adopt?

Answer:

WN 1: Valuation of American Put option:



- In an American option, we have a choice to exercise the option immediately or on expiry.
- Value of any node will be higher of immediate exercise (GPO on that day) or later exercise (weighted average of its branches)
- Valuation of Rs.5,040 in Month 2 will be higher of the following:
 - Immediate exercise: GPO = 0
 - Later exercise: $(0 \times 0.5) + (0 \times 0.5) = \text{Rs.}0$
- Valuation of Rs.5,010 in Month 2 will be higher of the following:
 - Immediate exercise: GPO = 10
 - Later exercise: $(0 \times 0.5) + (20 \times 0.5) = \text{Rs.}10$
- Valuation of Rs.4,980 in Month 2 will be higher of the following:
 - Immediate exercise: GPO = 40**
 - Later exercise: $(20 \times 0.5) + (50 \times 0.5) = \text{Rs.}35$
- Valuation of Rs.5,020 in Month 1 will be higher of the following:

- Immediate exercise: $GPO = 0$
- **Later exercise = $(0 \times 0.5) + (10 \times 0.5) = \text{Rs.5}$**
- Valuation of Rs.4,990 in Month 1 will be higher of the following:
 - **Immediate exercise: $GPO = 30$**
 - Later exercise = $(10 \times 0.5) + (40 \times 0.5) = \text{Rs.25}$
- Valuation of Rs.5,000 in Month 0 will be higher of the following:
 - **Immediate exercise: $GPO = 20$**
 - Later exercise = $(5 \times 0.5) + (30 \times 0.5) = \text{Rs.17.50}$

Final value of Put:

- The above-computed value does not consider time value of money while rolling backwards and doing the valuation of option. However, value of Rs.20 arises due to immediate exercise and hence there is no discounting to be done
- In this case the investor should buy the option and immediately exercise it to make maximum gain out of the put option

WN 2: Strategy of the investor:

Actual put price of Rs.12	• Fair value of put is Rs.20 whereas actual value of put is Rs.12. This would mean that put is currently under-valued • We should buy under-valued securities and hence put option will be bought
Actual put price of Rs.28	• Fair value of put is Rs.20 whereas actual value of put is Rs.28. This would mean that put is currently over-valued • We should sell over-valued securities and hence put option will be written

84. Binomial model [May 2009, Nov 2019 RTP]

Consider a two year American call option with a strike price of Rs. 50 on a stock the current price of which is also Rs. 50. Assume that there are two time periods of one year and in each year the stock price can move up or down by equal percentage of 20%. The risk free interest rate is 6%. Using binomial option model, calculate the probability of price moving up and down. Also draw a two step binomial tree showing prices and payoffs at each node.

Answer:**WN 1: Computation of upside and downside probability:**

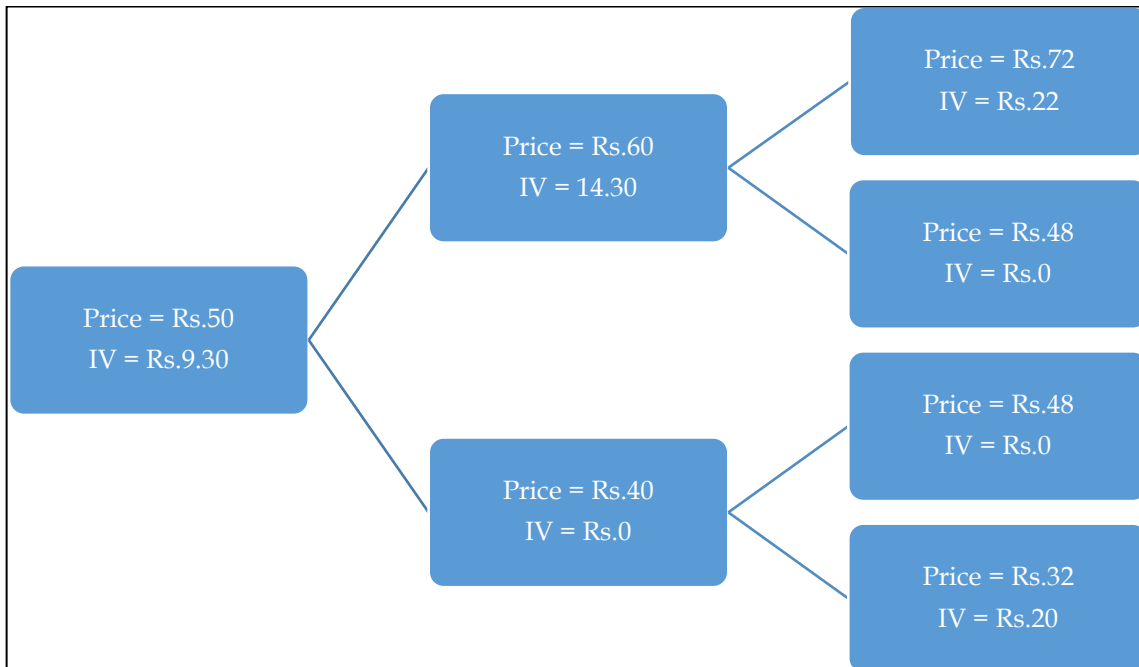
- Let us assume P to be the probability of price increase by 20% and 1-P to be the probability of price fall by 20%
- Risk-free rate of interest is 6% per annum
- Expected price at end of year = $50 + 6\% = \text{Rs. 53}$

Price	Probability	Product
60	P	60P
40	1-P	40-40P
Total		60P+40-40P=53

$$60P + 40 - 40P = 53; 20P = 13; P = \frac{13}{20} = 0.65$$

- Hence probability of price raise is 65% and probability of price fall is 35%

WN 2: Valuation of call option:



Note:

- Valuation of Rs.60 in year 1 will be higher of the following:
 - Immediate exercise: GPO = Rs.10
 - Later exercise: $(22 \times 0.65) + (0 \times 0.35) = \text{Rs.14.30}$**
- Valuation of Rs.40 in year 1 will be higher of the following:
 - Immediate exercise: GPO = 0
 - Later exercise: $(0 \times 0.65) + (0 \times 0.35) = \text{Rs.0}$
- Valuation of Rs.50 in year 0 will be higher of the following:
 - Immediate exercise: GPO = 0
 - Later exercise: $(14.30 \times 0.65) + (0 \times 0.35) = \text{Rs.9.30}$

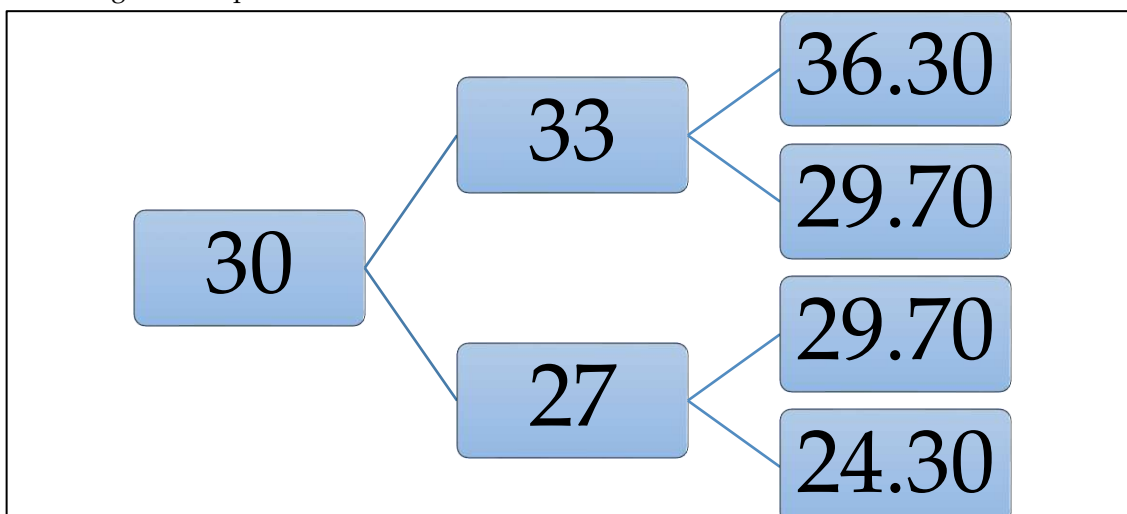
Final value of Call:

- The above-computed value does not consider time value of money while rolling backwards and doing the valuation of option. We need to give effect of time value of money to find the value of option in Month 0

$$\text{Value of call option} = \frac{9.30}{(1.06)(1.06)} = \text{Rs. 8.28}$$

85. Binomial model [Nov 2020]

Following is a two-period tree for a share of stock in CAB Limited:



Using the binomial model, calculate the current fair value of a regular call option on CAB stock with the following characteristics. $X = \text{Rs.}28$, Risk free rate = 2.5 percent (per sub period). You should also indicate the composition of the implied riskless hedge portfolio at the valuation date.

Answer:

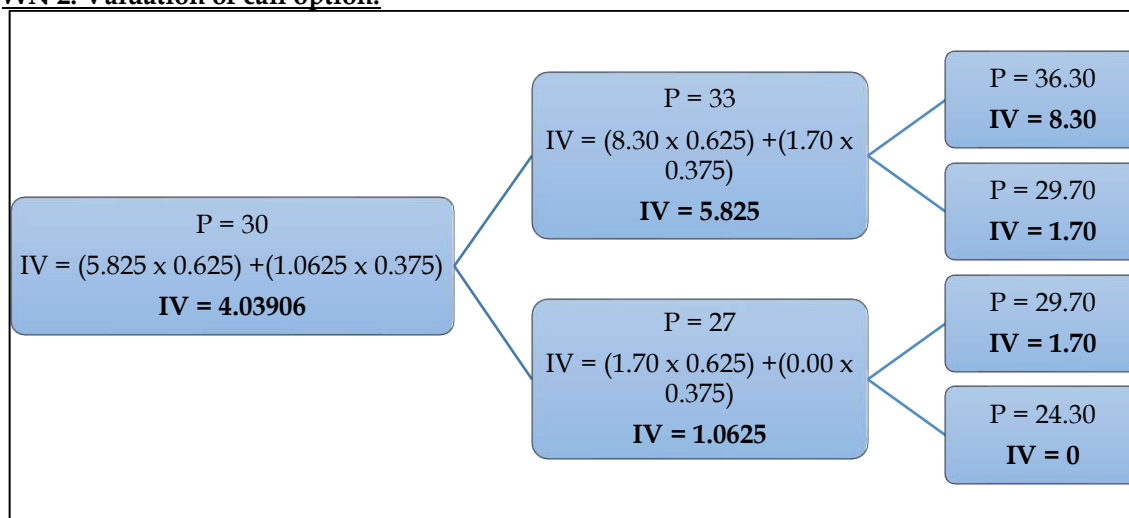
WN 1: Computation of upside and downside probability:

Let us assume p to be the probability of price touching 33 and $1-p$ to be the probability of price touching 27.

PV	Probability	Product
33	P	33P
27	1-P	27 - 27P
Expected Price		30.75

- ❖ Expected price at end of sub-period will be Rs.30.75 [$30 + 2.5\%$]
- ❖ $33P + 27 - 27P = 30.75$
- ❖ $6P = 3.75$
- ❖ $P = 3.75/6 = 0.625$
- ❖ Probability of price touching 33 is 0.625 and probability of price touching 27 is 0.375

WN 2: Valuation of call option:



Note:

- ❖ Option under binomial model is valued from left to right. Value in sub-period 2 is the difference between current market price and exercise price
- ❖ Value in sub-period 1 = Weighted average of possible intrinsic value (IV) with probability being the assigned weight
- ❖ Value today = Weighted average of possible intrinsic value (IV) with probability being the assigned weight
- ❖ We have not considered the impact of time value of money in above analysis and the same will be discounted to get the fair value of call

$$\text{Fair value of call} = \frac{4.03906}{1.025^2} = 3.84$$

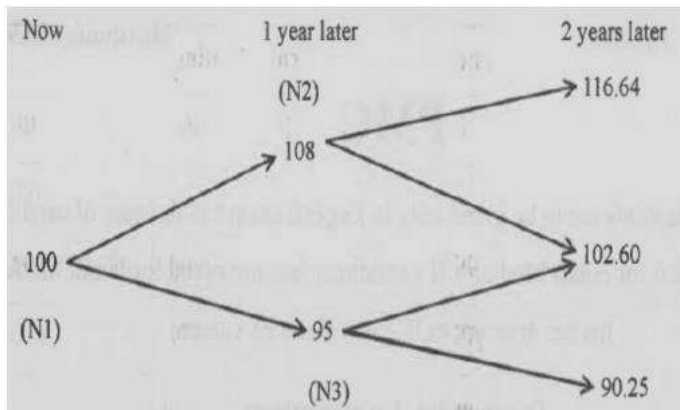
WN 3: Formation of riskless hedge portfolio:

$$\text{Delta} = \frac{\text{Spread in option price}}{\text{Spread in stock price}} = \frac{5.825 - 1.0625}{33 - 27} = 0.79 \text{ times}$$

- ❖ Delta of option is 0.79 times. This would mean that option price change would be 0.79 times of the change in share price.
- ❖ Hence a combination of 1 option and 0.79 shares can create a riskless hedge portfolio. Alternatively a combination of 1 share and 1.27 options ($1/0.79$) will create a riskless hedge portfolio.

86. Binomial model – American Option – May 2023 RTP

A two-year tree for a share of stock in ABC Ltd., is as follows:



Consider a two years American call option on the stock of ABC Ltd., with a strike price of Rs. 98. The current price of the stock is Rs. 100. Risk free return is 5 per cent per annum with a continuous compounding and $e^{0.05} = 1.05127$.

Assume two time periods of one year each. Using the Binomial Model, calculate:

- The probability of price moving up and down;
- Expected pay offs at each nodes i.e. N1, N2 and N3 (round off upto 2 decimal points).

Answer:

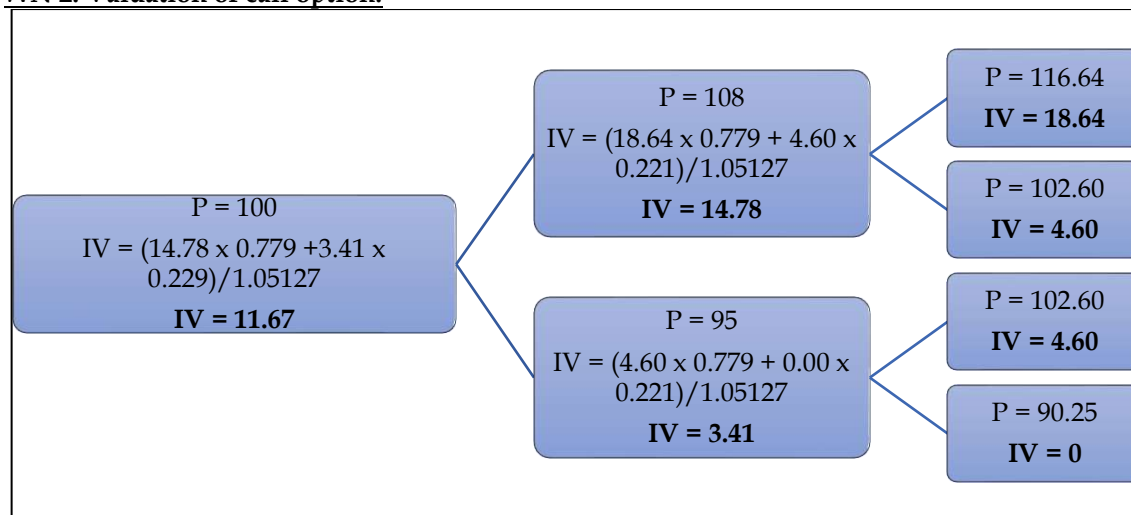
WN 1: Computation of upside and downside probability:

Let us assume p to be the probability of price touching 108 and $1-p$ to be the probability of price touching 95.

PV	Probability	Product
108	P	$108P$
95	$1-P$	$95-95P$
Expected Price		105.127

- ❖ Expected price at end of year = $100 \times 1.05127 = 105.127$
- ❖ $108P + 95 - 95P = 105.127$
- ❖ $13P = 10.127$
- ❖ $P = 10.127/13 = 0.779$ or 77.90%
- ❖ **Probability of price touching moving up is 77.90% and price moving down is 22.10%**

WN 2: Valuation of call option:



Note:

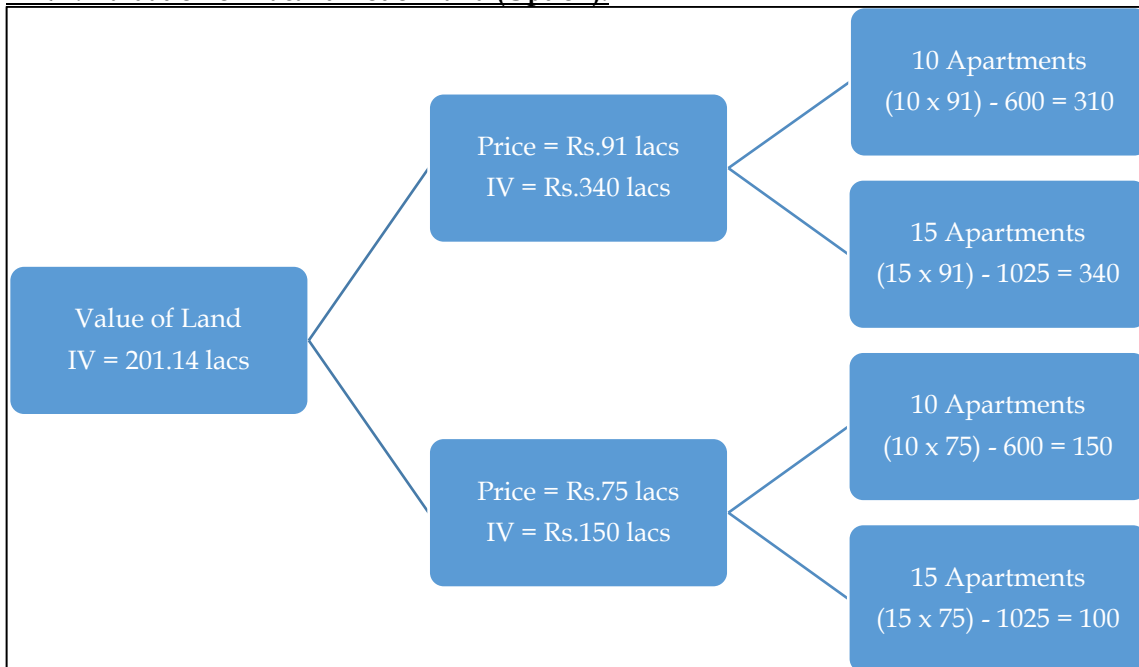
- ❖ Option under binomial model is valued from left to right. Value in sub-period 2 is the difference between current market price and exercise price
- ❖ Value in sub-period 1 = Weighted average of possible intrinsic value (IV) with probability being the assigned weight. The value was thereafter discounted at time value of money.
- ❖ Value today = Weighted average of possible intrinsic value (IV) with probability being the assigned weight. The value was thereafter discounted at time value of money.

87. Valuation of option [Nov 2015 MTP, May 2013]

Ramesh owns a plot of land on which he intends to construct apartment units for sale. No. of apartment units to be constructed may be either 10 or 15. Total construction costs for these alternatives are estimated to be Rs. 600 lakhs or Rs. 1025 lakhs respectively. Current market price for each apartment unit is Rs. 80 lakhs. The market price after a year for apartment units will depend upon the conditions of market. If the market is buoyant, each apartment unit will be sold for Rs. 91 lakhs, if it is sluggish, the sale price for the same will be Rs. 75 lakhs. Determine the current value of vacant plot of land. Should Ramesh start construction now or keep the land vacant? The yearly rental per apartment unit is Rs. 7 lakhs and the risk free interest rate is 10% p.a. Assume that the construction cost will remain unchanged.

Answer:**WN 1: Analysis of the question:**

- Vacant plot of land is like an American option. The person can decide to start the construction immediately (exercising of option on day 0) or wait for a year and do construction (exercising of option at end of year 1)

WN 2: Valuation of Vacant Plot of Land (Option):**Note:**

- Price of the Apartment at end of year can be either Rs.91 lacs or Rs.75 lacs. The company can decide on construction of 10 or 15 apartments depending on which is more beneficial
- **Price of Rs.91 lacs:** The company can either earn Rs.310 lacs from 10 apartments or earn Rs.340 lacs from 15 apartments. The company will choose to construct 15 apartments and hence the intrinsic value will be Rs.340 lacs when price is Rs.91 lacs
- **Price of Rs.75 lacs:** The company can either earn Rs.150 lacs from 10 apartments or earn Rs.100 lacs from 15 apartments. The company will choose to construct 10 apartments and hence the intrinsic value will be Rs.150 lacs when price is Rs.75 lacs
- Value of land on day 0 will be higher of immediate construction or later construction
 - **Immediate construction:** The company can either earn Rs.200 lacs from 10 apartments (10 x 80 lacs – 600 lacs) or earn Rs.175 lacs from 15 apartments (15 x 80 lacs – 1025 lacs). The company will choose to construct 10 apartments and hence the intrinsic value will be Rs.200 lacs if company opts to do immediate construction
 - **Later construction:** Weighted average of Rs.340 lacs and Rs.150 lacs with probability being the assigned weights. Value of later construction = (340 lacs x 0.375) + (150 lacs x 0.625) = Rs.221.25. We need to discount this value to day 0 to compare the same with immediate construction value. **Present value of later construction = (221.25/1.10) = Rs.201.14 lacs**
- The company should wait for construction and should exercise option at end of year 1 (construction at end of year 1). The value of vacant plot of land is Rs.201.14 lacs

Computation of upside and downside probability:

- Let us assume P to be the probability of price increasing to Rs.91 lacs and 1-P to be the probability of price falling to Rs.75 lacs
- Risk-free rate of interest is 10% per annum
- Expected price at end of year = $(80 + 10\%) - 7 = \text{Rs. } 81 \text{ lacs}$
- Current price of Apartment is Rs.80 lacs. We need 10 percent return from Apartment and the same would be Rs.8 lacs. We earn rental income of Rs.7 lacs and hence capital appreciation is expected to be Rs.1 lac. Hence expected price of Apartment at end of year 1 is Rs.81 lacs

Price	Probability	Product
91	P	91P
75	1-P	75-75P
Total		91P+75-75P=81

$$91P + 75 - 75P = 81; 16P = 6; P = \frac{6}{16} = 0.375$$

- Hence probability of price raise is 37.50% and probability of price fall is 62.50%

88. Valuation of option [May 2016 RTP, Nov 2017 MTP]

IPL already in production of Fertilizer is considering a proposal of building a new plant to produce pesticides. Suppose, the PV of proposal is Rs. 100 crore without the abandonment option. However, if market conditions for pesticide turns out to be favourable the PV of proposal shall increase by 30%. On the other hand market conditions remain sluggish the PV of the proposal shall be reduced by 40%. In case company is not interested in continuation of the project it can be disposed off for Rs. 80 crore. If the risk free rate of interest is 8% then what will be value of abandonment option

Answer:

WN 1: Analysis of option:

- The PV of proposal is Rs.100 crores. This would be like the current market price of the share
- Share price can increase by 30% to Rs.130 crores or fall by 40% to Rs.60 crores. Question has not mentioned information on the time period over which the change is to happen. It is assumed that increase of 30%/decrease of 40% would happen over a period of one year
- The company can dispose the project for Rs.80 crores if the market conditions are not favourable. This is similar to put option with exercise price of Rs.80 crores

WN 2: Computation of upside and downside probability:

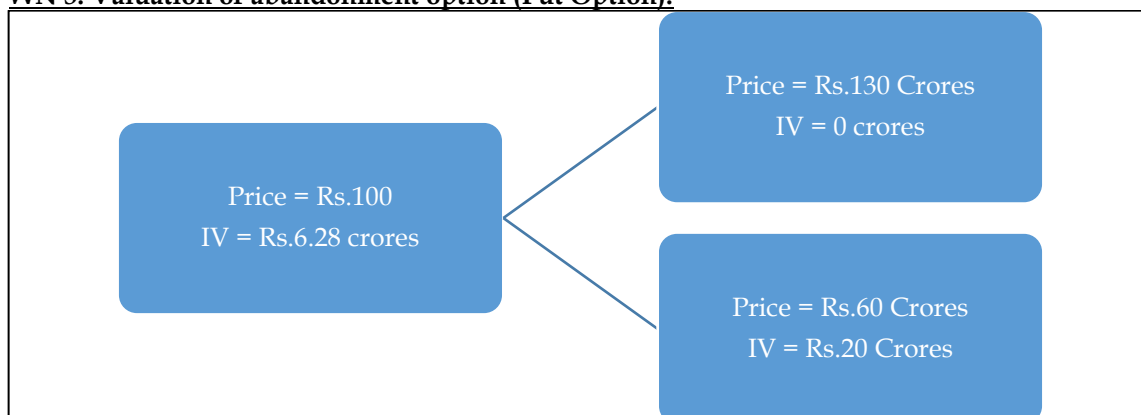
- Let us assume P to be the probability of price increasing to Rs.130 crores and 1-P to be the probability of price falling to Rs.60 crores
- Risk-free rate of interest is 8% per annum
- Expected price at end of year = $(100 + 8\%) = \text{Rs. } 108 \text{ crores}$

Price	Probability	Product
130	P	130P
60	1-P	60-60P
Total		130P+60-60P=108

$$130P + 60 - 60P = 108; 70P = 48; P = \frac{48}{70} = 0.686$$

- Hence probability of price raise is 68.60% and probability of price fall is 31.40%

WN 3: Valuation of abandonment option (Put Option):



Note:

- Value of option in year 1 is as per GPO of Put option
- Value of option today = $(0 \times 0.686) + (20 \times 0.314) = \text{Rs.6.28 Crores}$

The above analysis does not consider the time value of money and the final value of abandonment option is computed below:

$$\text{Value of abandonment option} = \frac{6.28 \text{ crores}}{1.08} = \text{Rs. 5.81 crores}$$

89. Option valuation [May 2017, May 2017 RTP]

Ram chemical is in production line of chemicals and considering a proposal of building new plant to produce pesticides. The Present value (PV) of new proposal is Rs.150 crores. Since this is a new product market, survey indicates following variation in present value (PV):

Condition favourable in first year	PV will increase 30% from original estimate
Condition sluggish in first year	PV will decrease by 40% from original figures

In addition Rama chemical has a option to abandon the project at the end of year and dispose it at Rs.100 Crores. If risk free rate of interest is 8%, what will be the present value of put option?

Answer:**WN 1: Computation of probability:**

Let us assume p to be the probability of PV touching 195 crores and 1-p to be the probability of price touching 90 crores.

PV	Probability	Product
195	P	195P
90	1-P	90-90P
Expected PV		162

- ❖ Expected PV at end of the year will be Rs.162 Crores [150 crores + 8%]
- ❖ $195P + 90 - 90P = 162$
- ❖ $105P = 72$
- ❖ $P = 72/105 = 0.6857$
- ❖ Probability of PV touching Rs.195 Crores is 0.6857 and probability of PV touching 90 Crores is 0.3143

WN 2: Computation of value of put option:

PV	EP	GPO	Probability	Product [GPO x Prob]
195	100	0	0.6857	0
90	100	10	0.3143	3.143
Future value of Put				3.143
Present value of Put = $\frac{3.143}{1.08}$				2.91 Crores

90. Black-scholes model [Nov 2008]

Following information is available for X Ltd's shares:

Current share price	185
Option exercise price	170
Risk free interest rate	7%
Time of the expiry of option	3 years
Standard deviation	0.18

Calculate the value of the option using Black-Scholes formula. Rework the problem if dividend of Rs.2 is expected at end of year 1, 2 & 3.

Answer:**WN 1: Valuation of option:**

- Type of option is not given in the question and hence we will first value the call option as per Black-scholes model. Post this we can value put option as per PCPT

$$\text{Value of call option} = (S_0 \times N(d_1)) - (PV_{EP} \times N(d_2))$$

Where:

$$d_1 = \frac{\left(\text{Naturallog} \left(\frac{S_0}{E} \right) + (r + 0.5\sigma^2)t \right)}{\sigma\sqrt{t}}$$

$$d_2 = \frac{\left(\text{Naturallog} \left(\frac{S_0}{E} \right) + (r - 0.5\sigma^2)t \right)}{\sigma\sqrt{t}} \text{ (or) } d_1 - \sigma\sqrt{t}$$

Term	Calculation	Amount
S0 (CMP)	Given	185
Exercise Price	Given	170
$\frac{S_0}{E}$	$\frac{185}{170}$	1.0882
$\text{Naturallog} \left(\frac{S_0}{E} \right)$	= NL of 1.08 + 82% of (NL of 1.09 - NL of 1.08) = 0.07696 + 82% (0.08618 - 0.07696)	0.08452
$r + 0.5\sigma^2$	$0.07 + 0.5 \times 0.18 \times 0.18$	0.0862
$(r + 0.5\sigma^2)t$	0.0862×3	0.2586
$\sigma\sqrt{t}$	$0.18\sqrt{3}$	0.31177
d_1	$\frac{0.08452 + 0.2586}{0.31177}$	1.1006
$r - 0.5\sigma^2$	$0.07 - 0.5 \times 0.18 \times 0.18$	0.0538
$(r - 0.5\sigma^2)t$	0.0538×3	0.1614
d_2	$\frac{0.08452 + 0.1614}{0.31177}$ (or) $1.1006 - 0.31177$	0.7888
$N(d_1)$	= Prob of 1.10 + 6% of (Prob of 1.11 - Prob of 1.10) = 0.8643 + 6% $\times$ (0.8665 - 0.8643)	0.8644
$N(d_2)$	= Prob of 0.78 + 88% of (Prob of 0.79 - Prob of 0.78) = 0.7823 + 88% $\times$ (0.7852 - 0.7823)	0.7849
PV_{EP}	$\frac{170}{e^{(0.07)(3)}} = \frac{170}{e^{0.21}} = \frac{170}{1.23368}$	137.80
Value of call	= $(S_0 \times N(d_1)) - (PV_{EP} \times N(d_2))$ = $(185 \times 0.8644) - (137.80 \times 0.7849)$	51.75
Value of Put	Share + Put = Call + PV of exercise price $185 + \text{Put} = 51.75 + 137.80$	4.55

WN 2: Valuation of option in rework scenario:

- Dividend of Rs.2 will be declared at end of each of year 1,2 and 3. In this scenario share price will be replaced with adjusted share price
- Adjusted share price = Share price - PV of dividend income

$$PV \text{ of dividend} = \frac{2}{e^{0.07}} + \frac{2}{e^{0.14}} + \frac{2}{e^{0.21}} = 1.8648 + 1.7387 + 1.6212 = \text{Rs. } 5.22$$

- Adjusted share price = $185 - 5.22 = \text{Rs. } 179.78$

Term	Calculation	Amount
S0 (CMP)	Given	179.78
Exercise Price	Given	170
$\frac{S_0}{E}$	$\frac{179.78}{170}$	1.0575
$\text{Naturallog} \left(\frac{S_0}{E} \right)$	= NL of 1.05 + 75% of (NL of 1.06 - NL of 1.05) = 0.04879 + 75% $\times$ (0.05827 - 0.04879)	0.0559
$r + 0.5\sigma^2$	$0.07 + 0.5 \times 0.18 \times 0.18$	0.0862
$(r + 0.5\sigma^2)t$	0.0862×3	0.2586
$\sigma\sqrt{t}$	$0.18\sqrt{3}$	0.31177
d_1	$\frac{0.0559 + 0.2586}{0.31177}$	1.0088
$r - 0.5\sigma^2$	$0.07 - 0.5 \times 0.18 \times 0.18$	0.0538
$(r - 0.5\sigma^2)t$	0.0538×3	0.1614

d_2	$\frac{0.0559 + 0.1614}{0.31177}$ (or) $1.0088 - 0.31177$	0.6970
$N(d_1)$	= Prob of 1.00 + 88% of (Prob of 1.01 - Prob of 1.00) = 0.8413 + 88% x (0.8438 - 0.8413)	0.8435
$N(d_2)$	= Prob of 0.69 + 70% of (Prob of 0.70 - Prob of 0.69) = 0.7549 + 70% x (0.7580 - 0.7549)	0.7571
PV_{EP}	$\frac{170}{e^{(0.07)(3)}} = \frac{170}{e^{0.21}} = \frac{170}{1.23368}$	137.80
Value of call	$= (S_0 \times N(d_1)) - (PV_{EP} \times N(d_2))$ $= (179.78 \times 0.8435) - (137.80 \times 0.7571)$	47.32
Value of Put	Share + Put = Call + PV of exercise price 179.78 + Put = 47.32 + 137.80	5.34

91. Black-scholes model [Nov 2006, May 2020 RTP]

From the following details find the value of call option

Current share price	80
Option exercise price	75
Risk free interest rate	12%
Maturity period	6 months
Standard deviation	0.40

Given:

Number of SD from mean	Area of the left or right (one tail)
0.25	0.4013
0.30	0.3821
0.55	0.2912
0.60	0.2743

$$e^{0.06} = 1.062$$

$$\ln 1.0667 = 0.0646$$

Answer:

$$\text{Value of call option} = (S_0 \times N(d_1)) - (PV_{EP} \times N(d_2))$$

Where:

$$d_1 = \frac{\left(\text{Naturallog} \left(\frac{S_0}{E} \right) + (r + 0.5\sigma^2)t \right)}{\sigma\sqrt{t}}$$

$$d_2 = \frac{\left(\text{Naturallog} \left(\frac{S_0}{E} \right) + (r - 0.5\sigma^2)t \right)}{\sigma\sqrt{t}} \quad (\text{or}) \quad d_1 - \sigma\sqrt{t}$$

Term	Calculation	Amount
S_0 (CMP)	Given	80
Exercise Price	Given	75
$\frac{S_0}{E}$	$\frac{80}{75}$	1.0667
$\text{Naturallog} \left(\frac{S_0}{E} \right)$	Given	0.0646
$r + 0.5\sigma^2$	$0.12 + 0.5 \times 0.40 \times 0.40$	0.20
$(r + 0.5\sigma^2)t$	0.20×0.5	0.10
$\sigma\sqrt{t}$	$0.40\sqrt{0.5}$	0.2828
d_1	$\frac{0.0646 + 0.10}{0.2828}$	0.5820
$r - 0.5\sigma^2$	$0.12 - 0.5 \times 0.40 \times 0.40$	0.04
$(r - 0.5\sigma^2)t$	0.04×0.5	0.02
d_2	$\frac{0.0646 + 0.02}{0.2828}$ (or) $0.5820 - 0.2828$	0.2992
$N(d_1)$	Note 1	0.7196

$N(d_2)$	Note 2	0.6176
PV_{EP}	$\frac{75}{e^{(0.12)(0.5)}} = \frac{70}{e^{0.06}} = \frac{70}{1.062}$	70.62
Value of call	$= (S_0 \times N(d_1)) - (PV_{EP} \times N(d_2))$ $= (80 \times 0.7196) - (70.62 \times 0.6176)$	13.95

Note 1: Computation of $N(d_1)$:

Z value	Given Prob	Residual prob (1 - Given Prob)
0.55	0.2912	0.7088
0.60	0.2743	0.7257

Note:

- Probability for positive Z values will be higher than 0.5. However, the given probability is less than 0.5 and this is because of single tail values
- Actual probability = 1 - Given Probability

$$\text{Prob of 0.5820} = \text{Prob of 0.55} + \left((\text{Prob of 0.60} - \text{Prob of 0.55}) \times \frac{0.5820 - 0.55}{0.60 - 0.55} \right)$$

$$\text{Prob of 0.5820} = 0.7088 + \left((0.7257 - 0.7088) \times \frac{0.0320}{0.0500} \right) = 0.7196$$

Note 2: Computation of $N(d_2)$:

Z value	Given Prob	Residual prob (1 - Given Prob)
0.25	0.4013	0.5987
0.30	0.3821	0.6179

$$\text{Prob of 0.2991} = \text{Prob of 0.25} + \left((\text{Prob of 0.30} - \text{Prob of 0.25}) \times \frac{0.2991 - 0.2500}{0.3000 - 0.2500} \right)$$

$$\text{Prob of 0.2991} = 0.5987 + \left((0.6179 - 0.5987) \times \frac{0.0491}{0.0500} \right) = 0.6176$$

92. Black-scholes model of valuation:

- The shares of TIC Ltd. are currently priced at Rs. 415 and call option exercisable in three months' time has an exercise rate of Rs. 400. Risk free interest rate is 5% p.a. and standard deviation (volatility) of share price is 22%. Based on the assumption that TIC Ltd. is not going to declare any dividend over the next three months, is the option worth buying for Rs. 25?
- Calculate value of aforesaid call option based on Black Scholes valuation model if the current price is considered as Rs. 380.
- What would be the worth of put option if current price is considered Rs. 380.
- If TIC Ltd. share price at present is taken as Rs. 408 and a dividend of Rs. 10 is expected to be paid in the two months time, then, calculate value of the call option.

Answer:**WN 1: Computation of value of call option as per Black Scholes Model:**

Term	Calculation	Amount
S_0 (Current Market Price)	Given	415
Exercise Price (EP)	Given	400
Present value of EP	$400 \times e^{(-0.05)(\frac{3}{12})}$	395.03
$\frac{S_0}{E}$	$\frac{415}{400}$	1.0375
$\text{Naturallog} \left(\frac{S_0}{E} \right)$	Taken from Natural log tables	0.03681
$(r + 0.5\sigma^2)$	$[0.05 + 0.5 \times 0.22 \times 0.22]$	0.07420
$(r + 0.5\sigma^2)t$	0.0742×0.25	0.01855
$\sigma\sqrt{t}$	$0.22\sqrt{0.25}$	0.11000
d_1	$\frac{\text{Naturallog} \left(\frac{S_0}{E} \right) + (r + 0.5\sigma^2)t}{\sigma\sqrt{t}}$	0.50327
$(r - 0.5\sigma^2)t$	$[0.05 - 0.5 \times 0.22 \times 0.22]0.25$	0.00645

d2	$\frac{\text{Naturallog} \left(\frac{S_0}{E} \right) + (r - 0.5\sigma^2)t}{\sigma\sqrt{t}}$	0.39327
N (d1)	Taken from Probability tables	0.6926
N (d2)	Taken from Probability tables	0.6529
Call	$\frac{(S_0 \times N(d1)) - (PV_{EP} \times N(d2))}{(415 \times 0.6926) - (395.03 \times 0.6529)}$	29.51

Conclusion: Fair value of option is Rs.29.51 and current value is Rs.25.00. Hence it is better to buy the option.

WN 2: Valuation of call option is current market price is Rs.380:

Term	Calculation	Amount
S ₀ (Current Market Price)	Given	380
Exercise Price (EP)	Given	400
Present value of EP	$400 \times e^{(-0.05)(\frac{3}{12})}$	395.03
$\frac{S_0}{E}$	$\frac{380}{400}$	0.95
Naturallog $\left(\frac{S_0}{E} \right)$	Taken from Natural log tables	-0.05129
$(r + 0.5\sigma^2)$	$[0.05 + 0.5 \times 0.22 \times 0.22]$	0.07420
$(r + 0.5\sigma^2)t$	0.0742×0.25	0.01855
$\sigma\sqrt{t}$	$0.22\sqrt{0.25}$	0.11000
d1	$\frac{\text{Naturallog} \left(\frac{S_0}{E} \right) + (r + 0.5\sigma^2)t}{\sigma\sqrt{t}}$	-0.29764
$(r - 0.5\sigma^2)t$	$[0.05 - 0.5 \times 0.22 \times 0.22]0.25$	0.00645
d2	$\frac{\text{Naturallog} \left(\frac{S_0}{E} \right) + (r - 0.5\sigma^2)t}{\sigma\sqrt{t}}$	-0.40764
N (d1)	Taken from Probability tables	0.3830
N (d2)	Taken from Probability tables	0.3418
Call	$\frac{(S_0 \times N(d1)) - (PV_{EP} \times N(d2))}{(415 \times 0.3830) - (395.03 \times 0.3418)}$	10.52

WN 3: Valuation of Put Option:

- ❖ Share + Put = Call + Present value of exercise Price
- ❖ $380 + \text{Put} = 10.52 + 395.03$
- ❖ $\text{Put} = 10.52 + 395.03 - 380 = \text{Rs.}25.55$

WN 4: Computation of value of call option if current market price is Rs.418 and dividend of Rs.10 will be paid in two months:

Term	Calculation	Amount
S ₀ (Current Market Price)	Given	408
Dividend in Month 2		10
Present value of Dividends	$10 \times e^{(-0.05)(\frac{2}{12})}$	9.92
Adjusted spot price	$408 - 9.92$	398.08
Exercise Price (EP)	Given	400
Present value of EP	$400 \times e^{(-0.05)(\frac{3}{12})}$	395.03
$\frac{S_0}{E}$	$\frac{398.08}{400}$	0.9952
Naturallog $\left(\frac{S_0}{E} \right)$	Taken from Natural log tables	-0.00481
$(r + 0.5\sigma^2)$	$[0.05 + 0.5 \times 0.22 \times 0.22]$	0.07420
$(r + 0.5\sigma^2)t$	0.0742×0.25	0.01855

$\sigma\sqrt{t}$	$0.22\sqrt{0.25}$	0.11000
d1	$\frac{\text{Naturallog}\left(\frac{S_0}{E}\right) + (r + 0.5\sigma^2)t}{\sigma\sqrt{t}}$	0.12491
$(r - 0.5\sigma^2)t$	$[0.05 - 0.5 \times 0.22 \times 0.22]0.25$	0.00645
d2	$\frac{\text{Naturallog}\left(\frac{S_0}{E}\right) + (r - 0.5\sigma^2)t}{\sigma\sqrt{t}}$	0.01491
N (d1)	Taken from Probability tables	0.5497
N (d2)	Taken from Probability tables	0.5059
Call	$(S_0 \times N(d1)) - (PV_{EP} \times N(d2))$ $(398.08 \times 0.5497) - (395.03 \times 0.5059)$	18.98

93. Black-Scholes Model:

You are trying to value a long term call option on the Standard and Poor's 500, expiring in 2 months, with a strike price of \$900. The index is currently at \$930, and the annualized standard deviation in stock prices is 20% per annum. The average dividend yield on the index is 3% per annum, and is expected to remain unchanged over the next month. The treasury bond rate is 8%.

- Estimate the value of the long term call option.
- Estimate the value of a put option, with the same parameters.
- What are the implicit assumptions you are making when you use the Black-Scholes model to value this option? Which of these assumptions are likely to be violated? What are the consequences for your valuation?

Answer:**WN 1: Valuation of call option:**

Term	Calculation	Amount
S_0 (Current Market Price)	Given	930
Exercise Price (EP)	Given	900
Present value of EP	$400 \times e^{(-0.08)(\frac{2}{12})}$	888.08
$\frac{S_0}{E}$	$\frac{930}{900.00}$	1.0333
$\text{Naturallog}\left(\frac{S_0}{E}\right)$	Taken from Natural log tables	0.03279
$(r - y + 0.5\sigma^2)$	$[0.08 - 0.03 + 0.5 \times 0.20 \times 0.20]$	0.07000
$(r + 0.5\sigma^2)t$	$0.07000 \times 2/12$	0.01167
$\sigma\sqrt{t}$	$0.20 \sqrt{\left(\frac{2}{12}\right)}$	0.08165
d1	$\frac{\text{Naturallog}\left(\frac{S_0}{E}\right) + (r - y + 0.5\sigma^2)t}{\sigma\sqrt{t}}$	0.54448
$(r - y - 0.5\sigma^2)t$	$([0.08 - 0.03] - [0.5 \times 0.20 \times 0.20])(2/12)$	0.00500
d2	$\frac{\text{Naturallog}\left(\frac{S_0}{E}\right) + (r - y - 0.5\sigma^2)t}{\sigma\sqrt{t}}$	0.46283
N (d1)	Taken from Probability tables	0.7069
$N(d1) \times e^{-yt}$	$0.7069 \times e^{-0.03 \times (\frac{2}{12})}$	0.7034
N (d2)	Taken from Probability tables	0.6783
Call	$(S_0 \times N(d1) \times e^{-yt}) - (PV_{EP} \times N(d2))$ $(930 \times 0.7034) - (888.08 \times 0.6783)$	51.78

Note:

- ❖ In this question dividend yield is given in percentage. We should replace r with $(r-y)$ for computing $d1$ and $d2$. We should not replace r with $r-y$ while calculating PV of exercise price

WN 2: Valuation of put option:

- ❖ Share + Put = Call + Present value of exercise Price
- ❖ $930 + \text{Put} = 51.78 + 892.53$

$$\text{❖ Put} = 51.78 + 892.53 - 930 = \text{Rs.}14.31$$

Note:

❖ For PCPT, present value of exercise price should be calculated by considering r as $(r-y)$.

$$\text{❖ PV of EP} = (900 \times (e^{-(r-y)t})) = 900 \times (e^{-(0.08-0.03)(\frac{2}{12})}) = \text{Rs.} 892.53$$

WN 3: Assumption of black-Scholes model:

- ❖ The variance will be unchanged for the life of the option. This is likely to be violated because stock price variances do change substantially over time.
- ❖ There will be no early exercise. This is reasonable and is unlikely to be violated.
- ❖ Any deviations from the option value will be arbitrated away. While there are plenty of arbitrageurs eager to exploit deviations from true value, arbitrating an index is clearly more difficult to do than arbitrating an individual stock.

94. Real option:

ABC Ltd. is a pharmaceutical company possessing a patent of a drug called 'Aidrex', a medicine for aids patient. Being an approach drug ABC Ltd. holds the right of production of drugs and its marketing. The period of patent is 15 years after which any other pharmaceutical company produce the drug with same formula. It is estimated that company shall require to incur \$ 12.5 million for development and market of the drug. As per a survey conducted the expected present value of cashflows from the sale of drug during the period of 15 years shall be \$ 16.7 million. Cash flow from the previous similar type of drug have exhibited a variance of 26.8% of the present value of cashflows. The current yield on Treasury Bonds of similar duration (15 years) is 7.8%.

Determine the value of the patent.

$$\text{Given } \ln(1.336) = 0.2897 \quad e^{1.0005} = 0.3677 \quad \text{and } e^{-1.17} = 0.3104$$

Answer:**Valuation of Patent as per Black-Scholes Model:****Basic information:**

CMP = Present value of cash flows	16.70
EP = Cost of development formula	12.50
Dividend Yield per annum	6.67%
Risk-free rate	7.80%
Variance of cash flows	0.268
Standard deviation	0.5177
Time period	15 years

Note:

- Benefit of patent will be earned over 15 years and hence annual cash inflow/dividend yield is 6.67% (1/15)

Term	Calculation	Amount
S_0 (Current Market Price)	Present value of cash flows	16.70
Exercise Price (EP)	Cost of Development formula	12.50
Present value of EP	$12.50 \times e^{-(0.078)(15)} = 12.50 \times 0.3104$	3.88
$\frac{S_0}{E}$	$\frac{16.70}{12.50}$	1.336
Naturallog $\left(\frac{S_0}{E}\right)$	Given	0.2897
$(r - y + 0.5\sigma^2)$	$[0.078 - 0.0667 + 0.5 \times 0.268]$	0.1453
$(r - y + 0.5\sigma^2)t$	0.1453×15	2.1795
$\sigma\sqrt{t}$	$0.5177\sqrt{15}$	2.0050
d_1	$\frac{\text{Naturallog}\left(\frac{S_0}{E}\right) + (r - y + 0.5\sigma^2)t}{\sigma\sqrt{t}}$ $\frac{0.2897 + 2.1795}{2.0050}$	1.2315
d_2	$d_1 - \sigma\sqrt{t} = 1.2315 - 2.0050$	-0.7735
N (d_1)	Taken from Probability tables	0.8910

$N(d1) \times e^{-yt}$	$0.8910 \times e^{-0.0667 \times 15} = 0.8910 \times 0.3677$	0.3276
$N(d2)$	Taken from Probability tables	0.2196
Call	$(S_0 \times N(d1) \times e^{-yt}) - (PV_{EP} \times N(d2))$ $(16.70 \times 0.3276) - (3.88 \times 0.2196)$	4.6189

- Value of patent as per BS model is Rs.4.6189 million.

95. Valuation of option:

Suppose MIS Ltd. is considering installation of solar electricity generating plant for light the staff quarters. The plant shall cost Rs. 2.50 crore and shall lead to saving in electricity expenses at the current tariff by Rs. 21 lakh per year forever. However, with change in Government in state, the rate of electricity is subject to change. Accordingly, the saving in electricity can be of Rs. 12 lakh or Rs. 35 lakh per year and forever. Assuming WACC of MIS Ltd. is 10% and risk-free rate of rate of return is 8%. Decide whether MIS Ltd. should accept the project or wait and see.

Answer:

WN 1: Evaluation of project today:

Particulars	Calculation	Amount
PV of cash inflows	$\frac{21,00,000}{10\%}$	2,10,00,000
Less: Cost of project		-2,50,00,000
NPV of project		-40,00,000

Since NPV is negative, it does not worth to accept the project

WN 2: Analysis after one year:

Particulars	Saving of 12 lacs	Saving of 35 lacs
PV of cash inflows	1,20,00,000	3,50,00,000
Less: Cost of project	-2,50,00,000	-2,50,00,000
NPV of project	-1,30,00,000	1,00,00,000
Rate of return on project [NPV/Cost of project]	-52.00%	40.00%
Probability	0.348	0.652
Expected Value	-45,24,000	65,20,000

- Expected NPV after one year = $-45,24,000 + 65,20,000 = \text{Rs.}19,96,000$
- Thus, it shall be advisable to wait and see as NPV may turn out to be positive after one year

Note: Computation of probability:

- Let us assume P to be the probability of earning return of 40% and (1-P) to be the probability of earning return of -52%
- Risk-free rate of interest is 8% per annum

Price	Probability	Product
40	P	40P
-52	1-P	52P - 52
Total		92P - 52 = 8

$$92P = 60; P = \frac{60}{92} = 0.652$$

- Hence probability of 40% return is 0.652 and probability of -52% return is 0.348

96. Expected value of option [May 2018 MTP, Nov 2010, Nov 2012, May 2014 MTP, May 2015 MTP, May 2022]

You as an investor had purchased a 3 month call option on the equity shares of X Ltd. of Rs.30, of which the current market price is Rs. 560 and the exercise price Rs. 590. You expect the price to range between Rs.540 to Rs.640. The expected share price of X Ltd. and related probability is given below:

Expected Price	540	560	580	600	620	640
Probability	0.10	0.15	0.05	0.35	0.20	0.15

Compute the following:

- ❖ Expected Share price at the end of 3 months.
- ❖ Value of Call Option at the end of 3 months, if the exercise price prevails.
- ❖ In case the option is held to its maturity, what will be the expected value of the call option?

- ❖ Find out the price of the shares quoted at the stock exchange to get the value of the call option as computed in (iii) above.

Answer:

Computation of expected share price and value of call option:

Expected Price	Probability	Product	Intrinsic value	Product
540	0.10	54.00	0.00	0.00
560	0.15	84.00	0.00	0.00
580	0.05	29.00	0.00	0.00
600	0.35	210.00	10.00	3.50
620	0.20	124.00	30.00	6.00
640	0.15	96.00	50.00	7.50
Expected value		597.00		17.00

- Expected share price at end of month 3 = Rs.597.00
- Expected value of call option at end of month 3 = Rs.17.00
- If the exercise price prevails on the maturity date then the share price will be equal to exercise price. If both are same, option will lapse and value of call option will be zero
- Price to be quoted at the stock exchange to get the value of the call option = Rs.590 + Rs.17 = Rs.607

97. Computation of break-even price [May 2016 MTP]

A call option has been entered into by Arnav for delivery of share of X Limited at Rs.460. The expected future prices at the time of expiry of contract are as follows:

Price	Probability
470	0.20
450	0.25
480	0.35
490	0.05
500	0.15

Determine the premium at which Arnav will break even.

Answer:

WN 1: Computation of fair value of option:

Price	Probability	Intrinsic value	Product [Prob x Intrinsic value]
470	0.20	10	2
450	0.25	0	0
480	0.35	20	7
490	0.05	30	1.5
500	0.15	40	6
Fair value of option/Break-even premium			16.50

Part VII - Delta Hedging

98. Delta Hedging:

A trader sold 20 option contracts (2000 options) on a certain stock. The option price is USD 10, the stock price is USD 100 and option delta is 0.6.

- ❖ Suggest a hedge strategy to make the portfolio delta neutral
- ❖ Suppose due to share price increase, the delta changes to 0.65, under a dynamic hedge strategy, what should the trader do?

Answer:

WN 1: Hedge strategy to make portfolio delta neutral:

Security	Number	Delta	Adjusted Delta
Option	-2,000	0.6	-1,200
Shares	1,200	1	1,200
			0

- The above table indicates that the investor should buy 1,200 shares to make portfolio delta neutral

WN 2: Action to be taken under dynamic hedging:

Security	Number	Delta	Adjusted Delta
Option	-2,000	0.65	-1,300
Shares	1,300	1	1,300
			0

- Investor should buy additional 100 shares to make the portfolio delta neutral

99. Delta Hedging:

Find the delta of the following individual positions of a stock X given the delta of call = +1 and of put = -1

- ❖ 4 long calls
- ❖ 2 short puts
- ❖ 6 long puts and long 4 shares
- ❖ 5 short calls and short 5 shares
- ❖ 4 long puts and short 4 shares
- ❖ 3 long calls and long 3 shares

Answer:

Particulars	Calculation	Delta
4 long calls	4 x 1	4
2 short puts	-2 x -1	2
6 long puts and long 4 shares	(6 x -1) + (4 x 1)	-2
5 short calls and short 5 shares	(-5 x 1) + (-5 x 1)	-10
4 long puts and short 4 shares	(4 x -1) + (-4 x 1)	-8
3 long calls and long 3 shares	(3 x 1) + (3 x 1)	6

100. Delta computation:

Calculate delta of an at-the-money six month European call option for a non-dividend paying stock when the risk free rate is 10% per annum and the stock price volatility is 25%. What should be the delta if this is a European put option? Recalculate the delta of the European call and put option if the dividend yield is 4% for the aforesaid stock

Answer:

WN 1: Computation of call and put delta:

- Delta of call option = $N(d_1)$ of Black Scholes model
- Delta of Put option = Call Delta - 1

$$d_1 = \frac{\left(\text{Naturallog} \left(\frac{S_0}{E} \right) + (r + 0.5\sigma^2)t \right)}{\sigma\sqrt{t}}$$

Term	Calculation	Amount
S ₀ (CMP)	Assumed	100
Exercise Price	At the money option and hence CMP will be equal to EP	100
$\frac{S_0}{E}$	$\frac{100}{100}$	1
$\text{Naturallog} \left(\frac{S_0}{E} \right)$		0.0000
$r + 0.5\sigma^2$	$0.1 + 0.5 \times 0.25 \times 0.25$	0.1313
$(r + 0.5\sigma^2)t$	0.1313×0.5	0.0657
$\sigma\sqrt{t}$	$0.25\sqrt{0.5}$	0.1768
d_1	$\frac{0 + 0.0657}{0.1768}$	0.3716
$N(d_1)$	= Prob of 0.37 + 16% of (Prob of 0.38 - Prob of 0.37) = $0.6443 + 16\% \times (0.6480 - 0.6443)$	0.6449
Call Delta		0.6449
Put delta	$0.6449 - 1$	-0.3551

WN 2: Computation of call and Put delta for rework scenario (dividend yield):

Call delta = $N(d_1) \times e^{-yt}$

Put delta = Call delta - 1

Term	Calculation	Amount

S ₀ (CMP)	Assumed	100
Exercise Price	At the money option and hence CMP will be equal to EP	100
$\frac{S_0}{E}$	$\frac{100}{100}$	1
$\text{Naturallog}\left(\frac{S_0}{E}\right)$		0.0000
$r + 0.5\sigma^2$	$(0.1 - 0.04) + 0.5 \times 0.25 \times 0.25$	0.0913
$(r + 0.5\sigma^2)t$	0.0913×0.5	0.0457
$\sigma\sqrt{t}$	$0.25\sqrt{0.5}$	0.1768
d_1	$\frac{0 + 0.0457}{0.1768}$	0.2585
$N(d_1)$	= Prob of 0.25 + 85% of (Prob of 0.26 - Prob of 0.25) = 0.5987 + 85% x (0.06026 - 0.5987)	0.6020
Call Delta	$0.6020 \times e^{-(0.04 \times 0.5)} = \frac{0.6020}{e^{0.02}} = \frac{0.6020}{1.0202}$	0.5901
Put delta	$0.5901 - 1$	-0.4099

101. Portfolio delta hedging:

Consider a financial institution that has the following positions in USD options:

Option	Position	Strike Price	Expiration	Delta
1 lacs call	Long	USD 0.55	3 months	0.533
2 lacs call	Short	USD 0.56	5 months	0.468
50000 put	Short	USD 0.56	2 months	-0.508

Make the portfolio delta neutral. How is hedging portfolio cheaper than hedging individual stocks?

Answer:

WN 1: Hedging on day 0 to make the portfolio delta neutral:

Security	Delta	Weight	Product
Call	0.533	1,00,000	53,300
Call	0.468	-2,00,000	-93,600
Put	-0.508	-50,000	25,400
Underlying asset	1.000	14,900	14,900
Total	0.000		0

- We should buy 14,900 USD on day 0 to make the portfolio delta neutral

WN 2: Hedging at end of month 2 post expiry of 50,000 Put:

Security	Delta	Weight	Product
Call	0.533	1,00,000	53,300
Call	0.468	-2,00,000	-93,600
Underlying asset	1.000	40,300	40,300
Total	0.000		0

- We should buy additional 25,400 USD at end of M2 to make the portfolio delta neutral

WN 3: Hedging at end of month 3 post expiry of 1 lac call:

Security	Delta	Weight	Product
Call	0.468	-2,00,000	-93,600
Underlying asset	1.000	40,300	93,600
Total	0.000		0

- We should buy additional 53,300 USD to make the portfolio delta neutral
- 2,00,000 short call will expire at end of month 5 and post that we should sell available 93,600 USD to make the portfolio delta neutral

Advantages of portfolio hedging:

- Individual hedging is costlier exercise as the company needs to spend cost on each transaction. The company can shift to cheaper hedging alternative of portfolio hedging wherein a single transaction can make the entire portfolio delta neutral

102. Valuation of option and calculation of Delta [Nov 2010]

X Ltd.'s share is currently trading at Rs. 220. It is expected that in six months some if could double or halved (equivalent to a $\sigma=98\%$). One year call option on X Ltd.'s share has an exercise price of Rs. 165. Assuming risk free rate of interest to be 20%, calculate.

(a) Value of call option on X Ltd's share.

(b) Option Delta for the second six month, in case stock price rises to Rs. 440 or falls to Rs. 110.

(c) Now suppose in 6 months the share price is Rs. 110. How at this point we can replicate portfolio of call options and risk-free lending.

Answer:

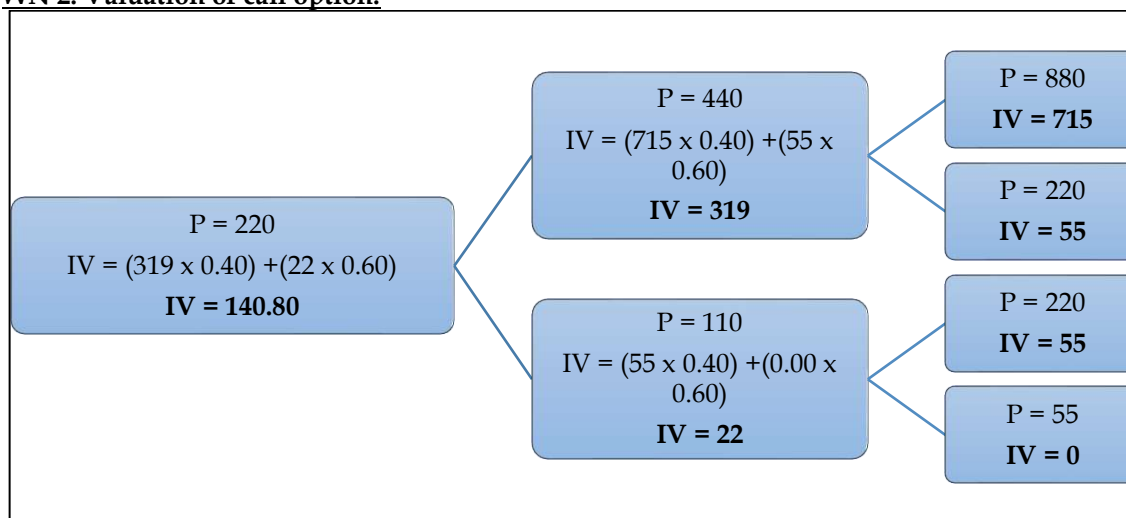
WN 1: Computation of upside and downside probability:

Let us assume p to be the probability of price touching 440 and 1-p to be the probability of price touching 110.

Price	Probability	Product
440	P	440P
110	1-P	110 - 110P
Expected Price		242

- ❖ Interest rate is 20% for a year and hence it will be 10% for 6 months
- ❖ Expected price at end of 6 months will be Rs.242 [$220 + 10\%$]
- ❖ $440P + 110 - 110P = 242$
- ❖ $330P = 132$
- ❖ $P = 132/330 = 0.4$
- ❖ Probability of price touching 440 is 0.400 and probability of price touching 110 is 0.600

WN 2: Valuation of call option:



Note:

- ❖ We have not considered the impact of time value of money in above analysis and the same will be discounted to get the fair value of call

$$\text{Fair value of call} = \frac{140.80}{1.10^2} = 116.36$$

WN 2: Option delta in case stock price touches 440

$$\text{Delta} = \frac{\text{Spread in option price}}{\text{Spread in stock price}} = \frac{715 - 55}{880 - 220} = 1 \text{ Time}$$

WN 3: Option delta in case stock price touches 110:

$$\text{Delta} = \frac{\text{Spread in option price}}{\text{Spread in stock price}} = \frac{55 - 0}{220 - 55} = 0.33 \text{ Times}$$

WN 4: Creation of riskless portfolio if price touches 110 at end of 6 months:

- ❖ Delta of option is 0.33 times. This would mean that option price change would be 0.33 times of the change in share price.
- ❖ Hence a combination of 1 option and 0.33 shares can create a riskless hedge portfolio. Alternatively, a combination of 1 share and 3 options ($1/0.33$) will create a riskless hedge portfolio.

Part VIII – Credit Derivatives**Example of CDS Transaction:**

Let's consider a simple example of a Credit Default Swap (CDS) transaction involving three parties: a company (Company A), a bank (Bank B), and an investor (Investor C).

- **Company A:** This is the underlying company and the Company A issues bonds to raise funds, and these bonds are traded in the market.
- **Bank B:** This is the financial institution that acts as the protection seller in the CDS transaction. It assumes the risk of Company A defaulting on its bond payments.
- **Investor C:** This is the investor who wants to hedge against the risk of Company A defaulting. Investor C buys protection from Bank B in the form of a CDS contract.
- **CDS Contract Agreement:** Investor C approaches Bank B to enter into a CDS contract to hedge against the default risk of Company A. They agree on the terms, including the notional amount, premium (also known as the CDS spread), and maturity date.
- **Notional Exposure:** The notional amount is the hypothetical or reference amount on which the CDS contract is based. It represents the face value of the bonds that Company A has issued. Let's say the notional amount is Rs.10,00,000.
- **Premium (CDS Spread):** Investor C agrees to pay Bank B a periodic premium or spread for the duration of the CDS contract. The premium is typically expressed as a percentage of the notional amount. For example, if the CDS spread is 2%, then Investor C pays Rs.20,000 annually ($\text{Rs.10,00,000} \times 2\%$) to Bank B as the premium.
- **Default Event:** If Company A defaults on its bond payments during the term of the CDS contract, Bank B will be required to compensate Investor C for the loss incurred due to the default.
- **Cash Settlement:** If a credit event (default) occurs, the CDS contract is triggered. Bank B will pay Investor C an amount equal to the notional amount (Rs.10,00,000 in this case) minus the recovery value of the defaulted debt. The recovery value is the percentage of the bond's face value that the investor expects to recover after the default. For example, if the recovery value is 40%, then Bank B would pay Investor C: Rs.6,00,000 [$10,00,000 - 40\%$]
- **Physical Settlement:** This is the traditional method of settlement. It involves the delivery of Bonds or debts of the reference entity by the buyer to the seller and seller pays the buyer the par value. For example, as mentioned above suppose Company A defaults then Bank B will pay Rs.10,00,000 to Investor C and Investor C will deliver Rs.10,00,000 face value of Bonds to Bank B
- **No Default:** If Company A does not default during the term of the CDS contract, Investor C will continue to pay the agreed premium to Bank B, and the contract will expire at the maturity date without any payment for default events.

103. Basic terms

Company A has issued 10% bonds of Rs.50,00,000. Investor A has purchased bonds worth Rs.10,00,000 but is worried about the risk of default. He therefore wants protection against the risk of default and hence has purchased protection from Axis Bank in terms of CDS contract. The CDS spread for the transaction is 1% per annum. Compute the following:

- a) Amount of annual premium to be paid

- b) Company A has defaulted on the debt and the bonds are now trading at 15% of face value. How much settlement would Bank B give to the investor
- c) Company A has not defaulted and the bonds have been redeemed in accordance with debenture terms. Investor A has paid premium for 5 years. How much would the settlement be from Axis Bank to investor A on maturity date?
- d) Another investor wants to buy the protection and has approached Axis Bank for premium and the bank has now quoted a premium of 2.5%. What is the inference on credit quality based on this?

Answer:

Annual premium = $10,00,000 \times 1\% = \text{Rs.}10,000$
Cash settlement: - Company A has defaulted on debt obligations and hence now Axis Bank has to give settlement to investor A - Bonds are trading at 15% of face value and hence recovery rate of the bond is 15% - Cash settlement = $10,00,000 - 15\% = \text{Rs.}8,50,000$
Repayment of debt: Company A has repaid debt on time and there has been no default. In this case there will be no settlement from Axis bank to investor A. Premiums paid for five years will not be returned as the same as paid for bearing the credit risk.
Increase in premium: - Premium percentage has increased from 1% to 2.5%. Higher premium basically indicates deterioration in credit quality of underlying asset (Bonds of Company A) - Premium increase basically is due to increase in default risk. Axis Bank would now be needing a higher compensation as they believe there has been a deterioration in credit quality

104. Index CDS

Gill Westmore is the fixed income portfolio manager for Allied Insurance. Westmore has bought protection using a 2-year CDS on CDX-IG (125 constituent) index. The notional is Rs.200 crores. Company X, an index constituent defaults and trades at 25% of par. Compute the payoff on the CDS on account of default of X and the notional principal of the CDS after default?

Answer:

Notional principal of company X = $200 \text{ crores} / 125 = \text{Rs.}1.6 \text{ crores}$
Settlement amount = $1.6 \text{ crores} - 25\% = \text{Rs.}1.2 \text{ crores}$
Notional principal of CDS post default = $200 \text{ crores} - 1.6 \text{ crores} = \text{Rs.}198.4 \text{ crores}$

105. Cash settlement

The Rose Foundation enters into a 2-year CDS on a notional amount of Rs.10,00,000 of 5-year bonds issued by the Crescent Corporation as a protection buyer. The swap specifies an annual premium of 55 basis points and cash settlement. Assume that the Crescent Corporation defaults at the end of the first year when the bonds are trading at 60 paise on one rupee. Calculate the cash flows associated with the credit default swap.

Answer:

- The Rose Foundation would pay Rs.5,500 ($0.0055 \times \text{Rs.}10,00,000$) at the beginning of the first year to the seller of the CDS.
- If Crescent defaults after one year, the Rose Foundation would receive a payment of Rs.4,00,000 [$10,00,000 - 60\%$]. This would basically represent the decline in value of bonds

106. Profit/loss due to change in credit spread

An investor buys Rs.10,00,000 of five-year protection and the CDS contract has a duration of four years. The company's credit spread was originally 500 bps and the same has now widened to 800 bps.

You are required to answer the following:

- Does the investor (credit protection buyer) benefit or lose from the change in credit spreads
- Estimate the CDS price change and estimated profit to the investor

Answer:

Part (a):

- Credit protection buyer will see a profit with the change in credit spread. This is because contracted premium is 500 bps and the current premium is 800 bps.
- Hence, he would gain due to the increase in the credit premium

Part (b):

- Price change of CDS = Change in spread $\times$ Duration = $3\% \times 4 = 12\%$
- Profit to the investor = $12\% \times 10,00,000 = \text{Rs.}1,20,000$

107. CDS spread through POD and recovery rate

A company issues one-year bond and the same has a probability of default of 2%. The expected recovery rate is 20%. How much would the CDS spread for this bond?

Answer:

- CDS spread = Probability of default $\times$ (1 - Recovery rate)
- CDS spread = $2\% \times (1 - 20\%) = 1.60\%$

108. Probability of Default and Probability of Survival

Assume that a company's hazard rate is a constant 8% per year or 2% per quarter. An investor sells five-year CDS protection on the company with the premiums paid quarterly over the next five years. You are required to compute:

- What is the probability of survival for first quarter?
- What is the conditional probability of survival for the second quarter?
- What is the probability of survival through second quarter?

Answer:

Probability of survival for first quarter = 1 - Probability of default of first quarter Probability of survival for first quarter = $1 - 2\% = 98\%$ Note: Hazard rate is basically the risk of default
Conditional probability of survival for second quarter is also 98% because the hazard rate is constant at 2%. In other words, conditional on the company having survived the first quarter, there is a 2% probability of default in the second quarter
• Probability of survival in first two quarters = Survival in first quarter $\times$ Survival in second quarter • Probability of survival in first two quarters = $98\% \times 98\% = 96.04\%$ • Alternatively, we can also say that 3.96% is the probability of default in the first two quarters

109. Upfront premium:

5-year, 5% Zillon Corp. bonds currently trade at Rs.980 reflecting credit spread of 3%. A 5-year CDS for Zillon bonds has a coupon rate of 5%. The duration of the CDS = 4. Compute the upfront payment made/received by the protection buyer on a Rs.40,00,000 notional CDS?

Answer:

- CDS spread basically represents the credit risk on a CDS and hence the ideal premium of CDS is 3%
- CDS coupon is the actual premium paid on CDS and the same in this case is 5%. Hence protection buyer is going to pay higher premium than what is needed and hence he would be given an initial upfront payment
- Upfront receipt by protection buyer = $[5\% - 3\%] \times 4 \text{ years} \times 40,00,000 = \text{Rs.}3,20,000$



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This book wouldn't have been possible without a strong support group. Firstly, my parents (**Ramesh Jain and Leela Jain**) who have not just supported me in all my endeavours but also have been a constant source of inspiration. Secondly my dearest wife (**Aarthi Jain**) whose constant support and motivation kept me going. Thirdly, my family members and well-wishers who have always believed in me.

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Any suggestions/feedback will be highly appreciated and incorporated in future editions.

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Chapter 10 – Foreign Exchange Exposure and Risk Management**1. Explain the Role of SWIFT in Foreign Exchange?**

- Foreign Exchange Dealers use SWIFT (Society for Worldwide Interbank Financial Communication), a messaging system founded in 1973, **for business transactions**.
- With offices worldwide, it uses a dedicated computer network system for fund transfers.
- To avoid miscommunication, SWIFT **assigns 3 lettered codes to each country's currency**, ensuring international cross-border communication. Example: USD for US Dollar and INR for Indian Rupee
- SWIFT is a **standardized communication system for financial transactions**, and is not a transaction settlement system.
- SWIFT plays an important role in Foreign Exchange dealings because of the following reasons
 - In addition to validation statements and documentation it is a form of quick settlement as **messaging takes place within seconds**.
 - Security and reliability helps to **reduce Operational Risk**.
 - Operational efficiencies and reduced costs due to **standardised transaction**
 - It also ensures **full backup and recovery system**.
 - Acts as a catalyst that brings financial agencies to **work together in a collaborative manner** for mutual interest

2. What is a payment gateway?

- A Payment Gateway is a secure virtual mode for transferring cash, authenticating and routing payment details. It collects and sends payments to **banks or e-commerce sites, ensuring authorization and approval**.
- The gateway uses encrypted data from the buyer's PC/Mobile Phone/Tablet to the Point of Sale (POS) and **completes the transaction with a reference number**.
- **Benefits of Payment Gateway:** A Payment Gateway offers 24/7 convenience, real-time card authorization, efficient transaction processing, multiple payment options, risk mitigation, real-time reports, customer refund facility, and secure servers. It eliminates complex software and data maintenance, collects bulk data cost-efficiently, and provides multiple host interfaces. It offers comprehensive administrative control and customer support.
- **Challenges faced by Payment Gateway:** Payment gateways face challenges like insufficient customer accounts (customer account not available with the bank supporting payment gateway), limited bank networks, reliability issues, and customer trust issues, hindering growth.
- **International Payment Gateways:** International Payment Gateways offer global/multi-currency payments and multiple-language interfaces, **increasing customer conversion rates**. These gateways enable merchants to accept international payments in their native currency, making transactions easier and enabling customers to easily benchmark prices.

3. Write short note on Nostro, Vostro and Loro Account? [Nov 2020]

- ❖ Banks maintain three types of current accounts in order to facilitate quick transfer of funds in different currencies. These accounts are **Nostro, Vostro and Loro accounts meaning “our”, “your” and “their”**
- ❖ A bank's foreign currency account maintained by the bank in a foreign country and in the home currency of that country is known as **Nostro Account or “our account with you”**. For example, An Indian bank's Swiss franc account with a bank in Switzerland.
- ❖ **Vostro account** is the local currency account maintained by a foreign bank/branch. It is also called **“your account with us”**. For example, Indian rupee account maintained by a bank in Switzerland with a bank in India.
- ❖ The **Loro account** is an account **wherein a bank remits funds in foreign currency to another bank for credit** to an account of a third bank.

4. Explain Merchant Rate and Interbank Rate?

- ❖ In foreign exchange market, **banks consider customers as ‘merchants’** for historical reasons. **Exchange rates applied to all types of customers** including that for converting inward remittance in USD to INR are called **merchant rates** as against the rates quoted to **each other by banks** in the interbank market, which are called **interbank rates**.
- ❖ Exchange margin will be added/subtracted to/from the interbank rate to arrive at the merchant rate for the customer

5. What are the techniques for exchange rate forecasting?

- ❖ **Technical Forecasting:** It involves the use of historical data to predict future values. For example, time series models. Speculators may find the models useful for predicting day-to-day movements. However, since the models typically focus on the near future and rarely provide point or range estimates, they are of limited use to MNCs.
- ❖ **Fundamental Forecasting:** It is based on the fundamental relationships between economic variables and exchange rates. For example, subjective assessments, quantitative measurements based on regression models and sensitivity analyses. In general, fundamental forecasting is limited by
 - the uncertain timing of the impact of the factors,
 - the need to forecast factors that have an immediate impact on exchange rates,
 - the omission of factors that are not easily quantifiable, and
 - changes in the sensitivity of currency movements to each factor over time
- ❖ **Market-Based Forecasting:** It uses market indicators to develop forecasts. The current spot/forward rates are often used, since speculators will ensure that the current rates reflect the market expectation of the future exchange rate
- ❖ **Mixed Forecasting:** It refers to the use of a combination of forecasting techniques. The actual forecast is a weighted average of the various forecasts developed

6. What are the factors that affect foreign exchange rate?

- Inflation rate
- Interest rate
- **Deficit/Surplus on Capital/Current Account:** Deficit in Current Account leads to depreciation of currency, the surplus results in appreciation of home currency. In case of Capital Account if net inflow is positive then home currency is appreciated and if it is negative then home currency depreciates because of oversupply
- **Trade Barriers:** Generally, with the increase in trade barriers or quota restrictions for import of goods from any country the value of own currency appreciates in the long run. For example, if India puts some restriction on import from China for any goods, then demand for Indian goods will be increased and will be sold for higher price
- **Intervention by Central Bank:** Sometimes to regulate the prices of foreign exchange the Central Bank of or Monetary Authorities of country intervenes by selling or buying foreign exchange in/from the Market
- **Government Controls:** Government Controls such as restrictions on FDI, FPI or repatriation of Foreign Exchange also affects the foreign exchange rates.
- **Expectations (Band Wagon Effect):** Sometimes speculations by the speculators on any currency can have a substantial impact on exchange rate. When a dominant speculator in Foreign Exchange market expects a fall in value of any currency and he starts taking short position in the same currency, other speculators may also follow the same path. This will ultimately result in fall in the value of same currency.

7. What are the various participants in foreign exchange market?

- ❖ **Non-bank Entities:** Many multinational companies exchange currencies to meet their import or export commitments or hedge their transactions against fluctuations in exchange rate. Even at the individual level, there is an exchange of currency as per the needs of the individual.
- ❖ **Banks:** Banks also exchange currencies as per the requirements of their clients.
- ❖ **Speculators:** This category includes commercial and investment banks, multinational companies and hedge funds that buy and sell currencies with a view to earn profit due to fluctuations in the exchange rates.
- ❖ **Arbitrageurs:** This category includes those investors who make profit from price differential existing in two markets by simultaneously operating in two different markets.
- ❖ **Governments:** The governments participate in the foreign exchange market through the central banks. They constantly monitor the market and help in stabilizing the exchange rates

8. What are the types of exposure in foreign exchange market?

Transaction Exposure	It measures the effect of an <u>exchange rate change on outstanding obligations</u> that existed before exchange rates changed but were settled after the exchange rate changes. Thus, it deals with cash flows that result from <u>existing contractual obligations</u>

Translation exposure	Translation exposure, also called as accounting exposure , is the potential for accounting derived changes in owner's equity to occur because of the need to "translate" foreign currency financial statements of foreign subsidiaries into a single reporting currency to prepare worldwide consolidated financial statements
Economic Exposure	It refers to the extent to which the economic value of a company declines due to changes in exchange rate. It is the overall impact of exchange rate changes on the value of the firm

9. What is foreign exchange risk management and state its importance?

- Foreign exchange risk management is crucial for **businesses handling international transactions**, identifying, assessing, and mitigating risks.
- It helps to protect against volatility, reduce costs, gain a competitive advantage, improve cash flow, and ensure compliance with regulations

Importance of foreign exchange risk management:

- Protection against volatility:** Foreign exchange risk management protects businesses from volatility by **locking in exchange rates** in advance, ensuring stability and certainty in financial planning.
- Cost reduction:** Effective foreign exchange risk management can help businesses reduce costs **associated with foreign transactions**. By minimizing currency exchange rate losses and reducing the need for hedging, businesses can save significant amounts of money in the long run.
- Competitive advantage:** Companies managing foreign exchange risks gain competitive advantage by offering competitive prices and attractive payment terms.
- Improved cash flow:** Foreign exchange risk management improves cash flow by increasing visibility and predictability in international transactions, ensuring sufficient funds for obligations.
- Compliance with regulations:** Many countries have regulations in place that require businesses to **manage their foreign exchange risks**. Failure to comply with these regulations can result in significant fines and penalties. **Effective foreign exchange risk management can help businesses to stay in compliance with these regulations and avoid potential legal issues.**

10. Explain Natural Hedging strategy to mitigate exchange rate risk?

- Though there are a range of hedging instruments that can be used to reduce risk but often Exporters use Natural Hedging Strategy to mitigate **transaction exposure risk by availing different Short Term Foreign currency loans i.e. Pre-Shipment Credit in Foreign Currency (PCFC)/ Foreign Currency Non-Resident Account (FCNR B) Loans** because of following two major benefits:
 - PCFC is available to exporters for exporting their goods in Foreign Currencies. This product is available at **cheaper rate** compared to other Domestic Currency rates.
 - Secondly by availing PCFC, one can hedge foreign currency transaction risk against exports receivables by **settling exports collection against PCFC loans outstanding.**

11. What is a non-deliverable forward contract?

- ❖ A cash-settled, short-term forward contract on a **thinly traded or non-convertible foreign currency**, where the profit or loss at the time at the settlement date is calculated by taking the **difference between the agreed upon exchange rate and the spot rate at the time of settlement**, for an agreed upon notional amount of funds.
- ❖ All NDFs have a fixing date and a settlement date. The fixing date is the date at which the difference between the prevailing market exchange rate and the agreed upon exchange rate is calculated. The **settlement date is the date by which the payment of the difference is due to the party receiving payment.**
- ❖ NDFs are commonly quoted for time periods of **one month up to one year**, and are normally quoted and settled in U.S. dollars. They have become a popular instrument for corporations seeking to hedge exposure to foreign currencies that are not internationally traded

12. Distinguish between options and futures?

Options	Futures
Only the seller (writer) is obliged to perform	Both the parties are obligated to perform
Premium is paid by the buyer to the seller at the inception of the contract	No premium is paid by any party.

Loss is restricted while there is unlimited gain potential for the option buyer	There is potential/risk for unlimited gain/loss for the futures buyer.
An American option contract can be exercised any time during its period by the buyer.	A futures contract has to be honoured by both the parties only on the date specified

13. What is currency swap?

Currency swaps involve an **exchange of liabilities between currencies**. A currency swap can consist of three stages:

- ❖ **A spot exchange of principal:** this forms part of the swap agreement as a similar effect can be obtained by using the spot foreign exchange market.
- ❖ **Continuing exchange of interest payments during the term of the swap:** this represents a series of forward foreign exchange contracts during the term of the swap contract. The contract is typically fixed at the same exchange rate as the spot rate used at the outset of the swap.
- ❖ **Re-exchange of principal on maturity**

A currency swap has the following benefits:

- ❖ Treasurers can **hedge currency risk**.
- ❖ It can provide **considerable cost savings**. A strong borrower in the Japanese Yen market may be interested in borrowing in the American USD markets where his credit rating may not be as good as it is in Tokyo. Such a borrower could get a better US dollar rate by raising funds first in the Tokyo market and then swapping Yen for US dollars.
- ❖ The swap market **permits funds to be accessed in currencies**, which may otherwise command a high premium.
- ❖ It offers **diversification of borrowings**

14. What are the strategies for exposure management?

Low Risk: Low Reward - All exposures hedged	This option involves <u>automatic hedging of exposures</u> in the forward market as soon as they arise, irrespective of the attractiveness or otherwise of the forward rate
Low Risk: Reasonable Reward - Selective hedging	This strategy requires <u>selective hedging of exposures</u> whenever forward rates are attractive but keeping exposures open whenever they are not.
High Risk: Low Reward -All exposures left unhedged	Perhaps the worst strategy is to leave all exposures unhedged. The risk of destabilization of cash flows is very high. The merit is zero investment of managerial time or effort
High Risk: High Reward - Active Trading	This strategy involves <u>active trading in the currency market through continuous cancellations</u> and re-bookings of forward contracts. With exchange controls relaxed in India in recent times, a few of the larger companies are adopting this strategy

15. "Netting helps in minimizing the total value of intercompany fund flows". EXPLAIN. [May 2022 MTP]

Yes to some extent the given statement is correct as it is a technique of optimising cash flow movements with the combined efforts of the subsidiaries thereby reducing administrative and transaction costs resulting from currency conversion. There is a co-ordinated international interchange of materials, finished products and parts among the different units of MNC with many subsidiaries buying /selling from/to each other.

Advantages derived from netting system includes:

- Reduces the number of cross-border transactions between subsidiaries thereby decreasing the overall administrative costs of such cash transfers
- Reduces the need for foreign exchange conversion and hence decreases transaction costs associated with foreign exchange conversion.
- Improves cash flow forecasting since net cash transfers are made at the end of each period
- Gives an accurate report and settles accounts through co-ordinated efforts among all subsidiaries.

Theory to Solve Problems

Why exchange rate is required?

1. Export	Receive dollars, convert to INR	Hence exchange rate is important
2. Import	Buy dollars and pay dollars	Hence exchange rate is important
3. Global finance	Raise money globally, receive dollars and convert to INR	Hence exchange rate is important
4. Global investment	Buy dollars and pay investment	Hence exchange rate is important

Nature of quotation:

- ❖ Exchange rate is that rate at which one currency is exchanged (bought & sold) for another.
- ❖ **Example:** Rs.12 per apple is the exchange rate between apple and rupees. Rs. is the price and Apple is the product.
- ❖ Rs.65 per dollar is the exchange rate between dollar and rupees. Here Rs. is the price and dollar is the product

Direct quote Vs indirect quote:

- ❖ Direct quote expresses the exchange rate as home currency per unit of foreign currency. Rs.65 per dollar is the direct quote in India.
- ❖ Indirect quote expresses the exchange rate as foreign currency per unit of home currency. Rs.65/dollar is the indirect quote in USA.
- ❖ In short an exchange rate which is a direct quote in one country is an indirect quote in another country.

Conversion of direct quote into indirect quote:

- ❖ A direct quote and an indirect quote are an inverse of each other.
- ❖ Indirect quote = $1/\text{direct quote}$

Price and Product:

- ❖ In a direct quote home currency is the price and foreign currency is the product
- ❖ In an indirect quote foreign currency is the price and home currency is the product
- ❖ In either case the first currency is the price and the second currency is the product
- ❖ To decide price & product it would be good to view every quote as a direct quote. This is because what is indirect for someone is direct for someone else.

American Term Versus European Terms:

- ❖ An exchange rate which is in the direct mode in USA is said to be in American terms. Example: USD/GBP, USD/INR
- ❖ An exchange rate which is in the indirect mode in USA is said to be in European terms. Example: GBP/USD, INR/USD
- ❖ Internationally all exchange rates are expressed with reference to USD
- ❖ All international quotes except Pound are expressed in European terms [Indirect mode in USA]

Concept: Bid, Ask, Spread and middle rates

Term	Meaning
1. Bid rate	The rate at which the bank buys the product
2. Ask rate	The rate at which the bank sells the product
3. Spread rate	The difference between bid and ask rate
4. Middle rate	Simple average of bid and ask rate. This is used primarily for statistical purpose
5. Spread %	Spread is calculated as a percentage of offer rate when the same is expressed in percentage

Two way quote:

- In a two way quote Bid precedes Ask. Rs.62.50-62.80 per Dollar means that bank is buying dollar at 62.50 and the bank is selling dollar at 62.80.

Quote in decimals:

- The numbers after the decimal are referred to as PIPS.
- If the numbers before the decimal in bid and ask is identical then while quoting the ASK portion of the two way quote only the PIP is quoted. Example: Rs.67.80 – 67.90 per USD is quoted as Rs.67.80-90.
- If the numbers in the PIP are same those numbers are not quoted in the two way quote in case of ASK. Example Rs.12.315-70 / rand mean 12.315-12.370.

Cross rates:

- ❖ Cross rate is the rate which does not contain USD in it. Example: Rs./YEN, Rs/GBP etc/
- ❖ Straight rate is the rate at which has USD in it. Example: Rs/USD, USD/GBP.

Cross multiplication:

- ❖ Cross multiplication is the procedure by which when two exchange rates are given a third exchange rate is ascertained.

Three rules of cross multiplication

$\text{Bid} \left(\frac{A}{C} \right) = \text{Bid} \left(\frac{A}{B} \right) \times \text{Bid} \left(\frac{B}{C} \right)$
$\text{Ask} \left(\frac{A}{C} \right) = \text{Ask} \left(\frac{A}{B} \right) \times \text{Ask} \left(\frac{B}{C} \right)$
$\text{Bid} \left(\frac{A}{B} \right) = \frac{1}{\text{Ask} \left(\frac{B}{A} \right)}$
$\text{Ask} \left(\frac{A}{B} \right) = \frac{1}{\text{Bid} \left(\frac{B}{A} \right)}$

Forward rate:

- ❖ Forward rate is the rate that is contracted today for the exchange of currencies at a specified future date
- ❖ In contrast spot rate is the rate at which the currencies are exchanged today
- ❖ The forward rate can be either expressed either as
 - Outright forward rate
 - Swap rate
- ❖ The forward differential is called as the swap rate. Example: Spot rate: Rs.62/USD; Forward Rs.64/USD; Swap = Rs2/USD

Spot rate:

- ❖ Like spot rate which has both bid & ask rate, Forward too has a bid and ask rate, consequently there will be a swap bid and swap ask.

	Spot	Forward	Swap
BID	P	R	R-P
ASK	Q	S	S-Q
Spread	Q-P	S-R	

Rules:

- ❖ In a direct quote if forward rate is greater than the spot rate then the foreign currency is appreciating (at a premium). For example if spot rate is 104 YEN/USD and forward is 106 YEN/USD then USD is appreciating.
- ❖ In a direct quote if forward rate is less than spot rate then the foreign currency is depreciating (at a discount). If spot is 110 YEN/USD and forward is 105 YEN/USD then USD is depreciating.
- ❖ If one currency is appreciating with reference to the other then the other is depreciating with reference to the first currency.
- ❖ If forward bid in points is less than forward ask in points, then forward rate of foreign currency is at a premium.
- ❖ If forward bid in points is more than forward ask in points, then forward rate of foreign currency is at a discount
- ❖ Swap points can be converted into an outright rate by
 - If **ascending order**, Add the swap points to the spot rate

- If **descending order**, deduct the swap points from the spot rate
- ❖ If the swap points for the desired forward period are not given then the same is to be computed using interpolation method. For example if the swap points for 1, 2 and 3 months are given, then the swap points for 2.5 months can be computed by using interpolation technique on 2 and 3 months swap points

Calculation of % of appreciation/depreciation:

The price of a bottle of coke is Rs.10 today and is expected to be Rs.11, 6 months from now. Compute appreciation/depreciation %?

In the case of a direct quote

Particulars	Formula
For the Product Currency	$\frac{\text{Forward rate} - \text{Spot rate}}{\text{Spot rate}} \times \frac{12}{m} \times 100$
For the Price Currency	$\frac{\text{Spot rate} - \text{Forward rate}}{\text{Forward rate}} \times \frac{12}{m} \times 100$

Interest rate parity theory:

- ❖ High interest rates in a country will be offset by depreciation in a currency of that country.
 - Example: If interest rate in India is 5 percent and that in USA is 2 percent then the rupee is expected to depreciate against the dollar.
 - Example: If interest rate in India is 6 percent and that in England is 9 percent then the dollar will depreciate against the rupee

Formula	$\frac{1 + R_h}{1 + R_f} = \frac{F_1}{e_0}$
R_h = Risk free rate of home country R_f = Risk free rate of foreign country F_1 = Forward rate e_0 = Spot rate	

- ❖ If the above equilibrium does not hold good, arbitrage opportunities will open up as a result of which over a period of time the above equilibrium will start holding hold.
- ❖ The interest rates must be expressed for the same period as the forward period.
- ❖ To arrive at the forward rate:
 - Add the appreciation percent of the product to the spot rate
 - Deduct the depreciation percent of the produce from the spot rate

Arbitrage:

- ❖ Arbitrage involves play in exchange rate differentials. This happens when a product is quoted at two different prices in two different markets.
 - Space arbitrage means buying and selling at the same time in two different markets (bank A and bank B)
 - Time arbitrage means entering into contract today to buy & sell in two different period either in the same bank or different bank

Steps in case of space arbitrage:

- ❖ Step 1: Express the exchange rate in different banks in same mode (currency A/currency B)
- ❖ Step 2:
 - Buy from the bank which has the lower ask rate
 - Sell to bank which has the higher bid rate
- ❖ Step 3: If the result of step 2 is gain, arbitrage exist.

Steps in case of time arbitrage:

- ❖ Time arbitrage means buying in one market (spot or forward) and selling in another market (spot or forward)
- ❖ Step 1: Compute fair home interest rate using IRPT formula. Home in this would be the first currency in the pair of currencies.
- ❖ Step 2: Identify whether arbitrage exists and record the flow of money as per the following details:

❖ Actual $R_h < \text{Fair } R_h$	❖ From home to foreign
❖ Actual $R_h = \text{Fair } R_h$	❖ No arbitrage

❖ Actual $R_h > \text{Fair } R_h$

❖ From Foreign to Home

- ❖ Show how arbitrage gain works
 - Borrow in the currency of the country from which money flow in
 - Convert @ spot rate into the other currency
 - Invest the converted amount
 - Take forward cover
 - Realize the investment along with the interest thereon
 - Reconvert @ the forward rate
 - Repay the principal along with the interest thereon
 - Compute arbitrage gain

Time arbitrage (Bid rate not equal to ask rate)

- ❖ In this case instead of using a detailed formula, we will first check whether there is arbitrage in borrowing from one country and then check whether there is arbitrage in borrowing from another country.
- ❖ While converting we must be clear about selecting the bid or ask rate as the case may be
- ❖ While reconverting we must appropriately select the bid or ask rate as the case may be and this should be kept in mind while taking the forward cover also.

Purchasing power parity theory:

- ❖ High inflation rate in a country is offset by depreciation in a currency of that country.
 - Example: If the price of bike in India is Rs.50,000 and the same in USA is USD 1000. Then the exchange rate should be Rs.50/USD. If the exchange rate is not Rs.50, then arbitrage opportunities will open up.
 - If the inflation for the bike is 5 percent in India and 2 percent in USA, the price one year later in India will be Rs.52500 and USD 1020 respectively. The exchange rate will therefore be Rs.51.47 USD.
 - The rupee has depreciated against the dollar because the inflation rate in India is higher than the rate in USA.

Formula	$\frac{1 + I_h}{1 + I_f} = \frac{F_1}{e_0}$
I_h = Inflation rate of home country I_f = Inflation rate of foreign country F_1 = Forward rate e_0 = Spot rate	

Risk Management:**Technique No.1 - Currency Invoicing:**

- ❖ The exchange rate risk is eliminated if:
 - In case of exports the invoicing is in home currency
 - In case of imports invoicing in home currency
- ❖ Currency invoicing does not eliminate the exchange rate risk in a transaction. It only transfers the risk to the counterparty
- ❖ If the counterparty is unwilling to accept the invoicing strategy an insistence on home currency invoicing can lead to loss of business

Principle: Which invoicing to do

- ❖ The decision on whether to do home currency invoicing or foreign currency invoicing depends on whether the foreign currency is expected to appreciate or depreciate
- ❖ The decision on invoicing will depend on which alternative will lead to higher inflow of INR in case of exports and will lead to lower INR outflow in case of imports
- ❖ The above points are relevant only if the company wants to take advantage of exchange rate risk
- ❖ If the company wants to avoid exchange rate risk then it should invoice in home currency

Technique No.2 - Leading & Lagging

- ❖ The term lead means "NOW" and the term lag means "LATER"

- ❖ Leading a receipt means receiving payment now and lagging a receipt means receiving payment later
- ❖ Leading a payment means making payment now and lagging a payment means making payment later
- ❖ The company should choose an option which leads to higher inflow of INR in case of receivables and lower outflow of INR in case of payables

Technique No.3 – Netting:

- ❖ Netting refers to the process by which dues receivable and dues payable between two parties are set off against each other
- ❖ This would require
 - The receivable and payable are converted to the same currency if they are not in same currency
 - They mature on the same date

Types of Netting:

- ❖ Bilateral netting – Involves two parties only
- ❖ Multilateral netting – Involves more than 2 parties

Note: Multilateral netting is likely to be feasible only amongst group companies because a company might not like the other company to know at to which company it deals with

Technique 4 - Forward contract:

When to take forward contract:

- The decision is dependent on
 - Whether you are an importer or an exporter
 - Whether the forward rate will be greater than the expected spot rate on the date of maturity of the forward cover
- Forward cover will be taken if
 - In the case of importer it results in payment of Lower INR
 - In the case of exporter it results in receipt of higher INR

Situation	Exporter	Importer
Forward rate > expected spot rate	Take FC	Exposed
Forward rate < expected spot rate	Exposed	Take FC

Cancellation of forward contract:

- A forward contract can be cancelled if a customer so desires
- This would be taking a position opposite to that of the original position
- The cancellation can be done either on due date or before the due date

Step 1: Identify original position

- Exporter – Sell forward
- Importer – Buy forward

Step 2: Take opposite position

- Applicable rate: Spot if you come on due date and forward if you come early
- No of months forward: No of months by which we are early

Step 3: Amount of settlement – Compare the new rate and the old rate and arrive at the amount of settlement.

Honour of forward contract:

- ❖ A forward contract can be honoured either on due date or early
- ❖ If honour takes place on due date, no further transaction is required except the exchange of currencies at agreed rates
- ❖ If honour happens early following steps are involved
 - A. Identify original position – Forward
 - B. Identify opposite position – Forward

- C. Take new position – Spot
- D. Compute effective rate $(A+B+C)$
- E. Loss/gain = Original rate – effective rate

Roll over of a forward contract:

- Roll over of a forward contract can take place either
 - Early or
 - On due date
- Roll over involves
 - Identifying the original position
 - Entering into opposite position
 - Entering into new position

Extension of contract when customer doesn't appear on due date:

Cancellation Rate	Spot rate + margin on the date on which customer appears for cancellation
Amount payable by the customer	Difference between customer's original customer rate and cancellation rate as calculated above
Swap loss	It is an amount paid by bank due to cancellation by customer to another bank in the interbank channel. Bank generally does a swap by taking 1 transaction in spot and taking cover by a reverse position in the immediate forward rate. All this is done on due date
Interest on outlay of funds	Bank will charge interest to the customer on the cancellation charges paid by bank by cancelling contract on due date. It is calculated on banks original covered rate and the reverse rate on the maturity date. Interest is calculated for the period of disappearance of the customer from the due date
Total cost to customer	Cancellation charges + Swap loss + Interest on outlay of funds

Money market hedge:

- Money market hedge involves creating a matching dollar liability for a dollar asset for an exporter and vice versa for an importer.

Steps in the case of exporter:

- Step 1: Identify that a foreign currency receivable exists
- Step 2: Borrow foreign currency such that the amount borrowed along with interest thereon mature in value to the foreign currency asset of Step 1
- Step 3: Convert the foreign currency borrowed in step 2 into home currency
- Step 4: Invest the home currency for a period maturing on the date when the foreign currency receivable of step 1 matures
- Step 5: Realize on the maturity value of the home currency investment of step 4 along with investment thereon.
- Step 6: Collect the foreign currency receivable of step 1 and repay the foreign currency liability and interest thereon

Steps in the case of importer:

- Step 1: Identify that a foreign currency liability exists
- Step 2: Identify the amount to be invested to create a foreign currency asset
- Step 3: Borrow money in Home currency (Step 2 * conversion rate)
- Step 4: Convert the value of step 3 to foreign currency
- Step 5: Invest the foreign currency of step 4
- Step 6: Realize the investment along with interest thereon
- Step 7: Settle foreign currency liability of step 2 with realization of step 6
- Step 8: Repay the home currency borrowing along with interest thereon

Miscellaneous areas:

Nostro, Vostro and Loro account:

Type of account	Meaning	Example
Nostro account	A bank's foreign currency account maintained by the bank in a foreign country and in the home currency of that country	ICICI Bank having a \$ account with CITI Bank USA
Vostro account	Local currency account maintained by a foreign bank/branch	CITI Bank USA having an INR account with ICICI Bank, India
Loro account	Loro account is an account wherein a bank remits funds in foreign currency to another bank for credit to an account of a third bank	

Exchange position versus cash position:

- ❖ Exchange position refers to the extent of overbought/oversold position of a foreign currency by a bank
- ❖ Cash position refers to the actual foreign currency balance maintained in a Nostro account by a bank

Transaction affecting Exchange position and cash position:

Transaction	Exchange position	Cash position
Immediate cash flow (Telegraphic transfer)	Yes	Yes
Demand draft	Yes – Sale Transaction	No. Will be impacted only when the draft is realized
Bills purchase	Yes – Buy Transaction	No. Will be impacted only when the bill is realized
Forward purchase/sale	Yes	No. Will be impacted only on delivery

Note:

- ❖ Exchange position records all purchase and sale of foreign currency irrespective of cash flow.
- ❖ Cash position is impacted only when the cash flow happens for a transaction

Currency futures:

- ❖ A futures contract gives the right as well as an obligation to buy/sell a currency at a specified rate on the future date

Futures mechanism:

- ❖ **Day 1:** Enter into a futures contract to buy/sell a currency at a specified rate. The exchange rate will be different in the spot market and futures market
- ❖ **Maturity date:**
 - Realize/pay the foreign currency amount using the spot rate in the cash market
 - Calculate gain/loss on futures position = (Realization using originally contracted rate – Payment using today's futures rate)

Note: The above gain/loss has been calculated on the assumption that company sells the foreign currency initially.

Practical Problems**Overview:**

- Part I – Basics of International Finance
- Part II – Premium/discount and appreciation/depreciation
- Part III – IRPT and PPT
- Part IV – Arbitrage
- Part V – Currency Invoicing
- Part VI – Leading and Lagging
- Part VII – Netting
- Part VIII – Forward Contract

- Part IX – Money Market Hedge
- Part X – Exchange Position and Cash Position
- Part XI – Currency Futures and Options
- Part XII – Currency Swaps
- Part XIII – Multiple Forex Hedging Strategies

Part I – Basics of International Finance

1. Direct & Indirect quote

A Mumbai banker has given the following quotes. Identify whether they are direct or indirect. For each direct quote give the corresponding indirect quote and vice versa

Currency	Rate	Currency
Danish Kroner	8.8438	Rs. per kroner
AUD	0.03038	AUD per Rs
UAE Dirham	14.3038	Rs. per dirham
SA Rand	7.08	Rs per rand
Euro	0.015	Euro per Re
Pounds	82.0385	Rs. per pound

Answer:

- We are analyzing from the point of view of Mumbai banker and hence any quote which has INR(home currency) as the first currency in the quote will be direct quote

Given Quote	Nature	Other Quote
INR 8.8438/DKR	Direct	DKR 0.1131/INR
AUD 0.03038/INR	Indirect	INR 32.9164/AUD
INR 14.3038/AED	Direct	AED 0.0699/INR
INR 7.08/Rand	Direct	Rand 0.1412/INR
EUR 0.015/INR	Indirect	INR 66.67/EUR
INR 82.0385/GBP	Direct	GBP 0.0122/INR

2. Spot the rate

Column 1 gives the nature of the quote for the currency named in column 3 in the city named in column 4. Find the quote named in column 5 for the city named in column 6

1	2	3	4	5	6
Quote	Rate	For	City	Quote	City
Direct	1.43	GBP	New York	Direct	London
Direct	67.57	Euro	Chennai	Indirect	Rome
Indirect	11.08	Pound	London	Indirect	Hong-Kong
Indirect	3.2051	NZ dollar	Auckland	Direct	Cairo

Answer:

Situation 1:

- The given quote is a direct quote for GBP in New York
- Two currencies involved in the quote are USD and GBP
- It is a direct quote in New York and hence home currency (USD) will be the first currency in quote
- **Given quote has been interpreted as USD 1.43/GBP**
- Question wants us to find direct quote in London. For a direct quote in London, home currency (GBP) should be the first currency in quote
- **Direct quote in London = GBP 0.6993/USD**

Situation 2:

- The given quote is a direct quote for Euro in Chennai
- Two currencies involved in quote are EUR and INR
- It is a direct quote in Chennai and hence home currency (INR) will be the first currency in quote
- **Given quote has been interpreted as INR 67.57/EUR**
- Question wants us to find indirect quote in ROME and hence home currency (EUR) will be the second currency in quote

- Indirect quote in Rome = INR 67.57/EUR

Situation 3:

- The given quote is indirect quote in London
- Two currencies involved are HKD and GBP
- It is an indirect quote in London and hence home currency (GBP) will be the second currency in quote
- **Given quote has been interpreted as HKD 11.08/GBP**
- Question wants us to find indirect quote in Hong Kong. For an indirect quote, home currency (HKD) should be the second currency in quote
- **Indirect quote in Hong Kong = GBP 0.0903/HKD**

Situation 4:

- The given quote is indirect quote in New Zealand
- Two currencies involved in quote are NZD and EGP (Egyptian Pound)
- It is an indirect quote in New Zealand and hence home currency (NZD) will be the second currency in quote
- **Given quote has been interpreted as EGP 3.2051/NZD**
- Question wants us to compute Direct Quote in Cairo. For a direct quote, home currency (EGP) should be the first currency in quote
- **Direct quote in Cairo = EGP 3.2051/NZD**

3. Bid, Ask, Spread and Middle rate

The following are direct quotes

Rs. per GBP	82.20 – 70
USD per GBP	1.5606 – 950

Identify:

- The country where the quote is made and identify the indirect quote in that country
- The bid, ask, spread (in amount and in %) and middle rates
- The currency being bought by the bank in the case of Bid and in the case of Ask
- The currency being bought by you from the bank in the case of Bid and in the case of Ask

Answer:

Particulars	INR per GBP	USD per GBP
1. Given quote (Note 1 and 2)	Rs.82.20-82.70 per GBP	USD 1.5606-1.5950 per GBP
2. Country where quote is made	India	USA
3. Indirect quote	GBP 0.1209 - 0.1217 per INR	GBP 0.6270 – 0.6408/USD
Bid rate (1/Ask rate)	$\frac{1}{82.70} = 0.1209$	$\frac{1}{1.5950} = 0.6270$
Ask rate (1/Bid rate)	$\frac{1}{82.20} = 0.1217$	$\frac{1}{1.5606} = 0.6408$
4. Bid rate	Rs.82.20/GBP	USD 1.5606/GBP
5. Ask rate	Rs.82.70/GBP	USD 1.5950/GBP
6. Spread rate (in amount)	Rs.0.50/GBP	USD0.0344/GBP
7. Spread rate (in %) Spread (profit) is normally computed on selling price (ask rate)	$\frac{0.50}{82.70} \times 100 = 0.605\%$	$\frac{0.0344}{1.5950} \times 100 = 2.157\%$
8. Middle rate (Bid + Ask)/2	Rs.82.45/GBP	USD 1.5778/GBP
9. Currency bought by Bank: Bid rate Ask rate	GBP INR	GBP USD
10. Currency bought by us: Bid rate Ask rate	INR GBP	USD GBP

Note:

- Quote given in question is Rs.82.20 – 70. In a two-way quote normally only the pips portion is quoted. So, in this case 70 has been interpreted as pips and hence the quote is interpreted as Rs.82.20 – 82.70
- Quote given in question is USD 1.5606 – 950. For ask rate only three-digit number is quote whereas pips for the quote is of four digits. So in this case 950 has been interpreted as last three digits of pips and hence the quote will be interpreted as USD 1.5606 – USD 1.5950

4. Cross rates

Consider the following quotes and derive the cross rates

Quote I	Quote II	Quote III	Required
Rs./GBP 82.0385	Rs./USD 52.70	NA	USD/GBP
USD/AUD 0.6160	Rs./AUD 32.3990	NA	USD/Rs. & Rs./USD
Rs./OMR 135.500	AUD/OMR 4.1791	AUD/CAD 1.254	Rs./CAD
Rs./USD 52.50-70	Rs./GBP 82.50-80	NA	USD/GBP

Answer:

Part 1:

$$\frac{\text{USD}}{\text{GBP}} = \frac{\text{USD}}{\text{INR}} \times \frac{\text{INR}}{\text{GBP}}$$

$$\frac{\text{USD}}{\text{GBP}} = \frac{1}{52.70} \times 82.0385 = \text{USD 1.5567/GBP}$$

Note:

- Cross-rates are arrived through a process of cross-multiplication. In this question the common connecting currency is INR and that was used to expand the quote. The quote is expanded in such a manner that if we cancel INR, the balance part will become USD/GBP
- INR/GBP is directly available in the question whereas USD/INR is not available. Hence for USD/INR we have taken 1/(INR/USD) quote

Part 2:

$$\frac{\text{USD}}{\text{INR}} = \frac{\text{USD}}{\text{AUD}} \times \frac{\text{AUD}}{\text{INR}}$$

$$\frac{\text{USD}}{\text{INR}} = 0.6160 \times \frac{1}{32.3990} = \text{USD 0.0190/INR}$$

$$\frac{\text{INR}}{\text{USD}} = \frac{1}{0.0190} = \text{INR52.6316/USD}$$

Part 3:

$$\frac{\text{INR}}{\text{CAD}} = \frac{\text{INR}}{\text{OMR}} \times \frac{\text{OMR}}{\text{AUD}} \times \frac{\text{AUD}}{\text{CAD}}$$

$$\frac{\text{INR}}{\text{CAD}} = 135.50 \times \frac{1}{4.1791} \times 1.254$$

Final quote = INR 40.6588/CAD

Part 4:

Bid rate:

$$\text{BID} \left(\frac{\text{USD}}{\text{GBP}} \right) = \text{BID} \left(\frac{\text{USD}}{\text{INR}} \right) \times \text{BID} \left(\frac{\text{INR}}{\text{GBP}} \right)$$

$$\text{BID} \left(\frac{\text{USD}}{\text{GBP}} \right) = \frac{1}{\text{ASK} \left(\frac{\text{INR}}{\text{USD}} \right)} \times \text{BID} \left(\frac{\text{INR}}{\text{GBP}} \right)$$

$$\text{BID} \left(\frac{\text{USD}}{\text{GBP}} \right) = \frac{1}{52.70} \times 82.50$$

Final Bid rate = USD 1.5655/GBP

Ask rate:

$$\text{Ask} \left(\frac{\text{USD}}{\text{GBP}} \right) = \text{Ask} \left(\frac{\text{USD}}{\text{INR}} \right) \times \text{Ask} \left(\frac{\text{INR}}{\text{GBP}} \right)$$

$\text{Ask} \left(\frac{\text{USD}}{\text{GBP}} \right) = \frac{1}{\text{Bid} \left(\frac{\text{INR}}{\text{USD}} \right)} \times \text{Ask} \left(\frac{\text{INR}}{\text{GBP}} \right)$ $\text{Ask} \left(\frac{\text{USD}}{\text{GBP}} \right) = \frac{1}{52.50} \times 82.80$ Final Ask rate = USD 1.5771/GBP

Final quote: USD 1.5655-1.5771/GBP (or) USD 1.5655-771/GBP

5. Basics of international finance:

The following spot rates are observed in the foreign currency market:

Currency	Foreign currency per USD
Britain Pound	00.62
Netherlands Guilder	1.90
Sweden Kroner	6.40
Switzerland Franc	1.50
Italy Lira	1,300.00
Japan Yen	140.00

On the basis of this information, compute the nearest second decimal the number of:

- British pounds that can be acquired for USD 100
- Dollars that 50 Dutch Guilders (a European Monetary Union Legacy Currency) will buy
- Swedish Kroner that can be acquired for USD 40
- Dollars that 200 Swiss francs can buy
- Italian lira (an EMU legacy currency) that can be acquired for USD 10
- Dollars that 1,000 Japanese Yen will buy

Answer:

WN 1: British pounds that can be acquired for USD 100:

- ❖ Known component = USD 100
- ❖ Unknown component = ? GBP

$\text{GBP} = \text{USD} \times \left(\frac{\text{GBP}}{\text{USD}} \right)$ $\text{GBP} = 100 \times 00.62$ $\text{GBP} = 62 \text{ GBP}$

WN 2: Dollars that 50 Dutch Guilders (a European Monetary Union Legacy Currency) will buy

- ❖ Known component = 50 Dutch Guilders
- ❖ Unknown component = ? USD

$\text{USD} = \text{Dutch Guilders} \times \left(\frac{\text{USD}}{\text{Dutch Guilders}} \right)$ $\text{USD} = 50 \times \left(\frac{1}{1.90} \right)$ $\text{USD} = 26.32$

WN 3: Swedish Kroner that can be acquired for USD 40

- ❖ Known component = 40 USD
- ❖ Unknown component = ? Swedish Kroner

$\text{Swedish Kroner} = \text{USD} \times \left(\frac{\text{Swedish Kroner}}{\text{USD}} \right)$ $\text{Swedish Kroner} = 40 \times 6.40$ $\text{Swedish Kroner} = 256 \text{ Kroner}$

WN 4: Dollars that 200 swiss franc can buy:

- ❖ Known component = 200 Swiss Franc
- ❖ Unknown component = ? USD

$\text{USD} = \text{Swiss Franc} \times \left(\frac{\text{USD}}{\text{Swiss Franc}} \right)$ $\text{USD} = 200 \times \left(\frac{1}{1.50} \right)$ $\text{USD} = 133.33 \text{ USD}$

WN 5: Italian Lira that can be acquired for USD 10:

- ❖ Known component = 10 USD
- ❖ Unknown component = ? Italian Lira

Italian Lira = USD x $\left(\frac{\text{Italian Lira}}{\text{USD}}\right)$
Italian Lira = 10 x 1,300
Italian Lira = 13,000 Liras

WN 6: Dollars that 1,000 Japanese Yen can buy:

- ❖ Known component = 1,000 JPY
- ❖ Unknown component = ? USD

USD = JPY x $\left(\frac{\text{USD}}{\text{JPY}}\right)$
USD = 1,000 x $\left(\frac{1}{140}\right)$
USD = 7.14 USD

6. Indirect quote

Following spot rates are available in the London Forex market.

Currency	Rate	Rate
Euro	1.24	1.40
Danish Kroner	9.274	9.356
Japanese Yen	147.636	147.650
USD	1.5606	1.5650

Since these currencies were in short supply, you are required to operate only through sterling which is quoted at Rs.75.25-35 in Mumbai. Compute:

- ❖ The quantum of Euro and DKR that you can buy, if you have a sum of Rs.1,20,000
- ❖ What is the likely rate of Yen against US Dollar

Answer:**Part 1:**

The given quotations are considered to be in indirect terms for GBP. This is because of the following two reasons:

- JPY is a cheaper currency as compared to GBP and hence quote will be JPY/GBP and same logic will be followed for other currencies
- Internationally all exchange rates are given in indirect terms for USD (INR/USD, JPY/USD) except GBP. GBP with USD would be in direct term for USD and hence quote will be USD/GBP

Quantum of Euros that can be purchased with Rs.1,20,000:

- Known component = Rs.1,20,000 (Rs.1,20,000 is called as known component as we know that we have Rs.1,20,000 and we need to buy Euros with that)
- Unknown component = ? Euros (we are planning to buy Euros but how many Euros is not known and hence Euros is called as unknown component)

Unknown component = Known component x ?
Euro = INR x $\left(\frac{\text{Euro}}{\text{INR}}\right)$
Note: We have written Euro/INR in the formula. This is stage one of formula expansion. In this case INR and INR will get cancelled and we will get Euro = Euro
Deciding Bid rate/Ask Rate: We need to check what the customer is doing with denominator currency (INR). Customer is going to sell INR and bank is going to buy INR. Bank buys INR at Bid rate and hence bid rate will be used in the formula
Euro = INR x BID $\left(\frac{\text{Euro}}{\text{INR}}\right)$
Expanding the formula: EURO/INR is not directly available in the question and we will use connecting currency GBP to expand and get the answer

$$\text{Euro} = \text{INR} \times \text{BID} \left(\frac{\text{Euro}}{\text{GBP}} \right) \times \text{BID} \left(\frac{\text{GBP}}{\text{INR}} \right)$$

$$\text{Euro} = 1,20,000 \times 1.24 \times \frac{1}{75.35}$$

Euros = 1,974.78

Quantum of DKR that can be purchased with Rs.1,20,000

- Known component = Rs.1,20,000 (Rs.1,20,000 is called as known component as we know that we have Rs.1,20,000 and we need to buy DKR with that)
- Unknown component = ? DKR (we are planning to buy DKR but how many DKR is not known and hence DKR is called as unknown component)

Unknown component = Known component x ?
$\text{DKR} = \text{INR} \times \left(\frac{\text{DKR}}{\text{INR}} \right)$
Deciding Bid rate/Ask Rate:
We need to check what the customer is doing with denominator currency (INR). Customer is going to sell INR and bank is going to buy INR. Bank buys INR at Bid rate and hence bid rate will be used in the formula
$\text{DKR} = \text{INR} \times \text{BID} \left(\frac{\text{DKR}}{\text{INR}} \right)$
$\text{DKR} = \text{INR} \times \text{BID} \left(\frac{\text{DKR}}{\text{GBP}} \right) \times \text{BID} \left(\frac{\text{GBP}}{\text{INR}} \right)$
$\text{DKR} = 1,20,000 \times 9.274 \times \frac{1}{75.35}$
DKR = 14,769.48

Part 2 - Likely rate of Yen against USD:

- We are required to find the rate of Yen. Yen is basically the product and hence we are required to calculate (USD/Yen)

Bid rate	Ask rate
$\text{Bid} \left(\frac{\text{USD}}{\text{Yen}} \right) = \text{Bid} \left(\frac{\text{USD}}{\text{GBP}} \right) \times \text{Bid} \left(\frac{\text{GBP}}{\text{Yen}} \right)$	$\text{Ask} \left(\frac{\text{USD}}{\text{Yen}} \right) = \text{Ask} \left(\frac{\text{USD}}{\text{GBP}} \right) \times \text{Ask} \left(\frac{\text{GBP}}{\text{Yen}} \right)$
$\text{Bid} \left(\frac{\text{USD}}{\text{Yen}} \right) = 1.5606 \times \frac{1}{147.650} = 0.01057$	$\text{Ask} \left(\frac{\text{USD}}{\text{Yen}} \right) = 1.5650 \times \frac{1}{147.636} = 0.01060$

USD/Yen rate = USD 0.01057 - 0.01060/Yen

7. Cross rate [Nov 2018, Nov 2018 RTP, May 2005, Nov 2011, May 2014, May 2017 RTP]

On January 28, 2012 an importer customer requested a bank to remit Singapore Dollar (SGD) 25,00,000 under an irrevocable LC. However, due to bank strikes, the bank could affect the remittance only on February 4, 2012. The interbank market rates were as follows:

	January, 28	February 4
Bombay US\$1	Rs. 45.85/45.90	Rs.45.91/45.97
London Pound 1	\$1.7840/1.7850	\$1.7765/1.7775
Pound 1 =	SGD 3.1575/3.1590	SGD 3.1380/3.1390

The bank wishes to retain an exchange margin of 0.125%.

- ❖ How much does the customer stand to gain or lose due to the delay?
- ❖ Find out how much INR can the company get by selling 1,50,000 SGD on January 28, 2012

Answer:**Part 1 - Computation of gain/loss due to delay in remittance by Bank:****Computation of likely outflow if payment was done on January,28:**

- Known component = SGD 25,00,000 (SGD 25,00,000 is called as known component as we know that we have to buy SGD 25,00,000 and we need to use INR to buy the same)
- Unknown component = ? INR (we are planning to sell INR but how many INR needed is not known and hence INR is unknown component)

Unknown component = Known component x ?
$\text{INR} = \text{SGD} \times \left(\frac{\text{INR}}{\text{SGD}} \right)$
Deciding Bid rate/Ask Rate:

We need to check what the customer is doing with denominator currency (SGD). Customer is going to buy SGD and bank is going to sell SGD. Bank sells SGD at Ask rate and hence Ask rate will be used in the formula

$$\text{INR} = \text{SGD} \times \text{Ask} \left(\frac{\text{INR}}{\text{SGD}} \right)$$

$$\text{INR} = \text{SGD} \times \text{Ask} \left(\frac{\text{INR}}{\text{USD}} \right) \times \text{ASK} \left(\frac{\text{USD}}{\text{GBP}} \right) \times \text{ASK} \left(\frac{\text{GBP}}{\text{SGD}} \right)$$

$$\text{INR} = 25,00,000 \times \left\{ \left[45.90 \times 1.7850 \times \frac{1}{3.1575} \right] + 0.125\% \right\}$$

$$\text{INR} = 25,00,000 \times \{ [25.94822] + 0.125\% \}$$

$$\text{INR} = 25,00,000 \times 25.98066$$

$$\text{INR outflow} = \text{Rs.6,49,51,650}$$

Note:

- Exchange margin is an additional income for banker and the same would increase the spread between bid and ask rate. Exchange margin is added to ask rate which increases customer outflow and the same is deducted from bid rate leading to lower inflow for customer.
- Exchange margin can be applied individually on the quote which has INR in it (or) we apply it finally on the cross quote. In this question we have applied it finally on cross quote

Computation of actual outflow when payment was done on February, 04:

$$\text{INR} = \text{SGD} \times \text{Ask} \left(\frac{\text{INR}}{\text{USD}} \right) \times \text{ASK} \left(\frac{\text{USD}}{\text{GBP}} \right) \times \text{ASK} \left(\frac{\text{GBP}}{\text{SGD}} \right)$$

$$\text{INR} = 25,00,000 \times \left\{ \left[45.97 \times 1.7775 \times \frac{1}{3.1380} \right] + 0.125\% \right\}$$

$$\text{INR} = 25,00,000 \times \{ [26.03941] + 0.125\% \}$$

$$\text{INR} = 25,00,000 \times 26.07196$$

$$\text{INR outflow} = \text{Rs.6,51,79,900}$$

Computation of loss:

Loss = Actual Payment on February 04 – Probable payment on January 28

Loss = Rs.6,51,79,900 – Rs.6,49,51,650 = **Rs.2,28,250**

Part 2 – Computation of INR receipt by selling 1,50,000 SGD on January 28:

Known component = SGD 1,50,000; Unknown component = ? INR

Unknown component = Known component x ?

$$\text{INR} = \text{SGD} \times \left(\frac{\text{INR}}{\text{SGD}} \right)$$

Deciding Bid rate/Ask Rate:

We need to check what the customer is doing with denominator currency (SGD). Customer is going to sell SGD and bank is going to buy SGD. Bank buys SGD at Bid rate and hence bid rate will be used in the formula

$$\text{INR} = \text{SGD} \times \text{Bid} \left(\frac{\text{INR}}{\text{SGD}} \right)$$

$$\text{INR} = \text{SGD} \times \text{Bid} \left(\frac{\text{INR}}{\text{USD}} \right) \times \text{ASK} \left(\frac{\text{USD}}{\text{GBP}} \right) \times \text{ASK} \left(\frac{\text{GBP}}{\text{SGD}} \right)$$

$$\text{INR} = 1,50,000 \times \left\{ \left[45.85 \times 1.7840 \times \frac{1}{3.1590} \right] - 0.125\% \right\}$$

$$\text{INR} = 1,50,000 \times \{ [25.89313] - 0.125\% \}$$

$$\text{INR} = 1,50,000 \times 25.86076$$

$$\text{INR inflow} = \text{Rs.38,79,114}$$

8. Cross rates [Nov 2005, May 2013, May 2014, Nov 2014, Nov 2020]

You sold Hong Kong Dollar 1,00,00,000 value spot to your customer at Rs.5.70 & covered yourself in London market on the same day, when the exchange rates were US\$ 1 = H.K.\$ 7.5880-7.5920. Local interbank market rates for US\$ were Spot US\$ 1 = Rs.42.70- 42.85

Calculate cover rate & ascertain the profit or loss in the transaction. Ignore brokerage.

Answer:

- The bank has sold HKD 1,00,00,000 at the rate of Rs.5.70 and hence the sale proceeds would be Rs.5,70,00,000

- The bank now needs to cover the transaction. Covering the transaction would mean taking an opposite position and hence the bank has to buy HKD 1,00,00,000

Known component = HKD 1,00,00,000; Unknown component = ? INR
Unknown component = Known component x ?
$INR = HKD \times \left(\frac{INR}{HKD} \right)$
Deciding Bid rate/Ask Rate:
- In this question the bank is going to deal with some other bank. The bank would be considered similar to normal customer when dealing with another bank. - Bank needs to buy HKD 1,00,00,000. This would be sold by another bank and the other bank will be selling this at Ask rate
$INR = HKD \times Ask \left(\frac{INR}{HKD} \right)$
$INR = HKD \times Ask \left(\frac{INR}{USD} \right) \times Ask \left(\frac{USD}{HKD} \right)$
$INR = 1,00,00,000 \times 42.85 \times \frac{1}{7.5880}$
$INR = 1,00,00,000 \times 5.64707$
$INR = Rs. 5,64,70,700$
Cover rate = Rs.5.64707/HKD
Profit = 5,70,00,000 - 5,64,70,700 = Rs.5,29,300

9. Computation of cover rate and profit and loss [Nov 2013, May 2015 MTP]

You, a foreign exchange dealer of your bank, are informed that your bank has sold a T.T. on Copenhagen for Danskish Kroner 10,00,000 at the rate of Danish Kroner 1 = Rs.6.5150. You are required to cover the transaction either in London or New York market. The rate on that date are as under:

Mumbai-London	Rs.74.3000	Rs.74.3200
Mumbai-New York	Rs.49.2500	Rs.49.2625
London-Copenhagen	DKK 11.4200	DKK 11.4350
New York - Copenhagen	DKK 7.5670	DKK 7.5840

In which market will you cover the transaction, London or New York, and what will be the exchange profit or loss in the transaction?

Answer:

WN 1: Covering in New York Market:

- ❖ Known component = 10,00,000 DKK
- ❖ Unknown component = ? INR

$INR = DKK \times ASK \left(\frac{INR}{DKK} \right)$
$INR = 10,00,000 \times ASK \left(\frac{INR}{USD} \times \frac{USD}{DKK} \right)$
$INR = 10,00,000 \times \left(49.2625 \times \frac{1}{Bid \left(\frac{DKK}{USD} \right)} \right)$
$INR = 10,00,000 \times \left(49.2625 \times \frac{1}{7.5670} \right)$
$INR = 10,00,000 \times (6.510176)$
$INR = 65,10,176$
$Profit/Loss = (10,00,000 \times 6.5150) - (10,00,000 \times 6.510176)$
Profit/Loss = 65,15,000 - 65,10,176 = Rs.4,824

WN 2: Covering in London Market:

- ❖ Known component = 10,00,000 DKK
- ❖ Unknown component = ? INR

$INR = DKK \times ASK \left(\frac{INR}{DKK} \right)$
$INR = 10,00,000 \times ASK \left(\frac{INR}{GBP} \times \frac{GBP}{DKK} \right)$

$\text{INR} = 10,00,000 \times \left(74.3200 \times \frac{1}{\text{Bid} \left(\frac{\text{DKK}}{\text{GBP}} \right)} \right)$
$\text{INR} = 10,00,000 \times \left(74.3200 \times \frac{1}{11.4200} \right)$
$\text{INR} = 10,00,000 \times (6.507881)$
$\text{INR} = 65,07,881$
$\text{Profit/Loss} = (10,00,000 \times 6.5150) - (10,00,000 \times 6.507881)$
Profit/Loss = 65,15,000 - 65,07,881 = Rs.7,119

Conclusion:

- ❖ The transaction should be covered in London Market
- ❖ The cover rate is Rs.6.507881/DKK and the profit is Rs.7,119

10. Computation of quoted rate [May 2018]

An imported customer of your bank wishes to book a forward contract with your bank on 3rd September for sale to him of SGD 5,00,000 to be delivered on 30th October. The spot rates on 3rd September are USD 49.3700/3800 and USD/SGD 1.7058/68. The swap points are:

USD/INR		USD/SGD	
Spot/September	0300/0400	1 st month forward	48/49
Spot/October	1100/1300	2 nd month forward	96/97
Spot/November	1900/2200	3 rd month forward	138/140
Spot/December	2700/3100		
Spot/January	3500/4000		

Calculate the rate to be quoted to the importer by assuming an exchange margin of 5 paisa.

Answer:

Note: The given quotes have been interpreted as INR/USD and SGD/USD as per current exchange rates

Note 1: Computation of relevant rates:**INR/USD**

Particulars	Bid rate	Ask Rate
Spot rate	49.3700	49.3800
Add: Swap points for October	0.1100	0.1300
Revised rate	49.4800	49.5100
Add/Less: Exchange margin	0.0500	0.0500
Rate for October 31	49.4300	49.5600

SGD/USD:

Particulars	Bid rate	Ask Rate
Spot rate	1.7058	1.7068
Add: Swap points for October	0.0096	0.0097
Rate for October 31	1.7154	1.7165

Note 2: Computation of quoted rate:

- ❖ Known component = SGD
- ❖ Unknown component = INR
- ❖ Required quote = (INR/SGD)

$\frac{\text{INR}}{\text{SGD}} = \frac{\text{INR}}{\text{USD}} \times \frac{\text{USD}}{\text{SGD}}$
$\text{ASK} \left(\frac{\text{INR}}{\text{SGD}} \right) = \text{ASK} \left(\frac{\text{INR}}{\text{USD}} \times \frac{\text{USD}}{\text{SGD}} \right)$
$\text{ASK} \left(\frac{\text{INR}}{\text{SGD}} \right) = \text{ASK} \left(49.5600 \times \frac{1}{\text{BID} \left(\frac{\text{USD}}{\text{SGD}} \right)} \right)$
$\text{ASK} \left(\frac{\text{INR}}{\text{SGD}} \right) = \left(49.5600 \times \frac{1}{1.7154} \right)$
$\text{ASK} \left(\frac{\text{INR}}{\text{SGD}} \right) = 28.8912$

11. Covering an exchange transaction [Nov 2014]

Edelweiss Bank Ltd. sold Hong Kong dollar 2 crores value spot to its customer at Rs.8.025 and covered itself in the London market on the same day, when the exchange rates were

USD 1 = HKD 7.5880 – 7.5920

Local interbank market rates for USD were

Spot USD – Rs.60.70 – 61.00

Calculate the cover rate and ascertain the profit or loss on the transaction.

Answer:

- The bank has sold HKD 2,00,00,000 at the rate of Rs.8.025 and hence the sale proceeds would be Rs.16,05,00,000
- The bank now needs to cover the transaction. Covering the transaction would mean taking an opposite position and hence the bank has to buy HKD 2,00,00,000

Known component = HKD 1,00,00,000; Unknown component = ? INR
Unknown component = Known component x ?
$INR = HKD \times \left(\frac{INR}{HKD} \right)$
Deciding Bid rate/Ask Rate:
- In this question the bank is going to deal with some other bank. The bank would be considered similar to normal customer when dealing with another bank. - Bank needs to buy HKD 2,00,00,000. This would be sold by another bank and the other bank will be selling this at Ask rate
$INR = HKD \times Ask \left(\frac{INR}{HKD} \right)$
$INR = HKD \times Ask \left(\frac{INR}{USD} \right) \times Ask \left(\frac{USD}{HKD} \right)$
$INR = 2,00,00,000 \times 61.00 \times \frac{1}{7.5880}$
$INR = 2,00,00,000 \times 8.039009$
$INR = Rs. 16,07,80,180$
Cover rate = Rs.8.039009/HKD
Loss = 16,05,00,000 – 16,07,80,180 = Rs.2,80,180

12. Calculation of security return

If the price of the bond in the beginning of the period is USD 100 and it is USD 105 at the end of the period. The coupon interest during the period is USD 7. USD appreciates during the period by 3%. Find the ROI in terms of home currency

Answer:

Computation of ROI in terms of home currency:

- Let us assume today's exchange rate is Rs.50/USD. Today's investment is Rs.5,000 (USD 100 x Rs.50)
- USD has appreciated by 3 percent and the same would be Rs.51.50/USD
- Investment of USD 100 will become USD 112 by end of period. This would include interest income of USD 7 and principal value of USD 105
- Maturity value of investment is equal to Rs.5,768 (USD 112 x Rs.51.50)

$$\text{Return in home currency (INR)} = \frac{5,768 - 5,000}{5,000} \times 100 = 15.36\%$$

Alternative way of computing return:

- Foreign currency return = 12%. This is because 100 USD has become 112 USD

$$(1 + \text{Home currency return}) = (1 + \text{Foreign currency return}) \times (1 + \text{Appreciation/Depreciation})$$

$$(1 + \text{Home currency return}) = (1 + 12\%) \times (1 + 3\%)$$

$$(1 + \text{Home currency return}) = 1.1536$$

$$\text{Home currency return} = 1.1536 - 1 = 0.1536 \text{ (or) } 15.36\%$$

13. Calculation of security return [May 2012, Nov 2018 MTP]

The price of a bond just before a year of maturity is USD 5,000. Its redemption value is USD 5,250 at the end of the said period. Interest is USD 350 per annum. The dollar appreciates by 2% during the said period. Calculate the rate of return

Answer:

Computation of rate of return:

- Let us assume today's exchange rate is Rs.50/USD. Today's investment is Rs.2,50,000 (USD 5,000 x 50)
- USD has appreciated by 2 percent and the same would be Rs.51/USD
- Investment of USD 5,000 will become USD 5,600 by end of period
- Maturity value of investment is equal to Rs.2,85,600 (5,600 x 51)

$$\text{Return in home currency (INR)} = \frac{2,85,600 - 2,50,000}{2,50,000} \times 100 = 14.24\%$$

14. Computation of return [May 2016 MTP]

With the relaxation of investment norms in India in international market upto USD 2,50,000 Mr.X to hedge himself against the risk of declining Indian economy and weakening of Indian Rupee during last few year decided to diversify into International market.

Accordingly, Mr.X invested a sum of Rs.1.58 Crores on 1.1.2011 in S&P Index. On 1.1.2012, Mr.X sold his investment. The other relevant data is given below:

Particulars	1.1.2011	1.1.2012
Index of stock market in India	7395	?
S&P Index	2028	1919
Exchange rate	62.00/62.25	67.25/67.50

You are required to:

- Determine the return for a US investor
- Determine return of Mr.X of holding period
- Determine the value of index of stock market in India as on 1.1.2012 at which Mr.X would be indifferent between investment in S&P Index and Indian Stock Market

Answer:

WN 1: Computation of return for US Investor:

$$\text{Return} = \frac{\text{Ending Index} - \text{Opening index}}{\text{Opening Index}} \times 100$$

$$\text{Return} = \frac{1,919 - 2,028}{2,028} \times 100 = -5.37\%$$

WN 2: Return of Mr.X for holding period:

Particulars	Calculation	Amount
Amount of investment		Rs.1,58,00,000
Investment in USD	$1,58,00,000 \times \left(\frac{1}{62.25}\right)$	USD 2,53,815.26
Purchase price of S&P		2,028
Ending price of S&P		1,919
Proceeds realized in USD	$2,53,815.26 \times \left(\frac{1919}{2028}\right)$	USD 2,40,173.32
Exchange rate on 1.1.2012		67.25
INR realization on 1.1.2012	$2,40,173.32 \times 67.25$	Rs.1,61,51,655
Return in INR	$1,61,51,655 - 1,58,00,000$	3,51,655
Return in %	$\frac{3,51,655}{1,58,00,000} \times 100$	2.23%

WN 3: Computation of indifferent level of index for investment in Indian stock market:

- ❖ The investor is earning a return of 2.23% in US market. He would want to earn the same rate of return in Indian market
- ❖ Closing index value = $7,395 + 2.23\% = 7,560$

15. Nominal and real return [Jan 2021]

A US investor chose to invest in Sensex for a period of one year. The relevant information is given below.

Size of investment (USD)	20,00,000
Spot rate 1 year ago (INR/USD)	42.50/60
Spot rate now (INR/USD)	43.85/90
Sensex 1 year ago	3,256
Sensex now	3,765
Inflation in US	5%

Inflation in India	9%

Required:

- Compute the nominal rate of return to the US investor.
- Compute the real depreciation / appreciation of Rupee.
- What should be the exchange rate if relevant purchasing power parity holds good?
- What will be the real return to an Indian investor in Sensex?

Answer:**WN 1: Computation of nominal rate of return to the US investor:**

Particulars	Calculation	Amount
Size of investment		USD 20,00,000
Investment in INR	20,00,000 x 42.50	INR 8,50,00,000
No of units of Sensex purchased	$\frac{8,50,00,000}{3,256}$	26,105
Maturity value of investment	26,105 x 3,765	INR 9,82,85,325
Maturity value of investment in USD	$\frac{9,82,85,325}{43.90}$	USD 22,38,846
Nominal return in USD	$\frac{22,38,846 - 20,00,000}{20,00,000} \times 100$	11.94%

WN 2: Computation of real return of Indian investor in Sensex:

Particulars	Calculation	Amount
Opening value of Sensex		3,256
Closing value of Sensex		3,765
Nominal return of Sensex	$\frac{3,765 - 3,256}{3,256} \times 100$	15.63%
Real return of Indian Investor	$(1 + \text{Inflation}) \times (1 + \text{real rate}) = (1 + \text{Nominal rate})$ $(1 + 9\%) \times (1 + \text{real rate}) = (1 + 15.63\%)$ $(1 + \text{real rate}) = \frac{1.1563}{1.09}$ $\text{Real rate} = \frac{1.1563}{1.09} - 1$	6.08%

WN 3: Computation of real depreciation/appreciation of Rupee:

Particulars	Calculation	Amount
Analysis based on BID rate		
Spot rate 1 year ago		INR 42.50/USD
Spot rate now		INR 43.85/USD
Current spot rate (Adjusted for inflation)	$43.85 \times \frac{1.05}{1.09}$	INR 42.24/USD
% Appreciation in INR	$\frac{42.50 - 42.24}{42.24} \times 365$	0.62%
Analysis based on Ask Rate		
Spot rate 1 year ago		INR 42.60/USD
Spot rate now		INR 43.90/USD
Current spot rate (Adjusted for inflation)	$43.90 \times \frac{1.05}{1.09}$	INR 42.29/USD
% Appreciation in INR	$\frac{42.60 - 42.29}{42.29} \times 365$	0.73%

WN 4: Computation of relevant exchange rate if purchasing power parity theory holds:**Computation of BID rate:**

$$\frac{1 + I_h}{1 + I_f} = \frac{\text{Forward Rate}}{\text{Spot Rate}}$$

$$\frac{1 + 5\%}{1 + 9\%} = \frac{\text{Forward Rate}}{42.50}$$

$$\text{Forward Rate} = 42.50 \times \frac{1.09}{1.05} = \text{INR } 44.12/\text{USD}$$

Computation of ASK rate:

$$\text{Forward Rate} = 42.60 \times \frac{1.09}{1.05} = \text{INR } 44.22/\text{USD}$$

- **Relevant exchange rate = INR 44.12-22/USD**

Note: Forward rate basically mean today's exchange rate and spot rate would mean exchange rate a year-ago in the above formula

16. Return from USD investment [July 2021]

Mr. Mammen, an Indian investor invests in a listed bond in USA. If the price of the bond at the beginning of the year is USD 100 and it is USD 103 at the end of the year. The coupon rate is 3% payable annually. Find the return on investment in terms of home country currency if:

- USD is Flat.
- USD appreciates during the year by 3%.
- USD depreciates during the year by 3%.
- Indian Rupee appreciates during the year by 5%.
- Will your answer differs if Mr. Mammen invests in the bond just before the interest payable.

Answer:**USD is flat:**

$$\text{Return} = \frac{3 + 103 - 100}{100} \times 100 = 6\%$$

USD appreciates by 3%:

$$(1 + \text{INR return}) = (1 + \text{USD return}) \times (1 + \text{USD Appreciation})$$

$$(1 + \text{INR return}) = (1 + 6\%) \times (1 + 3\%)$$

$$\text{INR return} = [(1.06) \times (1.03)] - 1 = 0.0918 \text{ (or) } 9.18\%$$

USD depreciates by 3%:

$$(1 + \text{INR return}) = (1 + \text{USD return}) \times (1 + \text{USD Appreciation})$$

$$(1 + \text{INR return}) = (1 + 6\%) \times (1 - 3\%)$$

$$\text{INR return} = [(1.06) \times (0.97)] - 1 = 0.0282 \text{ (or) } 2.82\%$$

INR appreciates by 5%:

$$(1 + \text{USD return}) = (1 + \text{INR return}) \times (1 + \text{INR Appreciation})$$

$$(1 + 6\%) = (1 + \text{INR return}) \times (1 + 5\%)$$

$$\text{INR Return} = \frac{1.06}{1.05} - 1 = 0.95\%$$

Impact of investment before interest payable date:

No, our answer will not differ even if Mr. Mammen invests in bond just before the interest is payable

Part II - Premium/Discount and Appreciation/Depreciation
17. Premium/discount

The spot rate for INR/AUD is 29.45 - 29.90 and the three-month forward rate is 29.36 - 29.80. Identify the following:

- ❖ Which currency is appreciating and which is depreciating
- ❖ Which currency is trading at a discount and which at a premium
- ❖ Which currency is more expensive
- ❖ Compute the annual percentage premium or discount

Answer:

- The forward rate for INR/AUD is declining and this indicates that AUD is depreciating. Hence INR is appreciating
- INR is at premium and AUD is at discount
- INR is becoming more expensive

Computation of Annual premium or discount percentage:

- Spot rate = INR 29.45-29.90/ AUD

- Three-month forward = INR 29.36-29.80/ AUD

Calculation for product (AUD):

Premium or discount %	$\frac{\text{Forward rate} - \text{Spot rate}}{\text{Spot rate}} \times \frac{12}{m} \times 100$	
Using BID Rate	$\frac{29.36 - 29.45}{29.45} \times \frac{12}{3} \times 100$	-1.22% (depreciation)
Using ASK Rate	$\frac{29.80 - 29.90}{29.90} \times \frac{12}{3} \times 100$	-1.34% (depreciation)

Calculation for Price (INR):

Premium or discount %	$\frac{\text{Spot rate} - \text{Forward rate}}{\text{Forward rate}} \times \frac{12}{m} \times 100$	
Using BID Rate	$\frac{29.45 - 29.36}{29.36} \times \frac{12}{3} \times 100$	1.23% (appreciation)
Using ASK Rate	$\frac{29.90 - 29.80}{29.80} \times \frac{12}{3} \times 100$	1.34% (appreciation)

18. Appreciation/depreciation

Compute the annual percentage appreciation (or depreciation) of rupee in terms of the foreign currencies in the following cases:

Quote in Mumbai for	Spot	6 Months Forward
Rand	6.53 - 6.90	20/15
Canadian Dollar	40.66 - 41.20	50/60
GBP	78	80

Answer:

The given quotations are considered to be in direct terms for INR. This is because INR is a cheaper currency as compared to GBP and hence quote will be INR/GBP and same logic will be followed for other currencies

WN 1: Analysis of INR/RAND Quote:

- Spot rate = INR 6.53-6.90 per Rand
- 6-month Swap points = 20/15
- Swap points are in descending order and hence they have to be deducted to get the forward rate
- Forward rate = INR 6.33/6.75 per Rand

Calculation for product (RAND):

Premium or discount %	$\frac{\text{Forward rate} - \text{Spot rate}}{\text{Spot rate}} \times \frac{12}{m} \times 100$	
Using BID Rate	$\frac{6.33 - 6.53}{6.53} \times \frac{12}{6} \times 100$	-6.13% (depreciation)
Using ASK Rate	$\frac{6.75 - 6.90}{6.90} \times \frac{12}{6} \times 100$	-4.35% (depreciation)

Calculation for Price (INR):

Premium or discount %	$\frac{\text{Spot rate} - \text{Forward rate}}{\text{Forward rate}} \times \frac{12}{m} \times 100$	
Using BID Rate	$\frac{6.53 - 6.33}{6.33} \times \frac{12}{6} \times 100$	6.32% (appreciation)
Using ASK Rate	$\frac{6.90 - 6.75}{6.75} \times \frac{12}{6} \times 100$	4.44% (appreciation)

WN 2: Analysis of INR/CAD Quote:

- Spot rate = INR 40.66-41.20 per CAD
- 6-month Swap points = 50/60
- Swap points are in ascending order and hence they have to be added to get the forward rate
- Forward rate = INR 41.16/41.80 per CAD

Calculation for product (CAD):

Premium or discount %	$\frac{\text{Forward rate} - \text{Spot rate}}{\text{Spot rate}} \times \frac{12}{m} \times 100$	

Using BID Rate	$\frac{41.16 - 40.66}{40.66} \times \frac{12}{6} \times 100$	2.46% (appreciation)
Using ASK Rate	$\frac{41.80 - 41.20}{41.20} \times \frac{12}{6} \times 100$	2.91% (appreciation)

Calculation for Price (INR):

Premium or discount %	$\frac{\text{Spot rate} - \text{Forward rate}}{\text{Forward rate}} \times \frac{12}{m} \times 100$	
Using BID Rate	$\frac{40.66 - 41.16}{41.16} \times \frac{12}{6} \times 100$	-2.43% (depreciation)
Using ASK Rate	$\frac{41.20 - 41.80}{41.80} \times \frac{12}{6} \times 100$	-2.87% (appreciation)

WN 3: Analysis of INR/GBP Quote:

- Spot rate = INR 78/GBP
- Forward rate = INR 80/GBP

Premium or discount % For GBP (product)	$\frac{\text{Forward rate} - \text{Spot rate}}{\text{Spot rate}} \times \frac{12}{m} \times 100$ $\frac{80 - 78}{78} \times \frac{12}{6} \times 100$	5.13% (appreciation)
Premium or discount % For INR (price)	$\frac{\text{Spot rate} - \text{Forward rate}}{\text{Forward rate}} \times \frac{12}{m} \times 100$ $\frac{78 - 80}{80} \times \frac{12}{6} \times 100$	-5.00% (depreciation)

19. Computation of premium/discount % [May 2019 MTP, Nov 2016]

On April 3, 2016, a Bank quotes the following:

- ❖ Spot exchange rate (USD 1) = INR 66.2525/67.5945
- ❖ 2 months' swap points = 70/90
- ❖ 3 months' swap points = 160/186

In a spot transaction, delivery is made after two days. Assume spot date as April 5, 2016 and 1 swap point = 0.0001.

You are required to:

- Ascertain swap points for 2 months and 15 days (For June 20, 2016)
- Determine foreign exchange rate for June 20, 2016 and
- Compute the annual rate of premium/discount of USD on INR, on an average rate

Answer:**WN 1: Computation of swap points for 2 months and 15 days:**

Particulars	Bid	Ask
Swap points for 2 months	70	90
Swap points for 3 months	160	186
Swap points for 30 days	90	96
Swap points for 15 days	45	48
Swap points for 30 days $\times \left(\frac{15}{30}\right)$		
Swap points for 2 months and 15 days	115	138

WN 2: Computation of exchange rate for June 20, 2016:

Particulars	Bid	Ask
Spot rate	66.2525	67.5945
Add: Swap points for 2.5 months	0.0115	0.0138
Exchange rate for June 20, 2016	66.2640	67.6083

WN 3: Computation of premium/discount percentage of USD:

Particulars	Bid	Ask
Spot rate	66.2525	67.5945
Exchange rate for June 20, 2016	66.2640	67.6083
Premium	0.0115	0.0138

Average rate (Spot + Forward)/2	66.2583	67.6014
Premium %	$\frac{0.0115}{66.2583} \times \frac{12}{2.5} \times 100$ =0.0833%	$\frac{0.0138}{67.6014} \times \frac{12}{2.5} \times 100$ =0.0980%

20. Swap points

The following information pertains to exchange rates quoted in London for spot and forward:

	Spot	Swap Points 1-month Forward	Swap points 3-month forward
Canadian Dollar	1.8640-8650	40-30	90-80
Euro	1.4468-72	10-20	45-55
USD	1.5865-70	20-30	25-35

Calculate the cost or value in Sterling to a customer, who wishes to:

- ❖ Sell Canadian dollars 19,200 spot
- ❖ Buy Euro 34,250 one month-forward
- ❖ Sell USD 93,750 three month forward
- ❖ Buy USD 1,00,000 two months forward

Answer:

The given quotations are considered to be in indirect terms for GBP. This is because USD is a cheaper currency as compared to GBP and hence quote will be USD/GBP and same logic will be followed for other currencies

WN 1: Sell CAD 19,200 Spot:

Known component = CAD 19,200; Unknown component = ? GBP
Unknown component = Known component x ?
$GBP = CAD \times \left(\frac{GBP}{CAD} \right)$
Deciding Bid rate/Ask Rate:
We need to check what the customer is doing with denominator currency (CAD). Customer is going to sell CAD and bank is going to buy CAD. Bank buys CAD at Bid rate and hence bid rate will be used in the formula
$GBP = CAD \times Bid \left(\frac{GBP}{CAD} \right)$
$GBP = 19,200 \times \frac{1}{ASK \left(\frac{CAD}{GBP} \right)}$
$GBP = 19,200 \times \frac{1}{1.8650}$
GBP inflow = GBP 10,294.91

WN 2: Buy EURO 34,250 one month forward:

- Spot rate = EUR 1.4468-1.4472/GBP
- One-month swap points are 10-20. Swap points are in ascending order and hence the same needs to be added to spot rate to get one-month forward rate
- One-month forward rate = EUR 1.4478-1.4492/GBP

Known component = EUR 34,250; Unknown component = ? GBP
Unknown component = Known component x ?
$GBP = EUR \times \left(\frac{GBP}{EUR} \right)$
Deciding Bid rate/Ask Rate:
We need to check what the customer is doing with denominator currency (EUR). Customer is going to buy EUR and bank is going to sell EUR. Bank sells EUR at ask rate and hence ask rate will be used in the formula
$GBP = EUR \times ASK \left(\frac{GBP}{EUR} \right)$
$GBP = 34,250 \times \frac{1}{BID \left(\frac{EUR}{GBP} \right)}$

$$\text{GBP} = 34,250 \times \frac{1}{1.4478}$$

$$\text{GBP outflow} = \text{GBP } 23,656.58$$

WN 3: Sell USD 93,750 three months forward:

- Spot rate = USD 1.5865-1.5870/GBP
- Three-month swap points are 25-35. Swap points are in ascending order and hence the same needs to be added to spot rate to get one-month forward rate
- Three-month forward rate = USD 1.5890-1.5905/GBP

Known component = USD 93,750; Unknown component = ? GBP

Unknown component = Known component x ?

$$\text{GBP} = \text{USD} \times \left(\frac{\text{GBP}}{\text{USD}} \right)$$

Deciding Bid rate/Ask Rate:

We need to check what the customer is doing with denominator currency (USD). Customer is going to sell USD and bank is going to buy USD. Bank buys USD at bid rate and hence bid rate will be used in the formula

$$\text{GBP} = \text{USD} \times \text{BID} \left(\frac{\text{GBP}}{\text{USD}} \right)$$

$$\text{GBP} = 93,750 \times \frac{1}{\text{ASK} \left(\frac{\text{USD}}{\text{GBP}} \right)}$$

$$\text{GBP} = 93,750 \times \frac{1}{1.5905}$$

$$\text{GBP inflow} = \text{GBP } 58,943.73$$

WN 4: Buy USD 1,00,000 two months forward:**Swap points for 2 months:**

Particulars	BID	ASK
1-month swap points	20	30
3-month swap points	25	35
2-month swap points	22.50	32.50

- Spot rate = USD 1.5865-1.5870/GBP
- Two-month swap points are 22.5-32.5. Swap points are in ascending order and hence the same needs to be added to spot rate to get one-month forward rate
- Three-month forward rate = USD 1.58875-1.59025/GBP

Known component = USD 1,00,000; Unknown component = ? GBP

Unknown component = Known component x ?

$$\text{GBP} = \text{USD} \times \left(\frac{\text{GBP}}{\text{USD}} \right)$$

Deciding Bid rate/Ask Rate:

We need to check what the customer is doing with denominator currency (USD). Customer is going to buy USD and bank is going to sell USD. Bank sells USD at ASK rate and hence ASK rate will be used in the formula

$$\text{GBP} = \text{USD} \times \text{ASK} \left(\frac{\text{GBP}}{\text{USD}} \right)$$

$$\text{GBP} = 1,00,000 \times \frac{1}{\text{BID} \left(\frac{\text{USD}}{\text{GBP}} \right)}$$

$$\text{GBP} = 1,00,000 \times \frac{1}{1.58875}$$

$$\text{GBP outflow} = \text{GBP } 62,942.56$$

21. Swap points [May 2019 MTP, May 2009]

You have following quotes from Bank A and Bank B:

	Bank A	Bank B
SPOT	CHF/USD 1.4650/55	CHF/USD 1.4653/60
3 Months	5/10	
6 Months	10/15	

SPOT	USD/GBP 1.7645/60	USD/GBP 1.7640/50
3 Months	25/20	
6 Months	35/25	

Calculate:

- How much minimum CHF amount you have to pay for 1 Million GBP spot?
- Considering the quotes from Bank A only, for CHF/GBP what are the implied swap points for spot over 3 months?

Answer:**WN 1: Computation of minimum CHF amount to buy 1 million GBP:**

Known component = GBP 10,00,000; Unknown component = ? CHF
Unknown component = Known component x ?
$\text{CHF} = \text{GBP} \times \left(\frac{\text{CHF}}{\text{GBP}} \right)$
Deciding Bid rate/Ask Rate: We need to check what the customer is doing with denominator currency (GBP). Customer is going to buy GBP and bank is going to sell GBP. Bank sells GBP at ASK rate and hence ASK rate will be used in the formula $\text{CHF} = \text{GBP} \times \text{ASK} \left(\frac{\text{CHF}}{\text{GBP}} \right)$ $\text{CHF} = \text{GBP} \times \text{ASK} \left(\frac{\text{CHF}}{\text{USD}} \times \frac{\text{USD}}{\text{GBP}} \right)$ $\text{CHF} = 10,00,000 \times (1.4655 \times 1.7650)$ CHF outflow = CHF 25,86,607.50

Note:

- Since there are two banks, the customer can choose either of the two banks. The customer should choose a bank which leads to lower outflow and higher inflow
- For CHF/USD we are using Bank A as it has lower ASK rate and for USD/GBP we are using Bank B as it has lower ASK rate

WN 2: Computation of implied swap points for CHF/GBP rate:**Spot rates:**

$$\text{BID} \left(\frac{\text{CHF}}{\text{GBP}} \right) = \text{BID} \left(\frac{\text{CHF}}{\text{USD}} \right) \times \text{BID} \left(\frac{\text{USD}}{\text{GBP}} \right)$$

$$\text{BID} \left(\frac{\text{CHF}}{\text{GBP}} \right) = 1.4650 \times 1.7645 = 2.5850$$

$$\text{ASK} \left(\frac{\text{CHF}}{\text{GBP}} \right) = \text{ASK} \left(\frac{\text{CHF}}{\text{USD}} \right) \times \text{ASK} \left(\frac{\text{USD}}{\text{GBP}} \right)$$

$$\text{ASK} \left(\frac{\text{CHF}}{\text{GBP}} \right) = 1.4655 \times 1.7660 = 2.5881$$

3-month Forward rates:

$$\text{BID} \left(\frac{\text{CHF}}{\text{GBP}} \right) = \text{BID} \left(\frac{\text{CHF}}{\text{USD}} \right) \times \text{BID} \left(\frac{\text{USD}}{\text{GBP}} \right)$$

$$\text{BID} \left(\frac{\text{CHF}}{\text{GBP}} \right) = 1.4655 \times 1.7620 = 2.5822$$

$$\text{ASK} \left(\frac{\text{CHF}}{\text{GBP}} \right) = \text{ASK} \left(\frac{\text{CHF}}{\text{USD}} \right) \times \text{ASK} \left(\frac{\text{USD}}{\text{GBP}} \right)$$

$$\text{ASK} \left(\frac{\text{CHF}}{\text{GBP}} \right) = 1.4665 \times 1.7640 = 2.5869$$

Swap points:

Particulars	BID Rate	ASK Rate
Spot rate	2.5850	2.5881
3-month forward rate	2.5822	2.5869
3-month swap points	0.0028 (or) 28	0.0012 (or) 12

22. Forward gain/loss [May 2009, May 2014 MTP, Nov 2014 RTP]

Your forex dealer had entered into a cross currency deal and had sold USD 10,00,000 against EURO at USD 1 = EURO 1.4400 for spot delivery. However, later during the day, the market became volatile and the dealer in compliance with his management's guidelines had to square-up the position when the quotations were:

Spot USD 1	INR 31.4300/4500
1 month margin	25/20
2 months margin	45/35
Spot USD 1	EURO 1.4400/4450
1 month forward	1.4425/4490
2 months forward	1.4460/4530

What will be the gain or loss in the transaction?

Answer:

- Squaring up means that we have to take opposite position. The forex dealer has sold USD 10,00,000 and hence he has to now buy 10,00,000 USD
- The forex dealer has sold 10,00,000 USD and he would get 14,40,000 EUROS (10,00,000 × 1.4400)
- In order to square up the position, the dealer has to buy 10,00,000 USD

Known component = USD 10,00,000; Unknown component = ? EUROS
Unknown component = Known component × ?
$\text{EUR} = \text{USD} \times \left(\frac{\text{EUR}}{\text{USD}} \right)$
Deciding Bid rate/Ask Rate: We need to check what the forex dealer is doing with denominator currency (USD). Forex dealer is going to buy USD and the other bank is going to sell USD. Bank sells USD at ASK rate and hence ASK rate will be used in the formula $\text{EUR} = \text{USD} \times \text{ASK} \left(\frac{\text{EUR}}{\text{USD}} \right)$ $\text{EUR} = 10,00,000 \times 1.4450$ Euros outflow = EUR 14,45,000
Net loss of forex dealer = Receipt of EUR 14,40,000 – Payment of EUR 14,45,000 = EUR 5,00,000
The dealer has made a loss of 5,000 EUROS and he should buy the same by paying INR. It is assumed that forex dealer is based out of India and hence loss is finally converted into INR
Known component = EUR 5,000; Unknown component = ? INR
Unknown component = Known component × ?
$\text{INR} = \text{EUR} \times \left(\frac{\text{INR}}{\text{EUR}} \right)$
Deciding Bid rate/Ask Rate: We need to check what the forex dealer is doing with denominator currency (EUR). Forex dealer is going to buy EUR and the other bank is going to sell EUR. Bank sells EUR at ASK rate and hence ASK rate will be used in the formula $\text{INR} = \text{EUR} \times \text{ASK} \left(\frac{\text{INR}}{\text{EUR}} \right)$ $\text{INR} = \text{EUR} \times \text{ASK} \left(\frac{\text{INR}}{\text{USD}} \times \frac{\text{USD}}{\text{EUR}} \right)$ $\text{INR} = 5,000 \times 31.4500 \times \frac{1}{1.4400}$ Loss in INR = Rs.1,09,201.39

23. Appreciation and depreciation of foreign currency:

Fleur du lac, a French co., had shipped on Jan 2, 2012 goods to an American importer under a letter of credit arrangement, which calls for payment at the end of 90 days. The invoice is for USD 1,24,000. On the date of shipment the exchange rate was 5.70 French francs to the USD. If the French Franc were to strengthen by 5% by the end of 90 days what would be the transactions gain or loss in French Francs? If it were to weaken by 5%, what would happen?

WN 1: Computation of exchange rate at end of day 90:

Scenario 1: French Franc strengthens by 5%:

- ❖ Spot rate is 5.70 French Franc/USD.
- ❖ French Franc is appreciating by 5 percent. We need to ensure that French Franc is the product for applying this percentage. Hence the quote is converted as USD 0.175439/French Franc
- ❖ There has been a gain of 5 percent and the appreciation is USD 0.008772/French Franc
- ❖ 90 days quote post appreciation is USD 0.184211/French Franc

- ❖ The quote is converted back to the base quote and the same is 5.4286 French Franc/USD

Gain or loss calculation:

Particulars	Calculation	Amount
Realization pre appreciation	1,24,000 × 5.70	FF 7,06,800
Realization post appreciation	1,24,000 × 5.4286	FF 6,73,146
Loss post appreciation		FF 33,654

Note:

- ICAI Solution to this question is wrong as they have directly applied 5 percent on quote of 5.70. But we cannot apply directly as French Franc is the price and not the product.

Scenario 2: French Franc weakens by 5%:

- ❖ Spot rate is 5.70 French Franc/USD.
- ❖ French Franc is appreciating by 5 percent. We need to ensure that French Franc is the product for applying this percentage. Hence the quote is converted as USD 0.175439/French Franc
- ❖ There has been a loss of 5 percent and the appreciation is USD 0.008772/French Franc
- ❖ 90 days quote post depreciation is USD 0.166667/French Franc
- ❖ The quote is converted back to the base quote and the same is 6.00 French Franc/USD

Gain or loss calculation:

Particulars	Calculation	Amount
Realization pre depreciation	1,24,000 × 5.70	FF 7,06,800
Realization post depreciation	1,24,000 × 6.00	FF 7,44,000
Gain post depreciation		FF 37,200

24. Discount computation [Nov 2019 RTP, Nov 2004, Nov 2018]

Excel Exporters are holding an Export bill in United States Dollar (USD) 1,00,000 due 60 days hence. They are worried about the falling USD value which is currently at Rs.45.60 per USD. The concerned export consignment has been priced on an exchange rate of Rs.45.50 per USD. The firm's banker have quoted a 60-day forward rate of Rs.45.20.

Calculate:

- Rate of discount quoted by the bank
- The probable loss of operating profit if the forward sale is agreed to

Answer:**WN 1: Computation of rate of discount quoted by the bank:**

$$\text{Rate of discount} = \frac{\text{Forward rate} - \text{Spot rate}}{\text{Spot rate}} \times \frac{365}{60} \times 100$$

$$\text{Rate of discount} = \frac{45.20 - 45.60}{45.60} \times \frac{365}{60} \times 100 = 5.34\%$$

WN 2: Probable loss of operating profit:

Particulars	Calculation	Amount
Amount billed	1,00,000 × 45.50	45,50,000
Expected realization	1,00,000 × 45.20	45,20,000
Loss of operating profit		30,000

Part III - IRPT and PPT**25. IRPT [Nov 2012, May 2004]**

The US dollar is selling in India at Rs.55.50. If the interest rate in India is 10% per annum and the corresponding rate in USA is 4%

- Do you expect that USD will be at a premium or at discount in the Indian forex market?
- What will be the expected forward rate for US dollar in India after six months and 1 year?
- What will be the rate of forward premium or discount?
- What will be the forward rate after 365 days if the interest rates are compounded continuously?

Answer:**Part a:**

- Interest rate in USA is lower than that of India. High interest rates in India will be offset by depreciation of INR. Hence the USD will be at a premium in the Indian forex market

Part b:

6-month forward rate:

Spot rate = INR 55.50/USD
Home currency = INR
R _h (Indian rate) = 5% per half year
Foreign currency = USD
R _f (USA rate) = 2% per half year
$\frac{1 + R_h}{1 + R_f} = \frac{F_1}{e_0}; \frac{1 + 5\%}{1 + 2\%} = \frac{F_1}{55.50}$
$F_1 = \frac{55.50 \times 1.05}{1.02} = \text{RS. } 57.13 \text{ per USD}$

1-year forward rate:

Spot rate = INR 55.50/USD
Home currency = INR
R _h (Indian rate) = 10% per year
Foreign currency = USD
R _f (USA rate) = 4% per year
$\frac{1 + R_h}{1 + R_f} = \frac{F_1}{e_0}; \frac{1 + 10\%}{1 + 4\%} = \frac{F_1}{55.50}$
$F_1 = \frac{55.50 \times 1.10}{1.04} = \text{Rs. } 58.70 \text{ per USD}$

Part c:**Computation of forward premium or discount:****Using 6-month rates:**

Premium or discount % For USD (product)	$\frac{\text{Forward rate} - \text{Spot rate}}{\text{Spot rate}} \times \frac{12}{m} \times 100$ $\frac{57.13 - 55.50}{55.50} \times \frac{12}{6} \times 100$	5.87% (appreciation)
Premium or discount % For INR (price)	$\frac{\text{Spot rate} - \text{Forward rate}}{\text{Forward rate}} \times \frac{12}{m} \times 100$ $\frac{55.50 - 57.13}{57.13} \times \frac{12}{6} \times 100$	-5.71% (depreciation)

Using 1-year rates:

Premium or discount % For USD (product)	$\frac{\text{Forward rate} - \text{Spot rate}}{\text{Spot rate}} \times \frac{12}{m} \times 100$ $\frac{58.70 - 55.50}{55.50} \times \frac{12}{12} \times 100$	5.77% (appreciation)
Premium or discount % For INR (price)	$\frac{\text{Spot rate} - \text{Forward rate}}{\text{Forward rate}} \times \frac{12}{m} \times 100$ $\frac{55.50 - 58.70}{58.70} \times \frac{12}{12} \times 100$	-5.45% (depreciation)

Part d:

- Interest rates are compounded continuously and hence we should calculate effective rate using e^x values
- Interest rate in India = 10% per annum; Effective rate = $e^{0.10} - 1 = 10.52\%$
- Interest rate in USD = 4% per annum; Effective rate = $e^{0.04} - 1 = 4.08\%$

Spot rate = INR 55.50/USD
Home currency = INR
R _h (Indian rate) = 10.52% per year
Foreign currency = USD
R _f (USA rate) = 4.08% per year
$\frac{1 + R_h}{1 + R_f} = \frac{F_1}{e_0}; \frac{1 + 10.52\%}{1 + 4.08\%} = \frac{F_1}{55.50}$
$F_1 = \frac{55.50 \times 1.1052}{1.0408} = \text{Rs. } 58.93 \text{ per USD}$

26. IRPT

The following table shows interest rates for USD and EURO. Spot exchange rate is 0.8006 EURO per dollar. Complete the missing entries:

Particulars	6 Months
USD interest p.a.	8%
France interest p.a.	XX
Forward Euro per dollar	XX
Forward discount on Euro percent per year	(4%)

Answer:

WN 1: Computation of forward rate:

- Spot exchange rate = 0.8006 EURO per USD
- Forward discount on EURO is 4% per year and the same would be 2% for 6 months
- Forward discount/premium can be applied only to the product only to get the forward rate
- In the above quote USD is the product and hence we should convert this into the other quote
- 0.8006 EURO per USD = 1.2491 USD/EURO
- **Forward rate = 1.2491 - 2% = 1.2241 USD/EURO (or) 0.8169 EURO/USD**

WN 2: Computation of France Interest:

Spot rate = EUR 0.8006 per USD
Home currency = EUR
R _h (France rate) = ?
Foreign currency = USD
R _f (USA rate) = 8% per year (or) 4% per half-year
$\frac{1 + R_h}{1 + R_f} = \frac{F_1}{e_0}; \frac{1 + X}{1 + 4\%} = \frac{0.8169}{0.8006}$
$1 + X = \frac{0.8169 \times 1.04}{0.8006}; 1 + X = 1.0612$
X = 6.12%;
France Interest rate = 6.12% per half-year (or) 12.24% per annum

27. IRPT [Nov 2008]

On 1st April, 3 months interest rate in the US and Germany are 6.5 percent and 4.5 percent per annum respectively. The \$/DM spot rate is 0.6560. What would be the forward rate for DM for delivery on 30th June?

Answer:

Spot rate = USD 0.6560 per DM
Home currency = USD
R _h (USA) = 6.5% per annum (or) 1.625% per 3 months
Foreign currency = DM
R _f (Germany rate) = 4.5% per year (or) 1.125% per 3 months
$\frac{1 + R_h}{1 + R_f} = \frac{F_1}{e_0}; \frac{1 + 1.625\%}{1 + 1.125\%} = \frac{F_1}{0.6560}$
$F_1 = \frac{0.6560 \times 1.011625}{1.01125} = 0.6592$
3-month forward rate = USD 0.6592/DM

28. IRPT

Shoe Company sells to a wholesaler in Germany. The purchase price of a shipment is 50,000 deutsche marks with term of 90 days. Upon payment, Shoe Company will convert the DM to dollars. The present spot rate for DM per dollar is 1.71, whereas the 90-day forward rate is 1.70.

You are required to calculate and explain:

- If Shoe Company were to hedge its foreign-exchange risk, what would it do? What transactions are necessary?
- Is the deutsche mark at a forward premium or at a forward discount?
- What is the implied differential in interest rates between the two countries?

Answer:

- **Part A:** The shoe company can hedge its foreign exchange risk by taking a forward contract. The forward contract would be for selling 50,000 DM
- **Part B:** The spot rate is DM 1.71/USD whereas the forward rate is DM 1.70/USD. This indicates that USD is depreciating and hence DM is appreciating.
- **Part C:** Implied differential in exchange rates would be equal to appreciation or depreciation of currency

Premium or discount % For USD (product)	$\frac{\text{Forward rate} - \text{Spot rate}}{\text{Spot rate}} \times \frac{365}{d} \times 100$ $\frac{1.70 - 1.71}{1.71} \times \frac{365}{90} \times 100$	-2.37% (depreciation)

- USD has annual depreciation of 2.37%. This would mean that interest rate in USA will be higher than that of Germany. Hence Interest rate in USA would be 2.37% higher than that of Germany

29. IRPT

The following table shows interest rates for the United States dollar and French francs. The spot exchange rate is 7.05 francs per dollars complete the missing entries:

Particulars	3 months	6 months	1 year
Dollar interest rate (Annually compounded)	11.5%	12.25%	?
Franc interest rate (Annually compounded)	19.5%	?	20%
Forward France per Dollar	?	?	7.5200
Forward discount per Franc p.a.	?	-6.30%	

Answer:

WN 1: Computation of 3 month missing entries:

Spot rate = 7.05 FFR/USD
Home currency = FFR
R _h (Franc) = 19.5% per annum (or) 4.875% per 3 months
Foreign currency = USD
R _f (Dollar rate) = 11.5% per year (or) 2.875% per 3 months
$\frac{1 + R_h}{1 + R_f} = \frac{F_1}{e_0}; \frac{1 + 4.875\%}{1 + 2.875\%} = \frac{F_1}{7.05}$
$F_1 = \frac{7.05 \times 1.04875}{1.02875} = 7.19$
3-month forward rate = 7.19 FFR/USD

Computation of Forward Discount for FFR (Price)

Premium or discount % For FFR (price)	$\frac{\text{Spot rate} - \text{Forward rate}}{\text{Forward rate}} \times \frac{12}{m} \times 100$ $\frac{7.05 - 7.19}{7.19} \times \frac{12}{3} \times 100$	-7.79% (Depreciation)

WN 2: Computation of 6 month missing entries:

Spot rate = 7.05 FFR/USD (or) 0.141844 USD/FFR
Forward discount on Franc per year = 6.3% per year
Forward discount on Franc per 6-months = 3.15% per half-year
6-month Forward rate = 0.141844 USD/FFR - 3.15%
6-month Forward rate = 0.137376 USD/FFR (or)
6-month Forward rate = 7.28 FFR/USD
Home currency = FFR
R _h (Franc) = ?
Foreign currency = USD
R _f (Dollar rate) = 12.25% per year (or) 6.125% per 6 months
$\frac{1 + R_h}{1 + R_f} = \frac{F_1}{e_0}; \frac{1 + X}{1 + 6.125\%} = \frac{7.28}{7.05}$
$1 + X = \frac{7.28 \times 1.06125}{7.05} = 1.0959$
X = 9.59%; Franc interest rate = 9.59% per 6 months (or) 19.18% per annum

WN 3: Computation of 1-year missing entries:

Spot rate = 7.05 FFR/USD
1-year Forward rate = 7.52 FFR/USD
Home currency = FFR
R _h (Franc) = 20%
Foreign currency = USD
R _f (Dollar rate) = ?
$\frac{1 + R_h}{1 + R_f} = \frac{F_1}{e_0}; \frac{1 + 20\%}{1 + X} = \frac{7.52}{7.05}$
$1 + X = \frac{7.05 \times 1.20}{7.52} = 1.125$
X = 12.50%; USD Interest rate = 12.50% per annum

WN 4: Solution:

Particulars	3 months	6 months	1 year
Dollar interest rate (Annually compounded)	11.5%	12.25%	12.50%
Franc interest rate (Annually compounded)	19.5%	19.18%	20%
Forward France per Dollar	7.19	7.28	7.5200
Forward discount per Franc p.a.	7.79%	-6.30%	

30. Law of one price - estimating future rate

A laptop bag is priced at USD 105.00 in New York. The same bag is priced at Rs.4,200 in Mumbai.

- ❖ Determine exchange rate in Mumbai.
- ❖ Determine the price of the bag in both the cities if next year price increases by 7 percent in Mumbai and by 4 percent in New York
- ❖ Determine the appreciation or depreciation in Rupee in one year from now

Answer:**WN 1: Computation of spot exchange rate and forward exchange rate:****Spot exchange rate:**

Price of bag in India = Rs.4,200
Price of bag in USA = USD 105
Price of Bag in India = Price of Bag in USA
Rs.4,200 = USD 105; Rs.40 = USD 1
Spot exchange rate = Rs.40/USD

Forward exchange rate after 1 year:

Price of bag in India = Rs.4,200 + 7% = Rs.4,494
Price of bag in USA = USD 105 + 4% = USD 109.20
Price of Bag in India = Price of Bag in USA
Rs.4,494 = USD 109.20; Rs.41.15 = USD 1
1-year forward rate = Rs.41.15/USD

WN 2: Computation of appreciation/depreciation in rupee (Price):

Premium or discount % For INR (Price)	$\frac{\text{Spot rate} - \text{Forward rate}}{\text{Forward rate}} \times \frac{12}{m} \times 100$ $\frac{40 - 41.15}{41.15} \times \frac{12}{12} \times 100$	-2.80% (depreciation)

31. Estimating future rate [May 2010, Nov 2008]

The rate of inflation in India is 8% per annum and in the USA it is 4%. The current spot rate for USD in India is Rs.46. What will be the expected rate after 1 year and after 4 years applying the purchasing power parity theory.

Answer:**WN 1: Computation of 1-year forward rate:**

Spot rate = Rs.46 per USD
Home currency = INR

I_h (India) = 8% per annum
Foreign currency = USD
I_f (USA rate) = 4% per annum
$\frac{1 + I_h}{1 + I_f} = \frac{F_1}{e_0}; \frac{1 + 8\%}{1 + 4\%} = \frac{F_1}{46}$
$F_1 = \frac{46 \times 1.08}{1.04} = 47.77$
1-year forward rate = Rs.47.77 per USD

WN 2: Computation of 4-year forward rate:

Spot rate = Rs.46 per USD
Home currency = INR
I_h (India) = 8% per annum
Foreign currency = USD
I_f (USA rate) = 4% per annum
$\frac{(1 + I_h)^4}{(1 + I_f)^4} = \frac{F_4}{e_0}; \frac{(1 + 8\%)^4}{(1 + 4\%)^4} = \frac{F_4}{46}$
$F_4 = \frac{46 \times 1.08^4}{1.04^4} = 53.50$
4-year forward rate = Rs.53.50 per USD

32. PPT

A pen drive costs USD 22.84 in New York, SGD 69 in Singapore and Rs.3500 in India.

- ❖ If the law of one price held, ascertain the exchange rate between the three countries?
- ❖ The actual exchange rates on that day was USD 1 = SGD 1.63 & USD 1 = INR 52.68. Where would it be beneficial to buy a pen drive?

Answer:**WN 1: Computation of exchange rates:****New York and Singapore:**

Price in New York = Price in Singapore
USD 22.84 = SGD 69
USD 1 = SGD 3.02
Exchange rate = SGD 3.02/USD

New York and India:

Price in New York = Price in India
USD 22.84 = INR 3,500
USD 1 = INR 153.24
Exchange rate = INR 153.24/USD

India and Singapore:

Price in Singapore = Price in India
SGD 69 = INR 3,500
SGD 1 = INR 50.72
Exchange rate = INR 50.72/SGD

WN 2: Identification of beneficial place to buy pen drive:

- We should convert the prices of different countries into one common currency in order to find the favorable place to buy pen drive
- The quote has been given in terms of USD for other two currencies and hence let us convert the price in USD at difference places

Price in USA = USD 22.84
Price in Singapore = SGD 69 (or) USD 42.33 (69/1.63)
Price in India = INR 3,500 (or) USD 66.44 (3,500/52.68)

- It is beneficial to buy pen drive in USA as the outflow is lowest in USA

33. Space arbitrage

In International Monetary Market an international forward bid for December, 15 on pound sterling is \$ 1.2816 at the same time that the price of IMM sterling future for delivery on December 15, is \$ 1.2806. The contract size of pound sterling is 62,500. How could the dealer use arbitrage in profit from this situation and how much profit is earned?

Answer:

- In the forward market, the exchange rate is USD 1.2816 per GBP
- In the futures market, the exchange rate is USD 1.2806 per GBP.
- In order to exploit the arbitrage opportunity, the dealer can buy pounds in futures market at USD 1.2806 per GBP. He can also enter into a forward contract for selling pounds at USD 1.2816 per GBP
- Arbitrage profit = Contract size x (Selling price - Purchase price)
- Arbitrage profit = GBP 62,500 x (1.2816 - 1.2806) = USD 62.50

34. Arbitrage (Nov 2020 RTP):

Citi Bank quotes JPY/ USD 105.00 -106.50 and Honk Kong Bank quotes USD/JPY 0.0090 - 0.0093.

(a) Are these quotes identical if not then how they are different.

(b) Is there a possibility of arbitrage?

(c) If there is an arbitrage opportunity, then show how would you make profit from the given quotation in both cases if you are having JPY 1,00,000 or US\$ 1,000.

Answer:**Part 1:**

No, while Citi Bank's quote is a Direct Quote for JPY (i.e. for Japan) the Hong Kong Bank quote is a Direct Quote for USD (i.e. for USA)

Part 2:

To decide on arbitrage, we need to convert the quote in similar terms and hence we can convert USD/JPY quote of Honk Kong Bank into JPY/USD rate

BID $\left(\frac{\text{JPY}}{\text{USD}}\right)$	$= \frac{1}{0.0093}$	JPY 107.53/USD
BID $\left(\frac{\text{USD}}{\text{JPY}}\right)$	$= \frac{1}{0.0090}$	JPY 111.11/USD

- Arbitrage opportunity would exist as we can buy USD at the rate of JPY 106.50/USD in Citi Bank and sell the same at JPY 107.53/USD in Hong Kong Market

Part 3:**Profit if we start with JPY 1,00,000**

Particulars	Calculation	Amount
Sell 1,00,000 JPY and buy USD at the rate of 106.50 (Citi Bank)	$= \frac{1,00,000}{106.50}$	USD 939.97
Sell USD 939.97 in Hong Kong Market	939.97×107.53	JPY 1,00,967.44
Arbitrage gain	1,00,967.44 - 1,00,000	JPY 967.44

Profit if we start with USD 1,000:

Particulars	Calculation	Amount
Sell 1,000 USD in Hong Kong Market	$1,000 \times 107.53$	JPY 1,07,530
Sell JPY 1,07,530 in Citi Bank	$\frac{1,07,530}{106.50}$	USD 1,009.67
Arbitrage gain	1,009.67 - 1,000	USD 9.67

35. Arbitrage [Nov 2018 RTP, Nov 2020 RTP]:

The current spot exchange rate is \$1.35/£ and the three-month forward rate is \$1.30/£. According to your analysis of the exchange rate, you are quite confident that the spot exchange rate will be \$1.32/£ after 3 months.

(i) Suppose you want to speculate in the forward market then what course of action would be required and what is the expected dollar Profit (Loss) from this speculation?

(ii) What would be your Profit (Loss) in Dollar terms on the position taken as per your speculation if the spot exchange rate turns out to be \$1.26/£.

Assume that you would like to buy or sell £1,000,000.

Answer:

i) If you believe the spot exchange rate will be \$ 1.32/£ in three months, you should buy £ 1,000,000 forward for \$1.30/£ and sell at \$ 1.32/£ 3 months hence. Your expected profit will be: £1,000,000 × (\$1.32 - \$1.30) = \$20,000

(ii) If the spot exchange rate turns out to be \$1.26/£ in three months, your loss from the long position in Forward Market will be: £ 1,000,000 × (\$ 1.26 - \$1.30) = \$ 40,000

36. Time arbitrage

The interest rate on pounds is 12 percent in UK and 7 percent in US. The pound spot rate is 1.79 and the one-year forward rate is 1.68. Check whether arbitrage opportunity exists.

Answer:

The given quote has been interpreted as USD/GBP. This is because GBP is costlier currency as compared to USD

WN 1: Computation of Fair home currency interest rate:

Spot rate = USD 1.79/GBP
1-year forward rate = USD 1.68/GBP
Home currency = USD
Fair interest rate in USA = ?
Foreign currency = GBP
R _f (UK) rate = 12% per annum
$\frac{1 + R_h}{1 + R_f} = \frac{F_1}{e_0}, \frac{1 + R_h}{1 + 12\%} = \frac{1.68}{1.79}$
$1 + R_h = \frac{1.68 \times 1.12}{1.79} = 1.0512$
Fair interest rate in USA = 5.12%
Actual interest rate in USA = 7.00%

WN 2: Arbitrage mechanism:

- Actual interest rate is higher than fair interest rate. In order to exploit the arbitrage opportunities, we should borrow money from UK and invest in USA. We are investing in USA as we will earn interest higher than the fair rate

Particulars	Amount
Day 0:	
Borrow 1,00,000 GBP @ 12% for 1 year	GBP 1,00,000
Convert GBP into USD at spot rate (1,00,000 × 1.79)	USD 1,79,000
Invest USD 1,79,000 @ 7% for 1 year	USD 1,79,000
Enter into forward contract to convert investment proceeds @ USD 1.68 per GBP after one year	
Day 365:	
Redeem USD deposit along with interest (1,79,000 + 7%)	USD 1,91,530
× Convert USD into GBP at pre-agreed forward rate (1,79,000/1.68)	GBP 1,14,005.95
Repay GBP loan along with interest (1,00,000 + 12%)	GBP 1,12,000
Arbitrage gain	GBP 2,005.95

- Final Arbitrage gain = GBP 2,005.95 (or) USD 3,370 (2,005.95 × 1.68)

37. Time arbitrage [May 2006, Nov 2010, May 2016, May 2018, May 2018 MTP, Nov 2014 MTP]

Given the following information:

Exchange rate - Canadian dollar 0.665 per DM (spot)

Canadian dollar 0.670 per DM (3 months)

Interest rates - DM 7% p.a.

Canadian Dollar - 9% p.a.

What operations would be carried out to take the possible arbitrage gains?

Answer:

WN 1: Computation of Fair home currency interest rate:

Spot rate = CAD 0.665/DM
3-month forward rate = CAD 0.670/DM
Home currency = CAD
Fair interest rate in Canada = ?
Foreign currency = DM
R _f (DM) rate = 7% per annum (or) 1.75% per 3 months
$\frac{1 + R_h}{1 + R_f} = \frac{F_1}{e_0}; \frac{1 + R_h}{1 + 1.75\%} = \frac{0.670}{0.665}$
$1 + R_h = \frac{0.670 \times 1.0175}{0.665} = 1.0252$
Fair interest rate in CAD = 2.52% per 3 months (or) 10.08% per annum
Actual interest rate in CAD = 9.00% per annum (or) 2.25% per 3 months

WN 2: Arbitrage mechanism:

- Actual interest rate is lower than fair interest rate. In order to exploit the arbitrage opportunities, we should borrow money in CAD and invest in DM. We are borrowing in CAD as we are paying interest lower than the fair rate

Particulars	Amount
Day 0:	
Borrow 1,00,000 CAD @ 9% for 3 months	CAD 1,00,000
Convert CAD into DM at spot rate (1,00,000/0.665)	DM 1,50,375.94
Invest DM 1,50,375.94 @ 7% for 3-months	DM 1,50,375.94
Enter into forward contract to convert investment proceeds @ CAD 0.670 per DM after three months	
Month 3:	
Redeem DM deposit along with interest (1,50,375.94 + 1.75%)	DM 1,53,007.52
Convert DM into CAD at pre-agreed forward rate (1,53,007.52 x 0.670)	CAD 1,02,515.04
Repay CAD loan along with interest (1,00,000 + 2.25%)	CAD 1,02,250
Arbitrage gain	CAD 265.04

- Final Arbitrage gain = CAD 265.04 (or) DM 395.58

38. Time arbitrage [May 2012 RTP]

The risk free rate of interest rate in USA is 8% per annum and in UK is 5% per annum. The spot exchange rate between USD and GBP is 1 USD = GBP 0.75. Assume that interest is compounded on daily basis then what should be the forward rate of 2 year? Further show how an investor could make risk-less profit, if two year forward price is 1 USD = 0.85 GBP.

Given $e^{-0.06} = 0.9413$; $e^{-0.016} = 0.852$; $e^{0.16} = 1.1735$; $e^{-0.1} = 0.9051$

Answer:**WN 1: Computation of forward rate as per IRPT:**

- ❖ Spot rate = GBP 0.75/USD
- ❖ Home rate = Interest rate in UK = 5% per annum or 10% per 2 years
- ❖ Foreign rate = Interest rate in USA = 8% per annum or 16% per 2 years
- ❖ Forward rate after 2 years = ?

Forward rate calculation:

$\frac{1 + R_h}{1 + R_f} = \frac{F_1}{e_0}$
$\frac{e^{0.10}}{e^{0.16}} = \frac{F_1}{0.75}$
$\frac{1.1049}{1.1735} = \frac{F_1}{0.75}$
$F_1 = \frac{0.75 \times 1.1049}{1.1735}$
F₁ = GBP 0.706/USD

WN 2: Arbitrage opportunity if the actual exchange rate is GBP 0.85/USD:

- ❖ Actual exchange rate of GBP 0.85/USD is higher than fair exchange rate of GBP 0.706/USD. This would mean that dollar is going to costlier than what the fair rate suggests. Hence we should go ahead and invest in USD and borrow in GBP.

Arbitrage steps:

Particulars	Calculation	Amount
Day 0:		
1. Borrow 1,00,000 GBP for 2 years at 5% CCRFI		GBP 1,00,000
2. Convert GBP into USD at spot rate	1,00,000/0.75	USD 1,33,333
3. Invest USD 1,33,333 for 2 years at 8% CCRFI		USD 1,33,333
4. Enter into forward contract to sell USD at the rate of GBP 0.85/USD		USD 1,33,333
Year 2:		
5. Redeem USD deposit along with interest	1,33,333 x 1.1735	USD 1,56,466
6. Convert USD into GBP at forward rate	1,56,466 x 0.85	GBP 1,32,996
7. Repay GBP loan along with interest	1,00,000 x 1.1049	GBP 1,10,490
8. Arbitrage gain		GBP 22,506

- Final arbitrage gain = GBP 22,506 (or) USD 26,477.65 (22,506/0.85)

39. Arbitrage opportunity [Nov 2018]

Spot rate 1 USD = Rs.68.50; USD premium on a six month forward is 3%. The annualized interest in USA is 4% and 9% in India. Is there any arbitrage possibility? If yes, how a trader can take advantage of the situation if he is willing to borrow USD 3 million.

Answer:**WN 1: Computation of fair interest rate of home currency:**

- ❖ Spot rate = INR 68.50/USD
- ❖ Forward rate = INR 70.555/USD (Spot rate + 3%)
- ❖ Actual Interest rate of home country = 9%
- ❖ Actual interest rate of foreign country = 4%

$\frac{1 + R_h}{1 + R_f} = \frac{F_1}{e_0}$
$\frac{1 + R_h}{1 + 2\%} = \frac{70.555}{68.50}$
$\frac{1 + R_h}{1.02} = 1.03$
$1 + R_h = 1.02 \times 1.03$
$1 + R_h = 1.0506$
$R_h = 5.06\%$

Actual interest rate in India (4.5%) is lower than Fair interest rate (5.06%). Hence we should borrow in India and invest in USA.

Particulars	Calculation	Amount (in lacs)
Day 0:		
1. Borrow INR equivalent of 3 million USD for 6 months at 4.5%	30 lacs x 68.50	INR 2,055
2. Convert INR into USD at spot rate	2,055/68.50	USD 30
3. Invest USD 30 lacs for 6 months at 2%		USD 30
4. Enter into forward contract to convert USD into INR at INR 70.555/USD		USD 30
Year 2:		
5. Redeem USD deposit along with interest	30 + 2%	USD 30.60
6. Convert USD into INR at forward rate	30.60 x 70.56	INR 2,159.136
7. Repay INR loan along with interest	2,055 + 4.5%	INR 2,147.475
8. Arbitrage gain		INR 11.661

- ❖ Arbitrage gain = Rs.11,66,100 (or) USD 16,526 (11,66,100/70.56)

40. Time arbitrage [Nov 2006, May 2016 MTP]

Spot rate 1USD = Rs.48.0123

180 days Forward rate for 1 USD = Rs.48.8190

Annualized interest rate for 6 months – Rupee = 12%

Annualized interest rate for 6 months – USD = 8%

Is there any arbitrage possibility? If yes how an arbitrageur can take advantage of the situation, if he is willing to borrow Rs.40,00,000 or USD 83,312.

Answer:

WN 1: Computation of Fair home currency interest rate:

Spot rate = Rs.48.0123/USD
6-month forward rate = INR 48.8190/USD
Home currency = INR
Fair interest rate in INR = ?
Foreign currency = USA
Rf (USA) rate = 8% per annum (or) 4% per half-year
$\frac{1 + R_h}{1 + R_f} = \frac{F_1}{e_0} ; \frac{1 + R_h}{1 + 4\%} = \frac{48.8190}{48.0123}$
$1 + R_h = \frac{48.8190 \times 1.04}{48.0123} = 1.0575$
Fair interest rate in India = 5.75% per half year (or) 11.50% per year
Actual interest rate in India = 12.00%

WN 2: Arbitrage mechanism:

- Actual interest rate is higher than fair interest rate. In order to exploit the arbitrage opportunities, we should borrow money in USD and invest in INR. We are investing in India as we will earn interest higher than the fair rate

Particulars	Amount
Day 0:	
Borrow 83,312 USD @ 8% for 6 months	USD 83,312
Convert USD into INR at spot rate (83,312 x 48.0123)	INR 40,00,000
Invest INR 40,00,000 @ 12% for 6 months	INR 40,00,000
Enter into forward contract to convert investment proceeds @ INR 48.8190 per USD after 6-months	
Day 180:	
Redeem INR deposit along with interest (40,00,000 + 6%)	INR 42,40,000
Convert INR into USD at pre-agreed forward rate (42,40,000/48.8190)	USD 86,851.43
Repay USD loan along with interest (83,312 + 4%)	USD 86,644.48
Arbitrage gain	USD 206.95

- Final Arbitrage gain = USD 206.05 (or) INR 10,103 (206.95 x 48.8190)

41. Decision on forward cover [May 2012 RTP]

True Blue Cosmetics Ltd. is an old line producer of cosmetics products made up of herbals. Their products are popular in India and all over the world but are more popular in Europe. The company invoice in Indian Rupee when it exports to guard itself against the fluctuation in exchange rate. As the company is enjoying monopoly position, the buyer normally never objected to such invoices. However, recently, an order has been received from a whole-saler of France for FFr 80,00,000. The other conditions of the order are as follows:

- The delivery shall be made within 3 months.
- The invoice should be FFr.

Since, company is not interested in losing this contract only because of practice of invoicing in Indian Rupee. The Export Manager Mr. E approached the banker of Company seeking their guidance and further course of action.

The banker provided following information to Mr. E.

- Spot rate 1 FFr = Rs. 6.60
- Forward rate (90 days) of 1 FFr = Rs. 6.50
- Interest rate in India is 9% and in France is 12%.

Mr. E entered in forward contract with banker for 90 days to sell FFr at above mentioned rate. When the matter come for consideration before Mr. A, Accounts Manager of company, he approaches you. You as a Forex consultant is required to comment on:

- Whether there is an arbitrage opportunity exists or not.

(ii) Whether the action taken by Mr. E is correct and if bank agrees for negotiation of rate, then at what forward rate company should sell FFR to bank.

Answer:

WN 1: Computation of forward rate as per IRPT:

- ❖ Spot rate = Rs.6.60/FFR
- ❖ Home rate = Interest rate in India = 9% per annum or 2.25% per 90 days
- ❖ Foreign rate = Interest rate in France = 12% per annum or 3% per 90 days
- ❖ 90 days forward rate = ?

Forward rate calculation:

$\frac{1 + R_h}{1 + R_f} = \frac{F_1}{e_0}$
$\frac{1 + 2.25\%}{1 + 3\%} = \frac{F_1}{6.60}$
$F_1 = \frac{1.0225 \times 6.60}{1.03}$
$F_1 = 6.55 \text{ INR/FFR}$

WN 2: Arbitrage opportunity if the actual exchange rate is INR 6.50/FFR

- ❖ Actual exchange rate of INR 6.50/FFR is lower than fair exchange rate of INR 6.55/FFR. This would mean that FFR is going to cheaper than what the fair rate suggests. Hence we should go ahead and borrow in FFR and invest in INR.

WN 3: Rate to be renegotiated with bank:

- ❖ The Fair forward rate is INR 6.55/FFR. The actual forward rate is INR 6.50/FFR.
- ❖ The company can renegotiate the rate with bank for a higher realization of INR 6.55/FFR

42. Asymmetrical rates

Following are the rates quoted at Mumbai for Pounds Sterling

Rs/GBP 82.03-90
3 month forward 20-30

Interest rates (3months)		
	Rupees	Pounds
Investment	8%	5%
Borrowing	10%	8%

- ❖ Verify whether there is any scope for covered interest arbitrage if you borrow rupees
- ❖ Verify whether there is any scope for covered interest arbitrage if you borrow pounds

Answer:

It is assumed that borrowing rates given in the question are annual rates applicable for 3-month borrowing.

WN 1: Check on arbitrage opportunity if we borrow in INR:

Particulars	Amount
Day 0:	
Borrow 1,00,000 INR @ 10% for 3 months	INR 1,00,000
Convert INR into GBP at spot rate (1,00,000 / 82.90)	GBP 1,206.27
Invest GBP 1,206.27 @ 5% for 3 months	GBP 1,206.27
Enter into forward contract to convert investment proceeds @ INR 82.23-83.20 per GBP after 3-months	
Day 90:	
Redeem GBP deposit along with interest (1,206.27 + 1.25%)	GBP 1,221.35
Convert GBP into INR at pre-agreed forward rate (1,221.35 x 82.23)	INR 1,00,431.61
Repay INR loan along with interest (1,00,000 + 2.5%)	INR 1,02,500
Arbitrage gain/loss	(INR 2,068.39)

- There is no arbitrage opportunity if we borrow money in INR

WN 2: Check on arbitrage opportunity if we borrow in GBP:

Particulars	Amount
Day 0:	

Borrow 1,00,000 GBP @ 8% for 3 months	GBP 1,00,000
Convert GBP into INR at spot rate (1,00,000 x 82.03)	INR 82,03,000
Invest INR 82,03,000 @ 8% for 3 months	INR 82,03,000
Enter into forward contract to convert investment proceeds @ INR 82.23-83.20 per GBP after 3-months	
Day 90:	
Redeem INR deposit along with interest (82,03,000 + 2%)	INR 83,67,060
Convert INR into GBP at pre-agreed forward rate (83,67,060/83.20)	GBP 1,00,565.63
Repay GBP loan along with interest (1,00,000 + 2%)	GBP 1,02,000
Arbitrage gain/loss	(GBP 1,434.37)

- There is no arbitrage possibility if we borrow money in GBP

43. Triangular arbitrage

The following exchange rates are available:

Bank	Quote	Quote
Bank A	INR/USD	52-55
Bank B	INR/AED	14-15
Bank C	USD/AED	0.27-0.29

Decide whether there is an arbitrage opportunity.

Answer:

- Arbitrage will exist if we are able to buy it lower ask rate and sell the same at higher bid rate to Bank
- Quotes of three banks have been given but the same is not for pair of currencies
- Let us take INR/USD as the base quote for analyzing arbitrage opportunities
- Quote 1 = Bank A = INR 52-55/USD
- Quote 2 = INR/USD quote can be computed by getting cross rates from Bank B and C. Cross rate is computed below

$$\text{BID} \left(\frac{\text{INR}}{\text{USD}} \right) = \text{BID} \left(\frac{\text{INR}}{\text{AED}} \right) \times \text{BID} \left(\frac{\text{AED}}{\text{USD}} \right)$$

$$\text{BID} \left(\frac{\text{INR}}{\text{USD}} \right) = \text{BID} \left(\frac{\text{INR}}{\text{AED}} \right) \times \frac{1}{\text{ASK} \left(\frac{\text{USD}}{\text{AED}} \right)} = \frac{14}{0.29} = \text{INR 48.28 per USD}$$

$$\text{ASK} \left(\frac{\text{INR}}{\text{USD}} \right) = \text{ASK} \left(\frac{\text{INR}}{\text{AED}} \right) \times \text{ASK} \left(\frac{\text{AED}}{\text{USD}} \right)$$

$$\text{ASK} \left(\frac{\text{INR}}{\text{USD}} \right) = \text{ASK} \left(\frac{\text{INR}}{\text{AED}} \right) \times \frac{1}{\text{BID} \left(\frac{\text{USD}}{\text{AED}} \right)} = \frac{15}{0.27} = \text{INR 55.56 per USD}$$

- We have now got two quotes and can check for arbitrage opportunities. The two quotes are summarized in the below table:

Bank A Quote = INR 52-55 per USD
Bank B & C Quote = INR 48.28-55.56 per USD

- We should buy USD from bank at lower Ask rate of Rs.55 per USD. We should sell USD to bank at higher bid rate of Rs.52 per USD
- Arbitrage gain/loss = 52 - 55 = (Rs.3). Arbitrage opportunity does not exist for the given quotes

44. Triangular arbitrage [Nov 2008, Nov 2016 MTP, May 2020 RTP]

Followings are the spot exchange rates quoted at three different forex markets:

INR/USD	Rs.48.30 in Mumbai
INR/GBP	Rs.77.52 in London
USD/GBP	USD 1.6231 in New York

The arbitrageur has USD 1,00,00,000. Assuming that there are no transaction costs, explain whether there is any arbitrage gain possible from the quoted spot exchange rates

Answer:

- The arbitrageur has USD 1,00,00,000. He can convert this into other currency and convert it back into USD in following two ways:
 - USD - INR - GBP - USD
 - USD - GBP - INR - USD

Option 1: USD - INR - GBP - USD:

Particulars	Amount

USD available	USD 1,00,00,000
Convert USD into INR (1,00,00,000 x 48.30)	INR 48,30,00,000
Convert INR into GBP (48,30,00,000/77.52)	GBP 62,30,650
Convert GBP into USD (62,30,650 x 1.6231)	USD 1,01,12,968
Arbitrage gain (USD 1,01,12,968 - USD 1,00,00,000)	USD 1,12,968

- Above approach can lead to arbitrage gain of USD 1,12,968

Option 2: USD - GBP - INR - USD:

Particulars	Amount
USD available	USD 1,00,00,000
Convert USD into GBP (1,00,00,000 /1.6231)	GBP 61,61,050
Convert GBP into INR (61,61,050 x 77.52)	INR 47,76,04,596
Convert INR into USD (47,76,04,596/48.30)	USD 98,88,294
Arbitrage gain (USD 98,88,294 - USD 1,00,00,000)	(USD 1,11,706)

- This approach is not preferable as the same leads to loss

Conclusion:

- The company should use approach 1 and the same can help in earning USD 1,12,968

45. Triangular Arbitrage [May 2017 RTP]:

Bharat Silk Limited, an established exporter of silk materials, has a surplus of USD 20 million as on 31st May, 2015. The banker of the company informs the following exchange rates that are quoted at three different forex markets:

- GBP/INR =99.10 at London
- INR/GBP = 0.01 at London
- USD/INR = 64.10 at Mumbai
- INR/USD = 0.02 at Mumbai
- USD/GBP = 0.65 at New York
- GBP/USD = 1.5530 at New York

Assuming that there are no transaction costs, advise the company how to avail the arbitrage gain from the above quoted exchange rates.

Answer:

- The company has USD 2,00,00,000. It can convert this into other currency and convert it back into USD in following two ways:
 - USD - INR - GBP - USD
 - USD - GBP - INR - USD
- The above quotes have been interpreted as INR/GBP, GBP/INR and so on depending on actual exchange rates

Option 1: USD - INR - GBP - USD:

Particulars	Amount
USD available	USD 2,00,00,000
Convert USD into INR (2,00,00,000 x 64.10)	INR 128,20,00,000
Convert INR into GBP (128,20,00,000/99.10)	GBP 1,29,36,427.85
Convert GBP into USD (1,29,36,427.85 x 1.5530)	USD 2,00,90,272.45
Arbitrage gain (USD 2,00,90,272.45 - USD 2,00,00,000)	USD 90,272.45

- Above approach can lead to arbitrage gain of USD 90,272.45

Note:

- We have used the favorable quote for conversion. For instance, we can use one of the below quotes:
 - 2 Crores x 64.10 = INR 128.20 Crores
 - 2 crores/0.01 = INR 100 Crores
- We have used the quote of 64.10 and the same approach is used for other currency conversions as well

Option 2: USD - GBP - INR - USD:

Particulars	Amount

USD available	USD 2,00,00,000
Convert USD into GBP ($2,00,00,000 \times 0.65$)	GBP 1,30,00,000
Convert GBP into INR ($1,30,00,000/0.01$)	INR 130,00,00,000
Convert INR into USD ($130,00,00,000 \times 0.02$)	USD 2,60,00,000
Arbitrage gain (USD 2,60,00,000 - 2,00,00,000)	USD 60,00,000

- This approach leads to arbitrage gain of USD 60,00,000

Conclusion:

- The company should use approach 2 and the same can help in earning USD 60,00,000

46. Triangular Arbitrage [Nov 2014 RTP, Nov 2020]:

Following are the spot exchange rates quoted at three different forex markets:

- USD/INR = 59.25/59.35 in Mumbai
- GBP/INR = 102.50/103.00 in London
- GBP/USD = 1.70/1.72 in New York

The arbitrageur has USD 1,00,00,000. Assuming that the bank wishes to retain an exchange margin of 0.125%, explain whether there is any arbitrage gain possible from the quoted spot exchange rates.

Answer:

- The company has USD 1,00,00,000. It can convert this into other currency and convert it back into USD in following two ways:
 - USD - INR - GBP - USD
 - USD - GBP - INR - USD

Option 1: USD - INR - GBP - USD:

Particulars	Amount
USD available	USD 1,00,00,000
Convert USD into INR ($1,00,00,000 \times (59.25 - 0.125\%) = (1,00,00,000 \times 59.18)$)	INR 59,18,00,000
Convert INR into GBP $\frac{59,18,00,000}{103 + 0.125\%} = \frac{59,18,00,000}{103.13}$	GBP 57,38,388
Convert GBP into USD ($57,38,388 \times (1.70 - 0.125\%) = (57,38,388 \times 1.6979)$)	USD 97,43,209
Arbitrage loss (97,43,209 - 1,00,00,000)	USD 2,56,791

- Above approach can lead to arbitrage loss of USD 2,56,791

Option 2: USD - GBP - INR - USD:

Particulars	Amount
USD available	USD 1,00,00,000
Convert USD into GBP $\frac{1,00,00,000}{1.72 + 0.125\%} = \frac{1,00,00,000}{1.722}$	GBP 58,07,200
Convert GBP into INR ($58,07,200 \times (102.50 - 0.125\%) = 58,07,200 \times 102.37$)	INR 59,44,83,064
Convert INR into USD $\frac{59,44,83,064}{59.35 + 0.125\%} = \frac{59,44,83,064}{59.42}$	USD 1,00,04,763
Arbitrage gain (USD 1,00,04,763 - 1,00,00,000)	USD 4,763

- This approach leads to arbitrage gain of USD 4,763

Conclusion:

- The company should use approach 2 and the same can help in earning USD 4,763

Part V - Currency Invoicing**47. Currency invoicing**

Gupta Garments exports goods to US. It can elect to bill either in Dollars or in Euro. Payment terms are 90 days. The 90 dollar swap is 1 - 0.5 and for Euro is 1.5 - 2. Help the company decide.

Answer:

- The company is exporting goods and hence a receivable(asset) would be created
- Gupta Garments should choose a currency which is expected to appreciate (assets should appreciate)
- The 90-day dollar swap is in descending order and hence dollar is expected to depreciate. Similarly, 90-day euro swap is in ascending order and hence Euro is expected to appreciate
- The company should opt for billing in Euros (appreciating currency)

48. Currency invoicing

If 60 days forward rate swap is Rs.0.5 – 0.6 and you have just used the services of a UK company for USD 60,000.

- In what currency would you prefer the invoicing to take place?
- Will the position change if the forward swap rate is Rs.0.6 – 0.5?

Answer:**Original scenario:**

- We have used the services of a UK company and hence a liability (payable would be created)
- Swap points are in ascending order and hence the product (USD) is expected to appreciate. This also indicates that INR will depreciate
- Liability should get created in a depreciating currency and hence we should opt for INR billing

Rework scenario:

- If the swap points are Rs.0.6-0.5 (descending order) then USD will depreciate and INR will appreciate
- The billing should happen in USD (depreciating currency)

49. Currency invoicing

XYZ Limited has imported a machinery worth USD 5,00,000. It can have it invoiced either in Dollars or in Euro. The comparable rates agreed are Rs.52 per USD and Rs.65 per Euro. The 6 months rate for USD is Rs.53 – 55. The USD per Euro is 1.2 – 1.25. The 6 month rate for Euro is Rs.80-81. In which currency should XYZ accept invoicing?

Answer:

- The company has an option of going for dollar or Euro invoicing. We should accept invoicing in a currency which will lead to lower outflow of INR

Billing in USD:

Known component = USD 5,00,000; Unknown component = ? INR
Unknown component = Known component x ?
$INR = USD \times \left(\frac{INR}{USD}\right)$
$INR = USD \times ASK\left(\frac{INR}{USD}\right)$
$INR = 5,00,000 \times 55$
INR outflow = Rs.2,75,00,000

Billing in EUROS:

Amount of billing in USD = 5,00,000; USD rate = Rs.52 per USD
EURO rate = Rs.65 per USD; Billing in EUROS = $5,00,000 \times (52/65) = EUR\ 4,00,000$
Known component = EUR 4,00,000; Unknown component = ? INR
Unknown component = Known component x ?
$INR = EUR \times \left(\frac{INR}{EUR}\right)$
$INR = EUR \times ASK\left(\frac{INR}{EUR}\right)$
$INR = 4,00,000 \times 81$
INR outflow = Rs.3,24,00,000

- The company should opt for dollar invoicing as the same leads to lower outflow of INR

50. Currency Invoicing [July 2021]

XP Pharma Ltd., has acquired an export order for Rs. 10 million for formulations to a European company. The Company has also planned to import bulk drugs worth Rs. 5 million from a company in UK. The proceeds of exports will be realized in 3 months from now and the payments for imports will be due after 6

months from now. The invoicing of these exports and imports can be done in any currency i.e. Dollar, Euro or Pounds sterling at company's choice. The following market quotes are available.

Quote	Spot Rate	Annualized Premium
INR/USD	67.10/67.20	USD - 7%
INR/EURO	63.15/63.20	EURO - 6%
INR/GBP	88.65/88.75	GBP - 5%

Advice XP Pharma Ltd. about invoicing in which currency. (Calculation should be upto three decimal places).

Answer:

WN 1: Identification of currency for export transaction:

Currency	Invoice value at spot rate	Expected rate after 3 months	Realization after 3 months
USD	$\frac{1,00,00,000}{67.10} = 1,49,031.297$	$67.10 \times \left(1 + \frac{0.07}{4}\right) = 68.27$	$1,49,031.297 \times 68.27$ = Rs.1,01,74,367
EURO	$\frac{1,00,00,000}{63.15} = 1,58,353.127$	$63.15 \times \left(1 + \frac{0.06}{4}\right) = 64.10$	$1,58,353.127 \times 64.10$ = Rs.1,01,50,435
GBP	$\frac{1,00,00,000}{88.65} = 1,12,803.158$	$88.65 \times \left(1 + \frac{0.05}{4}\right) = 89.76$	$1,12,803.158 \times 89.76$ = Rs.1,01,25,211

Conclusion:

- Since INR inflow is highest in USD billing we should opt for USD billing

Note:

- The above solution has been presented as per ICAI working. However, we can answer this question even without doing above calculation. We should opt for billing in the currency which has maximum appreciation (asset) and the same in this case is USD

WN 2: Identification of currency for import transaction:

Currency	Invoice value at spot rate	Expected rate after 6 months	Realization after 3 months
USD	$\frac{50,00,000}{67.20} = 74,404.762$	$67.20 \times \left(1 + \frac{0.07}{2}\right) = 69.55$	$74,404.762 \times 69.55$ = Rs.51,74,851
EURO	$\frac{50,00,000}{63.20} = 79,113.924$	$63.20 \times \left(1 + \frac{0.06}{2}\right) = 66.10$	$79,113.924 \times 66.10$ = Rs.51,50,316
GBP	$\frac{50,00,000}{88.75} = 56,338.028$	$88.75 \times \left(1 + \frac{0.05}{2}\right) = 90.97$	$56,338.028 \times 90.97$ = Rs.51,25,070

Conclusion:

- Since INR inflow is lowest in GBP billing we should opt for GBP billing

Note:

- The above solution has been presented as per ICAI working. However, we can answer this question even without doing above calculation. We should opt for billing in the currency which has minimum appreciation (liability) and the same in this case is GBP

Part VI - Leading and Lagging

51. Leading and lagging

JK Limited has accepted an invoice of 10 lakh yen. Spot rate is Rs.0.50 per Yen and the 90 day forward rate is Rs.0.52 per Yen.

- Advice JK Limited on whether they should avail the full credit of 90 days or lead the payment if the interest rate in India is
 - 6% p.a.
 - 18% p.a.
- Will the position change if the company is running a cash surplus?
- What would be the position if JK Limited had raised rather than accepted an invoice?

Answer:

WN 1: Leading vs Lag Analysis if interest rate is 6% per annum:

Particulars	Pay Today	Pay after 90 days
Today outflow	5,00,000 (10,00,000 x 0.50)	-
Interest on loan for 3 months	7,500 (5,00,000 x 6% x 3/12)	-

Outflow after 90 days	-	5,20,000 (10,00,000 x 0.52)
Total outflow	5,07,500	5,20,000

- We are adding interest to option 1 to make it comparable to option 2. We are basically bringing both cash flows to end of day 90
- The company should make the payment today

WN 2: Leading vs Lag Analysis if interest rate is 18% per annum:

Particulars	Pay Today	Pay after 90 days
Today outflow	5,00,000 (10,00,000 x 0.50)	-
Interest on loan for 3 months	22,500 (5,00,000 x 18% x 3/12)	-
Outflow after 90 days	-	5,20,000 (10,00,000 x 0.52)
Total outflow	5,22,500	5,20,000

- The company should make the payment at end of day 90

WN 3: Position if the company has cash surplus:

- If the company is running a cash surplus, then the decision would remain the same assuming borrowing and investment rates are same. Basically, we should consider opportunity cost as interest in the above statements. With our assumption of same borrowing and investment rates, the above calculation would remain same and hence decision would remain same

WN 4: If JK Limited has raised an invoice:

- If the company has raised an invoice, then it would be an exporter and would be receiving money. We should choose an option leading to higher inflow of INR
- **Interest rate of 6%:** We should lag the receipt and collect in 90 days as the same has higher inflow of INR
- **Interest rate of 18%:** We should lead the receipt and collect the money immediately. It is assumed that there would be no cash discount offered to customer for early payment.

52. Leading and lagging [May 2009, Nov 2018 MTP, May 2019 RTP]

The following 2-way quotes appear in the foreign exchange market

Spot rate Rs.46.00/46.25 per USD

2-months forward rate Rs.47.00/ 47.50 per USD

Required:

- How many US dollars should a firm sell to get Rs.25 lacs after 2 months?
- How many rupees is the firm required to pay to obtain USD 2,00,000 in the spot market?
- Assume the firm has USD 69,000 in current account earning no interest. ROI on rupee investment is 10% p.a. Should the firm encash the USD now or 2 months later?

Answer:**WN 1: Computation of USD to buy Rs.25 lacs after two months:**

Known component = INR 25,00,000; Unknown component = ? USD
Unknown component = Known component x ?
$USD = INR \times \left(\frac{USD}{INR} \right)$
$USD = INR \times ASK \left(\frac{USD}{INR} \right)$
$USD = 25,00,000 \times \left(\frac{1}{47} \right)$
USD outflow = 53,191,49

WN 2: Computation of INR required to buy USD 2,00,000 in spot market:

Known component = USD 2,00,000; Unknown component = ? INR
Unknown component = Known component x ?
$INR = USD \times \left(\frac{INR}{USD} \right)$

$$\text{INR} = 2,00,000 \times \text{ASK} \left(\frac{\text{INR}}{\text{USD}} \right)$$

$$\text{INR} = 2,00,000 \times 46.25$$

$$\text{INR outflow} = \text{INR } 92,50,000$$

WN 3: Decision on redeeming USD deposit:

Particulars	Redeem today	Redeem after 2 months
INR receipt today on conversion	31,74,000 (69,000 × 46)	-
Interest income for 2 months	52,900 (31,74,000 × 10% × 2/12)	-
INR receipt on conversion in M2	-	32,43,000 (69,000 × 47)
Total inflow in INR	32,26,900	32,43,000

- The company should wait and redeem USD deposit into INR at end of 2 months

53. Offer from Foreign Branch [May 2022]

M/s. Daksh Ltd is planning to import multipurpose machine from USA at a cost of \$15000. The company can avail loans at 19% Interest per annum with quarterly rests with which it can import the machine. However, there is an offer from New York branch of an Indian based bank extending credit of 180 days at 2% per annum against opening of an irrevocable letter of credit. Other Information: Spot rate US\$ 1 = Rs. 75 180 days forward rate US \$ 1 = Rs. 77 Commission charges for letter of credit at 2% per 12 months.

- Justify why the offer from the foreign branch should be accepted?
 - Based on the present market condition company is not interested to take the risk of currency fluctuations and wanted to hedge with an additional expenses of Rs. 30,000, if so, what is your advise to the company?
- Assume 360 days in the year

Answer:**WN 1: Financing the equipment with loan in India:**

Particulars	Calculation	Amount
Payment on day 0	15,000 USD × 75	11,25,000
Interest for quarter 1	11,25,000 × 19% × 3/12	53,438
Interest for quarter 2	11,78,438 × 19% × 3/12	55,976
Total outflow		12,34,414

- Interest has been computed separately for quarter 1 and 2. This is because of quarterly compounding of interest rates

WN 2: Offer of foreign branch:**Part 1: Cost of letter of credit:**

Particulars	Calculation	Amount
LC commission on day 0	15,000 × 75 × 2% × (180/360)	11,250
Interest	11,250 × 19% × (180/360)	1,069
Total outflow		12,319

Part 2: Payment to foreign branch:

Particulars	Calculation	Amount)
Loan taken		USD 15,000
Interest for 6 months	15,000 × 2% × 180/360	USD 150
Total payment at end of M6		USD 15,150
INR outflow	15,150 × 77	11,66,550

- Total outflow in option 2 = 12,319 + 11,66,550 = 11,78,869**

Conclusion:

- Option 2 is cheaper by (Rs. 12,34,413 – Rs. 11,78,869) lakh or Rs. 55,544. Hence, the offer may be accepted

Part (ii):

If company is not interested to take the risk of currency fluctuations and wanted to hedge with an additional expense of Rs. 30,000 then it can do so because even taking forward position is resulting in increased cash outflow by the same amount.

54. Leading and lagging [Nov 2011]

An Indian importer has to settle an import bill for USD 1,30,000. The exporter has given the Indian importer two options:

- ❖ Pay immediately without any interest charges
- ❖ Pay after three months with interest at 5 percent per annum

The importer's bank charges 15 percent per annum on overdrafts. The exchange rates in the market are as follows:

Spot rate Rs.48.35/48.36 per USD

3-months forward rate Rs.48.81/48.83 per USD

The importer seeks your advice on the option to be selected.

Answer:

Computation of INR Outflow:

Particulars	Pay Today	Pay after 3 months
Today outflow	62,86,800 (1,30,000 × 48.36)	-
Interest on loan for 3 months	2,35,755 (62,86,800 × 15% × 3/12)	-
USD interest @ 5%		1,625 (1,30,000 × 5% × 3/12)
USD to be paid at end of M3		1,31,625
Outflow after 90 days	-	64,27,249 (1,31,625 × 48.83)
Total outflow	65,22,555	64,27,249

- The company should pay after three months to the supplier

55. Leading and lagging [Nov 2014, Nov 2016 MTP]

Gibraltar Limited has imported 5,000 bottles of shampoo at landed cost in Mumbai, of USD 20 each. The company has the choice for paying for the goods immediately or in 3 months time. It has a clean overdraft where 14% p.a. rate of interest is charged. Calculate which of the following two methods would be cheaper to Gibraltar Limited:

- (i) Pay in 3 months time with interest @10% and cover risk forward for 3 months
- (ii) Settle now at a spot rate and pay interest on the overdraft for 3 months

The rates are as follows:

- ❖ Mumbai INR/USD spot : 60.25-60.55
- ❖ 3 months swap : 35/25

Answer:

Evaluation of option 1:

Particulars	Calculation	Amount
USD liability on Day 0	5,000 × 20	USD 1,00,00
Add: Interest for 3 months @ 10%	1,00,000 × 10% × (3/12)	USD 2,500
Amount to be paid at end of Month 3		USD 1,02,500
INR outflow at end of Month 3	USD × ASK $\left(\frac{\text{INR}}{\text{USD}}\right)$ 1,02,500 × 60.30	INR 61,80,750

Evaluation of option 2:

Particulars	Calculation	Amount
USD liability on Day 0	5,000 × 20	USD 1,00,000
INR outflow on Day 0	USD × ASK $\left(\frac{\text{INR}}{\text{USD}}\right)$ 1,00,000 × 60.55	INR 60,55,000
Add: Interest for 3 months @ 14%	60,55,000 × 14% × (3/12)	INR 2,11,925
INR outflow at end of Month 3	60,55,000 + 2,11,925	INR 62,66,925

Conclusion: Option 1 is to be preferred as the same has lower outflow in INR.

56. Leading and Lagging:

BC Export co are holding an export bill in USD 1,00,000 due 60 days hence. Rate at which deal was finalized @ Rs.47.50 per USD. The company is worried about the fluctuating exchange rate. The firm's bankers have agreed to make advance against the bill after deduction of interest @ 9% per annum and quoted a 60-days forward rate of Rs.48.10. The cost of capital for the exporter is 15% p.a. Advise whether the exporter will agree to the banker's offer.

Answer:**Evaluation of option 1 - Acceptance of banker's offer:**

Particulars	Calculation	Amount
USD asset on day 0		USD 1,00,000
Less: Discounting charges	$1,00,000 \times 9\% \times (2/12)$	USD 1,500
Net USD realization on day 0		USD 98,500
INR realization on day 0	$98,500 \times 47.50$	INR 46,78,750
Interest saving at cost of capital of 15% for 60 days	$46,78,750 \times 15\% \times (2/12)$	INR 1,16,969
Effective INR realization at end of day 60		INR 47,95,719

Evaluation of option 2 - Rejection of banker's offer:

Particulars	Calculation	Amount
USD asset on day 0		USD 1,00,000
Forward rate		48.10
INR realization at end of day 60	$1,00,000 \times 48.10$	INR 48,10,000

Conclusion: Exporter should not agree to banker's offer and realize the proceeds using forward rate.

57. Leading and lagging [May 2015 RTP, Nov 2008, Nov 2014 MTP, Jan 2021]

Sun Ltd. is planning to import equipment from Japan at a cost of 3,400 lakh yen. The company may avail loans at 18 percent per annum with quarterly rests with which it can import the equipment. The company has also an offer from Osaka branch of an India based bank extending credit of 180 days at 2 percent per annum against opening of an irrecoverable letter of credit.

Additional information:

Present exchange rate Rs.100 = 340 yen

180 day's forward rate Rs.100 = 345 yen

Commission charges for letter of credit at 2 per cent per 12 months.

Advise the company whether the offer from the foreign branch should be accepted.

Answer:**WN 1: Financing the equipment with loan in India:**

Particulars	Calculation	Amount (in lacs)
Payment on day 0	$3,400 \text{ lacs} \times (100/340)$	1,000.00
Interest for quarter 1	$1,000 \times 18\% \times 3/12$	45.00
Interest for quarter 2	$1,045 \times 18\% \times 3/12$	47.03
Total outflow		1,093.03

- Interest has been computed separately for quarter 1 and 2. This is because of quarterly compounding of interest rates

WN 2: Offer of foreign branch:**Part 1: Cost of letter of credit:**

Particulars	Calculation	Amount (in lacs)
LC commission on day 0	$3,400 \times (100/340) \times 2\% \times (6/12)$	10.00
Interest for quarter 1	$10 \times 18\% \times 3/12$	0.45
Interest for quarter 2	$10.45 \times 18\% \times 3/12$	0.47
Total outflow		10.92

Part 2: Payment to foreign branch:

Particulars	Calculation	Amount (in lacs)
Loan taken		JPY 3,400
Interest for 6 months	$3,400 \times 2\% \times 6/12$	JPY 34
Total payment at end of M6		JPY 3,434
INR outflow	$3,434 \times (100/345)$	995.36

- Total outflow in option 2 = $10.92 + 995.36 = 1,006.28$ lacs

Conclusion:

- The company should go ahead with acceptance of foreign branch as the same leads to lower outflow of INR

58. Leading and Lagging [Nov 2020 MTP]:

XYZ Ltd. has imported goods to the extent of US\$ 8 Million. The payment terms are as under:

- 1% discount if full amount is paid immediately or
- 60 days interest free credit. However, in case of a further delay up to 30 days, interest at the rate of 8% p.a. will be charged for additional days after 60 days. M/s XYZ Ltd. has Rs. 25 Lakh available and for remaining it has an offer from bank for a loan up to 90 days @ 9.0% p.a.

The quotes for foreign exchange rates are as follows:

- Spot rate (INR/USD) = Rs.66.98
- 60 days forward rate (INR/USD) = Rs.67.16
- 90 days forward rate (INR/USD) = Rs.68.03

Advise which one of the following options would be better for XYZ Ltd.

(i) Pay immediately after utilizing cash available and for balance amount take 90 days loan from bank.

(ii) Pay the supplier on 60th day and avail bank's loan (after utilizing cash) for 30 days.

(iii) Avail supplier offer of 90 days credit and utilize cash available.

Further presume that the cash available with XYZ Ltd. will fetch a return of 4% p.a. in India till it is utilized.

Assume year has 360 days. Ignore Taxation. Compute your working upto four decimals and cash flows in Rs. in Crore

Answer:**WN 1: Computation of total outflow if payment is done immediately:**

Particulars	Calculation	Amount
Amount payable in 60 days		USD 8 million
Amount payable today	8 million x 99%	USD 7.92 million
Amount required as per day 0 spot rate	7.92 million x 66.98	Rs.53.0482 crores
Less: Cash available		Rs.0.2500 Crores
Amount to be borrowed		Rs.52.7982 Crores
Interest on loan @ 9%	$52.7982 \times 9\% \times (90/360)$	Rs.1.1880 Crores
Total Outflow		Rs.53.9862 Crores

WN 2: Computation of total outflow if payment is done in 60 days:

Particulars	Calculation	Amount
Amount payable in 60 days		USD 8 million
Amount required as per day 60 spot rate	8.00 million x 67.16	Rs.53.7280 Crores
Less: Cash available		Rs.0.2500 Crores
Amount to be borrowed		Rs.53.4780 Crores
Interest on loan @ 9%	$53.4780 \times 9\% \times (30/360)$	Rs.0.4011 Crores
Less: Interest income on 0.25 Crores for 60 days	$0.25 \times 4\% \times (60/360)$	(Rs.0.0017 Crores)
Net Outflow		Rs.53.8774 Crores

WN 3: Computation of total outflow if payment is done in 90 days:

Particulars	Calculation	Amount
Amount payable in 60 days		USD 8 million
Add: Interest payable @ 8% for 30 days	$8 \times 8\% \times (30/360)$	USD 0.0533 million
Total amount payable in 90 days		USD 8.0533 million
Amount required as per day 90 spot rate	8.0533×68.03	Rs.54.7866 Crores
Less: Cash available		(Rs.0.2500 Crores)
Less: Interest income on 0.25 Crores for 90 days	$0.25 \times 4\% \times (90/360)$	(Rs.0.0025 Crores)
Net Outflow		Rs.54.5341 Crores

Decision: Cash outflow is least in case of Option (ii) same should be opted for.

59. Multilateral netting

A group of companies is controlled from UK. This group has subsidiaries in Belgium, France and USA. Cash flow forecasts indicate inter-company dues, as follows:

- French subsidiary to pay Belgian subsidiary – BF 144,381,000
- Belgian subsidiary to pay US subsidiary – USD 1,060,700
- US subsidiary to pay EURO 14,438,000 to French subsidiary
- French subsidiary to pay USD 800,000 to US subsidiary

In terms of Group policy, inter-company dues are netted off, and net payments are made. Relevant exchanges rates in terms of pound sterling 1 are USD 1.415, Euro 1.3834 and BF 68.10. Quantify the payments to be authorized by HQ, the entities who would remit the payments and the entities who would receive the payments.

Answer:

Particulars	French	Belgian	US
FS to BS (14,43,81,000/68.10)	-21,20,132.16	21,20,132.16	
BS to US (10,60,700/1.415)		-7,49,611.31	7,49,611.31
US to FS (1,44,38,000/1.3834)	1,04,36,605.46		-1,04,36,605.46
FS to US (8,00,000/1.415)	-5,65,371.02		5,65,371.02
Net Amount	77,51,102.28	13,70,520.85	-91,21,623.13

- US Subsidiary should pay 77.51.102.88 GBP to French subsidiary
- US subsidiary should pay 13,70,520.85 GBP to Belgian subsidiary

60. Netting [May 2007, Nov 2015 RTP]

AMK Ltd. an Indian based company has subsidiaries in U.S. and U.K.

Forecasts of surplus funds for the next 30 days from two subsidiaries are as below:

US	USD 12.5 million
UK	GBP 6 million

Following exchange rate information is obtained

	USD/INR	GBP/INR
Spot	0.0215	0.0149
30 days forward	0.0217	0.0150

Annual borrowing/deposit rates (simple) are available:

- ❖ INR = 6.4%/6.2%
- ❖ USD = 1.6%/1.5%
- ❖ GBP = 3.9%/3.7%

The Indian operation is forecasting a deficit of Rs.500 million. It is assumed that interest rates are based on a year of 360 days.

- Calculate the cash balance at the end of 30 days period is INR for each company under each of the following scenarios:
 - Each company invests/finances its own cash balances/deficits in local currency independently
 - Cash balances are pooled immediately in India and the net balances are invested/borrowed for the 30 days period
- Which method do you think is preferable from the parent company's point of view?

Answer:

WN 1: Cash balance in INR if the companies act independently:

(in lacs)

Entity	Surplus/ Deficit	Invest/ Borrow	Interest rate	Maturity value	Maturity value (INR)
US	125 USD	Invest	1.5%	125.1625	5,767.569
UK	60 GBP	Invest	3.7%	60.185	4,012.333
India	(5,000) INR	Borrow	6.4%	(5,026.667)	(5,026.667)
Net cash balance on day 30					4,753.235

- Maturity value (col 5) = Surplus + Interest for 1 month

- Maturity value (INR) = Maturity value (col 5)/exchange rate

WN 2: Immediate cash pooling:

Entity	Surplus/ Deficit	Surplus/ Deficit (INR)	Invest/ borrow	Interest rate	Maturity value (INR)
US	125 USD	5,813.953			
UK	60 GBP	4026.846			
India	(5,000) INR	(5,000)			
Net balance		4,840.799	Invest	6.2%	4,865.810

- Surplus/deficit (INR) = Col 2/Exchange rate
- Maturity value = Col 3 + Interest for 1 month

Conclusion:

- The company should go for immediate cash pooling as the same has resulted in higher INR at end of day 30

61. Computation of net exposure [Nov 2006, Nov 2019 RTP]

Following are the details of cash inflows and outflows in foreign currency denominations of MNP co. an Indian export firm, which have no foreign subsidiaries:

Currency	Inflow	Outflow	Spot rate	Forward rate
USD	4,00,00,000	2,00,00,000	48.01	48.82
French Franc	2,00,00,000	80,00,000	7.45	8.12
GBP	3,00,00,000	2,00,00,000	75.57	75.98
JPY	1,50,00,000	2,50,00,000	3.20	2.40

- Determine the net exposure of each foreign currency in terms of Rupees
- Are any of the exposure positions offsetting to some extent

WN 1: Computation of net exposure:

Currency	Inflow	Outflow	Net exposure	Spot rate	Net exposure at spot rate	Forward rate	Net exposure at forward rate	Spread	Net exposure at spread
USD	40	20	20	48.01	960.20	48.82	976.40	0.81	16.20
FFR	20	8	12	7.45	89.40	8.12	97.44	0.67	8.04
GBP	30	20	10	75.57	755.70	75.98	759.80	0.41	4.10
JPY	15	25	-10	3.20	-32.00	2.40	-24.00	-0.80	8.00
Total exposure					1,773.30		1,809.64		36.34

- Exposure of each currency is being offset partly because of payable/receivable. Additionally, exposure of JPY is being offset by a better forward rate.

Part VIII - Forward Contract**62. FC - Borrowing [Nov 2003, Jan 2021]**

ABC Co. have taken a 6 month loan from their foreign collaborators for US Dollars 2 millions. Interest payable on maturity is at LIBOR plus 1.0%. Current 6-month LIBOR is 2%. Enquiries regarding exchange rates with their bank elicits the following information:

- ❖ Spot USD 1 = Rs.48.5275
- ❖ 6 months forward USD 1 = Rs.48.4575

What would be their total commitment in Rupees, if they enter into a forward contract? Will you advise them to do so? Explain giving reasons.

Answer:

- Loan maturity along with interest = $20,00,000 + (20,00,000 \times 3\% \times 6/12) = \text{USD } 20,30,000$
- Total commitment in INR = $20,30,000 \times 48.4575 = \text{Rs.}9,83,68,725$
- The forward rate indicates that INR will appreciate over the next 6 months
- If the company believes that INR appreciation would be more than the forward rate, then the company should not enter into a forward contract
- If the company believes that INR will depreciate or appreciation would be less than forward rate, then it should enter into forward contract

- If the company has no view on exchange rates, then it should enter into forward contract for risk reduction. Given the interest rate differential between India and USA it would be unwise to expect continuous depreciation of dollar. The US Dollar is a stronger currency than the Indian Rupee based on past trends and it would be advisable to cover the exposure.

63. FC – Importer [Nov 2012 RTP, May 2008, Nov 2015 MTP]

A company is considering hedging its foreign exchange risk. It has made a purchase on 1st Aug, 2012 for which it has to make a payment of US \$ 50,000 on November 30, 2012. The present exchange rate is 1 US \$ = Rs.40. It can purchase forward 1 US \$ at Rs.39. The company will have to make a upfront premium (margin) of 2% of the forward amount purchased. The cost of funds to the company is 10% per annum and the rate of corporate tax is 50%. Ignore taxation. Consider the following situations and compute the Profit/Loss the company will make if it hedges its foreign exchange risk:

- If the exchange rate on November 30, 2012 is Rs. 42 per US \$.
- If the exchange rate on November 30, 2012 is Rs. 38 per US \$.

Answer:

WN 1: Computation of cover rate:

Particulars	Calculation	Amount
Base rate		39.000
Premium	$39 \times 2\%$	0.780
Interest on premium	$0.78 \times 10\% \times (4/12)$	0.026
Effective cover rate		39.806

WN 2: Computation of profit or loss through forward contract:

Particulars	ER of Rs.42	ER of Rs.38
Outflow under forward contract (1)	19,90,300 (50,000 x 39.806)	19,90,300 (50,000 x 39.806)
Outflow if forward contract was not taken (2)	21,00,000 (50,000 x 42)	19,00,000 (50,000 x 38)
Net profit/loss due to hedging (2 - 1)	1,09,700	(90,300)

64. Profit/loss on forward contract [Nov 2016, Nov 2020]

A company is considering hedging its foreign exchange risk. It has made a purchase on 1st July, 2016 for which it has to make a payment of USD 60,000 on December 31, 2016. The present exchange rate is Rs.65/USD. It can purchase forward 1USD at Rs.64. The company will have to make an upfront premium @ 2% of the forward amount purchased. The cost of funds to the company is 12% per annum. In the following situations, compute the profit/loss the company will make if it hedges its foreign exchange risk with the exchange rate on 31st December 2016 as:

- Rs.68 per USD
- Rs.62 per USD
- Rs.70 per USD
- Rs.65 per USD

Answer:

WN 1: Computation of cover rate:

Particulars	Amount
Forward Rate	INR 64.00/USD
Forward premium (64 x 2%)	INR 1.28/USD
Interest on forward premium (1.28 x 12% x (6/12))	INR 0.0768/USD
Cover rate	INR 65.3568/USD

WN 2: Computation of profit/loss under different scenarios:

Particulars	Rs.68/USD	Rs.62/USD	Rs.70/USD	Rs.65/USD
Foreign currency exposure	60,000 USD	60,000 USD	60,000 USD	60,000 USD
Cover rate	65.3568	65.3568	65.3568	65.3568
Payment made under forward contract [A]	39,21,408	39,21,408	39,21,408	39,21,408
Spot rate	68.00	62.00	70.00	65.00
Payment made under spot rate [B]	40,80,000	37,20,000	42,00,000	39,00,000
Profit/Loss [B-A]	1,58,592	(2,01,408)	2,78,592	(21,408)

65. Exporter hedging [Jan 2021]

M/s. Sky products Ltd., of Mumbai, an exporter of sea foods has submitted a 60 days bill for EUR 5,00,000 drawn under an irrevocable Letter of Credit for negotiation. The company has desired to keep 50% of the bill amount under the Exchange Earners Foreign Currency Account (EEFC). The rates for Rs./USD and USD/EUR in inter-bank market are quoted as follows:

Particulars	INR/USD	USD/EUR
Spot	67.8000-67.8100	1.0775-1.8000
1 month forward	10/11 paise	0.20/0.25 cents
2 months forward	21/22 paise	0.40/0.45 cents
3 months forward	32/33 paise	0.70/0.75 cents

Transit Period is 20 days. Interest on post shipment credit is 8% p.a. Exchange Margin is 0.1%. Assume 365 days in a year.

You are required to calculate:

- Exchange rate quoted to the company
- Cash inflow to the company
- Interest amount to be paid to bank by the company

Answer:

WN 1: Computation of exchange rate quoted to the company:

- The company plans to sell euros and hence we would need BID (INR/EUR) rate for realization
- The amount will be realized in 80 days (including transit period of 20 days). It will have to be rounded off to the lower of months and hence 2 months forward bid rate is to be taken

$$\text{BID} \left(\frac{\text{INR}}{\text{EUR}} \right) = \text{BID} \left(\frac{\text{INR}}{\text{USD}} \right) \times \text{BID} \left(\frac{\text{USD}}{\text{EUR}} \right)$$

$$\text{BID} \left(\frac{\text{INR}}{\text{EUR}} \right) = 67.9420 \times 1.0815 = \text{INR } 73.4793 \text{ per EUR}$$

Note:

Particulars	INR/USD	USD/EUR
Spot rate	67.8000	1.0775
Add: Swap points	0.2100	0.0040
Forward rate without exchange margin	68.0100	1.0815
Less: Exchange margin @ 0.1%	-0.0680	-
Final forward bid rate	67.9420	1.0815

- Exchange margin has been applied only on INR/USD rate. It is assumed that USD/EUR rate is the final merchant rate and hence exchange margin is not applicable on the same

Solution:

- Exchange rate quoted = INR 73.4793 per EUR
- Realization = EUR 2,50,000 × 73.4793 = Rs.1,83,69,825 [Only half of EUR 5,00,000 will be realized and balance half will be transferred to EEFC account]
- Interest for 80 days @ 8% = 1,83,69,825 × 8% × (80/365) = Rs.3,22,101

66. FC - Exporter [May 2018 MTP, Nov 2018 MTP, May 2016]

A company expects to receive 500,000 CD falling due six months from now. The finance manager decides to hedge the transaction using forward contracts. Interest rate in Canada is 15 % while that in UK is 12%. Current spot rate is 1 GBP = 2.5 CD. Evaluate the situation if sterling was to

- Gain 4%
- Lose 2%
- Remain stable at present level

Assume that the forward exchange rate differential reflects the interest rate parity analysis of forward rates.

Answer:

WN 1: Computation of cover rate using IRPT:

Spot rate = CD 2.50/GBP
Home currency = CD
Rh (CD) = 15% per annum (or) 7.5% per half-year
Foreign currency = GBP

Rf (GBP rate) = 12% per annum (or) 6% per half-year
$\frac{1 + R_h}{1 + R_f} = \frac{F_1}{e_0} \cdot \frac{1 + 7.5\%}{1 + 6\%} = \frac{F_1}{2.50}$
$F_1 = \frac{2.50 \times 1.075}{1.06} = 2.5354 \text{ CD/GBP}$

WN 2: Computation of profit/loss for three scenarios:

Particulars	Gain of 4%	Loss of 2%	No change
Current Spot rate	2.5CD/GBP	2.5CD/GBP	2.5CD/GBP
Future spot rate	2.6CD/GBP	2.45CD/GBP	2.5CD/GBP
Forward rate (cover rate)	2.5354CD/GBP	2.5354CD/GBP	2.5354CD/GBP
Realization:			
Hedged (Forward rate) (5,00,000/Forward rate)	1,97,209.30	1,97,209.30	1,97,209.30
Unhedged (Future spot rate) (5,00,000/Future spot rate)	1,92,307.69	2,04,081.63	2,00,000
Profit/Loss due to hedging (Hedged - Unhedged)	4,901.61	-6,872.33	-2,790.70

Note:

- Any appreciation/depreciation percentage is to be applied only on product. In this case GBP is the product and appreciation/depreciation percentage is given for the product and hence the same is directly applied

67. FC - Importer [Nov 2003]

A company operating in Japan has today effected sales to an Indian company, the payment being due 3 months from the date of invoice. The invoice amount is 108 lakhs yen. At today's spot rate, it is equivalent to Rs.30 lakhs. It is anticipated that the exchange rate will decline by 10% over the 3 months period and in order to protect the yen payments, the importer proposes to take appropriate action in the foreign exchange market. The 3 months forward rate is presently quoted as 3.3 yen per rupee. You are required to calculate the expected loss and to show how it can be hedged by a forward contract.

Answer:**WN 1: Computation of expected loss:**

Particulars	Calculation	Amount
Amount of exposure		YEN 108 lacs
Outflow today		INR 30 lacs
Today exchange rate	$\frac{\text{YEN 108}}{\text{INR 30}}$	YEN 3.60/INR
Expected exchange rate	3.60 - 10%	YEN 3.24/INR
Expected outflow after 3 months	$\frac{108}{3.24}$	INR 33.33 lacs
Expected loss	30 lacs - 33.33 lacs	INR 3.33 lacs

WN 2: Hedging through forward contract:

Particulars	Calculation	Amount
Amount of exposure		YEN 108 lacs
Forward rate		YEN 3.30/INR
Expected outflow after 3 months	$\frac{108}{3.30}$	INR 32.73 lacs
Expected loss	30 lacs - 32.73 lacs	INR 2.73 lacs

- The company can take a forward contract at YEN 3.30 per INR. This would reduce the loss from Rs.3.33 lacs to Rs.2.73 lacs.

68. Decision on hedging [May 2015 MTP, May 2014, Nov 2018 RTP]

JKL Ltd., an Indian company has an export exposure of JPY 10,000,000 payable August 31, 2014. Japanese Yen (JPY) is not directly quoted against Indian Rupee. The current spot rates are:

INR/US \$	=	Rs. 62.22
JPY/US\$	=	JPY 102.34

It is estimated that Japanese Yen will depreciate to 124 level and Indian Rupee to depreciate against US \$ to Rs. 65. Forward rates for August 2014 are

INR/US \$ = Rs. 66.50

JPY/US\$ = JPY 110.35

Required:

(i) Calculate the expected loss, if the hedging is not done. How the position will change, if the firm takes forward cover?

(ii) If the spot rates on August 31, 2014 are:

INR/US \$ = Rs. 66.25

JPY/US\$ = JPY 110.85

Is the decision to take forward cover justified?

Answer:

WN 1: Computation of collections as per different rates:

Collection as per current spot rates:

❖ Known component = 1,00,00,000 JPY

❖ Unknown component = ? INR

$\text{INR} = \text{JPY} \times \left(\frac{\text{INR}}{\text{JPY}} \right)$
$\text{INR} = 1,00,00,000 \times \left(\frac{\text{INR}}{\text{USD}} \times \frac{\text{USD}}{\text{JPY}} \right)$
$\text{INR} = 1,00,00,000 \times \left(62.22 \times \frac{1}{102.34} \right)$
$\text{INR} = 1,00,00,000 \times (0.6080)$
INR = 60,80,000

Collection as per expected spot rates:

❖ Known component = 1,00,00,000 JPY

❖ Unknown component = ? INR

$\text{INR} = \text{JPY} \times \left(\frac{\text{INR}}{\text{JPY}} \right)$
$\text{INR} = 1,00,00,000 \times \left(\frac{\text{INR}}{\text{USD}} \times \frac{\text{USD}}{\text{JPY}} \right)$
$\text{INR} = 1,00,00,000 \times \left(65 \times \frac{1}{124.4} \right)$
$\text{INR} = 1,00,00,000 \times (0.5242)$
INR = 52,42,000

Collection as per forward rates:

❖ Known component = 1,00,00,000 JPY

❖ Unknown component = ? INR

$\text{INR} = \text{JPY} \times \left(\frac{\text{INR}}{\text{JPY}} \right)$
$\text{INR} = 1,00,00,000 \times \left(\frac{\text{INR}}{\text{USD}} \times \frac{\text{USD}}{\text{JPY}} \right)$
$\text{INR} = 1,00,00,000 \times \left(66.50 \times \frac{1}{110.35} \right)$
$\text{INR} = 1,00,00,000 \times (0.6026)$
INR = 60,26,000

Collection as per actual spot rates:

❖ Known component = 1,00,00,000 JPY

❖ Unknown component = ? INR

$\text{INR} = \text{JPY} \times \left(\frac{\text{INR}}{\text{JPY}} \right)$
$\text{INR} = 1,00,00,000 \times \left(\frac{\text{INR}}{\text{USD}} \times \frac{\text{USD}}{\text{JPY}} \right)$
$\text{INR} = 1,00,00,000 \times \left(66.25 \times \frac{1}{110.85} \right)$

INR = 1,00,00,000 x (0.5977)
INR = 59,77,000

WN 2: Computation of expected loss and decision on forward cover:

Expected loss w/o hedging = Realization on expected spot rates – Realization on current spot rates Expected loss w/o hedging = 52,42,000 – 60,80,000 Expected loss w/o hedging = Rs.8,38,000
Expected loss with hedging = Realization on forward rates – Realization on current spot rates Expected loss with hedging = 60,26,000 – 60,80,000 Expected loss with hedging = Rs.54,000
Benefit of forward cover = Realization on forward rates – Realization on actual spot rates Benefit of forward cover = 60,26,000 – 59,77,000 Benefit of forward cover = Rs.49,000

The company has benefitted due to forward cover and hence the decision to take forward cover is justified.

69. FC – Exporter

In March, 2012, the Multinational Industries makes the following assessment of dollar rates per British pound to prevail as on 1.9.2012:

\$/£	Probability
1.60	0.15
1.70	0.20
1.80	0.25
1.90	0.20
2.00	0.20

- What is the expected spot rate for 1.9.2012?
- If, as of March, 2012, the 6-month forward rate is \$ 1.80, should the firm sell forward its dollar receivables due in September, 2012?

Answer:**WN 1: Computation of expected spot rate:**

USD/GBP	Probability	Product
1.60	0.15	0.24
1.70	0.20	0.34
1.80	0.25	0.45
1.90	0.20	0.38
2.00	0.20	0.40
Expected spot rate	1.81	

- Expected spot rate = USD 1.81/GBP

WN 2: Decision on hedging pound receivables:

- Let us assume the company would be receiving 1,00,000 USD
- Inflow under forward contract = 1,00,000/1.80 = GBP 55,555.56
- Inflow if forward contract is not taken = 1,00,000/1.81 = GBP 55,248.62
- The company should take the forward contract for its dollar receivables as the same leads to higher inflow of GBP

70. Honor of forward contract

A limited has imported goods worth 1 lakh Euros from B Limited payable on 31st December. A limited has entered into a forward contract maturing on 31st December when the rate offered was Rupee per Euro was Rs.66 – 68.

- ❖ Today is 31st December. A Limited wants to honour the contract. What action will follow?
- ❖ Today is 30th November. Spot rate is Rupees per Euro: 65-66. The 1 month forward rate is Euro 66.5 – 67.5. What action will follow if he wants to honour today?
- ❖ Today is 15th November. The company wants to honor the contract on 30th November. Spot rate is INR 66-66.5 / Euro. The forward rate for 30th November is INR 67-67.5 / Euro. The forward rate for 31st December is INR 67.5-68.5/Euro. What action will follow?
- ❖ If A limited was an exporter, what action will follow in the earlier 3 situations?

Answer:

Importer Analysis:**Situation A:**

- A Limited has entered into a contract to buy 1 lac euros at Rs.68. On 31st December, A Limited should pay (Ask rate) Rs.68 lacs and get 1 lac Euros from Bank

Situation B:

- The company wants to honour the contract on November 30. This would basically involve cancellation of original contract and then honouring the contract at spot rate of November 30

Date	Position	Action	Reference Date	Rate
Original date	Original Position	Buy (ASK)	December 31	-68.00
November 30	Opposite Position	Sell (BID)	December 31	66.50
November 30	New Position	Buy (ASK)	November 30	-66.00
Effective rate				-67.50
Loss on cancellation per USD			-68.00 + 66.50	-1.50
Total loss on cancellation			-1.50 x 1,00,000	-1,50,000
Effective gain per USD			-67.50 - (-68.00)	0.50
Total effective gain			0.50 x 1,00,000	50,000

Note:

- Cancellation would involve taking an opposite position to that of the original position
- BID rate on Nov 30 for December 31:** This is basically one-month forward rate of Rs.66.50. We should always ensure reference date remains same as that of original position. Original contract was taken for December 31 and hence the cancellation rate will also be of December 31.
- ASK rate on Nov 30 for Nov 30:** This is basically spot ask rate on November 30
- The company will have to pay Rs.66,00,000 to honour the contract on November 30. It also needs to pay 1,50,000 $(68 - 66.50) \times 1,00,000$ for cancelling the original contract.
- The company has to effectively pay Rs.67,50,000 $(1,00,000 \times 67.50)$ for honouring the contract on November 30
- Cancellation loss is computed by comparing original position and opposite position
- Effective loss is computed by comparing original contracted rate with effective rate. Originally company wanted to pay Rs.68 per EURO but they have effectively paid only Rs.67.50 per EURO and hence they gain Rs.0.50 per EURO.

Situation C:

- The company wants to honour the contract on November 30. The company has informed the bank about this on November 15. This would basically involve cancellation of original contract and then honouring the contract at forward rate of November 30

Date	Position	Action	Reference Date	Rate
Original date	Original Position	Buy (ASK)	December 31	-68.00
November 15	Opposite Position	Sell (BID)	December 31	67.50
November 15	New Position	Buy (ASK)	November 30	-67.50
Effective rate			-68 + 67.50 - 67.50	-68.00
Loss on cancellation per USD			-68.00 + 67.50	-0.50
Total loss on cancellation			-0.50 x 1,00,000	-50,000
Effective loss per USD			-68.00 - (-68.00)	0
Total effective loss			0 x 1,00,000	0

- The company will have to pay Rs.67,50,000 to honour the contract on November 30. It also needs to pay 50,000 $(68 - 67.50) \times 1,00,000$ for cancelling the original contract.
- The company has to effectively pay Rs.68,00,000 $(1,00,000 \times 68.50)$ for honouring the contract

Exporter Analysis:**Situation A:**

- A Limited has entered into a contract to sell 1 lac euros at Rs.68. On 31st December, A Limited should sell 1 lac Euros and receive (BID rate) Rs.66 lacs from Bank

Situation B:

- The company wants to honour the contract on November 30. This would basically involve cancellation of original contract and then honouring the contract at spot rate of November 30

Date	Position	Action	Reference Date	Rate
Original date	Original Position	Sell (BID)	December 31	66.00

November 30	Opposite Position	Buy (ASK)	December 31	-67.50
November 30	New Position	Sell (BID)	November 30	65.00
Effective rate				63.50
Loss on cancellation per USD			-67.50 + 66.00	-1.50
Total loss on cancellation			-1.50 x 1,00,000	-1,50,000
Effective loss per USD			63.50 - 66.00	-2.50
Total effective loss			-2.50 x 1,00,000	-2,50,000

- The company will receive Rs.65,00,000 to honour the contract on November 30. However, it needs to pay 1,50,000 $(67.50 - 66.) \times 1,00,000$ for cancelling the original contract.
- The company will effectively receive Rs.63,50,000 $(1,00,000 \times 63.50)$ for honouring the contract on November 30

Situation C:

- The company wants to honour the contract on November 30. The company has informed the bank about this on November 15. This would basically involve cancellation of original contract and then honouring the contract at forward rate of November 30

Date	Position	Action	Reference Date	Rate
Original date	Original Position	Sell (BID)	December 31	66.00
November 15	Opposite Position	Buy (ASK)	December 31	-68.50
November 15	New Position	Sell (BID)	November 30	67.00
Effective rate				64.50
Loss on cancellation per USD			-68.50 + 66.00	-2.50
Total loss on cancellation			-2.50 x 1,00,000	-2,50,000
Effective loss per USD			64.50 - 66.00	-1.50
Total effective loss			-1.50 x 1,00,000	1,50,000

- The company will receive Rs.67,00,000 to honour the contract on November 30. However, it needs to pay 2,50,000 $(68.50 - 66) \times 1,00,000$ for cancelling the original contract.
- The company will effectively receive Rs.64,50,000 $(1,00,000 \times 64.50)$ for honouring the contract

Note: Interest cost has not been considered for early honour as the question does not provide information on interest cost.

71. Early cancellation [Nov 2004]

A customer with whom the Bank had entered into 3 months' forward purchase contract for Swiss France 10,000 at the rate of Rs. 27.25 comes to the bank after 2 months and request cancellation of the contract. On this date, the rates, prevailing, are:

- ❖ Spot CH 1 = Rs. 27.30 27.35
- ❖ One-month forward Rs. 27.45 27.52

What is the loss/gain to the customer on cancellation?

Answer:

Computation of cancellation gain/loss:

Date	Position	Action	Reference Date	Rate
Original date	Original Position	Sell (BID)	Month 3	27.25
Month 2	Opposite Position	Buy (ASK)	Month 3	-27.52
Loss on cancellation per USD			27.25 - 27.52	-0.27
Total loss on cancellation			-0.27 x 10,000	2,700

Note:

- A customer with whom the bank has entered into forward purchase contract. This would mean that the bank has entered into purchase contract and customer has entered into sell contract

72. Early cancellation [Nov 2015]

A bank enters into a forward purchase covering the export bill for Swiss France 1,00,000 at Rs 32.4000 due on 25th April and converted itself for same delivery in the local interbank market at Rs.32.4200. However, on 25th March exporter sought for cancellation of the contract as the tenor of the bill is changed.

In Singapore market, Swiss Francs were quoted against US dollars as under

- ❖ Spot USD 1=Sw.Fcs.1.5076/1.5120
- ❖ One-month forward 1.5150/1.5160

- ❖ Two months forward 1.5250/1.5270
- ❖ Three months forward 1.5415/1.5445

And in the interbank market US dollars were quoted as under:

- ❖ Spot USD 1=Rs.49.4302/.4455
- ❖ Spot/April .4100/.4200
- ❖ Spot/May .4300/.4400
- ❖ Spot/June .4500/.4600

Calculate the cancellation charges payable by the customer if exchange margin required by the bank is 0.10% on buying and selling.

Answer:

Computation of cancellation gain/loss:

Date	Position	Action	Reference Date	Rate
Original date	Original Position	Sell (BID)	April 25	32.4000
March 25	Opposite Position	Buy (ASK)	April 25	-32.9474
Loss on cancellation per USD			32.4000 – 32.9432	-0.05474
Total loss on cancellation			-0.05474 x 1,00,000	54,740

Note:

- It is assumed that original contract rate of 32.4000 is after including exchange margin of 0.10%
- Buy rate on March 25 for April 25 (one-month forward rate) is calculated as under:

$$\text{ASK} \left(\frac{\text{INR}}{\text{CHF}} \right) = \text{ASK} \left(\frac{\text{INR}}{\text{USD}} \right) \times \text{ASK} \left(\frac{\text{USD}}{\text{CHF}} \right)$$

$$\text{ASK} \left(\frac{\text{INR}}{\text{CHF}} \right) = 49.9154 \times \frac{1}{1.5150} = 32.9474$$

- 1-month forward ASK(INR/USD) rate = (49.4455+0.4200) + 0.10% = 49.9154
- Exchange margin is applicable only for interbank market rate and not considered for Singapore market. Hence USD/CHF rate has not been adjusted for exchange margin of 0.10%

73. Leading and lagging & FC-Cancellation [May 2018 RTP, May 2012]

NP and Co. has imported goods for US \$ 7,00,000. The amount is payable after three months. The company has also exported goods for US \$ 4,50,000 and this amount is receivable in two months. For receivable amount a forward contract is already taken at Rs. 48.90.

The market rates for Rupee and Dollar are as under:

Spot	Rs.48.50/70
Two months	25/30 points
Three months	40/45 points

The company wants to cover the risk and it has two options as under:

- To cover payables in the forward market and
- To lag the receivables by one month and cover the risk only for the net amount. No interest for delaying the receivables is earned. Evaluate both the options if the cost of Rupee Funds is 12%. Which option is preferable?

Answer:

WN 1: Evaluation of option of covering payables in the forward market:

Particulars	Calculation	Amount (in lacs)
Day 0: Enter into forward contract to buy 7,00,000 USD in M3 at Rs.49.15 per USD (48.70 + 0.45)		
Month 2: Receive 4,50,000 USD at contracted rate of 48.90	4.5 x 48.90	220.05
Day 60 to 90: Interest earned/saved for one month on Rs.220.05 lacs	220.05 x 1%	2.20
Day 90: Payment of 7,00,000 USD in M3	7 x 49.15	-344.05
Net outflow		-121.80

WN 2: Evaluation of option of lagging the receivables:

- The company plans to lag the receivables by one month. In this option the company will have to cover payables of 2,50,000 USD as balance 4,50,000 USD will be paid out of export proceeds
- Under this option the company will have to cancel the forward contract as they will not be able to honour the same in month 2

Calculation of cancellation gain or loss:

Date	Position	Action	Reference Date	Rate

Original date	Original Position	Sell (BID)	Month 2	48.90
Day 0	Opposite Position	Buy (ASK)	Month 2	-49.00
Loss on cancellation per USD			48.90 – 49.00	-0.10
Total loss on cancellation			-0.10 x 4.5 lacs	0.45 lacs

Total outflow:

Particulars	Calculation	Amount (in lacs)
Day 0: Enter into forward contract to buy 2,50,000 USD in M3 at Rs.49.15 per USD (48.70 + 0.45)		
Day 0: Payment of cancellation loss		-0.45
Day 0 to Day 90: Interest on cancellation loss for 3 months	0.45 x 3%	-0.01
Day 90: Payment of 2,50,000 USD in M3	2.5 x 49.15	-122.88
Net outflow		-123.34

Conclusion:

- The company should go for option 1 as the same has lower net outflow. Hence we should go for covering the entire payables

74. Due date cancellation

TP Limited is located in India. They sold goods to P Co Inc in USA. They concluded on 1st January a transaction for sale of goods worth USD 100,000. TP will receive this amount six months from now. They therefore enter into a forward contract with their bankers. The contract provides that the Bank buy USD 100,000. TP Limited was not able to perform the contract fully but dispatched goods worth only USD 70,000. The rates prevailing on different dates are as under:

January 1	Spot 52.56-52.90 6 m Swap 50-60
July 1	Spot 52.70 – 53

- Compute the settlement to be done
- What would have been the position if TP Limited had done a purchase of goods instead of a sale of goods and was in a position to import only USD 70,000

Answer:**WN 1: Computation of net settlement:****Part 1: Cancellation gain/loss:**

- The company had entered into contract for USD 1,00,000. However, they could supply only USD 70,000. Hence, they will have to cancel contract worth USD 30,000

Date	Position	Action	Reference Date	Rate
Jan 1	Original Position	Sell (BID)	June 30	53.06
June 30	Opposite Position	Buy (ASK)	June 30	-53
Gain on cancellation per USD			53.06 – 53	0.06
Total gain on cancellation			0.06 x 30,000	1,800

Part 2: Receipt on delivery of 70,000 USD:

- The company will deliver 70,000 USD and collect Rs.37,14,200 (70,000 x 53.06)

Total receipt:

- Total inflow = 37,14,200 + 1,800 = Rs.37,16,000

WN 2: Computation of net settlement if TP Limited was an importer:**Part 1: Cancellation gain/loss:**

- The company had entered into contract for USD 1,00,000. However, they could import only USD 70,000. Hence, they will have to cancel contract worth USD 30,000

Date	Position	Action	Reference Date	Rate
Jan 1	Original Position	Buy (ASK)	June 30	-53.50
June 30	Opposite Position	Sell (BID)	June 30	52.70
Loss on cancellation per USD			52.70 – 53.50	-0.80
Total loss on cancellation			-0.80 x 30,000	-24,000

Part 2: Payment on purchase of 70,000 USD:

- The company will purchase 70,000 USD and pay Rs.37,45,000 ($70,000 \times 53.50$)

Total Payment:

- Total outflow = $37,45,000 + 24,000 = \text{Rs.}37,69,000$

75. Roll over – importer

On 31st July AB Limited approaches SBI for 90 day forward contract on an installment of 300,000 Euro payable on 31st October. The exchange rates are as under:

	Spot rate	Forward Rate
July 31	65.40 – 66.80	3M 65.00 – 66.00
Oct 31	65.50 – 66.50	1M 65.75 – 66.75

- On due date AB Limited seeks one-month extension. What action would follow?
- What would be the position if prior to one month of the maturity of the forward contract the company had come for extension? The relevant dates on that date are:

Spot rate	1M Forward	2M Forward
66.85 – 67.25	66.25 – 66.50	65.35 – 65.80

Answer:**WN 1: Extension of one-month on due date:**

Date	Position	Action	Reference Date	Rate
July 31	Original Position	Buy (ASK)	October 31	-66.00
October 31	Opposite Position	Sell (BID)	October 31	65.50
October 31	New Position	Buy (ASK)	November 30	-66.75
Effective rate			-66 + 65.50 – 66.75	-67.25
Loss on cancellation per USD			-66 + 65.50	-0.50
Total loss on cancellation			-0.50 × 3,00,000	-1,50,000
Effective loss per USD			-67.25 – (-66.00)	-1.25
Total effective loss			-1.25 × 3,00,000	-3,75,000

WN 2: Extension of one-month on one month before due date:

Date	Position	Action	Reference Date	Rate
July 31	Original Position	Buy (ASK)	October 31	-66.00
Sep 30	Opposite Position	Sell (BID)	October 31	66.25
Sep 30	New Position	Buy (ASK)	November 30	-65.80
Effective rate			-66 + 66.25 – 65.80	-65.55
Gain on cancellation per USD			-66 + 66.25	0.25
Total gain on cancellation			0.25 × 3,00,000	75,000
Effective gain per USD			-65.55 – (-66.00)	0.45
Total effective gain			0.45 × 3,00,000	1,35,000

76. Roll over – exporter

L Limited exported goods worth USD 300,000 to U Limited on 1st August and immediately took a three month forward cover. On that date spot rate is Rupee per USD: 52.56 – 52.76. 3M forward rate is Rupee per USD : 52.25 – 52.55. The sum is expected to be realized on 31st October.

- On 30th September, U Limited informs of further 1 month delay from due date. Spot rate is Rupee per USD : 52.35 – 52.60. One month forward rate is 52.50 – 52.80. Two month forward rate is 52.65 – 52.80. What are the implications?
- If U Limited informs L of a further 1 month delay only on 31st October and the 1 month forward rate on that date were to be 52.85-53.00. The spot rate on 31st October was 52.50-80. What are the implications?

Answer:**WN 1: Extension of one-month on Sep 30:**

Date	Position	Action	Reference Date	Rate
August 1	Original Position	Sell (BID)	October 31	52.25
Sep 30	Opposite Position	Buy (ASK)	October 31	-52.80
Sep 30	New Position	Sell (BID)	November 30	52.65
Effective rate			52.25-52.80+52.65	52.10
Loss on cancellation per USD			52.25-52.80	-0.55

Total loss on cancellation	-0.55 x 3,00,000	-1,65,000
Effective loss per USD	52.10 - 52.25	-0.15
Total effective loss	-0.15 x 3,00,000	-45,000

WN 2: Extension of one-month on Oct 31:

Date	Position	Action	Reference Date	Rate
August 1	Original Position	Sell (BID)	October 31	52.25
Oct 31	Opposite Position	Buy (ASK)	October 31	-52.80
Oct 31	New Position	Sell (BID)	November 30	52.85
Effective rate			52.25-52.80+52.85	52.30
Loss on cancellation per USD			52.25-52.80	-0.55
Total loss on cancellation			-0.55 x 3,00,000	-1,65,000
Effective gain per USD			52.30 - 52.25	0.05
Total effective gain			0.05 x 3,00,000	15,000

77. Roll over – importer [Nov 2010, May 2015 MTP, Nov 2016 MTP, Nov 2018 MTP, May 2015 RTP]

An importer requests his bank to extend the forward contract for US\$ 20,000 which is due for maturity on 30 October, 2010, for a further period of 3 months. He agrees to pay the required margin money for such extension of the contract.

Contracted Rate - US\$ 1= Rs. 42.32

The US Dollar quoted on 30-10-2010:-

- ❖ Spot - 41.5000/41.5200
- ❖ 3 months' Premium -0.87% /0.93%
- ❖ Margin money for buying and selling rate is 0.075% and 0.20% respectively.

Compute:

- a) The cost to the importer in respect of the extension of the forward contract, and
- b) The rate of new forward contract.

Answer:**WN 1: Computation of cancellation gain/loss:**

Date	Position	Action	Reference Date	Rate
Original date	Original Position	Buy (ASK)	October 31	-42.32
Oct 31	Opposite Position	Sell (BID)	October 31	41.47
Oct 31	New Position	Buy (ASK)	November 30	-41.99
Effective rate			-42.32+41.47-41.99	-42.81
Loss on cancellation per USD			-42.32+41.47	-0.85
Total loss on cancellation			-0.85 x 20,000	-17,000
Effective loss per USD			-42.81 - (-42.32)	0.49
Total effective loss			0.49 x 20,000	-9,800

- Cost to the importer in respect of extension of forward contract = Rs.17,000 (Loss on cancellation). However, the effective loss for the importer is Rs.9,800
- Rate of new forward contract = Rs.41.99

Note:**BID rate on October 31 for October 31:**

- BID rate on October 31 = 41.50 - 0.075% = 41.50 - 0.0311 = Rs.41.4689 ~ Rs.41.47
- It is assumed that margin money percentage of buying and selling rate is to be interpreted from banker point of view. Hence margin of 0.075% is considered for Banker buying rate (BID rate) and 0.20% is considered for Banker selling rate (ASK Rate)

ASK rate on October 31 for November 30:

- Spot ask rate = 41.52
- 3-month forward rate without exchange margin = 41.52 + 0.93% = 41.9061
- Final 3-month forward rate with exchange margin = 41.9061 + 0.20% = 41.9899 ~ Rs.41.99

78. Roll over – exporter

On 31st March X Limited entered into a forward sale contract for USD 5000 with its banker at the rate of Rs.50 delivery due on 30th June. On 30th May the company requests the bank to postpone the date to 31st July.

- Calculate the extension charges payable to the banker
- Suppose X Limited comes on 30th June seeking extension when the rates are as under. What action will follow?

The relevant rates are as under:

Date	Spot rate Rs/USD	1M Forward	2M Forward	3M forward
30 th May	48.5-49.0	49.75-80	49.25-50	50.5-51.75
30 th June	48.7-49.1	49.30-80	49.55-70	50.1-51.20

Answer:

WN 1: Extension of one-month on May 30:

Date	Position	Action	Reference Date	Rate
March 31	Original Position	Sell (BID)	June 30	50.00
May 30	Opposite Position	Buy (ASK)	June 30	-49.80
May 30	New Position	Sell (BID)	July 31	49.25
Effective rate			50-49.80+49.25	49.45
Gain on cancellation per USD			50-49.80	0.20
Total gain on cancellation			0.20 x 5,000	1,000
Effective loss per USD			49.45 - 50	-0.55
Total effective loss			-0.55 x 5,000	-2,750

WN 2: Extension of one-month on June 30:

Date	Position	Action	Reference Date	Rate
March 31	Original Position	Sell (BID)	June 30	50.00
June 30	Opposite Position	Buy (ASK)	June 30	-49.10
June 30	New Position	Sell (BID)	July 31	49.30
Effective rate			50-49.10+49.30	50.20
Gain on cancellation per USD			50-49.10	0.90
Total gain on cancellation			0.90 x 5,000	4,500
Effective gain per USD			50.20 - 50	0.20
Total effective gain			0.20 x 5,000	1,000

79. Cancellation of forward contract:

On 15th January 2015 you as a banker booked a forward contract for USD 2,50,000 for your import customer deliverable on 15th March 2015 at Rs.65.3450. On due date customer request you to cancel the contract. On this date quotation for USD in the inter-bank market is as follows:

- ❖ Spot rate = Rs.65.2900/2975 per USD
- ❖ Spot/April = 3000/3100
- ❖ Spot/May = 6000/6100

Assume that the flat charges for the cancellation is Rs.100 and exchange margin is 0.10%, then determine the cancellation charges payable by the customers.

WN 1: Computation of cancellation gain/loss:

Date	Position	Action	Reference Date	Rate
Jan 15	Original Position	Buy	March 15	(65.3450)
Mar 15	Opposite Position	Sell	March 15	65.2247
Loss per USD				0.1203
Loss for 2,50,000 USD			2,50,000 x 0.1203	Rs.30,075

Note 1: Sell rate on March 15:

- ❖ Sell rate on March 15 (bid rate) is Rs.65.2900/USD. Exchange margin is 0.10% and the same will be deducted for calculating bid rate. Bid rate = 65.2900 - 0.06529 = Rs.65.2247/USD

Note 2: Cancellation charges:

- ❖ Cancellation charges payable by customer = 30,075 + 100 = Rs.30,175

80. Early cancellation:

Suppose you are a banker and one of your export customer has booked a USD 1,00,000 forward sale contract for 2 months with you at the rate of Rs.62.5200 and simultaneously you covered yourself in the interbank market at Rs.62.5900. However on due date, after 2 months your customer comes to you and requests for

cancellation of the contract and also requests for extension of the contract by one month. On this date quotation for USD in the market was as follows:

- ❖ Spot rate = Rs.62.6800/62.7200
- ❖ 1 month forward = Rs.62.6400/62.7400

Determine the extension charges payable by the customer assuming exchange margin of 0.10% on buying as well as selling.

Answer:

Date	Position	Action	Reference Date	Rate
Day 0	Original Position	Sell	Month 2	62.5200
Month 2	Opposite Position	Buy	Month 2	(62.7827)
Month 2	New Position	Sell	Month 3	62.5774
Effective rate			62.52 – 62.7827 + 62.5774	62.3147
Loss on cancellation per USD			62.5200 – 62.7827	0.2627
Total loss on cancellation			0.2627 x 1,00,000	26,270
Effective loss per USD			62.52 – 62.3147	0.2053
Total effective loss			0.2053 x 1,00,000	20,530

Note 1: Buy rate on Month 2:

- ❖ Buy rate in Month 2 (ask rate) for Month 2 is 62.7200. Exchange margin is 0.10% and the same will be added to get ask rate. Ask rate = 62.7200 + 0.06272 = 62.7827

Note 2: Sell rate in Month 2 for Month 3:

- ❖ Sell rate in Month 2 (bid rate) for Month 3 (1-month forward is 62.6400. Exchange margin is 0.10% and the same will be deducted to get bid rate. Bid rate = 62.6400 – 0.06264 = 62.5774

Summary:

- ❖ Cancellation loss = Rs.26,270
- ❖ New rate = Rs.62.5774

81. Extension before due date:

Suppose you as a banker entered into a forward purchase contract for USD 50,000 on 5th March with an export customer for 3 months at the rate of Rs.59.6000. On the same day you also covered yourself in the market at Rs.60.6025. However on 5th May your customer comes to you and requests extension of the contract to 5th July. On this date (5th May) quotation for USD in the market is as follows:

- ❖ Spot rate = Rs.59.1300/1400 per USD
- ❖ Spot/5th June = Rs.59.2300/2425 per USD
- ❖ Spot/5th July = Rs.59.6300/6425 per USD

Assuming a margin of 0.10% on buying and selling, determine the extension charges payable by the customer and the new rate quoted to the customer.

Answer:

Date	Position	Action	Reference Date	Rate
March 5	Original Position	Sell	June 5	59.6000
May 5	Opposite Position	Buy	June 5	(59.3017)
May 5	New Position	Sell	July 5	59.5704
Effective rate			59.6000 – 59.3017 + 59.5704	59.8687
Gain on cancellation per USD			59.6000 – 59.3017	0.2983
Total gain on cancellation			0.2983 x 50,000	14,915
Effective gain per USD			59.8687 – 59.6000	0.2687
Total effective gain			0.2687 x 50,000	13,435

Note 1: June 5 buy rate on May 5:

- ❖ Buy rate on May 5 (ask rate) for June 5 is 59.2425. Exchange margin is 0.10% and the same will be added to get ask rate. Ask rate = 59.2425 + 0.0592 = 59.3017

Note 2: Sell rate on May 5 for July 5:

- ❖ Sell rate on May 5 (bid rate) for July 5 (2-month forward is 59.6300. Exchange margin is 0.10% and the same will be deducted to get bid rate. Bid rate = 59.6300 – 0.0596 = 59.5704

Summary:

- ❖ Cancellation gain = Rs.14,915
- ❖ New rate = Rs.59.5704

82. Customer not appearing on due date [May 2018 RTP, May 2015, May 2018, Nov 2020]

An importer booked a forward contract with his bank on 10th April for USD 2,00,000 due on 10th June @ Rs. 64.4000. The bank covered its position in the market at Rs. 64.2800.

The exchange rates for dollar in the interbank market on 10th June and 13th June were:

	June 10	June 13
Spot USD 1	63.8000/8200	63.6800/7200
Spot/June	63.9200/9500	63.8000/8500
July	64.0500/0900	63.9300/9900
August	64.3000/3500	64.1800/2500
September	64.6000/6600	64.4800/5600

Exchange Margin 0.10% and interest on outlay of funds @ 12%. The importer requested on 13th June for extension of contract with due date on 10th August. Rates rounded to 4 decimal in multiples of 0.0025. On 10th June, Bank Swaps by selling spot and buying one month forward. Calculate:

- ❖ Cancellation rate
- ❖ Amount payable on \$ 2,00,000
- ❖ Swap loss
- ❖ Interest on outlay of funds, if any
- ❖ New contract rate
- ❖ Total Cost

Answer:**WN 1: Evaluation from importer point of view:**

Date	Position	Action	Reference Date	Rate
Apr 10	Original Position	Buy (ASK)	June 10	-64.4000
June 13	Opposite Position	Sell (BID)	June 13	63.6175
June 13	New Position	Buy (ASK)	Aug 10	-64.3150
Effective rate			-64.40+63.6175-64.3150	-65.0975
Loss on cancellation per USD			-64.40+63.6175	-0.7825
Total loss on cancellation			-0.7825 x 2,00,000	-1,56,500
Effective loss per USD			-65.0975 - (-64.40)	-0.6975
Total effective loss			-0.6975 x 2,00,000	-1,39,500

Note:**BID rate on June 13 (Spot rate):**

- BID rate = $63.6800 - 0.10\% = 63.6163 \sim 63.6175$ (multiples of 0.0025)

ASK rate on June 13 for August 10:

- Ask rate without exchange rate = 64.2500
- Final Ask rate = $64.25 + 0.10\% = 64.31425 \sim 64.3150$

WN 2: Computation of swap loss (evaluation from bank point of view):

Date	Position	Action	Reference Date	Rate
Apr 10	Original Position	Buy (ASK)	June 10	-64.28
June 10	Opposite Position	Sell (BID)	June 10	63.80
June 10	New Position	Buy (ASK)	June 30	-63.95
Effective rate			-64.28+63.80-63.95	-64.43
Loss on cancellation per USD			-64.28+63.80	-0.48
Total loss on cancellation			-0.48 x 2,00,000	-96,000
Effective loss per USD			-64.43 - (-64.28)	-0.15
Total effective loss			-0.15 x 2,00,000	-30,000

Note:

- The customer did not come on due date and is yet to give instructions to the company on honour/instruction/cancellation

- As per FEDAI Rule 8 a forward contract which remains overdue without any instructions from the customers on or before due date shall stand automatically cancelled on 3rd day from the date of maturity.
- However, customer can ask for honour/cancellation/extension within 3 days and hence the bank is required to roll-over his contract with the next available contract. The process of extension has been presented in WN 2 and the effective loss of the bank will be recovered from the customer in the form of swap loss

WN 3: Final solution:

Particulars	Calculation	Amount
Cancellation rate	WN 1	63.6175
Amount payable on USD 2,00,000	WN 1	1,56,500
Swap loss	WN 2	30,000
Interest on outlay of funds (This is banker outflow on cancellation due to non-receipt of instructions from customer)	$96,000 \times 12\% \times \left(\frac{3}{365}\right)$	95
New Contract rate	WN 1	64.3150
Total cost	$1,56,500 + 30,000 + 95$	1,86,595

83. Customer not appearing on due date [Nov 2016]

On 10th July, an importer entered into a forward contract with bank for USD 50,000 due on 10th September at an exchange rate of Rs.66.8400. The bank covered position in the inter-bank market at Rs.66.6800.

How the bank would react if the customer requests on 13th September:

- ❖ To cancel the contract?
- ❖ To execute the contract?
- ❖ To extend the contract with due date to fall on 10th November?

The exchange rates for USD in the interbank market were as follows:

	September 10	September 13
Spot	66.1500/1700	65.9600/9900
Spot/September	66.2800/3200	66.1200/1800
Spot/October	66.4100/4300	66.2500/3300
Spot/November	66.5600/6100	66.4000/4900

Exchange margin was 0.1% on buying and selling. Interest on outlay of funds was 12%. You are required to show the calculations to:

- ❖ Cancel the contract
- ❖ Execute the contract and
- ❖ Extend the contract

Answer:**WN 1: Evaluation from importer point of view:**

Date	Position	Action	Reference Date	Rate
July 10	Original Position	Buy (ASK)	Sep 10	-66.8400
Sep 13	Opposite Position	Sell (BID)	Sep 13	65.8940
Loss on cancellation per USD			$-66.84 + 65.8940$	-0.946
Total loss on cancellation			$-0.946 \times 50,000$	47,300

Note:**BID rate on Sep 20 (Spot rate):**

- BID rate = $65.9600 - 0.10\% = 65.8940$

WN 2: Computation of swap loss (evaluation from bank point of view):

Date	Position	Action	Reference Date	Rate
Jul 10	Original Position	Buy (ASK)	Sep 10	-66.68
Sep 10	Opposite Position	Sell (BID)	Sep 10	66.15
Sep 10	New Position	Buy (ASK)	Sep 30	-66.32
Effective rate			$-66.68 + 66.15 - 66.32$	-66.85
Loss on cancellation per USD			$-66.68 + 66.15$	-0.53
Total loss on cancellation			$0.53 \times 50,000$	26,500
Effective loss per USD			$-66.85 - (-66.68)$	-0.17

Total effective loss	-0.17 x 50,000	8,500

Note:

- The customer did not come on due date and is yet to give instructions to the company on honour/instruction/cancellation
- As per FEDAI Rule 8 a forward contract which remains overdue without any instructions from the customers on or before due date shall stand automatically cancelled on 3rd day from the date of maturity.
- However, customer can ask for honour/cancellation/extension within 3 days and hence the bank is required to roll-over his contract with the next available contract. The process of extension has been presented in WN 2 and the effective loss of the bank will be recovered from the customer in the form of swap loss

WN 3: Cost to be paid for cancellation/extension/honour:

Particulars	Calculation	Amount
Cancellation loss	WN 1	47,300
Swap loss	WN 2	8,500
Interest on outlay of funds (This is banker outflow on cancellation due to non-receipt of instructions from customer)	$26,500 \times 12\% \times \left(\frac{3}{365}\right)$	26
Total cost	47,300+8,500+26	55,826

WN 4: Action under different scenarios:**Situation 1: Cancel the contract:**

- The customer has to pay Rs.55,826 towards cancellation of contract.

Situation 2: Execute the contract:

- The customer has to pay Rs.55,826 towards cancellation of contract.
- Execution of the contract will happen at the spot rate of Sep 13. Ask rate on Sep 13 = 65.99 + 0.10% = Rs.66.0560. Total payment for purchase of 50,000 USD = 50,000 x 66.0560 = Rs.33,02,800
- Total payment = Rs.33,02,800 + Rs.55,887 = Rs.33,58,687**

Situation 3: Extend the contract:

- The customer has to pay Rs.55,826 towards cancellation of contract.
- New contract rate = 66.49 + 0.10% = Rs.66.5565

84. Late extension of forward contract [Nov 2021 MTP]

Z has to remit USD \$1,00,000 for her daughter's education on 4th April 2021. Accordingly, she has booked a forward contract with his bank on 4th January 2021 @ Rs. 73.8775. The Bank has covered its position in the market @ Rs. 73.7575.

The exchange rates for USD \$ in the interbank market on 4th, 7th and 14th April 2021 were:

Particulars	April 4	April 7	April 14
Spot USD = 1	73.2775/72.3975	73.1575/73.1975	73.1375/73.1775
Spot/April	73.3975/73.4275	73.2775/73.3275	73.2575/73.3075
May	73.5275/73.5675	73.4075/73.4650	73.3875/73.4475
June	73.7775/73.8250	73.6575/73.7275	73.6375/73.7050
July	74.0700/74.1325	73.9575/74.0675	73.9500/74.0525

Exchange margin of 0.10 percent and interest outlay of funds @ 12 percent are applicable. The remitter, due to rescheduling of the semester, has requested on 14th April 2021 for extension of contract with due date on 14th July 2021.

Calculate:

- Cancellation Rate;
- Amount Payable on \$ 100,000;
- Swap loss;
- Interest on outlay of funds, if any;
- New Contract Rate; and
- Total Cost

Note: Rates must be rounded to 4 decimal places in multiples of 0.0025 and assume 365 days in a year.

Answer:**WN 1: Evaluation from importer point of view:**

Date	Position	Action	Reference Date	Rate
Jan 4	Original Position	Buy (ASK)	Apr 4	-73.8775
Apr 7	Opposite Position	Sell (BID)	Apr 7	73.0850
Apr 14	New Position	Buy (ASK)	Jul 14	-74.1275
Effective rate			-73.8775 + 73.0850 - 74.1275	-74.9200
Loss on cancellation per USD			-73.8775 + 73.0850	-0.7925
Total loss on cancellation			-0.7925 x 1,00,000	-79,250
Effective loss per USD			-74.9200 - (-73.8775)	-1.0425
Total effective loss			-1.0425 x 1,00,000	-1,04,250

Note:

- Customer had appeared on 14th April. However as per rule, the bank will wait for 3 days of grade period (April 4 to April 7) and will automatically cancel the contract on April 7 if the customer does not appear.

BID rate on Apr 7 (Spot rate):

- BID rate = 73.1575 - 0.10% = 73.0843 ~ 73.0850 (multiples of 0.0025)

ASK rate on Apr 14 for July 14:

- Ask rate without exchange rate = 74.0525
- Final Ask rate = 74.0525 + 0.10% = 74.1266 ~ 74.1275

WN 2: Computation of swap loss (evaluation from bank point of view):

Date	Position	Action	Reference Date	Rate
Jan 4	Original Position	Buy (ASK)	Apr 4	-73.7575
Apr 4	Opposite Position	Sell (BID)	Apr 4	73.2775
Apr 4	New Position	Buy (ASK)	Apr 30	-73.4275
Effective rate			-73.7575 + 73.2775 - 73.4275	-73.9075
Loss on cancellation per USD			-73.7575 + 73.2775	-0.48
Total loss on cancellation			-0.48 x 1,00,000	-48,000
Effective loss per USD			-73.9075 - (-73.7575)	-0.15
Total effective loss			-0.15 x 1,00,000	-15,000

Note:

- The customer did not come on due date and is yet to give instructions to the company on honour/instruction/cancellation
- As per FEDAI Rule 8 a forward contract which remains overdue without any instructions from the customers on or before due date shall stand automatically cancelled on 3rd day from the date of maturity.
- However, customer can ask for honour/cancellation/extension within 3 days and hence the bank is required to roll-over his contract with the next available contract. The process of extension has been presented in WN 2 and the effective loss of the bank will be recovered from the customer in the form of swap loss

WN 3: Final solution:

Particulars	Calculation	Amount
Cancellation rate	WN 1	73.0850
Amount payable on USD 2,00,000	WN 1	79,250
Swap loss	WN 2	15,000
Interest on outlay of funds (This is banker outflow on cancellation due to non-receipt of instructions from customer)	$48,000 \times 12\% \times \left(\frac{3}{365}\right)$	47
New Contract rate	WN 1	74.1275
Total cost	$79,250 + 15,000 + 47$	94,297

85. Honor of forward contract [Early Honour – Nov 2018 MTP, May 2021 MTP, July 2021]

On 1st October, 2020 Mr. Guru, an exporter, enters into a forward contract with the Bank to sell USD 1,00,000 on 31st December 2020 at INR/USD 75.40. However, at the request of the importer, Mr. Guru received the amount on 30th November, 2020. Mr. Guru requested the bank take delivery of the remittance on 30th November, 2020 i.e. before due date.

The inter-bank rate on 30th November 2020 was as follows:

- Spot INR/USD 75.22-75.27
- One Month Premium 10/15

Assume 365 days in a year.

- If bank agrees to take early delivery then what will be net inflow to Mr. Guru assuming that the prevailing prime lending rate is 18% per annum.
- If Mr. Guru can deploy these funds in USD, he gets return at the rate of 3% per annum. Which is better ? Why ?

Answer:

WN 1: Computation of net inflow if early delivery is done:

Note 1: Analysis from customer's point of view:

Date	Position	Action	Reference Date	Rate
Oct 1	Original Position	Sell (BID)	December 31	75.40
Nov 30	Opposite Position	Buy (ASK)	December 31	-75.42
Nov 30	New position	Sell (BID)	Nov 30	75.22
Effective rate			75.40 - 75.42 + 75.22	75.20
Swap loss per USD			75.40 - 75.20	0.20
Total Swap loss			0.20 x 1,00,000	20,000

❖ Swap loss is the difference between effective rate – original rate

Note 2: Computation of interest cost:

Analysis from bank's point of view:

Particulars	Amount
Nov 30 – Bank will buy from customer	-75.40
Nov 30 – Bank will sell at spot rate to some other Bank	75.22
Outflow for banker	0.18
Total outflow for banker (1,00,000 x 0.18)	18,000
Interest cost to be recovered (18,000 x 18% x 31/365)	275

Note 3: Total outflow for early honour:

Particulars	Amount
Swap loss	20,000
Interest charges	275
Total recovery from customer	20,275

Note 4: Net realization for customer:

Particulars	Amount
Sale of 1,00,000 USD at original rate (1,00,000 x 75.40)	75,40,000
Less: Charges (Note 3)	(20,275)
Net realization for customer	75,19,725

WN 2: Computation of net inflow if funds are invested in USD:

Particulars	Amount
Amount received on Nov 30	USD 1,00,000
Interest on USD deposit [1,00,000 x 3% x 31/365]	USD 254.79
Total receipt on Dec 31	USD 1,00,254.79
Inflow in INR	
Originally contracted amount [1,00,000 x 75.40]	75,40,000
Interest amount converted at forward rate [254.79 x 75.32]	19,191
Inflow in INR on Dec 31	75,59,191

Selection of option:

Particulars	Early delivery	Delivery on Dec 31
Inflow in INR	75,19,725	75,59,191
Add: Interest saving for 31 days at 18%	1,14,959 [75,19,725 x 18% x 31/365]	-
Total cash inflow	76,34,684	75,59,191

Advice: Since Cash Inflow will be higher in early delivery, option the same should be chosen

86. Forward contract – Early Delivery [May 2019]

On 1st January 2019 Global Limited, an exporter entered into a forward contract with BBC Bank to sell USD 2,00,000 on 31st March 2019 at Rs.71.50/USD. However due to the request of the importer, Global Limited received the amount on 28 February 2019. Global Limited requested the Bank to take delivery of the remittance on 2nd March 2019. The Inter-banking rates on 28th February were as follows:

- ❖ Spot rate = Rs.71.20/71.25
- ❖ One month premium = 5/10

If bank agrees to take early delivery then what will be the net inflow to Global Limited assuming that the prevailing lending rate is 15%. Assume 365 days in a year.

Answer:**WN 1: Computation of swap loss:****Analysis from customer's point of view:**

Date	Position	Action	Reference Date	Rate
Jan 1	Original Position	Sell	March 31	71.50
Feb 28	Opposite Position	Buy	March 31	(71.35)
Feb 28	New position	Sell	Feb 28	71.20
Effective rate			71.50 – 71.35 + 71.20	71.35
Swap loss per USD			71.50 – 71.35	0.15
Total Swap loss			0.15 x 2,00,000	30,000

- ❖ Swap loss is the difference between effective rate – original rate

WN 2: Computation of interest cost:**Analysis from bank's point of view:**

Particulars	Amount
Feb 28 – Bank will buy from customer	(71.50)
Feb 28 – Bank will sell at spot rate to some other Bank	71.20
Outflow for banker	0.30
Total outflow for banker (2,00,000 x 0.30)	60,000
Interest cost to be recovered (60,000 x 15% x 29/365)	715

WN 3: Total outflow for early honour:

Particulars	Amount
Swap loss	30,000
Interest charges	715
Total recovery from customer	30,715

WN 4: Net realization for customer:

Particulars	Amount
Sale of 2,00,000 USD at original rate (2,00,000 x 71.50)	1,43,00,000
Less: Charges (WN 3)	(30,715)
Net realization from customer	1,42,69,285

Comment:

- ❖ Net realization is basically to be computed at effective rate of 71.35 per USD. Hence it can also be calculated as Rs.1,42,70,000 (2,00,000 x 71.35)
- ❖ Net realization = 1,42,70,000 – Interest cost (715) = Rs.1,42,69,285

87. Forward contract – Early Delivery [Nov 2018]

On 19th January, Bank A entered into forward contract with a customer for forward sale of USD 7,000, delivery 20th March at Rs.46.67. On the same day, it covered its position by buying forward from the market due 19th March at the rate of Rs.46.655. On 19th February, the customer, approaches the bank and requests for early delivery of USD. Rates prevailing in the interbank markets on that date are as under:

- ❖ Spot rate = Rs.46.5725/5800
- ❖ March = Rs.46.3550/3650

Interest on outflow of funds is 16% and on inflow of funds is 12%. Flat charges for early delivery are Rs.100. What is the amount that would be recovered from the customer on the transaction?

Note: Calculation are to be made on months basis than on days basis.

Answer:

WN 1: Computation of swap loss:

Analysis from customer's point of view:

Date	Position	Action	Reference Date	Rate
Jan 19	Original Position	Buy	March 19	(46.67)
Feb 19	Opposite Position	Sell	March 19	46.3550
Feb 19	New position	Buy	Feb 19	(46.5800)
Effective rate			-46.6700 + 46.3550 - 46.5800	-46.8950
Swap loss per USD			46.8950 - 46.67	0.225
Total Swap loss			0.225 x 7,000	1,575

- ❖ Swap loss is the difference between effective rate - original rate

WN 2: Computation of interest cost:

Analysis from bank's point of view:

Particulars	Amount
Feb 19 - Bank will sell to customer at original contracted rate	46.67
Feb 19 - bank will have to buy in spot market from other bank to make the above sale	(46.58)
Inflow for banker	0.09
Total inflow for banker (0.09 x 7,000)	630
Interest to be paid to customer (630 x 12% x 1/12)	6.30

WN 3: Total outflow for early honour:

Particulars	Amount
Swap loss	1,575
Flat charges	100
Interest to be paid to customer	(6.30)
Total recovery from customer	1,668.70

WN 4: Net payment by customer:

Particulars	Amount
Purchase of 7,000 USD at original rate (7,000 x 46.67)	3,26,690
Add: Charges (WN 3)	1,668.70
Total outflow for customer	3,28,358.70

88. Time value and currency fluctuation component [Nov 2017 RTP]

India Imports co., purchased USD 100,000 worth of machines from a firm in New York, USA. The value of the rupee in terms of the Dollar has been decreasing. The firm in New York offers 2/10, net 90 terms. The spot rate for the USD is Rs. 55; the 90 days forward rate is Rs. 56.

- i. Compute the Rupee cost of paying the account within the 10 days.
- ii. Compute the Rupee cost of buying a forward contract to liquidate the account in 90 days.
- iii. The difference between part a and part b is the result of the time value of money (the discount for prepayment) and protection from currency value fluctuation. Determine the magnitude of each of these components.

Answer:

(i) Rupee cost of paying the account within 10 days = 98,000 USD x Rs.55 = Rs.53,90,000

Note:

- ❖ 2/10 net 90 would mean that the company will get 2 percent discount if the payment is done in 10 days. Hence the company will be making a payment of only 98,000 USD

- ❖ It is assumed that current spot rate would be applicable for day 10 as well

(ii) Rupee cost of paying in 90 days = 1,00,000 USD × 56 = Rs.56,00,000

(iii) Computation of the difference in part (a) and part (b) and the magnitude of components:

Particulars	Calculation	Amount
Difference in part (a) and Part (b)	56,00,000 – 53,90,000	2,10,000
Time value of money component (difference between 1,00,00 USD and 98,000 USD)	(1,00,000 – 98,000) × 56	1,12,000
Currency value fluctuation component (difference between spot rate and forward rate)	98,000 × (56 – 55)	98,000

89. Evaluation of forward contract [Nov 2010 RTP]

Somu Electronics imported goods from Japan on July 1st 2009, of JP ¥ 1 million, to be paid on 31st, December 2009. The treasury manager collected the following exchange rates on July 01, 2009 from the bank.

- ❖ Delhi Rs./US\$ = 45.86 /88
- ❖ Spot 6 months forward = 46.00/03
- ❖ Tokyo JP ¥/ US\$ = 108/108.50
- ❖ Spot 6 months forward = 110/110.60

In spite of fact that the forward quotation for JP ¥ was available through cross currency rates, Mr. X, the treasury manager purchased spot US\$ and converted US\$ into JP ¥ in Tokyo using 6 months forward rate. However, on 31st December, 2009 Rs./US\$ spot rate turned out to be 46.24 /26.

You are required to calculate the loss or gain in the strategy adopted by Mr. X by comparing the notional cash flow involved in the forward cover for Yen with the actual cash flow of the transaction.

Answer:

WN 1: Computation of payment using forward contract:

- ❖ Known component = JPY 1 million
- ❖ Unknown component = ? INR

$\text{INR} = \text{JPY} \times \text{Ask} \left(\frac{\text{INR}}{\text{JPY}} \right)$
$\text{INR} = \text{JPY} \times \text{Ask} \left(\frac{\text{INR}}{\text{USD}} \times \frac{\text{USD}}{\text{JPY}} \right)$
$\text{INR} = 10,00,000 \times \text{Ask} \left(46.03 \times \frac{1}{110} \right)$
INR = 4,18,454.50

WN 2: Computation of payable using forward contract for USD/JPY and actual spot rate for INR/USD:

- ❖ Known component = JPY 1 million
- ❖ Unknown component = ? INR

$\text{INR} = \text{JPY} \times \text{Ask} \left(\frac{\text{INR}}{\text{JPY}} \right)$
$\text{INR} = \text{JPY} \times \text{Ask} \left(\frac{\text{INR}}{\text{USD}} \times \frac{\text{USD}}{\text{JPY}} \right)$
$\text{INR} = 10,00,000 \times \text{Ask} \left(46.26 \times \frac{1}{110} \right)$
INR = 4,20,545.50

WN 3: Profit/loss due to strategy:

- ❖ The company did not go for hedging the cash flow. They would have paid Rs.4,18,454.50 if forward contract was taken. However, hedging was not done and hence they have paid Rs.4,20,545.50
- ❖ Loss due to company's strategy = 4,20,545.50 – 4,18,454.50 = Rs.2,091

90. Computation of expected loss [Nov 2003, May 2019 MTP]

A company operating in a country having the dollar as its unit of currency has today invoiced sales to an Indian company, the payment being due three months from the date of invoice. The invoice amount is \$ 7,500 and at today's spot rate of \$0.025 per Rs.1, is equivalent to Rs. 3,00,000. It is anticipated that the exchange rate will decline by 10% over the three months period and in order to protect the dollar proceeds, the importer proposes to take appropriate action through foreign exchange market. The three months forward rate is

quoted as \$0.0244 per Rs. 1. You are required to calculate the expected loss and to show, how it can be hedged by forward contract.

Answer:

Particulars	Calculation	Amount
Amount of exposure		USD 7,500
Spot rate		USD 0.025/INR
Payment at today's spot rate	$\frac{7,500}{0.025}$	Rs.3,00,000
Expected spot rate	0.025 – 10%	USD 0.0225/INR
Payment at expected spot rate	$\frac{7,500}{0.0225}$	Rs.3,33,333
Expected loss	3,00,000 – 3,33,333	Rs.33,333
Forward rate		USD 0.0244/INR
Payment at forward rate	$\frac{7,500}{0.0244}$	Rs.3,07,377
Loss under forward contract	3,00,000 – 3,07,377	Rs.7,377

Hence, by forward contract the company can cover Rs.25,956 (Rs.33,333 – Rs.7,377) i.e. about 78% of the expected loss.

91. Decision on hedging exposure – [Nov 2019, Nov 2018 MTP, Nov 2007]:

Following information relates to M/s A Ltd. which is a manufacturing-cum-exporting unit. It is exporting some electronic components to Japan, USA and Europe on 90 days credit terms:

Cost and Sales information:

Particulars	Japan	USA	Europe
Variable cost per unit	Rs.225	Rs.395	Rs.510
Export sale price per unit	Yen 650	USD 10.23	EUR 11.99
Receipts from sale due in 90 days	YEN 78,00,000	USD 1,02,300	EUR 95,920
Foreign exchange rate information:	YEN/INR	USD/INR	EUR/INR
Spot market	2.417-2.437	0.0214-0.0217	0.0177-0.0180
3 months forward	2.397-2.427	0.0213-0.0216	0.0176-0.0178
3 months spot	2.423-2.459	0.02144-0.02156	0.0177-0.0179

Advise the company by calculating average contribution to sales ratio whether it should hedge its currency risk or not.

Answer:

Decision on whether to hedge the forex exposure:

Particulars	Japan	USA	Europe	Total
Receipts from sale due in 90 days	YEN 78,00,000	USD 1,02,300	EUR 95,920	
Export sale price per unit	Yen 650	USD 10.23	EUR 11.99	
No of units sold	12,000	10,000	8,000	
Variable cost per unit	225	395	510	
Total variable costs	Rs.27,00,000	Rs.39,50,000	Rs.40,80,000	Rs.1,07,30,000
Realization if exposure is hedged:				
3-month forward rate	2.427	0.0216	0.0178	
Realization in INR (Exposure/rate)	Rs.32,13,844	Rs.47,36,111	Rs.53,88,764	Rs.1,33,38,719
Contribution				26,08,719
Contribution to sales ratio				19.56%
Realization if exposure is not hedged:				
3-month spot rate	2.459	0.02156	0.0179	
Realization in INR (Exposure/rate)	31,72,021	47,44,898	53,58,659	1,32,75,578
Contribution				25,45,578
Contribution to sales ratio				19.17%

Decision: A Ltd. is advised to hedge its foreign currency exchange risk.

Part IX – Money Market Hedge

92. MMH exporter [May 2019 RTP, Nov 2008, Nov 2009, Nov 2015 MTP, Nov 2017 MTP]

An exporter is a UK based company. Invoice amount is \$3,50,000. Credit period is three months.

Exchange rates in London are :

- ❖ Spot Rate (\$/£) 1.5865 – 1.5905
- ❖ 3-month Forward Rate (\$/£) 1.6100 – 1.6140

Rates of interest in Money Market :

	Deposit	Loan
\$	7%	9%
£	5%	8%

- Compute and show how a money market hedge can be put in place.
- Compare and contrast the outcome with a forward contract.
- Rework the MMH if the tax rates in UK is 30% and in USA is 40%

Answer:

WN 1: Creation of Money Market Hedge:

Particulars	Calculation	Amount
Day 0:		
Identify a foreign currency asset/liability – Foreign currency Asset		USD 3,50,000.00
Create a matching liability – we will take a USD loan which will mature to USD 3,50,000	$\frac{3,50,000}{1 + 2.25\%}$	USD 3,42,298.29
Convert USD 3,42,298.29 into GBP at spot rate	$3,42,298.29 \times \left(\frac{1}{1.5905}\right)$	GBP 2,15,214.27
Invest GBP 2,15,214.27 for three months at the rate of 5%		GBP 2,15,214.27
Day 90:		
Receive USD 3,50,000 from customer and repay USD Loan		USD 3,50,000.00
Redeem GBP deposit along with interest	$2,15,214.27 + 1.25\%$	GBP 2,17,904.45

- **Net inflow with money market hedge = GBP 2,17,904.45**

WN 2: Computation of inflow under forward contract:

$$\text{GBP} = \text{USD} \times \left(\frac{\text{GBP}}{\text{USD}}\right); \text{GBP} = \text{USD} \times \text{BID} \left(\frac{\text{GBP}}{\text{USD}}\right)$$

$$\text{GBP} = 3,50,000 \times \frac{1}{\text{ASK} \left(\frac{\text{USD}}{\text{GBP}}\right)} = 3,50,000 \times \frac{1}{1.6140} = \text{GBP } 2,16,852.54$$

Conclusion:

- Company should go ahead with money market hedge option as the same leads to higher inflow of INR

WN 3: Evaluation of MMH with taxes:

Particulars	Calculation	Amount
Day 0:		
Identify a foreign currency asset/liability – Foreign currency Asset		USD 3,50,000.00
Create a matching liability – we will take a USD loan which will mature to USD 3,50,000 Borrowing rate = 2.25% per quarter. Post-tax rate = $2.25 \times 60\% = 1.35\%$	$\frac{3,50,000}{1 + 1.35\%}$	USD 3,45,337.94
Convert USD 3,42,298.29 into GBP at spot rate	$3,45,337.94 \times \left(\frac{1}{1.5905}\right)$	GBP 2,17,125.39
Invest GBP 2,15,214.27 for three months at the rate of 5% per annum. Quarterly rate = 1.25% Post-tax rate = $1.25\% \times 70\% = 0.875\%$		GBP 2,17,125.39
Day 90:		
Receive USD 3,50,000 from customer and repay USD Loan		USD 3,50,000.00
Redeem GBP deposit along with interest	$2,17,125.39 + 0.875\%$	GBP 2,19,025.24

- In case tax rates are given then we should work with post-tax interest rates for borrowing as well as investment

93. MMH importer

A UK Company owes a German Company 25 lakhs Euros payable in 3 months. The spot rate EURO/GBP is 1.25-1.27. The company can borrow pounds @ 8% and deposit pounds @6%. It can borrow Euro @12% and deposit Euro@10%.

- How much is the cost of money market hedge?
- What is the forward rate?
- What should the company do?

Answer:

WN 1: Cost of Money Market Hedge:

Particulars	Calculation	Amount
Day 0:		
Identify a foreign currency asset/liability - Foreign currency Liability		EUR 25,00,000
Create a matching asset- we need to create a EUR deposit which will mature to EUR 25,00,000 Deposit rate = 2.5% per quarter	$\frac{25,00,000}{1 + 2.50\%}$	EUR 24,39,024
Take a GBP loan at 2% per 3 months which will help in buying EUR 24,39,024	$24,39,024 \times \left(\frac{1}{1.25}\right)$	GBP 19,51,219
Convert GBP 19,51,219 into Euros and create Euro deposit		EUR 24,39,024
Day 90:		
Redeem Euro deposit along with interest	$24,39,024 + 2.5\%$	EUR 25,00,000
Pay supplier with deposit proceeds		EUR 25,00,000
Repay GBP loan along with interest of 2%	$19,51,219 + 2\%$	GBP 19,90,243

WN 2: Computation of forward rate:

EUR 25,00,000 = GBP 19,90,243
EUR 1.2561 = GBP 1
Forward rate = EUR 1.2561/GBP

WN 3: Decision of the company:

- The decision of Money Market Hedge would depend on the company's view on exchange rates
- If the company believes that the exchange rate would be equal to or more than EUR 1.2561/GBP, then the company should leave the exposure open
- If the company believes that the exchange rate would be less than EUR 1.2561/GBP, then the exposure should be covered through MMH
- If the company has no view on the exchange rates, then also it should cover using MMH

94. MMH - exporter [Nov 2018 MTP, Nov 2008, Nov 2012 RTP]

An Indian exporting firm, Rohit and Bros., would like to cover itself against a likely depreciation of pound sterling. The following data is given:

- ❖ Receivables of Rohit and Bros : £ 500,000
- ❖ Spot rate : Rs.56.00/£
- ❖ Payment date : 3-months
- ❖ 3 months interest rate : India: 12 % per annum, UK: 5 % per annum

What should the exporter do?

Answer:

- The company has a foreign currency Asset of GBP 5,00,000. The company is likely worried about depreciation of pound. This would lead to depreciation of asset and hence the company is worried about it
- The company can go for money market hedge option to cover the forex exposure of GBP 5,00,000

Particulars	Calculation	Amount
Day 0:		
Identify a foreign currency asset/liability - Foreign currency Asset		GBP 5,00,000
Create a matching liability - we will take a GBP loan which will mature to GBP 5,00,000	$\frac{5,00,000}{1 + 1.25\%}$	GBP 4,93,827
Convert GBP 4,93,827 into INR at spot rate	$4,93,827 \times 56$	INR 2,76,54,312

Invest INR 2,76,54,312 for three months at the rate of 12%		INR 2,76,54,312
Day 90:		
Receive GBP 5,00,000 from customer and repay GBP Loan		GBP 5,00,000
Redeem INR deposit along with interest	2,76,54,312 + 3%	INR 2,84,83,941

- The company will have INR receipt of Rs.2,84,83,941 through Money Market Hedge route

Part X- Exchange Position Versus Cash Position

95. Exchange position versus cash position [Nov 2018, Nov 2005, May 2013 RTP]

You as a dealer of foreign exchange have the following position in Swiss Francs on October 31, 2009:

	Swiss Francs
Balance in the Nostro Account Credit	1,00,000
Opening position overbought	50,000
Purchased a bill on Zurich	80,000
Sold forward TT	60,000
Forward purchase contract cancelled	30,000
Remitted by TT	75,000
Draft on Zurich cancelled	30,000

What steps would you take, if you are required to maintain a credit balance of Swiss Francs 30,000 in the Nostro Account and keep as overbought position on Swiss Francs 10,000?

Answer:

WN 1: Exchange position account (swiss franc):

Particulars	Purchase/ Inflow	Sales/ Outflow
Opening balance	50,000	
Purchase of bill	80,000	
Forward sale		60,000
Cancellation of forward purchase		30,000
Remittance by TT		75,000
Cancellation of demand draft	30,000	
Total	1,60,000	1,65,000
Purchase of swiss franc	5,000	-
Revised total	1,65,000	1,65,000

WN 2: Cash position account (swiss franc):

Particulars	Receipt/ Inflow	Payment/ Outflow
Opening balance	1,00,000	
Remittance by TT		75,000
Purchase of swiss franc	5,000	
Total	1,05,000	75,000
Closing balance		30,000

Analysis on exchange position:

- The company needs closing cash position of 30,000. There was SFR 25,000 and now they can buy SFR 5,000 in spot market to make the balance as 30,000.
- The closing exchange position is zero as inflow and outflow total matches
- The company wants an overbought position of Swiss Franc 10,000. The company can do a forward purchase of Swiss Franc 10,000 to make the overbought position as 10,000

96. Exchange position versus cash position:

Suppose you are a dealer of ABC Bank and on 20.10.2014 you found that balance in your Nostro Account with XYZ Bank in London is GBP 65,000 and you had overbought GBP 35,000. During the day following transaction have taken place:

Particulars	GBP
DD Purchased	12,500

Purchased a bill on London	40,000
Sold forward TT	30,000
Forward purchase contract cancelled	15,000
Remitted by TT	37,500
Draft on London cancelled	15,000

What steps would you take, if you are required to maintain a credit balance of GBP 7,500 in the Nostro Account and keep as overbought position on GBP 7,500?

Answer:

WN 1: Exchange Position:

Particulars	Purchase	Sale
Opening balance overbought	35,000	
DD Purchased	12,500	
Purchased a bill on London	40,000	
Sold forward TT		30,000
Cancellation of forward purchase contract		15,000
Remitted by TT		37,500
Draft on London cancelled	15,000	
Remittance in spot market		20,000
Forward purchase to get target overbought position (balancing figure)	7,500	
Net overbought position		7,500
Total	1,10,000	1,10,000

WN 2: Cash Position:

Particulars	Receipt	Payment	Balance
Opening Balance			65,000
Remitted by TT		37,500	27,500
Sales done in spot market to get target balance (27,500 - 7,500)		20,000	7,500

97. Squaring up position [Nov 2014 MTP]

You as a forex dealer have dealing position in your account in London:

Particulars	GBP
Opening balance (oversold)	1,87,500
Purchase of cheques not credited to the account	1,64,000
Outstanding forward contracts	
Sales	40,96,500
Purchases	36,51,500
DD issued but not yet presented for payment	6,10,040
Bill purchased in hand not due for	14,42,820

What must you do to square up your position?

Answer:

Particulars	Purchase	Sale
Opening balance oversold		1,87,500
Purchase of cheques not credited to the account	1,64,000	
Outstanding forward sales		40,96,500
Outstanding forward purchases	36,51,500	
DD issued but not yet presented for payment		6,10,040
Bill purchased in hand not due for	14,42,820	
Closing balance overbought (balancing figure)		3,64,280
Total	52,58,320	52,58,320

The bank currently has overbought position of GBP 3,64,280. This can be squared off by doing sale of GBP 3,64,000 (nearest amount because it has to buy in interbank market where the deals are available in rounding off)

98. Exposure types [Nov 2009, May 2019 MTP]

Omega Electronics Limited exports air conditioners to Germany by importing all the components from Singapore. The company is exporting 2,400 units at a price of € 500 per unit. The cost of imported components is S\$ 800 per unit. The fixed cost and other variables cost per unit are Rs. 1,000 and Rs.1,500 respectively. The cash flows in foreign currencies are due in six months. The current exchange rates are as follows:

- ❖ Rs./€ 51.50/55
- ❖ Rs./S\$ 27.20/25

After six months the exchange rates turn out as follows:

- ❖ Rs./€ 52.00 - 05
- ❖ Rs./SG\$ 27.10 - 75

Required:

- a) You are required to calculate loss/gain due to transaction exposure.
- b) Based on the following additional information calculate the loss/gain due to transaction and operating exposure if the contracted price of air conditioners is Rs.25,000:
 - a. The current exchange rate changes to
 - i. Rs./€ 51.75/80
 - ii. Rs./S\$ 27.10/15
 - b. Price elasticity of demand is estimated to be 1.5
 - c. Payments and receipts are to be settled at the end of six months

Answer:

WN 1: Computation of gain/loss due to transaction exposure:

- Transaction exposure refers to gain/loss due to change in exchange rates. Euro and SGD exchange rates undergo changes over the next 6 months
- Gain/loss due to transaction exposure = Profit at spot rates – Profit at future rates

(in lacs)

Particulars	Spot Rates	Future Rates
Sales	618.00 (2,400 x 500 Euros x 51.50)	624.00 (2,400 x 500 Euros x 52.00)
Less: Imported component cost	-523.30 (2,400 x 800 SGD x 27.25)	-532.80 (2,400 x 800 SGD x 27.75)
Less: Variable cost	-36.00 (2,400 x 1,500)	-36.00 (2,400 x 1,500)
Less: Fixed cost	-24.00 (2,400 x 1,000)	-24.00 (2,400 x 1,000)
Profit	34.80	31.20

- The company would have made profits of Rs.34,80,000 as per current spot rates. However, the profits as per futures spot rates will be Rs.31,20,000
- **Loss due to transaction exposure = 34,80,000 – 31,20,000 = Rs.3,60,000**

WN 2: Computation of gain/loss due to transaction and operating exposure:

- Transaction exposure would be fall/increase in profits due to change in exchange rates
- Operating exposure would be fall/increase in profits due to change in price of conditions and demand

(in lacs)

Particulars	Spot Rates	Future Rates
Sales	630.50000 (2,522 x 25,000)	630.50000 (2,522 x 25,000)
Less: Imported component cost	-547.77840 (2,522 x 800 SGD x 27.15)	-559.88400 (2,522 x 800 SGD x 27.75)
Less: Variable cost	-37.83000 (2,522 x 1,500)	-37.83000 (2,522 x 1,500)
Less: Fixed cost	-24.00 (2,400 x 1,000)	-24.00 (2,400 x 1,000)
Profit	20.89160	8.78600

- Loss due to operating exposure = [Existing Profit as per spot rate – Revised profit as per spot rates]
= 34,80,000 – 20,89,160 = Rs.13,90,840

- Loss due to transaction exposure = [Revised profit as per spot rate – Revised profit as per futures spot rates] = [20,89,160 – 8,78,600] = Rs.12,10,560

Note: Computation of units sold:

Particulars	Amount
Earlier selling price (500 EUROS x 51.75]	25,875
New selling price	25,000
Fall in selling price	875
% fall in selling price (875/25,875 x 100)	3.38%
% increase in units sold (3.38% x 1.50)	5.07%
Revised units sold (2,400 + 5.07%)	2,522

- Price elasticity of demand is 1.5 times. This would mean that if price falls by 1 percent then volume would increase by 1.5 percent. In this question price has fell by 3.38% and hence volumes will increase by 5.07%

Note:

- This answer does not match with ICAI solution as there are some errors in ICAI solution and it is not possible to reconcile the answer with that of ICAI solution

99. Computation of transaction exposure [Mar 2016 MTP]

Shanti exported 200 pieces of designer jewellery to USA at \$ 200 each. To manufacture and design this jewellery she imported raw material from Japan of the cost of JP¥ 6000 for each piece. The labour cost and variable overhead incurred in producing each piece of jewellery are Rs. 1,300 and Rs. 650 respectively.

Suppose Spot Rates are:

- ❖ Rs./ US\$ Rs. 65.00 – Rs. 66.00
- ❖ JP¥/ US\$ JP¥ 115 – JP¥ 120

Shanti is expecting that by the time the export remittance is received and payment of import is made the expected Spot Rates are likely to be as follows:

- ❖ Rs./ US\$ Rs. 68.90 – Rs. 69.25
- ❖ JP¥/ US\$ JP¥ 105 – JP¥ 112

You are required to calculate the resultant transaction exposure.

Answer:**WN 1: Computation of profit as per current spot rates:**

Particulars	Calculation	Amount
Sales revenues	(USD 200 x 200 x 65)	26,00,000
Less: Cost of imported raw material	$\left(200 \times \left(\frac{6000}{115}\right) \times 66\right)$	(6,88,696)
Labour cost	(200 x 1,300)	(2,60,000)
Variable overheads	(200 x 650)	(1,30,000)
Profit		15,21,304

WN 2: Computation of profit as per expected spot rates:

Particulars	Calculation	Amount
Sales revenues	(USD 200 x 200 x 68.90)	27,56,000
Less: Cost of imported raw material	$\left(200 \times \left(\frac{6000}{105}\right) \times 69.25\right)$	(7,91,429)
Labour cost	(200 x 1,300)	(2,60,000)
Variable overheads	(200 x 650)	(1,30,000)
Profit		15,74,571
Increase in profit due to transaction exposure	1,74,571 – 15,21,304	53,267

- ❖ Transaction exposure is the change in profit due to variation in exchange rate. The same is calculated as difference between profit as per expected exchange rate – profit as per current exchange rates

100. Nostro, Vostro and Loro account [Nov 2013, May 2015 MTP, Nov 2017 MTP, May 2019 RTP]

XYZ Bank, Amsterdam, wants to purchase Rs.25 million against GBP for funding their Nostro account and they have credited LORO account with Bank of London, London.

Calculate the amount of GBP credited. Ongoing inter-bank rates are per \$, Rs.61.3625/3700 and per GBP, \$ 1.5260/70

Answer:

- The bank wants to buy Rs.25 million by paying GBP
- Known component = Rs.25 million
- Unknown component = ? GBP

$$\text{GBP} = \text{INR} \times \left(\frac{\text{GBP}}{\text{INR}}\right); \text{GBP} = \text{INR} \times \text{ASK} \left(\frac{\text{GBP}}{\text{INR}}\right); \text{GBP} = \text{INR} \times \text{ASK} \left[\left(\frac{\text{GBP}}{\text{USD}}\right) \times \left(\frac{\text{USD}}{\text{INR}}\right)\right]$$

$$\text{GBP} = 2,50,00,000 \times \left(\frac{1}{1.5260}\right) \times \left(\frac{1}{61.3625}\right) = \text{GBP } 2,66,982$$

Part XI - Currency Futures and Options**101. Currency options**

The exchange rate for sterling is currently \$1.5 = GBP 1. Suppose you need to buy pounds at the year end. You want to be sure that, regardless of the future market price, you will not pay more than \$1.6 per GBP. In return you are prepared to pay a guaranteed minimum price of \$1.4 per GBP. What option positions would provide you with this cap and floor?

Answer:

- The company does not want to pay anything more than \$1.6/GBP. This is possible by buying a call option with a strike price of \$1.6/GBP
- The company is willing to pay a minimum purchase price of \$1.4/GBP. This would mean that counterparty gets a minimum selling price of \$1.4/GBP. The company can pay a minimum price of \$1.4/GBP by writing a put option with strike price of \$1.4/GBP
- Buying a call and writing a put will give the desired purchase price range of \$1.4 to \$1.6 per GBP

102. Forex options

An Indian Company buys a 6 month call on 10 lakh USD with a strike price of Rs. 50/\$ and a premium of Re. 1/\$. The opportunity cost of money is 12% p.a. At what spot rate on the date of maturity of futures contract would the Indian Company gain? If the forward rate when the option was bought was Rs. 50 under what future spots rates would this have proved better than the option contract?

Answer:**Note 1: Computation of maximum outflow under option:**

- Strike price of option = Rs.50/USD
- Premium of option = Rs.1/USD
- Interest on premium = Rs.1 x 12% x (6/12) = Rs.0.06/USD
- Total outflow per USD = 50 + 1 + 0.06 = Rs.51.06/USD

Comparison of option and spot:

- Under option contract the maximum purchase price will be restricted to Rs.51.06/USD. Under spot position the outflow will depend on future spot rates
- Any spot rates above Rs.51.06/USD, the outflow under option contract will be lower than that of spot contract. Hence option contract is beneficial above Rs.51.06/USD while comparing option and spot alternative

Comparison of option and forward:

- Under option contract the maximum purchase price will be restricted to Rs.51.06/USD. However, if the future spot rate is less than Rs.50/USD, then outflow would be Spot rate + 1.06.
- Under forward option, the company has to pay Rs.50/USD irrespective of future spot rates
- Hence option contract can be beneficial if the outflow under option contract is lower than Rs.50/USD. Outflow will be Rs.50/USD if spot rate is Rs.48.94/USD (48.94 + 1.06 = 50). **Hence option contract will be beneficial if future spot rates are lower than Rs.48.94/USD**

103. Forex options

An Indian Company buys a 6 month put on 10 lakh USD with a strike price of Rs. 55/\$ and a premium of Re. 2/\$. The opportunity cost of money is 6% p.a. At what spot rate on the date of maturity of futures contract would the Indian Company gain? If the forward rate when the option was bought was Rs. 55 under what future spots rates would this have proved better than the option contract?

Answer:**Note 1: Computation of minimum inflow under option:**

- Strike price of option = Rs.55/USD
- Premium of option = Rs.2/USD
- Interest on premium = $\text{Rs.}2 \times 6\% \times (6/12) = \text{Rs.}0.06/\text{USD}$
- Net inflow per USD = $55 - 2 - 0.06 = \text{Rs.}52.94/\text{USD}$

Comparison of option and spot:

- Under option contract the minimum selling price will be to Rs.52.94/USD. Under spot position the inflow will depend on future spot rates
- Any spot rates below Rs.52.94/USD, the inflow under option contract will be higher than that of spot contract. Hence option contract is beneficial below Rs.52.94/USD, while comparing option and spot alternative

Comparison of option and forward:

- Under option contract the minimum selling price will be Rs.52.94/USD. However, if the future spot rate is higher than Rs.55/USD, then inflow will be Spot rate - 2.06.
- Under forward option, the company will receive Rs.55/USD irrespective of future spot rates
- Hence option contract can be beneficial if the inflow under option contract is higher than Rs.55/USD. Inflow will be Rs.55/USD if spot rate is Rs.57.06/USD ($57.06 - 2.06 = 55$). **Hence option contract will be beneficial if future spot rates are higher than Rs.57.06/USD**

104. Forex futures

Dart Ltd exports agricultural products. They have branch in London. This London office has concluded a deal with Giants USA. Sale is to take place in December. Payment is due in January. Value of sales is 15 lakh US \$. Remittance will come from Giants USA to the London branch of the Indian company. Spot rate in London for Dollar/Pound is 1.5050.

Dart Ltd is concerned about a distinct possibility of sterling gaining in the interim against dollar. Taking a "FUTURES" contract is explored. Pound 62,500 (trading unit), for Jan/Feb futures is quoted at \$ 1.50 per pound. Spot price on futures by end Jan moves to \$ 1.52 pound. Advise if Dart Ltd can authorize their London office to take a position in Dollar/Sterling futures?

Answer:

- Dart Limited plans to export in USD. Hence, they will have asset(receivable) in USD
- Dart Limited believes that GBP will appreciate and this would mean that USD will depreciate. Dart Limited is concerned as its assets (USD) are expected to depreciate
- Spot rate is USD 1.5050/GBP whereas futures rate is USD 1.50/GBP. Futures quote indicate that GBP will depreciate and USD will appreciate. Dart Limited should go ahead with Futures contract as that will help in appreciation of its receivable asset

Computation of net inflow under Futures contract:**Note 1: Computation of no of contracts:**

Particulars	Amount
1. Amount of exposure	USD 15,00,000
2. Amount of exposure in GBP ($15,00,000/1.50$)	GBP 10,00,000
3. Size of one contract	GBP 62.50
4. No of contracts ($10,00,000/62.50$)	16,000

- The company should enter into 16,000 contracts of buying pounds (selling USD)

Note 2: Futures settlement:

Date	Position	Action	Reference Date	Rate
Day 0	Original Position	Buy	Jan 31	(1.50 USD/GBP)
Jan 31	Opposite Position	Sell	Jan 31	1.47 USD/GBP
Profit per GBP				0.02 USD/GBP
Profit for 16,000 contracts ($0.02 \times 62.50 \times 16,000$)				USD 20,000

Note 3: Total realizations:

Particulars	Calculation	Amount
1. Spot realization	15,00,000/1.52	GBP 9,86,842.11
2. Gain from futures	20,000/1.52	GBP 13,157.89
3. Total Realization		GBP 10,00,000

105. Forex option versus forward

A company has a 12 month payable of DM 1,00,000. The current INR/DM spot rate is Rs.20, rupee interest rate is 21% p.a. and DM interest rate is 10% p.a. You are considering a forward hedge at the current forward rate of Rs.22. An executive of another company tells you that the recently bought a call on DM 1,00,000 at a strike price of Rs.20 and is willing to sell it to you at the historic premium of Rs.1 per DM. The call matures at the same time as your payable and is a European call. What should you do?

Answer:**Computation of maximum outflow under option:**

- Strike price of option = Rs.20/DM
- Premium of option = Rs.1/DM
- Interest on premium = $1 \times 21\% \times (12/12) = \text{Rs.}0.21/\text{DM}$
- Total outflow per DM = $20 + 1 + 0.21 = \text{Rs.}21.21/\text{DM}$

Option contract will always be beneficial than forward contract as the outflow under forward contract is Rs.22/DM. The company therefore should go ahead with option contract for hedging its payable exposure

106. Currency futures for hedging receivables

On January 5, an Indian firm exported goods to an US firm for a consideration of USD 4,00,000 receivable on 15th of February. The spot exchange rate is Rs.44/USD and a March dollar future is trading at Rs.45/USD. Suggest a strategy to the Indian firm to hedge its receivable exposure. On 15th February if the exchange rate in cash market drops to Rs.39/USD and in the futures markets it is trading at Rs.41/USD. Calculate the hedge efficiency. Redo the computations if the spot exchange rate on February 15 is Rs.47 and the dollar futures are trading on that day at Rs.46. For computations assume futures contract size to be USD 1000.

Answer:**WN 1: Hedge strategy:**

- The company has receivables exposure of USD 4,00,000. Strike price of March futures contract is Rs.45/USD.
- The futures contract can help in buying/selling USD at the rate of Rs.45/USD.
- The company should enter into futures contract to sell USD at the rate of Rs.45/USD

WN 2: No of contracts:

Particulars	Amount
1. Amount of exposure	USD 4,00,000
2. Size of one contract	USD 1,000
3. No of contracts (4,00,000/1,000)	400

WN 3 Futures settlement:

Date	Position	Action	Reference Date	Rate
Jan 5	Original Position	Sell	March 31	Rs.45/USD
Feb 15	Opposite Position	Buy	March 31	(Rs.41/USD)
Profit per USD				Rs.4/USD
Profit for 400 contracts (Rs.4 x 1,000 x 400)				Rs.16,00,000

WN 4: Total realizations:

Particulars	Calculation	Amount
1. Spot realization	4,00,000 x 39	1,56,00,000
2. Gain from futures	WN 3	16,00,000
3. Total Realization		1,72,00,000

WN 5: Hedge efficiency:

Particulars	Calculation	Amount
1. Gain from futures contract	WN 3	16,00,000

2. Loss in spot contract	$4,00,000 \times (45 - 39)$	24,00,000
3. Hedge efficiency (%)	$\frac{16,00,000}{24,00,000} \times 100$	66.67%

Rework scenario:**Note 1: Futures settlement:**

Date	Position	Action	Reference Date	Rate
Jan 5	Original Position	Sell	March 31	Rs.45/USD
Feb 15	Opposite Position	Buy	March 31	(Rs.46/USD)
Loss per USD				Rs.1/USD
Loss for 400 contracts (Rs.1 x 1,000 x 400)				Rs.4,00,000

Note 2: Total realizations:

Particulars	Calculation	Amount
1. Spot realization	$4,00,000 \times 47$	1,88,00,000
2. Loss from futures	Note 1	(4,00,000)
3. Net Realization		1,84,00,000

Note 3: Hedge efficiency:

Particulars	Calculation	Amount
1. Loss from futures contract	Note 1	4,00,000
2. Gain in spot contract	$4,00,000 \times (47 - 45)$	8,00,000
3. Hedge efficiency (%)	$\frac{4,00,000}{8,00,000} \times 100$	50.00%

107. Currency futures hedging – Payables

Today is March 1. A UK firm is planning to import chemicals worth USD 6 million from US. The payment is due on June 1. The spot USD/GBP rate is 1.5765 and the three month forward rate is 1.5685. Futures are currently trading at 1.5695/GBP. Explain how the firm can hedge its payable by using futures. The contract size for futures is GBP 62,500. On June 1 the USD/GBP spot rate turns out to be 1.5875 and June futures price is 1.5850. Explain why the futures hedge did not turn out to be a perfect hedge. In retrospect, would a forward hedge have been better?

Answer:**WN 1: Hedging through futures contract:**

- The company has forex payable of USD 6 million. Size of one contract is GBP 62,500
- Contract currency for futures is GBP. This would mean that we can buy or sell GBP at the rate of USD 1.5695/GBP
- The company should enter into futures contract of selling GBP at the rate of USD 1.5695/GBP

Computation of net outflow under Futures contract:**Note 1: Computation of no of contracts:**

Particulars	Amount
1. Amount of exposure	USD 60,00,000
2. Amount of exposure in GBP (60,00,000/1.5695)	GBP 38,22,874
3. Size of one contract	GBP 62,500
4. No of contracts	61.17 ~ 61

- The company should enter into 61 contracts of selling pounds (buying USD)

Note 2: Futures settlement:

Date	Position	Action	Reference Date	Rate
March 1	Original Position	Sell	June 1	USD 1.5695/GBP
June 1	Opposite Position	Buy	June 1	(USD 1.5850/GBP)
Loss per GBP				USD 0.0155/GBP
Overall loss (0.0155 x 61 x 62,500)				USD 59,094

Note 3: Total payment:

Particulars	Calculation	Amount

1. Spot payment	60,00,000/1.5875	GBP 37,79,528
2. Futures settlement	59,094/1.5875	GBP 37,225
3. Total payment	37,79,528 + 37,225	GBP 38,16,753

Comments:

- The company's original plan was to pay GBP 38,22,874. However, they have paid GBP 38,16,753. This indicates that hedge is not perfect
- Hedge is not perfect due to following two reasons:
 - Not covering the entire amount:** The company has taken 61 contracts as compared to requirement of 61.17 contracts
 - Difference in futures and cash market rate on maturity date:** On June 1, the futures rate is USD 1.5850/GBP whereas spot market rate is USD 1.5875/GBP

WN 2: Hedging through forward contract:

Particulars	Calculation	Amount
1. Amount of exposure		USD 60,00,000
2. Forward rate		USD 1.5685/GBP
3. Outflow under forward contract	60,00,000/1.5685	GBP 38,25,311

Comments:

- Futures contract will be beneficial than forward contract due to lower outflow

108. Currency futures hedging – receivables

The corporate treasurer of a US multinational receives a fax on 21st February from its European subsidiary. The subsidiary will transfer Euro 10 million to the parent company on 16th August. The corporate treasurer decides to hedge the position using currency futures. The available spot and future rate of the Euro on 21st February are:

Spot per Euro	September Future Euro	December future Euro
USD 1.0600	USD 1.000	USD 1.600

- ❖ What expiry month will be chosen for the future by the corporate treasurer
- ❖ Will the corporate treasurer go long or short on the euro future
- ❖ If the corporate treasurer plans to hedge through futures in the dollar market, will he buy or sell dollar futures?
- ❖ What is the unhedged and hedged outcome on 16th august, if the spot and futures rate on 16th August are as follows

Spot per Euro	September Future Euro	December future Euro
USD 1.0100	USD 1.0200	USD 1.200

Answer:**Expiry month identification:**

- The company is going to receive EURO 10 million on August 16. We should take the closest live contract for hedging.
- September futures is the closest available contract and hence we should hedge it with September futures
- We should enter into selling EUROS at the rate of USD 1.0000/EURO

Action in Euro futures:

- The company plans to sell EUROS and hence we should go short in EURO futures

Action in USD futures:

- The company plans to buy USD (Sell EUROS) and hence we should go long in USD futures

WN 2: Inflow under unhedged scenario:

Particulars	Calculation	Amount
1. Amount of exposure		EURO 1,00,00,000
2. Spot rate		USD 1.0100/EURO
3. Inflow		USD 1,01,00,000

WN 3: Inflow under hedged scenario:

- It is assumed that size of one contract is EURO 10 million and hence we will need one contract to hedge exposure

Note 1: Futures settlement:

Date	Position	Action	Reference Date	Rate
Feb 21	Original Position	Sell	Sep 30	USD 1.0000/EURO
Aug 16	Opposite Position	Buy	Sep 30	(USD 1.0200/EURO)
Loss per EURO				USD 0.0200/EURO
Overall loss (0.0200 x 1,00,00,000)				USD 2,00,000

Note 2: Final realization

Particulars	Calculation	Amount
1. Spot realization	1,00,00,000 x 1.01	USD 1,01,00,000
2. Futures settlement	Note 1	(USD 2,00,000)
3. Net realization		USD 99,00,000

109. Currency options versus forward:

A German firm buys a call on \$ 10,00,000 with a strike of DM1.60/USD and a premium of DM0.03/USD. The interest opportunity cost is 6% per annum and the maturity is 180 days.

- What is the break-even maturity spot rate beyond which the firm makes a net gain?
- Suppose the six-month forward rate at the time the option was bought was DM1.62/USD. What is the range of maturity spot rate for which the option would prove to be better than the forward cover? For what range of values would the forward cover be better?

Answer:**WN 1: Computation of break-even maturity spot rate:**

Particulars	Amount
Strike Price	DM 1.60/USD
Premium	DM 0.03/USD
Interest on premium (0.03 x 6% x 180/360)	DM 0.0009/USD
Break-even maturity spot rate	DM 1.6309/USD

WN 2: Range of maturity spot rate at which option would be better than forward cover:

- ❖ Forward rate for 6 months = DM 1.62/USD. Option would prove to be better so long as the cost under option is cheaper than that of the forward.
- ❖ Cost under forward is DM 1.62/USD; Maximum rate under option is DM 1.6309/DM.
- ❖ The cost comparison under option and forward cover is given below:

Particulars	Forward Contract	Option contract
Spot rate = 1.58	1.62	1.6109
Spot rate = 1.59	1.62	1.6209
Spot rate = 1.60	1.62	1.6309
Spot rate > 1.60	1.62	1.6309

Option contract would be beneficial if the maturity spot rate is lower than 1.5891 (1.62 - 0.0309)

Part XII – Currency Swaps**110. Currency swaps:**

ABC Limited wishes to lend USD 5,00,000 to its Japanese subsidiary. At the same time, DEF Limited is interested in making a medium-term loan of approximately the same amount to its US subsidiary. The two parties are brought together by an investment bank for the purpose of making parallel loans. ABC will lend USD 5,00,000 to DEF's US subsidiary for 4 years at 13 percent. Principal and interest are payable only at the end of the fourth year, with interest being compounded annually. DEF will lend the Japanese subsidiary of ABC Limited 70 million yen for 4 years at 10 percent. Again the principal and interest are payable at the end. The current exchange rate is 140 yen to the dollar. However the dollar is expected to decline by 5 yen to the dollar per year over the next 4 years.

- ❖ If these expectations prove to be correct, what will be the dollar equivalent of principal and interest payments to DEF at the end of 4 years

- ❖ What total dollars will ABC receive at the end of 4 years from the payment of interest and principal on its loan by the US subsidiary of DEF
- ❖ Which party is better off with the parallel loan arrangement? What would happen if the yen did not change in value?
- ❖ Calculate the break even maturity future spot rate

Answer:**WN 1: Computation of dollar Equivalent of Principal and Interest to DEF at end of 4 years:**

Particulars	Calculation	Amount
1. Loan given on day 0		JPY 70 million
2. Maturity amount at end of year 4	$(70 \text{ million} \times (1.10)^4)$	JPY 102.487 million
3. Expected exchange rate in year 4		JPY 120/USD
4. Dollar equivalent maturity amount	$\frac{102.487}{120}$	USD 8,54,058

WN 2: Computation of dollar Equivalent of Principal and Interest to ABC at end of 4 years:

Particulars	Calculation	Amount
1. Loan given on day 0		USD 5,00,000
2. Maturity amount at end of year 4	$(5,00,000 \times (1.13)^4)$	USD 8,15,237

Conclusion:

- DEF Limited is better off in parallel loan arrangement as they are expected to receive a net settlement of USD 38,823

WN 3: Computation of dollar Equivalent of Principal and Interest to DEF at end of 4 years if the yen did not change value:

Particulars	Calculation	Amount
1. Loan given on day 0		JPY 70 million
2. Maturity amount at end of year 4	$(70 \text{ million} \times (1.10)^4)$	JPY 102.487 million
3. Expected exchange rate in year 4		JPY 140/USD
4. Dollar equivalent maturity amount	$\frac{102.487}{140}$	USD 7,32,050

- ABC Limited is better off in parallel loan arrangement as they are expected to receive a net settlement of USD 83,187

WN 4: Computation of break-even maturity spot rate:

Maturity for ABC Limited = Maturity for DEF Limited
$8,15,237 = \frac{102.487 \text{ million}}{\text{Spot rate}}$
Spot rate = JPY 125.71/USD

111. Cash flow from currency swap:

A Limited and B Limited has entered into a currency swap arrangement on 1.2.2015, where A Limited will pay 11% interest on a notional principal of GBP 10 million, in exchange for a USD interest of 8% on a notional principal of USD 15 million. The swap takes place annually for a term of 5 years. Write the swap cash flows from A Limited point of view.

Answer:**Computation of cash flows from A Limited point of view (GBP):**

Year	GBP Payable	USD receivable	Exchange rate	Equivalent GBP receivable	Net cash flow
1	11,00,000	12,00,000	1.4595	8,22,199	-2,77,801
2	11,00,000	12,00,000	1.4200	8,45,070	-2,54,930
3	11,00,000	12,00,000	1.3816	8,68,558	-2,31,442
4	11,00,000	12,00,000	1.3443	8,92,658	-2,07,342
5	1,11,00,000	1,62,00,000	1.3080	1,23,85,321	12,85,321

Note:

- Exchange rates have been computed with the help of Interest rate Parity Theory.
- Spot rate: GBP 10 million = USD 15 million; 1 GBP = USD 1.50; USD 1.50/GBP
- Home currency interest rate = USD rate = 8%

- Foreign currency interest rate = GBP rate = 11%
- Forward rate of year 1:

$$\frac{1 + 8\%}{1 + 11\%} = \frac{F_1}{1.50}; F_1 = \frac{1.50 \times 1.08}{1.11} = \text{USD } 1.4595 \text{ per GBP}$$

112. Advantage of swap arrangement:

The following is the interest rates at which ABC Limited and DEF Limited can borrow in two currencies:

Company	USD	AUD
ABC Limited	5%	12.6%
DEF Limited	7%	13%

ABC Limited wants to borrow in AUD and DEF wants to borrow in USD. A financial institution has offered to arrange for a currency swap with dealers margin of 0.2%. Explain how swap can be structured to the benefit of all the parties. Under the following situations:

- ❖ Financial institution bears the exchange rate risk. How it can hedge?
- ❖ DEF Limited bears the exchange rate risk and the financial institution earns 0.2% dealers margin in dollars

Answer:**WN 1: Structure of interest rates:**

Particulars	USD	AUD
ABC Limited	5%	12.6%
DEF Limited	7%	13%

- Total interest rate of combination 1 [ABC Limited (USD) & DEF Limited (AUD)] = 5% + 13% = 18%
- Total interest rate of combination 2 [ABC Limited (AUD) & DEF Limited (USD)] = 12.6% + 7% = 19.6%
- Ideal combination:** Combination 1 - ABC Limited should borrow in USD and DEF Limited should borrow in AUD
- Actual scenario:** Combination 2 - ABC Limited wants to borrow in AUD and DEF Limited wants to borrow in USD
- Scope for Currency cum interest rate swap exist as the actual scenario does not match with ideal scenario
- Amount of swap gain = 19.6% - 18% = 1.6%**
- Share of swap gain:**
 - Dealer's margin (Share) = 0.2%
 - ABC Limited's share = 0.7%
 - DEF Limited's share = 0.7%

WN 2: Structuring of swap:

Particulars	ABC Limited		DEF Limited	
	Currency	%	Currency	%
1. Payment to bank as per ideal scenario	USD	5%	AUD	13%
2. Receive from swap intermediary	USD	(5%)	AUD	(13%)
3. Pay to swap intermediary (balancing figure)	AUD	11.9%	USD	6.3%
4. Effective cost (original - swap gain)	AUD	11.9%	USD	6.3%

- Swap intermediary will receive a net amount of 1.3% in USD and pay a net amount of 1.1% in AUD

WN 3: Structuring of swap if DEF Limited is willing to take exchange rate risk

Particulars	ABC Limited		DEF Limited	
	Currency	%	Currency	%
1. Payment to bank as per ideal scenario	USD	5%	AUD	13%
2. Receive from swap intermediary	USD	(5%)	AUD	(11.9%)
3. Pay to swap intermediary (balancing figure)	AUD	11.9%	USD	5.2%
4. Effective cost (original - swap gain)	AUD	11.9%	USD & AUD	5.2% & 1.1%

113. Currency swaps:

Companies A and B face the following interest rates:

Particulars	A	B
US Dollars (Floating rate)	LIBOR + 0.5%	LIBOR + 1.0%
Canadian (Fixed rate)	5.0%	6.5%

Assume that A wants to borrow USD at floating rate of interest and B wants to borrow Canadian dollars at a fixed rate of interest. A financial institution is planning to arrange a swap and requires a 50-basis point spread. If the swap is equally attractive to A and B, what rates of interest will A and B end up paying?

Answer:

WN 1: Identification of interest rate benefit:

Particulars	Calculation	Amount
Total cost of combination 1 [A (USD) and B (Canadian dollars)]	LIBOR + 0.5% + 6.5%	LIBOR + 7%
Total cost of combination 2 [A (CAD) and B (USD)]	5% + LIBOR + 1%	LIBOR + 6%

- ❖ Ideal combination as per the above table is combination 2 as the same has lower net cost. Therefore, Company A should borrow in CAD and company B should borrow in USD. However, the actual borrowing requirement is opposite and hence the opportunity for interest rate swap exists
- ❖ Swap will have total gain of 1 percent. The swap intermediary will charge 50 basis point and the balance 50 bps will be shared. Net gain for A Limited is 25 bps and Net gain for B Limited is 25 bps

WN 2: Structuring Interest Rate Swap (IRS):

Particulars	Company A	Company B
Borrow from bank as per ideal combination	CAD 5%	USD LIBOR + 1%
Receive from swap intermediary (receive what is paid to bank)	CAD 5%	USD LIBOR + 1%
Pay to swap intermediary (bal figure)	USD LIBOR + 0.25%	CAD 6.25%
Effective cost (original planned cost - swap gain)	USD LIBOR + 0.25%	CAD 6.25%

- ❖ Net receipt for swap intermediary in USD = USD LIBOR + 0.25% - USD LIBOR + 1% = (USD LIBOR + 0.75%)
- ❖ Net receipt for swap intermediary in CAD = 6.25% - 5% = 1.25%
- ❖ Hence swap intermediary will have net receipt of 1.25 percent in CAD and net payment of 0.75% for USD

114. Currency swap [May 2011]

A Inc. and B Inc. intent to borrow \$ 2,00,000 and \$2,00,000 in JPY respectively for a time horizon of one year. The prevalent interest rates are as follows:

Company	YEN Loan	USD Loan
A Inc	5%	9%
B Inc	8%	10%

The prevalent exchange rate is USD 1 = YEN 120.

They entered in a currency swap under which it is agreed that B Inc will pay A Inc @ 1% over the YEN loan interest rate which the later will have to pay as a result of the agreed currency swap whereas A Inc will reimburse interest to B Inc only to the extent of 9%. Keeping the exchange rate invariant, quantity the opportunity gain or loss component of the ultimate outcome, resulting from the designed currency swap.

Answer:

WN 1: Structuring of swap arrangement:

Particulars	Company A	Company B
Borrow from bank	YEN 5%	USD 10%
B to A	(YEN 6%)	YEN 6%
A to B	USD 9%	(USD 9%)
Effective borrowing cost	USD 9% and negative YEN (1%)	YEN 6% and USD 1%
Effective original borrowing cost	USD 9%	YEN 8%
Net gain in swap arrangement	YEN 1%	YEN 2% but pay USD 1%
Net gain in % terms	1%	1%

WN 2: Cash flows of swap arrangement:

Particulars	Company A	Company B

Payment to bank	YEN 12,00,000 [2,40,00,000 x 5%]	USD 20,000 [2,00,000 x 10%]
B to A	YEN 14,40,000 [2,40,00,000 x 6%]	YEN 14,40,000 [2,40,00,000 x 6%]
A to B	USD 18,000 [2,00,000 x 9%]	USD 18,000 [2,00,000 x 9%]
Effective borrowing cost	Pay USD 18,000 and receipt of YEN 2,40,000	Pay USD 2,000 and YEN 14,40,000

Net Benefit for Company A:

- ❖ Company A is receiving YEN of 2,40,000. The same will be converted into USD 2,000
- ❖ Net borrowing cost for company A is USD 16,000
- ❖ Original borrowing cost as per given rates is USD 18,000 [2,00,000 x 9%]
- ❖ Net gain of Swap arrangement is USD 2,000 [1%]

Net Benefit for Company B:

- ❖ Company A is paying USD 2,000. The same will be converted into YEN 2,40,000
- ❖ Total borrowing cost is YEN 16,80,000
- ❖ Rate as per original borrowing rate is YEN 19,20,000 [2,40,00,000 x 8%]
- ❖ Net gain of swap arrangement is YEN 2,40,000 [1%]

115. Swap arrangement:

Firm A is a US based company and firm B is a France based company. Both companies has till now borrowed exclusively in their home currency. Now firm A can issue five year USD bond at 7.5 % interest and five year FFR bond at 11%. Firm B can issue five year USD bond at 7% and five year FFR bond at 12%. Firm A required USD 100 million whereas firm B requires FFR 550 million. Current exchange rate is 5.5 FFR per USD.

- ❖ What kind of swap can A and B enter into?
- ❖ What will be the total cost and savings to each party?

Answer:**WN 1: Structure of interest rates:**

Particulars	USD	FFR
Firm A	7.5%	11%
Firm B	7%	12%

- Total interest rate of combination 1 [Firm A (USD) & Firm B(FFR)] = 7.5% + 12% = 19.5%
- Total interest rate of combination 2 [Firm A (FFR) & Firm B(USD)] = 11% + 7% = 18%
- **Ideal combination:** Combination 2 – Firm A should borrow in FFR and Firm B should borrow in USD
- **Actual scenario:** Combination 1 – Firm A wants to borrow in USD and Firm B wants to borrow in FFR [respective home currencies]
- Scope for Currency cum interest rate swap exist as the actual scenario does not match with ideal scenario
- **Amount of swap gain = 19.5% - 18% = 1.5%**
- **Share of swap gain:**
 - Firm A = 0.75%
 - Firm B = 0.75%

WN 2: Structuring of swap arrangement:

- It is assumed that Firm B is willing to take exchange rate risk

Particulars	Firm A		Firm B	
	Currency	%	Currency	%
1. Payment to bank as per ideal scenario	FFR	11%	USD	7%
2. Firm B to Firm A	FFR	(11%)	FFR	11%
3. Firm A to Firm B	USD	6.75%	USD	(6.75%)
4. Effective cost (original – swap gain)	USD	6.75%	FFR & USD	11% & 0.25%

WN 3: Structuring of swap arrangement if Firm A is taking exchange rate risk:

Particulars	Firm A		Firm B	
	Currency	%	Currency	%
1. Payment to bank as per ideal scenario	FFR	11%	USD	7%
2. Firm A to Firm B	USD	7%	USD	(7%)
3. Firm B to Firm A	FFR	(11.25%)	FFR	11.25%
4. Effective cost (original - swap gain)	USD & FFR	7% & (0.25%)	FFR	11.25%

116.Valuation of currency swap

A currency swap has a remaining life of 15 months. It involves exchanging interest at 14% on GBP 20 million for interest at 10% on USD 30 million once a year. The term structure of interest rates in both the countries is flat and if the swap were negotiated today the interest rates would be 8% in dollars and 11% in sterling. All the interest rates quoted is with annual compounding. The current exchange rate is USD 1.65 per GBP. What is the value of the swap to the party paying dollar and to the party paying sterling

Answer:**WN 1: Forecasting of exchange rates as per IRPT:**

- Swap has remaining life of 15 months. This would mean that cash flow will happen in Month 3 and Month 15.
- We should predict exchange rates for Month 3 and Month 15 in order to value swap

Exchange rate for Month 3:

Spot rate = 1.65 USD/GBP
Interest rate in home country = 8% per annum (or) 2% per quarter
Interest rate in foreign country = 11% per annum (or) 2.75% per quarter

IRPT calculation:

$\frac{1 + R_h}{1 + R_f} = \frac{F_1}{e_0}$
$\frac{1 + 2.00\%}{1 + 2.75\%} = \frac{F_1}{1.65}$
Forward rate = USD 1.6380/GBP

Exchange rate for 15 months:

$\frac{1 + R_h}{1 + R_f} = \frac{F_2}{F_1}$
$\frac{1 + 8\%}{1 + 11\%} = \frac{F_2}{1.6380}$
Forward rate = USD 1.5937/GBP

WN 2: Valuation of swap for party paying USD:

Month	GBP Receivable	USD Payable	Exchange rate	Equivalent USD receivable	Net cash flow	PVF @ 8%	DCF
3	28,00,000	30,00,000	1.6380	45,86,400	15,86,400	0.981	15,56,258
15	2,28,00,000	3,30,00,000	1.5937	3,63,36,360	33,36,360	0.908	30,29,415
Swap asset							45,85,673

WN 3: Valuation of swap for party paying GBP:

- Party paying USD has a swap asset of USD 45,85,673. Party paying GBP will have a swap liability

$$\text{Swap Liability} = \frac{45,85,673}{1.65} = \text{GBP } 27,79,196$$

117.Hedging currency exposure [May 2016 MTP, May 2013 RTP, May 2019 RTP]

ABC Limited, a US based company, has won a contract in India for drilling oil field. The project will require an initial investment of Rs.500 Crores. The oil field along with equipments will be sold to Indian Government for Rs.740 crores in one year time. Since the Indian Government will pay for the amount in Indian Rupee, the company is worried about exposure due to exchange rate volatility. You are required to:

- ❖ Construct a swap that will help ABC Limited to reduce the exchange rate risk
- ❖ Assume that Indian Government offers a swap at a spot rate which is 1 USD = Rs.50 in one year, then should the company opt for this option or should it do nothing. The spot rate after one year is expected to be 1 USD = Rs.54. Further you may also assume that the ABC Limited can also take a USD loan at 8% p.a.

Answer:

WN 1: Construction of swap:

Currency swap can be created by following the below steps:

- ABC Limited to borrow USD 10 Crores in USA
- Swap USD 10 Crores with INR 500 Crores on day 0. This swap will be done with Government of India
- Swap back INR 500 Crores with USD 10 Crores on day 365. This will ensure that company is impacted only to the extent of profit

WN 2: Benefit of swap arrangement:

Particulars	Without Swap	With Swap
1. INR receipt on day 365	740 crores	740 crores
2. Swap Rs.500 crores with 10 Crores USD at agreed rate of Rs.50	NA	USD 10 Cr
3. Swap balance at rate of Rs.54	USD 13.7037 cr	USD 4.4444 Cr
4. Total USD earned	13.7037 Cr	14.4444 Cr
5. USD loan to be repaid	10.80 cr	10.80 cr
6. Net gain	2.9037 Crores	3.6444 Crores

- Company should go ahead with swap arrangement as the same has higher net gain

Part XIII - Multiple Forex Hedging Strategies

118. Comprehensive [May 2018 MTP, May 2007, May 2015 MTP, Nov 2015]

XYZ Limited, a US firm will need GBP 3,00,000 in 180 days. In this connection, the following information is available

Spot rate 1 GBP = USD 2.00

180 days forward rate 1 GBP = USD 1.96

Interest rates are as follows:

	UK	US
180 days deposit rate	4.5%	5%
180 days borrowing rate	5%	5.5%

A call option on GBP that expires in 180 days has an exercise price of USD 1.97 and a premium of USD 0.04.

XYZ limited has forecasted the spot rates 180 days hence as below:

Future rate	Probability
USD 1.91	25%
USD 1.95	60%
USD 2.05	15%

Which of the following strategies would be most preferable to XYZ Limited?

- a) A forward contract
- b) A money market hedge
- c) An option contract
- d) No hedging

Answer:

WN 1: Computation of USD outflow in case of forward contract:

- 180 days forward rate for 1.96 USD/GBP. The company needs to pay 3,00,000 GBP in 180 days
- Outflow in USD = 3,00,000 x 1.96 = USD 5,88,000

WN 2: Computation of USD outflow in case of Money Market Hedge:

- The company has a foreign currency liability of GBP 3,00,000. XYZ Limited should create a matching GBP deposit which will mature to GBP 3,00,000 in 180 days

Particulars	Calculation	Amount
Day 0		
1. Amount of GBP deposit to be created	$\frac{3,00,000}{1 + 4.5\%}$	GBP 2,87,081
2. USD loan to be taken on day 0	$2,87,081 \times 2$	USD 5,74,162
3. Take USD loan and create GBP deposit		
Day 180		
4. Redeem GBP deposit and pay supplier		GBP 3,00,000
5. USD outflow on day 180	$5,74,162 + 5.5\%$	USD 6,05,741

Note:

- It is assumed that given interest rates are applicable for 180 days period. Hence, we have directly taken the given rate for computation. Alternatively, this can be assumed for a year and we can calculate proportionate rate.

WN 3: Computation of USD outflow in case of option contract:

Expected rate	Outflow (incl premium)	Probability	Product
USD 1.91	USD 1.95	0.25	0.4875
USD 1.95	USD 1.99	0.60	1.1940
USD 2.05	USD 2.01	0.15	0.3015
Effective rate			1.983
Total Outflow	$3,00,000 \times 1.983$		5,94,900
Interest on premium	$(0.04 \times 3,00,000 \times 5.5\%)$		660
Final Outflow			5,95,560

WN 4: Computation of USD outflow in case of no hedge:

Expected rate	Probability	Product
USD 1.91	0.25	0.4775
USD 1.95	0.60	1.1700
USD 2.05	0.15	0.3075
Effective rate		1.955

USD outflow on day 180 = $3,00,000 \times 1.955$ = USD 5,86,500

Conclusion:

The company should opt for no hedge route as USD outflow is lowest in case of no hedge.

119. Multiple forex hedging strategies [May 2019]

Sun Limited, an Indian company will need \$ 5,00,000 in 90 days. In this connection, the following information is given below:

- ❖ Spot rate = Rs.71/USD
- ❖ 90 days forward rate = Rs.73/USD

Interest rates are as follows:

- ❖ 90 days Deposit rate = USA (2.5%) and India (4%)
- ❖ 90 days Borrowing rate = USA (4.0%) and India (6%)

A call option on USD that expires in 90 days has an exercise price of Rs.74 and a premium of Rs.0.10. Sun Limited has forecasted the spot rates for 90 days as below:

Future Rate	Probability
Rs.72.50	25%
Rs.73.00	50%
Rs.74.50	25%

Which of the following strategies would be the most preferable to Sun Limited:

- i. A forward contract
- ii. A Money Market Hedge
- iii. An option contract

- iv. No hedging

Answer:**WN 1: Computation of outflow under Forward Contract:**

- ❖ Outflow in INR = $5,00,000 \times 73 = \text{Rs.} 3,65,00,000$

WN 2: Computation of outflow under Money Market Hedge:

Particulars	Calculation	Amount
Day 0:		
Identify foreign currency liability		USD 5,00,000
Create a matching asset that will mature to 5,00,000 USD	$\frac{\text{USD } 5,00,000}{1 + 1.0250\%}$	USD 4,87,805
INR loan to be taken	$4,87,805 \times 71$	Rs.3,46,34,155
Take INR loan and created USD deposit		
Day 90		
Redeem USD deposit along with interest and pay supplier		USD 5,00,000
INR repayment along with interest	$3,46,34,155 \times 1.06$	Rs.3,67,12,204

Note: It is assumed that given interest rates are for 90 days period and not for a year

WN 3: Computation of outflow under Call Option:

Expected Spot Rate	Total cost including premium	Probability	Product
72.50	72.60	0.25	18.15
73.00	73.10	0.50	36.55
74.50	74.10	0.25	18.525
Total cost			73.225
INR outflow ($5,00,000 \times 73.225$)			3,66,12,500
Add: Interest on premium ($5,00,000 \times 0.10 \times 6\%$)			3,000
Total outflow in option route			3,66,15,500

WN 4: Computation of outflow under No Hedge Route:

Expected Spot Rate	Probability	Product
72.50	0.25	18.125
73.00	0.50	36.50
74.50	0.25	18.625
Total Cost		73.25
INR outflow ($5,00,000 \times 73.25$)		3,66,25,000

Conclusion: The company should go ahead with forward contract route for hedging.

120. Comprehensive [May 2019 RTP, Nov 2006, Nov 2014 MTP, Nov 2016 RTP, May 2021 RTP]

XYZ Ltd. is an export oriented business house based in Mumbai. The Company invoices in customers' currency. Its receipt of US \$ 1,00,000 is due on September 1, 2009.

Market information as at June 1, 2009 is:

Exchange rates		Currency futures	Contract size Rs.4,72,000
USD /INR		USD/INR	
Spot	0.02140	June	0.02126
1 month forward	0.02136	September	0.02118
3 months forward	0.02127		

	Initial Margin	Interest rates in India
June	Rs.10,000	7.50%
September	Rs.15,000	8.00%

On September 1, 2009 the spot rate US \$/Re. is 0.02133 and currency future rate is 0.02134. Comment which of the following methods would be most advantageous for XYZ Ltd.

- Using forward contract
- Using currency futures
- Not hedging currency risks

It may be assumed that variation in margin would be settled on the maturity of the futures contract.

Answer:**WN 1: Computation of INR inflow in case of forward contract:**

- September 1 forward rate is USD 0.02127/INR. The company will receive 1,00,000 USD on September 1
- Inflow in INR = $1,00,000/0.02127 = \text{INR } 47,01,457$

Computation of INR inflow under Futures contract:**Note 1: Computation of no of contracts:**

Particulars	Amount
1. Amount of exposure	USD 1,00,000
2. Amount of exposure in INR ($1,00,000/0.02118$)	INR 47,21,435
3. Size of one contract	INR 4,72,000
4. No of contracts	10

- The company should enter into 10 contracts of buying INR (selling USD)
- Margin money paid on day 0 = $15,000 \times 10 = \text{Rs. } 1,50,000$
- Interest on Margin Money = $1,50,000 \times 8\% \times (3/12) = \text{Rs. } 3,000$

Note 2: Futures settlement:

Date	Position	Action	Reference Date	Rate
June 1	Original Position	Buy	Sep 01	(USD 0.02118/INR)
Sep 1	Opposite Position	Sell	Sep 01	USD 0.02134/INR
Profit per INR				USD 0.00016/INR
Total Profit ($0.00016 \times 10 \times 4,72,000$)				USD 755.20

Note 3: Final Realization:

Particulars	Calculation	Amount
1. Spot realization	$1,00,000/0.02133$	Rs.46,88,233
2. Futures settlement	$755.20/0.02133$	Rs.35,406
3. Interest on margin money		(Rs.3,000)
4. Net realization		47,20,639

WN 3: Computation of INR inflow in case of no hedge:

- September 1 spot rate is USD 0.021233/INR. The company will receive 1,00,000 USD on September 1
- Inflow in INR = $1,00,000/0.02133 = \text{Rs. } 46,88,233$

Conclusion:

- The company should go ahead with futures contract for hedging

121. Comprehensive [May 2018 MTP, May 2010, May 2015 MTP, Nov 2016 RTP]

A Ltd. of U.K. has imported some chemical worth of USD 3,64,897 from one of the U.S. suppliers. The amount is payable in six months time. The relevant spot and forward rates are:

- ❖ Spot rate USD 1.5617-1.5673
- ❖ 6 months' forward rate USD 1.5455 -1.5609

The borrowing rates in U.K. and U.S. are 7% and 6% respectively and the deposit rates are 5.5% and 4.5% respectively. Currency options are available under which one option contract is for GBP 12,500. The option premium for GBP at a strike price of USD 1.70/GBP is USD 0.037 (call option) and USD 0.096 (put option) for 6 months period.

The company has 3 choices:

- Forward cover
- Money market cover and
- Currency option

Which of the alternatives is preferable by the company?

Answer:**WN 1: Computation of GBP outflow in case of forward contract:**

- 6 months forward rate = $\text{USD } 1.5455 - 1.5609/\text{GBP}$
- GBP outflow on day 180 = $3,64,897/1.5455 = \text{GBP } 2,36,102.88$

WN 2: Computation of GBP outflow in case of Money Market Hedge:

- The company has foreign currency (USD) liability and hence has to create USD deposit for money market hedge

Particulars	Calculation	Amount
Day 0		
1. Amount of USD deposit to be created	$3,64,897 / (1 + 2.25\%)$	USD 3,56,867.48
2. GBP loan to be taken on day 0	$3,56,867.48 \times (1 / 1.5617)$	GBP 2,28,512.19
3. Take GBP loan, convert into USD and create USD deposit		
Day 180		
4. Redeem USD deposit and pay supplier		USD 3,64,897
5. GBP outflow after 6 months	$2,28,512.19 + 3.5\%$	GBP 2,36,510.12

WN 3: Computation of GBP outflow in case of Option Contract:

- The strike price of option is USD 1.70/GBP. Product currency is GBP and hence we can buy/sell GBP with option contract
- The company needs to buy USD. This can also be considered as selling GBP.
- The company plans to sell GBP and hence we should opt for Put option

Note 1: Computation of no of contracts:

Particulars	Amount
1. Amount of exposure	USD 3,64,897
2. Amount of exposure in GBP ($3,64,897 / 1.70$)	GBP 2,14,645
3. Size of one contract	GBP 12,500
4. No of contracts ($2,14,645 / 12,500$)	17.17 ~ 17

Note 2: Computation of premium:

Particulars	Amount
1. Premium per GBP	USD 0.096
2. Premium per contract ($12,500 \times 0.096$)	USD 1,200
3. Premium for 17 contracts ($1,200 \times 17$)	USD 20,400
4. Premium in GBP ($20,400 / 1.5617$)	GBP 13,062.69
5. Interest on premium ($13,062.69 \times 7\% \times 6/12$)	GBP 457.19

Note: It is assumed that A Limited is running a cash deficit and hence interest on premium is considered at borrowing rates.

Note 3: Final outflow:

Particulars	Amount
1. Sale of GBP of 17 contracts ($17 \times 12,500 \times 1.70$)	USD 3,61,250
2. GBP outflow for above 3,61,250 USD ($17 \times 12,500$)	GBP 2,12,500
3. Balance USD required ($3,64,897 - 3,61,250$)	USD 3,647
4. Purchase of above USD using forward rate ($3,647 / 1.5455$)	GBP 2,359.75
5. Premium paid	GBP 13,062.69
6. Interest on premium	GBP 457.19
7. Final outflow ($2 + 4 + 5 + 6$)	GBP 2,28,379.63

Conclusion:

The company should go ahead with option contract for hedging the exposure

122. Comprehensive [Nov 2011, Nov 2016 MTP, Nov 2017 MTP, Nov 2015 RTP, May 2021 RTP]

Nitrogen Ltd, is in the process of negotiating an order amounting €4 Mln with a large German retailer on 6 months credit. If successful this will be the first time that Nitrogen Ltd has exported goods into highly competitive market. The following three alternatives are being considered for managing the transaction risk before the order is finalized.

- Invoice the German firm in sterling using the current exchange rate to calculate the invoice amount.
- Alternative of invoicing the German firm in € and using a forward foreign exchange contract to hedge the transaction risk.

- c) Invoice the German first in € and use sufficient 6months sterling future contracts (to the nearly whole number) to hedge the transaction risk.
- ❖ Spot rate € 1.1750-1.1770/£
 - ❖ 6 months forward premium 0.60-0.55 Euro cents
 - ❖ 6 months future contract is available at €1.1760/£
 - ❖ 6 month future contract size is £62500
 - ❖ Spot rate and 6 months futures rate €1.1785/£

Required:

- a) Calculate to the nearest £ the receipt for Nitrogen Ltd. Under each of the three proposals.
 b) In your opinion, which alternative would you consider to be the most appropriate and thereof

Answer:

WN 1: Hedging through forward contract:

- Spot rate is EURO 1.1750 – 1.1770/GBP
- 6 months forward premium EURO 0.0060 – 0.0055/GBP [1 cent = 0.01 EURO]
- Swap points are in descending order. However, the question says premium and hence these points need to be added to get forward rate
- **6 months forward rate = EURO 1.1810 – 1.1825/GBP**
- **Inflow in GBP = 40,00,000/1.1825 = GBP 33,82,664**

WN 2: Hedging using futures contract:

Note 1: Computation of no of contracts:

Particulars	Amount
1. Amount of exposure	EUR 40,00,000
2. Amount of exposure in GBP (40,00,000/1.1760)	GBP 34,01,361
3. Size of one contract	GBP 62,500
4. No of contracts	54 Contracts

Note: The company should enter into 54 contracts of buying pounds (selling EUROS)

Note 2: Futures settlement:

Date	Position	Action	Reference Date	Rate
Day 0	Original Position	Buy	Day 180	(EURO 1.1760/GBP)
Day 180	Opposite Position	Sell	Day 180	EURO 1.1785/GBP
Profit per GBP				EURO 0.0025
Total Profit (0.0025 x 62,500 x 54)				EURO 8,437.50

Note 3: Final Realization:

Particulars	Calculation	Amount
1. Spot realization	40,00,000/1.1785	GBP 33,94,145
2. Futures settlement	8,437.50/1.1785	GBP 7,160
3. Total realization		GBP 34,01,305

WN 3: Hedging through Currency invoicing

- Under currency invoicing, the billing will happen in GBP
- It is assumed that Ask rate of EURO 1.1770/GBP is used for finding the amount to be billed
- **Amount to be billed = 40,00,000/1.1770 = GBP 33,98,471**
- **Amount realized after 6 months = GBP 33,98,471**

Conclusion:

- The company should go ahead with futures contract for hedging as the same has higher GBP inflow

123.Options versus forward contracts [Nov 2013]

An American firm is under obligation to pay interests of Can\$ 1010000 and Can\$ 705000 on 31st July and 30th September respectively. The Firm is risk averse and its policy is to hedge the risks involved in all foreign currency transactions. The Financial Manager of the firm is thinking of hedging the risk considering two methods i.e. fixed forward or option contracts.

It is now June 30. Following quotations regarding rates of exchange, US\$ per Can\$, from the firm's bank were obtained:

Spot	1 Month Forward	3 Months Forward
0.9284 – 0.9288	0.9301	0.9356

Price for a Can\$ / US\$ option on U.S. stock exchange (cents per Can\$, payable on purchase of the option, contract size Can\$ 50000) are as follows:

Strike Price	Calls		Puts	
(US \$ / Can \$)	July	Sept.	July	Sept.
0.93	1.56	2.56	2.56	1.75
0.94	1.02	1.05	NA	NA
0.95	0.65	1.64	1.92	2.34

According to the suggestion of financial manager if options are to be used, one month option should be bought at a strike price of 94 cents and three month option at a strike price of 95 cents and for the remainder uncovered by the options the firm would bear the risk itself. For this, it would be appropriate for the American firm to hedge its foreign exchange risk on two interest payments.

Recommend which of the above two methods would be appropriate for the American Firm to hedge its foreign exchange risk on the two interest payments

Answer:

WN 1: Hedging of exposure of CA\$ 10,10,000 payable on 31st July:

Option 1: Forward Contract:

- July 31 forward rate = USD 0.9301/CAD
- Outflow in USD = 10,10,000 × 0.9301 = USD 9,39,401

Option 2: Option contract:

- Relevant strike price = USD 0.94/CAD
- Product currency is CAD and this is a contract to buy/sell CAD
- The company has to buy CAD and hence we should go for call option

Note 1: Computation of no of contracts:

Particulars	Amount
1. Amount of exposure	CAD 10,10,000
2. Size of one contract	CAD 50,000
3. No of contracts	20

Note 2: Computation of premium:

Particulars	Amount
1. Premium per CAD	USD 0.0102/CAD
2. Premium per contract (50,000 × 0.0102)	USD 510
3. Premium for 20 contracts (510 × 20)	USD 10,200

Note: Interest on premium is ignored as the rate of interest is not given in problem

Note 3: Final outflow:

Particulars	Amount
1. Purchase of 10,00,000 CAD using call option [10,00,000 × 0.94]	USD 9,40,000
2. Purchase of balance 10,000 CAD using future spot rate [10,000 × 0.9301]	USD 9,301
3. Premium Paid	USD 10,200
4. Total outflow [1+2+3]	USD 9,59,501

Conclusion:

The company should go ahead with forward contract for hedging the exposure

WN 2: Hedging of exposure of CA\$ 7,05,000 payable on 30th September:

Option 1: Forward Contract:

- September 30 forward rate = USD 0.9356/CAD
- Outflow in USD = 7,05,000 × 0.9356 = USD 6,59,598

Option 2: Option contract:

- Relevant strike price = USD 0.95/CAD
- Product currency is CAD and this is a contract to buy/sell CAD
- **The company has to buy CAD and hence we should go for call option**

Note 1: Computation of no of contracts:

Particulars	Amount
1. Amount of exposure	CAD 7,05,000
2. Size of one contract	CAD 50,000
3. No of contracts	14

Note 2: Computation of premium:

Particulars	Amount
1. Premium per CAD	USD 0.0164/CAD
2. Premium per contract (50,000 x 0.0164)	USD 820
3. Premium for 14 contracts (820 x 14)	USD 11,480

Note: Interest on premium is ignored as the rate of interest is not given in problem

Note 3: Final outflow:

Particulars	Amount
1. Purchase of 7,00,000 CAD using call option [7,00,000 x 0.95]	USD 6,65,000
2. Purchase of balance 5,000 CAD using future spot rate [5,000 x 0.9356]	USD 4,678
3. Premium Paid	USD 11,480
4. Total outflow [1+2+3]	USD 6,81,158

Conclusion:

The company should go ahead with forward contract for hedging the exposure

124.FC versus option [Nov 2015]

XYZ an Indian firm, will need to pay JAPANESE YEN (JY) 5, 00,000 on 30th June. In order to hedge the risk involved in foreign currency transaction, the firm is considering two alternative methods i.e. forward market cover and currency option contract.

On 1st April, following quotations (JY/INR) are made available:

Spot	3 months forward
1.9516/1.9711	1.9726/1.9923

The prices for forex currency option on purchase are as follows:

- ❖ Strike Price JY 2.125
- ❖ Call option (June) JY 0.047
- ❖ Put option (June) JY 0.098

For excess or balance of JY covered, the firm would use forward rate as future spot rate. You are required to recommend cheaper hedging alternative for XYZ.

Answer:**WN 1: Hedging through forward contract:**

- The company needs to pay JPY 5,00,000 on 30th June. The same can be covered through 3-month forward contract

$$\text{INR} = \text{JPY} \times \text{ASK} \left(\frac{\text{INR}}{\text{JPY}} \right); \text{INR} = 5,00,000 \times \frac{1}{1.9726} = \text{RS. } 2,53,472.57$$

WN 2: Hedging through option contract:

- Relevant strike price = JPY 2.125/INR
- Product currency is INR and this is a contract to buy/sell INR
- **The company has to sell INR and hence we should go for put option**

Note 1: Computation of no of contracts:

Particulars	Amount
1. Amount of exposure	JPY 5,00,000
2. Amount of exposure in INR $[5,00,000/2.125]$	INR 2,35,294.12
3. Size of one contract	INR 1
4. No of contracts	2,35,294

Note 2: Computation of premium:

Particulars	Amount
1. Premium per INR	JPY 0.098
2. Premium for 2,35,294 contracts $(2,35,294 \times 0.098)$	JPY 23,058.81
3. Premium in INR $(JPY 23,058.81/1.9516)$	INR 11,815.34

Note: Interest on premium is ignored as the rate of interest is not given in problem

Note 3: Final outflow:

Particulars	Amount
1. Sale of 2,35,294 INR $(2,35,294 \times 2.125)$	JPY 5,00,000.00
2. Outflow in INR for purchase of 5,00,000 JPY	INR 2,35,294.00
3. Premium paid	INR 11,815.34
4. Total Premium (2+3)	INR 2,47,109.34

Conclusion:

The company should go ahead with option contract for hedging the exposure

125. Forex derivatives [May 2009]

On 19th April following are the spot rates .Spot USD/EURO 1.20000 INR/USD 44.8000

Following are the quotes of European Options:

Currency pair	Call/Put	Strike price	Premium	Expiry date
\$/€	Call	1.2000	\$0.035	July 19
\$/€	Put	1.2000	\$0.04	July 19
Rs./\$	Call	44.8000	Rs.0.12	Sep 19
Rs./\$	Put	44.8000	Rs.0.04	Sep 19

- A trader sells an at-the-money spot straddle [buying call and put of same exercise price] expiring at three months (July 19). Calculate gain or loss if three months later the spot rate is USD/EUR 1.2900.
- Which strategy gives a profit to the dealer if five months later (Sep. 19) expected spot rate is USD/INR 45.00? Also calculate profit for a transaction USD 1.5 million.

Answer:**WN 1: Computation of profit/loss if the spot rate turns out to be USD/EURO 1.29:**

- Straddle would mean buying/selling a call and put of same exercise price
- Trader has sold the straddle and hence he would be writer of call and put option

Particulars	Amount
1. GPO of call	(USD 0.09)
2. GPO of Put	0
3. Total GPO	(USD 0.09)
4. Premium received	USD 0.075
5. NPO (loss)	(USD 0.015)

WN 2: Strategy if the expected INR/USD rate is 45.00:

- Expected rate is 45; Strike price is 44.80. This would mean that call option will get exercise on maturity date and Put option will lapse on maturity date
- Trader can make profit using one of the below strategies:
 - Buying a call option
 - Writing a Put option

Profit if call option is bought:

Particulars	Amount
1. GPO of call	0.20
2. Premium	(0.12)
3. NPO per USD	0.08

4. NPO for 1.5 million USD (0.08 x 15,00,000)	Rs.1,20,000

Profit if Put option is written:

Particulars	Amount
1. GPO of Put	0
2. Premium	0.04
3. NPO per USD	0.04
4. NPO for 1.5 million USD (0.04 x 15,00,000)	60,000

126. Investment decision [May 2018 RTP, Nov 2013, May 2017 MTP, Nov 2015 MTP]

Your bank's London office has surplus funds to extent of USD 5, 00,000/- for a period of 3 months. The cost of the funds to the bank is 4% p.a. it proposes to invest these funds in London. New York or Frankfurt and obtain the best yield, without any exchange risk to the bank. The following rates of interest are available at the three centers for investment of domestic funds there at for a period of 3 months.

- ❖ London 5% p.a.
- ❖ New York 8% p.a.
- ❖ Frankfurt 3% p.a.

The market rates in London for US dollars and Euro are as under:

London on New York

- ❖ Spot 1.5350/90
- ❖ 1 month 15/18
- ❖ 2 month 30/35
- ❖ 3 month 80/85

London on Frankfurt

- ❖ Spot 1.8260/90
- ❖ 1 month 60/55
- ❖ 2 month 95/90
- ❖ 3 month 145/140

At which center, will the investment be made & what will be the net gain (to the nearest pound) to the bank on the invested funds?

Answer:**WN 1: Computation of net gain if investment is made in New York (USD):**

Particulars	Calculation	Amount
1. Amount of surplus/amount invested		USD 5,00,000
2. Interest earned	$5,00,000 \times 8\% \times (3/12)$	USD 10,000
3. Amount on maturity		USD 5,10,000
4. Amount required to be earned	$5,00,000 + (5,00,000 \times 4\% \times 3/12)$	USD 5,05,000
5. Gain in USD		USD 5,000
6. Gain in GBP	$5,000 \times \frac{1}{1.5475}$	GBP 3,231.02

WN 2: Computation of net gain if investment is made in London (GBP):

Particulars	Calculation	Amount
1. Amount of surplus		USD 5,00,000
2. Surplus in GBP/Amount invested	$5,00,000 \times \frac{1}{1.5390}$	GBP 3,24,886
3. Interest earned	$3,24,886 \times 5\% \times (3/12)$	GBP 4,061
4. Amount on maturity		GBP 3,28,947
5. Less: GBP needed to buy 5,05,000 USD	$5,05,000 \times \frac{1}{1.5430}$	GBP 3,27,285
6. Gain in GBP (4-5)		GBP 1,662

WN 3: Computation of net gain if investment is made in Frankfurt (Euros):

Particulars	Calculation	Amount
1. Amount of surplus		USD 5,00,000
2. Surplus in Euros/Amount invested	$5,00,000 \times 1.8260 \times \frac{1}{1.5390}$	EUR 5,93,242
3. Interest earned	$5,93,242 \times 3\% \times (3/12)$	EUR 4,449

4. Amount on maturity		EUR 5,97,691
5. Less: Euros needed to buy 5,05,000 USD	$5,05,000 \times 1.8150 \times \frac{1}{1.5430}$	EUR 5,94,021
6. Gain in Euros (4-5)		EUR 3,670
7. Gain in GBP	$3,670 \times \frac{1}{1.8150}$	GBP 2,022

Conclusion:

The company should invest the surplus in New York as the same leads to maximum gain in GBP

127. Benefit of netting [Nov 2018 RTP, May 2016 MTP]

Suppose you are a treasurer of XYZ plc in the UK. XYZ have two overseas subsidiaries, one based in Amsterdam and one in Switzerland. The Dutch subsidiary has surplus Euros in the amount of 725,000 which it does not need for the next three months but which will be needed at the end of that period (91 days). The Swiss subsidiary has a surplus of Swiss Francs in the amount of 998,077 that, again, it will need on day 91. The XYZ plc in UK has a net balance of £75,000 that is not needed for the foreseeable future.

Given the rates below, what is the advantage of swapping Euros and Swiss Francs into Sterling?

❖ Spot Rate (€)	£0.6858- 0.6869
❖ 91 day Pts	0.0037 0.0040
❖ Spot Rate(£)	CHF 2.3295- 2.3326
❖ 91 day Pts	0.0242 0.0228

Interest rates for the Deposits:

Amount of currency	91 day Interest rate % p.a.		
	GBP	EURO	CHF
0 to 1,00,000	1	0.25	0
1,00,001 to 5,00,000	2	1.5	0.25
5,00,001 to 10,00,000	4	2	0.50
Over 10,00,000	5.375	3	1

Answer:**WN 1: Individual investment and then final swapping into GBP:**

Currency	Surplus	Interest rate	Interest earned (Amount x rate x 91/365)	Maturity Amount	Conversion rate	GBP Maturity Amount
EURO	7,25,000	2%	3,615.07	7,28,615.07	0.6895 [0.6858 + 0.0037]	5,02,380.09 [7,28,615.07 x 0.6895]
CHF	9,98,077	0.50%	1,244.18	9,99,321.18	2.3098 [2.3326- 0.0228]	4,32,644.03 [9,99,321.18 / 2.3098]
GBP	75,000	1%	186.99	75,186.99	1	75,186.99
Maturity value at end of day 91						10,10,211.11

WN 2: Immediate swap and investment in GBP:

Currency	Surplus	Conversion rate	GBP on day 0	Interest rate	Interest amount	GBP Maturity Amount
EURO	7,25,000	0.6858	4,97,205 [7,25,000 x 0.6858]			
CHF	9,98,077	2.3326	4,27,881.76 [9,98,077 / 2.3326]			
GBP	75,000	1	75,000			
Total GBP balance			10,00,086.76	5.375	13,401.85 [10,00,086.76 x 5.375% x 91/365]	10,13,488.61

❖ Benefit of swapping = 10,13,488.61 - 10,10,211.11 = GBP 3,277.50

128. Investment decision [Nov 2018 Exam, Nov 2020 Exam, May 2021 MTP]

ICL an Indian MNC is executing a plant in Sri Lanka. It has raised Rs. 400 billion. Half of the amount will be required after six months' time. ICL is looking an opportunity to invest this amount on 1st April, 2020 for a period of six months. It is considering two underlying proposals:

Particulars	Japan	USA
Nature of investment	Index Fund (JPY)	Treasury Bills (USD)
Dividend (in billions)	25	-
Income from stock lending (in billions)	11.9276	-
Discount on initial investment at the end	2%	-
Interest	-	5 percent per annum
Exchange rate (1 st April 2020)	JPY/INR 1.58	USD/INR 0.014
Exchange rate (30 th September 2020)	JPY/INR 1.57	USD/INR 0.013

You, as an Investment Manager, is required to suggest the best course of option.

Answer:

WN 1: Computation of INR at end of 6 months if investment is made in JPY:

Particulars	Calculation	Amount (in billions)
1. Amount of surplus		INR 200.0000
2. Surplus in JPY/ Amount invested	200×1.58	JPY 316.0000
Amount on maturity:		
3. Dividend income		JPY 25.0000
4. Stock lending income		JPY 11.9276
5. Value of shares sold	$316.00 \times 98\%$	JPY 309.6800
6. Total amount on maturity (3+4+5)		JPY 346.6076
7. Amount on maturity (INR)	$\frac{346.6076}{1.57}$	INR 220.76917

WN 2: Computation of INR at end of 6 months if investment is made in USD:

Particulars	Calculation	Amount (in billion)
1. Amount of surplus		INR 200.0000
2. Surplus in USD/ Amount invested	200×0.014	USD 2.8000
3. Interest earned	$2.8000 \times 5\% \times (6/12)$	USD 0.0700
4. Amount on maturity (USD)		USD 2.8700
5. Amount on maturity (INR)	$\frac{2.8700}{0.013}$	INR 220.76923

- The equivalent amount at the end of 6 months shall be almost same in both the options.
- The bank can go for any of the options. However, from risk perspective, the investment in fixed income desk of US is more beneficial as the chance of variation in fixed income securities is less as compared to Equity Desk.

129. Forward contract versus money market hedge [May 2015 RTP]

Columbus Surgicals Inc. is based in US, has recently imported surgical raw materials from the UK and has been invoiced for GBP 4,80,000, payable in 3 months. It has also exported surgical goods to India and France. The Indian customer has been invoiced for GBP 1,38,000, payable in 3 months, and the French customer has been invoiced for EUR 5,90,000, payable in 4 months.

Current spot and forward rates are as follows:

❖ Spot GBP/USD	0.9830-0.9850
❖ Three month forward GBP/USD	0.9520-0.9545
❖ Spot USD/EUR	1.8890-1.8920
❖ Four months forward	1.9510-1.9540

Current money market rates are as follows:

❖ UK	10.0%-12.0% p.a.
❖ France	14.0%-16.0% p.a.
❖ USA	11.5%-13.0% p.a.

You as a treasury manager are required to show how the company can hedge its foreign exchange exposure using Forward Markets and Money markets hedge and suggest which the best hedging technique is

Answer:**WN 1: Hedging of payables exposure:**

GBP Exposure: Since Columbus has a GBP receipt (1,38,000) and payment of (4,80,000) maturing at the same time, it can match them against each other leaving a net liability of GBP 3,42,000 to be hedged

Option 1- Forward Market Hedge:

$$\text{USD} = \text{GBP} \times \text{ASK} \left(\frac{\text{USD}}{\text{GBP}} \right) = 3,42,000 \times \frac{1}{\text{BID} \left(\frac{\text{GBP}}{\text{USD}} \right)} = 3,42,000 \times \left(\frac{1}{0.9520} \right) = \text{USD } 3,59,244$$

Option 2- Money Market Hedge:

Particulars	Calculation	Amount
Day 0:		
Identify foreign currency liability		GBP 3,42,000
Create a matching asset that will mature to 3,42,000 GBP	$\frac{\text{GBP } 3,42,000}{1 + 2.5\%}$	GBP 3,33,659
Borrow USD loan with which we can create GBP deposit of 3,33,659 Known component = GBP 3,33,659; Unknown component = ? $\text{USD} = \text{GBP} \times \text{ASK} \left(\frac{\text{USD}}{\text{GBP}} \right); \text{USD} = 3,33,659 \times \left(\frac{1}{0.9830} \right)$		USD 3,39,429
Borrow USD loan and create GBP deposit		
Day 90		
Redeem GBP deposit along with interest and pay supplier		GBP 3,42,000
USD repayment along with interest @ 3.25%	$3,39,429 \times 1.0325$	USD 3,50,460

Conclusion: The company should go ahead with MMH route for hedging the forex payable of GBP 3,42,000

WN 2: Hedging of receivables exposure:

Foreign exchange exposure = EUR 5,90,000

Option 1 - Forward Market Hedge:

$$\text{USD} = \text{EUR} \times \text{BID} \left(\frac{\text{USD}}{\text{EUR}} \right) = 5,90,000 \times 1.9510 = \text{USD } 11,51,090$$

Option 2 - Money Market Hedge:

Particulars	Calculation	Amount
Day 0:		
Identify foreign currency asset		EUR 5,90,000
Create a matching liability that will mature to 5,90,000 EUR	$\frac{\text{EUR } 5,90,000}{1 + 5.33\%}$	EUR 5,60,144
Borrow EUR 5,60,144 and convert into USD at spot rate Known component = EUR 5,60,144; Unknown component = ? $\text{USD} = \text{EUR} \times \text{BID} \left(\frac{\text{USD}}{\text{EUR}} \right); \text{USD} = 5,60,144 \times 1.8890$		USD 10,58,112
Create USD deposit of 10,58,112 for four months		
Day 90		
Receive EUR 5,90,000 from customer and repay EURO loan		EUR 5,90,000
USD deposit maturity along with interest	$10,58,112 + 3.83\%$	USD 10,98,637

Conclusion: The company should go ahead with Forward Market Hedge route for hedging the receivable of EUR 5,90,000

130. Forward contract and foreign currency option:

Airlines Company entered into an agreement with Airbus for buying latest plans for a total value of F.F. (French Francs) 1,000 Million payable after 6 months. The current spot exchange rate is INR (Indian Rupees) 6.60/FF. The Airlines Company cannot predict the exchange rate in the future. Can the Airlines Company hedge its Foreign Exchange risk? Explain by examples.

Answer:

Airlines Company can hedge its foreign exchange risk by the following ways:

(i) Hedging through Forward Contract: The Company can take full forward cover against foreign exchange exposure and entirely hedge its risk. It can contract with a bank to buy French franc forward at an agreed exchange rate e.g. suppose the 6 months forward rate is INR 6.77/FF. The liability is fixed and the airlines can concentrate on operation. Cost of forward contract

$$= \frac{6.60 - 6.77}{6.60} \times \frac{360}{\text{days}}$$

(ii) Foreign Currency Option:

- ❖ Foreign currency option is the right (not an obligation) to buy or sell a currency at an agreed exchange rate (exercise price) on or before an agreed maturity period. The right to buy is called a call option and right to sell is put option. Suppose, the airlines wants to purchase a 6 months call option. The call option exercise rate (say) is INR 6.70. The Airlines will be required to pay a premium for purchasing the option say 5% of the value of call option INR 6700 × 0.05 = INR 335
- ❖ Maximum final cost = 6700 + 335 = INR 7035
- ❖ Suppose at the end of 6 months the exchange rate stay at INR 6.8/FF Airlines will exercise its call option hence it will buy FF at INR 6.7 Suppose exchange rate at the end of 6 months is INR 6.35, Airlines should not exercise its option. In the open market it need to pay only INR 6.35 (instead of INR 6.70) to buy one FF. However, it has already paid the option premium.

(iii) Money Market Operations: Airlines can borrow in Indian Rupee an amount and get it converted in FFs at Spot Rate. This amount can be invested in France for 6 months so that this amount along with interest due on it becomes equal to FFs 1000 million and is used for making the payment. The loan in Indian Rupee can be repaid back after 6 months along with the interest due thereon. If interest rate parity holds, the difference in the forward rate and the spot rate is the reflection of the difference in the interest rates in two countries. Thus Airlines will be able to hedge against the changes in the exchange rate. The problem with money market is that all markets are not open and all countries are not fully convertible.

131. Exposure management strategy matrix [Nov 2018 RTP]

Place the following strategies by different persons in the Exposure Management Strategies Matrix.

Strategy 1: Kuljeet a wholesaler of imported items imports toys from China to sell them in the domestic market to retailers. Being a sole trader, he is always so much involved in the promotion of his trade in domestic market and negotiation with foreign supplier that he never pays attention to hedge his payable in foreign currency and leaves his position unhedged.

Strategy 2: Moni, is in the business of exporting and importing brasswares to USA and European countries. In order to capture the market he invoices the customers in their home currency. Lavi enters into forward contracts to sell the foreign exchange only if he expects some profit out of it other-wise he leaves his position open.

Strategy 3: TSC Ltd. is in the business of software development. The company has both receivables and payables in foreign currency. The Treasury Manager of TSC Ltd. not only enters into forward contracts to hedge the exposure but carries out cancellation and extension of forward contracts on regular basis to earn profit out of the same. As a result management has started looking Treasury Department as Profit Centre.

Strategy 4: DNB Publishers Ltd. in addition to publishing books are also in the business of importing and exporting of books. As a matter of policy the movement company invoices the customer or receives invoice from the supplier immediately covers its position in the Forward or Future markets and hence never leave the exposure open even for a single day.

Answer:

- ❖ **Strategy 1:** This strategy is covered by High Risk: Low Reward category and worst as it leaves all exposures unhedged. Although this strategy does not involve any time and effort, it carries high risk.
- ❖ **Strategy 2:** This strategy covers Low Risk: Reasonable reward category as the exposure is covered wherever there is anticipated profit otherwise it is left.
- ❖ **Strategy 3:** This strategy is covered by High Risk: High Reward category as to earn profit, cancellations and extensions are carried out. Although this strategy leads to high gains but it is also accompanied by high risk.
- ❖ **Strategy 4:** This strategy is covered by Low Risk: Low Reward category as company plays a very safe game.

132. Hedging currency risk:

On 1st March, 2008, A Inc, a US company bought certain products from Tapland. The currency of Tapland is Tapa. The price agreed was Tapa 900000 payable on 31st May, 2008.

The spot price on 1st March, 2008 was 10 Tapa per US \$. The expected future spot rate was 8 Tapa per US \$; and the 3-months forward rate is 9 Tapa per US\$. The US and Tapland annual interest rate are 12% and 8% respectively. The tax rate for both countries is 40%. A Inc., is considering three alternatives to deal with the risk of exchange rate fluctuations.

(a) To enter the forward market to buy Tapa 9,00,000 at 3 months forward rate.

(b) To borrow appropriate amount in \$ to buy Tapa at current spot rate and to invest the Tapa purchased for 3 months.

(c) To wait until May 31, 2008, and buy Tapa at whatever spot rate prevailing at that time.

Which alternative the A Inc. should follow in order to minimize its cost of future payment of Tapa.

Answer:

WN 1: Forward Market Hedge:

Particulars	Calculation	Amount
Outflow at forward rate	9,00,000/9	1,00,000
Outflow at spot rate	9,00,000/10	90,000
Expected loss		10,000
Tax shield on exchange loss	10,000 × 40%	4,000
Net cost of using forward contract	1,00,000 – 4,000	96,000

WN 2: Money Market Hedge Route:

- ❖ The interest rate in USA and Tapaland is 12% and 8%. Post tax interest in USA and Tapaland is 7.20% and 4.80%

Particulars	Calculation	Amount
Day 0:		
Identify foreign currency liability		Tapa 9,00,000
Create a matching asset that will mature to 9,00,000 Tapa	$\frac{\text{Tapa 9,00,000}}{1 + 1.2\%}$	Tapa 8,89,328
Borrow USD loan with which we can create Tapa deposit of 8,89,328	$(8,89,328/10)$	USD 88,932.80
Borrow USD loan and create Tapa Deposit		
Day 90		
Redeem Tapa deposit along with interest and pay supplier		Tapa 9,00,000
USD repayment along with interest @ 1.80%	$88,932.80 \times 1.018$	USD 90,533.59

WN 3: No hedge

Particulars	Calculation	Amount
Outflow at expected spot rate	9,00,000/8	1,12,500
Outflow at spot rate	9,00,000/10	90,000
Expected loss		22,500
Tax shield on exchange loss	22,500 × 40%	9,000
Net cost of no hedge	1,12,500 – 9,000	1,03,500

Conclusion: The company should go ahead with Money Market Hedge route as the outflow is lowest.

133. Multiple forex hedging strategies:

CQS plc is a UK company that sells goods solely within UK. CQS plc has recently tried a foreign supplier in Netherland for the first time and need to pay €250,000 to the supplier in six months' time. You as financial manager are concerned that the cost of these supplies may rise in Pound Sterling terms and has decided to hedge the currency risk of this account payable. The following information has been provided by the company's bank:

- ❖ Spot rate (€ per £): 1.998 ± 0.002
- ❖ Six months forward rate (€ per £): 1.979 ± 0.004

Money market rates available to CQS plc:

- ❖ One year Pound Sterling interest rates: 6.1%-5.4%
- ❖ One year Euro interest rates: 4.0%-3.5%

Assuming CQS plc has no surplus cash at the present time you are required to evaluate whether a money market hedge, a forward market hedge or a lead payment should be used to hedge the foreign account payable

Answer:

WN 1: Forward contract hedge:

$$\text{GBP} = \text{EURO} \times \text{ASK} \left(\frac{\text{GBP}}{\text{EUR}} \right); \text{GBP} = 2,50,000 \times \left(\frac{1}{\text{BID} \left(\frac{\text{EUR}}{\text{GBP}} \right)} \right) = \frac{2,50,000}{1.975} = \text{GBP } 1,26,582$$

WN 2: Money Market Hedge:

Particulars	Calculation	Amount
Day 0:		
Identify foreign currency liability		EUR 2,50,000
Create a matching asset that will mature to 2,50,000 EUR	$\frac{\text{EUR } 2,50,000}{1 + 1.75\%}$	EUR 2,45,700
Borrow GBP loan with which we can create EUR deposit of 2,45,700 Known component = GBP 2,45,700; Unknown component = ? $\text{GBP} = \text{EUR} \times \text{ASK} \left(\frac{\text{GBP}}{\text{EUR}} \right); \text{GBP} = 2,45,700 \times \left(\frac{1}{1.996} \right)$		GBP 1,23,096
Borrow GBP loan and create EUR deposit		
Day 180		
Redeem EUR deposit along with interest and pay supplier		EUR 2,50,000
GBP repayment along with interest @ 3.05%	1,23,096 + 3.05%	GBP 1,26,850

WN 3: Lead Payment:

Particulars	Calculation	Amount
Day 0:		
Borrow GBP loan with which we can get EUR 2,50,000 and pay supplier Known component = GBP 2,50,000; Unknown component = ? $\text{GBP} = \text{EUR} \times \text{ASK} \left(\frac{\text{GBP}}{\text{EUR}} \right); \text{GBP} = 2,50,000 \times \left(\frac{1}{1.996} \right)$		GBP 1,25,251
Day 180		
GBP repayment along with interest @ 3.05%	1,25,251 + 3.05%	GBP 1,29,071

Evaluation of hedges: The relative costs of the three hedges can be compared since they have been referenced to the same point in time, i.e. six months in the future. The most expensive hedge is the lead payment, while the cheapest is the forward market hedge. Using the forward market to hedge the account payable currency risk can therefore be recommended.

134. Determination of financing currency [May 2020 MTP, Nov 2018, Jan 2021, May 2021 MTP]

An Indian Company obtains the following quotes (Rs./USD):

- ❖ Spot Rate 35.90/36.10
- ❖ 3 months forward rate 36.00/36.25
- ❖ 6 months forward rate 36.10/36.40

The company needs \$ funds for six months. Determine whether the company should borrow in USD or INR. Interest rates are:

- ❖ 3 months interest rate : INR:12%, USD:6%
- ❖ 6 months interest rate : INR:11.50%, USD:5.5%

Also determine what should be the rate of interest after 3-months to make the company indifferent between 3-months borrowing and 6-months borrowing in the case of:

- i. Rupee Borrowing
- ii. Dollar Borrowing

Note: For the purpose of calculation you can take the units of dollar and rupee as 100 each.

Answer:

WN 1: Decision making on borrowing currency:

Computation of outflow if the borrowing is in USD:

Particulars	Calculation	Amount
USD borrowing on day 0		USD 100

Add: Interest for 6 months	$100 \times 5.5\% \times 6/12$	USD 2.75
Total payment on Month 6		USD 102.75
6 month forward rate		36.40
Total outflow in INR	102.75×36.40	Rs.3,740.10

Computation of outflow if borrowing is in INR:

Particulars	Calculation	Amount
USD needed on Day 0		USD 100
INR loan taken on day 0	100×36.10	Rs.3,610
Add: Interest for 6 months	$3,610 \times 11.50\% \times 6/12$	Rs.207.58
Total payment on Month 6		Rs.3,817.58

Conclusion: Since cash outflow is lower in USD borrowing, the company should opt for USD borrowing.

WN 2: Computation of indifferent interest rate for month 3 to month 6 (3x6 FRA):**INR borrowing:**

Interest rate for 3 months = 12.00%
Interest rate for 6 months = 11.50%
$(1 + \text{Int rate for 3 months}) \times (1 + \text{Interest rate for 3 to 6}) = (1 + \text{Int rate for 6 months})$
$(1 + 3\%) \times (1 + \text{Interest rate for 3 to 6}) = (1 + 5.75\%)$
$(1 + \text{Interest rate for 3 to 6}) = \frac{(1 + 5.75\%)}{1 + 3\%}$
Interest rate for 3 to 6 = 2.67% for 3 months (or) 10.68% per annum

USD borrowing:

Interest rate for 3 months = 6.00%
Interest rate for 6 months = 5.50%
$(1 + \text{Int rate for 3 months}) \times (1 + \text{Interest rate for 3 to 6}) = (1 + \text{Int rate for 6 months})$
$(1 + 1.5\%) \times (1 + \text{Interest rate for 3 to 6}) = (1 + 2.75\%)$
$(1 + \text{Interest rate for 3 to 6}) = \frac{(1 + 2.75\%)}{1 + 1.5\%}$
Interest rate for 3 to 6 = 1.23% for 3 months (or) 4.92% per annum

135. Investment decision [May 2019, Nov 2019]

KGF Bank's Sydney branch has surplus funds of USD \$ 7,00,000 for a period of 2 months. Cost of funds to the bank is 6% p.a. They propose to invest these funds in Sydney, New York or Tokyo and obtain the best yield, without any exchange risk to the bank. The Following rates of interest are available at the three centres for investment of domestic funds there for a period of 2 Months.

- ❖ Sydney 7.5% p.a.
- ❖ New York 8% p.a.
- ❖ Tokyo 4% p.a.

The market rates in Australia for US Dollars and Yen are as under:

Sydney on New York:

- ❖ Spot 0.7100/0.7300
- ❖ 1 Months 10/20
- ❖ 2 Months 25/30

Sydney on Tokyo:

- Spot 79.0900/79.2000
- 1 Months 40/30
- 2 Months 55/50

At which centre, will the investment be made & what will be the net gain to the bank on the invested funds?

Answer:**WN 1: Computation of net gain if the investment is made in Sydney:**

Particulars	Calculation	Amount
Surplus funds		USD 7,00,000
Investment in Sydney (Aus \$)	$\frac{7,00,000}{0.73}$	A \$ 9,58,904

Add: Interest in Sydney	$9,58,904 \times 7.5\% \times (2/12)$	A \$ 11,986
Total amount at end of Month 2		A \$ 9,70,890
Target funds in USD at end of Month 2	$7,00,000 + (7,00,000 \times 6\% \times 2/12)$	USD 7,07,000
Target funds in A \$ at end of Month 2	$7,07,000 / 0.7125$	A \$ 9,92,281
Net loss	$9,70,890 - 9,92,281$	A \$ 21,391

WN 2: Computation of net gain if investment is made in New York:

Particulars	Calculation	Amount
Surplus funds		USD 7,00,000
Add: Interest in New York	$7,00,000 \times 8\% \times 2/12$	USD 9,333.33
Total amount at end of Month 2		USD 7,09,333.33
Target funds in USD at end of Month 2	$7,00,000 + (7,00,000 \times 6\% \times 2/12)$	USD 7,07,000
Net gain		USD 2,333.33
Net gain in A \$	$2,333.33 / 0.7330$	A \$ 3,183

WN 3: Computation of net gain if investment is made in Tokyo:

Particulars	Calculation	Amount
Surplus funds in USD		USD 7,00,000
Surplus funds in JPY (Note 1)		JPY 7,58,39,726
Add: Interest in Tokyo	$7,58,39,726 \times 4\% \times 2/12$	JPY 5,05,598
Total amount at end of Month 2		JPY 7,63,45,324
Total amount at end of Month 2 in AUD (Note 2)		AUD 9,64,017
Target funds in A \$ at end of Month 2 (WN 1)		A \$ 9,92,281
Net loss in A \$	$9,64,017 - 9,92,281$	A \$ 28,264

Note 1: Computation of surplus funds in JPY:

$$\text{JPY} = \text{USD} \times \text{BID} \left(\frac{\text{JPY}}{\text{USD}} \right); \text{JPY} = \text{USD} \times \text{BID} \left(\frac{\text{JPY}}{\text{AUD}} \times \frac{\text{AUD}}{\text{USD}} \right)$$

$$\text{JPY} = 7,00,000 \times (79.0900 \times \left(\frac{1}{0.73} \right)) = \text{JPY } 7,58,39,726$$

Note 2: Computation of maturity funds in AUD:

$$\text{AUD} = \text{JPY} \times \text{BID} \left(\frac{\text{AUD}}{\text{JPY}} \right); \text{AUD} = 7,63,45,324 \times \left(\frac{1}{79.1950} \right); \text{AUD} = 9,64,017$$

Conclusion: The investment should be made in New York as the company makes gain while investing in New York.

136. Money Market Hedge Versus Forward Contract [Nov 2019]:

H Ltd. is an Indian firm exporting handicrafts to North America. All the exports are invoiced in US\$. The firm is considering the use of money market or forward market to cover the receivable of \$50,000 expected to be realized in 3 months time and has the following information from its banker:

Particulars	Exchange Rate
Spot	Rs.72.65/73
3-month forward	Rs.72.95/73.40

The borrowing rates in US and India are 6 % and 12% p.a. and the deposit rates are 4% and 9% p.a. respectively.

(i) Which option is better for H Ltd. ?

(ii) Assume that H Ltd. anticipates the spot exchange rate in 3-months time to be equal to the current 3-months forward rate. After 3-months the spot exchange rate turned out to be Rs./\$: 73/73.42. What is the foreign exchange exposure and risk of H Ltd.?

Answer:**WN 1: Computation of inflow under forward contract:**

- 3 months forward rate = Rs.72.95/73.40 per USD
- INR inflow at end of M3 = $50,000 \times 72.95 = \text{Rs.}36,47,500$

WN 2: Computation of inflow in case of Money Market Hedge:

- The company has foreign currency (USD) asset and hence has to create USD loan for money market hedge

Particulars	Calculation	Amount
Day 0		
1. Amount of USD loan to be taken	$\frac{50,000}{1 + 1.5\%}$	USD 49,261.08
2. Conversion of USD into INR	$49,261.08 \times 72.65$	INR 35,78,817
3. Create INR deposit for 3 months at 9% per annum		INR 35,78,817
Month 3		
4. Receive money from customer and repay loan		USD 50,000
5. Redeem INR deposit with interest	$35,78,817 + 2.25\%$	INR 36,59,340

Conclusion: The company should go with money market hedge option as the inflow is higher under MMH.

WN 3: Computation of foreign exchange exposure risk:

Particulars	Calculation
Expected realization considering future spot rate (50,000 x 72.95)	36,47,500
Actual realization considering actual spot rate (50,000 x 73)	36,50,000
Gain due to foreign exchange risk	2,500

137. Spot vs Non-deliverable forward contract [May 2021 MTP]

On 1st February 2020, XYZ Ltd. a laptop manufacturer imported a particular type of Memory Chips from SKH Semiconductor of South Korea. The payment is due in one month from the date of Invoice, amounting to 1190 Million South Korean Won (SKW). Following Spot Exchange Rates (1st February) are quoted in two different markets:

USD/INR	75.00/75.50	in Mumbai
USD/SKW	1190.00/1190.75	in New York

Since hedging of Foreign Exchange Risk was part of company's strategic policy and no contract for hedging in SKW was available at any in-shore market, it approached an off-shore NonDeliverable Forward (NDF) Market for hedging the same risk.

In NDF Market a dealer quoted one-month USD/ SKW at 1190.00/1190.50 for notional amount of USD 1,000,000 to be settled at reference rate declared by Bank of Korea. After 1 month (1st March 2020) the dealer agreed for SKW 1185/ USD as rate for settlement and on the same day the Spot Rates in the above markets were as follows:

USD/INR	75.50/75.75	in Mumbai
USD/SKW	1188.00/1188.50	in New York

Analyze the position of company under each of the following cases, comparing with Spot Position of 1st February:

- Do Nothing.
- Opting for NDF Contract.

Note: Both Rs./ SKW Rate and final payment (to be computed in Rs. Lakh) to be rounded off upto 4 decimal points

Answer:

Note: The rates have been interpreted as INR/USD and SKW/USD as per current exchange rates

WN 1: Analysis of No-hedge scenario:

Outflow on Feb 1:

- Known component = 11,900 Lacs SKW
- Unknown component = ? INR

$INR = SKW \times \left(\frac{INR}{SKW} \right)$
$INR = SKW \times ASK \left(\frac{INR}{SKW} \right)$

$\text{ASK} \left(\frac{\text{INR}}{\text{SKW}} \right) = \text{ASK} \left(\frac{\text{INR}}{\text{USD}} \times \frac{\text{USD}}{\text{SKW}} \right)$
$\text{ASK} \left(\frac{\text{INR}}{\text{SKW}} \right) = 75.50 \times \left(\frac{1}{1,190} \right) = 0.0634$
$\text{INR} = 11,900 \times 0.0634 = \text{INR } 754.4600 \text{ Lacs}$

Outflow on Mar 1:

- ❖ Known component = 11,900 Lacs SKW
- ❖ Unknown component = ? INR

$\text{INR} = \text{SKW} \times \left(\frac{\text{INR}}{\text{SKW}} \right)$
$\text{INR} = \text{SKW} \times \text{ASK} \left(\frac{\text{INR}}{\text{SKW}} \right)$
$\text{ASK} \left(\frac{\text{INR}}{\text{SKW}} \right) = \text{ASK} \left(\frac{\text{INR}}{\text{USD}} \times \frac{\text{USD}}{\text{SKW}} \right)$
$\text{ASK} \left(\frac{\text{INR}}{\text{SKW}} \right) = 75.75 \times \left(\frac{1}{1,188} \right) = 0.0638$
$\text{INR} = 11,900 \times 0.0638 = \text{INR } 759.2200 \text{ Lacs}$
Loss under no-hedge scenario = 754.4600 lacs – 759.2200 lacs
Loss under no-hedge scenario = INR 4.7600 lacs

WN 2: Analysis of Non-deliverable forward contract:

- Under a forward contract the delivery is normally made and hence the settlement at the end of contract happens by delivery of foreign currency
- However, in case of NDF, the delivery will not happen and hence from analysis point of view it will be same as futures. It will involve profit/loss on NDF position and actual settlement will happen at spot rate

Note 1: NDF settlement:

- Investor has entered into a notional contract for 10,00,000 USD. We are planning to buy SKW and hence we will be selling USD

Date	Position	Action	Reference Date	Rate
Feb 1	Original Position	Sell (BID)	Mar 1	SKW 1,190/USD
Mar 1	Opposite Position	Buy (ASK)	Mar 1	(SKW 1,185/USD)
Profit per USD				SKW 5.00/USD
Total Profit (1.50 x 10,00,000)				SKW 50,00,000

Note 2: Final payment:

- The company is required to make a payment of SKW 11,900 lacs. We have a profit of SKW 50 lacs in NDF and hence net payment to be made is SKW 11,850 lacs

Outflow on Mar 1:

$\text{INR} = 11,850 \text{ lacs} \times 0.0638 = \text{INR } 756.0300 \text{ lacs}$
Loss under NDF scenario = 754.4600 lacs – 756.0300 lacs
Loss under no-hedge scenario = INR 1.5700 lacs

Decision: Since Exchange Loss is less in case of NDF same can be opted for.

Chapter 11 – International Financial Management**1. What are the complexities in multinational capital budgeting? [May 2020 MTP]**

Multinational Capital Budgeting has to take into consideration the different factors and variables which affect a foreign project and are complex in nature than domestic projects

- ❖ Cash flows from foreign projects have to be converted into the currency of the parent organization.
- ❖ Parent cash flows are quite different from project cash flows
- ❖ Profits remitted to the parent firm are subject to tax in the home country as well as the host country
- ❖ Effect of foreign exchange risk on the parent firm's cash flow
- ❖ Changes in rates of inflation causing a shift in the competitive environment and thereby affecting cash flows over a specific time period
- ❖ Restrictions imposed on cash flow distribution generated from foreign projects by the host country
- ❖ Initial investment in the host country to benefit from the release of blocked funds
- ❖ Political risk in the form of changed political events reduce the possibility of expected cash flows
- ❖ Concessions/benefits provided by the host country ensures the upsurge in the profitability position of the foreign project
- ❖ Estimation of the terminal value in multinational capital budgeting is difficult since the buyers in the parent company have divergent views on acquisition of the project

2. Explain the problems that are faced in International Capital Budgeting Decision and how these can be overcome? [Nov 2020 MTP]

- ❖ Multinational companies investing elsewhere are subjected to foreign exchange risk in the sense that currency appreciates/ depreciates over a span of time. To include foreign exchange risk in the cash flow estimates of any project, it is necessary to forecast the inflation rate in the host country during the lifetime of the project. Adjustments for inflation are made in the cash flows depicted in local currency. The cash flows are converted in parent country's currency at the spot exchange rate multiplied by the expected depreciation rate obtained from purchasing power parity.
- ❖ Due to restrictions imposed on transfer of profits, depreciation charges and technical differences exist between project cash flows and cash flows obtained by the parent organization. Such restriction can be diluted by the application of techniques viz internal transfer prices, overhead payments. Adjustment for blocked funds depends on its opportunity cost, a vital issue in capital budgeting process.
- ❖ In multinational capital budgeting, after tax cash flows need to be considered for project evaluation. The presence of two tax regimes along with other factors such as remittances to the parent firm in the form of royalties, dividends, management fees etc., tax provisions withheld in the host country, presence of tax treaties, tax discrimination pursued by the host country between transfer of realized profits vis-à-vis local re-investment of such profits cause serious impediments to multinational capital budgeting process. MNCs are in a position to reduce overall tax burden through the system of transfer pricing. For computation of actual after tax cash flows accruing to the parent firm, higher of home/ host country tax rate is used. If the project becomes feasible then it is acceptable under a more favourable tax regime. If not feasible, then, other tax saving aspects need to be incorporated in order to find out whether the project crosses the hurdle rate.

3. Explain project cash flows and parent cash flows in the context of international capital budgeting?

- ❖ Evaluation of a project on the basis of own cash flows entails that the project should compete favourably with domestic firms and earn a return higher than the local competitors. If not, the shareholders and management of the parent company shall invest in the equity/ government bonds of domestic firms. A comparison cannot be made since foreign projects replace imports and are not competitors with existing local firms. Project evaluation based on local cash flows avoid currency conversion and eliminates problems associated with fluctuating exchange rate changes.
- ❖ For evaluation of foreign project from the parent firm's angle, both operating and financial cash flows actually remitted to it form the yardstick for the firm's performance and the basis for distribution of dividends to the shareholders and repayment of debt/interest to lenders. An investment has to be evaluated on basis of net after tax operating cash flows generated by the project. As both types of cash flows (operating and financial) are clubbed together, it is essential to see that financial cash flows are not mixed up with operating cash flows.

4. Write short note on Foreign Currency Convertible Bonds (FCCBs)? [May 2021 RTP, Nov 2020]

- ❖ **Meaning:** A type of convertible bond issued in a currency different than the issuer's domestic currency. A convertible bond is a mix between a debt and equity instrument. It acts like a bond by making regular coupon and principal payments, but these bonds also give the bondholder the option to convert the bond into stock
- ❖ These types of bonds are attractive to both investors and issuers. The investors receive the safety of guaranteed payments on the bond and are also able to take advantage of any large price appreciation in the company's stock. Due to the equity side of the bond, which adds value, the coupon payments on the bond are lower for the company, thereby reducing its debt-financing costs

Advantages	Disadvantages
❖ The convertible bond gives the investor the <u>flexibility to convert the bond into equity at a price or redeem the bond</u> at the end of a specified period, normally three years if the price of the share has not met his expectations. ❖ Companies prefer bonds as it leads to <u>delayed dilution of equity</u> and allows company to avoid any current dilution in earnings per share that a further issuance of equity would cause. ❖ FCCBs are <u>easily marketable as investors enjoys option of conversion into equity if resulting to capital appreciation</u>. Further investor is assured of a minimum fixed interest earnings.	❖ <u>Exchange risk is more</u> in FCCBs as interest on bonds would be payable in foreign currency. Thus companies with low debt equity ratios, large forex earnings potential only opt for FCCBs. ❖ FCCBs mean <u>creation of more debt</u> and a forex outgo in terms of interest which is in foreign exchange. ❖ In the case of convertible bonds, the interest rate is low, say around 3–4% but there is exchange risk on the interest payment as well as re-payment if the bonds are not converted into equity shares.

5. Write short note on American Depositary Receipts (ADR)?

- ❖ Depositary receipts issued by a company in the United States of America (USA) is known as American Depositary Receipts (ADRs). Such receipts must be issued in accordance with the provisions stipulated by the Securities and Exchange Commission of USA (SEC) which are very stringent.
- ❖ An ADR is generally created by the deposit of the securities of a non-United States company with a custodian bank in the country of incorporation of the issuing company. The custodian bank informs the depository in the United States that the ADRs can be issued
- ❖ ADRs are United States dollar denominated and are traded in the same way as are the securities of United States companies. The ADR holder is entitled to the same rights and advantages as owners of the underlying securities in the home country
- ❖ One variation of ADR is the GDR which are identical in structure to an ADR, the only difference being that they can be traded in more than one currency and within as well as outside the United States

6. Write short note on Global Depositary Receipts (GDR)?

- ❖ A depository receipt is basically a negotiable certificate, denominated in a currency not native to the issuer, that represents the company's publicly - traded local currency equity shares.
- ❖ Most GDRs are denominated in USD, while a few are denominated in Euro and Pound Sterling. The Depositary Receipts issued in the US are called American Depositary Receipts (ADRs), which anyway are denominated in USD and outside of USA, these are called GDRs
- ❖ Through the issue of depository receipts, companies in India have been able to tap global equity market to raise foreign currency funds by way of equity. In addition, it has been perceived that a GDR issue has been able to fetch higher prices from international investors than those that a domestic public issue would have been able to extract from Indian investors

7. Explain the impact of GDRs on Indian Capital Market?

- ❖ Indian stock market to some extent is shifting from Bombay to Luxemburg.
- ❖ There is arbitrage possibility in GDR issues.
- ❖ Indian stock market is no longer independent from the rest of the world. This puts additional strain on the investors as they now need to keep updated with world-wide economic events.
- ❖ Indian retail investors are completely side-lined. GDRs/Foreign Institutional Investors' placements + free pricing implies that retail investors can no longer expect to make easy money on heavily discounted rights/public issues

8. What are the characteristics of GDR issues?

- ❖ Holders of GDRs participate in the economic benefits of being ordinary shareholders, though they do not have voting rights.
- ❖ GDRs are settled through CEDEL & Euro-clear international book entry systems.
- ❖ GDRs are listed on the Luxemburg stock exchange.
- ❖ Trading takes place between professional market makers on an OTC (over the counter) basis.
- ❖ The instruments are freely traded.
- ❖ They are marketed globally without being confined to borders of any market or country as it can be traded in more than one currency.
- ❖ Investors earn fixed income by way of dividends which are paid in issuer currency converted into dollars by depository and paid to investors and hence exchange risk is with investor.
- ❖ As far as the case of liquidation of GDRs is concerned, an investor may get the GDR cancelled any time after a cooling off period of 45 days. A non-resident holder of GDRs may ask the overseas bank (depository) to redeem (cancel) the GDRs.

9. What are Euro Convertible bonds? [Jan 2021]

A convertible bond is a debt instrument which gives the holders of the bond an option to convert the bond into a predetermined number of equity shares of the company. Usually, the price of the equity shares at the time of conversion will have a premium element. The bonds carry a fixed rate of interest. If the issuer company desires, the issue of such bonds may carry call and put option.

10. What are the other sources of international finance?

- **Euro-Convertible Zero-Coupon Bonds:** These bonds are structured as a convertible bond. No interest is payable on the bonds. But conversion of bonds takes place on maturity at a pre-determined price. Usually there is a 5 years maturity period and they are treated as a deferred equity issue.
- **Euro-bonds with Equity Warrants:** These bonds carry a coupon rate determined by the market rates. The warrants are detachable. Pure bonds are traded at a discount. Fixed income funds may like to invest in these bonds for the purposes of regular income.
- **Syndicated bank loans:** It is one of the earlier ways of raising funds in the form of large loans from banks with good credit rating, can be arranged in reasonably short time and with few formalities. The maturity of the loan can be for a duration of 5 to 10 years. The interest rate is generally set with reference to an index, say, LIBOR plus a spread which depends upon the credit rating of the borrower.
- **Euro-bonds:** These are basically debt instruments denominated in a currency issued outside the country of that currency for examples Yen bond floated in France. Primary attraction of these bonds is the refuge from tax and regulations and provide scope for arbitraging yields. These are usually bearer bonds and can take the form of
 - Traditional Fixed Rate Bonds
 - Floating Rate Notes (FRNs)
 - Convertible Bond
- **Foreign Bonds:** Foreign bonds are denominated in a currency which is foreign to the borrower and sold at the country of that currency. Such bonds are always subject to the restrictions and are placed by that country on the foreigners funds.
- **Euro Commercial Papers:** These are short term money market securities usually issued at a discount, for maturities less than one year.
- **Credit Instruments:** There are many types of credit instruments used in effecting foreign remittances. They differ in the speed, with which money can be received by the creditor at the other end after it has been paid in by the debtor at his end. The price or the rate of each instrument, therefore, varies with extent of the loss of interest and risk of loss involved. There are, therefore, different rates of exchange applicable to different types of credit instruments.

11. Explain International Financial Centre?

- IFC is a hub that deals with flow of funds, financial products and financial services in their own land but with different set of regulation and laws.
- It caters the needs of the customer outside their own jurisdiction.
- It Provides flexibility in currency trading, Banking and other financial services.

12. What are the benefits of establishing IFC?

- Opportunity for qualified professionals working outside India come here and practice their profession.
- A platform for qualified and talented professionals to pursue global opportunities without leaving their homeland.
- Stops Brain Drain from India.
- Bringing back those financial services transactions presently carried out abroad by overseas financial institutions/entities or branches or subsidiaries of Indian Financial Market.
- Trading of complicated financial derivative can be started from India.

13. What are the constituents of IFC?

Highly Developed Infrastructure	• It is a prerequisite for <u>creating a platform</u> to offer internationally complete financial services
Stable Political Environment	• It is also a prerequisite to <u>accelerate foreign participation in growth of Financial centre</u>. Destabilised Political Environment brings country risk Investment by foreign nationals.
Strategic Location	• The location of the centre should be strategic. E.g Near to airport, Seaport and Friendly weather.
Quality Life	• The quality of life at the center should be good as <u>center retains highly paid professional</u> from own country as well from outside.
Rationale Regulatory framework	• IFC should be <u>fair and transparent</u>
Sustainable Economy	• The economy should be sustainable and should possess <u>capacity to absorb all the shocks</u> as it will boost investors confidence.

14. Write a note on GIFT City?

- Government of India operationalized International Financial Services Centre (IFSC) at GIFT Multi Services SEZ in April 2015
- GIFT IFSC provides very competitive cost of operations with very competitive tax regime, single window clearance; relax company law provisions, international arbitration centre with overall facilitation of doing business. GIFT IFSC is now moving toward unified regulatory mechanism.
- GIFT City is a new Financial & Technology Gateway of India for the World. To be internationalized, exchange controls cannot apply. So, FEMA is not applicable at GIFT city.
- Hence, with all these development more and more financial institutions are setting business units in GIFT as they will pay reduced taxes as valid for special economic zones and can easily offer foreign currency loans to Indian Companies abroad and foreign firm.

15. What are sovereign funds and explain the role played by them?

- A sovereign wealth fund (SWF) is a state-owned investment fund generating money from a country's surplus reserves. It benefits the economy and citizens.
- Funding sources include surplus reserves from natural resource revenues, bank reserves, foreign currency operations, privatizations, and government transfer payments. The legal basis varies between governments.
- SWFs are created for targeted purposes, aiming to protect revenues, stabilize exports, diversify, earn better returns, assist monetary authorities, increase savings, fund social and economic development, and ensure sustainable long-term capital growth for target countries.
- SWFs have various objectives, risk tolerances, terms, and liquidity concerns. They can range from conservative to high-risk management depending on assets and objectives.
- Classification of SWF: Traditional classifications include stabilization funds, savings or future generation funds, public benefit pension funds, reserve investment funds, and strategic development SWFs.
- Investment vehicles: Sovereign Wealth Funds (SWFs), Public Pension Funds, State-Owned Enterprises and Sovereign Wealth Enterprises (SWEs)

16. What are the complexities in International Working Capital Management?

- Wider financing option: A multinational firm has a wider option for financing its current assets. Therefore, it may choose to avail financing either locally or from global financial markets.

- **Multiple interest and tax rates:** Interest and tax rates may vary from one country to another. A Treasurer associated with a multinational firm has to consider the interest/ tax rate differentials while financing current assets.
- **Forex risk:** A multinational firm is confronted with **foreign exchange risk** as the value of inflow/outflow of funds as well as the value of import/export are influenced by exchange rate variations.
- **Restrictions:** Restrictions imposed by the **home or host country government towards** movement of cash and inventory on account of political considerations affect the growth of MNCs.
- **Multiple countries:** Multinational firm managers struggle with managing working capital in host countries due to limited knowledge of politico-economic conditions; communication system development alleviates this issue.
- **Full capital convertibility:** MNCs can efficiently mobilize funds in countries with full capital convertibility, unlike those without, like India, where such freedom may not be available.

17. What are the main objectives of international cash management? [Nov 2019 (exam)]

- ❖ To minimise currency exposure risk.
- ❖ To minimise overall cash requirements of the company as a whole without disturbing smooth operations of the subsidiary or its affiliate.
- ❖ To minimise transaction costs.
- ❖ To minimise country's political risk.
- ❖ To take advantage of economies of scale as well as reap benefits of superior knowledge.

18. What are the benefits of Centralized Cash Management?

- To maintain **minimum cash balance** during the year.
- To manage judiciously **liquidity requirements** of the centre.
- To optimally use various **hedging strategies** so that MNC's foreign exchange exposure is minimised.
- To aid the centre to **generate maximum returns** by investing all cash resources optimally.
- To aid the centre to take advantage of **multinational netting** so that transaction costs and currency exposure are minimised.
- To make maximum utilization of **transfer pricing mechanism** so that the firm enhances its profitability and growth.
- To exploit currency movement correlations:
 - Payables & receivables in different currencies having positive correlations.
 - Payables of different currencies having negative correlations.
 - Pooling of funds allows for reduced holding – **the variance of the total cash flows for the entire group will be smaller than the sum of the individual variances**

19. International cash management has an objective of optimizing cash flow movements. What are the numerous ways of achieving the same?

- **Accelerating cash inflows:** Faster cash inflow recovery enables firms to invest or use them for better returns.
- **Managing Blocked Funds:** The parent company has to assess the **potential of future funds blockage in a foreign country**. MNCs have to be aware of political risks cropping up due to unexpected blockage of funds and devise ways to benefit their shareholders by using different methods for moving blocked funds **through transfer pricing strategies, direct negotiations, leading and lagging and so on.**
- Leading and Lagging
- Minimising Tax on Cash Flows through Transfer Pricing Mechanism
- **Netting:** This includes both bilateral netting system and multilateral netting system
- Investing excess cash

Theory to Solve Problems

International capital budgeting

- ❖ Host country is the country in which investment is made. Home country is the country which is making the investment

- ❖ Example: If China invests in Japan, then Japan is the host country and China is the home country
- ❖ Home currency refers to the currency of the home country and host currency is the currency of the host country
- ❖ Home currency approach means computing NPV in home currency
- ❖ Host currency approach means computing NPV in host currency
- ❖ All cash flows in steps 1,2 and 3 should consistently be either in home currency or the host currency
- ❖ The appropriate discount rate is the home currency discount rate if the home currency approach is used
- ❖ The appropriate discount rate is the host currency discount rate if the host currency approach is used

$$(1 + \text{Risky rate}) = (1 + \text{Risk free rate}) * (1 + \text{Risk Premium})$$

- ❖ The link between the host currency NPV and home currency NPV is the spot rate

$$\text{Home currency NPV} = \text{Host currency NPV} \times \text{Spot rate}$$

Practical Problems

1. International capital budgeting [Nov 2019 RTP, Nov 2006, May 2018 MTP, Nov 2015 MTP, Nov 2016 MTP, May 2013 RTP]

ABC Ltd. is considering a project in US, which will involve an initial investment of USD1,10,00,000. The project will have 5 years of life. Current spot exchange rate is Rs.48 per US \$. The risk-free rate in US is 8% and the same in India is 12%. Cash inflow from the project is as follows:

Year	Cash inflow
1	US\$20,00,000
2	US\$25,00,000
3	US\$30,00,000
4	US\$40,00,000
5	US\$50,00,000

Required rate of return on this project is 14%.

- ❖ Calculate the NPV of the project using foreign currency approach.
- ❖ Re-calculate the NPV of the project using home currency approach

Answer:

WN 1: Computation of required rate of return in USD:

- It is assumed that required rate of return of 14% is INR return
- Risk premium of the project is computed as under:

$$(1 + R_f) \times (1 + \text{risk premium}) = (1 + \text{risky rate})$$

$$(1 + 0.12) \times (1 + \text{risk premium}) = (1 + 0.14)$$

$$(1 + \text{risk premium}) = \frac{1.14}{1.12} = 1.0179; \text{Risk premium} = 0.0179 \text{ (or) } 1.79\%$$

- Required return in USD is computed as under:

$$(1 + R_f) \times (1 + \text{risk premium}) = (1 + \text{risky rate})$$

$$(1 + 0.08) \times (1 + 0.0179) = (1 + \text{risky rate})$$

$$(1 + \text{risky rate}) = 1.0993; \text{Risky rate} = 0.0993 \text{ (or) } 9.93\%$$

- Hence the required return for USD cash flows is 9.93% and return for INR cash flows is 14%

WN 2: Computation of NPV using foreign currency approach:

- ABC Limited is assumed to be based out of India and hence foreign currency is USD

Year	Cash flow	PVF @ 9.93%	DCF
0	-1,10,00,000	1.000	-1,10,00,000
1	20,00,000	0.910	18,20,000
2	25,00,000	0.827	20,67,500
3	30,00,000	0.753	22,59,000
4	40,00,000	0.685	27,40,000
5	50,00,000	0.623	31,15,000
NPV in USD			10,01,500

WN 3: Computation of NPV using home currency approach:

- Home currency is INR. The same can be computed as under:

- NPV in INR = NPV in USD x Exchange rate
- NPV in INR = 10,01,500 x 48.00 = Rs.480.72 lacs

2. International capital budgeting [Nov 2018 MTP, Nov 2015]

XYZ Ltd., a company based in India, manufactures very high quality modern furniture and sells to a small number of retail outlets in India and Nepal. It is facing tough competition. Recent studies on marketability of products have clearly indicated that the customer is now more interested in variety and choice rather than exclusively and exceptional quality. Since the cost of quality wood in India is very high, the company is reviewing the proposal for import of woods in bulk from Nepalese Supplier.

The estimate of net Indian (Rs) and Nepalese Currency (NC) cash flows for this proposal is shown below:

Net cash Flows (in millions)

Year	0	1	2	3
NC	-25.000	2.600	3.800	4.100
INR	0	2.869	4.200	4.600

The following information is relevant:

- XYZ Ltd evaluates all investments by using a discount rate of 9% p.a All Nepalese customers are involved in NC. NC cash flows are converted to Indian (Rs) at the forward rate and discounted at the Indian rate.
- (ii) Inflation rates in Nepal and India are expected to be 9% and 8% p.a respectively. The current exchange rate is Rs. = NC 1.6

Assuming that you are the finance manager of XYZ Ltd. Calculate the net present value (NPV) and modified internal rate of return (MIRR) of the proposal.

Answer:

WN 1: Computation of forward rates using PPT:

Year	Calculation	Rate
0		NC 1.6000/INR
1	$\frac{1.60 \times 1.09}{1.08}$	NC 1.6148/INR
2	$\frac{1.6148 \times 1.09}{1.08}$	NC 1.6298/INR
3	$\frac{1.6298 \times 1.09}{1.08}$	NC 1.6449/INR

WN 2: Computation of project cash flows in INR:

Year	INR CF	NCF	ER	Equivalent INR CF	Total INR CF
0	-	-2,50,00,000	1.6000	-1,56,25,000	-1,56,25,000
1	28,69,000	26,00,000	1.6148	16,10,107	44,79,107
2	42,00,000	38,00,000	1.6298	23,31,574	65,31,574
3	46,00,000	41,00,000	1.6449	24,92,553	70,92,553

WN 3: Computation of NPV in INR:

Year	Cash flow	PVF	DCF
0	-1,56,25,000	1.000	-1,56,25,000
1	44,79,107	0.917	41,07,341
2	65,31,574	0.842	54,99,585
3	70,92,553	0.772	54,75,451
Project NPV in INR			-5,42,623

WN 4: Computation of modified IRR:

Part 1: Calculation of maturity cash flow with reinvestment rate of 9% (cost of capital):

Year	Cash flow	Reinvestment period	FVF @ 9%	Maturity cash flow
1	44,79,107	2	1.1881	53,21,627
2	65,31,574	1	1.0900	71,19,416
3	70,92,553	0	1.0000	70,92,553
Maturity Cash Flow				1,95,33,596

Part 2: Computation of Modified IRR:

Year	Cash flow	PVF @ 8%	DCF	PVF @ 7%	DCF
0	-1,56,25,000	1.000	-1,56,25,000	1.000	-1,56,25,000
3	1,95,33,596	0.794	1,55,09,675	0.816	1,59,39,414
NPV			-1,15,325		3,14,414

- Project gives positive NPV at discount rate of 7 percent and negative NPV at discount rate of 8%

$$\text{Modified IRR} = L_1 + \frac{\text{NPV at } L_1}{\text{NPV at } L_1 - \text{NPV at } L_2} \times (L_2 - L_1)$$

$$\text{Modified IRR} = 7 + \frac{3,14,414}{3,14,414 - (-1,15,325)} \times (8 - 7) = 7 + 0.73 = 7.73\%$$

- Modified IRR = 7.73%**

3. International capital budgeting [May 2018 RTP, Nov 2007, May 2015 MTP, Nov 2012 RTP]

A USA based company is planning to set up a software developing unit in India. Software development at the Indian unit will be bought back by the US parent at a transfer price of US \$ 10 million. The unit will remain in existence in India for one year; the software is expected to get developed within this time frame. The US based company will be subjected to corporate tax of 30 per cent and with – holding tax of 10% in India and will not be eligible for tax credit in the US. The software developed will be sold in the US market for US \$ 12.0 million. Other establishments are as follows

Rent for fully furnished unit with necessary hard ware in India	Rs.15,00,000
Man power cost (80 software professional will be working for 10 hours each day)	Rs. 400 per man hour
Administrative and other costs	Rs. 12,00,000

Advise the US Company on financial viability of the project. The rupee-dollar rate is Rs.48/\$.

Answer:**Computation of cost of Developing the Project:**

Particulars	Calculation	Amount (in lacs)
Revenues	100 x 48	4,800.00
Less: Costs		
Rent		-15.00
Manpower cost	(365 x 10 x 400 x 80)/1,00,000	-1,168.00
Admin cost		-12.00
Profit before tax		3,605.00
Less: Tax @ 30%	3,605 x 30%	-1,081.50
Profit after tax		2,523.50
Less: Withholding tax @ 10%	2,523.50 x 10%	-252.35
Amount repatriated		2,271.15
Cost of development	Amount paid – amount repatriated 4,800.00 – 2,271.15	2,528.85
Cost of development (USD)	2,528.85/48	52.6844

- The cost of development is therefore USD 5.26844 million and the same would be sold for USD 12 million. Hence the project is financially viable

4. Withholding taxes – Eligible for tax credit [Nov 2021 RTP]

A USA based company is planning to set up a software developing unit in India. Software development at the Indian unit will be bought back by the US parent at a transfer price of US \$ 10 million. The unit will remain in existence in India for one year; the software is expected to get developed within this time frame. The US based company will be subjected to corporate tax of 30 per cent and with – holding tax of 10% in India and will be eligible for tax credit in India. The software developed will be sold in the US market and many companies are ready to acquire the same. Other estimates are as follows

Rent for fully furnished unit with necessary hard ware in India	Rs.18,75,000
Man power cost (80 software professional will be working for 10 hours each day)	Rs. 500 per man hour
Administrative and other costs	Rs. 15,00,000

Advise the US Company the minimum amount it should charge from the prospective buyer. The rupee-dollar rate is Rs.60/\$.

Answer:

Computation of cost of Developing the Project:

Particulars	Calculation	Amount (in lacs)
Revenues	100 x 60	6,000.000
Less: Costs		
Rent		-18.750
Manpower cost	(365 x 10 x 500 x 80)/1,00,000	-1,460.000
Admin cost		-15.000
Profit before tax		4,506.250
Less: With-holding tax @ 10%	4,506.25 x 10%	-450.625
Earnings after with-holding tax		4,055.625
Less: Tax @ 30%	4,506.250 x 30% - 450.625 (with-holding tax is eligible for credit)	-901.250
Amount repatriated		3,154.375
Cost of development	Amount paid - amount repatriated 6,000.00 - 3,154.375	2,845.625
Cost of development (USD)	2,845.625/60	47,42,708

The cost of development is USD 47,42,708 and hence the minimum amount to be charged would be the same.

5. International capital budgeting [Nov 2018 MTP, May 2013, May 2018 MTP, Nov 2014 MTP, Nov 2015 RTP]

XY Limited is engaged in large retail business in India. It is contemplating for expansion into a country of Africa by acquiring a group of stores having the same line of operation as that of India. The exchange rate for the currency of the proposed African country is extremely volatile. Rate of inflation is presently 40% a year. Inflation in India is currently 10% a year. Management of XY Limited expects these rates likely to continue for the foreseeable future. Estimated projected cash flows, in real terms, in India as well as African country for the first three years of the project are as follows:

Particulars	Year -0	Year-1	Year-2	Year-3
Cash flows in INR ('000s)	-50,000	-1,500	-2,000	-2,500
Cash flows in African Rands ('000s)	-2,00,000	+50,000	+70,000	+90,000

XY Ltd. Assumes the year 3 nominal cash flows will continue to be earned each year indefinitely. It evaluates all investments using nominal cash flows and a nominal discounting rate. The present exchange rate is African Rand 6 to Rs. 1. You are required to calculate the net present value of the proposed investment considering the following:

African Rand cash flows are converted into rupees and discounted at a risk adjusted rate. All cash flows for these projects will be discounted at a rate of 20% to reflect its high risk.

Answer:

WN 1: Computation of forward rates using PPT:

Year	Calculation	Rate
0		Rand 6.00/INR
1	$\frac{6.00 \times 1.40}{1.10}$	Rand 7.64/INR
2	$\frac{7.64 \times 1.40}{1.10}$	Rand 9.72/INR
3	$\frac{9.72 \times 1.40}{1.10}$	Rand 12.37/INR

WN 2: Computation of nominal cash flows by compounding at inflation rate:

(in '000s)

Year	African Rand (40%)		INR (10%)	
	Real	Nominal	Real	Nominal
0	-2,00,000	-2,00,000	-50,000	-50,000
1	50,000	70,000	-1,500	-1,650
2	70,000	1,37,200	-2,000	-2,420
3	90,000	2,46,960	-2,500	-3,328

Nominal Cash flow = Real cash flow x (1 + Inflation rate)ⁿ

WN 3: Computation of project cash flows in INR:

Year	INR CF	Rand CF	ER	Equivalent INR CF	Total INR CF
0	-50,000	-2,00,000	6.00	-33,333	-83,333
1	-1,650	70,000	7.64	9,162	7,512
2	-2,420	1,37,200	9.72	14,115	11,695
3	-3,328	2,46,960	12.37	19,964	16,636

- Year 3 cash flows will be earned every year and hence the same takes the character of a perpetuity.

$$\text{Valuation of perpetuity (Y3)} = \frac{\text{Y4 cash flow}}{K_o - \text{Growth}} = \frac{16,636}{20\% - 0\%} = \text{Rs. } 83,180$$

WN 4: Computation of NPV in INR:

Year	Cash flow	PVF @ 20%	DCF
0	-83,333	1.000	-83,333
1	7,512	0.833	6,257
2	11,695	0.694	8,116
3	99,816	0.579	57,793
Project NPV in INR			-11,167

- Project will get rejected as the same has negative NPV

6. International capital budgeting [Nov 2018 MTP, Nov 2018 RTP, May 2014, May 2017 RTP]

A multinational company is planning to set up a subsidiary company in India (where hitherto it was exporting) in view of growing demand for its product and competition from other MNCs. The initial project cost (consisting of Plant and Machinery including installation) is estimated to be US\$ 500 million. The net working capital requirements are estimated at US\$ 50 million. The company follows straight line method of depreciation. Presently, the company is exporting two million units every year at a unit price of US\$ 80, its variable cost per unit being US\$ 40. The Chief Financial Officer has estimated the following operating cost and other data in respect of proposed project:

- ❖ Variable operating cost will be US \$ 20 per unit of production;
- ❖ Additional cash fixed cost will be US \$ 30 million p.a. and project's share of allocated fixed cost will be US \$ 3 million p.a. based on principle of ability to share;
- ❖ Production capacity of the proposed project in India will be 5 million units;
- ❖ Expected useful life of the proposed plant is five years with no salvage value
- ❖ Existing working capital investment for production & sale of two million units through exports was US \$ 15 million;
- ❖ Export of the product in the coming year will decrease to 1.5 million units in case the company does not open subsidiary company in India, in view of the presence of competing MNCs that are in the process of setting up their subsidiaries in India;
- ❖ Applicable Corporate Income Tax rate is 35%, and
- ❖ Required rate of return for such project is 12%.

Assuming that there will be no variation in the exchange rate of two currencies and all profits will be repatriated, as there will be no withholding tax, estimate Net Present Value (NPV) of the proposed project in India.

Answer:

WN 1: Initial outflow:

Particulars	Amount (million USD)
Capital expenditure	-500.00
Working capital (50 - 15)	-35.00
Initial outflow	-535.00

WN 2: In-between cash flows (million USD)

Particulars	Existing	Revised

Units sold	1.50	5.00
Revenues	120	400
Less: Variable cost	-60	-100
Less: Fixed cost	0	-30
PBDT	60	270
Less: Depreciation	0	-100
PBT	60	170
Less: Tax @ 35%	-21	-59.50
PAT	39	110.50
Add: Depreciation	0	100.00
CFAT	39	210.50

- Incremental CFAT = 210.50 - 39 = USD 171.50 million

WN 3: Terminal Cash flow:

Particulars	Amount (million USD)
Net salvage value	0.00
Recapture of working capital (50 - 15)	35.00
Terminal flow	35.00

WN 4: Computation of NPV:

Year	Cash flow	PVF @ 12%	DCF
0	-535.00	1.000	-535.00
1 to 5	171.50	3.605	618.26
5	35.00	0.567	19.85
Project NPV			103.11

- The company should go ahead with the project as the same has resulted in positive NPV of USD 103.11 million

7. Valuation of share [May 2019 RTP]

The directors of Implant Inc. wishes to make an equity issue to finance a \$10 m (million) expansion scheme which has an excepted Net Present Value of \$2.2m and to re-finance an existing \$6 m 15% Bonds due for maturity in 5 years time. For early redemption of these bonds there is a \$3,50,000 penalty charges. The Co. has also obtained approval to suspend these pre-emptive rights and make a \$15 m placement of shares which will be at a price of \$0.5 per share. The floatation cost of issue will be 4% of Gross proceeds. Any surplus funds from issue will be invested in IDRs which is currently yielding 10% per year. The Present capital structure of Co. is as under:

Particulars	'000
Ordinary share (USD 1 per share)	7,000
Share premium	10,500
Free reserves	25,500
Total equity	43,000
15% term bonds	6,000
11% debentures (2012 - 2020)	8,000
Total capital	57,000

Current share price is \$2 per share and debenture price is \$ 103 per debenture. Cost of capital of Co. is 10%. It may be further presumed that stock market is semi -strong form efficient and no information about the proposed use of funds from the issue has been made available to the public. You are required to calculate expected share price of company once full details of the placement and to which the finance is to be put, are announced.

Answer:**Computation of expected share price:**

Particulars	Calculation	Amount (in '000s)
Existing Networth	7,000 x 2	14,000
New issue made		15,000

Less: Issue expenses	15,000 × 4%	-600
NPV of new project		2,200
NPV of bond refunding	Note 1	787.90
Expected Networth (A)		31,387.90
No of shares (B)	7,000 + (15,000/0.50)	37,000
Expected price (A/B)		0.8483

Note 1: Computation of NPV of bond refunding:

Year	Cash flow	PVF @ 10%	DCF
0	-6,350	1.000	-6,350.00
1 to 5	900	3.791	3,411.90
5	6,000	0.621	3,726.00
NPV of bond refunding			787.90

- The company will have to pay 6,350 today for bond refunding (6 million + 3,50,000)
- The company will save interest of 900 for a period of 5 years and will save principal payment of 6,000 at end of five years
- Cost of capital is 10%

8. International capital budgeting:

Perfect Inc., a U.S. based Pharmaceutical Company has received an offer from Aidsure Ltd., a company engaged in manufacturing of drugs to cure Dengue, to set up a manufacturing unit in Baddi (H.P.), India in a joint venture.

As per the Joint Venture agreement, Perfect Inc. will receive 55% share of revenues plus a royalty @ US \$0.01 per bottle. The initial investment will be Rs.200 crores for machinery and factory. The scrap value of machinery and factory is estimated at the end of five (5) year to be Rs.5 crores. The machinery is depreciable @ 20% on the value net of salvage value using Straight Line Method. An initial working capital to the tune of Rs.50 crores shall be required and thereafter Rs.5 crores each year.

As per GOI directions, it is estimated that the price per bottle will be Rs.7.50 and production will be 24 crores bottles per year. The price in addition to inflation of respective years shall be increased by Rs.1 each year. The production cost shall be 40% of the revenues.

The applicable tax rate in India is 30% and 35% in US and there is Double Taxation Avoidance Agreement between India and US. According to the agreement tax credit shall be given in US for the tax paid in India. In both the countries, taxes shall be paid in the following year in which profit have arisen.

The Spot rate of \$ is Rs.57. The inflation in India is 6% (expected to decrease by 0.50% every year) and 5% in US. As per the policy of GOI, only 50% of the share can be remitted in the year in which they are earned and remaining in the following year.

Though WACC of Perfect Inc. is 13% but due to risky nature of the project it expects a return of 15%. Determine whether Perfect Inc. should invest in the project or not (from subsidiary point of view).

Answer:**WN 1: Initial Outflow:**

Particulars	Amount (in INR Cr)
Capital expenditure	-200.00
Working capital	-50.00
Initial outflow	-250.00

WN 2: In-between flows:

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Revenues (Note 1)	118.75	132.27	145.61	158.61	171.55	
Less: Costs	-41.98	-47.36	-52.70	-57.92	-63.15	
PBDT	76.77	84.91	92.91	100.69	108.40	

Less: Depreciation (200-5)/5	-39.00	-39.00	-39.00	-39.00	-39.00	
PBT	37.77	45.91	53.91	61.69	69.40	
Less: Tax		-11.33	-13.77	-16.17	-18.51	-20.82
PAT	37.77	34.58	40.14	45.52	50.89	-20.82
Add: Depreciation	39.00	39.00	39.00	39.00	39.00	-
CFAT	76.77	73.58	79.14	84.52	89.89	-20.82
Less: Increase in working capital	-5.00	-5.00	-5.00	-5.00		
Revised CFAT	71.77	68.58	74.14	79.52	89.89	-20.82
Tax paid in India (IN USD) (Tax paid/Exchange rate)		-0.1960	-0.2382	-0.2811	-0.3249	-0.3707

Note:

- Production cost = 40% of parent share revenues as per Note 1. Production cost is not considered for Royalty Revenues
- Taxes are paid one year in arrears. Hence tax for profits of year 1 is paid in year 2 and so on
- Taxes paid in India is converted into USD for computing the tax payable in USA. Tax paid in India can be claimed as tax credit as per DTAA

Note 1: Computation of revenues:

(in INR Crores)

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5
1. Units sold	24	24	24	24	24
2. Pre-inflation adjusted price	7.5	8.5	9.5	10.5	11.5
3. Inflation rate	6%	5.50%	5%	4.50%	4%
4. Final selling price	7.95	8.97	9.98	10.97	11.96
5. Revenues (1 x 4)	190.8	215.28	239.52	263.28	287.04
6. Parent share (55% of 5)	104.94	118.4	131.74	144.8	157.87
7. Add: Royalty (Note 2)	13.81	13.87	13.87	13.81	13.68
8. Final revenues (6 + 7)	118.75	132.27	145.61	158.61	171.55

Note 2: Computation of Royalty:

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
1. Inflation in India (home country)	6%	5.50%	5%	4.50%	4%	3.50%
2. Inflation in USA (Foreign country)	5%	5%	5%	5%	5%	5%
3. Exchange rate as per PPT	57.54	57.81	57.81	57.53	56.98	56.17
4. Royalty in USD crores	0.24	0.24	0.24	0.24	0.24	
5. Royalty in INR Crores	13.81	13.87	13.87	13.81	13.68	

WN 3: Terminal flow:

Particulars	Amount (in Cr)
1. Net salvage value	5
2. Recapture of working capital (50 Cr + 5 cr x 4 years)	70
Total terminal flow	75

WN 4: Repatriation Analysis:

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
CFAT (WN 2)	71.77	68.58	74.14	79.52	164.89	-20.82	
50% of current year	35.89	34.29	37.07	39.76	82.45	-20.82	
50% of previous year		35.89	34.29	37.07	39.76	82.45	
Total inflow to parent (in INR)	35.89	70.18	71.36	76.83	122.21	61.63	
Total inflow to parent (in USD)	0.6237	1.214	1.2344	1.3355	2.1448	1.0972	
Tax payable in USA		0.2183	0.4249	0.432	0.4674	0.7507	0.3823

Tax credit as per DTAA (WN 2)		0.196	0.2382	0.2811	0.3249	0.3707	0
Final tax paid		0.0223	0.1867	0.1509	0.1425	0.38	0.3823
Net cash flow	0.6237	1.1917	1.0477	1.1846	2.0023	0.7172	-0.3823

Note:

- 50% of current year profit can be repatriated in same year and balance 50% will be repatriated in next year.
- Cash flows in WN 2 is project's earning and what can be repatriated is computed in line 4 of above WN
- Cash flow in INR is converted into cash flow in using exchange rate as per Note 2
- Tax payable in USA = 35% of profits of previous year. This is because taxes are paid in the following year in which profit has arisen
- However, tax payable in USA will be adjusted for tax paid in India as per DTAA and final tax paid is computed
- Net cash flow in USD = Total inflow to parent in USD – Final tax paid in USD

WN 5: Computation of NPV in USD (Crores):

Year	Cash flow	PVF @ 15%	DCF
0	-4.386	1	-4.386
1	0.6237	0.8696	0.5424
2	1.1917	0.7561	0.901
3	1.0477	0.6575	0.6889
4	1.1846	0.5718	0.6774
5	2.0023	0.4972	0.9955
6	0.7172	0.4323	0.31
7	-0.384	0.3759	-0.1443
NPV in USD Crores			-0.4151

- The project is not be accepted as the same has resulted in negative NPV

9. International capital budgeting:

Opus Technologies Ltd., an Indian IT company is planning to make an investment through a wholly owned subsidiary in a software project in China with a shelf life of two years. The inflation in China is estimated as 8 percent. Operating cash flows are received at the year end.

For the project an initial investment of Chinese Yuan (CN¥) 30,00,000 will be in a piece of land. The land will be sold after the completion of project at estimated value of CN¥ 35,00,000. The project also requires an office complex at cost of CN¥ 15,00,000 payable at the beginning of project. The complex will be depreciated on straight-line basis over two years to a zero salvage value. This complex is expected to fetch CN¥ 5,00,000 at the end of project.

The company is planning to raise the required funds through GDR issue in Mauritius. Each GDR will have 5 common equity shares of the company as underlying security which are currently trading at Rs. 200 per share (Face Value = Rs. 10) in the domestic market. The company has currently paid a dividend of 25% which is expected to grow at 10% p.a. The total issue cost is estimated to be 1 percent of issue size.

The annual sales is expected to be 10,000 units at the rate of CN¥ 500 per unit. The price of unit is expected to rise at the rate of inflation. Variable operating costs are 40 percent of sales. Current Fixed Operating costs is CN¥ 22,00,000 per year which is expected to rise at the rate of inflation.

The tax rate applicable in China for business income and capital gain is 25 percent and as per GOI Policy no further tax shall be payable in India. The current spot rate of CN¥ 1 is Rs. 9.50. The nominal interest rate in India and China is 12% and 10% respectively and the international parity conditions hold.

You are required to

- Identify expected future cash flows in China and determine NPV of the project in CN¥.
- Determine whether Opus Technologies should go for the project or not, assuming that there neither there is any restriction nor any charges/taxes payable on the transfer of funds from China to India.

Answer:**WN 1: Computation of initial outflow:**

Particulars	Amount (CNY)
Land	30,00,000
Office Complex	15,00,000
Total Outflow	45,00,000

WN 2: In-between cash flows:

Particulars	Year 1	Year 2
Annual units	10,000	10,000
Selling price	540.00	583.20
Sales	54,00,000	58,32,000
Less: Variable cost (40%)	(21,60,000)	(23,32,800)
Less: Depreciation (15,00,000/2)	(7,50,000)	(7,50,000)
Less: Fixed Cost	(23,76,000)	(25,66,080)
Profit before tax	1,14,000	1,83,120
Less: Tax @ 25%	(28,500)	(45,780)
Profit After Tax	85,500	1,37,340
Add: Depreciation	7,50,000	7,50,000
CFAT	8,35,500	8,87,340

WN 3: Terminal Cash Flow:

Particulars	Land	Building
Sale value	35,00,000	5,00,000
Less: Book value	(30,00,000)	0
Capital gain	5,00,000	5,00,000
Tax paid @ 25%	1,25,000	1,25,000
Net salvage value	33,75,000	3,75,000

WN 4: Computation of cost of capital:

$$K_e = \left(\frac{D_1}{P_0 - F} \right) + \text{Growth rate}$$

$$K_e = \left(\frac{2.75 \times 5}{1,000 - 10} \right) + 0.10 = 0.1139 \text{ (or) } 11.39\%$$

WN 5: Computation of NPV in CNY:

Year	Cash flow	PVF @ 11.39%	DCF
0	(45,00,000)	1	(45,00,000)
1	8,35,500	0.898	7,50,279
2	46,37,340 [8,87,340+33,75,000+3,75,000]	0.806	37,37,696
NPV in CNY			(12,025)

Conclusion: The project should not be accepted as the project has negative NPV.

WN 6: Analysis of NPV in INR:**Note 1: Computation of Exchange Rate:**

Year	Calculation	Rate
1	$9.50 \times \frac{1.12}{1.10}$	9.67
2	$9.67 \times \frac{1.12}{1.10}$	9.85

Note 2: Computation of INR Discount rate:**CNY rate analysis:**

$$(1 + R_f) \times (1 + R_p) = (1 + \text{Risky Rate})$$

$$(1 + 10\%) \times (1 + R_p) = (1 + 11.39\%)$$

$$(1 + R_p) = \frac{1 + 11.39\%}{1 + 10\%}; 1 + R_p = 1.0126; \text{Risk Premium} = 1.26\%$$

INR Rate Analysis:

$$(1 + 12\%) \times (1 + R_p) = (1 + \text{Risky Rate})$$

$$(1 + 12\%) \times (1 + 1.26\%) = (1 + \text{Risky Rate})$$

$$1 + \text{Risky Rate} = 1.1341; \text{Risky Rate} = 13.41\%$$

Note 3: Computation of NPV in INR:**Option 1: Cash flows in CNY are repatriated in the same year:**

Year	CNY CF	Exchange rate	INR CF	PVF @ 13.41%	DCF
0	(45,00,000)	9.50	(4,27,50,000)	1	(4,27,50,000)
1	8,35,500	9.67	80,79,285	0.882	71,25,929
2	46,37,340	9.85	4,56,77,799	0.777	3,54,91,650
Project NPV					(1,32,421)

Conclusion: The company should not go ahead with project as the project has negative NPV of Rs.1,32,421

Option 2: Cash flows in CNY are repatriated at end of the project:

Year	CNY CF	Exchange rate	INR CF	PVF @ 13.41%	DCF
0	(45,00,000)	9.50	(4,27,50,000)	1	(4,27,50,000)
1		9.67		0.882	
2	54,72,840	9.85	5,39,07,474	0.777	4,18,86,107
Project NPV					(8,63,893)

Conclusion: The company should not go ahead with project as the project has negative NPV of Rs.8,63,893

Author's Note: ICAI solution to this question is wrong and they have taken nominal interest rate of 12% for computation of NPV in INR

10. International capital budgeting:

Its Entertainment Ltd., an Indian Amusement Company is happy with the success of its Water Park in India. The company wants to repeat its success in Nepal also where it is planning to establish a Grand Water Park with world class amenities. The company is also encouraged by a marketing research report on which it has just spent Rs. 20,00,000.

The estimated cost of construction would be Nepali Rupee (NPR) 450 crores and it would be completed in one years time. Half of the construction cost will be paid in the beginning and rest at the end of year. In addition, working capital requirement would be NPR 65 crores from the year end one. The after tax realizable value of fixed assets after four years of operation is expected to be NPR 250 crores. Under the Foreign Capital Encouragement Policy of Nepal, company is allowed to claim 20% depreciation allowance per year on reducing balance basis subject to maximum capital limit of NPR 200 crore. The company can raise loan for theme park in Nepal @ 9%.

The water park will have a maximum capacity of 20,000 visitors per day. On an average, it is expected to achieve 70% capacity for first operational four years. The entry ticket is expected to be NPR 220 per person. In addition to entry tickets revenue, the company could earn revenue from sale of food and beverages and fancy gift items. The average sales expected to be NPR 150 per visitor for food and beverages and NPR 50 per visitor for fancy gift items. The sales margin on food and beverages and fancy gift items is 20% and 50% respectively. The park would open for 360 days a year.

The annual staffing cost would be NPR 65 crores per annum. The annual insurance cost would be NPR 5 crores. The other running and maintenance costs are expected to be NPR 25 crores in the first year of operation which is expected to increase NPR 4 crores every year. The company would apportion existing overheads to the tune of NPR 5 crores to the park.

All costs and receipts (excluding construction costs, assets realizable value and other running and maintenance costs) mentioned above are at current prices (i.e. 0 point of time) which are expected to increase by 5% per year.

The current spot rate is NPR 1.60 per Rs. The tax rate in India is 30% and in Nepal it is 20%. The current WACC of the company is 12%. The average market return is 11% and interest rate on treasury bond is 8%. The company's current equity beta is 0.45. The company's funding ratio for the Water Park would be 55% equity and 45% debt.

Being a tourist Place, the amusement industry in Nepal is competitive and very different from its Indian counterpart. The company has gathered the relevant information about its nearest competitor in Nepal. The competitor's market value of the equity is NPR 1850 crores and the debt is NPR 510 crores and the equity beta is 1.35.

State whether Its Entertainment Ltd. should undertake Water Park project in Nepal or not.

Answer:

WN 1: Computation of Asset Beta of Competitor:

Security	Beta	Weight	Product
Equity	1.35	1850	2,497.50
Debt	0	408 [510 × 0.80]	0
Firm	1.106	2,258	2,497.50

Note: We have used tax rate of Nepal for computing weight of debt in Nepal. This is because the competitor is based out of Nepal

WN 2: Computation of Equity Beta of Its Entertainment Limited:

Security	Beta	Weight	Product
Equity	1.83	0.55	1.006
Debt	0	0.36 [0.45 × 0.80]	0
Firm	1.106	0.910	1.006

Note: Weight for Debt is taken as Debt × (1 – Tax rate of Nepal)

WN 3: Computation of WACC of Project:

Source	Cost	Weight	Product
Equity	13.49	0.55	7.42
Debt	7.20 [9% × 0.80]	0.45	3.24
Firm			10.66

$$\diamond \text{ Cost of equity} = R_f + \text{beta} \times (R_m - R_f) = 8\% + 1.83 \times (11\% - 8\%) = 13.49\%$$

WN 4: Initial outflow:

Particulars	Amount (in Cr)
Construction cost (450/2)	-225
Total initial outflow	-225

WN 5: In-between cash flows:

(in crores)

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5
Annual visitors (20,000 × 70% × 360)		0.504	0.504	0.504	0.504
Ticket price (220 of Y0 plus inflation)		242.55	254.68	267.41	280.78
Profit on beverages (30 of Y0 plus inflation)		33.08	34.73	36.47	38.29
Profit on fancy items (25 of Y0 plus inflation)		27.56	28.94	30.39	31.91
Revenue per visitor		303.19	318.35	334.27	350.98
Total revenues (No of visitors × revenues/visitor)		152.81	160.45	168.47	176.89
Less: Staff cost [65 Cr of Y0 plus inflation)		71.66	75.25	79.01	82.96
Less: Insurance cost [5 Cr of Y0 plus inflation)		5.51	5.79	6.08	6.38
Less: Running and maintenance cost		25.00	29.00	33.00	37.00
Less: Depreciation (Note 1)		40.00	32.00	25.60	20.48

Profit before tax		10.64	18.41	24.78	30.07
Less: Tax @ 20%		-2.13	-3.68	-4.96	-6.01
Profit after tax		8.51	14.73	19.82	24.06
Add: Depreciation		40.00	32.00	25.60	20.48
CFAT	0.00	48.51	46.73	45.42	44.54
Less: Construction cost	-225.00				
Less: Working capital	-65.00	-3.25	-3.41	-3.59	
Revised CFAT	-290.00	45.26	43.32	41.83	44.54

Note 1: Computation of depreciation:

Particulars	Year 2	Year 3	Year 4	Year 5
Opening balance	200.00	160.00	128.00	102.40
Less: Depreciation @ 20%	40.00	32.00	25.60	20.48
Closing balance	160.00	128.00	102.40	81.92

Note 2: Computation of working capital requirement:

Particulars	Year 2	Year 3	Year 4
Opening balance	65.00	68.25	71.66
Closing balance (Opening + Inflation)	68.25	71.66	75.25
Increase in working capital	3.25	3.41	3.59

WN 6: Terminal flow:

Particulars	Amount
Realizable value of fixed assets	250
Recapture of working capital	75.25
Total terminal flow	325.25

WN 7: Computation of NPV:

Year	Cash flow	PVF @ 10.66%	DCF
0	-225	1	-225.00
1	-290	0.904	-262.16
2	45.26	0.817	36.98
3	43.32	0.738	31.97
4	41.83	0.667	27.91
5	369.79	0.603	222.98
			-167.32

Conclusion: The company should not go ahead with project as the same generates negative NPV of NPR 167.32 crores.

11. NPV computation in foreign currency:

LB Inc is considering a new plant in the Netherlands the plant will cost 26 million Euros. Incremental cash flows are expected to be 3 million Euros per year for the first 3 years, 4 million Euros the next three, 5 million Euros in year 7 through 9 and 6 million Euros in years 10 through 19, after which the project will terminate with no residual value. The present exchange rate is 1.90 EUROS per USD. The required rate of return on repatriated USD is 16%.

- If the exchange rate stays at 1.90, what is the project's NPV?
- If the Euro appreciates to 1.84 for years 1 to 3, to 1.78 for years 4 to 6, to 1.72 for years 7 to 9, and to 1.65 for years 10 to 19, what happens to the NPV?

Answer:

WN 1: Computation of NPV if exchange rate remains at 1.90:

Year	Cash flow (Euro)	Exchange rate	Cash flow (USD)	PVF @ 16%	DCF
0	-26	1.9	-13.68	1	-13.68
1	3	1.9	1.58	0.862	1.36
2	3	1.9	1.58	0.743	1.17
3	3	1.9	1.58	0.641	1.01
4	4	1.9	2.11	0.552	1.16

5	4	1.9	2.11	0.476	1
6	4	1.9	2.11	0.41	0.87
7	5	1.9	2.63	0.354	0.93
8	5	1.9	2.63	0.305	0.8
9	5	1.9	2.63	0.263	0.69
10	6	1.9	3.16	0.227	0.72
11	6	1.9	3.16	0.195	0.62
12	6	1.9	3.16	0.168	0.53
13	6	1.9	3.16	0.145	0.46
14	6	1.9	3.16	0.125	0.4
15	6	1.9	3.16	0.108	0.34
16	6	1.9	3.16	0.093	0.29
17	6	1.9	3.16	0.08	0.25
18	6	1.9	3.16	0.069	0.22
19	6	1.9	3.16	0.06	0.19
Project NPV					-0.67

WN 2: Computation of NPV for scenario II:

Year	Cash flow (Euro)	Exchange rate	Cash flow (USD)	PVF @ 16%	DCF
0	-26	1.9	-13.68	1	-13.68
1	3	1.84	1.63	0.862	1.41
2	3	1.84	1.63	0.743	1.21
3	3	1.84	1.63	0.641	1.04
4	4	1.78	2.25	0.552	1.24
5	4	1.78	2.25	0.476	1.07
6	4	1.78	2.25	0.41	0.92
7	5	1.72	2.91	0.354	1.03
8	5	1.72	2.91	0.305	0.89
9	5	1.72	2.91	0.263	0.77
10	6	1.65	3.64	0.227	0.83
11	6	1.65	3.64	0.195	0.71
12	6	1.65	3.64	0.168	0.61
13	6	1.65	3.64	0.145	0.53
14	6	1.65	3.64	0.125	0.46
15	6	1.65	3.64	0.108	0.39
16	6	1.65	3.64	0.093	0.34
17	6	1.65	3.64	0.08	0.29
18	6	1.65	3.64	0.069	0.25
19	6	1.65	3.64	0.06	0.22
Project NPV					0.53

12. International capital budgeting:

OJ Ltd. Is a supplier of leather goods to retailers in the UK and other Western European countries. The company is considering entering into a joint venture with a manufacturer in South America. The two companies will each own 50 per cent of the limited liability company JV(SA) and will share profits equally. £ 450,000 of the initial capital is being provided by OJ Ltd. and the equivalent in South American dollars (SA\$) is being provided by the foreign partner. The managers of the joint venture expect the following net operating cash flows, which are in nominal terms:

Particulars	SA\$ 000	Forward Rates of exchange to GBP
Year 1	4,250	10
Year 2	6,500	15
Year 3	8,350	21

For tax reasons JV(SV) the company to be formed specifically for the joint venture, will be registered in South America. Ignore taxation in your calculations.

Assuming you are financial adviser retained by OJ Limited to advise on the proposed joint venture.

(i) Calculate the NPV of the project under the two assumptions explained below. Use a discount rate of 16 per cent for both assumptions.

Assumption 1: The South American country has exchange controls which prohibit the payment of dividends above 50 per cent of the annual cash flows for the first three years of the project. The accumulated balance can be repatriated at the end of the third year.

Assumption 2: The government of the South American country is considering removing exchange controls and restriction on repatriation of profits. If this happens all cash flows will be distributed as dividends to the partner companies at the end of each year.

(ii) Comment briefly on whether or not the joint venture should proceed based solely on these calculations.

Answer:

WN 1: Computation of NPV with exchange controls:

(in '000s)

Year	Project cash flow (SA \$)	OJ' share	Dividends	Exchange rate	Cash flow (GBP)	PVF @ 16%	DCF
0	-9000	-4500		10	-450	1	-450
1	4250	2125	1063	10	106	0.862	91.37
2	6500	3250	1625	15	108	0.743	80.24
3	8350	4175	2088	21	99	0.641	63.46
3			4775	21	227	0.641	145.51
Project NPV							-69.42

❖ Year 3 repatriated amount = 9,550 (Cumulative cash flows of 3 years) – Dividends paid

❖ Project will not be acceptable as it generates Negative NPV

WN 2: Computation of NPV without exchange controls:

(in '000s)

Year	Project cash flow (SA \$)	OJ' share	Exchange rate	Cash flow (GBP)	PVF @ 16%	DCF
0	-9000	-4500	10	-450	1	-450
1	4250	2125	10	213	0.862	183.61
2	6500	3250	15	217	0.743	161.23
3	8350	4175	21	199	0.641	127.56
Project NPV						22.4

❖ Project will be acceptable as it generates positive NPV

Conclusion:

If exchange controls exist in the south American Country the project has a negative NPV and should not be undertaken. Investing in countries with a history of high inflation and political volatility adds to the risk of the project and OJ Limited should proceed with caution.

13. International capital budgeting:

An Indian company is planning to set up a subsidiary in US. The initial project cost is estimated to be US \$40 million; Working Capital required is estimated to be \$4 million. The finance manager of company estimated the data as follows:

Variable Cost of Production (Per Unit Sold)	USD 2.50
Fixed cost per annum	USD 3 million
Selling Price	USD 10
Production capacity	5 million units
Expected life of Plant	5 years
Method of Depreciation	SLM
Salvage Value at the end of 5 years	NIL

The subsidiary of the Indian company is subject to 40% corporate tax rate in the US and the required rate of return of such types of project is 12%. The current exchange rate is Rs.48/US\$ and the USD is expected to appreciate by 3% per annum for next five years.

The subsidiary company shall be allowed to repatriate 70% of the CFAT every year along with the accumulated arrears of blocked funds at the end of 5 years, the withholding taxes are 10%. The blocked fund will be invested in the USA money market by the subsidiary, earning 4% (free of taxes) per year. Determine the feasibility of having a subsidiary company in the USA, assuming no tax liability in India on earnings received by the parent company from the US subsidiary.

Answer:**WN 1: Initial outflow:**

Particulars	Amount (in million)
Plant and Machinery	40
Working capital	4
Total outflow in USD	44
Exchange rate	48
Total outflow in INR	2,112

WN 2: In-between flows:

Particulars	Calculation	Amount
Sales revenues	5 million x 10	50.00
Less: Variable cost	5 million x 2.5	(12.50)
Less: Fixed cost		(3.00)
Less: Depreciation		(8.00)
Profit before tax		26.50
Less: Tax @ 40%		(10.60)
Profit after tax		15.90
Add: Depreciation		8.00
CFAT		23.90
Repatriable amount	23.90 x 70%	16.73
Less: Withholding tax @ 10%	16.73 x 10%	-1.673
Amount repatriated		15.057

WN 3: Terminal cash flow:

Particulars	Amount
Non-repatriated amount of year 1 (7.17×1.04^4)	8.39
Non-repatriated amount of year 2 (7.17×1.04^3)	8.07
Non-repatriated amount of year 3 (7.17×1.04^2)	7.76
Non-repatriated amount of year 4 (7.17×1.04^1)	7.46
Normal cash flow of year 5	23.90
Total non-repatriated amount of year 1 to 4	55.58
Less: Withholding tax @ 10%	-5.56
Operating cash flow repatriable in year 5	50.02
Add: Release of working capital	4.00
Amount repatriated in year 5	54.02

WN 4: Computation of NPV:

Year	Cash flow (USD)	Exchange rate	Cash flow (INR)	PVF @ 12%	DCF
0	-44	48	-2112	1	-2112
1	15.057	49.44	744.42	0.893	664.77
2	15.057	50.92	766.7	0.797	611.06
3	15.057	52.45	789.74	0.712	562.29
4	15.057	54.02	813.38	0.636	517.31
5	54.02	55.64	3005.67	0.567	1704.21
					1947.64

Conclusion: The company should go ahead with the investment as the project generates positive NPV.

14. Computation of effective borrowing rate [May 2019]

K Ltd. currently operates from 4 different buildings and wants to consolidate its operations into one building

which is expected to cost Rs. 90 crores. The Board of K Ltd. had approved the above plan and to fund the above cost, agreed to avail an External Commercial Borrowing (ECB) of GBP 10 m from G Bank Ltd. on the following conditions:

- The Loan will be availed on 1st April, 2019 with interest payable on half yearly rest.
- Average Loan Maturity life will be 3.4 years with an overall tenure of 5 years.
- Upfront Fee of 1.20%.
- Interest Cost is GBP 6 months LIBOR + Margin of 2.50%.
- The 6-month LIBOR is expected to be 1.05%.

K Ltd. also entered into a GBP-INR hedge at 1 GBP = INR 90 to cover the exposure on account of the above ECB Loan and the cost of the hedge is coming to 4.00% p.a. As a Finance Manager, given the above information and taking the 1 GBP = INR 90:

(i) Calculate the overall cost both in percentage and rupee terms on an annual basis.

(ii) What is the cost of hedging in rupee terms?

(iii) If K Ltd. wants to pursue an aggressive approach, what would be the net gain/loss for K Ltd. if the INR depreciates/appreciates against GBP by 10% at the end of the 5 years assuming that the loan is repaid in GBP at the end of 5 years?

Ignore time value and taxes and calculate to two decimals.

Answer:

WN 1: Computation of overall cost both in percentage and rupee terms:

Particulars	Calculation	Amount
Upfront premium	10 million × 1.20%	GBP 0.12 million
Interest cost	10 million × 3.55% × 3.4 years	GBP 1.207 million
Hedging cost	10 million × 4% × 3.4 years	GBP 1.36 million
Total cost for 3.4 years		GBP 2.687 million
Total cost for 1 year	2.687/3.4	GBP 0.7903 million
Loan Taken		GBP 10 million
Effective rate (%)	(0.7903/10) × 100	7.903%
Effective cost (INR) for 3.4 years	2.687 × 90	INR 241.83 million
Effective cost (INR) per annum	241.83/3.4 years	INR 71.127 million

WN 2: Computation of cost of hedging in rupee terms:

- Hedging cost for 3.4 years = GBP 1.36 million
- Hedging cost in INR = 1.36 million × 90 = INR 122.40 million
- **Hedging cost per year = GBP 10 million × 4% × 90 = INR 36 million**

WN 3: Gain/loss if INR depreciates by 10%

- The company has taken a loan in GBP. They have taken an aggressive approach and this would mean that hedging is not done
- Liability of company is in GBP.
- Spot rate is INR 90/GBP (or) GBP 0.011111/INR
- INR has depreciated by 10% and hence revised rate is **GBP 0.01/INR (or) INR 100/GBP**
- INR has depreciated by 10% and this has increased the loan liability to Rs.100 Crores.
- Loss due to currency movement = Rs.10 crores
- The company has not hedged the loan exposure and hence they will save hedging cost of Rs.12.24 crores (WN 2)
- **Net gain = 12.24 crores - 10 Crores = Rs.2.24 crores**

WN 4: Gain/loss if INR appreciates by 10%:

- The company has taken a loan in GBP. They have taken an aggressive approach and this would mean that hedging is not done.
- Liability of company is in GBP.
- Spot rate is INR 90/GBP (or) GBP 0.011111/INR
- INR has appreciated by 10% and hence revised rate is **GBP 0.012222/INR (or) INR 81.82/GBP**
- INR has appreciated and this would reduce the loan liability to Rs.81.82 Crores.
- Gain due to currency movement = Rs.8.18 crores
- The company has not hedged the loan exposure and hence they will save hedging cost of Rs.12.24 crores (WN 2)

- Total gain = 12.24 crores + 8.18 Crores = Rs.20.42 crores

15. International financial management:

An MNC company in USA has surplus funds to the tune of USD 10 million for six months. The finance director of the company is interested in investing in EURO for higher returns. There is DTAA in force between USA and Germany. The company received the following information from London:

Particulars	Amount
EURO/USD Spot	0.4040/41
6 months forward	67/65
Rate of interest for 6 months (p.a.)	5.95%-6.15%
Withholding tax applicable for interest income	22%
Tax as per DTAA	10%

If the company invests in EUR, what is the gain for the company?

Answer:

Computation of net gain for the company:

Particulars	Calculation	Amount
Surplus in USD		1,00,00,000 USD
Euro investment	$1,00,00,000 \times 0.4040$	40,40,000 EUR
Interest earned	$40,40,000 \times 5.95\% \times 6/12$	1,20,190 EUR
Less: Withholding tax as per DTAA	$1,20,190 \times 10\%$	-12,109 EUR
Net interest earned		1,08,171 EUR
Net amount available for repatriation	40,40,000 + 1,08,171	41,48,171 EUR
Amount converted into USD at forward rate	$\frac{41,48,171}{0.3976}$	1,04,33,026 USD
Amount earned in USD		4,33,026 USD

16. Capital Budgeting [Jan 2021]

A proposed foreign investment involves creation of a plant with an annual output of 1 million units. The entire production will be exported at a selling price of USD 10 per unit. At the current rate of exchange dollar cost of local production equals to USD 6 per unit. Dollar is expected to decline by 10% or 15%. The change in local cost of production and probability from the expected current level will be as follows:

Decline in value of USD (%)	Reduction in local cost of production (USD/unit)	Probability
0	-	0.40
10	0.30	0.40
15	0.15 [Additional Reduction]	0.20

The plant at the current rate of exchange will have a depreciation of USD 1 million annually. Assume local Tax rate as 30%.

You are required to find:

- Annual Cash Flow After Tax (CFAT) under all the different scenarios of exchange rate.
- Expected value of CFAT assuming no repatriation of profits.
- Viability of the investment proposal assuming an initial investment of USD 25 million on plant and working capital with a required rate of return of 11% on investment and on the basis of CFAT arrived under option (ii). The CFAT will grow @ 3% per annum in perpetuity.

Answer:

WN 1: Computation of CFAT under different scenarios:

Particulars	Scenario 1	Scenario 2	Scenario 3
Annual output	10,00,000	10,00,000	10,00,000
Selling price	10.00	10.00	10.00
Cost price	-6.00	-5.70 [6 - 0.30]	-5.55 [5.70 - 0.15]
Gross profit per unit	4.00	4.30	4.45
Total gross profit	40,00,000	43,00,000	44,50,000
Less: Depreciation	-10,00,000	-9,00,000 [10,00,000 - 10%]	-8,50,000 [10,00,000 - 15%]
Profit before tax	30,00,000	34,00,000	36,00,000
Less: Tax @ 30%	-9,00,000	-10,20,000	-10,80,000

Profit after tax	21,00,000	23,80,000	25,20,000
Add: Depreciation	10,00,000	9,00,000	8,50,000
Cash flow after taxes	31,00,000	32,80,000	33,70,000

WN 2: Computation of expected value of CFAT:

- Expected CFAT = $(31,00,000 \times 0.40) + (32,80,000 \times 0.40) + (33,70,000 \times 0.20)$
- Expected CFAT = USD 32,26,000

WN 3: Analysis of viability of investment proposal:

Particulars	Calculation	Amount
PV of inflow [growing perpetuity]	$\frac{(32,26,000 + 3\%)}{11\% - 3\%}$	4,15,34,750
Less: Investment cost		-2,50,00,000
NPV of Project		1,65,34,750

- Since NPV is positive, project is viable

Note: It is assumed that 32,26,000 is current CFAT and hence growth of 3 percent is applied

17. Capital budgeting with withholding taxes [Jan 2021]:

X Ltd., an Indian company, is considering a proposal to make an investment of USD 1,65,00,000 in Latin America. The project will have a life of 5 years. The current spot exchange rate is INR/USD 72. All investments and revenues will occur in USD. The USD and INR risk free rates are 8% and 12% respectively. The following cash flow is expected from the project

Year	Cash inflow (USD)
1	30,00,000
2	37,50,000
3	45,00,000
4	60,00,000
5	75,00,000

Assume required rate of return on the project as 14%.

You are required to calculate:

- The viability of the project using foreign currency approach.
- What will be the impact if there is a withholding tax of 10% applicable on the project.

Answer:**WN 1: Computation of required rate of return in USD:**

- It is assumed that required rate of return of 14% is INR return
- Risk premium of the project is computed as under:

$$(1 + R_f) \times (1 + \text{risk premium}) = (1 + \text{risky rate})$$

$$(1 + 0.12) \times (1 + \text{risk premium}) = (1 + 0.14)$$

$$(1 + \text{risk premium}) = \frac{1.14}{1.12} = 1.0179; \text{Risk premium} = 0.0179 \text{ (or) } 1.79\%$$

- Required return in USD is computed as under:

$$(1 + R_f) \times (1 + \text{risk premium}) = (1 + \text{risky rate})$$

$$(1 + 0.08) \times (1 + 0.0179) = (1 + \text{risky rate})$$

$$(1 + \text{risky rate}) = 1.099; \text{Risky rate} = 0.099 \text{ (or) } 9.90\%$$

- Hence the required return for USD cash flows is 9.90% and return for INR cash flows is 14%

WN 2: Computation of NPV using foreign currency approach:

- X Limited is assumed to be based out of India and hence foreign currency is USD

Year	Cash flow	PVF @ 9.90%	DCF
0	-1,65,00,000	1.000	-1,65,00,000
1	30,00,000	0.910	27,30,000
2	37,50,000	0.828	31,05,000
3	45,00,000	0.753	33,88,500
4	60,00,000	0.686	41,16,000
5	75,00,000	0.624	46,80,000

NPV in USD	15,19,500
NPV in INR [15,19,500 x 72]	10,94,04,000

- Company can go ahead with project as NPV is positive

WN 3: Computation of revised NPV with withholding tax of 10%:

Particulars	Calculation	Amount
PV of inflows [WN 2]		1,80,19,500
Less: Withholding tax @ 10%		-18,01,950
Revised cash inflows		1,62,17,550
Less: Cost of project		-1,65,00,000
NPV in USD		-2,82,450
NPV in INR	2,82,450 x 72	-2,03,36,400

- Project is not viable as the same has negative NPV

18. Home currency and foreign currency approach [Dec 2021]

DK Ltd. is considering an investment proposal in Sri Lanka involving an initial investment of LKR 25 billion. The current spot exchange rate is INR/LKR 0.37. The risk free rate in India is 6% and the same in Sri Lanka is 5.02%. The project will generate a cash flow of LKR 5 billion in the first year. The cash flow will increase by LKR 1 billion each year for the next 4 years. The project will bind up on completion of 5 years with no salvage value.

The required rate of return for the project is 8%

(i) You are required to find out the investment worth of the project by (1) Home Currency Approach (2) Foreign Currency Approach

(ii) Compare the outcome under both the approaches.

Note: Use five decimal for PVF

Answer:

WN 1: Computation of NPV under home currency approach (INR):

Note 1: Computation of forward exchange rates:

Year 0		INR 0.37/LKR
Year 1	$0.37 \times \frac{1.06}{1.052}$	INR 0.373/LKR
Year 2	$0.373 \times \frac{1.06}{1.052}$	INR 0.376/LKR
Year 3	$0.376 \times \frac{1.06}{1.052}$	INR 0.380/LKR
Year 4	$0.380 \times \frac{1.06}{1.052}$	INR 0.384/LKR
Year 5	$0.384 \times \frac{1.06}{1.052}$	INR 0.388/LKR

Note 2: Computation of NPV:

Year	LKR CF	ER	INR CF	PVF @ 8%	DCF
0	-25.00	0.370	-9.2500	1.00000	-9.2500
1	5.00	0.373	1.8650	0.92593	1.7269
2	6.00	0.376	2.2560	0.85734	1.9342
3	7.00	0.380	2.6600	0.79383	2.1116
4	8.00	0.384	3.0720	0.73503	2.2580
5	9.00	0.388	3.4920	0.68058	2.3766
NPV of Project					1.1573

Note: It is assumed that given return of 8 percent is INR return

WN 2: Computation of NPV using foreign currency approach:

Note 1: Computation of LKR Discount Rate:

$$(1 + R_f) \times (1 + \text{risk premium}) = (1 + \text{risky rate})$$

$$(1 + 0.06) \times (1 + \text{risk premium}) = (1 + 0.08)$$

$$(1 + \text{risk premium}) = \frac{1.08}{1.06} = 1.0189; \text{Risk premium} = 0.0189 \text{ (or) } 1.89\%$$

- Required return in LKR is computed as under:

$$(1 + R_f) \times (1 + \text{risk premium}) = (1 + \text{risky rate})$$

$$(1 + 0.0502) \times (1 + 0.0189) = (1 + \text{risky rate})$$

$$(1 + \text{risky rate}) = 1.0700; \text{Risky rate} = 0.07 \text{ (or) } 7.00\%$$

Note 2: Computation of NPV in LKR:

Year	LKR CF	PVF @ 7%	DCF
0	-25.00	1.00000	-25.0000
1	5.00	0.93457	4.6729
2	6.00	0.87344	5.2406
3	7.00	0.81630	5.7141
4	8.00	0.76290	6.1032
5	9.00	0.71299	6.4169
NPV in LKR			3.1477

Comparison of NPV:

$$\text{NPV in INR} = \text{NPV in LKR} \times \text{Current Spot rate}$$

$$\text{NPV in INR} = 3.1477 \times 0.3700 = \text{INR 1.1646 billion}$$

Conclusion:

NPV is positive and hence project is worth investing.

19. Computation of NPV [Dec 2021]

A US company wants to setup a manufacturing plant in India which requires an initial outlay of Rs. 8 Million. It is expected to have a useful life of 5 years with a salvage of Rs. 2 Million. The company follows straight line method of depreciation. To support additional level of activity, investment would require one-time additional working capital of Rs. 1 Million.

Since the cost of production lower in India, the variable cost of production would be Rs. 30 per unit. Additional fixed cost per annum is estimated at Rs. 0.5 Million. The company is projecting its annual sales to 80,000 units at the price of Rs. 100 per unit. Applicable tax rate to the company is 34% and its cost of capital is 8%.

Inflation rates in US and India are expected to be 8% and 9% respectively. The current exchange rate is Rs. 72 per US Dollar.

Assuming that all profit will be repatriated every year and there will be no withholding taxes, estimate the net present value of the proposed project in India and evaluate its feasibility.

Answer:

WN 1: Computation of cash flows in INR:

Step 1: Initial outflow:

Particulars	Amount
Capital expenditure	-80,00,000
Working capital	-10,00,000
Initial outflow	-90,00,000

Step 2: In-between flows:

Particulars	Amount
Revenues (80,000 x 100)	80,00,000
Less: Variable cost (80,000 x 30)	-24,00,000
Less: Fixed cost	-5,00,000
Less: Depreciation	-12,00,000
Profit before tax	39,00,000
Less: Tax @ 34%	-13,26,000
Profit after tax	25,74,000
Add: Depreciation	12,00,000
Cash flow after tax	37,74,000

Step 3: Terminal flow:

Particulars	Amount
Net salvage value	20,00,000
Recapture of Working capital	10,00,000
Terminal flow	30,00,000

WN 2: Computation of exchange rates:

Year 0		INR 72.00/USD
Year 1	$72.00 \times \frac{1.09}{1.08}$	INR 72.67/USD
Year 2	$72.67 \times \frac{1.09}{1.08}$	INR 73.34/USD
Year 3	$73.34 \times \frac{1.09}{1.08}$	INR 74.02/USD
Year 4	$74.02 \times \frac{1.09}{1.08}$	INR 74.71/USD
Year 5	$74.71 \times \frac{1.09}{1.08}$	INR 75.40/USD

WN 3: Computation of NPV in USD:

Year	INR CF	ER	USD CF	PVF @ 8%	DCF
0	-90,00,000	72.00	-1,25,000.00	1.000	-1,25,000.00
1	37,74,000	72.67	51,933.40	0.926	48,090.33
2	37,74,000	73.34	51,458.96	0.857	44,100.33
3	37,74,000	74.02	50,986.22	0.794	40,483.06
4	37,74,000	74.71	50,515.33	0.735	37,128.77
5	67,74,000	75.40	89,840.85	0.681	61,181.62
NPV of Project					1,05,984.11

Since the NPV of the project is positive, it is feasible

20. Evaluation of import decision [Dec 2021]

DD Ltd. a company based in India manufactures good quality of leather bags and sells to retail outlets in India and USA. The cost of quality leather in India is very high, the company is reviewing the proposal of importing of leather in bulk from USA supplier. The estimate of net US \$ and Indian Rs. Currency Cash Flows in nominal terms for this proposal is given below:

	Net cash flow (in Lakh)			
Year	0	1	2	3
In USD	-25.00	5	7	8
In INR	0	60	80	90
If not imported cost of leather to be imported in India	400	450	500	600

Other information:

- (i) DD Ltd. evaluates all investments by using discount rate of 9% p.a.
 - (ii) All US customers are invoiced in US \$. US \$ Cash flows converted into Rs. at the forward rate and discounted at Indian Rate.
 - (iii) Inflation in USA and India are expected to be 9% and 8% respectively.
 - (iv) The current exchange rate 1 US \$ = Rs. 74
- You are required to Calculate Net Present Value and recommend the decision.

Answer:**WN 1: Computation of exchange rates:**

Year 0		INR 74.00/USD
Year 1	$74.00 \times \frac{1.08}{1.09}$	INR 73.32/USD
Year 2	$73.32 \times \frac{1.08}{1.09}$	INR 72.65/USD
Year 3	$72.65 \times \frac{1.08}{1.09}$	INR 71.98/USD

WN 2: Computation of INR cash flows:

Particulars	Year 0	Year 1	Year 2	Year 3
USD cash flow	-25.00	5.00	7.00	8.00
Exchange rate	74.00	73.32	72.65	71.98
Cash flows in INR (a)	-1,850.00	366.60	508.55	575.84
INR local cash flow (b)	-	60.00	80.00	90.00
Saving in INR leather cost due to import (c)	400.00	450.00	500.00	600.00
Total cash flow in INR (a+b+c)	-1,450.00	876.60	1,088.55	1,265.84

WN 3: Computation of NPV in INR:

Year	INR CF	PVF @ 9%	DCF
0	-1,450.00	1.000	-1,450.00
1	876.60	0.917	803.84
2	1,088.55	0.842	916.56
3	1,265.84	0.772	977.23
NPV of Project			1,247.63

Conclusion: We should go ahead with the proposal of importing as the same leads to positive NPV.

Author's Note: The above solution does not match with ICAI solution as there are logical errors in suggested answers.

Chapter 12 – Interest rate risk Management**1. How interest rates are determined?**

- **Supply and Demand of money:** When economic growth is high, demand for money increases, pushing the interest rates up and vice versa.
- **Inflation:** The higher the inflation rate, the more interest rates are likely to rise.
- **Government:** Government is the biggest borrower. The level of borrowing also determines the interest rates. Central bank i.e. RBI by either printing more notes or through its Open Market Operations (OMO) changes the key rates (CRR, SLR and bank rates) depending on the state of the economy or to combat inflation.

2. Explain the concept of Benchmark Rates?

- Benchmark interest is an interest rate that forms the basis for determination of other interest rates. These rates are also known as ‘Reference Rates’
- It is crucial in economic and banking systems, particularly in financial transactions. These rates are used in derivative transactions, floating rate loans, and are determined by an independent body. Benchmark rates are used in both domestic and international financial transactions.
- **Popular Benchmark Rates:** LIBOR was the popular benchmark rate. LIBOR (London Interbank Offered Rate), a popular benchmark rate in the international financial market, was discontinued in 2017 due to bank manipulations. Starting January 1, 2022, companies must use Alternative Reference Rates (ARRs) for contracts. ARRs are based on secured or unsecured overnight transactions, while LIBOR is unsecured and relies on panel bank judgment. ARR is considered risk-free with no term premium.
- Different ARR's are Secured Overnight Financing Rate (SOFR in USA), Sterling Overnight Index Average (SONIA in USA), Euro-Short-Term Rate (€STER in Europe), Tokyo Overnight Average Rate (TONAR in Japan) and Swiss Average Rate Overnight (SARON in Switzerland)
- **India Benchmark Rates:** India has various benchmark interest rates, including Repo Rate, Prime Lending Rate, and MCLR. MIBOR (Mumbai Inter Bank Offered Rate and MIBID (Mumbai Interbank Bid Rate) are the most common, used in derivative deals like Interest Rate Swaps, Forward Rate Agreements, and Floating Rate Debentures. These rates also form the basis for valuation of financial instruments like bonds and debentures.

3. What are the different types of interest rate risk?

Gap Exposure	❖ A <u>gap or mismatch risk</u> arises from holding assets and liabilities and off-balance sheet items with different principal amounts, maturity dates or repricing dates, thereby creating exposure to unexpected changes in the level of market interest rates. This exposure is more important in relation to banking business ❖ Positive Gap indicates that banks <u>have more interest Rate Sensitive Assets (RSAs)</u> than interest Rate Sensitive Liabilities (RSLs) ❖ Negative gap indicates that banks have more RSLs than RSAs
Basis Risk	❖ The risk that the <u>interest rate of different assets, liabilities and off-balance sheet items may change in different magnitude</u> is termed as basis risk. For example, while assets <u>may be benchmarked to Fixed Rate of Interest</u>, liabilities may be benchmarked to floating rate of interest. The degree of basis risk is <u>fairly high in respect of banks</u> that create composite assets out of composite liabilities. ❖ When the variation in market interest rate <u>causes the Net Interest Income (NII) to expand</u>, the banks have experienced <u>favourable basis shifts</u> and if the interest rate movement causes the <u>NII to contract</u>, the <u>basis has moved against</u> the banks
Embedded Option Risk	❖ <u>Significant changes in market interest rates</u> create another source of risk to banks' profitability by <u>encouraging prepayment of cash credit/demand loans/term loans and exercise of call/put options on bonds/debentures</u> and/or premature withdrawal of term deposits before their stated maturities. ❖ The <u>faster and higher the magnitude of changes in interest rate</u>, the greater will be the embedded option risk to the banks' NII.

Yield Risk	Curve	❖ In a floating interest rate scenario, <u>banks may price their assets and liabilities based on different benchmarks</u>, i.e. TBs yields, fixed deposit rates, call money rates, MIBOR, etc. ❖ In case the banks use <u>two different instruments maturing at different time horizon</u> for pricing their assets and liabilities, any <u>non-parallel movements in yield curves would affect the NII</u>
Price Risk		❖ Price risk occurs when <u>assets are sold before their stated maturities</u>. In the financial market, bond prices and yields are inversely related. The price risk is closely associated with the trading book, which is created for making profit out of short-term movements in interest rates
Reinvestment Risk		❖ Uncertainty with regard to interest rate at <u>which the future cash flows could be reinvested is called reinvestment risk</u>. Any mismatches in cash flows would expose the banks to variations in NII as the market interest rates move in different directions
Net Interest Position Risk		❖ The size of <u>non-paying liabilities is one of the significant factors contributing towards profitability of banks</u>. Where banks have more earning assets than paying liabilities, interest rate risk arises when the market interest rates adjust downwards

4. What are the various methods to hedge interest rate risk?

Traditional Methods	<u>Asset and Liability Management (ALM):</u> ❖ ALM is one of the important tools of risk management in commercial banks of India ❖ ALM is a <u>comprehensive and dynamic framework for measuring, monitoring and managing the market risk of a bank</u>. It is the management of structure of balance sheet (liabilities and assets) in such a way that the <u>net earnings from interest are maximized</u> within the overall risk preference (present and future) of the institutions. ❖ The ALM functions extend to liquidity risk management, management of market risk, trading risk management, funding and capital planning and profit planning and growth projection <u>Forward Rate Agreements (FRA):</u> ❖ Forward Rate Agreement (FRA) is an <u>agreement between two parties through which a borrower/ lender protects itself</u> from the unfavourable changes to the interest rate ❖ It is used by banks to fix interest costs on anticipated future deposits or interest revenues on variable-rate loans indexed to LIBOR ❖ It is an off-Balance Sheet instrument ❖ It does <u>not involve any transfer of principal</u>. The principal amount of the agreement is termed "notional" because, while it determines the amount of the payment, actual exchange of the principal never takes place ❖ It is settled at maturity in cash representing the profit or loss ❖ The differential amount is discounted at <u>post change (actual) interest rate as it is settled in the beginning of the period</u> not at the end
Modern Methods	<u>Interest Rate Futures (IRF):</u> ❖ An interest rate future is a contract between the buyer and seller <u>agreeing to the future delivery of any interest-bearing asset</u>. The interest rate future <u>allows the buyer and seller to lock</u> in the price of the interest-bearing asset for a future date ❖ A borrower will enter to sell a future today. Then if interest rates rise in the future, the value of the future will fall (as it is linked to the underlying asset, bond prices), and hence a profit can be made when closing out of the future (i.e. buying the future) <u>Interest Rate Options (IRO):</u> ❖ Interest rate options (Interest Rate Guarantee (IRG)) is a right not an obligation and <u>acts as insurance by allowing businesses to protect themselves against</u>

	<u>adverse interest rate movements</u> while allowing them to benefit from favourable movements. ❖ It should be noted that the <u>IRO is basically a series of FRAs which are exercisable at predetermined bench marked interest rates on each period</u> say 3 months, 6 months etc. ❖ Some of the important types of Interest Rate Options are cap option, floor option and collar option Interest Rate Swaps (IRS): ❖ In an interest rate swap, the parties to the agreement, termed the swap counterparties, <u>agree to exchange payments indexed to two different interest rates</u>. Total payments are determined by the specified notional principal amount of the swap, which is never actually exchanged

5. What are the types of interest rate swaps?

Plain Vanilla Swap	❖ This is also called as Generic Swap and it involves the exchange of a fixed rate loan to a floating rate loan. ❖ Floating rate basis can be LIBOR, MIBOR, Prime Lending Rate etc
Basis Rate Swap	❖ This is also called as Non-Generic Swap. Similar to plain vanilla swap with the difference payments based on the <u>difference between two different variable rates</u>. For example, one rate may be 1-month LIBOR and other may be 3-month LIBOR. ❖ Two legs of swap are floating but measured against different benchmarks
Asset Swap	❖ Like plain vanilla swaps with the difference <u>that it is the exchange fixed rate investments such as bonds which pay a guaranteed coupon rate with floating rate investments</u> such as an index
Amortising Swap	❖ An interest rate swap in which the notional principal for the interest payments declines during the life of the swap. ❖ They are particularly useful for borrowers <u>who have issued redeemable bonds</u> or debentures

6. What are swaptions and explain its types?

- ❖ An interest rate swaption is simply an option on an interest rate swap. It gives the holder the right but not the obligation to enter into an interest rate swap at a specific date in the future, at a particular fixed rate and for a specified term. Example: A 3-month into 5-year swaption would therefore be seen as an option to enter into a 5-year IRS, 3 months from now.
- ❖ Following are the two types of swaption contracts:
 - A fixed rate payer swaption gives the owner of the swaption the right but not the obligation to enter into a swap where they pay the fixed leg and receive the floating leg
 - A fixed rate receiver swaption gives the owner of the swaption the right but not the obligation to enter into a swap in which they will receive the fixed leg, and pay the floating leg
- ❖ Following are the uses of swaptions:
 - Swaptions can be applied in a variety of ways for both active traders as well as for corporate treasurers
 - Swap traders can use them for speculation purposes or to hedge a portion of their swap books.
 - Swaptions have become useful tools for hedging embedded optionality which is common to the natural course of many businesses.
 - Swaptions are useful to borrowers targeting an acceptable borrowing rate.
 - Swaptions are also useful to those businesses tendering for contracts.
 - Swaptions also provide protection on callable/puttable bond issues

7. What do you mean by the term 'Cheapest to Deliver' in context of Interest Rate Futures? (May 2020 MTP)

- ❖ All the deliverable bonds have different maturities and coupon rates. To make them comparable to each other, and also with the notional bond, RBI introduced Conversion Factor. Conversion factor for each deliverable bond and for each expiry at the time of introduction of the contract is being published by NSE. (Conversion Factor) x (futures price) = actual delivery price for a given deliverable bond

- ❖ The CTD is the bond **that minimizes difference between the quoted Spot Price of bond and the Futures Settlement Price (adjusted by the conversion factor)**. It is called CTD bond because it is the least expensive bond in the basket of deliverable bonds.
- ❖ CTD bond is determined **by the difference between cost of acquiring the bonds for delivery and the price received by delivering the acquired bond**. This difference gives the profit / loss of the seller of the futures.
- ❖ Profit of seller of futures = (Futures Settlement Price x Conversion factor) – Quoted Spot Price of Deliverable Bond
- ❖ Loss of Seller of futures = Quoted Spot Price of deliverable bond – (Futures Settlement Price x Conversion factor)
- ❖ **That bond is chosen as CTD bond which either maximizes the profit or minimizes the loss.**

8. Explain default risk and re-investment risk? [May 2021 MTP]

Re-investment risk:

- This risk is again akin to all those securities, which **generate intermittent cash flows in the form of periodic coupons**. The most prevalent tool deployed to measure returns over a period of time is the Yield-to-Maturity (YTM) method. **The YTM calculation assumes that the cash flows generated during the life of a security is reinvested at the rate of YTM**. The risk here is that the rate at which the interim cash flows are reinvested may fall thereby affecting the returns.
- Thus, reinvestment risk is the risk that future coupons from a bond will not be reinvested at the prevailing interest rate when the bond was initially purchased.

Default Risk:

- The event in which companies or individuals **will be unable to make the required payments on their debt obligations**. Lenders and investors are exposed to default risk in virtually all forms of credit extensions.
- **To mitigate the impact of default risk, lenders often charge rates of return that correspond the debtor's level of default risk**. The higher the risk, the higher the required return, and vice versa. This type of risk in the context of a Government security is always zero.

Theory to solve problems

Interest rate options:

Interest rate caps	❖ Buyer of an interest rate cap pays the seller a premium for the right to receive the difference in the interest cost on some notional principal amount if the market interest rate goes above a stipulated “cap” rate ❖ Cap resembles an option that it represents a right rather than an obligation to the buyer
Interest rate floors	❖ A derivative instrument which protects the buyer of the floor from losses arising from decrease in interest rates ❖ The seller of the floor compensates the buyer with a payoff when the interest rate falls below the strike rate of the floor
Interest rate collars	❖ Buyer of an interest rate collar purchases an interest rate cap while selling a floor indexed to the same interest rate ❖ Collar = Cap + Floor. This enables the borrower to restrict the maximum interest outflow. However the buyer cannot benefit from significant fall in interest rates as the minimum floor rate is to be paid ❖ <u>Collar versus Cap:</u> Cap and collar both restrict the maximum interest outflow. However the minimum interest outflow is restricted in case of collar. However investor may prefer buying a collar due to lower premium outflow as compared to a cap

Note: Option Premium for every reset period is calculated using the below formula:

$$\frac{\text{Rate of Premium}}{(\text{PVAF}(\text{Fixed rate of interest, Number of Periods}))} \times \text{Notional Amount}$$

Forward Rate Agreement (FRA):

- ❖ A forward rate agreement involves entering into an agreement with the bank under which the bank will give loan at a specified interest rate on a specified future date

- ❖ When a bank quotes a FRA it will give the rate at which it will borrow money and the rate at which it will lend money
- ❖ **Example:** Bank quotes FRA at 4%-5%. This would mean that the bank will pay 4 percent interest in future and will receive 5 percent interest in case it lends money
- ❖ 3 X 9 FRA means a customer has entered into an agreement that he would borrow/lend money after 3 months for month 4 to month 9 (6 months)
- ❖ FRA is settled on net-basis. A bank which sells an FRA agrees to pay the buyer the increased interest cost on some notional principal amount if some specified maturity of LIBOR is above stipulated forward rate on the settlement date. Conversely the buyer agrees to pay the seller any decrease in interest cost if market interest rates fall below the forward rate
- ❖ The net settlement of FRA is calculated using the below formula:

$$\left[\text{Notional Principal} \times (\text{Actual Rate} - \text{FRA Rate}) \times \left(\frac{\text{Days}}{360 \text{ or } 365} \right) \times 100 \right] \frac{1}{1 + \text{Actual Rate}}$$
- ❖ The differential interest amount in the FRA is discounted at actual interest rate as the FRA is settled in the beginning of the period and not at the end.

FRA versus Interest rate Futures:

- ❖ FRA is an OTC derivative instrument whereas the interest rate futures is traded in the exchange. Both instruments help in fixing the interest rate for a future period
 - ❖ Interest rate futures are quoted as 100 – Interest rate. Hence interest rate futures quote of 94 would mean that the future interest rate is 6%
- $$\text{No of contracts} = \frac{\text{Amount of borrowing}}{\text{Contract size}} \times \frac{\text{Duration of Loan}}{\text{Duration of Futures}}$$

Interest rate / currency swaps:

- An interest rate swap is an agreement between two parties who exchange interest payments based on a notional principal amount, over an agreed period of time.

Pre-requisites for a swap transaction:

- One party should be stronger than the other. This would mean that it enjoys lower borrowing rates than the other.
- The two parties should have opposite views about the direction of the movement of the interest rates.

Steps in effective swap:

- Step 1: Identify the rates – This involves tabulating the rates applicable to the two companies.
- Step 2: Compute the net differential
 - Difference in fixed rates
 - Difference in floating rates
 - Net differential
- Step 3: Split the net differential between two companies
- Step 4: Identify the sequence of operations.

S.No	STRONGER Company wants floating rate	STRONGER Company wants a fixed rate
Operations from view point of strong company		
1.	Pays bank at fixed rate	Pays bank at floating rate
2.	Receives from counter party fixed rate as per sequence 1 plus strong company's share of gain	Receives from counter party floating rate as per sequence A plus strong company's share of gain
3	Pays counter party the floating rate which strong company is entitled to from the market	Pays counterparty the fixed rate which strong is entitled to from the market
4	Aggregate after correctly considering the signs. This will be STRONG Company's revised floating rate.	Aggregate after correctly considering the signs. This will be STRONG company's revised fixed rate
Operations from view point of weaker company		
5	Pays bank at floating rate	Pays bank at fixed rate
6	Pays the fixed rate identified in sequence 2 above to the counter party	Pays the floating rate identified in sequence 2 above to the counter party

7	Receives the floating rate identified in sequence 3 above from the counter party	Receives the fixed rate identified in sequence 3 above from the counter party
8	Aggregate after correctly considering the signs. This will be WEAK's revised fixed rate	Aggregate after correctly considering the signs. This will be WEAK's revised floating rate

Conventions for calculation of interest:

Interest on a money market instrument is paid on March 31 and September 30. Interest for the period April 1 to June 20 is to be calculated under the following conventions.

Conventions	Numerator days	Denominator days
30/360 basis	April and May will be taken as 30 days irrespective of the number of days. Hence the numerator will be taken as 79 days (19 clean days in June)	Denominator will be taken as 180 (360/2)
Actual days/ 360	April = 30 days ; May = 31 days; June = 19 days Denominator = 80 days	Denominator will be taken as 180 (360/2)
Actual days/ reference period	April = 30 days; May = 31 days; June = 19 days. Denominator = 80 days	April = 30 days; May = 31 days; June = 30 days; July = 31 days; August = 31 days; September = 30 days Denominator = 183 days

Practical Problems**Overview:**

- Part I – Interest rate futures and options
- Part II – Forward Rate Agreements
- Part III – Interest Rate Swaps

Part I – Interest rate futures and options**1. Interest rate caps and floors [May 2013 RTP, May 2014 MTP]**

Suppose that a 1-year cap has a cap rate of 8% and a notional amount of Rs.100 Crores. The frequency of settlement is quarterly and the reference rate is 3-months MIBOR. Assume that 3-month MIBOR for the next four quarters is shown below:

Quarters	3-months MIBOR
1	8.70
2	8.00
3	7.80
4	8.20

You are required to compute payoff for each quarter

Answer:

- Cap option restricts the maximum interest outflow and will be exercised if the actual interest rate is higher than strike rate

Quarter	Interest rate	Exercise	Pay-off
1	8.70	Yes	17,50,000 (100,00,00,000 × 0.70% × 3/12)
2	8.00	No	0
3	7.80	No	0
4	8.20	Yes	5,00,000 (100,00,00,000 × 0.20% × 3/12)

2. Interest rate caps and floors [May 2013 RTP]

Suppose that a 1-year floor has a floor rate of 4% and a notional amount of Rs.100 Crores. The frequency of settlement is quarterly and the reference rate is 3-months MIBOR. Assume that 3-month MIBOR for the next four quarters is shown below:

Quarters	3-months MIBOR
1	4.70
2	4.40
3	3.80

4	3.40

You are required to compute payoff for each quarter

Answer:

- Floor option provided for minimum interest inflow and will be exercised if the actual interest rate is lower than the strike rate

Quarter	Interest rate	Exercise	Pay-off
1	4.70	No	0
2	4.40	No	0
3	3.80	Yes	5,00,000 (100,00,00,000 × 0.20% × 3/12)
4	3.40	Yes	15,00,000 (100,00,00,000 × 0.60% × 3/12)

3. Interest rate caps and floors [May 2014 RTP, Nov 2018 MTP, May 2019 RTP]

XYZ Limited issues a GBP 10 million floating rate loan on July 1, 2013 with resetting of coupon rate every 6 months equal to LIBOR + 0.50%. XYZ is interested in a collar strategy by selling a floor and buying a cap. XYZ buys 3 years cap and sell 3 years floor as per the following details on July 1, 2013.

- ❖ Notional principal amount : GBP 10 million
- ❖ Reference rate : 6 months LIBOR
- ❖ Strike rate : 4% for floor and 7% for cap
- ❖ Premium : 0 as premium paid on cap is compensated by premium receive on floor

Using the following data you are required to determine:

- ❖ Effective interest paid out at each reset date
- ❖ The average overall effective rate of interest

Reset Date	LIBOR (%)
31-12-2013	6.00
30-06-2014	7.00
31-12-2014	5.00
30-06-2015	3.75
31-12-2015	3.25
30-06-2016	4.25

Answer:

- Buying a cap will restrict maximum interest outflow and selling a floor will provide for minimum interest inflow.
- Collar strategy will ensure that interest outflow for all reset periods will be between 4 to 7%

Interest outflow for every reset period:

Reset date	No of days	LIBOR	Int outflow	Cap receipt	Floor payment	Total cost
31-Dec-13	184	6.00	3,27,671	0	0	3,27,671
30-Jun-14	181	7.00	3,71,918	0	0	3,71,918
31-Dec-14	184	5.00	2,77,260	0	0	2,77,260
30-Jun-15	181	3.75	2,10,753	0	12,397	2,23,150
31-Dec-15	184	3.25	1,88,525	0	37,705	2,26,230
30-Jun-16	182	4.25	2,36,202	0	0	2,36,202
Total	1,096					16,62,431

Note:

- No of days = Current reset date – Earlier reset date. For example ,184 days for December 31, 2013 is time gap between June 30, 2013 and December 31, 2013
- Interest outflow = 1,00,00,000 × (LIBOR + 0.50%) × (No of days/365 or 366). For last two reset periods denominator will be taken as 366 as the same is of leap year
- Cap receipt is applicable when LIBOR exceed 7%.
- Floor payment is applicable when LIBOR is below 4%. This is breached for June 2015 and we will have floor payment as 1,00,00,000 × 0.25% × (181/365). Additionally it was breached in December 2015 and we will have floor payment as 1,00,00,000 × 0.75% × (184/366)

- Total cost = Interest outflow – cap receipt + Floor Payment

Computation of overall effective rate of interest:

$$\text{Overall effective rate of interest} = \left(\frac{16,62,421}{1,00,00,000} \right) \times \left(\frac{365}{1,096} \right) \times 100 = 5.54\%$$

4. Interest Rate Collar [May 2022]

XYZ Limited issues a Rs.50 million floating rate loan on July 1, 2018 with resetting of coupon rate every 6 months equal to LIBOR + 0.50%. XYZ is interested in a collar strategy by selling a floor and buying a cap. XYZ buys 3 years cap and sell 3 years floor as per the following details on July 1, 2018.

- ❖ Notional principal amount : Rs.50 Million
- ❖ Reference rate : 6 months LIBOR
- ❖ Strike rate : 5% for floor and 8% for cap
- ❖ Premium : 0 as premium paid on cap is compensated by premium receive on floor

Using the following data you are required to determine:

- ❖ Effective interest paid out at each reset date (Round off to nearest rupee)
- ❖ The average overall effective rate of interest (round off to 2 decimals)

Reset Date	LIBOR (%)
31-12-2018	7.00
30-06-2019	8.00
31-12-2019	6.00
30-06-2020	4.75
31-12-2020	4.25
30-06-2021	5.25

Answer:**Interest outflow for every reset period:**

Reset date	Date of Payment	No of days	LIBOR	Int outflow	Cap receipt	Floor payment	Total cost
31-Dec-18	30-Jun-19	181	7.00	18,59,589	0	0	18,59,589
30-Jun-19	31-Dec-19	184	8.00	21,42,466	0	0	21,42,466
31-Dec-19	30-Jun-20	182	6.00	16,16,120	0	0	16,16,120
30-Jun-20	31-Dec-20	184	4.75	13,19,672	0	62,842	13,82,514
31-Dec-20	30-Jun-21	181	4.25	11,77,740	0	1,85,959	13,63,699
30-Jun-21	31-Dec-21	184	5.25	14,49,315	0	0	14,49,315
Total		1,096					98,13,703

Note:

- No of days = Date of Payment – Reset Date. For example ,181 days for December 31, 2018 is time gap between June 30, 2019 and December 31, 2018
- Interest outflow = 5,00,00,000 × (LIBOR + 0.50%) × (No of days/365 or 366). For third and fourth reset period denominator is taken as 366 due to leap year.
- Floor payment is applicable when LIBOR is below 5%. This is breached for fourth reset period and fifth reset period
- Total cost = Interest outflow – cap receipt + Floor Payment

Computation of overall effective rate of interest:

$$\text{Overall effective rate of interest} = \left(\frac{98,13,703}{5,00,00,000} \right) \times \left(\frac{365}{1,096} \right) \times 100 = 6.54\%$$

Author's Note:

- Loan has been taken on July 1, 2018 and hence the first payment should have been on December 31, 2018. However, ICAI solution has assumed the reset rate to be applicable for next six months and hence the first loan repayment happens on June 30, 2019. This should be technically considered as incorrect.

5. Caps [Nov 2016 RTP, May 2018 MTP, Nov 2018 MTP, May 2013]

XYZ Limited borrows £15 Million of six months LIBOR + 10.00% for a period of 24 months. The company anticipates a rise in LIBOR, hence it proposes to buy a Cap Option from its Bankers at the strike rate of 8.00%. The lumpsum premium is 1.00% for the entire reset periods and the fixed rate of interest is 7.00% per annum. The actual position of LIBOR during the forthcoming reset period is as under:

Reset Period	LIBOR
1	9.00%
2	9.50%
3	10.00%

You are required to show how far interest rate risk is hedged through Cap Option. For calculation, work out figures at each stage up to four decimal points and amount nearest to £. It should be part of working notes.

Answer:

WN 1: Computation of premium:

Lump-sum Premium = 1,50,00,000 × 1% = GBP 1,50,000
Premium per reset period = $\frac{\text{Total premium}}{\text{PVAF}(r, n)} = \frac{1,50,000}{\text{PVAF}(3.5\%, 4)} = \frac{1,50,000}{3.673} = 40,839$

Note:

- Premium will be amortized based on the fixed rate of interest. Fixed rate of interest is 7% per annum and the same will be 3.5% per half-year (reset period). Reset period is taken as six months as the borrowing is at six-month LIBOR
- Option is for a period of 24 months and hence the same will have 4 reset periods of 6 months

WN 2: Computation of interest outflow:

Period	LIBOR	Int paid to bank	Cap receipt	Premium	Net Payment
I	9.00%	14,25,000	75,000	40,839	13,90,839
II	9.50%	14,62,500	1,12,500	40,839	13,90,839
III	10.00%	15,00,000	1,50,000	40,839	13,90,839
		43,87,500	3,37,500	1,22,517	41,72,517

- Interest paid to Bank = 1,50,00,000 × (LIBOR + 10%) × (6/12)
- Cap receipt is applicable if the LIBOR rate is higher than 8%. LIBOR is higher than 8% for all reset periods and the difference between 8% and LIBOR is cap receipt
- Net payment = Interest paid to Bank + Premium – Cap receipt

Conclusion:

- The company would have paid extra interest of 3,37,500 (cap receipt) due to increase in interest rates. However due to cap receipt the interest payout for a reset period does not exceed 18% (LIBOR (8%) + 10%). However, in order to save this 3,37,500 the company has pay premium of 1,22,517
- Hence, the company is able to reduce the interest rate risk amount by 2,14,893 by using cap option

6. Collar

- A company has decided to take a 3 -year floating rate loan of \$25 million to finance a project. The loan is indexed to a 6-month LIBOR with a spread of 100 BP. The current level of LIBOR is 5.75%. The company thinks that the projected cash flows from the project will enable it to service the loan as long as the interest cost did not exceed 8.5%. A 3-year interest rate cap with a face value of \$25 million and a strike rate of 7% is available for a premium of 3.75 %. Calculate the effective cost of the capped loan for the following scenario of LIBORs on the next 5 roll-over dates: 5.50%, 6.00%, 6.25%, 6.50% & 6.75%(use a rate of 7% to amortize the premium).
- The above company is offered an interest rate collar with strike rates of 5.75% and 6.5% respectively for a net premium of 2%. Under this, the company has to compensate the seller of the collar if LIBOR falls below 5.75%, while the seller compensates the company if LIBOR rises above 6.5%. Compute the effective cost of the loan under the same scenario?

Answer:

Question No.6A:

WN 1: Computation of Premium:

Lump-sum Premium = 2,50,00,000 × 3.75% = USD 9,37,500

$$\text{Premium per reset period} = \frac{\text{Total premium}}{\text{PVAF}(r, n)} = \frac{9,37,500}{\text{PVAF}(3.5\%, 6)} = \frac{9,37,500}{5.329} = 1,75,924$$

Note:

- Premium per reset period = 1,75,924.
- Premium per reset period (in %) = $(1,75,924 / 2,50,00,000) \times 100 = 0.7037\%$
- Effective annualized premium = $0.7037 + 0.7037 = 1.41\%$

WN 2: Computation of effective cost of capped loan:

Reset Period	LIBOR	Int outflow	Cap receipt	Premium	Total cost
1	5.50	6.50	-	1.41	7.91
2	6.00	7.00	-	1.41	8.41
3	6.25	7.25	-0.25	1.41	8.41
4	6.50	7.50	-0.50	1.41	8.41
5	6.75	7.75	-0.75	1.41	8.41

Note:

- Interest outflow = LIBOR + 1%
- It is assumed that strike rate of 7% is on LIBOR + 1%. Cap receipt is applicable if interest outflow exceeds 7%
- Interest outflow and cap receipt rate is in terms of per year and hence the premium cost is also captured for a year
- Total cost = Interest outflow - cap receipt + Premium outflow

Question No.6B:**WN 1: Computation of Premium:**

$$\text{Lump-sum Premium} = 2,50,00,000 \times 2\% = \text{USD } 5,00,000$$

$$\text{Premium per reset period} = \frac{\text{Total premium}}{\text{PVAF}(r, n)} = \frac{5,00,000}{\text{PVAF}(3.5\%, 6)} = \frac{5,00,000}{5.329} = 93,826$$

Note:

- Premium per reset period = 93,826
- Premium per reset period (in %) = $(93,826 / 2,50,00,000) \times 100 = 0.3753\%$
- Effective annualized premium = $0.3753 + 0.3753 = 0.75\%$

WN 2: Computation of effective cost of collar loan:

Reset Period	LIBOR	Int outflow	Cap receipt	Floor Payment	Premium	Total cost
1	5.50	6.50	-	0.25	0.75	7.50
2	6.00	7.00	-	-	0.75	7.75
3	6.25	7.25	-	-	0.75	8.00
4	6.50	7.50	-	-	0.75	8.25
5	6.75	7.75	-0.25	-	0.75	8.25

- Strike rate for the option in this part is on LIBOR. This is clearly defined in the question
- Cap receipt will be applicable if LIBOR exceeds 6.50% and floor payment will be applicable if LIBOR falls below 5.75%

7. Interest rate futures

In two months-time, ABC Limited will receive Rs.3.9 million which it wants to deposit in money market for three months. ABC Limited at present can deposit at 8% per annum, but the treasurer fears a decrease in interest rate after two months and hence wishes to hedge using interest rate futures. Three months futures are currently priced at 93. The standard contract size in the futures market is 0.5 million.

- ❖ What strategy should the treasurer adopt to hedge the interest rate risk?
- ❖ If after two months, the futures are priced at 90.75 and interest rate increases to 10.5%, what would be the effective interest income earned by ABC Limited due to adoption of this strategy?
- ❖ If after two months, the futures are priced at 94.25 and interest rate falls to 6.5%, what would be the effective interest income earned by ABC Limited due to adoption of this strategy?

Answer:**Part 1:**

- The company wants to invest Rs.39,00,000 after two months. They can hedge the interest rate risk through interest rate futures
- No of contracts to be taken = $(39,00,000 / 5,00,000) = 7.8 \sim 8$ contracts.
- The company will take the interest rate futures which will enable them to invest the money at the rate of 7% (100 - 93)

Part 2:**Computation of effective interest income:****Net settlement in futures:**

Date	Position	Action	Ref date	Rate
Day 0	Original	Lend	Day 60	7%
Day 60	Opposite	Borrow	Day 60	-9.25%
Loss in %				-2.25%
Loss in rupees $(5,00,000 \times 8 \times 2.25\% \times 3/12)$				-22,500

- Interest rates have increased in the market and hence the company will earn higher interest income in spot market. However, part of the gains will be offset by loss in futures position

Effective interest income:

Particulars	Calculation	Amount
Interest income	$39,00,000 \times 10.5\% \times (3/12)$	1,02,375
Loss in futures		-22,500
Effective interest income		79,875

Part 3:**Computation of effective interest income:****Net settlement in futures:**

Date	Position	Action	Ref date	Rate
Day 0	Original	Lend	Day 60	7%
Day 60	Opposite	Borrow	Day 60	-5.75%
Gain in %				1.25%
Gain in rupees $(5,00,000 \times 8 \times 1.25\% \times 3/12)$				12,500

- Interest rates have declined in the market and hence the company will earn lower interest income in spot market. However, part of the losses will be offset by gain in futures position

Effective interest income:

Particulars	Calculation	Amount
Interest income	$39,00,000 \times 6.5\% \times (3/12)$	63,375
Gain in futures		12,500
Effective interest income		75,875

8. Interest rate futures

The monthly cash budget of ABC Limited shows that the company is likely to need Rs.18 million in two month's time for a period of four months. Financial markets have recently been volatile, and the finance director fears that short term interest rates could rise by as much as 150 ticks (1.5%). LIBOR is currently 6.5% and ABC can borrow at LIBOR + 0.75%.

The 3 months futures prices (contract size = Rs.5,00,000) are as follows:

- ❖ December 93.40
- ❖ March 93.10
- ❖ June 92.75

Assume that it is now 1 December and that exchange traded futures contracts expire at the end of the month. You are required to estimate the result of undertaking an interest rate futures hedge if LIBOR increases by 150 ticks (1.5%) and March future increases by 130 ticks (1.3%).

Answer:

- The company plans to borrow Rs.18 million in 2 months for a period of 4 months. The borrowing period therefore is from Month 2 to Month 6

- The finance director is worried about the potential increase in interest rates and hence wants to hedge this through futures market
- Today's date is December 1 and the borrowing is to be done on January 31. We do not have January futures and hence the closest available live futures would be March
- The company wants to borrow Rs.18 million for 4 months. Futures interest is computed for 3 months. Hence the amount to be hedged will be higher than Rs.18 million
- Amount to be hedged = 18 million $\times$ (4/3) = Rs.24 million
- Contract size of one futures contract = Rs.0.5 million
- No of contracts = (24/0.5) = 48 contracts
- The company will enter into 48 contracts of Rs.5 lacs each. This will enable the company to borrow money at 6.90% (100 – 93.10)

Action on maturity date:

- LIBOR has increased by 1.5 percent and hence the company will have to borrow at 8.75% (LIBOR of 8% + 0.75%)
- Interest expense = (180 lacs $\times$ 8.75% $\times$ (4/12)) = Rs.5,25,000
- Net interest expense = 5,25,000 – 78,000 (futures gain) = Rs.4,47,000

$$\text{Net interest rate} = \frac{4,47,000}{1,80,00,000} \times \frac{12}{4} \times 100 = 7.4\%$$

Futures settlement:

Date	Position	Action	Ref date	Rate
Dec 1	Original	Borrow	March 31	-6.90%
Jan 31	Opposite	Invest	March 31	8.20%
Gain in %				1.30%
Gain in rupees (5,00,000 $\times$ 48 $\times$ 1.30% $\times$ 3/12)				78,000

Note: 3-month futures are there in the question and this would mean that interest for futures settlement would be computed for three-month period.

9. Interest rate hedging [Nov 2017, Nov 2017 RTP]

A textile manufacturer has taken floating interest rate loan of Rs. 40,00,000 on 1st April, 2012. The rate of interest at the inception of loan is 8.5% p.a. interest is to be paid every year on 31st March, and the duration of loan is four years. In the month of October 2012, the Central bank of the country releases following projections about the interest rates likely to prevail in future.

(i) On 31st March, 2013, at 8.75%; on 31st March, 2014 at 10% on 31st March, 2015 at 10.5% and on 31st March, 2016 at 7.75%. Show how this borrowing can hedge the risk arising out of expected rise in the rate of interest when he wants to peg his interest cost at 8.50% p.a.

(ii) Assume that the premium negotiated by both the parties is 0.75% to be paid on 1st October, 2012 and the actual rate of interest on the respective due dates happens to be as: on 31st March, 2013 at 10.2%; on 31st March, 2014 at 11.5%; on 31st March, 2015 at 9.25%; on 31st March, 2016 at 8.25%. Show how the settlement will be executed on the perspective interest due dates.

Answer:**WN 1: Hedging interest rate risk:**

As borrower does not want to pay more than 8.5% p.a., on this loan where the rate of interest is likely to rise beyond this, hence, he has hedge the risk by entering into an agreement to buy interest rate caps with the following parameters:

- National Principal : Rs. 40,00,000/
- Strike rate: 8.5% p.a.
- Reference rate : the rate of interest applicable to this loan
- Calculation and settlement date : 31st March every year
- Duration of the caps : till 31st March 2016
- Premium for caps : negotiable between both the parties

To purchase the caps this borrower is required to pay the premium upfront at the time of buying caps. The payment of such premium will entitle him with right to receive the compensation from the seller of the caps as soon as the rate of interest on this loan rises above 8.5%. The compensation will be at the rate of the difference between the rate of none of the cases the cost of this loan will rise above 8.5% calculated on Rs.

40,00,000/-. This implies that in none of the cases the cost of this loan will rise above 8.5%. This hedging benefit is received at the respective interest due dates at the cost of premium to be paid only once.

The premium to be paid on 1st October 2012 is 30,000/- (Rs. 40,00,000 × 0.75/100). The payment of this premium will entitle the buyer of the caps to receive the compensation from the seller of the caps whereas the buyer will not have obligation

WN 2: Settlement on respective interest rates:

Date	Actual Rate	Settlement %	Settlement Amount
31 st March 2013	10.20%	1.70%	68,000
31 st March 2014	11.50%	3.00%	1,20,000
31 st March 2015	9.25%	0.75%	30,000
31 st March 2016	8.25%	-	-

10. Cheapest to Deliver Bond [May 2021 RTP]

In March 2020, XYZ Bank sold some 7% Interest Rate Futures underlying Notional 7.50% Coupon Bonds. The exchange provides following details of eligible securities that can be delivered:

Security	Quoted Price of the Bonds	Conversion Factor
7.96 GOI 2023	1037.40	1.0370
6.55 GOI 2025	926.40	0.9060
6.80 GOI 2029	877.50	0.9195
6.85 GOI 2026	972.30	0.9643
8.44 GOI 2027	1146.30	1.1734
8.85 GOI 2028	1201.70	1.2428

Recommend the Security that should be delivered by the XYZ Bank if Future Settlement Price is 1000.

Answer:

- Cheapest to Deliver Bond is one which gives maximum profit to seller of interest rate futures
- Profit = (Futures settlement price × Conversion Factor) – Quoted spot price of bond

Security	Spot Price	Conversion Factor	Inflow (Spot Price × Conversion Factor)	Quoted Price of the Bonds [Outflow]	Profit [Inflow – Outflow]
7.96 GOI 2023	1,000	1.0370	1,037.00	1037.40	-0.40
6.55 GOI 2025	1,000	0.9060	906.00	926.40	-20.40
6.80 GOI 2029	1,000	0.9195	919.50	877.50	42.00
6.85 GOI 2026	1,000	0.9643	964.30	972.30	-8.00
8.44 GOI 2027	1,000	1.1734	1,173.40	1146.30	27.10
8.85 GOI 2028	1,000	1.2428	1,242.80	1201.70	41.10

Since maximum profit to the Bank is in case of 6.80 GOI 2029, same should be opted for

Part II – Forward Rate Agreements

11. Forward Rate Agreements [Nov 2019, May 2018 MTP, Nov 2018 RTP, May 2013]:

P Ltd. is contemplating to borrow an amount of Rs. 50 crores for a period of 3 months in the coming 6 months time from now. The current rate of interest is 8% per annum but it may go up in 6 months time. The company wants to hedge itself against the likely increase in interest rate. The Company's Bankers quoted an FRA (Forward Rate Agreement) at 8.30% per annum.

Compute the effect of FRA and actual rate of interest cost to the company, if the actual rate of interest during consideration period happens to be (i) 8.60% p.a., or (ii) 7.80% p.a.

(Show your workings on the basis of months)

Answer:

WN 1: Computation of FRA settlement if rate of interest is 8.60% per annum:

- The company had entered into FRA agreement to borrow at the rate of 8.30%
- The borrowing rate has increased to 8.60% and they will have to borrow at higher rate. However this would be compensated by FRA settlement of 0.30%

FRA Settlement before discounting = 50 Crores x 0.30% x $\left(\frac{3}{12}\right)$ = Rs. 3,75,000

Net FRA Settlement post discounting = $\frac{3,75,000}{1 + 2.15\%}$ = **Rs. 3,67,107**

Banker will pay Rs.3,67,107 to P Limited

Net interest outflow if rate is 8.60%:

Particulars	Calculation	Amount
Interest on loan at 8.60%	50 crores x 8.60% x (3/12)	1,07,50,000
Less: FRA settlement		(3,67,107)
Net Amount		1,03,82,893
Effective borrowing rate	$\left(\frac{1,03,82,893}{50,00,00,000}\right) \times \left(\frac{12}{3}\right) \times 100$	8.31%

Note: The above computation is not fully logical as FRA settlement happens on day 0 whereas actual interest is paid after 3 months. However, we have followed this approach as per ICAI solution

WN 2: Computation of FRA Settlement if rate of interest is 7.80% per annum:

- The company had entered into FRA agreement to borrow at the rate of 8.30%
- The borrowing rate has decreased to 7.80% and they will have to borrow at lower rate. However, rate would increase due to FRA settlement of 0.50%

FRA Settlement before discounting = 50 Crores x 0.50% x $\left(\frac{3}{12}\right)$ = Rs. 6,25,000

Net FRA Settlement post discounting = $\frac{6,25,000}{1 + 1.95\%}$ = **Rs. 6,13,046**

P Limited will have to pay Rs.6,13,046 to Banker.

Net interest outflow if rate is 8.60%:

Particulars	Calculation	Amount
Interest on loan at 7.80%	50 crores x 7.80% x (3/12)	97,50,000
Add: FRA settlement		6,13,046
Net Amount		1,03,63,046
Effective borrowing rate	$\left(\frac{1,03,63,046}{50,00,00,000}\right) \times \left(\frac{12}{3}\right) \times 100$	8.29%

12. Forward loan arrangement versus FRA

ABC Limited estimates that it would need Rs.50 lacs in two months time for a six month period. The current 6 months money market interest rate is 5.50%-6.00%. But it feels that over the next two months, interest rates will rise. The other details obtained from the money market are as follows:

Two months	5.25% - 5.75%
Six months	5.5% - 6.00%
Eight months	5.625% - 6.1255%

- ❖ Explain how ABC Limited could hedge its interest rate exposure by means of forward loan
- ❖ If ABC Limited wants to enter into an agreement with the bank for FRA, what will be the forward interest rate that would be quoted by the Bank
- ❖ If on the date of borrowing the actual interest rate becomes 8%, explain how the FRA will be given effect?
- ❖ If on the date of borrowing the actual interest rate becomes 5%, explain how the FRA will be given effect?

Answer:

Part 1: Forward Loan Arrangement:

- ABC Limited needs Rs.50 lacs from Month 3 to Month 8 (2x8 FRA). The company can hedge its interest rate exposure through the following steps:
 - Borrow money for eight months at 6.1255%
 - Invest money for 2 months at 5.25%
 - Use money for balance 6 months and repay along with interest

$$\text{Money to be invested} = \frac{50,00,000}{1 + \left(5.25\% \times \frac{2}{12}\right)} = \frac{50,00,000}{1.00875} = \text{Rs. } 49,56,629$$

- We need to invest Rs.49,56,629 for 2 months. This will ensure we get Rs.50 lacs in Month 2 and we can use the same from Month 3 to Month 8. In order to create this deposit, we should borrow Rs.49,56,629 for a period of 8 months at the rate of 6.1255%

$$\text{Repayment after 8 months} = 49,56,629 \times \left(1 + \left(6.1255\% \times \frac{8}{12}\right)\right) = \text{Rs. } 51,59,041$$

- The above arrangement is effectively a forward loan arrangement where ABC Limited has effectively taken a loan of Rs.50 lacs in Month 2 and the company has repaid Rs.51,59,041 in Month 8

Particulars	Calculation	Amount
Interest cost in (Rs.)	51,59,041 – 50,00,000	1,59,041
Interest cost in (%)	$\frac{1,59,041}{50,00,000} \times \frac{12}{6} \times 100$	6.36%

Part 2: Forward Rate agreement to be quoted by Bank:

- ABC Limited would want to borrow for a period of 6 months from M2 to M8. This can be done by asking for 2 x 8 FRA Rate

$$\text{FRA}_{2 \times 8} = \frac{\text{FVF for 8 months}}{\text{FVF for 2 months}} - 1 = \frac{\left(1 + \left(6.1255\% \times \frac{8}{12}\right)\right)}{1 + \left(5.25\% \times \frac{2}{12}\right)} = \frac{1.04084}{1.00875} - 1$$

$$\text{FRA}_{2 \times 8} = 1.031812 - 1 = 0.031812 \text{ (or) } 3.18\% \text{ for 6 months (or) } 6.36\% \text{ per annum}$$

Note:

- In FRA calculation, if the purpose is to borrow money, then the borrowing rate is to be taken for 8 months and investment rate is to be taken for 2 months
- Similarly, if the purpose is to invest money, then take investment rate for 8 months and borrowing rate is to be taken for 2 months

Part 3: FRA Settlement if actual rate of interest is 8%:

- ABC Limited will borrow at actual rate of 8% from bank. However, they will get compensation as part of FRA settlement of 1.64%. This will make the effective borrowing cost as 6.36% (8% - 1.64%)

Part 4: FRA settlement if actual rate of interest is 5%:

- ABC Limited will borrow at actual rate of 5% from bank. However, they will also have to pay 1.36% as part of FRA settlement. This will make the effective borrowing cost as 6.36% (5% + 1.36%)

13. FRA [May 2018 RTP, May 2010, May 2019 MTP, May 2015 MTP, May 2017 RTP]

The following market data is available:

Spot USD/JPY 116.00

Deposit rates p.a.	USD	JPY
3 months	4.50%	0.25%
6 months	5.00%	0.25%

Forward Rate Agreement (FRA) for Yen is 0.25%.

- What should be 3 months FRA rate at 3 months forward?
- The 6 & 12 months LIBORS are 5% and 6.5% respectively. A bank is quoting 6/12 USD FRA at 6.50 – 6.75%. Is any arbitrage opportunity available?

Answer:

WN 1: Computation of FRA rate:

- The company wants 3 months FRA rate at 3 months forward. This would technically mean 3x6 FRA

$$3 \times 6 \text{ FRA} = \frac{\text{Future value factor for 6 months}}{\text{Future value factor for 3 months}} - 1$$

$$3 \times 6 \text{ FRA} = \frac{1 + 2.50\%}{1 + 1.125\%} - 1 = 1.0136 - 1 = 1.36\% \text{ per 3 months (or) } 5.44\% \text{ per annum}$$

WN 2: Computation of 6X12 FRA rate:

- We have been given 6 months and 12 months rate as 5% and 6.5%. We can use these rates and calculate 6X12 FRA rate

$$6 \times 12 \text{ FRA} = \frac{\text{Future value factor for 12 months}}{\text{Future value factor for 6 months}} - 1$$

$$6 \times 12 \text{ FRA} = \frac{1 + 6.50\%}{1 + 2.50\%} - 1 = 1.0390 - 1 = 3.90\% \text{ per 6 months (or) } 7.80\% \text{ per annum}$$

Creation of arbitrage:

- Fair FRA rate for month 6 to 12 is 7.80% per annum. Actual FRA rate is 6.50% - 6.75%.
- Actual FRA indicates that borrowing can be made at 6.75% and deposit can be created at 6.50% for month 6 to 12
- Actual borrowing rates are lower than Fair FRA rates and hence we should borrow money from month 6 to 12
- Arbitrage Mechanism:**
 - Borrow 1,00,000 USD for first 6 months
 - Create 1,00,000 USD deposit for 12 months
 - Borrow from M6 to M12 using FRA rate

Arbitrage steps:

Particulars	Calculation	Amount
Day 0		
1. Borrow 1,00,000 USD for 6 months @ 5%		1,00,000
2. Create 12-month deposit @ 6.50%		1,00,000
3. Enter into FRA to borrow money from M6 to M12 @ 6.75%		
Day 180		
4. Repay 6-month loan with fresh borrowing @ 6.75% as per FRA	$1,00,000 + (1,00,000 \times 5\% \times 6/12)$	1,02,500
Day 365:		
5. Maturity value of 12-month deposit	$1,00,000 + (1,00,000 \times 6.5\%)$	1,06,500
6. Repay loan along with interest	$1,02,500 + (1,02,500 \times 6.75\% \times 6/12)$	1,05,959
7. Arbitrage gain	$1,06,500 - 1,05,959$	541

14. FRA [Nov 2014 RTP, May 2019 RTP]

Two companies ABC Limited and XYZ Limited approach DEF Bank for FRA (Forward Rate Agreement). They want to borrow Rs.100 Crores after 2 years for a period of 1 year. Bank has calculated yield curve of both companies as follows:

Year	XYZ Limited	ABC Limited
1	3.86	4.12
2	4.20	5.48
3	4.48	5.78

- You are required to calculate the rate of interest DEF Bank would quote under 2v3 FRA, using the company's yield information as quoted above
- Suppose bank offers Interest rate guarantee for a premium of 0.1% of the amount of loan, you are required to calculate the interest payable by XYZ Limited if interest in 2 years turns out to be
 - 4.50%
 - 5.50%

Answer:**WN 1: Computation of FRA rate:**

- The company wants to borrow after 2 years for a period of 1 year. The company therefore is looking at getting 2x3 FRA rate

XYZ Limited:

$$2x3FRA = \frac{\text{Future value factor for 3 years}}{\text{Future value factor for 2 years}} - 1 = \frac{(1 + 4.48\%)^3}{(1 + 4.20\%)^2} - 1 = 5.04\%$$

ABC Limited:

$$2x3FRA = \frac{\text{Future value factor for 3 years}}{\text{Future value factor for 2 years}} - 1 = \frac{(1 + 5.78\%)^3}{(1 + 5.48\%)^2} - 1 = 6.38\%$$

WN 2: Computation of actual interest with interest rate guarantee:

- Interest rate guarantee is either a cap or floor option depending on whether we are borrower or lender
- XYZ Limited is borrower and they would want to restrict the maximum interest outflow
- It is assumed that strike rate of option is equal to fair FRA rate of 5.04%

Actual interest rate is 4.50%

- XYZ Limited will pay 4.50% and their overall cost will be 4.60% including premium

Actual interest rate is 5.50%

- XYZ Limited will pay 5.04% and their overall cost will be 5.14% including premium

15. FRA [May 2014 RTP, May 2018 RTP, Nov 2016 MTP, May 2021 RTP]

Electraspace is consumer electronics wholesaler. The business of the firm is highly seasonal in nature. In 6 months of a year, firm has a huge cash deposits and especially near Christmas time and other 6 months firm cash crunch, leading to borrowing of money to cover up its exposures for running the business. It is expected that firm shall borrow a sum of €50 million for the entire period of slack season in about 3 months. A Bank has given the following quotations:

- ❖ Spot 5.50% - 5.75%
- ❖ 3 × 6 FRA 5.59% - 5.82%
- ❖ 3 × 9 FRA 5.64% - 5.94%

3 month €50,000 future contract maturing in a period of 3 months is quoted at 94.15 (5.85%).

You are required to determine:

- ❖ How a FRA, shall be useful if the actual interest rate after 6 months turnout to be:
 - 4.5%
 - 6.5%
- ❖ How 3 months Future contract shall be useful for company if interest rate turns out as mentioned in part (a) above.

Answer:**WN 1: Effect of FRA:**

- The company wants to borrow after 3 months for entire slack season of 6 months. This would mean borrowing from M3 to M9.
- The company should enter into 3x9 FRA to hedge interest rate risk
- Relevant 3x9 FRA borrowing rate is 5.94%**

Particulars	Actual rate of 4.50%	Actual rate of 6.50%
1. Payment to original lender	4.50%	6.50%
2. Payment by Electraspace to bank (FRA settlement)	1.44%	-
3. Receipt by Electraspace from Bank (FRA settlement)	-	(0.56%)
4. Net borrowing cost	5.94%	5.94%

WN 2: Hedging through interest rate futures:

- The company wants to borrow 50 million for 6 months. Futures contracts are available only for 3 months and hence we should adjust the value of futures contract
- Borrowing 50 million for 6 months is similar to borrowing 100 million for 3 months

$$\text{No of futures contracts} = \frac{\text{Amount to be hedged}}{\text{Size of one contract}} = \frac{100 \text{ million}}{50,000} = 2,000 \text{ Contracts}$$

Actual interest rate is 4.50%

Particulars	Calculation	Amount
1. Interest to be paid on original loan	50 million x 4.50% x 6/12	11,25,000
2. Futures settlement (Note 1)		3,37,500
3. Total outflow		14,62,500
4. Effective borrowing cost	$\frac{14,62,500}{50 \text{ million}} \times \left(\frac{12}{6}\right) \times 100$	5.85%

Note 1: Computation of futures settlement:

Date	Position	Action	Reference Date	Rate
Day 0	Original Position	Borrow	Day 90	5.85%
Day 90	Opposite Position	Lend	Day 90	4.50%
Loss in %				1.35%
Loss in rupees (100 million x 1.35% x $\left(\frac{3}{12}\right)$)				3,37,500

Actual interest rate is 6.50%

Particulars	Calculation	Amount
1. Interest to be paid on original loan	50 million x 6.50% x 6/12	16,25,000
2. Futures settlement (Note 1)		(1,62,500)
3. Total outflow		14,62,500
4. Effective borrowing cost	$\frac{14,62,500}{50 \text{ million}} \times \left(\frac{12}{6}\right) \times 100$	5.85%

Note 1: Computation of futures settlement:

Date	Position	Action	Reference Date	Rate
Day 0	Original Position	Borrow	Day 90	5.85%
Day 90	Opposite Position	Lend	Day 90	6.50%
Profit in %				0.65%
Profit in rupees (100 million x 0.65% x $\left(\frac{3}{12}\right)$)				1,62,500

16. Forward rate agreement [Nov 2012 RTP, May 2019 MTP, May 2016 MTP]

TM Fincorp has bought a 6x9 Rs.100 crore Forward Rate Agreement (FRA) at 5.25%. On fixing date reference rate, MIBOR turns out to be as follows:

Period	Rate (%)
3 months	5.50
6 months	5.70
9 months	5.85

You are required to determine:

- Profit/Loss to TM Fincorp. In terms of basis points
- The settlement amounts

(Assume 360 days in a year)

Answer:

WN 1: Computation of profit/loss in terms of basis points:

- ❖ The company has taken a 6x9 FRA and hence the borrowing is from month 6 to month 9. We now have the actual rates for Month 6 and hence the relevant rate is for next 3 months. Therefore, the actual rate is 5.50%
- ❖ The company had taken FRA at 5.25% and the actual rate is 5.50%. Hence the company will be gaining 0.25% due to FRA

WN 2: Computation of profit/loss:

Particulars	Calculation	Amount
Profit in Forward Rate Agreement		0.25%

Amount of settlement (undiscounted)	$100 \text{ crores} \times 0.25\% \times (3/12)$	6,25,000
Amount of settlement (discounted)	$\frac{6,25,000}{\left(1 + \left(5.50\% \times \frac{3}{12}\right)\right)}$	6,16,523

Conclusion: Hence settlement on reference date will have to be done for Rs.6,16,523

17. Forward Rate Agreement [May 2014 MTP]

The treasurer of a company expects to receive a cash inflow of \$15,000,000 in 90 days. The treasurer expects short-term interest rates to fall during the next 90 days. In order to hedge against this risk, the treasurer decides to use an FRA that expires in 90 days and is based on 90-day LIBOR. The FRA is quoted at 1.5%. At expiration, LIBOR is 1.25%. Assume that the notional principal on the contract is \$15,000,000.

(i) Indicate whether the treasurer should take a long or short position to hedge interest rate risk.

(ii) Using the appropriate terminology identify the type of FRA used here.

(iii) Calculate the gain or loss to the company as a consequence of entering the FRA

Answer:

- The company needs to invest money and hence they should take a short position in FRA
- The company will receive money after 3 months. The investment is needed for a period of 3 months. Therefore, we should go for 3 x 6 FRA

iii. Computation of settlement:

Particulars	Calculation	Amount
Profit in Forward Rate Agreement		0.25%
Amount of settlement (undiscounted)	$150 \text{ lacs} \times 0.25\% \times (3/12)$	9,375
Amount of settlement (discounted)	$\frac{9,375}{\left(1 + \left(1.25\% \times \frac{3}{12}\right)\right)}$	9,346

Part III – Interest Rate Swaps

18. Mechanism of Interest rate swap

A and B Limited have entered into a three year swap on March 5, 2010 wherein A agrees to pay a fixed rate of interest of 5 percent per annum and B agrees to pay LIBOR on a notional principal of 100 million USD. The agreement specifies the payment to be arranged every six months. The floating rate of interest on various reset dates happened to be as follows:

Date	Floating rate
5/3/10	4.2
5/9/10	4.8
5/3/11	5.3
5/9/11	5.5
5/3/12	5.6
5/9/12	5.9
5/3/13	6.4

- ❖ Calculate the net cash flow to A and B from the swap arrangement
- ❖ Comment upon A and B regarding their view on interest rates
- ❖ A Limited has borrowed money at a floating rate of LIBOR + 0.10% and B Limited has borrowed at fixed rate of 5.2%. A Limited wants to transform its floating rate loan into fixed rate and B Limited wants to transform its fixed rate to floating rate. Illustrate how swap has been structured and what is the effective borrowing cost post swap arrangement.

Answer:

WN 1: Computation of net cash flows from swap arrangement:

Date	No of days	Fixed rate	Floating rate	Amount to be paid by A	Amount to be paid by B	Net cash flows B to A
05-Sep-10	184	5%	4.80%	25,20,548	24,19,726	-1,00,822
05-Mar-11	181	5%	5.30%	24,79,452	26,28,219	1,48,767
05-Sep-11	184	5%	5.50%	25,13,661	27,65,027	2,51,366

05-Mar-12	182	5%	5.60%	24,86,339	27,84,699	2,98,360
05-Sep-12	184	5%	5.90%	25,20,548	29,74,247	4,53,699
05-Mar-13	181	5%	6.40%	24,79,452	31,73,699	6,94,247

Note:

- It is assumed that LIBOR on reset dates is applicable for previous six months interest computation. For example, LIBOR on September 5, 2010 is 4.8 percent and the same was used to calculate interest from March 5, 2010 to September 5, 2010
- Negative net cash flows will indicate amount payable by A Limited to B Limited

View on interest rates:

- A is willing to pay a fixed rate of 5 percent in return for LIBOR receipt. This would help A Limited in converting a floating rate loan to a fixed rate loan. A Limited want to pay effective fixed rate and hence they will have a view of interest rates going up
- B Limited plans to pay effective floating rate and hence they will have a view of interest rate coming down

WN 2: Computation of effective borrowing rate:

Particulars	A Limited	B Limited
1. Pay to banker as per original borrowed rate	LIBOR + 0.10%	5.20%
2. A Limited to B Limited	5%	(5%)
3. B Limited to A Limited	(LIBOR)	LIBOR
4. Effective borrowing rate	5.10%	LIBOR + 0.20%

19. Interest rate swap

Madagascar Limited is an Indian company. They are in the process of raising a US dollar loan and are negotiating the rates with a foreign bank. The company has been offered a fixed rate of 8 percent with a proviso that they should opt for a floating rate, the interest rate is likely to be linked to the bench mark rate of 60 basis points over 10 year US T Bill rate with interest refixation on a three-monthly basis. The expectations of Madagascar Limited are that the Dollar interest rates will fall and are inclined to have a flexible mechanism built into their interest rates. On enquiry they find that they could go for a swap arrangement with Syndicate India Limited who have been offered a floating rate of 120 basis points over 10 year T Bill rate as against a fixed rate of 9.20 percent. Describe the swap on the assumptions that

- The swap differential is shared between the two equally or
- The swap differential is shared between Madagascar and Syndicate in the ratio of 3:1
- The swap banker charges 0.1% as charges and swap benefits are shared equally

Answer:**WN 1: Structure of interest rates:**

Particulars	Fixed rate	Floating rate
M Limited	8%	T+0.6%
S Limited	9.2%	T+1.2%

- Total interest rate of combination 1 [M limited (fixed) & S Limited (Floating)] = 8% + T + 1.2% = T+9.2%
- Total interest rate of combination 2 [M limited (floating) & S Limited (fixed)] = T + 0.6% + 9.2% = T+9.8%
- Ideal combination = Combination 1; This would mean that M Limited should borrow at fixed rate and S Limited should borrow at floating rate
- Actual scenario:** M Limited plans to borrow at floating rate and S Limited plans to borrow at fixed rate
- Scope for Interest rate swap exist as the ideal and actual scenario does not match
- Swap gain = Difference in total interest of combination 1 & 2 = (T + 9.8%) – (T + 9.2%) = 0.6%
- Share of swap gain (equal gain):**
 - M Limited = 0.30%
 - S Limited = 0.30%

WN 2: IRS structuring:

Particulars	M Limited	S Limited
1. Pay to banker as per ideal rate	8%	T + 1.2%
2. M Limited to S Limited	T	(T)
3. S Limited to M Limited (b/f)	(7.7%)	7.7%
4. Effective borrowing rate	T + 0.3%	8.9%

Notes:

- M Limited wanted to borrow at floating rate. They will be asked to pay Treasury bill rate to S Limited and this would swap their fixed loan to a floating loan
- Effective borrowing rate = Original rate – share of swap gain
- S Limited payment to M Limited will be taken as balancing figure

WN 3: IRS structuring if gain is shared in the ratio of 3:1**Share of swap gain:**

- M Limited = $0.60 \times (3/4) = 0.45\%$
- S Limited = $0.60 \times (1/4) = 0.15\%$

Particulars	M Limited	S Limited
1. Pay to banker as per ideal rate	8%	T + 1.2%
2. M Limited to S Limited	T	(T)
3. S Limited to M Limited (b/f)	(7.85%)	7.85%
4. Effective borrowing rate	T + 0.15%	9.05%

WN 4: IRS Structuring with swap intermediary:**Share of swap gain:**

- Intermediary = 0.10% (assumed to be combined charge from both companies)
- M Limited = 0.25%
- S Limited = 0.25%

Structuring for M Limited:

Particulars	M Limited
1. Pay to banker as per ideal rate	8%
2. M Limited to intermediary	T
3. Intermediary to M Limited (bal figure)	(7.65%)
4. Effective borrowing rate	T + 0.35%

Structuring for S Limited:

Particulars	S Limited
1. Pay to banker as per ideal rate	T + 1.20%
2. S Limited to intermediary (bal figure)	7.75%
3. Intermediary to S Limited	(T)
4. Effective borrowing rate	8.95%

20. Interest rate swap

There are two firms A and B. Firm A has invested USD 100 million in fixed rate bonds yielding 8.5 percent. Firm A is not a highly rated firm and it has raised its loan for funding its assets through floating rate loan from bank at an interest rate of LIBOR + 0.50%. Firm B has invested USD 100 million in floating rate bond yielding LIBOR + 0.75% and it has raised its loan for funding its assets through fixed rate loan from bank at 6%. There is a big bank which offers interest rate swap with a spread of 0.10% as follows:

- ❖ Swap Bid = 6.4% for LIBOR
- ❖ Swap Ask = 6.5% for LIBOR
- a) Explain how the two companies can reduce the interest rate risk
- b) Calculate the companies locked in spread

Answer:**Hedging interest rate risk:**

- Firm A has taken a floating rate loan and created a fixed rate deposit. Firm A will be impacted if interest rates go up. Firm A should enter into IRS with Big Bank. They should receive LIBOR and pay 6.5 percent to other party
- Firm B has taken a fixed rate loan and created a floating rate deposit. Firm B will be impacted if interest rates come down. Firm B should enter into IRS with Big Bank. They should pay LIBOR and receive 6.4 percent from other party

Computation of locked in spread:

Particulars	Firm A	Firm B
1. Investment rate	8.5%	LIBOR + 0.75%
2. Borrowing Rate	(LIBOR + 0.50%)	(6%)
3. Firm to Big Bank	(6.5%)	(LIBOR)
4. Big Bank to Firm	LIBOR	6.4%
5. Locked in spread	1.50%	1.15%

21. Interest rate swap [May 2010]

ABC Bank is seeking fixed rate funding. It is able to finance at a cost of six months LIBOR + 0.25% for Rs.200 million for 5 years. The bank is able to swap into a fixed rate at 7.5% versus six months LIBOR treating six months as exactly half a year.

- ❖ What will be the all in cost funds to ABC Bank?
- ❖ Another instrument being considered is the issue of a hybrid instrument which pays 7.5% for first three years and LIBOR – 0.25% of remaining two years. Given a three year swap rate of 8%, suggest the method by which the bank could achieve fixed rate funding.

Answer:**WN 1: Computation of effective borrowing rate:**

Particulars	Rate
1. Original borrowing rate	LIBOR + 0.25%
2. ABC Bank to counterparty	7.5%
3. Counterparty to ABC Bank	(LIBOR)
4. Effective borrowing rate	7.75%

WN 2: Hedging for hybrid instrument:

- ABC Bank will pay fixed rate for first three years and floating rate for next two years. They want to convert into fixed rate loan for all five years
- Five-year swap will not help as it will convert the first three year into floating rate. Three-year swap will also not help as it will convert first three years into floating rate
- To hedge the hybrid instrument, we need to follow the below steps:
 - Use 3-year swap and convert fixed rate into floating rate
 - Use 5-year swap and convert entire floating loan into fixed rate loan

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5
Original borrowing rate	7.5%	7.5%	7.5%	LIBOR – 0.25%	LIBOR – 0.25%
3-year swap					
Receipt	(8%)	(8%)	(8%)		
Payment	LIBOR	LIBOR	LIBOR		
Effective cost post 3-year swap	LIBOR – 0.5%	LIBOR – 0.5%	LIBOR – 0.5%	LIBOR – 0.25%	LIBOR – 0.25%
5-year swap					
Receipt	(LIBOR)	(LIBOR)	(LIBOR)	(LIBOR)	(LIBOR)
Payment	7.5%	7.5%	7.5%	7.5%	7.5%
Effective cost post 5-year swap	7%	7%	7%	7.25%	7.25%

22. Interest rate swap

Grades Limited enjoys a high credit rating and is capable of raising term funds either at a fixed rate of 10% p.a. or at a floating rate of 40 basis points over MIBOR. Level Limited enjoys a relatively lower credit rating

and is able to borrow either at 80 basis points over MIBOR or at affixed rate of 10.5%. Level limited wants to borrow at fixed rate whereas Grades would like to enjoy a floating rate. Structure a swap arrangement such that Grades gains 2/3rd of the total gain. Assume that there are no intermediaries. What action would follow if Grades apprehends that interest rates will harden while Level believes that interest rates will soften?

Answer:

WN 1: Structure of interest rates:

Particulars	Fixed rate	Floating rate
Grades Limited	10%	MIBOR + 0.40%
Level Limited	10.50%	MIBOR + 0.80%

- Total interest rate of combination 1 [Grades limited (fixed) & Level Limited (Floating)] = 10% + MIBOR + 0.8% = MIBOR + 10.80%
- Total interest rate of combination 2 [Grades limited (floating) & Level Limited (fixed)] = 10.50% + MIBOR + 0.40% = MIBOR + 10.90%
- Ideal combination = Combination 1; This would mean that Grades Limited should borrow at fixed rate and Level Limited should borrow at floating rate
- **Actual scenario:** Grades Limited plans to borrow at floating rate and Level Limited plans to borrow at fixed rate
- Scope for Interest rate swap exist as the ideal and actual scenario does not match
- Swap gain = Difference in total interest of combination 1 & 2 = 0.10%
- **Share of swap gain (2:1):**
 - Grades Limited = 0.07%
 - Level Limited = 0.03%

WN 2: IRS structuring:

Particulars	Grades Limited	Level Limited
1. Pay to banker as per ideal rate	10%	MIBOR + 0.80%
2. Grades Limited to Level Limited	MIBOR	(MIBOR)
3. Level Limited to Grades Limited (bal figure)	(9.67%)	9.67%
4. Effective borrowing rate	MIBOR + 0.33%	10.47%

Rework scenario:

- Grades Limited believes that interest rates will harden (go up) and hence they would opt for fixed rate loan. Level Limited believes that interest rates will soften (come down) and hence they would opt for floating rate loan
- The above scenario is in line with ideal combination and hence no scope for IRS exist

23. Interest rate swap [May 2019, May 2021 MTP, Nov 2020]

IM is an American firm having its subsidiary in Japan and JI is a Japanese firm having its subsidiary in USA. They face the following interest rates

Particulars	IM	JI
USD floating rate	LIBOR + 0.5%	LIBOR + 2.5%
JPY Fixed rate	4%	4.25%

IM wishes to borrow USD at floating rate and JI JY at fixed rate. The amount required by both the companies is same at the current exchange rate. A financial institution requires 75 basis points as commission for arranging swap. The companies agree to share the benefit/loss equally.

You are required to find out

- Whether a beneficial swap can be arranged?
- What rate of interest for both IM and JI?

Answer:

WN 1: Structure of interest rates:

Particulars	Fixed rate	Floating rate
IM	4%	LIBOR + 0.50%
JI	4.25%	LIBOR + 2.5%

- Total interest rate of combination 1 [IM limited (fixed) & JI Limited (Floating)] = 4% + LIBOR + 2.5% = LIBOR + 6.5%

- Total interest rate of combination 2 [IM limited (floating) & JI Limited (fixed)] = LIBOR + 0.5% + 4.25% = LIBOR + 4.75%
- Ideal combination = Combination 2; This would mean that IM Limited should borrow at floating rate and JI Limited should borrow at fixed rate
- **Actual scenario:** IM Limited plans to borrow at floating rate and JI Limited plans to borrow at fixed rate
- Scope for IRS does not exist as the actual scenario is in line with ideal scenario
- Effective borrowing rate for IM = LIBOR + 0.5%
- Effective borrowing rate for JI = 4.25%

Note: ICAI solution to this question is wrong and hence the same has not been followed

24. Interest rate swap:

Electronic Limited enjoys a high rating in Indian money market due to its strong financials and track record. Tim software Ltd., is a new but a growing company. Electronic and Tim Software Ltd., can obtain loans at the rate given below:

Particulars	CD (company Deposit) with Fixed rate	Mumbai Inter-bank Money Market with Variable rate
Electronic Limited	T + 0.50%	MIBOR + 0.10%
Tim Software Limited	T + 2.10%	MIBOR + 0.60%

*Here T means the risk free 15 years Government Bonds.

Electronic Ltd., wants to take a loan at variable rate, while Tim Software wants to take loan at fixed rate. The two companies approached a bank to design a suitable Swaps.

(a) If the bank wants to have a profit of 0.20% to be contributed from Tim Software's (out of total profits of Swap) share of Swap benefit, what would be the two agreements that the bank will enter with these two companies.

(b) What are the likely costs of debts to the two companies.

Answer:

WN 1: Identification of interest rate benefit:

Particulars	Calculation	Amount
Total cost of combination 1 Electronic (Fixed) & Tim (Floating)	T + 0.50% + MIBOR + 0.60%	T + MIBOR + 1.10%
Total cost of combination 1 Electronic (Floating) & Tim (Fixed)	MIBOR + 0.10% + T + 2.10%	T + MIBOR + 2.20%

- ❖ Ideal combination as per the above table is combination 1 as the same has lower net cost. Therefore, Electronic Limited should borrow in fixed and Tim Limited should borrow in Floating rate. However, the actual borrowing requirement is opposite and hence the opportunity for interest rate swap exists
- ❖ Swap will have total gain of 110 bps. The gain will be shared as 55 bps for Electronic Limited and 55 bps for Tim Software Limited. The swap intermediary will charge 20 bps from Tim Software Limited and hence net gain for Tim software Limited is 35 bps.

WN 2: Structuring of swap arrangement:

Particulars	Electronic Limited	Tim Software Limited
Borrow from bank as per ideal combination	T + 0.50%	MIBOR + 0.60%
Receive from swap intermediary (receive what is paid to bank)	(T + 0.50%)	(MIBOR + 0.60%)
Pay to swap intermediary (Balancing figure)	MIBOR - 0.45%	T + 1.75%
Effective cost (Original borrowing cost - swap gain)	MIBOR - 0.45%	T + 1.75%

25. Interest rate swap [May 2011 RTP]

The following details are related to the borrowing requirements of ABC Limited and DEF Limited.

Company	Requirement	Fixed rate	Floating rate
ABC Limited	Fixed rate	4.5%	PLR + 2%
DEF Limited	Floating rate	5.0%	PLR + 3%

Both companies are in need of Rs.2,50,00,000 for a period of 5 years. The interest rates on the floating rate loans are reset annually. The current PLR for various maturities are as follows:

Maturity (years)	PLR (%)
1	2.75
2	3.00
3	3.20
4	3.30
5	3.375

DEF Limited has bought an interest rate cap at 5.625% at an upfront premium payment of 0.25%. You are required to exhibit how these two companies can reduce their borrowing cost by adopting a swap assuming that gains resulting from swap shall be shared equally among them. Further calculate cost of funding to these two companies assuming that expectation theory holds good for the 4 years.

Answer:

WN 1: Structure of interest rates:

Particulars	Fixed rate	Floating rate
ABC Limited	4.5%	PLR + 2%
DEF Limited	5.0%	PLR + 3%

- Total interest rate of combination 1 [ABC limited (fixed) & DEF Limited (Floating)] = 4.5% + PLR + 3% = PLR + 7.5%
- Total interest rate of combination 2 [ABC limited (floating) & DEF Limited (fixed)] = 5.0% + PLR + 2% = PLR + 7%
- Ideal combination = Combination 2; This would mean that ABC Limited should borrow at floating rate and DEF Limited should borrow at fixed rate
- **Actual scenario:** ABC Limited plans to borrow at fixed rate and DEF Limited plans to borrow at floating rate
- Scope for Interest rate swap exist as the ideal and actual scenario does not match
- Swap gain = Difference in total interest of combination 1 & 2 = 0.50%
- **Share of swap gain (1:1):**
 - ABC Limited = 0.25%
 - DEF Limited = 0.25%

WN 2: IRS structuring:

Particulars	ABC Limited	DEF Limited
1. Pay to banker as per ideal rate	PLR + 2%	5%
2. ABC Limited to DEF Limited	2.25%	(2.25%)
3. DEF Limited to ABC Limited	(PLR)	PLR
4. Effective borrowing rate	4.25%	PLR + 2.75%

WN 3: Computation of effective borrowing rate:

ABC Limited:

- ABC Limited has effective fixed rate funding and hence their effective cost will be 4.25%

DEF Limited:

Part 1: Computation of forward interest rates:

FRA	Formula	Calculation	Rate
1 to 2	$\frac{\text{FVF for 2 years}}{\text{FVF for 1 year}} - 1$	$\frac{(1 + 3\%)^2}{(1 + 2.75\%)^1} - 1$	3.25%
2 to 3	$\frac{\text{FVF for 3 years}}{\text{FVF for 2 years}} - 1$	$\frac{(1 + 3.20\%)^3}{(1 + 3\%)^2} - 1$	3.60%
3 to 4	$\frac{\text{FVF for 4 years}}{\text{FVF for 3 years}} - 1$	$\frac{(1 + 3.30\%)^4}{(1 + 3.20\%)^3} - 1$	3.60%
4 to 5	$\frac{\text{FVF for 5 years}}{\text{FVF for 4 years}} - 1$	$\frac{(1 + 3.375\%)^5}{(1 + 3.30\%)^4} - 1$	3.68%

Part 2: Effective borrowing cost:

Year	Forward Rate	Borrowing cost	Cap receipt@	Net borrowing cost

		(PLR + 2.75%)		
1	2.75%	5.50%	0	5.50%
2	3.25%	6.00%	(0.375%)	5.625%
3	3.60%	6.35%	(0.725%)	5.625%
4	3.60%	6.35%	(0.725%)	5.625%
5	3.68%	6.43%	(0.805%)	5.625%
Effective borrowing rate#				5.60%

@ It is assumed that strike rate given in the question is for DEF's borrowing rate (PLR + 2.75%)

Effective borrowing cost excludes premium on interest rate cap

26. Interest rate swap [Nov 2016 RTP, Nov 2018, Nov 2008, Nov 2010, May 2021 MTP]

Suppose a dealer quotes 'All-in-cost' for a generic swap at 8% against six months LIBOR flat. If the notion principal amount of swap is Rs.5,00,000.

- Calculate semi-annual fixed payment
- Find the first floating rate payment for above if the six month period from the effective date of swap to the settlement date comprise of 181 days and that the corresponding LIBOR was 6% on the effective date of swap
- In (ii) above, if the settlement is on 'Net' basis, how much the fixed rate payer would pay to the floating rate payer? Generic swap is based on 30/360 days basis.

Answer:

$$\text{Semi - annual fixed payment} = 5,00,000 \times 8\% \times \left(\frac{1}{2}\right) = 20,000$$

$$\text{Floating payment} = 5,00,000 \times 6\% \times \left(\frac{181}{360}\right) = 15,083$$

$$\text{Net payment by fixed rate payer to floating rate payer} = 20,000 - 15,083 = \text{Rs. } 4,917$$

27. Evaluation of interest swap arrangement [Nov 2015 RTP]

NoBank offers a variety of services to both individuals as well as corporate customers. NoBank generates funds for lending by accepting deposits from customers who are paid interest at PLR which keeps on changing.

NoBank is also in the business of acting as intermediary for interest rate swaps. Since it is difficult to identify matching client, NoBank acts counterparty to any party of swap. Sleepless approaches NoBank who already have Rs. 50 crore outstanding and paying interest @PLR+80bp p.a. The duration of loan left is 4 years. Since Sleepless is expecting increase in PLR in coming year, he asked NoBank for arrangement of interest of interest rate swap that will give a fixed rate of interest.

As per the terms of agreement of swap NoBank will borrow Rs.50 crore from Sleepless at PLR+80bp per annum and will lend Rs. 50 crore to Sleepless at fixed rate of 10% p.a. The settlement shall be made at the net amount due from each other. For this services NoBank will charge commission @0.2% p.a. if the loan amount. The present PLR is 8.2%.

You as a financial consultant of NoBank have been asked to carry out scenario analysis of this arrangement. Three possible scenarios of interest rates expected to remain in coming 4 years are as follows:

	Year 1	Year 2	Year 3	Year 4
Scenario 1	10.25	10.50	10.75	11.00
Scenario 2	8.75	8.85	8.85	8.85
Scenario 3	7.20	7.40	7.60	7.70

Assuming that cost of capital is 10%, whether this arrangement should be accepted or not.

Answer:

WN 1: Computation of NPV of scenario 1:

Year	PLR	Payment by Nobank PLR + 0.80%	Receipt by nobank 10.20%	Net payment/ receipt	PVF @ 10%	DCF
1	10.25%	5,52,50,000	5,10,00,000	(42,50,000)	0.909	(38,63,250)
2	10.50%	5,65,00,000	5,10,00,000	(55,00,000)	0.826	(45,43,000)
3	10.75%	5,77,50,000	5,10,00,000	(67,50,000)	0.751	(50,69,250)

4	11.00%	5,90,00,000	5,10,00,000	(80,00,000)	0.683	(54,64,000)
NPV of scenario 1						(1,89,39,500)

WN 2: Computation of NPV of scenario 2:

Year	PLR	Payment by Nobank PLR + 0.80%	Receipt by nobank 10.20%	Net payment/ receipt	PVF @ 10%	DCF
1	8.75%	4,77,50,000	5,10,00,000	32,50,000	0.909	29,54,250
2	8.85%	4,82,50,000	5,10,00,000	27,50,000	0.826	22,71,500
3	8.85%	4,82,50,000	5,10,00,000	27,50,000	0.751	20,65,250
4	8.85%	4,82,50,000	5,10,00,000	27,50,000	0.683	18,78,250
NPV of scenario 2						91,69,250

WN 3: Computation of NPV of scenario 3:

Year	PLR	Payment by Nobank PLR + 0.80%	Receipt by nobank 10.20%	Net payment/ receipt	PVF @ 10%	DCF
1	7.20%	4,00,00,000	5,10,00,000	1,10,00,000	0.909	99,99,000
2	7.40%	4,10,00,000	5,10,00,000	1,00,00,000	0.826	82,60,000
3	7.60%	4,20,00,000	5,10,00,000	90,00,000	0.751	67,59,000
4	7.70%	4,25,00,000	5,10,00,000	85,00,000	0.683	58,05,500
NPV of scenario 3						3,08,23,500

Conclusion:

- Nobank should go ahead with IRS if they believe Scenario 2/3 is likely scenario. However, if they believe scenario 1 will happen they should avoid IRS

28. Calculation of interest expenditure:

Principal	USD 100 million
Interest	8% p.a.
Coupon	March 1 and September 1

Calculate interest from March 1 to July 3 under following day count conventions:

- ❖ 30/360 (coupon bonds)
- ❖ Actual days / 360 (money market instruments)
- ❖ Actual days / reference period days (treasury days)

Answer:**Computation of interest:**

Convention	Numerator	Denominator	Calculation	Amount
30/360	122 days [30+30+30+30+2]	180 days [360/2]	100 million x (122/180) x 4%	27,11,111
Actual days/360	124 days [31+30+31+30+2]	180 days [360/2]	100 million x (124/180) x 4%	27,55,556
Actual days/reference period	124 days [31+30+31+30+2]	184 days [31+30+31+30+31+31]	100 million x (124/184) x 4%	26,95,652

29. Calculation of interest rate [May 2012 RTP, Nov 2017 RTP, May 2018, Nov 2010, May 2014 MTP, Nov 2017 MTP]

Derivative Bank entered into a swap arrangement on a principal of Rs. 10 crores and agreed to receive MIBOR overnight floating rate for a fixed payment on the principal. The swap was entered into on Monday, 2 August, 2010 and was to commence on 3 August, 2010 and run for a period of 7 days. Respective MIBOR rates for Tuesday to Monday were:

7.75%, 8.15%, 8.12%, 7.95%, 7.98%, 8.15%.

Required:

- The nature of this swap arrangement
- If Derivative Bank received Rs. 317 net on settlement, calculate Fixed rate and interest under both legs.

Notes:

- ❖ Sunday is Holiday.
- ❖ Work in rounded rupees and avoid decimal working.

Answer:

- The given swap arrangement is Plain Vanilla Overnight Index Swap (OIS).

WN 1: Computation of interest to be paid by floating rate payer:

Date	ROI	Opening balance	Interest	Closing balance
August 3 (Tuesday)	7.75%	10,00,00,000	21,233	10,00,21,233
August 4 (Wednesday)	8.15%	10,00,21,233	22,334	10,00,43,567
August 5 (Thursday)	8.12%	10,00,43,567	22,256	10,00,65,823
August 6 (Friday)	7.95%	10,00,65,823	21,795	10,00,87,618
August 7 (Saturday)	7.98%	10,00,87,618	43,764	10,01,31,382
August 9 (Monday)	8.15%	10,01,31,382	22,358	10,01,53,740
Total			1,53,740	

- Interest under floating leg = Rs.1,53,740
- Derivative bank is paying fixed rate and receiving floating rate. Under net settlement they are receiving Rs.317. This is possible if interest under fixed leg is lower than interest under floating leg
- Interest under fixed leg = 1,53,740 - 317 = 1,53,423

Computation of fixed rate:

$$\text{Interest under fixed leg} = 10 \text{ Crores} \times \text{ROI} \times \left(\frac{7}{365}\right) = 1,53,423$$

$$\text{ROI} = 1,53,423 \times \left(\frac{365}{7}\right) \times \left(\frac{1}{10 \text{ Crores}}\right) = 0.079999 \text{ (or) } 8\%$$

30. Interest rate swap [Nov 2011 RTP]

Euroloan Bank has a differential advantage in issuing variable-rate loans, but wishes to avoid the income risk associated with such loan. Currently bank has a portfolio €25,000,000 loans with PLR + 150bp, reset monthly PLR is currently 4%. IB an investment bank has arranged for Euroloan to swap into a fixed interest payment of 6.5% on notional amount of loan for its variable interest income. If Euroloan agrees to this, what amount of interest is received and given in the first month? Further, assume that PLR increased by 200 bp. Compute interest income received and paid with the increase in PLR.

Answer:**WN 1: Computation of net settlement at current PLR of 4%**

Particulars	Calculation	Amount
Interest received from customer	2,50,00,000 × 5.5% × (1/12)	1,14,583.33
Interest paid to swap intermediary	Same as above	1,14,583.33
Interest received from swap intermediary	2,50,00,000 × 6.5% × (1/12)	1,35,416.67
Net inflow from swap intermediary	1,35,416.67 - 1,14,583.33	20,833.34

WN 2: Computation of net settlement if PLR increases by 200 bps

Particulars	Calculation	Amount
Interest received from customer	2,50,00,000 × 7.5% × (1/12)	1,56,250
Interest paid to swap intermediary	Same as above	1,56,250
Interest received from swap intermediary	2,50,00,000 × 6.5% × (1/12)	1,35,416.67
Net outflow to swap intermediary	1,56,250 - 1,35,416.66	20,833.34

31. Selection of source of funding [Nov 2019]:

A German subsidiary of an US based MNC has to mobilize 1,00,000 Euro's working capital for the next 12 months. It has the following options:

Loan from German Bank	5% per annum
Loan from US Parent Bank	4% per annum
Loan from Swiss Bank	3% per annum

Banks in Germany charge an additional 0.25% p.a. towards loan servicing. Loans from outside Germany attract withholding tax of 8% on interest payments. If the interest rates given above are market determined, examine which loan is the most attractive using interest rate differential.

Answer:**Computation of net cost under each of the options:**

Cost in Germany	Borrowing rate + Loan servicing cost 5% + 0.25%	5.25%
Cost in USA	Borrowing rate $\pm$ Premium/Discount (4%) $\frac{1 - 0.08}{1 - 0.08} + 0.96\%$ 4.35% + 0.96%	5.31%
Cost in Switzerland	Borrowing rate $\pm$ Premium/Discount (3%) $\frac{1 - 0.08}{1 - 0.08} + 1.94\%$ 3.26% + 1.94%	5.20%

Conclusion:

- German Subsidiary should borrow money from Swiss Bank as the effective cost is lowest

Computation of exchange rate premium in USA and Switzerland:**Premium in USA:**

$$(1 + \text{Home Currency Rate}) = (1 + \text{Foreign Currency Rate}) \times (1 + \text{Premium})$$

$$(1 + 5\%) = (1 + 4\%) \times (1 + \text{Premium})$$

$$(1 + \text{Premium}) = \frac{1.05}{1.04}; (1 + \text{Premium}) = 1.0096$$

$$\text{Premium} = 0.0096 \text{ (or) } 0.96\%$$

Premium in Switzerland:

$$(1 + \text{Home Currency Rate}) = (1 + \text{Foreign Currency Rate}) \times (1 + \text{Premium})$$

$$(1 + 5\%) = (1 + 3\%) \times (1 + \text{Premium})$$

$$(1 + \text{Premium}) = \frac{1.05}{1.03}; (1 + \text{Premium}) = 1.0194$$

$$\text{Premium} = 0.0194 \text{ (or) } 1.94\%$$

Chapter 13 – Business Valuation**1. Explain the various approaches for valuation?****Approaches:**

- **Asset base valuation Models:** The value of shares of target company is computed in terms of net assets acquired. This method of valuation is not based on income generation rather than on income generating assets. Following are the variants of asset-based valuation models
 - Net asset value - Valuing asset based on historical cost
 - Net realizable value - Valued based on liquidation value
 - Replaceable value – Valued based on replacement cost of assets
 - **Earning based Models:** This method is more suitable when acquiring company is intending to continue business of target company for foreseen future **without selling or liquidating assets of the same**. Accordingly, if any additional earning is there due to acquisition the same should also be considered in valuation. Variants of earning based models are:
 - PE Ratio or Earning Yield Multiplier
 - Capitalization of earning
 - **Cash flow-based models:** Cash flow approach takes into account the quantum of free cash that is available in future periods, and discounting the same appropriately to match to the flow's risk.
- 2. Explain how Cash flow-based approach of valuation is different from Income based approach and also explain briefly the steps involved in this approach. [May 2021 RTP]**
- As opposed to the asset based and income-based approaches, **the cash flow approach takes into account the quantum of free cash that is available in future periods**, and discounting the same appropriately to match to the flow's risk.
 - Simply speaking, **if the present value arrived post application of the discount rate is more than the current cost of investment, the valuation of the enterprise is attractive to both stakeholders as well as externally interested parties (like stock analysts)**. It attempts to overcome the problem of over-reliance on historical data. There are essentially five steps in performing DCF based valuation:
 - Arriving at the 'Free Cash Flows'
 - Forecasting of future cash flows (also called projected future cash flows)
 - Determining the discount rate based on the cost of capital
 - Finding out the Terminal Value (TV) of the enterprise
 - Finding out the present values of both the free cash flows and the TV, and interpretation of the results.

3. What are the steps in Valuation of unlisted companies?

Step 1	❖ <u>Take the industry beta:</u> The beta of similar listed companies would be good starting point. As stated above, the levered beta should be converted into unlevered to remove the impact of debt ❖ $\text{Unlevered beta} = \text{Beta} / (1 + (1 - \text{tax rate}) \times (\text{debt} / \text{equity}))$
Step 2	❖ You need to be acutely aware that unlike listed companies, the financial statements of privately held firms <u>may be having some gaps in accounting policies and accounting estimates</u> , that would be needed to be adjusted to determine the correct earnings estimate
Step 3	❖ Find out the Cost of equity using the CAPM technique
Step 4	❖ Compute the WACC for the company by assuming a target debt-equity mix and considering the after-tax cost of debt
Step 5	❖ Since this is a private company, <u>the owners will demand a return towards 'goodwill'</u> . However, in some cases, the acquisition price may include sweeteners for the erstwhile owners to continue in the merged firm, which will then dispense off the need to perform this step
Step 6	❖ Future cash flows of the private company will be treated (discounted) using the WACC rate obtained above as the discount factor
Step 7	❖ The sum of the PV of the cashflows generated by the DCF will be the value of the firm

4. Explain the relative valuation method?

- ❖ Relative Valuation is the method to arrive at a **'relative' value using a 'comparative' analysis to its peers or similar enterprises**. However, increasingly the contemporary financial analysts are using relative valuation in conjunction to the afore-stated approaches to validate the intrinsic value arrived earlier
- ❖ The Relative valuation, **also referred to as 'Valuation by multiples,'** uses financial ratios to derive at the desired metric (referred to as the 'multiple') and **then compares the same to that of comparable firms**. (Comparable firms would mean the ones having similar asset and risk dispositions, and assumed to continue to do so over the comparison period)
- ❖ Following are the steps in relative valuation method:
 - Find out the 'drivers' that will be the best representative for deriving at the multiple
 - Determine the results based on the chosen driver(s) thru financial ratios
 - Find out the comparable firms, and perform the comparative analysis, and
 - Iterate the value of the firm obtained to smoothen out the deviations

5. Explain Chop-Shop Method of Valuation?

- This approach attempts to identify **multi-industry companies** that are undervalued and would have more value if separated from each other. In other words as per this approach an attempt is made to buy assets below their replacement value.
- This approach involves following three steps:
 - Identify the firm's various **business segments** and calculate the average capitalization ratios for firms in those industries.
 - Calculate a "theoretical" market value based upon each of the **average capitalization ratios**.
 - Average the "theoretical" market values **to determine the "chop-shop" value of the firm**

6. Differentiate between Economic Value Added and Market Value Added? [Nov 2020]

Economic Value Added (EVA) – EVA is a holistic method of evaluating a company's financial performance in terms of its contribution to the society at large. The core concept behind EVA is that a company generates 'value' only if there is a creation of wealth in terms of returns in excess of its cost of capital

$$\text{EVA} = \{\text{EBIT} * (1 - \text{Tax rate})\} - \{\text{Invested capital} * \text{WACC}\}$$

Market Value added (MVA): MVA means Current Market Value of the firm minus Invested Capital. It is an alternative way to gauge performance efficiencies of an enterprise, albeit from a market capitalization point of view, the logic being that the market will discount the efforts taken by the management fairly. **Hence, MVA is the true value added that is perceived by the market while EVA is a derived value added that is for the more discerning investor**

7. How to value a company which is not a going-concern?

- Non-Going Concern Valuation is also known as **Liquidation Valuation** because it is the net value realised after disposing off all the assets and discharging all the liabilities. Since an on-going firm could continue to earn the profit, which contributes to its value in addition to its liquidation value the Going Concern Value is known as Total Value.
- **Generally, the going-concern value of a firm will be greater than its liquidation value** because when it is acquired as on basis the value of its assets and considers the value of its future profitability, intangible assets, and goodwill and hence the acquired firm can charge premium for the same.
- Another reason for lower valuation on non-going concern is **that liquidation not only implies the laying off its employees and, but it creates a feeling of bad reputation among potential investors**.

8. Why Conventional Methods cannot be used for valuation of distress Companies?

- A company is in distress when it struggles to **meet financial obligations**, often due to high fixed costs, illiquid assets, or economic downturns. This can lead to operational distress.
- Distressed companies may default on debts, but their assets still hold value, and not being unable to make payments **doesn't make them worthless**.

Conventional methods of valuation: Conventional methods of valuation cannot be used due to following reasons:

- Discounted cashflow valuation method required terminal value calculation which is based upon an **infinite life and ever-growing cashflows**. However, the assumption of perpetuity of cash flows may not be relevant in case of distressed firm because of negative cash flows.
- distressed firm generally **has negative and declining revenues** hence expects to lose money for some more time in the future. For such firms, estimating cash flows is difficult, since there is a high risk of bankruptcy. For firms expected to fail, DCF does not work very well, since DCF values a firm as a going concern – even if the firm is expected to survive, projections have to be made until the cash flows turn positive, else the DCF would yield a negative value for equity or firm.
- **Discount rates** used in conventional methods reflect companies which are operationally as well as financially sound. They **have to be adjusted for the probabilities of failures of the companies to be used in case of distressed companies**.

9. Why Traditional methods cannot be used for valuation of Start-ups?

- Each of the commonly used methods **pre-suppose an established business** – which is profitable, has established competitors and generates cash using its assets. However the same is missing in case of start-ups.
- Following are the reasons for failure of traditional methods:
 - **Income Approach:** Majority of startups operate under the assumption of **not generating positive cash flows in the foreseeable future**. Off late, this business model has been accepted and normalised by the investor community as well. Since there are no or minimal positive cash flows, it isn't easy to value the business correctly
 - **Asset Approach:** Startups have negligible assets because a large chunk of their assets are in the form of intellectual property and other intangible assets. **Start-ups are new, but usually operate under the going concern assumption; hence their value should not be limited to the realisable value of assets today.**
 - **Market Approach:** New-age startups are **disruptors**. They generally function in a market without **established competitors**. Their competition is from other startups working in the same genre. **The lack of established competitors indicates that their numbers may be skewed and not be comparable enough to form a base.**

10. What are the value drivers for Start-ups?

- **Product:** The uniqueness and readiness of the product or service offered by significantly impact the company's valuation
- **Management:** More than half of Indian unicorn startups have founders from IIT or IIM. While it may seem unfair prima facie, it is a fact that if the founders are educated from elite schools and colleges, the startup is looked upon more favourably by the investors and stakeholders alike
- **Traction:** Traction is quantifiable evidence that the product or service works and there is a demand for it.
- **Revenue:** The more revenue streams, the more valuable the company
- **Industry Attractiveness:** The industry's attractiveness plays a vital role in the value of a company. As good as the idea may be, to sustainably scale, various factors like logistics, distribution channels and customer base significantly impacts the startup value.
- **Demand-Supply:** If the industry is attractive, there will be more demand from investors, making the industry's individual company more valuable.
- **Competitiveness:** The lesser the competitors, the more valuable the startup will be. There is no escaping the first-mover advantage in any industry.

11. What are the different methods for valuation of Start-ups?

Berkus Approach:

- Valuation based on five key success factors such as Basic value, Technology, Execution, Strategic relationships in its core market and Production and Consequent sales
- A detailed assessment is carried out evaluating how much value the five critical success factors in **quantitative measure add up to the total value of the enterprise**. Based on these numbers, the startup is valued.
- This method **caps pre-revenue valuations at \$2 million and post-revenue valuations at \$2.5 million.**

Cost-to-Duplicate Approach:

- The Cost-to-Duplicate Approach involves taking into account all costs and expenses associated with the startup and its product development, including the purchase of its physical assets.
- All such expenses are considered determine the startup's fair market value based on all the expenses.
- This approach is often criticized for not focusing on the future revenue projections or the assets of the startup.

Comparable Transactions Method:

- Under this method the valuation is done on the basis of valuation of similar start-ups in past.
- With any comparison model, one needs to factor in ratios or multipliers for anything that is a differentiating factor. Examples would be proprietary technologies, intangibles, industry penetration, locational advantages, etc. Depending on the same, the multiplier may be adjusted.

Scorecard Valuation Method:

- Scorecard Method is another option for pre-revenue businesses. It also works by comparing the startup to others already funded but with added criteria
- First, we find the average pre-money valuation of comparable companies. Then, we consider how the business stacks up according to the following qualities:
 - Strength of the team
 - Size of the opportunity
 - Product or service
 - Competitive environment
 - Marketing, sales channels and partnerships
 - Need for additional investment
 - Others
- Then we assign each quality a comparison percentage. Essentially, it can be on par (100%), below average (<100%), or above average (>100%) for each quality compared to competitors/ industry. For example, the marketing team has a 150% score because it is thoroughly trained and has tested a customer base that has positively responded. You'd multiply 10% by 150% to get a factor of .15.
- This exercise is undertaken for each startup quality and the sum of all factors is computed. Finally, that sum is multiplied by the average valuation in the business sector to get a pre-revenue valuation

First Chicago Method:

- This method combines a Discounted Cash Flow approach and a market approach to give a fair estimate of startup value. It works out: Worst-case scenario, Normal case scenario and Best-case scenario
- Valuation is done for each of these situations and multiplied with a probability factor to arrive at a weighted average value.

Venture Capital Method:

- This approach is commonly used by early-stage investors and involves estimating the start-up's future value at the point of an exit event, such as an acquisition or initial public offering (IPO).
- The valuation is based on the expected return on investment that investors seek. For example, if an investor expects a 10x return on investment within five years, they would estimate the start-up's value at the time of exit to achieve that target return.
- The above value is discounted at the rate representing an investor's expected or required rate of return.

12. Explain the approach for valuation of digital platforms?

- A digital platform is a software based online infrastructure that facilitates interactions and transactions between users. Marketplace, Search Engine, Repository, Digital communication, Digital Community and Payments platform are some of the services provided by Digital Platforms

Income Approach:

- Valuation methods in digital platforms involve analyzing the Total Addressable Market (TAM) and Serviceable Addressable Market (SAM) to estimate future revenues and costs.

- The Top-Down Approach involves analyzing the total potential market, estimating the company's future share, and estimating the business plan to achieve objectives. The financial forecast should consider the platform's business model, such as streaming content or payments solution platforms, and its direct operating costs. Penetrative strategies are often employed to gain market share and popularize the platform among end users.
- The Bottom-Up Approach allows platforms to estimate earnings based on limited resources, allowing promoters to target high margin sales and cost-cutting methodologies to generate more cash. The value of a digital platform depends on the quality of financial forecasts, as growth and survival depend on the ability of promoters, investors, and stakeholders to create products or services that meet market needs and adapt to unexpected circumstances.
- Based on either of the approaches we would be able to estimate the future earnings of the company.
- **WACC/Cost of equity can be used as discount rate based on the cash flows being discounted**
- However, computation of Beta can be a challenge due to the unique nature of each digital platform and scarcity of listed traded comparable

Market Approach:

- The Market Approach values a company by drawing a comparison from similar valued companies based on multiples like profit to earnings ('P/E') ratio, Enterprise Value to Earnings before Interest, Tax, Depreciation and Amortization ('EV/EBITDA') ratio, Price to Book Value ratio, Price to Revenue/Sales Ratio.
- Digital platforms face challenges in comparison approach due to scarce comparables, negative underlying values, and low Book Value due to capital-lite nature.
- **Valuation can also be done on parameters such as No of bookings made, no of registered users, volume of transactions, no of active subscribers, no of registered merchants, time taken per search, no of searches etc.**

Cost Approach:

- The Cost Approach estimates the value of a digital platform by calculating the total cost of building it, focusing on the code written by developers.
- However, this approach may not be most appropriate as it fails to take into account the revenue generating capacity of the digital platform which may create significantly higher value for the shareholders of the company versus the cost spent on developing the platform

13. Explain the special considerations in valuation of Professional/Consultancy Firms?

- Professional services firms provide customized, knowledge-based services to clients, including Chartered Accountants, Advocates, and Management Consultancy firms.
- Understanding industry trends and historical data is crucial for determining an accurate valuation amount. Valuation experts compare firms against competitors using sources like Audited Annual Statements and Income Tax Returns.
- While historical data is important, projected growth (Terminal Value) also impacts the overall value. Although Valuation experts plan for future growth and compare it to the projected trends after conversations with management but there is an inherent risk associated with using future earnings potential, as results may or may not materialize. Hence, this risk should be factored into the overall calculation.
- In addition to analysis of financial statements and their comparison to industry standards, normalisation of net income and cash flows is another important aspect. This step allows comparison of firms on equal footing. This step involves adding back of non-cash items and specific items, which might not apply to a new firm. Then these normalized cash flows are applied to the chosen valuation method and used in calculating overall value.
- One commonly used method to analyse the extent that a firm meets expectations in comparison to current industry benchmarks and KPIs. Since professional services includes several different types of firms, KPIs can vary greatly and hence it is equally important to look at specific indicators which align with acquirer firm's goals.

14. What is the impact of ESG on valuation?

- Environmental, Social, Governance (ESG) is a framework designed to be embedded into an organization's strategy that considers the needs and ways in which to generate value for all organizational stakeholder

- ESG is a growing **concern for investors**, focusing on environmental, social, and governance aspects to create sustainable value. Key environmental concerns include climate change, natural resource scarcity, diversity, and cyber security.
- ESG performance and ratings are **influencing companies' financing options for future growth**. High ESG focus from investors, lenders, and financial institutions leads to **preferential debt costs and access to specialized financial products like Green, Social, and Sustainability linked bonds**.
- ESG is now considered a **must-have** in business ethics, sustainability, diversity, and community. Directors recognize the importance of operational efficiency, risk reduction, and long-term organizational resiliency.
- **ESG factors can be incorporated into valuation by discounting future cash flows and adjusting discount rates or expected cash flows**. However, the impact of ESG factors may not be as explicit, so adjusting them in cash flows would be more explicit. **Factors like environmental, social, and governance risks can be considered in the computation of expected cash flows**.

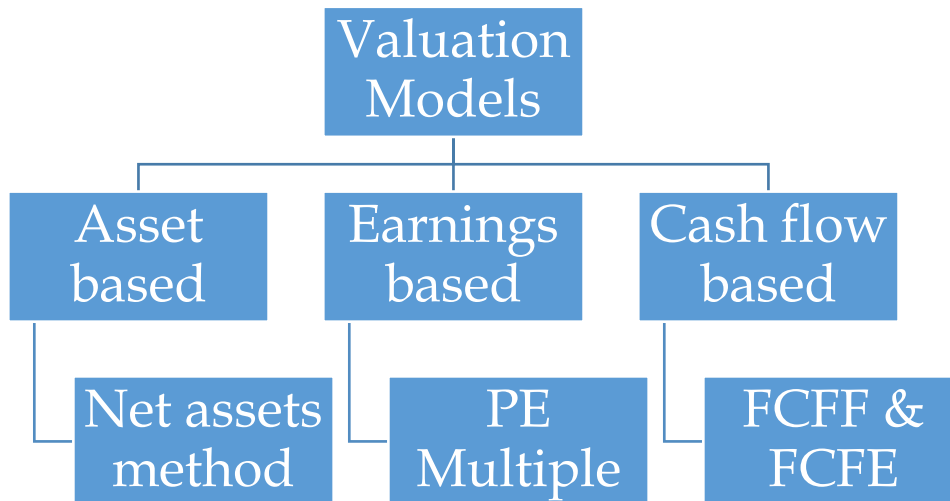
Theory to solve problems

Economic Value Added (EVA):

- ❖ EVA is a measure of a company's financial performance based on the residual wealth calculated by deducting its cost of capital from its operating profit, adjusted for taxes. EVA can also be referred to as economic profit and it attempts to capture the true economic profit of a company
- ❖ The purpose of EVA is to assess company and management performance. EVA champions the idea a business is only profitable when it creates wealth and returns for shareholders, and requires performance above a company's cost of capital
- ❖ **EVA = {EBIT * (1-Tax rate)} - {Invested capital * WACC}**
- ❖ EBIT has to be adjusted for non-recurring items, extra-ordinary items such as one-time advertisement expenditure, write-off of bad debts, loss due to fire among others
- ❖ Capital employed has to be ascertained on replacement cost basis and not on book value
- ❖ **EVA versus market value added:** EVA is calculated from earnings point of view whereas market value added represents the difference between market value of equity and book value of equity.

Adjustments to NOPAT and capital Employed:

- ❖ **For Advertising, Research and Development Items expensed, Staff Training**
 - **Impact on Profit:** Increase CY's profit, deduct economic depreciation on PY's EVA adjustment.
 - **Impact on Capital Employed:** Increase capital employed at the end of the year, increase capital employed in respect of similar add backs of PY's investments not treated as such in financial statements (net of economic depreciation)
- ❖ **For Depreciation**
 - **Impact on Profit:** Add accounting depreciation and subtract economic depreciation.
 - **Impact on Capital Employed:** Alter value of non-current assets (and capital employed) to reflect economic depreciation not accounting depreciation.
- ❖ **For Non- Cash Expenses**
 - **Impact on Profit:** Add back to profit.
 - **Impact on Capital Employed:** Add to retained profits at the end of the year.
- ❖ **For tax charge**, this will be based on 'cash taxes' rather than the accruals based methods used in financial reporting.

**Free cash flow to firm versus free cash flow to equity:**

Free Cash Flow to Firm (FCFF)	Free Cash Flow to Equity (FCFE)
FCFF is the cash available to all of the firm's investors, including stockholders and bondholders.	FCFE is the amount of FCFF left after the firm has met all its obligations to its other investors such as bondholders
Value of the firm can be calculated by discounting FCFF at weighted average cost of capital (WACC)	Value of the equity can be calculated by discounting FCFE at cost of equity

FCFF can be calculated using the following items:

From Net Income	Net Income + Non-cash charges + Interest * (1 - Tax rate) - Fixed capital investment - working capital investment
From EBIT	EBIT * (1 - Tax rate) + Non-cash charges - Fixed capital investment - working capital investment
From EBITDA	EBITDA * (1 - Tax rate) + (Depreciation * Tax rate) - Fixed capital investment - working capital investment
From cash flow from operations (CFO)	CFO + Interest * (1 - Tax rate) - Fixed capital investment

FCFE can be calculated using the following items:

From FCFF	FCFF - Interest * (1 - Tax rate) + Net borrowing
From Net Income	Net Income + Non-cash charges - Fixed capital investment - working capital investment + Net borrowing
From CFO	CFO - Fixed capital investment + Net borrowing

Market Value Added (MVA), Economic Value Added (EVA) and Shareholder Value Added (SVA):

EVA	[EBIT * (1 - Tax rate)] - [WACC * Invested capital]
MVA	Market value of firm - Book value of firm
SVA	SVA approach is based on future cash flows and it is used for calculating intrinsic value of equity

How to compute Shareholder Value Added?

- ❖ **Step 1:** Compute the future cash flows of the firm and discount the same at cost of capital. The sum of the values of step 1 will be the intrinsic value of firm
- ❖ **Step 2:** Intrinsic value of equity = Intrinsic value of Firm + Market value of non-core assets - Value of debt

Methods of valuation of distress companies:

Modified Discounted Cash Flow Valuation	• We need to identify various possible cash flows (for different scenarios) with their probability and based on the compute the estimated cash flows • We should adjust cash flows and discount rate for the likelihood of default

	In case we are not able to compute probability for entire distribution, the probability of distress is computed and the expected cash flows is computed as: <u>Expected cash flow = Cash flow x (1 - Probability of Distress)</u>
DCF Valuation + Distress Value	- Value the company as if it is a going concern and arrive at DCF valuation - Identify the probability of distress and compute the distress value Final value = DCF value of equity x (1 - Probability of Distress) + Distress value of equity x Probability of Distress
Adjusted Present value Model	Firm Value = Unlevered firm value + (Tax Benefits on debt - Expected Bankruptcy cost from the debt) - Unlevered firm value is computed by discounting cash flows at unlevered cost of equity - Present value of tax benefit on debt is computed by discounting the same at cost of debt Expected Bankruptcy Cost = [Unlevered Firm value - Distress sale value] x Probability of Distress
Relative Valuation	- Relative Valuation multiples such as <u>Revenue and EBITDA multiples are used more popular measures to value distressed firms</u> than healthy firms because multiples such as Price Earnings or Price to Book Value etc. often cannot even be used for a distressed firm. - However, the multiple <u>needs to be revised downwards to reflect the distress</u>. For example, assume that the average telecom firm trades at 2 times revenues. So, adjust this multiple down to 1.25 times revenues for a distressed telecom firm

Practical Problems

Overview:

- Part I – Economic Value Added
- Part II – Valuation of Business
- Part III – Market Value Added and Shareholder Value Added
- Part IV – Valuation of distressed companies
- Part V – Valuation of Start-ups
- Part VI – Valuation of Digital Platforms
- Part VII – Valuation of Professional/Consultancy firms
- Part VIII – Impact of ESG on valuation

Part I – Economic Value Added

1. Calculation of EVA [May 2012 RTP]

The following figures pertain to ABC Limited as on December 31, 2010

Particulars	Amount (in lacs)
Income from consultancy	935.00
EBIT	180.00
Less: Interest on loan	18.00
EBT	162.00
Tax @ 35%	56.70
EAT	105.30

Balance sheet as on December 31, 2010

Liabilities	Amount	Assets	Amount
Equity share capital of Rs.10 each	100	Land and Building	200
Reserves & Surplus	325	Computer & software	295
Loans	180	Current assets	290
Current liabilities	180		
	785		785

With the above information and following assumption you are required to compute:

- Economic value added

- Market value added

Assuming that:

- WACC is 12%
- The share of the company is currently quoted at Rs.50 each

Answer:

WN 1: Computation of Economic Value Added:

- $EVA = [EBIT \times (1 - \text{Tax rate})] - (\text{Capital employed} \times \text{WACC})$
- $EVA = [180 \times (1 - 35\%)] - [(100 + 325 + 180) \times 12\%]$
- $EVA = 117 - 72.60$
- **EVA = 44.40 lacs**

WN 2: Computation of market value added:

- Market value added = Market value of firm – Book value of firm
- $MVA = [(10 \times 50 + 180) - [100 + 325 + 180]]$
- **MVA = Rs.75 lacs**

Note:

- **Value of Firm = Value of equity + Value of debt + Value of preference**

2. Calculation of EVA [May 2015 RTP]

ABC Limited has divisions A, B & C. The Division C has recently reported an annual operating profit of Rs.2020 lacs. This figure arrived at after charging Rs.300 lacs full cost of advertisement expenditure for launching a new product. The benefits of this expenditure is expected to be lasted for 3 years. The cost of capital of Division C is 11% and cost of debt is 8%. The Net Assets (Invested capital) of Division C as per latest Balance Sheet is Rs.6000 lacs, but replacement cost of these assets is estimated at Rs.8400 lacs. You are required to compute EVA of Division C.

Answer:

Computation of Economic Value Added:

- $EVA = [EBIT \times (1 - \text{Tax rate})] - (\text{Capital employed} \times \text{WACC})$
- $EVA = [2,220 \times (1 - 25\%)] - [8,400 \times 11\%]$
- $EVA = 1,665 - 924$
- **EVA = Rs.741 lacs**

Note 1: Computation of Adjusted EBIT:

Particulars	Amount
Reported EBIT	2,020
Add: Full Advertisement expenditure	300
Less: Annual advertisement charge (300/3)	-100
Adjusted EBIT	2,220

Note 2: Tax rates:

- It is assumed that tax rates are 25%

3. Concept of EVA dividend [May 2019 MTP, May 2011, Nov 2010, Nov 2015 RTP]

Delta Limited's current financial year's income statement reports its net income as Rs.15 lacs. Delta's marginal tax rate is 40% and its interest expense for the year was Rs.15 lacs. The company has Rs.100 lacs of invested capital, of which 60% is debt. In addition, Delta Limited tries to maintain a WACC of 12.6%.

- Compute the operating income or EBIT earned by Delta Limited in the current year
- What is Delta Limited EVA for the current year
- Delta Limited has 2,50,000 equity shares outstanding. According to the EVA you computed in (ii), how much can Delta pay in dividend per share before the value of the company would start to decrease? If Delta Limited does not pay any dividends what would happen to value of the company.

Answer:

WN 1: Computation of operating income (EBIT)

Particulars	Calculation	Amount
Net income (PAT)		15,00,000
Income tax		10,00,000

Profit before tax	15,00,000	25,00,000
	1 – 0.4	
Add: Interest		15,00,000
Earnings before interest and taxes		40,00,000

WN 2: Computation of Economic Value Added:

- EVA = [EBIT x (1 – Tax rate)] – (Capital employed x WACC)
- EVA = [40,00,000 x (1 – 40%)] – [1,00,00,000 x 12.60%]
- EVA = 24,00,000 – 12,60,000
- EVA = Rs.11,40,000**

WN 3: Computation of amount of dividend payment:

- The company has reported economic value added (excess earnings) of Rs.11,40,000. This entire EVA will go the equity shareholders
- EVA per share = (11,40,000/2,50,000) = Rs.4.56 per share
- Therefore, the company can pay dividend of Rs.4.56 per share without any impact on the value of the company. If the company does not pay and dividends then the share price will increase by Rs.4.56 per share

4. WACC and EVA computation [May 2014, Nov 2015 MTP]

RST Limited's current financial year's income statement reported its net income as Rs.25,00,000. The applicable income tax rate is 30%. Following is the capital structure of RST Limited at the end of current financial year:

Particulars	Amount
Debt (Coupon rate = 11%)	40 lacs
Equity (Share capital + Reserves and Surplus)	125 lacs
Invested capital	165 lacs

Following data is given to estimate the cost of equity capital:

Particulars	Amount
Beta of RST Limited	1.36 Times
Risk-free rate	8.5%
Average market risk premium	9%

Required:

- Estimate weighted average cost of capital (WACC) of RST Limited and
- Estimate Economic Value Added (EVA) of RST Limited

Answer:**WN 1: Computation of WACC:**

Source	Cost	Weight	Product
Equity	20.74%	125	25.925
Debt	7.7%	40	3.08
Total	17.58%	165	29.005

Note:

- ❖ Cost of equity = $R_f + \text{Beta} \times (R_m - R_f)$
- ❖ Cost of equity = $8.5\% + 1.36 \times 9\% = 20.74\%$

WN 2: Computation of EVA:

EVA	=	EBIT x (1 – Tax rate) – (WACC x Invested capital)
EVA	=	40,11,429 x (1-0.3) – (17.58% x 1,65,00,000)
EVA	=	28,08,000 – 29,00,700
EVA	=	-92,700

Note: Computation of EBIT:

Net Income/PAT	=	25,00,000
PBT	=	$\frac{PAT}{1 - \text{Tax rate}} = \frac{25,00,000}{1 - 0.3} = 35,71,429$
EBIT	=	PBT + Interest
EBIT	=	35,71,429 + 4,40,000 = 40,11,429

5. EVA Computation [Nov 2020 MTP]:

STR Limited's current financial year's income statement reported its net income after tax as Rs.50 Crores. Following is the capital structure of STR Limited at the end of current financial year:

Debt (Coupon rate = 11%)	80 Crores
Equity (Share capital + Reserves and Surplus)	250 Crores
Invested capital	330 Crores

Following data is given to estimate the cost of equity capital:

Asset Beta of STR Limited	1.11 Times
Risk-free rate of return	8.50%
Average market risk premium	9.00%

The applicable income tax rate is 30%. Estimated Economic Value Added of STR Limited in lacs

Answer:

WN 1: Computation of equity Beta of STR Limited:

Source	Beta	Weight	Product
Equity	1.36	250	339.66
Debt	0.00	56	0.00
Total	1.11	306	339.66

Note:

- Weight of debt = Amount of debt $\times$ (1 – Tax rate) = 80 $\times$ (1 – 0.30) = Rs.56 Crores
- We are assuming debt to have beta of 0. Debt Beta can alternatively be calculated using CAPM. We have gone with debt beta as 0 in line with ICAI solution
- Equity Beta = 339.66/250 = 1.36 Times

WN 2: Computation of WACC of STR Limited:

Source	Cost	Weight	Product
Equity	20.74%	250	51.85
Debt	7.7%	80	6.16
Total	17.58%	330	58.01

- Cost of equity = 8.5 + 1.36 $\times$ 9 = 20.74%
- Cost of debt = 11 $\times$ 70% = 7.70%

WN 3: Computation of EVA:

(in lacs)

EVA	=	EBIT $\times$ (1 – Tax rate) – (WACC $\times$ Invested capital)
EVA	=	8,022.86 $\times$ (1-0.3) – (17.58% $\times$ 33,000)
EVA	=	5,616 – 5,801.40
EVA	=	-185.40 lacs

Note: Computation of EBIT:

(in lacs)

Net Income/PAT	=	5,000
PBT	=	$\frac{PAT}{1 - Tax\ rate} = \frac{5,000}{1 - 0.3} = 7,142.86$
EBIT	=	PBT + Interest
EBIT	=	7,142.86 + 880 = Rs.8,022.86 lacs

6. Calculation of EVA [Nov 2013 RTP, May 2018 MTP, May 2010, May 2021 MTP]

Consider the following operating information gathered from 3 companies that are identical except for capital structures

Particulars	P Limited	Q Limited	R Limited
Total invested capital	100,000	100,000	100,000
Debt/assets ratio	0.80	0.50	0.20
Shares outstanding	6,100	8,300	10,000
Before-tax cost of debt	14%	12%	10%
Cost of equity	26%	22%	20%

Operating income	25,000	25,000	25,000
Net income	8,970	12,350	14,950
Tax rate	35%	35%	35%

- Compute the weighted average cost of capital for each company
- Compute the EVA for each company
- Based on the results of your computation in part b, which company would be considered as best investment and why?
- Assume the industry P/E ratio generally is 15x. Using the industry norm, estimate the price for each share
- What factors would cause you to adjust the PE ratio value used in part d so that it is more appropriate?

Answer:

WN 1: Computation of weighted average cost of capital:

P Limited:

Source	Cost	Weight	Product
Equity	26	0.2	5.2
Debt	9.1	0.8	7.28
WACC			12.48

- Cost of debt = $14\% \times (1 - 35\%) = 9.10\%$

Q Limited:

Source	Cost	Weight	Product
Equity	22	0.5	11
Debt	7.8	0.5	3.9
WACC			14.9

- Cost of debt = $12\% \times (1 - 35\%) = 7.80\%$

R Limited:

Source	Cost	Weight	Product
Equity	20	0.8	16
Debt	6.5	0.2	1.3
WACC			17.3

- Cost of debt = $10\% \times (1 - 35\%) = 6.50\%$

WN 2: Computation of Economic value added:

EVA = [EBIT x (1 - Tax rate)] - (Capital employed x WACC)

Particulars	Company P	Company Q	Company R
EBIT (operating income)	25,000	25,000	25,000
EBIT x (1 - Tax rate) (A)	16,250	16,250	16,250
Capital employed	1,00,000	1,00,000	1,00,000
WACC	12.48	14.90	17.30
Cost of capital employed (WACC x Capital employed) (B)	12,480	14,900	17,300
EVA (A - B)	3,770	1,350	-1,050

- Company P would be considered as the best investment since the EVA of the company is highest and its weighted average cost of capital is the lowest

WN 3: Computation of Market price per share:

Particulars	Company P	Company Q	Company R
Net income (PAT)	8,970	12,350	14,950
No of shares	6,100	8,300	10,000
Earnings per share	1.4705	1.4880	1.495
PE Multiple	15	15	15
MPS (EPS x PE Multiple)	22.06	22.32	22.43

Comment on PE Multiple:

- The PE ratio can be adjusted for the change in capital structure of 3 companies. P Limited has a highly leverage capital structure. This will be considered as a risky company and hence will have lower PE Multiple
- R Limited has a better capital structure and hence it will be considered as less risky. This company will therefore have a higher PE Multiple

7. Computation of EVA [May 2019]

Compute Economic value Added (EVA) of Good Luck Limited from the following information:

Particulars	Amount in lacs
Revenue from operations	2000
Direct expenses	800
Indirect expenses	400
Profit before interest and tax	800
Interest	30
Profit before tax	770
Tax	231
Profit after tax	539
Balance sheet	
Shareholder funds	
Equity share capital	1000
Reserves and surplus	600
Long term borrowings	200
Current Liabilities	800
Total liabilities	2600
Assets	
Non-current assets	2000
Current assets	600

Other information:

- Cost of debts is 15%
- Cost of equity (Shareholder's expected return) is 12%
- Tax rate is 30%
- Bad debts provision of Rs.40 lacs is included in indirect expenses and Rs.40 lacs reduced from receivables in current assets.

Answer:

WN 1: Computation of NOPAT:

Particulars	Calculation	Amount (in lacs)
Profit after tax		539
Add: Interest		30
Add: Non-cash expenses		40
NOPAT		609

- EVA adjustments state that non-cash expenses (bad debt provision) need to be added back to profit
- Tax expense will be based on 'cash taxes' rather than accruals-based tax used in financial reporting. It is assumed that Rs.231 lac is the actual tax outflow and hence no adjustment is made for the same

WN 2: Computation of WACC:

Source	Cost	Weight	Product
Debt	10.50 (15% x 70%)	200	2,100
Equity	12.00	1,640	19,680
Total		1,840	21,780

$$\text{WACC} = \frac{\text{Sum of Products}}{\text{Sum of weights}} = \frac{21,780}{1,840} = 11.84\%$$

Note:

- It is assumed that cost of debt given in the question is pre-tax cost of debt
- Equity has been adjusted to give effect to the bad debt provision. Any non-cash item will be added to profits and will also finally get added to the equity of the company

WN 3: Computation of EVA:

- $EVA = NOPAT - (\text{Capital employed} \times WACC)$
- $EVA = 609 \text{ lacs} - (1,840 \times 11.84\%)$
- $EVA = 609 \text{ lacs} - 217.86 \text{ lacs}$
- **EVA = Rs.391.14 lacs**

8. Computation of EVA [Nov 2004, Nov 2012, Nov 2014 MTP, Nov 2016 MTP]

With the help of the following information of Jatayu Limited compute the Economic value Added:

Capital structure	Equity capital - Rs.160 lacs Reserves and surplus - Rs.140 lacs 10% debentures - Rs.400 lacs
Cost of equity	14%
Financial leverage	1.5 times
Income tax rate	30%

Answer:**Note 1: Computation of EBIT:**

Financial leverage	=	$\frac{EBIT}{EBIT - \text{Interest}}$
1.5	=	$\frac{EBIT}{EBIT - 40 \text{ lacs}}$
1.5EBIT - 60 lacs	=	EBIT
0.5 EBIT	=	60 lacs
EBIT	=	120 lacs

Note 2: Computation of WACC:

Source	Cost	Weight	Product
Equity	14%	300	42
Debt	7%	400	28
Total	10%	700	70

❖ Cost of debt should be post-tax cost of debt and the same would be $10\% \times (1 - 30\%) = 7\%$

❖ $WACC = \text{Sum of product} / \text{Sum of weights} = 70 / 700 = 10\%$

Note 3: Computation of EVA:

EVA	=	$EBIT \times (1 - \text{Tax rate}) - (WACC \times \text{Invested capital})$
EVA	=	$120 \text{ lacs} \times (1 - 0.3) - (10\% \times 700)$
EVA	=	84 lacs - 70 lacs
EVA	=	14 lacs

9. EVA calculation [May 2018]

Constant Engineering Ltd. has developed a high tech product which has reduced the Carbon emission from the burning of the fossil fuel. The product is in high demand. The product has been patented and has a market value of Rs. 100 Crore, which is not recorded in the books. The Net Worth (NW) of Constant Engineering Ltd. is Rs. 200 Crore. Long term debt is Rs. 400 Crore. The product generates a revenue of Rs. 84 Crore. The rate on 365 days Government bond is 10 percent per annum. Bond portfolio generates a return of 12 percent per annum. The stock of the company moves in tandem with the market. Calculate Economic Value added of the company

Answer:**Computation of WACC:**

Source	Cost	Weight	Product
Equity	12%	300	36
Debt	10%	400	40
Total	10.86%	700	76

Note:

- ❖ The rate of Government Bond is given as 10 percent per annum. It is assumed that cost of debt is equal to risk-free rate. There is no information on tax rate and hence no adjustment for the same is made

- ❖ Company's stock moves in line with market and hence cost of equity would be equal to return of market. Bond portfolio gives return of 12% and hence K_e would be equal to 12%
- ❖ Networth of the company is currently 200 crores. Patent has not been recorded in books. The networth will increase to Rs.300 crores post recording of patent

Computation of EVA:

EVA	=	EBIT × (1 – Tax rate) – (WACC × Invested capital)
EVA	=	84 crores – (10.86% × 700 crores)
EVA	=	84 crores – 76 crores
EVA	=	8 crores

Note:

- ❖ It is assumed that revenues given in the question as EBIT of the product. Tax information is not given in the question and hence no adjustment for the same

10. Computation of EVA [May 2018, Nov 2020]

Herbal World is a small, but profitable producer of beauty cosmetics using the plant Aloe Vera. Though it is not a high-tech business, yet Herbal's earnings have averaged around Rs. 18.5 lakh after tax, mainly on the strength of its patented beauty cream to remove the pimples. The patent has nine years to run, and Herbal has been offered Rs. 50 lakhs for the patent rights. Herbal's assets include Rs. 50 lakhs of property, plant and equipment and Rs. 25 lakhs of working capital. However, the patent is not shown in the books of Herbal World. Assuming Herbal's cost of capital being 14 percent, calculate its Economic Value Added (EVA)

Answer:

EVA	=	EBIT × (1 – Tax rate) – (WACC × Invested capital)
EVA	=	18.5 lacs – (14% × 125 lacs)
EVA	=	18.5 lacs – 17.5 lacs
EVA	=	1 lac

Note:

- ❖ Capital employed = Fixed assets + Working capital + Patent = 50 lacs + 25 lacs + 50 lacs = 125 lacs
- ❖ Tax adjustment is not needed for earnings as the given information is post-tax

11. Valuation of business as per EVA Method [Nov 2010 RTP]

From the following data compute the value of business using EVA method

Particulars	Current period	Projected period	
	2010	2011	2012
Total invested capital	Rs.90,00,000	Rs.1,00,00,000	Rs.1,10,00,000
Adjusted NOPAT	Rs.12,60,000	Rs.14,00,000	Rs.16,00,000
WACC	8.42%		

Capital growth (g) is projected = 6.5% per year after 2012

Answer:**Note 1: Computation of EVA for future years:**

Particulars	2011	2012
NOPAT (EBIT × (1 – Tax))	14,00,000	16,00,000
Invested capital	1,00,00,000	1,10,00,000
WACC	8.42%	8.42%
EVA	5,58,000	6,73,800

Note 2: Computation of present value of future EVA:

Year	EVA	PVF @ 8.42%	DCF
1	5,58,000	0.922	5,14,476
2	6,73,800	0.851	5,73,404
2	3,73,74,844	0.851	3,18,05,992
Total			3,28,93,872

Note:

- ❖ EVA will grow at rate of 6.5 percent from year 3 onwards. That would be a nature of growing perpetuity
- ❖ Value of growing perpetuity = $\frac{\text{EVA of Year 3}}{\text{WACC} - \text{Growth rate}} = \frac{6,73,800 \times 1.065}{8.42\% - 6.50\%} = 3,73,74,844$

Valuation of company:

- ❖ Value of company = Existing invested capital + Excess value due to EVA generation
- ❖ Value of company = Rs.90,00,000 + 3,28,93,872 = Rs.4,18,93,872

12. Computation of NOPAT and Capital Employed [Nov 2021]

Fragrance Ltd. has reported a Net Operating Profit after Tax (NOPAT) to Capital Employed as 2.5% plus Weighted Average Cost of Capital (WACC) for the year 31st March 2021. Economic Value added is Rs. 4 crore as on 31st March 2021.

You are required to calculate (i) The amount of Capital Employed (ii) NOPAT, if WACC is 10%

Answer:

EVA = NOPAT - [Capital Employed x WACC]
4,00,00,000 = [Capital employed x 12.50%] - [Capital employed x 10%]
4,00,00,000 = 2.5% of capital employed
Capital employed = 4,00,00,000/2.5% = Rs.160 Crores
NOPAT = 12.50% of capital employed
NOPAT = 12.50% x 160 Crores = Rs.20 Crores

13. Computation of EVA and MVA [Nov 2021]

Following is the information of M/s. DY Ltd. for the year ending 31/03/2021:

Particulars	Amount (in lacs)
Sales	1,000
Operating expenses including interest	620
8% debentures	250
Equity share capital (Face value of Rs.10)	250
Reserves and surplus	250
Market value of DY Limited	900
Corporate tax rate	30%
Risk free rate of return	7%
Market rate of return	12%
Equity Beta	1.40

You are required to

- i. Calculate Weighted Average Cost of Capital of DY Ltd.
- ii. Calculate Economic Value Added
- iii. Calculate Market Value Added

Answer:**WN 1: Computation of WACC:**

- Cost of equity = $R_f + \text{Beta} \times (R_m - R_f) = 7 + 1.40 \times (12 - 7) = 14.00\%$
- Cost of debt = $\text{Interest} \times (1 - \text{Tax rate}) = 8\% \times (1 - 0.30) = 5.60\%$

Source	Cost	Weight	Product
Equity	14.00	500.00	70.00
Debt	5.60	250.00	14.00
Total		750.00	84.00

$$\text{WACC} = \frac{\text{Sum of Products}}{\text{Sum of Weights}} = \frac{84.00}{750} \times 100 = 11.20\%$$

Note: WACC has been computed based on book value weights

WN 2: Computation of EVA:

EVA = EBIT x (1 - Tax Rate) - [Capital employed x WACC]
EBIT = Sales of 1,000 lacs - Operating expenses of 600 lacs (20 lacs of interest not deducted) = Rs.400 lacs
EVA = 400 lacs x (1 - 0.30) - [750 lacs x 11.20%] = 280 lacs - 84 lacs = Rs.196 lacs

WN 3: Computation of MVA:

MVA = Market value of firm - Book value of firm
MVA = 900 lacs - (500 lacs + 250 lacs) = Rs.150 lacs

Part II – Valuation of Business

14. Valuation of business [May 2010, May 2019 MTP, May 2016 MTP]

Following information's are available in respect of Intellect design arena Ltd. which is expected to grow at a higher rate for 4 years after which growth rate will stabilize at a lower level:

Base year information:

- ❖ Revenue - Rs. 2,000 crores
- ❖ EBIT - Rs. 300 crores
- ❖ Capital expenditure - Rs. 280 crores
- ❖ Depreciation - Rs. 200 crores

Information for high growth and stable growth period are as follows:

Particulars	High Growth	Stable Growth
Growth in revenues and EBIT	20%	10%
Growth in capital expenditure and depreciation	20%	Capex offset by depreciation
Risk free rate	10%	9%
Equity beta	1.15	1
Market risk premium	6%	5%
Pre-tax cost of debt	13%	12.86%
Debt equity ratio	1:1	2:3

For all time, working capital is 25% of revenue and corporate tax rate is 30%. What is the value of the firm?

Answer:

WN 1: Computation of cash flows:

- Value of firm is the present value of free cash flow to firm (FCFF) discounted at cost of capital
- We will not be deducting interest cost while computing FCFF
- High growth phase will last for four years and growth will stabilize 5th year onwards. We should compute cash flows till the first year of stabilization phase (Year 5)

(in crores)

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5
Revenues	2,400.00	2,880.00	3,456.00	4,147.20	4,561.92
EBIT	360.00	432.00	518.40	622.08	684.29
Tax	-108.00	-129.60	-155.52	-186.62	-205.29
PAT	252.00	302.40	362.88	435.46	479.00
Working capital increase	-100.00	-120.00	-144.00	-172.80	-103.68
Net capex	-96.00	-115.20	-138.24	-165.89	-
Free cash flow	56.00	67.20	80.64	96.77	375.32

Note:

- Revenues = Previous year revenues + Growth rate
- EBIT = Previous year EBIT + Growth rate
- Net capex = Capital expenditure - Depreciation
- Net capex of previous year = 280 cores - 200 crores = Rs.80 crores
- Capex of year 1 = 80 crores + 20% = Rs.96 crores. Capex is computed in similar manner for balance years
- Increase in working capital = Current year working capital - Previous year working capital
- WC increase for year 1 = (2,400 × 25%) - (2,000 × 25%). WC increase is computed in similar manner for other years

WN 2: Computation of WACC for high-growth and normal phase:**High-growth phase:**

Source	Cost	Weight	Product
Debt	9.10 (13 × 70%)	1	9.10
Equity	16.90	1	16.90
Total		2	26.00

$$\text{WACC} = \frac{\text{Sum of Products}}{\text{Sum of weights}} = \frac{26}{2} = 13.00\%$$

Note:

- Cost of equity = $R_f + \text{Beta} \times (R_m - R_f) = 10 + (1.15 \times 6) = 10 + 6.90 = 16.90\%$
- Discount rate will be taken as 13 percent for the cash flows from year 1 to 4 (High growth phase)

Normal phase:

Source	Cost	Weight	Product
Debt	9.00 (12.86 x 70%)	2	18.00
Equity	14	3	42.00
Total		5	60.00

$$\text{WACC} = \frac{\text{Sum of Products}}{\text{Sum of weights}} = \frac{60}{5} = 12.00\%$$

Note:

- Cost of equity = $R_f + \text{Beta} \times (R_m - R_f) = 9 + (1 \times 5) = 14\%$
- Discount rate will be taken as 14 percent for the cash flows from year 5 onwards (normal phase)

WN 3: Computation of value of firm:

Year	Cash flow	PVF	DCF
1	56.00	0.885	49.56
2	67.20	0.783	52.62
3	80.64	0.693	55.88
4	96.77	0.613	59.32
4	18,766.00	0.613	11,503.56
Value of Firm			11,720.94

Note:

- Growth rate stabilizes at 10 percent from year 5 onwards. This would therefore take the character of growing perpetuity. We can value the cash flows from year 5 onwards using Gordon model

$$\text{Year 4 value} = \frac{\text{CF}_5}{\text{Cost of capital} - \text{Growth rate}} = \frac{375.32}{12\% - 10\%} = \text{Rs. 18,766 Crores}$$

15. Valuation of Firm [Nov 2020 RTP, May 2014]

Following information is given in respect of WXY Ltd., which is expected to grow at a rate of 20% p.a. for the next three years, after which the growth rate will stabilize at 8% p.a. normal level, in perpetuity.

Particulars	For the year ended March 31, 2014
Revenues	Rs.7,500 Crores
COGS	Rs.3,000 crores
Operating expenses	Rs.2,250 Crores
Capital expenditure	Rs.750 Crores
Depreciation (included in operating expenses)	Rs.600 Crores

During high growth period, revenues & Earnings before Interest & Tax (EBIT) will grow at 20% p.a. and capital expenditure net of depreciation will grow at 15% p.a. From year 4 onwards, i.e. normal growth period revenues and EBIT will grow at 8% p.a. and incremental capital expenditure will be offset by the depreciation. During both high growth & normal growth period, net working capital requirement will be 25% of revenues. The Weighted Average Cost of Capital (WACC) of WXY Ltd. is 15%. Corporate Income Tax rate will be 30%. Required:

Estimate the value of WXY Ltd. using Free Cash Flows to Firm (FCFF) & WACC methodology.

Answer:**WN 1: Computation of free cash flows for year 1 to year 4:**

Particulars	Year 1	Year 2	Year 3	Year 4
Revenues	9,000.00	10,800.00	12,960.00	13,996.00
COGS	-3,600.00	-4,320.00	-5,184.00	-5,598.72
Operating expenses (other than depreciation)	-1,980.00	-2,376.00	-2,851.20	-3,079.30
Depreciation	-720.00	-864.00	-1,036.80	-1,119.74
EBIT	2,700.00	3,240.00	3,888.00	4,199.04
Tax @ 30%	-810.00	-972.00	-1,166.40	-1,259.71
EAT	1,890.00	2,268.00	2,721.60	2,939.33

Less: Net capex (capex – depreciation)	-172.50	-198.38	-228.13	-
Less: Increase in working capital (increase in revenues x 25%)	-375.00	-450.00	-540.00	-259.20
Free cash flow (FCFF)	1,342.50	1,619.62	1,953.47	2,680.13

WN 2: Valuation of WXY Limited:

Year	Cash flow	PVF @ 15%	DCF
1	1,342.50	0.8686	1,167.44
2	1,619.62	0.7561	1,224.59
3	1,953.47	0.6575	1,284.41
3	38,287.57	0.6575	24,174.08
Value with strategy			28,850.52

Note:

- The cash flows will remain be Rs.2,680.13 crores in year 4 and grow at the rate of 8%. This would take the character of growing perpetuity and the same is valued as under:

$$\text{Year 3 value} = \frac{\text{CF}_4}{\text{Cost of capital} - \text{Growth rate}} = \frac{2,680.13}{15\% - 8\%} = \text{Rs. 38,287.57 Crores}$$

16. Valuation of strategy [May 2017 RTP, Nov 2018, May 2007, Nov 2011, May 2014 MTP]

ABC Co. is considering a new sales strategy for the next 4 years. They want to know the value of the new strategy. Following information relating to the year which has just ended, is available

Particulars	Amount (in '000s)
Sales	20,000
Gross margin (20%)	4,000
Accounting, Administration and Distribution expenses (10%)	2,000
Profit before tax	2,000
Tax at 30%	600
Profit after tax	1,400
Balance Sheet Information	
Fixed assets	8,000
Current assets	4,000
Equity	12,000

As per the new strategy, sales will grow at 20 percent per year for the next three years. The gross margin ratio, assets turnover ratio, capital structure and income tax rate will remain unchanged. Depreciation is to be at 10 percent on the value of the net fixed assets at the beginning of the year. Company's target rate of return is 15%. Determine if the strategy is financially viable.

Answer:**WN 1: Valuation of firm with new strategy:****Part 1: Computation of cash flows:**

- The firm will grow at 20 percent for first three years and thereafter revenues is expected to remain same
- Growth stabilizes from year 4 onwards and hence we should compute cash flows till year 4

(in '000s)

Particulars	Year 1	Year 2	Year 3	Year 4
Sales	24,000.00	28,800.00	34,560.00	34,560.00
Gross margin (20%)	4,800.00	5,760.00	6,912.00	6,912.00
Less: Admin expense (10%)	-2,400.00	-2,880.00	-3,456.00	-3,456.00
PBT	2,400.00	2,880.00	3,456.00	3,456.00
Less: Tax @30%	-720.00	-864.00	-1,036.80	-1,036.80
PAT	1,680.00	2,016.00	2,419.20	2,419.20
WC change	-800.00	-960.00	-1,152.00	-
Net capex	-1,600.00	-1,920.00	-2,304.00	-
FCFF	-720.00	-864.00	-1,036.80	2,419.20

Note:

- Revenues = Previous year revenues + Growth rate
- Gross margin = 20 percent of revenues
- PBT = 10 percent of revenues
- Asset turnover ratio will remain same. This would mean that if revenues increase by 20 percent, net fixed assets and working capital will also increase by 20%. Hence net increase in fixed assets would be equal to net capex.
- Net capex of year 1 = $(8,000 + 20\%) - 8,000 = 1,600$ Crores. Net capex for balance years is computed in same manner
- Increase in working capital = Current year working capital - Previous year working capital
- WC increase for year 1 = $(4,000 + 20\%) - (4,000) = 800$ crores. WC increase is computed in similar manner for other years

Part 2: Valuation of firm:

(in '000s)

Year	Cash flow	PVF @ 15%	DCF
1	-720.00	0.870	-626.40
2	-864.00	0.756	-653.18
3	-1,036.80	0.658	-682.21
3	16,128.00	0.658	10,612.22
Value with strategy			8,650.43

Note:

- The cash flows will remain stable at Rs.2,419.20 from year 4 onwards. This would take the character of perpetuity and the same is valued as under:

$$\text{Year 3 value} = \frac{\text{CF}_4}{\text{Cost of capital} - \text{Growth rate}} = \frac{2,419.20}{15\% - 0\%} = \text{Rs. 16,128}$$

WN 2: Valuation of firm without strategy:

- Cash flow = PAT + Depreciation - Capital expenditure
- The company is not going to grow and hence net fixed assets would remain stable at Rs.8,000. This would mean that depreciation would be offset by the amount of capital expenditure
- Cash flow = $1,400 + (10\% \times 8,000) - 800 = \text{Rs.1,400}$
- The cash flow will remain stable at Rs.1,400 for all years and hence this would take the character of perpetuity. The same is valued as under:

$$\text{Year 0 value} = \frac{\text{CF}_1}{\text{Cost of capital} - \text{Growth rate}} = \frac{1,400}{15\% - 0\%} = \text{Rs. 9,333.33}$$

Conclusion:

- Strategy is not financially viable as the value of the firm falls to Rs.8,650.43 thousands from Rs.9,333.33 thousands
- **Value of strategy = $8,650.43 - 9,333.33 = -682.90$ thousands**

17. Business valuation [Nov 2014 RTP, Nov 2018 RTP, Nov 2012, May 2014 MTP, Nov 2017 MTP]

Yes Limited wants to acquire No Limited and the cash flows of Yes Limited and the merged entity are given below: (in lakhs)

Year	1	2	3	4	5
Yes Limited	175	200	320	340	350
Merged entity	400	450	525	590	620

Earnings would have witnessed 5% constant growth rate without merger and 6% with merger on account of economies of operations after 5 years in each case. The cost of capital is 15%. The number of shares outstanding in both the companies before the merger is the same and the companies agree to an exchange ratio of 0.5 shares of Yes Limited for each share of No Limited

You are required to:

- Compute the Value of Yes Limited before and after merger.
- Value of Acquisition and
- Gains to shareholders of Yes Limited

Answer:

WN 1: Valuation of Yes Limited before merger and after merger:

Year	Cash flow		PVF @ 15%	DCF	
	Before	After		Before	After
1	175.00	400.00	0.870	152.25	348.00
2	200.00	450.00	0.756	151.20	340.20
3	320.00	525.00	0.658	210.56	345.45
4	340.00	590.00	0.572	194.48	337.48
5	350.00	620.00	0.497	173.95	308.14
5	3,675.00	7,302.22	0.497	1,826.48	3,629.20
Value of Yes Limited				2,708.92	5,308.47

Note:**Valuation of perpetuity for cash flows after year 5:**

$$\text{Before merger } P_5 = \frac{CF_6}{K_0 - G} = \frac{350 \times 1.05}{15\% - 5\%} = \text{Rs. 3,675 lacs}$$

$$\text{After merger } P_5 = \frac{CF_6}{K_0 - G} = \frac{620 \times 1.06}{15\% - 6\%} = \text{Rs. 7,302.22 lacs}$$

WN 2: Solution for Part (i) and (ii):

Particulars	Calculation	Amount (in lacs)
Value of Yes Limited before merger		2,708.92
Value of Yes Limited after merger		5,308.47
Value of acquisition	5,308.47 - 2,708.92	2,599.55

WN 3: Computation of gains to shareholders of Yes Limited:

- Number of shares in both companies are same. Let us assume that number of shares is 100 in Yes and No Limited before acquisition

Particulars	Calculation	Amount
Shares in Yes Limited		
Existing shareholders of Yes Limited		100
Shares allotted to shareholders of No Limited		50
Total shares post-merger		150
Price per share post-merger	$\frac{5,308.47}{150}$	35.3898
Consideration paid to No Limited	50 shares x 35.3898	1,769.49
Benefit of acquisition/ value of acquisition		2,599.55
Gain to shareholders of Yes Limited		830.06

- Yes Limited is acquiring a company worth Rs.2,599.55 lacs. However, they are paying consideration of only Rs.1,769.49 lacs. Hence the gain to shareholders of Yes Limited out of merger is Rs.830.06 lacs

18. Valuation based on WACC [Nov 2013, Jan 2021]

M/S Tiger Limited wants to acquire M/S Leopard Limited. The balance sheet of Leopard Limited as on 31st March 2012 is as follows:

Liabilities	Amount	Assets	Amount
Equity capital (70,000 shares)	7,00,000	Cash	50,000
Retained earnings	3,00,000	Debtors	70,000
12% Debentures	3,00,000	Inventories	2,00,000
Creditors and other liabilities	3,20,000	Plants and equipment	13,00,000
	16,20,000		16,20,000

- ❖ Shareholders of Leopard Ltd. will get one share in Tiger Ltd. for every two shares. External liabilities are expected to be settled at Rs. 5,00,000. Shares of Tiger Ltd. would be issued at its current price of Rs. 15 per share. Debentureholders will get 13% convertible debentures in the purchasing company for the same amount. Debtors and inventories are expected to realize Rs. 2,00,000.
- ❖ Tiger Ltd. has decided to operate the business of Leopard Ltd. as a separate division. The division is likely to give cash flows (after tax) to the extent of Rs. 5,00,000

per year for 6 years. Tiger Ltd. has planned that, after 6 years, this division would be demerged and disposed of for Rs. 2,00,000.

- ❖ The company's cost of capital is 16%.

Make a report to the Board of the company advising them about the financial feasibility of this acquisition.

Answer:

WN 1: Computation of (Initial Outflow):

Particulars	Calculation	Amount
Shares allotted	35,000 shares x 15	5,25,000
Debentures allotted		3,00,000
Settlement of creditors		5,00,000
Less: Realization of debtors and inventory		-2,00,000
Less: Cash		-50,000
Net outflow		10,75,000

WN 2: Computation of NPV:

Year	Cash flow	PVF @ 16%	DCF
0	-10,75,000	1.000	-10,75,000
1	5,00,000	0.862	4,31,000
2	5,00,000	0.743	3,71,500
3	5,00,000	0.641	3,20,500
4	5,00,000	0.552	2,76,000
5	5,00,000	0.476	2,38,000
6	7,00,000	0.410	2,87,000
			8,49,000

Conclusion:

- The company should go ahead with the project as the same results in positive NPV of Rs.8,49,000

19. Valuation of business:

ABC (India) Ltd., a market leader in printing industry, is planning to diversify into defense equipment businesses that have recently been partially opened up by the GOI for private sector. In the meanwhile, the CEO of the company wants to get his company valued by a leading consultants, as he is not satisfied with the current market price of his scrip.

He approached consultant with a request to take up valuation of his company with the following data for the year ended 2009:

Share Price	Rs.66 per share
Outstanding debt	1934 lacs
Number of outstanding shares	75 lacs
Net income (PAT)	17.20 lacs
EBIT	245 lacs
Interest expenses	218.125 lacs
Capital expenditure	234.40 lacs
Depreciation	234.40 lacs
Working capital	44 lacs
Growth rate	8% (from 2010 to 2014)
Growth rate	6% (beyond 2014)
Free cash flow	240.336 lacs (year 2014 onwards)

The capital expenditure is expected to be equally offset by depreciation in future and the debt is expected to decline by 30% in 2014.

Required:

Estimate the value of the company and ascertain whether the ruling market price is undervalued as felt by the CEO based on the foregoing data. Assume that the cost of equity is 16%, and 30% of debt repayment is made in the year 2014.

Answer:

WN 1: Computation of FCFF:

(in lacs)

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5
EBIT/EBT	264.60	285.77	308.63	333.32	359.99
Less: Tax	-95.26	-102.88	-111.11	-120.00	-129.59
PAT	169.34	182.89	197.52	213.32	230.40
Increase in WC	3.52	3.80	4.10	4.43	4.78
Free cash flow	165.82	179.09	193.42	208.89	225.62

Note:

- Interest is not to be deducted while computing FCFF
- Tax rate has been taken as 36 percent and the same is computed as under:

Particulars	2009
EBIT	245.000
Less: Interest	-218.125
EBT	26.875
Less: Tax (B/f)	9.675
EAT	17.200
Tax rate (9.675/26.875) x 100	36

- Capital expenditure is offset by depreciation and hence net capex is zero
- Working capital increase for year 1 = 44 lacs x 8% = Rs.3.52 lacs. Increase for year 2 = 3.52 + 8% = Rs.3.80 lacs. Increase is computed in similar manner for future years
- Repayment of debt will not impact the cash flows as new debt/repayment of debt is not considered in FCFF computation

WN 2: Computation of WACC**WACC from 2010 to 2014 (Year 1 to Year 5)**

Source	Cost	Weight	Product
Debt	7.22	1,934.00	139.60
Equity	16.00	4,950.00	792.00
	13.53	6,884.00	931.60

- $WACC = (931.60/6,884) \times 100 = 13.53\%$
- Weight of equity = 75 lacs x 66 = 4,950 lacs
- Pre-tax cost of debt (218.125 lacs/1,934) x 100 = 11.28%
- Post-tax cost of debt = $11.28\% \times (1 - 36\%) = 7.22\%$

WACC from 2014 onwards (Year 6 onwards)

Source	Cost	Weight	Product
Debt	7.22	1,353.80	97.72
Equity	16.00	4,950.00	792.00
	14.11	6,303.80	889.72

- Weight of debt = 1,934 lacs x 70% = Rs.1,353.80 lacs

WN 3: Valuation of firm:

(in lacs)

Year	Cash flow	PVF	DCF
1	165.82	0.881	146.09
2	179.09	0.776	138.97
3	193.42	0.683	132.11
4	208.89	0.602	125.75
5	225.62	0.53	119.58
5	2963.45	0.53	1570.63
Value of Firm			2233.13

Note:

Value of growing perpetuity (Y6) = $\frac{240.336}{14.11\% - 6\%} = \text{Rs. } 2,963.45 \text{ lacs}$

- Discount factors have been taken at the rate of 13.53% for year 1 to year 5

WN 4: Valuation of equity

- Value of equity = Value of Firm – Value of debt
- Value of equity = 2,233.13 lacs – 1,934 lacs = Rs.299.13 lacs
- Fair value per share = 299.13 lacs/75 lacs = Rs.3.99 per share
- The current share price is Rs.66 per share whereas fair price is only Rs.3.99 per share. Hence the share price is currently overvalued in the market

Note:

- The answer does not match with ICAI solution as there are few errors in ICAI solution. Repayment of debt has been considered in FCFE computation. However, we should not deduct the same for computing FCFE

20. Valuation of firm and valuation of equity [May 2018 RTP, Nov 2012 RTP]

BRS Inc deals in computer and IT hardwares and peripherals. The expected revenue for the next 8 years is as follows:

Years	Sales Revenue (USD Million)
1	8
2	10
3	15
4	22
5	30
6	26
7	23
8	20

Summarized financial position as on 31 March 2012 was as follows:

Liabilities	Amount (USD Million)	Assets	Amount (USD Million)
Equity stocks	12	Fixed assets	17
12% bonds	8	Current assets	3
Total	20	20	

Additional information:

(a) Its variable expenses is 40% of sales revenue and fixed operating expenses (cash) are estimates to be as follows

Period	Amount (USD Million)
1 to 4 years	1.6
5 to 8 years	2

(b) An additional advertisement and sales promotion campaign shall be launched requiring expenditure as per following details

Period	Amount (USD Million)
1 year	0.50
2 to 3 years	1.50
4 to 6 years	3.00
7 to 8 years	1.00

(c) Fixed assets are subject to depreciation at 15% as per WDV method

(d) The company has planned additional capital expenditure (in the beginning of each year) for the coming 8 years as follows:

Period	Amount (USD Million)
1	0.50
2	0.80
3	2.00
4	2.50
5	3.50
6	2.50
7	1.50
8	1.00

(e) Investment in working capital is estimated to be 20% of revenue

(f) Applicable tax rate for the company is 30%

(g) Cost of equity is estimated to be 16%

(h) The free cash flow of the firm is expected to grow at 5% per annum after 8 years.

With above information you are required to determine the:

(i) Value of Firm

(ii) Value of equity

Answer:

WN 1: Computation of FCFE:

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Sales	8.00	10.00	15.00	22.00	30.00	26.00	23.00	20.00
VC	-3.20	-4.00	-6.00	-8.80	-12.00	-10.40	-9.20	-8.00
FC	-1.60	-1.60	-1.60	-1.60	-2.00	-2.00	-2.00	-2.00
Advertisement	-0.50	-1.50	-1.50	-3.00	-3.00	-3.00	-1.00	-1.00
Depreciation	-2.63	-2.35	-2.30	-2.33	-2.50	-2.50	-2.35	-2.15
Profit before Tax	0.07	0.55	3.60	6.27	10.50	8.10	8.45	6.85
Less: Tax	-0.02	-0.17	-1.08	-1.88	-3.15	-2.43	-2.54	-2.06
Profit after Tax	0.05	0.38	2.52	4.39	7.35	5.67	5.91	4.79
Add: Depreciation	2.63	2.35	2.30	2.33	2.50	2.50	2.35	2.15
Cash flow after Tax	2.68	2.73	4.82	6.72	9.85	8.17	8.26	6.94
Capex	-0.80	-2.00	-2.50	-3.50	-2.50	-1.50	-1.00	
Change in Work cap	1.40	-0.40	-1.00	-1.40	-1.60	0.80	0.60	0.60
FCFF	3.28	0.33	1.32	1.82	5.75	7.47	7.86	7.54

Note:

- Variable cost = 40% of revenues
- Advertisement and fixed cost are as per data given in question
- Depreciation has been taken as per below statement:

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Opening Value	17.00	14.87	13.32	13.02	13.19	14.19	14.19	13.34
Addition	0.50	0.80	2.00	2.50	3.50	2.50	1.50	1.00
Depreciation	2.63	2.35	2.30	2.33	2.50	2.50	2.35	2.15
Closing value	14.87	13.32	13.02	13.19	14.19	14.19	13.34	12.19

- Depreciation = (Opening value + Addition) x 15%; Closing value = Opening value + Addition - Depreciation
- Capital expenditure is made at the beginning of the year. Hence, capex of year 2 has been taken as year 1 ending capex and for other years in similar manner. Alternatively, we can take capex in the same year with the assumption that payment for capex is made at the end of the year
- Working capital change has been computed as per below statement:

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Revenues	8.00	10.00	15.00	22.00	30.00	26.00	23.00	20.00
WC investment @ 20%	1.60	2.00	3.00	4.40	6.00	5.20	4.60	4.00
Opening WC	3.00	1.60	2.00	3.00	4.40	6.00	5.20	4.60
Inc/decrease in WC	-1.40	0.40	1.00	1.40	1.60	-0.80	-0.60	-0.60

- Increase in working capital is an outflow and decrease in working capital will be an inflow

WN 2: Computation of WACC:

Source	Cost	Weight	Product
Debt	8.40	8.00	0.672
Equity	16.00	12.00	1.920
	12.96	20.00	2.592

- Post-tax cost of debt = $12 \times (1 - 30\%) = 8.40\%$
- WACC = $(2.592 \text{ lacs}/20 \text{ lacs}) \times 100 = 12.96\%$

WN 3: Computation of value of firm:

Year	Cash flow	PVF@ 12.96%	DCF
0	-0.50	1.000	-0.50
1	3.28	0.885	2.90

2	0.33	0.784	0.26
3	1.32	0.694	0.92
4	1.82	0.614	1.12
5	5.75	0.544	3.13
6	7.47	0.481	3.59
7	7.86	0.426	3.35
8	7.54	0.377	2.84
8	99.46	0.377	37.50
Value of Firm			55.10

- Cash flow of year 0 = Capex of 0.50 lacs at beginning of year 1

$$\text{Year 8 growing perpetuity} = \frac{7.54 \times 1.05}{12.96\% - 5\%} = \text{Rs. 99.46 lacs}$$

- Value of firm = Rs.55.10 lacs
- Value of equity = Rs.55.10 lacs – Rs.8 lacs (debt) = Rs.47.10 lacs

21. Range of valuation [Nov 2009, May 2013, May 2014 MTP, May 2021 MTP]

ABC Limited is considering acquisition of DEF Limited which has 3.10 crore shares issued and outstanding. The market price per share is Rs.440.00 at present. ABC Limited's average cost of capital is 12%. The cash inflows of DEF Limited for next three years are as under:

Year	Amount in crores
1	460.00
2	600.00
3	740.00

You are required to calculate the range of valuation that ABC Limited has to consider.

Answer:

WN 1: Valuation based on current market price:

- ❖ Value of Firm = No of shares x current market price = 3.10 crores x 440 = Rs.1,364 Crores

WN 2: Valuation based on discounted cash flows:

Year	Cash flow	PVF@ 12%	DCF
1	460	0.893	410.78
2	600	0.797	478.20
3	740	0.712	526.88
Value of business			1,415.86

Summary:

Range of valuation:

Particulars	Per share	Total
Minimum	440.00	1,364.00
Maximum	456.73 [1,415.86/3.10]	1,415.86

22. Computation of maximum price to be paid for acquisition [May 2016 MTP, Nov 2017 RTP]

Teer Ltd. is considering acquisition of Nishana Ltd. CFO of Teer Ltd. is of opinion that Nishana Ltd. will be able to generate operating cash flows (after deducting necessary capital expenditure) of Rs. 10 crore per annum for 5 years.

The following additional information was not considered in the above estimations.

- Office premises of Nishana Ltd. can be disposed of and its staff can be relocated in Teer Ltd.'s office not impacting the operating cash flows of either businesses. However, this action will generate an immediate capital gain of Rs. 20 crore.
- Synergy Gain of Rs. 2 crore per annum is expected to be accrued from the proposed acquisition.
- Nishana Ltd. has outstanding Debentures having a market value of Rs. 15 crore. It has no other debts.
- It is also estimated that after 5 years if necessary, Nishana Ltd. can also be disposed of for an amount equal to five times its operating annual cash flow.

Calculate the maximum price to be paid for Nishana Ltd. if cost of capital of Teer Ltd. is 20%. Ignore any type of taxation.

Answer:

WN 1: Valuation of business of Nishana Limited:

(in crores)

Year	Cash flow	PVF @ 20%	DCF
0	20	1.000	20.00
1 to 5	12	2.990	35.88
5	50 [10 x 5]	0.402	20.10
Value of business			75.98
Less: Value of debt			(15.00)
Consideration to equity shareholders			60.98

Note: Terminal flow can also be considered as Rs.60 Crores [12 crores x 5]

23. Valuation of firm and equity:

XYZ Limited is a paints manufacturer. The analyst's forecast of free cash flow is shown below:

Particulars	2013	2014	2015	2016	2017	2018	2019	2020
Free cash flow	13.75	6.27	7.37	7.66	6.04	5.69	6.35	7.05

The cost of capital of the company is 15 percent and value of debt is Rs.4.92 crores. Assuming that the company acquiring XYZ Limited will not make any operating improvement or change the capital structure and analyst expects the cash flows to grow at 10 percent forever after 2020, determine the value of Firm and Equity.

Answer:

Year	Cash flow	PVF @ 15%	DCF
1	13.75	0.87	11.96
2	6.27	0.756	4.74
3	7.37	0.658	4.85
4	7.66	0.572	4.38
5	6.04	0.497	3
6	5.69	0.432	2.46
7	6.35	0.376	2.39
8	7.05	0.327	2.31
8	155.1	0.327	50.72
Value of Firm			86.81
Less: Value of debt			(4.92)
Value of equity			81.89

Note 1: Valuation of perpetuity cash flow

$$\text{Y8 perpetuity} = \frac{\text{FCFF}_9}{K_e - \text{Growth}} = \frac{7.05 \times 1.10}{15\% - 10\%} = \text{Rs. 155.10 Crores}$$

24. Free cash flow-based valuation:

A Limited is considering the acquisition of T Limited with the following projected figures for the next 5 years.

(Rs. In Lacs)

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5
Profit before depreciation	150	180	220	250	270
Depreciation	30	32	34	36	38
Interest	30	28	26	24	22
Capital expenditure	20	20	20	20	20
Increase in working capital	30	30	30	30	30

The rate of income tax applicable to T Limited is 30%.

- Calculate the free cash flow for each year from the above projections
- Calculate the terminal value of the target company using a Price/Earnings (P/E) multiple of 12
- Assuming a discount rate of 10%, find the total value of the target company under the DCF approach.

Answer:

WN 1: Computation of free cash flows to equity shareholders:

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5
Profit before depreciation	150	180	220	250	270
Less: Depreciation	30	32	34	36	38
Less: Interest	30	28	26	24	22
Profit before tax	90	120	160	190	210
Less: Tax	-27	-36	-48	-57	-63
Profit after tax	63	84	112	133	147
Add: Depreciation	30	32	34	36	38
Less: Capital expenditure	20	20	20	20	20
Less: Increase in working capital	30	30	30	30	30
Free cash flow to equity	43	66	96	119	135

Note:

- A Limited is planning to acquire T Limited. We are basically finding out the consideration to be paid to shareholder of T Limited. We could have used FCFF approach and get value of Firm. However, amount of debt is not available and hence value of equity cannot be calculated. Therefore, we have directly gone ahead with FCFE approach of valuation

WN 2: Computation of terminal value:

- ❖ Terminal flow = Last year PAT × P/E Multiple
- ❖ Terminal flow = 147 lacs × 12 = 1,764 lacs

WN 3: Valuation of equity as per DCF approach:

Year	Cash flow	PVF @ 10%	DCF
1	43	0.909	39.09
2	66	0.826	54.52
3	96	0.751	72.10
4	119	0.683	81.28
5	1899	0.621	1179.28
Value of equity			1426.27

25. Valuation of firm [Nov 2019]:

Mr. X, a financial analyst, intends to value the business of PQR Ltd. in terms of the future cash generating capacity. He has projected the following after tax cash flows:

Year	1	2	3	4	5
Cash flows (in lacs)	1,760	480	640	860	1,170

It is further estimated that beyond 5th year, cash flows will perpetuate at a constant growth rate of 8% per annum, mainly on account of inflation. The perpetual cash flow is estimated to be Rs. 10,260 lakh at the end of the 5th year.

Required:

- What is the value of the firm in terms of expected future cash flows, if the cost of capital of the firm is 20%.
- The firm has outstanding debts of Rs. 3,620 lakh and cash/bank balance of Rs. 2,710 lakh. Calculate the shareholder value per share if the number of outstanding shares is 151.50 lakh.
- The firm has received a takeover bid from XYZ Ltd. of Rs. 225 per share. Is it a good offer?

Answer:**WN 1: Valuation of firm based on future cash flows:****(In lacs)**

Year	Cash flow	PVF @ 20%	DCF
1	1,760	0.833	1,466.08
2	480	0.694	333.12
3	640	0.579	370.56
4	860	0.482	414.52
5	1,170	0.402	470.34
5	92,340	0.402	37,120.68

Value of Firm	40,175.30

Note:

$$\text{Perpetual Inflow (Y5)} = \frac{10,260 \times 1.08}{20\% - 8\%} = 92,340 \text{ lacs}$$

Note:

- There is a possibility of interpreting Rs.10,260 lacs as the value of perpetuity itself. However, ICAI has considered the same as cash flows and based on that perpetuity has been valued. We have considered the solution in line with ICAI suggested answers

WN 2: Valuation of share:

Particulars	Amount In lacs
Value of Firm	40,175.30
Less: Value of debt	(3,620.00)
Value of equity	36,555.30
No of shares	151.50
Value per share	241.29

Takeover bid of Rs. 225 per share seems to be not a good offer as it is lesser than the intrinsic value i.e. value per share of Rs. 241.29.

26. Valuation of share

ABC Limited earned EPS of Rs.3.50 per share. Investment in fixed assets was Rs.2.00 per share, depreciation was Rs.1.60 per share and the investment in working capital was Rs.0.50 per share. ABC Limited is currently operating at its target debt-to-assets ratio of 40%. Shareholders require a return of 14 percent on their investment and the expected growth rate is 4 percent. Calculate the value of share of ABC Limited.

Answer:

- Valuation of share can be based on free cash flow to equity shareholders (FCFE)

$FCFE_0 = \text{EPS} - \text{equity funding for net capex and working capital}$

$$FCFE_0 = 3.50 - (0.6 \times 0.90) = 3.50 - 0.54 = 2.96 \text{ per share}$$

$$\text{Value of share} = \frac{FCFE_1}{K_e - \text{Growth}} = \frac{2.96 \times 1.04}{14\% - 10\%} = \text{Rs. 30.78}$$

Note:

- The company incurs net capex of Rs.0.40 per share (2.00 -1.60) and working capital requirement of Rs.0.50 per share
- Total funding required is Rs.0.90 per share
- The company operates at debt to assets ratio of 40% and hence 40% funding will be in the form of debt and the balance 60 percent will be in the form of equity

27. Valuation of firm and equity:

XYZ Limited earned Rs.30 million before interest and taxes on revenues of Rs.80 million last year. Capital expenditure was Rs.20 million and depreciation was Rs.15 million. The addition to working capital was Rs.6 million. The firm's WACC is 12.45% and the marginal tax rate is 40% and the expected cash flow growth is 5%. The market value of debt is Rs.25 million. Calculate the value of firm and equity?

Answer:

WN 1: Computation of FCFF:

Particulars	Amount (millions)
EBIT/EBT	30
Less: Tax @ 40%	-12
EAT	18
Add: Depreciation	15
Less: Capital expenditure	-20
Less: Working capital	-6
Free cash flow to firm (FCFF)	7

WN 2: Valuation of firm and equity:

$$\text{Value of Firm} = \frac{\text{FCFF}_1}{K_o - \text{Growth}} = \frac{7 \times 1.05}{12.45\% - 5\%} = \text{Rs. 98.66 million}$$

$$\text{Value of equity} = \text{Value of firm} - \text{Amount of debt} = 98.66 - 25 = \text{Rs. 73.66 million}$$

28. Calculation of FCFF and FCFE:

ABC Limited financial statement is provided below. You are required to calculate FCFF and FCFE:

Income statement

Particulars	2018 forecast	2017 actual
Sales	300	250
Cost of goods sold	120	100
Gross Profit	180	150
SG&A	35	30
Depreciation	50	40
EBIT	95	80
Interest expense	15	10
Pre-tax earnings	80	70
Taxes @ 30%	24	21
Net Income	56	49

Balance sheet:

Particulars	2018 forecast	2017 actual
Cash	10	5
Accounts receivable	30	15
Inventory	40	30
Total current assets	80	50
Gross property, plant and equipment	400	300
Less: Accumulated depreciation	(190)	(140)
Total assets	290	210
Accounts payable	20	20
Short-term debt	20	10
Current liabilities	40	30
Long-term debt	114	100
Common stock	50	50
Retained earnings	86	30
Total liabilities and owner's equity	290	210

Cash flow forecast for 2010:

Net income	56
Depreciation	50
Working capital investment	(25)
Cash flow from operations	81

Answer:

WN 1: Computation of FCFF:

Approach 1:

$$\text{FCFF} = \text{EAT} + \text{Depreciation} + \text{Interest} \times (1 - \text{Tax}) - \text{Capex} - \text{working capital}$$

$$\text{FCFF} = 56 + 50 + 15(0.7) - 100 - 25 = -8.5 \text{ million}$$

Approach 2:

$$\text{FCFF} = \text{EBIT} \times (1 - \text{Tax}) + \text{Depreciation} - \text{capex} - \text{working capital}$$

$$\text{FCFF} = (95 \times 0.7) + 50 - 100 - 25 = -8.5 \text{ million}$$

Approach 3:

$$\text{FCFF} = (\text{EBITDA} \times (1 - \text{Tax})) + (\text{Depreciation} \times \text{Tax}) - \text{capex} - \text{working capital}$$

$$\text{FCFF} = (180 - 35) \times 0.65 + (50 \times 0.3) - 100 - 25 = -8.5 \text{ million}$$

Approach 4:

$$\text{FCFF} = \text{CFO} + (\text{Interest} \times (1 - \text{Tax}) - \text{capital expenditure})$$

$$\text{FCFF} = 81 + (15 \times 0.7) - 100 = -8.5 \text{ million}$$

WN 2: Computation of FCFE:

FCFE = FCFF – Interest × (1 – Tax rate) + Net Borrowings
FCFE = -8.50 – 15 × (0.7) + 24 = Rs.5 million
Net borrowing = Increase in long term debt and short-term debt
Net borrowing = Rs.14 + Rs.10 = Rs.24 million

29. Value of firm and equity:

ABC Limited most recent FCFF is Rs.50,00,000. Its target debt to equity ratio is 0.25. The market value of firm's debt is Rs.1,00,00,000 and it has 20,00,000 equity shares of common stock outstanding. The firm's tax rate is 40%, the shareholder's require a return of 16 percent on their investment and the firm's pre-tax cost of debt is 8% and the growth is FCFF is 5%. Calculate the value of the firm and the value of the equity.

Answer:**WN 1: Computation of WACC:**

Source	Cost	Weight	Product
Debt	4.80 (8 × 60%)	0.25	1.20
Equity	16.00	1	16.00
Total		1.25	17.20

$$\text{WACC} = \frac{\text{Sum of Products}}{\text{Sum of weights}} = \frac{17.20}{1.25} = 13.76\%$$

WN 2: Valuation of firm and equity:

$$\text{Value of Firm} = \frac{\text{FCFF}_1}{K_o - \text{Growth}} = \frac{50,00,000 \times 1.05}{13.76\% - 5\%} = \text{Rs. } 5,99,31,507$$

$$\text{Value of equity} = \text{Value of firm} - \text{Amount of debt} = 5,99,31,507 - 1,00,00,000 = 4,99,31,507$$

30. Valuation with FCFF:

ABC Limited is expected to experience growth in three distinct stages in the future. Its most recent FCFE is Rs.0.90 per share. The following information has been compiled:

Particulars	High-growth	Transition Period	Stable-growth
Duration	3 years	3 years	Year 7 onwards
FCFE growth rate	30%	Will decline by 9 percent per year to the indicated stable growth rate	3%
Shareholders required return	20%	15%	10%

Calculate the fair value using the three-stage FCFE model.

Answer:**WN 1: Computation of growth rates and FCFE**

Year	1	2	3	4	5	6	7
Growth rate	30%	30%	30%	21%	12%	3%	3%
FCFE	1.17	1.52	1.98	2.40	2.69	2.77	2.85

WN 2: Valuation of share as per FCFE approach:

Year	FCFF	PVF	DCF
1	1.17	0.833	0.97
2	1.52	0.694	1.05
3	1.98	0.579	1.15
4	2.40	0.503	1.21
5	2.69	0.437	1.18
6	2.77	0.380	1.05
6	40.71	0.380	15.47
Value of share			22.08

Note:

- Cost of equity for first three years is 20%. Then it falls to 15% for year 4 to 6 and the same falls to 10% from year 7 onwards
- PVF is computed in the following manner for year 4 to 6:

PVF of year 4 =	$\frac{\text{PVF of year 3}}{1 + 15\%}$
PVF of year 5 =	$\frac{\text{PVF of year 4}}{1 + 15\%}$
PVF of year 6 =	$\frac{\text{PVF of year 5}}{1 + 15\%}$

- Growth stabilizes from year 7 and hence we can use Gordon's formula to calculate the price at the end of year 6. Cost of equity has been taken as 10 percent as K_e from year 6 onwards is 10%

$$P_6 = \frac{FCFE_7}{K_e - G} = \frac{2.85}{10\% - 3\%} = \text{Rs. } 40.71$$

31. Range of business valuation [May 2010, Nov 2016 MTP, Nov 2016 RTP]

ABC, a large business house is planning to sell its wholly owned subsidiary KLM. Another large business entity XYZ has expressed its interest in making a bid for KLM. XYZ expects that after acquisition the annual earning of KLM will increase by 10%. Following information, ignoring any potential synergistic benefits arising out of possible acquisitions, are available:

- Profit after tax for KLM for the financial year which has just ended is estimated to be Rs.10 crore.
- KLM's after tax profit has an increasing trend of 7% each year and the same is expected to continue.
- Estimated post tax market return is 10% and risk free rate is 4%. These rates are expected to continue.
- Corporate tax rate is 30%.

	XYZ	ABC	Proxy entity
No of shares	100 lakhs	80 lakhs	
Current share price	Rs.287	Rs.375	
Dividend payout	40%	50%	50%
Debt: Equity at market values	1:2	1:3	1:4
PE ratio	10	13	12
Equity beta	1	1.1	1.1

Assume gearing level of KLM to be the same as for ABC and a debt beta of zero. You are required to calculate:

- ❖ Appropriate cost of equity for KLM based on the data available for the proxy entity.
- ❖ A range of values for KLM both before and after any potential synergistic benefits to XYZ of the acquisition.

Answer:

WN 1: Computation of cost of equity of KLM based on proxy entity:

- Beta of two companies operating in similar business would remain the same, irrespective of the capital structure
- In this question, we will first compute Beta of proxy entity and the same would be equated to Beta of KLM

Beta of Proxy Entity:

Source	Beta	Weight	Product
Debt	0	0.7	0
Equity	1.1	4	4.4
Total		4.7	4.4

$$\text{Beta of proxy entity} = \frac{\text{Sum of Product}}{\text{Sum of weights}} = \frac{4.4}{4.7} = \mathbf{0.9362 \text{ Times}}$$

- Weight for debt should be equal to weight $\times (1 - \text{Tax rate})$. Weights for debt and equity given in the question is 1:4.
- Weight for debt for Beta computation is 0.7 (1×0.7)

Equity Beta of KLM:

Source	Beta	Weight	Product
Debt	0	0.70	0
Equity	1.1546	3.00	3.4639

Total	0.9362	3.70	3.4639

- Beta of proxy entity is 0.9362 Times and hence the Beta of KLM would also be 0.9362 Times
- Total of product of KLM = $0.9362 \times 3.70 = 3.4639$
- Product of equity will be balancing figure and the same would be 3.4639

$$\text{Equity Beta} = \frac{3.4639}{3} = 1.1546 \text{ Times}$$

Cost of equity of KLM:

$$\text{Cost of equity} = R_f + \text{Beta} \times (R_m - R_f)$$

$$\text{Cost of equity} = 4 + 1.1546 \times (10 - 4)$$

$$\text{Cost of equity} = 4 + 6.93 = 10.93\%$$

WN 2: Valuation of company before and after synergy benefits:

Particulars	Pre-acquisition		Post-acquisition	
	Calculation	Amount (Crores)	Calculation	Amount (Crores)
Based on PE Multiple Approach:				
Proxy company PE Multiple	10 crores x 12	120.00	11 crores x 12	132.00
ABC's PE Multiple	10 crores x 13	130.00	11 crores x 13	143.00
XYZ's PE Multiple	10 crores x 10	100.00	11 crores x 10	110.00
Based on Dividend-Payout Ratio:				
40% Payout	$10.7 \times 40\%$ $10.93\% - 7\%$	108.91	$11 \times 1.07 \times 40\%$ $10.93\% - 7\%$	119.80
50% Payout	$10.7 \times 50\%$ $10.93\% - 7\%$	136.13	$11 \times 1.07 \times 50\%$ $10.93\% - 7\%$	149.75

Note:

- Current earnings of the company is Rs.10 Crores and it is assumed that same will increase to Rs.11 Crores due to acquisition. Growth of 7 percentage is then applied on the base of this Rs.10 or Rs.11 Crores
- ICAI solution has assumed that growth rate will remain same at 7 percent in both scenarios

Conclusion:

- Range of pre-synergy valuation = Rs.100 Crores to Rs.136.13 Crores
- Range of post-synergy valuation = Rs.110 Crores to Rs.149.75 Crores

32. Break-up value approach [Nov 2011, Nov 2018 MTP, Nov 2016 MTP, Nov 2017 MTP, May 2018 RTP]

Using the chop-shop approach (or Break-up value approach), assign a value for Cranberry Ltd. whose stock is currently trading at a total market price of €4 million. For Cranberry Ltd, the accounting data set forth three business segments: consumer wholesale, retail and general centers. Data for the firm's three segments are as follows:

Business segment	Segment sales	Segment assets	Segment Operating Income
Wholesale	2,25,000	6,00,000	75,000
Retail	7,20,000	5,00,000	1,50,000
General	25,00,000	40,00,000	7,00,000

Industry data for "pure-play" firms have been compiled and are summarized as follows:

Business segment	Capitalization / Sales	Capitalization / Assets	Capitalization / Operating income
Wholesale	0.85	0.7	9
Retail	1.2	0.7	8
General	0.8	0.7	4

Answer:**WN 1: Valuation of company on basis of capitalization/sales multiple:**

Segment	Sales	Multiple	Capitalization
Wholesale	2,25,000	0.85	1,91,250
Retail	7,20,000	1.20	8,64,000
General	25,00,000	0.80	20,00,000
Value of company			30,55,250

WN 2: Valuation of company on the basis of capitalization/assets multiple:

Segment	Sales	Multiple	Capitalization
Wholesale	6,00,000	0.70	4,20,000
Retail	5,00,000	0.70	3,50,000
General	40,00,000	0.70	28,00,000
Value of company			35,70,000

WN 3: Valuation of company on the basis of capitalization/operating income multiple:

Segment	Sales	Multiple	Capitalization
Wholesale	75,000	9.00	6,75,000
Retail	1,50,000	8.00	12,00,000
General	7,00,000	4.00	28,00,000
Value of company			46,75,000

WN 4: Final valuation:

Value of Firm = Average values of three approaches

$$\text{Value of Firm} = \frac{30,55,250 + 35,70,000 + 46,75,000}{3} = \text{Rs. 37,66,750}$$

33. Valuation based on proxy company [Nov 2019]:

XY Ltd., a Cement manufacturing Company has hired you as a financial consultant of the company. The Cement Industry has been very stable for some time and the cement companies SK Ltd. & AS Ltd. are similar in size and have similar product market mix characteristic. Use comparable method to value the equity of XY Ltd. In performing analysis, use the following ratios:

- (i) Market to book value
- (ii) Market to replacement cost
- (iii) Market to sales
- (iv) Market to Net Income

The following data are available for your analysis:

Particulars	SK Limited	AS Limited	XY Limited
Market Value	450	400	
Book value	400	300	250
Replacement cost	600	550	500
Sales	550	450	500
Net Income	18	16	14

Answer:**WN 1: Valuation based on Market to Book value approach:**

Particulars	SK Limited	AS Limited	XY Limited
Market Value (A)	450	400	307.25 (250 × 1.2290)
Book value (B)	400	300	250
Market value to book value multiple (A/B)	1.125	1.333	1.2290 $\frac{1.125 + 1.333}{2}$

WN 2: Valuation based on Market to Replacement Cost:

Particulars	SK Limited	AS Limited	XY Limited
Market Value (A)	450	400	369.25 (500 × 0.7385)
Replacement Cost (B)	600	550	500
Market value to replacement cost multiple (A/B)	0.750	0.727	0.7385 $\frac{0.750 + 0.727}{2}$

WN 3: Valuation based on Market to Sales:

Particulars	SK Limited	AS Limited	XY Limited
Market Value (A)	450	400	426.75 (500 x 0.8535)
Sales (B)	550	450	500
Market value to sales (A/B)	0.818	0.889	0.8535 <u>0.818 + 0.889</u> 2

WN 4: Valuation based on Net Income:

Particulars	SK Limited	AS Limited	XY Limited
Market Value (A)	450	400	350 (25 x 14)
Net Income (B)	18	16	14
Market value to Net Income (A/B)	25	25	25 <u>25 + 25</u> 2

WN 5: Final valuation based on average of four approaches:

$$\text{Final Value of XY Limited} = \frac{307.25 + 369.25 + 426.75 + 350}{4} = \text{Rs. 363.31}$$

34. Valuation of company [Nov 2017 RTP, Nov 2018 RTP, May 2021 RTP]

T Ltd. Recently made a profit of Rs. 50 crore and paid out Rs. 40 crore (slightly higher than the average paid in the industry to which it pertains). The average PE ratio of this industry is 9. As per Balance Sheet of T Ltd., the shareholder's fund is Rs. 225 crore and number of shares is 10 crore. In case company is liquidated, building would fetch Rs. 100 crore more than book value and stock would realize Rs. 25 crore less. The other data for the industry is as follows:

- ❖ Projected Dividend Growth = 4%
- ❖ Risk Free Rate of Return = 6%
- ❖ Market Rate of Return = 11%
- ❖ Average Dividend Yield = 6%

The estimated beta of T Ltd. is 1.2.

You are required to calculate valuation of T Ltd. using

- (i) P/E Ratio
- (ii) Dividend Yield
- (iii) Valuation as per:
 - a. Dividend Growth Model
 - b. Book Value
 - c. Net Realizable Value

Answer:**WN 1: Valuation of company as per different methods:**

Particulars	Calculation	Amount
PE Multiple based	50 crores x 9	Rs.450.00 crores
Dividend yield	$\frac{40 \text{ crores}}{6\%}$	Rs.666.70 Crores
Dividend growth model (Note below)	$\frac{40 \text{ crores} \times 1.04}{12\% - 4\%}$	Rs.520 Crores
Book value	Shareholder funds	Rs.225 Crores
Net realizable value	225 Cr + 100 Cr - 25 Cr	Rs.300 Crores

Note:

- ❖ Cost of equity = $R_f + \text{Beta} \times (R_m - R_f) = 6\% + 1.2 \times (11\% - 6\%) = 12\%$

35. Valuation of business [May 2019, Nov 2019 RTP]

The closing price of LX Limited is Rs.24 per share as on 31st March, 2019 on NSE Limited. The Price earnings ratio was 6. It was found that an amount of Rs.24 lacs as income and an extra ordinary loss of Rs.9 lacs were included in the books of accounts. The existing operations except for the extraordinary items are expected to continue in future. Further the company has launched a new product during the year with the following expectations:

Particulars	Amount (in lacs)
Sales	150
Material cost	40
Labour cost	34
Fixed cost	24

The company has 5,00,000 equity shares of Rs.10 each and 1,00,000 9% preference shares of Rs.100 each. The price earnings ratio is 6 times. Post tax cost of capital is 10 percent per annum. Tax rate is 34 percent. You are required to determine:

- Existing profit from old operations
- The value of business

Answer:

WN 1: Computation of existing profit from old operations:

Particulars	Calculation	Amount
Market price per share		24
Price earning multiple		6
Earnings per share	24/6	4
No of shares		5,00,000
Earnings available to equity shareholders		20,00,000
Preference Dividend	1,00,000 x 100 x 9%	9,00,000
Profit after tax		29,00,000
Profit before tax	29,00,000 1 - 0.34	43,93,939
Less: Extraordinary Income		(24,00,000)
Add: Extraordinary losses		9,00,000
Existing profit from old operations		28,93,939
Profit from new product	150-40-34-24	52,00,000
Future Maintainable Profit before tax		80,93,939
Less: Tax @ 34%		(27,51,939)
Future Maintainable Profit		53,42,000
Capitalization rate		10%
Value of business	53,42,000/0.10	5,34,20,000

36. Valuation of business [May 2018 RTP, Nov 2018 RTP, May 2009, Nov 2012, May 2019 RTP]

Eagle Limited reported a profit of Rs.77 lacs after 30% tax for the financial year 2011-12. An analysis of the accounts revealed that the income included extraordinary items of Rs.8 lacs and an extraordinary loss of Rs.10 lacs. The existing operations, except for the extraordinary items, are expected to continue in the future. In addition, the results of the launch of a new product are expected to be as follows:

Particulars	Amount (in lacs)
Sales	70
Material costs	20
Labour costs	12
Fixed costs	10

You are required to:

- Calculate the value of the business, given that the capitalization rate is 14%
- Determine the market price per equity share, with Eagle Limited's share capital being comprised of 1,00,000 13% preference shares of Rs.100 each and 50,00,000 equity shares of Rs.10 each and the P/E ratio being 10 times.

Answer:

WN 1: Computation of value of business:

Particulars	Calculation	Amount (in lacs)
Existing PAT		77
Existing PBT	77 lacs/(1-0.3)	110
Less: Extraordinary income		(8)
Add: Extraordinary loss		10
Profit from new product	70 - 20 - 12 - 10	28
Future maintainable PBT		140
Less: Tax @ 30%		(42)

Future maintainable PAT		98
Capitalization factor		0.14
Value of business	98/0.14	700

WN 2: Valuation of equity share:

Particulars	Calculation	Amount (in lacs)
Future maintainable PAT		98
Less: Preference dividend	1,00,000 x 13	(13)
Earnings available to equity shareholders		85
No of shares		50
EPS		1.7
P/E Multiple		10
Market price per equity share		17

Note: EPS and MPS can alternatively be computed based on existing profits

37. Valuation of business [Nov 2016]:

XN Limited reported a profit of Rs.100.32 lacs after 34% tax for the financial year 2015-16. An analysis of the accounts reveals that the income included extra-ordinary items of Rs.14 lacs and an extra-ordinary loss of Rs.5 lacs. The existing operations, except for the extra-ordinary items, are expected to continue in future. Further a new product is launched and the expectations are as under:

Particulars	Amount in lacs
Sales	70
Material costs	20
Labour costs	16
Fixed costs	10

The company has 50,00,000 equity shares of Rs.10 each and 80,000 9% preference shares of Rs.100 each with P/E ratio being 6 times.

You are required to:

- Compute the value of business assuming cost of capital of 12% after tax and
- Determine the market price per equity share

Answer:**WN 1: Valuation of business:**

Particulars	Calculation	Amount (in lacs)
Profit after tax		100.32
Profit before tax	$\frac{100.32}{1 - 0.34}$	152
Less: Extraordinary Income		-14
Add: Extraordinary losses		5
Existing profit from old operations		143
Profit from new product	70-20-16-10	24
Future Maintainable Profit before tax		167
Less: Tax @ 34%		-56.78
Future Maintainable Profit		110.22
Capitalization rate		12%
Value of business	110.22/12%	918.50

WN 2: Computation of market price:

Particulars	Calculation	Amount (in lacs)
Future maintainable profit		110.22
Less: Preference dividend @ 9%		-7.20
EAES		103.02
No of shares		50
EPS	$\frac{103.02}{50}$	2.06
PE Multiple		6

Market price per share	2.06 x 6	12.36

38. Net assets valuations and earnings capitalization [Nov 2012]

H limited agrees to buy over the business of B Limited effective 1st April, 2012. The summarized Balance Sheets of H Limited and B Limited as on 31st March 2012 are as follows: Balance Sheet as at 31st March, 2012 (In Crores of Rupees)

Liabilities	H Limited	B Limited
Equity Shares of Rs 100 each	350.00	
Equity Shares of Rs 10 each		6.50
Reserves & Surplus	950.00	25.00
Total liabilities	1,300.00	31.50
Assets:		
Net fixed assets	220.00	0.50
Net current assets	1,020.00	29.00
Deferred tax assets	60.00	2.00
Total	1,300.00	31.50

H Limited proposes to buy out B Limited and the following information is provided to you as part of the scheme of buying:

- The weighted average post tax maintainable profits of H Limited and B Limited for the last 4 years are Rs.300 crores and 10 crores respectively.
- Both the companies envisage a capitalization rate of 8%.
- H Limited has a contingent liability of Rs.300 crores as on 31st March, 2012.
- H Limited to issue shares of Rs.100 each to the shareholders of B Limited in terms of the exchange ratio as arrived on a Fair Value basis. (Please consider weights of 1 and 3 for the value of shares arrived on Net Asset basis and Earnings capitalization method respectively for both H Limited and B Limited)

You are required to arrive at the value of the shares of both H Ltd. and B Ltd. under:

- Net Asset Value Method
- Earnings Capitalization Method
- Exchange ratio of shares of H Limited to be issued to the shareholders of B Limited. On a Fair value basis (taking into consideration the assumption mentioned in point 4 above)

Answer:**WN 1: Valuation of share as per net assets method:**

(in crores)

Particulars	H Limited	B Limited
Value of assets	1,300	31.50
Less: Liabilities (Note)	-300	-0
Net assets	1,000	31.50
No of shares	3.50	0.65
Value per share	285.71	48.46

Note:

- It is assumed that entire contingent liability will crystallize into actual liability

WN 2: Valuation of share as per Earnings capitalization method:

Particulars	H Limited	B Limited
Future maintainable profit	300	10
Capitalization rate	8%	8%
Value of company (FMP/Capitalization rate)	3,750	125
No of shares	3.50	0.65
Value per share	1,071.43	192.31

WN 3: Computation of fair value:

$$\text{Fair value} = \frac{(\text{Price as per Net assets method} \times 1) + (\text{Price as per Earnings method} \times 3)}{1 + 3}$$

$$\text{H Limited} = \frac{(285.71 \times 1) + (1,071.43 \times 3)}{1 + 3} = \text{Rs. 875 per share}$$

$$B \text{ Limited} = \frac{(48.46 \times 1) + (192.31 \times 3)}{1 + 3} = \text{Rs. } 156.35 \text{ per share}$$

WN 4: Exchange ratio on the basis of fair value:

Basis of exchange ratio		Fair Value
Base values	H Ltd: B Ltd	875: 156.35
Exchange ratio		156.35:875 (or) 0.1787:1

39. Net assets method and earnings capitalization method [May 2008, May 2017 RTP]

Given below is the balance sheet of S Limited as on March 31, 2008:

Liabilities	Rs. in lacs	Assets	Rs. in lacs
Share capital (of Rs.10 each)	100	Land and building	40
Reserves and surplus	40	Plant and machinery	80
Long term debts	30	Investments	10
		Stock	20
		Debtors	15
		Cash at Bank	5
	170		170

You are required to work out the value of the company's shares on the basis of Net Assets Method and Profit-earning capacity (capitalization) method and arrive at the fair price of the shares, by considering the following information:

- ❖ Profit for the current year Rs.64 lacs includes Rs.4 lacs extraordinary income and Rs.1 lac income from investments of surplus funds; such surplus funds are unlikely to recur
- ❖ In subsequent years, additional advertisement expenses of Rs.5 lacs are expected to be incurred each year
- ❖ Market value of Land and Building and Plant and Machinery has been ascertained at Rs.96 lacs and Rs.100 lacs respectively. This will entail additional depreciation of Rs.6 lacs each year
- ❖ Effective income tax rate is 30%
- ❖ The capitalization rate applicable to similar businesses is 15%

Answer:**WN 1: Valuation of company on the basis of net assets method:**

Particulars	Amount (in lacs)
Value of assets:	
Land and building	96.00
Plant and machinery	100.00
Investments	10.00
Stock	20.00
Debtors	15.00
Cash at bank	5.00
Total value of assets	246.00
Less: Long term debt	-30.00
Value of net assets	216.00
No of shares	10
Value per share (216/10)	21.60

WN 2: Valuation of company on the basis of earnings capitalization method:

Particulars	Amount (in lacs)
Profit before tax	64.00
Less: Extraordinary income	-4.00
Less: Investment income	-1.00
Less: Additional advertisement	-5.00
Less: Additional depreciation	-6.00
Future maintainable PBT	48.00
Less: Tax @ 30%	-14.40

Future maintainable PAT	33.60
Capitalization rate	15%
Value of firm (33.60/15%)	224.00
Less: Debt	-30.00
Value of equity (33.60/15%)	194.00
No of shares	10.00
Value per share (224/10)	19.40

- It is assumed that profit given in the question is profit before tax
- It is assumed that interest has not been subtracted while computing FMP and hence computed value is that of firm. Amount of debt is deducted to get value of equity

WN 3: Computation of fair value:

$$\text{Fair value} = \frac{21.60 + 19.40}{2} = \text{Rs. 20.50 per share}$$

40. Calculation of purchase consideration [May 2010, Nov 2018 MTP, May 2018 RTP, Nov 2018]

T Limited and E Limited are in the same industry. The former is in negotiation for acquisition of the latter. Important information about the two companies as per their latest financial statements is given below:

Particulars	T Limited	E Limited
Rs.10 equity shares outstanding	12 lakhs	6 lakhs
Debt:		
10% Debentures (Rs. Lakhs)	580	
12.5% Institutional loan (Rs. Lakhs)		240
Earnings before interest, depreciation and tax (EBIDAT) Rs. Lakhs	400.86	115.71
Market price per share	220	110

T Limited plans to offer a price for E Limited, business as a whole which will be 7 times EBIDAT reduced by outstanding debt, to be discharged by own shares at market price. E Limited is planning to seek one share in T Limited for every 2 shares in E Limited based on the market price. Tax rate for the two companies may be assumed as 30%. Calculate and show the following under both alternatives – T Limited's offer and E Limited's plan:

- ❖ Net consideration payable.
- ❖ No. of shares to be issued by T Limited
- ❖ EPS of T Limited after acquisition.
- ❖ Expected market price per share of T Limited after acquisition.
- ❖ State briefly the advantages to T Limited from the acquisition.

Calculations (except EPS) may be rounded off to 2 decimals in lakhs.

Answer:**Analysis of T Limited's offer and E Limited's plan:**

(in lacs)

Particulars	T Limited's offer	E Limited's plan
Net consideration	(7 × EBIDAT) – Debt (7 × 115.71) – 240 = 569.97	(6 lacs × 0.5) × 220 = 660 lacs
Issue price	220	220
No of shares issued	$\frac{569.97}{220} = 2.59$	$\frac{660}{220} = 3.00$
EPS post-merger:		
EBIDAT post-merger (400.86 + 115.71)	516.57	516.57
Less: Interest (580 × 10% + 240 × 12.5%)	-88.00	-88.00
EBT	428.57	428.57
Less: Tax @ 30%	-128.57	-128.57
EAT	300.00	300.00
No of shares (12 + new shares issued)	14.59	15.00
EPS (EAT/No of shares)	20.56	20.00
MPS post-merger:		
EPS	20.56	20.00
PE Multiple (Note 1)	11.00	11.00

MPS	226.16	220.00

Advantages of Acquisition:

Since the two companies are in the same industry, the following advantages could accrue:

- Synergy, cost reduction and operating efficiency.
- Better market share
- Avoidance of competition.

Note 1: PE Multiple:

- Post-merger PE Multiple will be taken as same as per-merger PE Multiple
- PAT before merger = $(400.86 - 58.00) \times 70\% = 240$ lacs
- EPS before merger = $(240 \text{ lacs} / 12 \text{ lacs}) = \text{Rs.}20$
- PE Multiple before merger = $220 / 20 = 11$ Times

41. Demerger [Nov 2005, May 2015 MTP]

The following information is relating to Fortune India Ltd. having two division, viz. Pharma Division and Fast Moving Consumer Goods Division (FMCG Division). Paid up share capital of Fortune India Ltd. is consisting of 3,000 Lakhs equity shares of Re. 1 each. Fortune India Ltd. decided to de-merge Pharma Division as Fortune Pharma Ltd. w.e.f. 1.4.2009. Details of Fortune India Ltd. as on 31.3.2009 and of Fortune Pharma Ltd. as on 1.4.2009 are given below:

Particulars	Fortune Pharma Limited	Fortune India Limited
Outside liabilities		
Secured loans	400 lakh	3,000 lakh
Unsecured loans	2,400 lakh	800 lakh
Current liabilities & provisions	1,300 lakh	21,200 lakh
Assets		
Fixed assets	7,740 lakh	20,400 lakh
Investments	7,600 lakh	12,300 lakh
Current assets	8,800 lakh	30,200 lakh
Loans & advances	900 lakh	7,300 lakh
Deferred tax/Misc. expenses	60 lakh	(200 lakh)

Board of Directors of the Company have decided to issue necessary equity shares of Fortune Pharma Ltd. of Re. 1 each, without any consideration to the shareholders of Fortune India Ltd. For that purpose following points are to be considered:

- ❖ Transfer of Liabilities & Assets at Book value.
- ❖ Estimated Profit for the year 2009-10 is Rs.11,400 Lakh for Fortune India Ltd. & Rs.1,470 lakhs for Fortune Pharma Ltd.
- ❖ Estimated Market Price of Fortune Pharma Ltd. is Rs. 24.50 per share.
- ❖ Average P/E Ratio of FMCG sector is 42 & Pharma sector is 25, which is to be expected for both the companies.

Calculate:

- The Ratio in which shares of Fortune Pharma are to be issued to the shareholders of Fortune India Ltd.
- Expected Market price of Fortune India (FMCG) Ltd.
- Book Value per share of both the Companies immediately after Demerger.

Answer:**WN 1: Computation of shares to be issued and price post-merger:**

(in lacs)

Particulars	Fortune Pharma	Fortune India FMCG
EAES	1,470	11,400
No of shares	1,500	3,000
EPS	0.98	3.8
PE Multiple	25	42
MPS	24.50	159.60

Note:

- Expected price of Fortune Pharma Limited = 24.50
- PE Multiple of Fortune Pharma Limited = 25
- Expected EPS of Fortune Pharma = $(24.50 / 25) = 0.98$ Times

- No of shares = (EAES/EPS) = 1,470/0.98 = 1,500 lacs

WN 2: Computation of book value per share after demerger:

Particulars	Fortune India (Merged)	Fortune Pharma (Demerged)	Fortune India FMCG
Total assets	70,000	25,100	44,900
Less: Outside liabilities	-25,000	-4,100	-20,900
Networth	45,000	21,000	24,000
No of shares	3,000	1,500	3,000
Book value per share	15	14	8

- Overall Networth of merged entity is captured in column 2. We have values separately for Fortune Pharma in question and hence Fortune India FMCG is taken as balancing figure

42. Valuation of business and market value added [Nov 2010 RTP]

Nappp.com plc is a closely held company based Lincolnshire in B2B business offering logistic services mainly to small and medium sized companies through internet, who cannot afford sophisticated logistics practices. Company is planning to go for public issue in the coming year and is interested to know what the company's share will be worth. The company engaged a consultant based in Leicestershire. The consultant evaluated company's future prospects and made following estimates of future free cash flows:

Particulars	Year 1	Year 2	Year 3	Year 4
Sales	1,00,000	1,15,000	1,32,250	1,32,250
EBIT	16,000	18,400	21,160	21,160
Less: Cash tax	(4,800)	(5,520)	(6,348)	(6,348)
NOPAT	11,200	12,880	14,812	14,812
Less: Investments in WC	(1,695.65)	(1,950)	(2,242.50)	
Less: Capex	(2,347.83)	(2,700)	(3,105)	
Free cash flow	7,156.52	8,230	9,464.50	14,812

Further the company's investment banker had done a study of the company's cost of capital and estimated WACC to be 12%. You are required to determine:

- Value of Nappp.com plc based on these estimates
- Market value added by company supposing that invested capital in the year 0 was 31,304.05
- Value of per share, if company has 2,000 common equity share outstanding and debt amounting to Rs.4,000

Answer:**WN 1: Valuation of Nappp.com:**

Year	Cash flow	PVF @ 12%	DCF
1	7,156.52	0.893	6,390.77
2	8,230	0.797	6,559.31
3	9,464.50	0.712	6,738.72
3	1,23,433 14,812 12%	0.712	87,884.3
Value of Firm			1,07,573.10

WN 2: Computation of market value added:

- ❖ Market value added = Value of firm – Invested capital
- ❖ Market value added = 1,07,573.10 – 31,304.05 = Rs.76,269.50

WN 3: Computation of value per share:

Value of equity = Value of Firm – Value of Debt
Value of equity = 1,07,573.10 – 4,000 = 1,03,573.10
Value per share = $\frac{1,03,573.10}{2,000}$ = Rs. 51.79

43. Determination of discount rate and valuation:

Cool-cool Ltd. makes thermal clothing for winter sports and outdoor work, and is considering acquiring Sking Shell Ltd. which manufactures and sells ski clothing. Sking Shell is about one quarter of Frozen's size

and manufactures its entire product line in a small rented factory on a mountaintop in Manali. It costs about Rs.10,00,000 a year in overhead to operate in the factory. Cool-cool Ltd. produces its output in a less popular in North but more popular north-east locations. Its factory has at least 50% excess capacity. Cool-cool's plan is to acquire Sking Shell, and combine production operations in its north-eastern factory, but otherwise run the companies separately.

Sking Shell's beta is 2.0, Treasury bills currently yield 5% and the Nifty Index is yielding 9%. The corporate income tax rate for both firms is 40%. Because Sking Shell will no longer be maintaining its own production facilities, it can be assumed that only a minimal amount of cash will have to be reinvested to keep its equipment current and for future growth. This amount is estimated at Rs. 1,00,000 per year. Selected financial information for Sking Shell is as follows:

❖ Revenue	Rs. 1,25,00,000
❖ EAT	Rs. 13,00,000
❖ Depreciation	Rs. 6,00,000

There will be annual synergy gain(post-tax) of Rs.6,00,000 post acquisition.

- Calculate the appropriate discount rate for evaluating the Sking Shell acquisition.
- Determine the annual cash flow expected by Cool-cool Ltd. from Sking Shell if the acquisition is made (don't forget to include the synergy).
- Calculate the value of the acquisition to Cool-cool Ltd. assuming the benefits last for (1) five years, (2) 10 years, and (3) 15 years.
- Sking Shell has 2,50,000 shares of stock outstanding. Calculate the maximum price Cool-cool Ltd. should be willing to pay per share to acquire the firm under the three assumptions in part c.
- If Cool-cool Ltd. is willing to assume the benefits of the Sking Shell acquisition will last indefinitely but not grow, what should it be willing to pay per share?

Answer:

WN 1: Computation of discount rate:

- ❖ $K_e = R_f + \text{Beta} \times (R_m - R_f)$
- ❖ $K_e = 5\% + 2 \times (9\% - 5\%)$
- ❖ $K_e = 13\%$

WN 2: Computation of annual cash flow:

Particulars	Amount
Profit after tax	13,00,000
Add: Depreciation	6,00,000
Add: Synergy gain	6,00,000
Less: Capital expenditure	(1,00,000)
Annual cash flow	24,00,000

WN 3: Computation of value of acquisition and offer price:

Particulars	Five years	Ten Years	Fifteen years	Perpetuity
Annual cash flow	24,00,000	24,00,000	24,00,000	24,00,000
PVAF	3.5172	5.4262	6.4624	
Value of business	84,41,280	1,30,22,880	1,55,09,760	1,84,61,538 [24,00,000/13%]
No of shares	2,50,000	2,50,000	2,50,000	2,50,000
Offer price	33.77	52.09	62.04	73.85

44. Valuation of business:

In above question, assume that the cash flow from the Sking Shell acquisition grows at 10% from its initial value for one year and then grows at 5% indefinitely (starting in the third year). Calculate the value of the firm and the implied stock price under these conditions. Use a terminal value at the beginning of the period of 5% growth. What premium is paid as a percent of market price if Sking Shell's stock is currently selling at Rs. 62?

Answer:

WN 1: Computation of cash flows till first year of stabilization phase:

Year	Cash flow
1	24,00,000

2	26,40,000 [24,00,000 + 10%]
3	27,72,000 [26,40,000 + 5%]

WN 2: Valuation of growing perpetuity:

$$\text{Year 2 value} = \frac{\text{Cash flow of year 3}}{\text{Cost of equity} - \text{Growth rate}} = \frac{27,72,000}{13\% - 5\%} = \text{Rs. 3,46,50,000}$$

WN 3: Value of acquisition:

Year	Cash flow	PVF @ 13%	DCF
1	24,00,000	0.885	21,24,000
2	26,40,000	0.783	20,67,120
2	3,46,50,000	0.783	2,71,30,950
Value of acquisition			3,13,22,070

$$\text{Value per share} = \frac{3,13,22,070}{2,50,000} = \text{Rs. 125.29}$$

$$\text{Premium per share} = \text{Rs. 125.29} - \text{Rs. 62} = \text{Rs. 63.29}$$

$$\text{Premium \%} = \frac{63.29}{62} \times 100 = 102.08\%$$

45. Divestiture of business [May 2017 MTP]

MS Stones has different divisions of home interiors products. Recently, due to economic slowdown, the Managing Director of the Company expressed its desire to divestiture its ceramic tile business. The relevant financial details of this business are as follows:

- ❖ Estimated pre tax cash flow of next year = Rs.200 crore
- ❖ Book value of liabilities = Rs.780 crore

In an order to increase its share in the ceramic tile market, the Tripati Tiles Ltd. showed its interest in the acquisition of this unit and offered a proceed of Rs. 950 Crore for the same to MS Stones. The other data pertaining to the business are as follows:

- ❖ Tax rate = 30%
- ❖ Growth rate = 4%
- ❖ Applicable discount rate for tile business = 12%

If market value of liabilities are Rs. 40 Crore more than book value, you are required to advice MD whether she should go for divestiture of the tile business or not.

Answer:**WN 1: Valuation of tiles business:**

Particulars	C PLC
Pre-tax cash flow of next year	200 crores
Post-tax cash flow of next year	140 Crores
Cost of equity	12%
Growth rate	4%
Value of company $\left[\frac{\text{Net cash flow}}{K_e - G} \right]$	1,750 Crores
Less: Value of liabilities (780 + 40)	820 Crores
Net assets value	930 crores

Since, the Tripati tiles is offering Rs.950 Crores, more than Net Asset value of Rs.930 Crores, the company should go further with decision of divestiture of tile business.

46. Valuation of business [Nov 2007]

AB Ltd. has recently approached the shareholders of CD Ltd. which is engaged in the same line of business as that of AB Ltd. with a bid of 4 new shares in AB Ltd. for every 5 CD Ltd. shares or a cash alternative of Rs.360 per share. Past records of earnings of CD Ltd. had been poor and the company's shares have been out of favour with the stock market for some time. Pre bid information for the year ended 31.3.2006 are as follows:

Particulars	AB Limited in lakhs	CD Limited in lakhs
Equity share capital	60	170
Number of shares	2.4	1.7

Pre-tax profit	125	110
P/E Ratio	11	7
Estimated post tax cost of equity capital	12%	10%

Both AB Ltd. and CD Ltd. pay income tax at 30%. Current earnings growth forecast is 4% for the foreseeable future of both the Companies.

Assuming no synergy exists, you are required to evaluate whether proposed share to share offer is likely to be beneficial to the shareholders of both the companies using merger terms available. AB Ltd.'s directors might expect their own pre bid P/E ratio to be applied to combined earnings.

Also comment on the value of the two Companies from the constant growth form of dividend valuation model assuming all earnings are paid out as dividends

Answer:

WN 1: Computation of gain to both sets of shareholders:

Note 1: Computation of expected share price:

Particulars	AB Limited	CD Limited	Merged entity
Profit before tax	125	110	235
Less: Tax @ 30%	-37.5	-33	-70.5
Profit after tax	87.5	77	164.5
No of shares	2.4	1.7	3.76
EPS	36.46	45.29	43.75
PE Multiple	11	7	11
MPS	401.06	317.03	481.25
No of shares	2.4	1.7	3.76
Market value of equity	962.54	538.95	1,809.50

❖ Shares allotted to CD Limited = 1.70 lacs $\times$ (4/5) = 1.36 lacs

❖ No of shares post-merger = 3.76 lacs

Note 2: Computation of gain for both sets of shareholders:

Particulars	AB Limited	CD Limited
Pre-merger price	401.06	317.03
Post-merger price	481.25	385 $\left(481.25 \times \frac{4}{5}\right)$
Gain/loss per share	80.19	67.97
% gain/loss (Gain/Pre-merger price)	20%	21.44%

Consideration in cash offer is only Rs.360 per share. Hence shareholders of CD Ltd are gaining more from the merger in a share exchange and cash alternative is unlikely to be accepted.

WN 2: Valuation of company as per constant dividend valuation model:

Particulars	AB Limited	CD Limited
Earnings per share/Dividend per share	36.46	45.29
Cost of equity	12%	10%
Growth rate	4%	4%
Value of company $\left[\frac{\text{Dividends} \times (1 + \text{Growth rate})}{K_e - G} \right]$	473.98	785.03

- ❖ On this basis market slightly undervalues AB Ltd share but share of CD Ltd., are highly undervalued possibly because of previous disappointments.
- ❖ However, if AB Ltd. forecast is believed that the AB Ltd., is getting CD Ltd. shares, it will be a cheap proposal for AB Ltd. to acquire the CD Ltd. on share exchange basis and especially if any of the shareholder of CD Ltd. accept the cash offer.
- ❖ The shareholders of CD Ltd. would also be benefited post-merger based on share exchange ratio since the value of their share would be going up from Rs.317.03 to Rs.385. However, their share price would still be undervalued as compared with the share price calculated by using constant growth model.

47. Consideration for promoters [Nov 2018 MTP, May 2014]

The equity shares of XYZ Ltd. are currently being traded at Rs. 24 per share in the market. XYZ Ltd. has

total 10,00,000 equity shares outstanding in number; and promoters' equity holding in the company is 40%. PQR Ltd. wishes to acquire XYZ Ltd. because of likely synergies. The estimated present value of these synergies is Rs. 80,00,000. Further PQR feels that management of XYZ Ltd. has been over paid. With better motivation, lower salaries and fewer perks for the top management, will lead to savings of Rs. 4,00,000 p.a. Top management with their families are promoters of XYZ Ltd. Present value of these savings would add Rs. 30,00,000 in value to the acquisition.

Following additional information is available regarding PQR Ltd.:

- ❖ Earnings per share = Rs.4
- ❖ Total number of equity shares outstanding = 15,00,000
- ❖ Market price of equity share = Rs.40

Required:

- ❖ What is the maximum price per equity share which PQR Ltd. can offer to pay for XYZ Ltd.?
- ❖ What is the minimum price per equity share at which the management of XYZ Ltd. will be willing to offer their controlling interest?

Answer:

WN 1: Computation of maximum price to be paid by PQR Limited:

Particulars	Calculation	Amount
Current value of XYZ Limited	(10 lacs x 24)	2,40,00,000
Synergy benefits		80,00,000
Savings in top management salaries		30,00,000
Potential value of XYZ Limited		3,50,00,000
No of shares		10,00,000
Maximum price per share		Rs.35

WN 2: Computation of minimum price per share at which promoters will offer controlling interest:

Particulars	Calculation	Amount
Current value of holding	(10 lacs x 24) x 40%	96,00,000
Loss of higher salaries		30,00,000
Total value of holding		1,26,00,000
No of shares		4,00,000
Minimum price per share	126 lacs/4 lacs	31.50

- Promoters would lose the benefit of higher salaries once they offer their controlling interest and hence, they would want to get compensation for that as well. Hence Rs.30,00,000 have been added in computing minimum price per share

48. Valuation of company with floor value [May 2019, May 2015 RTP]

R Limited and S Limited operating in same industry are not experiencing any rapid growth but providing a steady stream of earnings. R Limited's management is interested in acquisition of S Limited due to its excess plant capacity. Share of S Limited is trading in market at Rs.3.20 each. Other data relating to S Limited is as follows:

Liabilities	Amount	Assets	Amount
Current Liabilities	1,59,80,000	Current Assets	2,48,75,000
Long term liabilities	1,28,00,000	Other assets	94,00,000
Reserves and surplus	2,79,95,000	Property Plants and equipments	3,45,00,000
Share capital (80 lacs shares)	1,20,00,000		
Total	6,87,75,000	Total	6,87,75,000

Particulars	R Limited	S Limited	Combined Entity
Profit after tax	86,50,000	49,72,000	1,21,85,000
Residual net cash flows per year	90,10,000	54,87,000	1,85,00,000
Required return on equity	13.75%	13.05%	12.50%

You are required to compute the following:

- i. Minimum price per share S Limited should accept from R Limited
- ii. Maximum price per share R Limited shall be willing to offer to S Limited

iii. Floor value of per share of S Limited,. Whether it shall play any role in decision for its acquisition by R Limited

Answer:

WN 1: Valuation of company:

Particulars	R Limited	S Limited	Combined entity
Residual net cash flow	90,10,000	54,87,000	1,85,00,000
Cost of equity	13.75%	13.05%	12.50%
Growth rate	0%	0%	0%
Value of company $\left[\frac{\text{Net cash flow}}{K_e - G} \right]$	6,55,27,273	4,20,45,977	14,80,00,000

WN 2: Minimum price per share S Limited should accept from R Limited:

Minimum price per share should be lower of the following:

- ❖ **Cash flow based:** Total consideration of Rs.4,20,45,977 (or) Rs.5.26 per share (4,20,45,977/80,00,000)
- ❖ **Book-value based:** Total consideration of Rs.3,99,95,000 (or) Rs. 5 per share (3,99,95,000/80,00,000)

Hence minimum price per share to be paid is Rs.5 per share

WN 3: Computation of maximum price per share:

- ❖ Maximum consideration = Post-merger value – Pre-merger value
- ❖ Maximum consideration = 14,80,00,000 – 6,55,27,273
- ❖ Maximum consideration = Rs. 8,24,72,727
- ❖ Maximum price per share = Rs.10.31 (8,24,72,727/80,00,000)

WN 4: Relevance of floor value:

- Floor value of per share of S Ltd shall be Rs.3.20 (current market price) and it shall not play any role in decision for the acquisition of S Ltd. as it is lower than its current book value.

49. Computation of minimum price, maximum price and floor value [May 2015 RTP]

M Plc and C Plc operating in same industry are not experiencing any rapid growth but providing a steady stream of earnings. M Plc's management is interested in acquisition of C Plc due to its excess plant capacity. Share of C Plc is trading in market at GBP 4 each. Other data relating to C Plc is as follows:

Particulars	M Plc	C Plc	Combined entity
Profit after tax	48,00,000	30,00,000	92,00,000
Residual net cash flow per year	60,00,000	40,00,000	1,20,00,000
Required return on equity	12.5%	11.25%	12.00%

Balance Sheet of C PLC

Assets	Amount	Liabilities	Amount
Current Assets	2,73,00,000	Current Liabilities	1,34,50,000
Other Assets	55,00,000	Long term liabilities	1,11,00,000
Property Plants and Equipments	2,15,00,000	Reserves and Surplus	2,47,50,000
		Share capital(5 million common shares of GBP 1 each)	50,00,000
Total	5,43,00,000	Total	5,43,00,000

You are required to compute:

- (i) Minimum price per share C Plc should accept from M Plc
- (ii) Maximum price per share M plc should be willing to offer to C Plc
- (iii) Floor value of per share of C Plc. Whether it shall play any role in decision for its acquisition by M Plc.

Answer:

WN 1: Valuation of company:

Particulars	C PLC	M PLC	Combined entity
Residual net cash flow	40,00,000	60,00,000	1,20,00,000
Cost of equity	11.25%	12.50%	12.00%
Growth rate	0%	0%	0%
Value of company $\left[\frac{\text{Net cash flow}}{K_e - G} \right]$	3,55,55,556	4,80,00,000	10,00,00,000

WN 2: Minimum price per share C PLC should accept from M PLC:

Minimum price per share should be lower of the following:

- ❖ **Cash flow based:** Total consideration of GBP 3,55,55,556 (or) GBP 7.11 per share (3,55,55,556/50,00,000)
- ❖ **Assets based:** Total consideration of GBP 2,97,50,000 (or) GBP 5.95 per share (2,97,50,000/50,00,000)

Hence minimum price per share to be paid is GBP 5.95.

WN 3: Computation of maximum price per share:

- ❖ Maximum consideration = Value of M PLC post merger – Value of M PLC pre merger
- ❖ Maximum consideration = 10,00,00,000 – 4,80,00,000
- ❖ Maximum consideration = GBP 5,20,00,000
- ❖ Maximum price per share = GBP 10.40 (5,20,00,000/50,00,000)

WN 4: Relevant of floor value:

Floor value of per share of C PLC shall be GBP 4 (current market price) and it shall not play any role in decision for the acquisition of C PLC as it is lower than its current book value.

50. Corporate restructuring [Nov 2014 RTP, Nov 2018 MTP, Nov 2011, Nov 2018 RTP]

The following is the Balance-sheet of Grape Fruit Company Limited as at March 31, 2011:

Liabilities	Amount (in lacs)	Assets	Amount in lacs
Equity shares of Rs.100 each	600	Land and Building	200
14% preference shares of Rs.100 each	200	Plant and Machinery	300
13% debentures	200	Furniture and fixtures	50
Debenture interest accrued and payable	26	Inventory	150
Loan from bank	74	Sundry debtors	70
Trade creditors	340	Cash at Bank	130
		Preliminary expenses	10
		Cost of issue of debentures	5
		Profit and Loss account	525
	1440		1440

The Company did not perform well and has suffered sizable losses during the last few years. However, it is felt the company could be nursed back to health by proper financial restructuring. Consequently the following scheme of reconstruction has been drawn up :

- (i) Equity shares are to be reduced to Rs. 25/- per share, fully paid up;
- (ii) Preference shares are to be reduced (with coupon rate of 10%) to equal number of shares of Rs. 50 each, fully paid up.
- (iii) Debenture holders have agreed to forgo the accrued interest due to them. In the future, the rate of interest on debentures is to be reduced to 9 percent.
- (iv) Trade creditors will forego 25 percent of the amount due to them.
- (v) The company issues 6 lakh of equity shares at Rs. 25 each and the entire sum was to be paid on application. The entire amount was fully subscribed by promoters.
- (vi) Land and Building was to be revalued at Rs. 450 lakhs, Plant and Machinery was to be written down by Rs. 120 lakhs and a provision of Rs.15 lakhs had to be made for bad and doubtful debts.

Required:

- (i) Show the impact of financial restructuring on the company's activities.
- (ii) Prepare the fresh balance sheet after the reconstructions is completed on the basis of the above proposals.

Answer:**WN 1: Computation of Capital reserve:**

Particulars	Calculation	Amount in lacs
Benefits to Grape Fruit company:		
Reduction in equity share capital	6 lacs x 75	450
Reduction in preference share capital	2 lacs x 50	100
Waiver of outstanding debenture interest		26
Waiver from trade creditors	340 lacs x 25%	85

Appreciation of land and building	450 lacs – 200 lacs	250
Total Benefits		911
Less: Assets written off		
Writing off P&L Account		525
Cost of issue of debentures		5
Preliminary expenses		10
Provision for bad and doubtful debts		15
Revaluation of P&M		120
Total assets written off		675
Capital reserve		236

WN 2: Balance Sheet of Grape Fruit company as at 31st March 2016 (after reconstruction)**(in lacs)**

Liabilities	Amount	Assets	Amount
12 lacs equity shares of Rs.25 each	300	Land and building	450
10% preference shares of Rs.50 each	100	Plant and machinery	180
Capital reserve	236	Furniture and fixtures	50
9% debentures	200	Inventory	150
Loan from Bank	74	Sundry debtors	55
Trade creditors (340 – 85)	255	Cash at Bank [130 + 150]	280
Total	1165	Total	1165

51. Impact of wrong WACC on valuation [May 2019 RTP, May 2018, Nov 2010, Nov 2014, Nov 2018]

The valuation of Hansel Limited has been done by an investment analyst. Based on an expected free cash flow of Rs. 54 lakhs for the following year and an expected growth rate of 9 percent, the analyst has estimated the value of Hansel Limited to be Rs. 1800 lakhs. However, he committed a mistake of using the book values of debt and equity. The book value weights employed by the analyst are not known, but you know that Hansel Limited has a cost of equity of 20 percent and post tax cost of debt of 10 percent. The value of equity is thrice its book value, whereas the market value of its debt is nine-tenths of its book value. What is the correct value of Hansel Ltd?

Answer:**WN 1: Computation of wrong WACC used by the analyst:**

$$\text{Value of Firm} = \frac{FCF_1}{K_o - \text{Growth}}$$

$$1,800 \text{ lacs} = \frac{54 \text{ lacs}}{K_o - 0.09}; K_o - 0.09 = \frac{54}{1,800}; K_o = 0.03 + 0.09 = 0.12 \text{ (or) } 12\%$$

WN 2: Computation weighted used by the analyst:

Let us assume weight of equity to be X and weight of debt will be 1-X

Source	cost	Weight	Product
Equity	20	X	20X
Debt	10	1-X	10-10X
Total	12	1	20X+10-10X = 12

$$20X + 10 - 10X = 12; 10X = 2; X = 0.2 \text{ Times}$$

- Hence the weight of equity is 20% and weight of debt is 80%

WN 3: Computation of correct WACC with correct weights:

- Weight of equity = $0.20 \times 3 = 0.60$ Times
- Weight of debt = $0.80 \times (9/10) = 0.72$ Times

Source	cost	Weight	Product
Equity	20	0.60	12.00
Debt	10	0.72	7.20
Total		1.32	19.20

$$\text{WACC} = \frac{19.20}{1.32} = 14.55\%$$

WN 4: Correct valuation of Hansel Limited:

$$\text{Value of Firm} = \frac{\text{FCF}_1}{K_0 - \text{Growth}} = \frac{54}{14.55\% - 9\%} = \text{Rs. 972.97 lacs}$$

52. Valuation of firm:

There is a privately held company X Pvt. Ltd that is operating into the retail space, and is now scouting for angel investors. The details pertinent to valuing X Pvt. Ltd are as follows –

The company has achieved break even this year and has an EBITDA of 90. The leveraged beta based on the industry in which it operates is 1.8, and the average debt to equity ratio is hovering at 40:60. The rate of return provided by liquid bonds is 5%. The EV is to be taken at a multiple of 5 on EBITDA. The accountant has informed that the EBITDA of 90 includes an extraordinary gain of 10 for the year, and a potential write off of preliminary sales promotion costs of 20 are still pending. The internal assessment of rate of market return for the industry is 11%. The FCFs for the next 3 years are as follows:

Particulars	Y1	Y2	Y3
Future cash flows	100	120	150

The cost of debt will be 12%. Assume a tax regime of 30%. What is the potential value to be placed on X Pvt. Ltd?

Answer:**WN 1: Valuation as per EBITDA Multiple:**

- Enterprise value = Adjusted EBITDA x Multiple
- Adjusted EBITDA = 90 – extraordinary gain (10) – write-off (20) = 60
- Enterprise value = 60 x 5 = Rs.300

WN 2: Valuation based on cash flows:**Part 1: Cost of capital**

$$\text{Cost of capital} = R_f + \text{Beta} \times (R_m - R_f) = 5 + 1.8 \times (11 - 5) = 15.80\%$$

Part 2: Discounting of cash flows:

Year	CF	PVF	DCF
1	100	0.864	86.40
2	120	0.746	89.52
3	150	0.644	96.60
			272.52

- Value of Firm = Rs.272.52

Conclusion:

- Potential value of Firm = Rs.272.52 to Rs.300

53. Valuation and acceptance of offer [May 2019 MTP, Nov 2015 MTP, Nov 2017 MTP, Nov 2018 MTP]

Personal Computer Division of Distress Ltd., a computer hardware manufacturing company has started facing financial difficulties for the last 2 to 3 years. The management of the division headed by Mr. Smith is interested in a buyout on 1 April 2013. However, to make this buy-out successful there is an urgent need to attract substantial funds from venture capitalists. Ven Cap, a European venture capitalist firm has shown its interest to finance the proposed buy-out. Distress Ltd. is interested to sell the division for Rs. 180 crore and Mr. Smith is of opinion that an additional amount of Rs. 85 crore shall be required to make this division viable. The expected financing pattern shall be as follows:

Source	Mode	Amount (Rs. Crore)
Management	Equity shares of Rs.10 each	60.00
VenCap VC	Equity shares of Rs.10 each	22.50
	9% Debentures with attached warrant of Rs.100 each	22.50
	8% Loan	160.00
Total		265.00

The warrants can be exercised any time after 4 years from now for 10 equity shares @ Rs. 120 per share. The loan is repayable in one go at the end of 8th year. The debentures are repayable in equal annual installment consisting of both principal and interest amount over a period of 6 years. Mr. Smith is of view that the

proposed dividend shall not be kept more than 12.5% of distributable profit for the first 4 years. The forecasted EBIT after the proposed buyout is as follows:

Year	2013-14	2014-15	2015-16	2016-17
EBIT (Rs. Crore)	48	57	68	82

Applicable tax rate is 35% and it is expected that it shall remain unchanged at least for 5-6 years. In order to attract VenCap, Mr. Smith stated that book value of equity shall increase by 20% during above 4 years. Although, VenCap has shown their interest in investment but are doubtful about the projections of growth in the value as per projections of Mr. Smith. Further VenCap also demanded that warrants should be convertible in 18 shares instead of 10 as proposed by Mr. Smith.

You are required to determine whether or not the book value of equity is expected to grow by 20% per year. Further if you have been appointed by Mr. Smith as advisor then whether you would suggest to accept the demand of VenCap of 18 shares instead of 10 or not

Answer:

WN 1: Loan amortization table for 9% Debentures:

$$\text{Annual Instalment} = \frac{\text{Loan Amount}}{\text{PVA}(9\%, 6)} = \frac{22.50 \text{ crores}}{4.486} = 5.0156 \text{ Crores}$$

Year	Opening Balance	Interest	Instalment	Principal Repayment	Closing Balance
1	22.5000	2.025	5.0156	2.9906	19.5094
2	19.5094	1.756	5.0156	3.2596	16.2498
3	16.2498	1.462	5.0156	3.5536	12.6962
4	12.6962	1.143	5.0156	3.8726	8.8236

WN 2: Income statement and valuation of equity:

(in crores)

Particulars	2013-14	2014-15	2015-16	2016-17
EBIT	48.0000	57.0000	68.0000	82.0000
Less: Interest on 9% Debentures	2.0250	1.7560	1.4620	1.1430
Less: Interest on 8% Loan	12.8000	12.8000	12.8000	12.8000
Earnings before tax	33.1750	42.4440	53.7380	68.0570
Tax @ 35%	(11.6110)	(14.8550)	(18.8080)	(23.8200)
Earnings after tax	21.5640	27.5890	34.9300	44.2370
Dividend @ 12.5% of EAT	(2.6595)	(3.4490)	(4.3660)	(5.5300)
Retained earnings	18.8685	24.1400	30.5640	38.7070
Opening equity	82.5000	101.3685	125.5085	156.0725
Closing equity	101.3685	125.5085	156.0725	194.7795

- ❖ The company had opening equity of Rs.82.50 Crores in 2013-14. It has to grow at 20% for four years.
- ❖ Target closing balance of equity after four years = $82.50 \times 1.20^4 = \text{Rs.}171.072 \text{ crores}$
- ❖ The actual equity balance is more than Rs.171.072 crores and hence the company has met the target growth of 20 percent

WN 3: Decision on acceptance of demand of Vencap for 18 shares:

Particulars	Calculation	Amount
No of shares held by management		6.00 crores
No of shares held by Vencap at starting stage		2.25 Crores
Shares issued at rate of 18 shares per warrant	18×0.225	4.05 crores
Total holding by Vencap		6.30 Crores

Thus, it is likely that Mr. Smith may not accept this condition of VenCap as this may result in losing their majority ownership and control to VenCap. Mr. Smith may accept their condition if management has further opportunity to increase their ownership through other forms

54. Restructuring of company [May 2019 MTP]

The Nishan Limited has 35,000 shares of equity stock outstanding with a book value of Rs.20 per share. It owes debt Rs.15,00,000 at an interest rate of 12%. Selected financial results are as follows:

Income and Cash flow		Capital	
EBIT	80,000	Debt	15,00,000
Interest	(1,80,000)	Equity	7,00,000

EBT	(1,00,000)	Total	22,00,000
Tax	0		
EAT	(1,00,000)		
Depreciation	50,000		
Principal repayment	(75,000)		
Cash flow	(1,25,000)		

Restructure the financial items shown assuming a composition in which creditors agree to convert two thirds of their debt into equity at book value. Assume Nishan will pay tax at a rate of 15% on income after the restructuring, and that principal repayments are reduced proportionately with debt. Who will control the company and by how big a margin after the restructuring?

Answer:

- ❖ Creditors would convert Rs.10,00,000 in debt to equity and this would lead to allotment of 50,000 shares
- ❖ Shares held by original equity shareholders = 35,000
- ❖ Shares held by creditors = 50,000
- ❖ Percentage shareholding by creditors = 59% (50,000/85,000)
- ❖ Hence the creditors will control the company by a substantial majority

55. Venture capital financing [Nov 2007]

XY Ltd. which is specialized in manufacturing garments is planning for expansion to handle a new contract which it expects to obtain. An investment bank have approached the company and asked whether the Co. had considered venture Capital financing. In 2001, the company borrowed Rs.100 lacs on which interest is paid at 10% p.a. The Company shares are unquoted and it has decided to take your advice in regard to the calculation of value of the Company that could be used in negotiations using the following available information and forecast. Company's forecast turnover for the year to 31st March, 2005 is Rs.2,000 lacs which is mainly dependent on the ability of the Company to obtain the new contract, the chance for which is 60%, turnover for the following year is dependent to some extent on the outcome of the year to 31st March, 2005. Following are the estimated turnovers and probabilities:

	Year 2005		Year 2006
Turnover (in lacs)	Probability	Turnover (in lacs)	Probability
2,000	0.60	2,500	0.70
		3,000	0.30
1,500	0.30	2,000	0.50
		1,800	0.50
1,200	0.10	1,500	0.60
		1,200	0.40

Operating costs inclusive of depreciation are expected to be 40% and 35% of turnover respectively for the years 31st March, 2005 and 2006. Tax is to be paid at 30%. It is assumed that profits after interest and taxes are free cash flows. Growth in earnings is expected to be 40% for the years 2007, 2008 and 2009 which will fall to 10% each year after that. Industry average cost of equity (net of tax) is 15%

Answer:**WN 1: Computation of expected turnover:**

Particulars	Calculation	Amount
Year 2005	$(2,000 \times 0.60) + (1,500 \times 0.30) + (1,200 \times 0.10)$	1,770
Year 2006	$(2,500 \times 0.42) + (3,000 \times 0.18) + (2,000 \times 0.15) + (1,800 \times 0.15) + (1,500 \times 0.06) + (1,200 \times 0.04)$	2,298

Note: Concept of joint probability has been used for year 2006. Joint probability is equal to probability of year 1 $\times$ probability of year 2.

WN 2: Computation of free cash flows for 2005 and 2006:**(in lacs)**

Particulars	2005	2006
Turnover	1,770	2,298
Less: Operating costs @ 40% and 35%	(708)	(804)
Less: Interest (100 $\times$ 10%)	(10)	(10)
Profit before tax	1,052	1,484
Less: Tax @ 30%	(316)	(445)

Earnings/Cash flows	736	1,039

WN 3: Computation of free cash flows for 2007, 2008 and 2009:

Particulars	Amount
2007 cash flow (1,039 + 40%)	1,455
2008 cash flow (1,455 + 40%)	2,037
2009 cash flow (2,037 + 40%)	2,852

WN 4: Valuation of perpetuity:

$$\text{Value of perpetuity} = \frac{2,852 \times 1.10}{15\% - 10\%} = 62,744 \text{ lacs}$$

WN 5: Valuation of company:

Year	Cash flow	PVF @ 15%	DCF
2005	736	0.870	640
2006	1039	0.756	785
2007	1455	0.658	957
2008	2037	0.572	1,165
2009	2852	0.497	1,417
2009	62,744	0.497	31,184
Value of Firm			36,148

56. Computation of merger NPV:

The summarized balance sheet of R Co Limited as on 31st March 2006 is given below:

Liabilities	Amount	Assets	Amount
Equity share capital (2,00,000 @ Rs.10 each)	20,00,000	Fixed assets	19,00,000
13% Preference share capital	1,00,000	Investments	1,00,000
Retained earnings	4,00,000	Inventories	5,00,000
12% debentures	3,00,000	Debtors	4,00,000
Current liabilities	2,00,000	Bank	1,00,000
Total	30,00,000	Total	30,00,000

Negotiations for takeover of R Ltd. result in its acquisition by A Ltd.

The purchase consideration consists of :

- Rs.3,30,000 13% debentures of A Ltd., for redeeming the 12% debentures of R Ltd;
- Rs.1,00,000 12% convertible preference shares in A Ltd. for the payment of the preference share capital of R Ltd.;
- 1,50,000 equity shares of A Ltd. to be issued at its current market price of Rs.15; and
- A Ltd. would meet dissolution expenses of Rs.30,000. The breakup figures of eventual disposition by A Ltd., of unrequired assets and liabilities of R Ltd. are: investments- Rs.1,25,000; debtors- Rs.3,50,000; inventories- Rs.4,25,000; and payment of current liabilities – Rs.1,90,000.

The project is expected to generate yearly operating CFAT of Rs.7,00,000 for 6 years. It is estimated that fixed assets of R Ltd. would fetch Rs.3,00,000 at the end of 6th year. The firm's cost of capital is 15%. As a Financial Consultant, comment on the financial prudence of merger decision of A Ltd.

Answer:**WN 1: Computation of initial outflow (cost of acquisition):**

Particulars	Amount
13% Debentures	3,30,000
12% convertible preference shares	1,00,000
Equity share capital (1,50,000 x 15)	22,50,000
Dissolution expenses of R Limited	30,000
Payment of current liabilities	1,90,000
Total outflows	29,00,000
Less: Realized proceeds from sale of assets	
Investments	1,25,000
Debtors	3,50,000
Inventories	4,25,000

Bank balance	1,00,000
Net consideration paid	19,00,000

WN 2: Computation of NPV:

Year	Cash flow	PVF @ 15%	DCF
0	(19,00,000)	1	(19,00,000)
1 to 6	7,00,000	3.784	26,48,800
6	3,00,000	0.432	1,29,600
NPV of acquisition			8,78,400

Comment: NPV is positive by Rs.8,78,400 and hence the merger is beneficial to A Ltd.

57. Relative valuation:

A Limited made a gross profit of Rs.10,00,000 and incurred indirect expenses of Rs.4,00,000. The number of issued equity shares is 1,00,000. The company has a debt of Rs.3,00,000 and Reserves to the tune of Rs.5,00,000. The market related details are as follows:

- Risk-free rate of return = 4.50%
- Market rate of return = 12.00%
- Beta of company = 0.90 Times

Determine:

- Per share earning value of company
- Equity value of the company if applicable EBITDA multiple is 5

Answer:

WN 1: Computation of earning value per share:**Note 1: Computation of discount rate:**

- Capitalization rate = $R_f + \text{Beta} \times (R_m - R_f)$
- Capitalization rate = $4.50 + 0.90 \times (12.00 - 4.50) = 11.25\%$

Note 2: Computation of earning value per share:

Particulars	Amount
Gross profit	10,00,000
Less: Indirect expenses	-4,00,000
EBITDA	6,00,000
Earning value of company (6,00,000/11.25%)	53,33,333
Number of shares	1,00,000
Earning value per share	53.33

WN 2: Equity value of company if EBITDA multiple is 5 times:

Particulars	Amount
EBITDA	6,00,000
Enterprise valuation (6,00,000 × 5)	30,00,000
Less: Debt	(3,00,000)
Add: Surplus funds (Reserves)	5,00,000
Equity value of company	32,00,000

58. Valuation of units [Nov 2021]

Strong Ltd., (SL), an all equity financed, conglomerate is in need to borrow Rs. 2,000 crore to finance expansion of its crore current operations. However, SL is susceptible to raise the amount from the market. The CFO has suggested for divesting one of the two nonprime units to reduce the overall borrowings from the market. The following data, after internal due diligence, has been placed for consideration of the Board:

(in crores)

Particulars	Unit 1	Unit 2
Reported Profit after tax	147	140
Extra ordinary gains	16	8
Extra ordinary losses	20	12
Expected profit from the launch of new product	56	12

Price earnings ratio	10	12.50
Tax rate	30	30

You are required to advise the Borad on the following:

- The price at which the units can be divested,
- The unit which can be divested so as to minimise the borrowings from the market and
- The amount of borrowing.

Answer:

WN 1: Valuation of business:

Particulars	Unit 1	Unit 2
Existing PAT	147.00	140.00
Existing PBT [PAT/70%]	210.00	200.00
Less: Extraordinary income	-16.00	-8.00
Add: Extraordinary loss	20.00	12.00
Profit from new product	56.00	12.00
Future maintainable PBT	270.00	216.00
Less: Tax @ 30%	-81.00	-64.80
Future maintainable PAT	189.00	151.20
Price-earnings ratio	10.00	12.50
Value of units [PAT x PE Multiple]	1890.00	1890.00

- Both units can be divested at Rs.1,890 Crores

Part (ii):

- The unit I can be divested as it has lower PE Ratio

Part (iii):

- Amount of borrowing = Rs.2,000 Crores – Rs.1,890 Crores = Rs.110 Crores

59. Valuation [Nov 2020 Exam]

ICL is proposing to take over SVL with an objective to diversify. ICL's profit after tax (PAT) has grown @ 18 per cent per annum and SVL's PAT is grown @ 15 per cent per annum. Both the companies pay dividend regularly. The summarised Profit & Loss Account of both the companies are as follows:

(in Crores)

Particulars	ICL	SVL
Net Sales	4,545	1,500
PBIT	2,980	720
Interest	750	25
Provision for Tax	1,440	445
PAT	790	250
Dividends	235	125

Particulars	ICL		SVL	
Fixed Assets				
Land and building (Net)	720		190	
Plant and Machinery (Net)	900		350	
Furniture and fittings (Net)	30	1,650	10	550
Current assets		775		580
Less: Current Liabilities				
Creditors	230		130	
Overdrafts	35		10	
Provision for tax	145		50	
Provision for dividends	60	470	50	240
Net Assets		1,955		890
Paid-up share capital (Rs.10 per share)	250		125	
Reserves and surplus	1,050	1,300	660	785
Borrowing		655		105
Capital employed		1,955		890

Market price per share		52		75

ICL's Land & Buildings are stated at current prices. SVL's Land & Buildings are revalued three years ago. There has been an increase of 30 per cent per year in the value of Land & Buildings. SVL is expected to grow @ 18 per cent each year, after merger. ICL's Management wants to determine the premium on the shares over the current market price which can be paid on the acquisition of SVL. You are required to determine the premium using:

- Net Worth adjusted for the current value of Land & Buildings plus the estimated average profit after tax (PAT) for the next five years.
- The dividend growth formula.
- ICL will push forward which method during the course of negotiations?

Answer:

WN 1: Valuation of shares of SVL as per Method 1:

Particulars	Amount (in crores)
Networth as per balance sheet	785.00
Adjustment for Land and building (Note 1)	227.43
Adjusted Networth	1,012.43
Add: Estimated profit for 5 years (Note 2)	387.69
Total valuation of SVL Limited	1,400.12
No of shares [125/10]	12.50
Fair value per share [2,805.51/12.50]	112.01
Current market price	75.00
Premium per share	37.01
Premium percentage [37.01/75] x 100	49.35%

Note 1:

- Current value of Land and Building after growing at 30% for 3 years = $190 \times 1.30 \times 1.30 \times 1.30 = \text{Rs.}417.43$ Crores
- Amount of adjustment = $417.43 \text{ crores} - 190 \text{ crores} = \text{Rs.}227.43$ Crores

Note 2:

- SVL has been growing at the rate of 15 percent in the past and hence future five-year profits can be computed based on growth rate of 15 percent.
- Alternate view is that it will grow in future at the rate of 18 percent after merger and hence we can compute future profits at growth rate of 18 percent
- In practical world the final rate will depend on negotiation of two parties and the same would be accordingly finalized. We have taken growth rate of 15 percent for analysis purpose

Year	PAT
1	287.50
2	330.63
3	380.22
4	437.25
5	502.84
Total	1,938.43
Average Profit	387.69

WN 2: Valuation of shares as per method 2:

Basic data:

Particulars	Amount
Dividend per share [125/12.50] [assumed to be D1]	10.00
Earnings per share [250/12.50]	20.00
Growth rate (assumed to be post-merger rate)	18.00%
Cost of equity (Note 1)	28.33%

Note 1:

$$K_e = \frac{D_1}{P_0} + \text{Growth rate} = \frac{10}{75} + 15\% = 28.33\%$$

- Cost of equity has been computed based on current growth rate of 15%

Valuation of share:

Market Price	$\frac{D_1}{(K_e - G)}$	$\frac{10.00}{(28.33\% - 18\%)} = \frac{10.00}{10.33\%}$	Rs.96.81

Computation of premium %:

Particulars	Amount
Fair value per share	96.81
Current market price	75.00
Premium per share	21.81
Premium percentage $[21.81/75] \times 100$	29.08%

Method to be selected:

- ICL will push forward the negotiation in terms of dividend growth formula. This is because it would involve lower premium payout as compared to current market price

60. Funding of growth [Jan 2021]

The Balance Sheet of M/s. Sundry Ltd. as on 31-03-2020 is follows:

Liabilities	Amount (in lacs)	Assets	Amount (in lacs)
Share capital	300	Fixed assets	600
Reserves	200	Inventory	500
Long term loan	400	Receivables	240
Short term loan	300	Cash	60
Payables and provisions	200		
Total	1,400	Total	1,400

Sales for the year was Rs. 600 lakhs. The sales are expected to grow by 20% during the year. The profit margin and dividend pay-out ratio are expected to be 4% and 50% respectively. The company further desires that during the current year Sales to Short Term Loan and Payables and Provision should be in the ratio of 4:3. Ratio of fixed assets to Long Term Loans should be 1.5. Debt Equity Ratio should not exceed 1.5.

You are required to determine:

- The amount of External Fund Requirement (EFR)
- The amount to be raised from Short Term, Long Term and Equity funds.

Answer:**WN 1: Computation of external fund requirement:**

Particulars	Calculation	Amount (in lacs)
Sales of next year	$600 + 20\%$	720.00
Profit	$720 \times 4\%$	28.80
Less: Dividend	$28.80 \times 50\%$	-14.40
Retained earnings		14.40
Fund required for growth of 20%	$[1,400 - 200] \times 20\%$	240.00
Balance funds to be met from external sources	240.00 - 14.40	225.60

Note:

- The company plans to grow 20 percent in current year. In order to support growth, working capital will grow by 20% and fixed assets will also increase by 20%
- Fixed assets + Working capital = 1,400 lacs - 200 lacs = 1,200 lacs

WN 2: Amount to be raised from short-term, long-term and equity funds:**Amount raised as short-term loan:**

Particulars	Calculation	Amount (in lacs)

Sales of next year		720.00
Target short-term loans and payables	$720 \times \frac{3}{4}$	540.00
Less: Payables	$200 + 20\%$	-240.00
Target short-term loan		300.00
Existing short-term loan		300.00
New short-term loan raised		0.00

Amount raised as long-term loan:

Particulars	Calculation	Amount (in lacs)
Fixed assets of next year	$600 + 20\%$	720.00
Target long-term loan	$\frac{720}{1.50}$	480.00
Less: Existing long-term loan		400.00
New long-term loan to be raised		80.00

Amount raised as external equity:

Particulars	Calculation	Amount (in lacs)
Total external funds required	WN 1	225.60
Less: New short-term loan		0.00
Less: New long-term loan		80.00
Fresh issue of equity shares		145.60

Check on debt-equity ratio:

Particulars	Calculation	Amount (in lacs)
Closing equity	$300 + 200 + 145.60 + 14.40$	660.00
Closing debt	$480 + 300$	780.00
Debt-equity ratio	$780/660$	1.18

Conclusion:

- Debt-equity ratio does not exceed 1.50 times and hence the funds will be raised as:
 - External equity = 145.60
 - Retained earnings = 14.40
 - Long-term loan = 80.00
 - Short-term loan = 0.00

Part III - Market Value Added and Shareholder Value Added**61. Computation of market value added:**

The capital structure of ABC Limited is as under:

Particulars	Amount
Equity shares of Rs.100 each fully paid up	Rs.505 lacs
9% convertible preference shares of Rs.10 each	Rs.150 lacs
12% secured debentures of Rs.10 each	Rs.50 lacs
Reserves	Rs.101 lacs
Statutory fund	Rs.50.50 lacs

The statutory fund is required to be invested in Government securities. The ordinary shares are quoted at a premium of 500%. Preference shares are at Rs.30 per share and debentures are at par. You are required to compute the market value added

Answer:

- Market value added = Market value of firm – Book value of firm
- Market value of firm = Equity + Debt + Preference = $(505/100 \times 600) + (150/10 \times 30) + 50 = 3,030 + 450 + 50 = \text{Rs.}3,530$ lacs
- Book value of Firm = 505 lacs + 150 lacs + 50 lacs + 101 lacs + 50.50 lacs = Rs.856.50 lacs

- Market value added = 3,530 lacs – 856.50 lacs = Rs.2,673.50 lacs

62. Computation of Shareholder Value Added:

Compute the intrinsic value of equity using SVA approach from the following information:

- ❖ The company will earn EBIT of Rs.100 in year 1 and the same will grow at the rate of 5 percent per annum for a period of 4 years. The free cash flow of year 4 will continue to be earned perpetually
- ❖ Interest cost is expected to be 5 lacs, 6 lacs, 7 lacs and 8 lacs for the four years
- ❖ Tax rates of the company is 33 percent
- ❖ Depreciation will be 5 lacs, 5 lacs, 6 lacs and 7 lacs for the four year
- ❖ Capital investment will be 0 lacs, 12 lacs, 6 lacs and 9 lacs for the four years
- ❖ Net working capital requirement will be 5 lacs, 5 lacs, 6 lacs and 7 lacs for the four years
- ❖ WACC of the company is 12 percent
- ❖ Value of non-core assets is 35 lacs and the book value of debt is 19 lacs

Answer:

WN 1: Computation of Free Cash flow to Firm:

(in lacs)

Particulars	Year 1	Year 2	Year 3	Year 4
EBIT	100.00	105.00	110.25	115.76
Less: Interest	0.00	0.00	0.00	0.00
EBT	100.00	105.00	110.25	115.76
Less: Tax @ 33%	-33.00	-34.65	-36.38	-38.20
EAT	67.00	70.35	73.87	77.56
Add: Depreciation	5.00	5.00	6.00	7.00
Less: Capex	0	-12.00	-6.00	-9.00
Less: Working capital	-5.00	-5.00	-6.00	-7.00
FCFF	67.00	58.35	67.87	68.56

$$\text{PV of perpetuity(Y4)} = \frac{\text{Year 5 cash flow}}{12\%} = \frac{68.56}{12\%} = 571.33$$

WN 2: Computation of value of Firm:

Year	Cash flow	PVF @ 12%	DCF
1	67.00	0.893	59.83
2	58.35	0.797	46.50
3	67.87	0.712	48.32
4	68.56	0.636	43.60
4	571.33	0.636	363.37
Value of Firm			561.62

- Intrinsic value of equity = Value of firm – Value of debt + Market value of non-core assets
- Intrinsic value of equity = 561.62 lacs – 19 lacs + 35 lacs = Rs.577.62 lacs

Part IV – Valuation of distressed companies

63. Modified Discounted Cash flow approach:

Bhushan Power and steels limited is going through financial difficulties and has estimated the following projections:

(in crores)

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5
Cash flow from operations	20.00	30.00	35.00	40.00	45.00
Capital expenditure	10.00	12.00	15.00	15.00	20.00

Additional information:

- There is a 20% probability of default in year 2
- There is a 40% probability of default in year 3
- Terminal growth rate (beyond year 5) is 3%
- The investor is looking at return of 20% to factor in high-risk of the company
- The company currently has debt of Rs.50 crores and has cash and cash equivalents of Rs.10 Crores

You are required to arrive at the equity valuation of Bhushan Power and Steels Limited.

Answer:**WN 1: Computation of adjusted cash flows:**

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5
Cash flow from operations	20.00	30.00	35.00	40.00	45.00
Less: Capital expenditure	-10.00	-12.00	-15.00	-15.00	-20.00
Free cash flows	10.00	18.00	20.00	25.00	25.00
Probability of default		20%	40%		
Expected cash flows [Free cash flows x (1 - POD)]	10.00	14.40	12.00	25.00	25.00

WN 2: Computation of terminal value:

$$\text{Terminal value} = \frac{CF_6}{K_o - G} = \frac{25 \times 1.03}{20\% - 3\%} = \frac{25.75}{17\%} = \text{Rs. 151.47 crores}$$

WN 3: Valuation of company using FCFF approach:

Year	Cash flow	PVF @ 20%	DCF
1	10.00	0.833	8.33
2	14.40	0.694	9.99
3	12.00	0.579	6.95
4	25.00	0.482	12.05
5	25.00	0.402	10.05
5	151.47	0.402	60.89
Value of company			108.26

- Equity value = Value of company + Cash - Value of debt
- Equity value = 108.26 + 10 - 50 = Rs.68.26 Crores

64. DCF valuation + Distress Value:

XYZ Limited is currently going through financial distress and there is a 40% probability of the company defaulting. The analyst's forecast of free cash flow assuming the company is a going concern is shown below:

Particulars	2013	2014	2015	2016	2017	2018	2019	2020
Free cash flow	13.75	6.27	7.37	7.66	6.04	5.69	6.35	7.05

The cost of capital of the company is 15 percent and value of debt is Rs.4.92 crores. The analyst expects the cash flows to grow at 10 percent forever after 2020. In case the company defaults, then distress value is expected to be 20% of the going concern value.

Compute the value of equity of XYZ Limited.

Answer:**WN 1: Computation of valuation of XYZ Limited as a going concern:**

Year	Cash flow	PVF @ 15%	DCF
1	13.75	0.87	11.96
2	6.27	0.756	4.74
3	7.37	0.658	4.85
4	7.66	0.572	4.38
5	6.04	0.497	3
6	5.69	0.432	2.46
7	6.35	0.376	2.39
8	7.05	0.327	2.31
8	155.1	0.327	50.72
Value of Firm			86.81

Note 1: Valuation of perpetuity cash flow

$$\text{Y8 perpetuity} = \frac{FCFF_9}{K_e - \text{Growth}} = \frac{7.05 \times 1.10}{15\% - 10\%} = \text{Rs. 155.10 Crores}$$

WN 2: Computation of financial distress company valuation:

- Financial distress company valuation = 20% of Going concern value

- Financial distress company valuation = $20\% \times 86.81 \text{ crores} = \text{Rs.}17.36 \text{ Crores}$

WN 3: Final Valuation of XYZ Limited:

Final valuation = [Going concern value x Probability of survival] + [Distress value x Probability of default]
Final valuation = $[86.81 \times 60\%] + [17.36 \times 40\%] = \text{Rs.} 59.03 \text{ Crores}$
Value of equity = $59.03 \text{ Crores} - 4.92 \text{ Crores} = \text{Rs.}54.11 \text{ Crores}$

65. APV Approach:

Yes Bank is currently into severe financial distress and you have been asked to arrive at fair value of equity shares. Following is the information about the Bank:

Amount of debt	Rs.80 crores
Unlevered cost of equity	15%
Tax Rate	30%
Probability of distress	20%
Distress sale value	Rs.40 crores
Free cash flow for next five years	Rs.15 Crores annually

Answer:**WN 1: Computation of unlevered firm value:**

Year	Cash flow	PVF @ 15%	DCF
1 to 5	15.00	3.352	50.28

WN 2: Tax benefits due to debt:

- Tax benefit = Amount of debt x Tax rate = $\text{Rs.}80 \text{ crores} \times 30\% = \text{Rs.}24 \text{ Crores}$

WN 3: Value of company using DCF valuation + Distress value approach:

Valuation = [Unlevered company value x Probability of survival] + [Distress value x Probability of default]
Valuation = $[50.28 \times 80\%] + [40.00 \times 20\%] = \text{Rs.} 48.22 \text{ Crores}$
Valuation using APV approach = $48.22 \text{ crores} + 24 \text{ crores} = \text{Rs.}72.22 \text{ Crores}$

Alternative answer:

- Expected bankruptcy cost = (Unlevered company value - Distress value) x POD
- Expected bankruptcy cost = $(50.28 - 40) \times 20\% = \text{Rs.}2.06 \text{ Crores}$
- Value of company = Value of unlevered company + Tax benefits - Expected bankruptcy cost
- Value of company = $50.28 + 24 - 2.06 = \text{Rs.}72.22 \text{ Crores}$

WN 4: Valuation of equity:

- Value of equity = Value of company - Value of debt
- Value of equity = $72.22 \text{ crores} - 80 \text{ Crores} = -7.78 \text{ crores}$
- The calculated equity value is negative, indicating that the company's equity has little to no value in the current distressed state and the company is facing significant financial difficulties.

66. Relative valuation:

BSNL Limited is in the telecom industry and is currently facing financial distress due to increased competition, declining revenues, and rising debt levels.

To value BSNL Limited, you have identified comparable companies in the Telecom industry. Let's consider three healthy companies: Company A, Company B, and Company C. These companies are similar in terms of their business model, market presence, and size.

Operating and Financial data:**(in Crores)**

Particulars	BSNL Limited	Company A	Company B	Company C
Market capitalization		1,00,000	2,00,000	2,50,000
No of shares	1,000	1,000	2,000	2,500
Revenues	10,000	20,000	25,000	62,500
PAT	-5,000	10,000	16,000	20,000
Book value per share	20	50	25	40

You have decided to apply the following ratios:

- Market to book value
- Market to Sales

It was decided to adjust market to book value and market to sales ratios by 40% and 50% to reflect the stress in the company.

Required:

Compute the fair value of BSNL Limited

Answer:

WN 1: Computation of average industry ratios:

Particulars	Company A	Company B	Company C	Industry
Market to Book value ratio:				
Market capitalization	1,00,000	2,00,000	2,50,000	
No of shares (A)	1,000	2,000	2,500	
Book value per share (B)	50	25	40	
Overall book value (A x B)	50,000	50,000	1,00,000	
Market to Book value ratio [Market cap/Book value]	2.00	4.00	2.50	2.8333
Market to Sales Ratio:				
Market capitalization	1,00,000	2,00,000	2,50,000	
Sales	20,000	25,000	62,500	
Market to sales ratio [Market cap/Sales]	5.00	8.00	4.00	5.6667

WN 2: Valuation of BSNL Limited:

Particulars	Calculation	Amount (in Cr)
Market to Book value ratio:		
Book value of BSNL Limited	20 x 1,000	20,000
Adjusted ratio of industry	2.8333 - 40%	1.70
Value of BSNL Limited	60,000 x 1.70	34,000
Market to Sales Ratio:		
Sales of BSNL Limited	Given	10,000
Adjusted ratio of industry	5.6667 - 50%	2.8333
Value of BSNL Limited	10,000 x 2.8333	28,333
Final fair value of BSNL Limited	34,000 + 28,333 2	31,166.50

67. Valuation of distressed companies:

XYZ Ltd. is a distressed company operating in the manufacturing sector. The company has been experiencing financial difficulties and is on the verge of bankruptcy. You have been appointed as a consultant to assess the fair value of the distressed company. After conducting a thorough analysis, you have gathered the following information:

- The market capitalization of XYZ Ltd. is currently Rs.50 Crores.
- The company has a total debt of Rs.50 Crores. Debt is required to be repaid equally over next 5 years. Interest rate and tax rate is 10% and 30% respectively.
- The expected recovery rate for the distressed company's assets is 40% of their book value. Book value of the firm is Rs.100 Crores.
- The company's estimated liquidation expenses are Rs.10 Crores.
- The risk-free rate of return is 8%, and the distressed company's cost of equity is estimated to be 18%.
- The distressed company is expected to generate a free cash flow to the firm (FCFF) of Rs.15 Crores annually for the next five years, with no growth rate expected thereafter.
- Probability of default is 40% over the medium term.

Calculate the fair value of the distressed company using the Adjusted Present Value (APV) approach.

Answer:

WN 1: Valuation of un-levered firm:

Valuation of un-levered firm would be done by discounting the cash flows at cost of equity. The firm is likely to generate Rs.15 crores over the next five years and the same amount would continue even in future. Hence this is a case of perpetuity from day 1.

$$\text{Value of unlevered firm} = \frac{15}{18\% - 0} = \text{Rs. 83.33 crores}$$

WN 2: Computation of tax benefits of debt:

Year	Opening Debt	Interest 10%	Tax benefit 30%	PVF @ 10%	DCF
1	50.00	5.00	1.50	0.909	1.3635
2	40.00	4.00	1.20	0.826	0.9912
3	30.00	3.00	0.90	0.751	0.6759
4	20.00	2.00	0.60	0.683	0.4098
5	10.00	1.00	0.30	0.621	0.1863
Present value of tax saving					3.6267

WN 3: Computation of distress sale value:

- Gross distress sales value = 100 crores x 40% = Rs.40 crores
- Net distress sales value post liquidation expenses = 40 crores – 10 crores = Rs.30 crores

WN 4: Valuation of company:

- Expected bankruptcy cost = (Unlevered company value – Distress value) x POD
- Expected bankruptcy cost = (83.33 – 30) x 40% = Rs.21.33 crores
- Value of company = Value of unlevered company + Tax benefits – Expected bankruptcy cost
- Value of company = 83.33 + 3.62 – 21.33 = Rs.65.62 crores**

WN 5: Valuation of equity:

- Value of equity = Value of company – Value of debt
- Value of equity = 65.62 crores – 50 crores = Rs.15.62 crores**

Part V – Valuation of Start-ups

68. Berkus Approach:

An investor is planning an investment in ABC Tech Limited which has provided the following information:

- Basic value:** ABC Tech has a unique and innovative business idea that addresses a significant problem in the market
- Technology:** ABC Tech has developed a working prototype of its software solution, showcasing its functionality and capabilities.
- Execution:** The start-up has a highly skilled and experienced management team with a successful track record in the software industry.
- Strategic relationships:** ABC Tech has formed partnerships with key industry players, providing access to a broader customer base and resources.
- Production and consequent sales:** Although the start-up is still in the early stages, it has secured its first few clients and generated initial revenue

Methodology of valuation adopted by the investor:

Parameter	Range of Valuation	Score on a scale of 0 to 10
Basic value	0 to 20,00,000	8
Technology	0 to 10,00,000	6
Execution	0 to 15,00,000	8
Strategic relationships	0 to 40,00,000	9
Production and consequent sales	0 to 50,00,000	4

Arrive at fair value of ABC Tech Limited by following the above methodology of valuation.

Answer:

Parameter	Calculation	Amount
Basic value	$20,00,000 \times \frac{8}{10}$	16,00,000

Technology	$10,00,000 \times \frac{6}{10}$	6,00,000
Execution	$15,00,000 \times \frac{8}{10}$	12,00,000
Strategic relationships	$40,00,000 \times \frac{9}{10}$	36,00,000
Production and consequent sales	$50,00,000 \times \frac{4}{10}$	20,00,000
Overall value of ABC Tech		90,00,000

69. Cost-to-duplicate approach:

XYZ Tech is in the software development industry. The company has incurred the following expenses in building its business:

Particulars	Amount
Research and Development Cost	5,00,000
Cost of Physical Assets (Computers, Office equipment)	2,00,000
Intellectual Property costs (patent filings and copyrights)	1,00,000
Employee salaries and wages for the development team	3,00,000
Marketing and advertising expenses	1,50,000
Legal and administrative costs	50,000

Compute the value of XYZ Tech using the cost-to-duplicate approach

Answer:

Particulars	Amount
Research and Development Cost	5,00,000
Cost of Physical Assets (Computers, Office equipment)	2,00,000
Intellectual Property costs (patent filings and copyrights)	1,00,000
Employee salaries and wages for the development team	3,00,000
Marketing and advertising expenses	1,50,000
Legal and administrative costs	50,000
Total Value of XYZ Tech as per cost-to-duplicate approach	13,00,000

70. Comparable Transactions Method:

PharmaCo is a start-up operating in the pharmaceutical industry. There have been three recent comparable transactions in the pharma industry involving similar start-ups. The financial data and valuation multiples for these transactions are as follows:

(Amount in crores)

Particulars	Transaction 1	Transaction 2	Transaction 3
Transaction price	50.00	70.00	60.00
Revenues	10.00	15.00	12.00
EBITDA	4.00	6.00	5.00

PharmaCo has reported revenues and EBITDA of Rs.8 crores and Rs.3 crores in the recent year. Compute the value of PharmaCo

Answer:**WN 1: Computation of average ratios of past transactions:**

Particulars	Transaction 1	Transaction 2	Transaction 3	Average
Price to sales ratio				
Transaction price	50.00	70.00	60.00	
Sales	10.00	15.00	12.00	
Price to sales ratio	5.00	4.67	5.00	4.89
Price to EBITDA Ratio:				
Transaction price	50.00	70.00	60.00	
EBITDA	4.00	6.00	5.00	
Price to EBITDA ratio	12.50	11.67	12.00	12.06

WN 2: Valuation of PharmCo:

Particulars	Calculation	Amount (in Cr)

Price to Sales Ratio		
Sales of PharmaCo		8.00
Average ratio of industry		4.89
Value of PharmaCo	8.00 x 4.89	39.12
Price to EBITDA Ratio:		
EBITDA of PharmaCo		3.00
Average ratio of industry		12.06
Value of PharmaCo	3.00 x 12.06	36.18
Final fair value of Pharmaco	$\frac{39.12 + 36.18}{2}$	37.65

71. Comparable Transactions Method:

XYZ Ltd., a logistics startup, was acquired for Rs 560 crores. It had 28 crore, active users. Suppose you are valuing ABC Ltd, another logistics startup with 1.75 crore users. Arrive at fair value of ABC Limited.

Answer:

Value per user of XYZ Limited = $\frac{560}{28} = \text{Rs. 20 per user}$
Value of ABC Limited = Rs.20 per user x 1.75 Crore users = Rs.35.00 Crores

72. Scorecard Valuation Method:

EduTech is operating in the education industry. The start-up is looking at fund raising and hence has approached you for arriving at valuation of the entity. You have compared Edu-tech with another start-up in the education sector whose valuation is Rs.200 Crores. The summary of your comparison is as under:

- **Management Team Experience (Weight: 30%):** The experience and expertise of the management team are crucial for the success of the start-up. EduTech's management team has extensive experience in the education and technology sectors, and it receives a score of 120% (Above-average)
- **Market Opportunity (Weight: 25%):** The size of the addressable market is an essential factor in determining the potential growth of the start-up. EduTech operates in a large and growing education market, and it receives a score of 100% (par)
- **Stage of Development (Weight: 20%):** The stage of development indicates the progress of the start-up towards commercialization. EduTech is in the early revenue-generating stage, and it receives a score of 80% (below-average)
- **Competitive Landscape (Weight: 15%):** The level of competition in the market can impact the start-up's ability to capture market share. EduTech faces moderate competition, and it receives a score of 60% (below-average)
- **Funding Secured (Weight: 10%):** The amount of funding raised by the start-up can influence its ability to execute its business plan. EduTech has not received funding till date, and it receives a score of 50% (below-average)

Answer:

WN 1: Computation of average score of Edu-tech as compared to the other start-up:

Parameter	Calculation	Amount
Management team experience	30% x 120%	0.36
Market opportunity	25% x 100%	0.25
Stage of development	20% x 80%	0.16
Competitive landscape	15% x 60%	0.09
Funding Secured	10% x 50%	0.05
Overall Score		0.91
Valuation of Edutech (in crores)	0.91 x 200	182.00

73. Valuation of Start-up – First Chicago Method

XYZ Tech is operating in the software industry. Following is the information about expected performance of the company:

Particulars	Worst-case	Normal-case	Best-case
Cash flow of year 1 (in crores)	5.00	7.50	10.00
Cash flow growth	400%	6.00%	8.00%
Cost of equity	12.00%	12.00%	12.00%
Probability	0.30	0.50	0.20

Compute the fair value of XYZ Tech using First Chicago Method?

Answer:

Valuation of XYZ Tech for different scenarios:

Particulars	Worst-case	Normal-case	Best-case
Cash flow of year 1 (in crores)	5.00	7.50	10.00
Cash flow growth	4.00%	6.00%	8.00%
Cost of equity	12.00%	12.00%	12.00%
Value $\left(\frac{CF_1}{K_e - G} \right)$	$\frac{62.50}{5.00}$ $\left(\frac{12.00\% - 4.00\%}{12.00\% - 4.00\%} \right)$	$\frac{125.00}{7.50}$ $\left(\frac{12.00\% - 6.00\%}{12.00\% - 6.00\%} \right)$	$\frac{500.00}{10.00}$ $\left(\frac{12.00\% - 8.00\%}{12.00\% - 8.00\%} \right)$

- Value of XYZ Tech = [62.50 Crores x 0.30] + [125 crores x 0.50] + [500 crores x 0.20]
- Value of XYZ Tech = Rs.181.25 Crores

74. Venture Capital Method:

TMC is a venture capital financier. It received a proposal for financing requiring an investment of Rs.45 crore in ABC Limited. ABC Limited can earn Rs.600 crore after 6 years if succeeds. However, it may be possible that the company may fail at any time during the six years. The following table provide the estimates of probabilities of the failure of the projects.

Year	1	2	3	4	5	6
Probability of failure	0.28	0.25	0.22	0.18	0.18	0.10

In the above table the probability that the project fails in the second year is given that it has survived throughout year 1. Similarly for year 2 and so forth. TMC is considering an equity investment in the project. The beta of this type of project is 7. The market return and risk free rate of return are 8% and 6% respectively. You are required to compute the fair value of ABC Limited and compute the percentage stake which would be offered by ABC Limited to TMC for an investment of Rs.45 Crores.

Answer:

WN 1: Computation of probability of success of project:

- Probability of success till 6th year = (Probability of success in year 1 x Probability of success in year 2 x Probability of success in year 3 x Probability of success in year 4 x Probability of success in year 5 x Probability of success in year 6)
- Probability of success till 6th year = (72% x 75% x 78% x 82% x 82% x 90%) = 25.4893%

Note: Project will be successful only if it is able to succeed for all six years and hence we have to compute the joint probability of success till year 6.

WN 2: Valuation of ABC Limited:

- Value of ABC Limited in year 6 = Rs.600 crores x 25.4893% = Rs.152.9358 Crores
- Discount rate = 6% + 7 x (8% - 6%) = 20.00%

Fair post money valuation of ABC Limited today = $\frac{152.9358}{1.20^6}$ = Rs. 51.2335 Crores

Particulars	Amount	Percentage Stake
Post-money valuation	51.2335	100.00%
Less: Amount contributed by TMC	-45.000	87.83%
Pre-money valuation	6.2335	12.17%

- TMC limited would be offered a stake of 87.83% for the investment of Rs.45 Crores in ABC Limited.

75. Venture Capital Method:

A venture capitalist is considering an investment in TechCo. The venture capitalist has a desired rate of return of 20x on their investment. The estimated exit value of TechCo at the time of exit (through an acquisition) is Rs.200 Crores. The venture capitalist plans to invest Rs.5 Crores in TechCo. Using the Venture Capital Method, we can calculate the post-money valuation and pre-money valuation of TechCo.

Answer:

Particulars	Calculation	Amount (Crores)
Post-money valuation	$\frac{200}{20}$	10.00
Less: Amount contributed by Venture capitalist		-5.00
Pre-money valuation		5.00

Part VI - Valuation of Digital Platforms

76. Income Approach:

You are required to do a valuation of a digital platform "ShopHub" which connects buyers and sellers. Following is the information about the company's expected performance:

Particulars	Amount
Number of sellers in year 1	1,000
Average transactions per seller	300
Average transaction value per seller	1,000
Average transaction fees charged by ShopHub	5%
Operating expenses as % of revenues	80%
Tax rate	40%

Additional information:

- Number of sellers are expected to grow by 200 every year till year 5
- Average transaction per seller and transaction value per seller both will see an increase of 5% till year 5
- Transaction fees charged by ShopHub will increase by 0.5% for year 2 to year 5 and stabilize at 7%
- Cash flows from year 6 onwards will show a constant growth of 5%
- The return expected from investment in ShopHub is 20%

Compute fair value of ShopHub?

Answer:**WN 1: Computation of cash flows till year 5:**

(in lacs)

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5
Number of sellers (A)	1,000.00	1,200.00	1,400.00	1,600.00	1,800.00
Number of transactions (B)	300.00	330.00	363.00	399.30	439.23
Average transaction value (C)	1,000.00	1,100.00	1,210.00	1,331.00	1,464.10
Transaction value per seller (D = B X C)	3,00,000.00	3,63,000.00	4,39,230.00	5,31,468.30	6,43,076.64
Total transaction value (E = A x D)	3,000.00	4,356.00	6,149.22	8,503.49	11,575.38
Commission % (F)	5.00	5.50	6.00	6.50	7.00
Revenues of ShopHub (E x F)	150.00	239.58	368.95	552.73	810.28
Less: Operating expenses @ 80%	-120.00	-191.66	-295.16	-442.18	-648.22
Profit before tax	30.00	47.92	73.79	110.55	162.06
Less: Tax @ 40%	-12.00	-19.17	-29.52	-44.22	-64.82
Profit after tax/CFAT	18.00	28.75	44.27	66.33	97.24

WN 2: Computation of terminal value:

$$\text{Value}_5 = \frac{\text{Cash flow}_6}{K_0 - G} = \frac{97.24 \times 1.05}{20\% - 5\%} = \text{Rs. 680.68 lacs}$$

WN 3: Valuation of firm:

Year	Cash flow	PVF @ 20%	DCF
1	18.00	0.833	14.99
2	28.75	0.694	19.95
3	44.27	0.579	25.63
4	66.33	0.482	31.97
5	97.24	0.402	39.09
5	680.68	0.402	273.63
Value of ShopHub			405.26

77. Market Approach:

You are an investment analyst and have been asked to arrive at fair value of Google Inc with the following information:

Particulars	Google	Competitor
Number of users	10 Crores	5 Crores
Relevant search results (out of 10)	9	8
Time taken per search (in seconds)	0.1	0.2
Valuation	?	1,000 Crores

Additional information:

- Capitalization per User should be adjusted by 20% each for relevant search results and time taken per search

Answer:

Particulars	Calculation	Amount
Capitalization of competitor		1,000.00
Number of users		5.00
Capitalization per user	1,000/5.00	200
Add: Extra 20% for Google's favorable search results	200 x 20%	40
Add: Extra 20% for Google's favorable time taken per search	200 x 20%	40
Relevant capitalization per user for Google		280
Number of users		10
Valuation of Google	280 x 10	2,800

Part VII - Valuation of Professional/Consultancy firms**78. Valuation of Professional/Consultancy Firms:**

Consultancy Solutions Pvt. Ltd provides management consulting services to clients. Following is the financial information about the company:

Particulars	Year 1	Year 2	Year 3
Operating Profit	5,00,000	6,00,000	7,00,000
Depreciation	50,000	50,000	50,000
Tax rate	40%	40%	40%
One-time legal charges	-	-	50,000

- Projected growth rate after Year 3 = 5%
- Discount rate = 10%

KPI's:

Particulars	Company	Industry
Client retention rate	90.00%	80.00%
New client acquisition rate	15.00%	20.00%
Utilization rate of consultants (Percentage of billable hours worked by consultants)	75%	80%
Revenue per consultant	15 lacs	20 lacs

You are required to value the company based on future cash flows and adjust the valuation based on the above-mentioned KPI's. You can make suitable assumptions.

Answer:**WN 1: Computation of adjusted future cash flows:**

Particulars	Year 1	Year 2	Year 3
Operating Profit (EBIT/EBT)	5,00,000	6,00,000	7,00,000
Add: Non-recurring expenses	-	-	50,000
Adjusted EBT	5,00,000	6,00,000	7,50,000
Less: Tax @ 40%	-2,00,000	-2,40,000	-3,00,000
EAT	3,00,000	3,60,000	4,50,000
Add: Depreciation	50,000	50,000	50,000
Cash flow after tax	3,50,000	4,10,000	5,00,000

WN 2: Computation of terminal value:

$$\text{Value}_3 = \frac{\text{Cash flow}_4}{K_o - G} = \frac{5,00,000 \times 1.05}{10\% - 5\%} = \text{Rs. 105 lacs}$$

WN 3: Valuation of firm based on cash flows:

Year	Cash flow	PVF @ 10%	DCF
1	3,50,000	0.909	3,18,150
2	4,10,000	0.826	3,38,660
3	5,00,000	0.751	3,75,500
3	1,05,00,000	0.751	78,85,500
Value of Firm			89,17,810

WN 4: Adjustment of valuation:

- It is assumed that value of the firm will be increased by 10% for any favorable KPI and reduced by 10% for any adverse KPI

Particulars	Amount
Base valuation	89,17,810
Add: Favorable client retention rate [89,17,810 × 10%]	8,91,781
Less: Adverse client acquisition rate [89,17,810 × 10%]	-8,91,781
Less: Adverse utilization rate [89,17,810 × 10%]	-8,91,781
Less: Adverse revenue per consultant [89,17,810 × 10%]	-8,91,781
Final valuation of company	71,34,248

Part VIII - Impact of ESG on Valuation**79. ESG Impact:**

Ecotech industries is currently producing eco-friendly products. The expected cash flows of the company for next five years are as under:

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5
Cash flows (in crores)	10.00	12.00	14.00	15.00	16.00

- Discount rate (excluding ESG premium) is 10%
- EcoTech Industries faces the risk of potential regulatory changes due to climate-related policies. The analysis suggests a potential cost of Rs.1,00,00,000 annually to comply with stricter environmental regulations and maintain eco-friendly practices.
- EcoTech Industries actively invests in social initiatives, such as employee welfare, community development, and corporate social responsibility (CSR) activities. These initiatives are valued at Rs.50,00,000 annually, and they positively impact the company's brand reputation and employee retention.
- The company has a strong governance structure, but there is always a risk of compliance issues and penalties. A potential financial impact of Rs.30,00,000 per year is estimated due to governance risks.
- ESG premium to be considered in analysis is 2%
- Cash flows will grow at 4% after year 5 onwards

Answer:**WN 1: Computation of adjusted cash flows:**

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5
Normal cash flows	10.00	12.00	14.00	15.00	16.00
Less: Negative impact of Environmental risk	-1.00	-1.00	-1.00	-1.00	-1.00
Add: Favorable impact of social risk	0.50	0.50	0.50	0.50	0.50
Less: Negative impact of Governance risk	-0.30	-0.30	-0.30	-0.30	-0.30
Adjusted cash flows	9.20	11.20	13.20	14.20	15.20

WN 2: Valuation of terminal value:

- Discount rate = Normal discount rate + ESG premium
- Discount rate = 10% + 2% = 12.00%

$$\text{Value}_5 = \frac{\text{Cash flow}_6}{K_0 - G} = \frac{15.20 \times 1.04}{12\% - 4\%} = \text{Rs. 197.60 Crores}$$

WN 3: Valuation of firm based on cash flows:

Year	Cash flow	PVF @ 12%	DCF
1	9.20	0.893	8.22

2	11.20	0.797	8.93
3	13.20	0.712	9.40
4	14.20	0.636	9.03
5	15.20	0.567	8.62
5	197.60	0.567	112.04
Value of Firm			156.24

Chapter 14 – Mergers, Acquisitions & Corporate Restructuring**1. What is the rationale for Mergers and Acquisitions?**

- ❖ **Synergistic operating economics:** Synergy May be defined as $V(AB) > V(A) + V(B)$. In other words, the **combined value of two firms or companies** shall be more than their individual value. Synergy is the **increase in performance of the combined firm** over what the two firms are already expected or required to accomplish as independent firms. Economics of scale is one of the reasons for synergy benefits
- ❖ **Diversification:** In case of merger between two unrelated companies would lead to reduction in business risk, which in turn will increase the market value consequent upon the reduction in discount rate/ required rate of return
- ❖ **Taxation:** The provisions of set off and carry forward of losses as per Income Tax Act may be another strong reason for the merger and acquisition. Thus, there will be **Tax saving or reduction in tax liability** of the merged firm
- ❖ **Growth:** Merger and acquisition mode enables the firm to grow at a rate faster than the other mode viz., organic growth. The reason being the shortening of 'Time to Market'
- ❖ **Consolidation of Production Capacities and increasing market power:** Due to reduced competition, marketing power increases. Further, production capacity is increased by combined of two or more plants

2. What are the various forms(types) of mergers?

Horizontal Merger	The two companies which have merged are in the same industry , normally the market share of the new consolidated company would be larger and it is possible that it may move closer to being a monopoly or a near monopoly to avoid competition
Vertical Merger	This merger happens when two companies that have 'buyer-seller' relationship (or potential buyer-seller relationship) come together
Conglomerate Mergers	Such mergers involve firms engaged in unrelated type of business operations . In other words, the business activities of acquirer and the target are neither related to each other horizontally (i.e., producing the same or competing products) nor vertically (having relationship of buyer and supplier)
Congeneric Mergers	In these mergers, the acquirer and the target companies are related through basic technologies, production processes or markets . The acquired company represents an extension of product-line, market participants or technologies of the acquirer
Reverse Merger [Jan 2021]	Such mergers involve acquisition of a public (Shell Company) by a private company, as it helps private company to by-pass lengthy and complex process required to be followed in case it is interested in going public
Acquisition	This refers to the purchase of controlling interest by one company in the share capital of an existing company

3. Despite the fact there may be some degree of overlapping in one or more common factors of unrelated Companies come together to form an entity. EXPLAIN. [Nov 2022 MTP]

- Such mergers involve firms engaged in unrelated type of business operations. **In other words, the business activities of acquirer and the target are neither related to each other horizontally** (i.e., producing the same or competing products) **nor vertically** (having relationship of buyer and supplier).
- In a pure conglomerate merger, there are no important common factors between the companies in production, marketing, research and development and technology.
- **There may however be some degree of overlapping in one or more of these common factors. Such mergers are in fact, unification of different kinds of businesses under one flagship company. The purpose of merger remains utilization of financial resources, enlarged debt capacity and also synergy of managerial functions.**

4. What are the various Take over strategies?

When the process of acquisition is unfriendly it is called as takeover. Following are the various takeover strategies:

- ❖ **Street Sweep:** This refers to the technique where the acquiring company **accumulates larger number of shares in a target before making an open offer**. The advantage is that the target company is left with no choice but to agree to the proposal of acquirer for takeover.
- ❖ **Bear Hug:** When the acquirer threatens the target company to make an open offer, the **board of target company agrees to a settlement with the acquirer** for change of control.

- ❖ **Strategic Alliance:** This involves disarming the acquirer by offering a partnership rather than a buyout. The acquirer should assert control from within and takeover the target company.
- ❖ **Brand Power:** This refers to entering into an alliance with powerful brands to displace the target's brands and as a result, buyout the weakened company.

5. What are the various techniques to protect from hostile takeover?

- ❖ **Divestiture:** In a divestiture the target company divests or spins off some of its businesses in the form of an independent, subsidiary company. Thus, reducing the attractiveness of the existing business to the acquirer.
- ❖ **Crown jewels:** When a target company uses the tactic of divestiture it is said to sell the crown jewels. In some countries such as the UK, such tactic is not allowed once the deal becomes known and is unavoidable.
- ❖ **Poison pill:** Sometimes an acquiring company itself becomes a target when it is bidding for another company. The tactics used by the acquiring company to make itself unattractive to a potential bidder is called poison pills.
- ❖ **Poison Put:** In this case the target company issue bonds that encourage holder to cash in at higher prices. The resultant cash drainage would make the target unattractive.
- ❖ **Greenmail:** Greenmail refers to an incentive offered by management of the target company to the potential bidder for not pursuing the takeover. The management of the target company may offer the acquirer for its shares a price higher than the market price.
- ❖ **White knight:** In this a target company offers to be acquired by a friendly company to escape from a hostile takeover. The possible motive for the management of the target company to do so is not to lose the management of the company.
- ❖ **White squire:** This strategy is essentially the same as white knight and involves sell out of shares to a company that is not interested in the takeover. As a consequence, the management of the target company retains its control over the company.
- ❖ **Golden parachutes:** When a company offers hefty compensations to its managers if they get ousted due to takeover, the company is said to offer golden parachutes. This reduces their resistance to takeover.
- ❖ **Pac-man defence:** This strategy aims at the target company making a counter bid for the acquirer company. This would force the acquirer to defend itself and consequently may call off its proposal for takeover.

6. Write short note on reverse merger?

In a 'reverse takeover', a smaller company gains control of a larger one. This type of merger is also known as 'back door listing'. The concept of takeover by reverse bid, or of reverse merger, is thus not the usual case of amalgamation of a sick unit which is non-viable with a healthy or prosperous unit but is a case whereby the entire undertaking of the healthy and prosperous company is to be merged and vested in the sick company which is non-viable. Following are the three tests for reverse merger:

- ❖ the assets of the transferor company are greater than the transferee company,
- ❖ equity capital to be issued by the transferee company pursuant to the acquisition exceeds its original issued capital, and
- ❖ the change of control in the transferee company through the introduction of a minority holder or group of holders.

7. What is divestiture and the various reasons for the same?

It means a company selling one of the portions of its divisions or undertakings to another company or creating an altogether separate company. There are various reasons for divestment or demerger viz.,

- ❖ To pay attention on core areas of business;
- ❖ The Division's/business may not be sufficiently contributing to the revenues;
- ❖ The size of the firm may be too big to handle;
- ❖ The firm may be requiring cash urgently in view of other investment opportunities.

8. What are the various forms of divestiture or demerger? [May 2021 MTP]

Sell off/Partial Sell off	A sell off is the <u>sale of an asset, factory, division, product line</u> or subsidiary by one entity to another for a purchase consideration payable either in cash or in the form of securities. Partial Sell off, is a form of divestiture, wherein the firm <u>sells its business unit or a subsidiary to another because it deemed to be unfit with the company's core business strategy</u>

Spin-off [May 2021 MTP]	Part of the business is <u>separated and created as a separate firm</u> . The existing shareholders of the firm get <u>proportionate ownership</u> . So, there is no change in ownership and the <u>same shareholders continue to own the newly created entity</u> in the same proportion as previously in the original firm. The <u>management of spun-off division is however, parted with</u> . Spin-off does not bring fresh cash
Split-up	This involves <u>breaking up of the entire firm into a series of spin off</u> (by creating separate legal entities). The parent firm <u>no longer legally exists</u> and only the newly created entities survive. For instance, a corporate firm has <u>4 divisions namely A, B, C, D. All these 4 division shall be split-up to create 4 new corporate firms</u> with full autonomy and legal status.
Equity Carve Outs [May 2021 MTP]	This is like spin off, <u>however, some shares of the new company are sold in the market by making a public offer</u> , so this brings cash. More and more companies are using equity carve-outs to boost shareholder value.
Sale of a division	The <u>seller company is demerging its business whereas the buyer company is acquiring a business</u> .
Demerger or Division of family-managed business	The family-owned companies are, <u>under extraordinary pressure to yield control to professional managements</u> , as, in the emerging scenario of a liberalised economy the capital markets are broadening, with attendant incentives for growth. So, <u>many of these companies are arranging to hive off their unprofitable businesses or divisions</u> with a view to meeting a variety of succession problems

9. What are the various ways of doing ownership restructuring?

Going Private	This refers to the situation wherein a <u>listed company is converted into a private company</u> by buying back all the outstanding shares from the markets.
Management Buyout (MBO)	Buyouts initiated by the <u>management team of a company are known as a management buyout</u> . In this type of acquisition, the company is bought by its own management team. <u>MBOs are considered as a useful strategy for exiting those divisions</u> that does not form part of the core business of the entity
Leveraged Buyout (LBO)	An acquisition of a company or a division of another company which is <u>financed entirely or partially (50% or more) using borrowed funds is termed as a leveraged buyout</u> . The target company no longer remains public after the leveraged buyout; hence the transaction is also known as going private. The deal is usually secured by the acquired firm's physical assets
Equity Buyback	This refers to the situation wherein a company <u>buys back its own shares back from the market</u> . This results in reduction in the equity capital of the company. This strengthen the promoter's position by increasing his stake in the equity of the company

10. What is the difference between Management Buy Out and Leveraged Buyout? State the purpose of a leveraged buyout with the help of an example? [May 2020 RTP]

- ❖ **Management Buyout (MBO):** Buyouts initiated by the management team of a company are known as a management buyout. In this type of acquisition, the company is bought by its own management team. MBOs are considered as a useful strategy for exiting those divisions that does not form part of the core business of the entity
- ❖ **Leveraged Buyout (LBO):** An acquisition of a company or a division of another company which is financed entirely or partially (50% or more) using borrowed funds is termed as a leveraged buyout. The target company no longer remains public after the leveraged buyout; hence the transaction is also known as going private. The deal is usually secured by the acquired firm's physical assets
- ❖ **Purpose of LBO:** The intention behind an LBO transaction is to improve the operational efficiency of a firm and increase the volume of its sales, thereby increasing the cash flow of the firm. This extra cash flow generated will be used to pay back the debt in LBO transaction. After an, LBO the target entity is managed by private investors, which makes it easier to have a close control of its operational activities. The LBOs do not stay permanent. Once the LBO is successful in increasing its profit margin and improving its operational efficiency and the debt is paid back, it will go public again. Companies that are in a leading market position with proven demand for product, have a strong management team, strong relationships with key customers and suppliers and steady growth are likely to become the target for LBOs.

- ❖ **Example of LBO:** In India the first LBO took place in the year 2000 when Tata Tea acquired Tetley in the United Kingdom. The deal value was Rs. 2135 crores out of which almost 77% was financed by the company using debt. The intention behind this deal was to get direct access to Tetley's international market. The largest LBO deal in terms of deal value (7.6 Billion) by an Indian company is the buyout of Corus by Tata Steel

11. How can mergers and acquisitions and business restructuring unlock value?

- Horizontal growth helps to achieve optimum size, enlarge the market share, curb competition and use of unutilised capacity;
- Vertical combination helps to economise costs and eliminate avoidable taxes /duties;
- Diversification of business;
- Mobilising financial resources by utilising the idle funds lying with another company for the expansion of business.
- Merger of an export, investment or trading company with an industrial company or vice versa with a view to increase cash flow;
- Merging subsidiary company with the holding company with a view to improving cash flow;
- Taking over a 'shell' company which may have the necessary industrial licences etc., but whose promoters do not wish to proceed with the project.
- An amalgamation may also be resorted to for the purpose of nourishing a sick unit in the group and this is normally a merger for keeping up the image of the group.
- Business restructuring enhances competitiveness, survival, and provides new direction for a company.

12. What are the various steps in successful M&A Programme and what are the reasons for failure of M&A?

There are five principal steps in a successful M & A programme namely

- ❖ Manage the pre-acquisition phase.
- ❖ Screen candidates.
- ❖ Eliminate those who do not meet the criteria and value the rest.
- ❖ Negotiate.
- ❖ Post-merger integration

Following are some of the reasons for failure of M&A:

- ❖ Acquirers generally overpay;
- ❖ The value of synergy is over-estimated;
- ❖ Poor post-merger integration; and
- ❖ Psychological barriers.

13. What are Cross border Mergers & Acquisitions and what are the reasons for the same?

- ❖ Cross-border M&A is a popular route for global growth and overseas expansion. This refers to a scenario where the target company and acquiring company are based out of different countries
- ❖ Factors contributing to cross border M&A are:
 - Globalization of production and distribution of products and services
 - Integration of global economies.
 - Expansion of trade and investment relationships on International level
 - Many countries are reforming their economic and legal systems, and providing generous investment and tax incentives to attract foreign investment
 - Privatisation of state-owned enterprises and consolidation of the banking industry

14. Can a company with no commercial operations raise capital via an IPO? Discuss. [Nov 2021 RTP]
 Although the statement "a company with no commercial operation can launch an IPO" appears to be absurd but this is a fact that even if company does not have any business, it can float an IPO. In recent time the concept of Special Purpose Acquisition Companies (SPACs) has come into existence wherein an entity is set up with the objective to raise funds through an IPO to finance a merger or acquisition of an unidentified target within a specific time period. It is commonly known as a blank cheque company.

The main objective of SPAC is to raise money, despite not having any operations or revenues. The money raised from the public is kept in an escrow account, which can be accessed while making the acquisition. However, in case the acquisition is not made within stipulated period of time of the IPO, the SPAC is

delisted and the money is returned to the investors. Shareholders have the option to redeem their shares if they are not interested in participating in the proposed merger. Finally, if the merger is approved by shareholders, it is executed, and the target private company or companies become public entities. Once a formal merger agreement has been executed the SPAC target is usually publicly announced.

New investment opportunities in Indian companies have resurfaced and have set up new platform for SPAC transactions. The implementation of SPACs might face certain challenges since India does not have a specific regulatory framework guarding these transactions.

The current regulatory framework in India does not support the SPAC transactions. Further as per the Companies Act, 2013, the Registrar of Companies is authorized to strike-off the name of companies that do not commence operation within one year of incorporation. SPACs generally take 2 to 3 years to identify a target and performing due diligence and before it could get operationalized its name can be stricken off and hence enabling provisions relating to SPAC need to be inserted in the Companies Act in order to make it functional in India.

Though, SPACs do not find acceptance under the Securities and Exchange Board of India (SEBI) Act as it does not meet the eligibility criteria for public listing however SEBI is planning to come out with a framework for SPACs.

The International Financial Services Centres Authority (IFSCA), being the regulatory authority for development and regulation of financial services, financial products and financial institutions in the Gujarat International Finance Tec-City, has recently released a consultation paper defining critical parameters such as offer size to public, compulsory sponsor holding, minimum application size, minimum subscription of the offer size, etc. **SPAC approach offers several advantages over traditional IPO, such as providing companies access to capital, even when market volatility and other conditions limit liquidity. SPACs help to lower the transaction fees as well as expedite the timeline in becoming a public company. Raising money through a SPAC is easier as compared to traditional IPO since the SPAC has already raised money through an IPO.** This implies the company in question only has to negotiate with a single entity, as opposed to thousands of individual investors. This makes the process of fundraising a lot easier and quicker than through an IPO. The involvement of skilled professionals in identifying the target makes the investment a well thought and a well governed process.

However, the merger of a SPAC with a target company presents several challenges, such as complex accounting and financial reporting/registration requirements, to meet a public company readiness timeline and being ready to operate as a public company within a period of three to five months of signing a letter of intent.

It is typically more expensive for a company to raise money through a SPAC than an IPO. Investors' money invested in a SPAC trust to earn a suitable return for up to two years, could be put to better use elsewhere.

Theory to Solve Problems

Why Merge?

- ❖ **Create operating synergies** – Operating synergies can affect margins and growth [Positive impact]
 - Economies of scale
 - Greater pricing power from less competition
 - Combination of different functional strengths
 - Higher growth in markets
- ❖ **Create financial synergies** – With financial synergies the payoff can be either higher cash flow or lower cost of capital
 - Merger of a company with slack cash with a company with high-return projects
 - Increase in debt capacity
 - Tax benefits
- ❖ **Acquire under-valued firms:** Firms whose actual value is less than fair value
- ❖ **Diversification:** Leads to reduction in total risk. However an already diversified investor may not be excited

- ❖ Managerial self interest
 - Empire Building
 - Managerial ego
 - Board composition and side effects

Synergy gain:

- ❖ Synergy gain is possible when the combined value of two firms is greater than the sum of the value of two firms
- ❖ Synergy gain means the sum of the parts is less than the whole

Methods for distributing gain:

- ❖ The target company's share of synergy gain will normally be made over to them by the acquiring company at the onset of the merger itself. Should the planned synergy gain not come through, the acquirer loses
- ❖ The target's share of synergy gain is paid out
 - Either in the form of cash
 - Or in the form of shares in the merged entity

Steps in case of Cash deal:

Step	Description
Step 1	Compute synergy gain
Step 2	Compute value of consideration
Step 3	Target company's share of gain = Consideration less market value of target company
Step 4	Net gain to acquiring company = Step 1 - Step 3

Steps in case of stock deal:

Step	Description
Step 1	Compute synergy gain
Step 2	Compute theoretical post-merger price = $[\text{MV of acquiring company} + \text{MV of target company} + \text{synergy gain}] / [\text{Existing shares} + \text{shares to be issued}]$
Step 3	Consideration to target company = Shares issues * Step 2 price
Step 4	Target company's share of gain = Consideration less market value of target company
Step 5	Net gain to acquiring company = Step 1 - Step 4

How to compute swap ratio?

- ❖ Write the base values (based on which exchange ratio is computed)
- ❖ Switch it around. Example: EPS of A and T are 10 & 5. The exchange ratio is 5:10

Extent of gain:

- ❖ When stock deal takes place the percentage gain to the acquiring company is the change in market price (pre-merger & post-merger)
- ❖ To compute the percentage gain of the target company we must compare the pre-merger price of the target company with the adjusted MP of the merged company
- ❖ $\text{Adjusted MP} = \text{New MP} * \text{Exchange ratio}$

Synergy gain and no increase in earnings:

- ❖ If there is no increase in earnings it can be assumed that there is no synergy gain. Even when there is no increase in earnings synergy gain can be computed if we assume a certain P/E ratio of the merged entity
- ❖ In this case the MP of the merged entity can be obtained by multiplying the EPS with PE ratio of the merged entity

Exchange ratio and EPS:

- ❖ If there is no increase in earnings and if the EPS of the acquiring company is to be maintained then the ratio should be in the EPS

Weighted average swap ratio:

- ❖ The swap ratio is normally based on any of the following variables:
 - Book value per share
 - Fair value per share
 - Market value per share
 - EPS
- ❖ It is also possible to base the swap on more than one parameter by assigning to them appropriate weights and thus arrive at a weighted average swap ratio

Steps in computation:

- ❖ **Step 1:** Based on each agreed parameter compute no. of shares to be issued
- ❖ **Step 2:** Use the given weight and arrive at the weighted average no of shares to be issued
- ❖ **Step 3:** With the weighted average number of shares the exchange ratio can be calculated

How is the final exchange ratio determined?

- ❖ The exchange ratio is likely to be favorable to the company
 - Which is financially stronger and
 - Which is less desperate to merge
- ❖ It would also depend on the negotiating skills of two companies

Practical Problems**1. Cash deal and stock deal**

X Limited and Y Limited with perpetuity cash flows of Rs.36 lakhs and Rs.18 lakhs p.a. respectively, decide to merge. Consequent to merger there would be a Rs.6 lakhs p.a. cash savings every year. The cost of capital in the industry is 20 percent. X Limited plans to pay Y Limited rs.110 lakhs as merger consideration. Alternatively it is willing to offer a swap ratio of 5 shares for every 6 held. Currently the number of equity shares in X Limited is 10 lakhs and that in Y Limited is 6 lakhs respectively. You are required to ascertain:

- The gain from merger
- The cost of cash offer
- The cost of stock offer
- The NPV of cash offer
- The NPV of stock offer

Answer:

Particulars	Calculation	Amount
Value of X Limited	$\frac{36 \text{ lacs}}{20\%}$	180 lacs
Value of Y Limited	$\frac{18 \text{ lacs}}{20\%}$	90 lacs
Value of merged entity	$\frac{60 \text{ lacs}}{20\%}$	300 lacs
Gain of merger	300 lacs – 180 lacs – 90 lacs	30 lacs
Cash offer analysis:		
Consideration paid		110 lacs
Gross cost of cash offer		110 lacs
Net cost of cash offer	110 lacs – 90 lacs	20 lacs
NPV of cash offer	Synergy gain – Cost of cash offer 30 lacs – 20 lacs	10 lacs
Stock offer Analysis:		
No of shares issued	$6 \text{ lacs} \times \left(\frac{5}{6}\right)$	5 lacs
Post-merger share price	$\frac{300 \text{ lacs}}{10 \text{ lacs} + 5 \text{ lacs}}$	20
Consideration paid	5 lacs x 20	100 lacs
Gross cost of stock offer		100 lacs
Net cost of stock offer	100 lacs – 90 lacs	10 lacs
NPV of stock offer	Synergy gain – Cost of stock offer 30 lacs – 10 lacs	20 lacs

Note:

- Cash flow of merged entity = Cash flow of X (36 lacs) + Cash flow of Y (18 lacs) + Cash savings (6 lacs) = 60 lacs
- Present value of perpetuity has been used to value the company. Value = (Cash flow / Cost of capital)

2. Net cost of acquisition [July 2021]

Long Ltd., is planning to acquire Tall Ltd., with the following data available for both the companies:

Particulars	Long Limited	Tall Limited
Expected EPS	12	5
Expected DPS	10	3
No of shares	30,00,000	18,00,000
Current market price per share	180	50

As per an estimate Tall Ltd., is expected to have steady growth of earnings and dividends to the tune of 6% per annum. However, under the new management the growth rate is likely to be enhanced to 8% per annum without additional investment.

You are required to:

- Calculate the net cost of acquisition by Long Ltd., if Rs. 60 is paid for each share of Tall Ltd.
- If the agreed exchange ratio is one share of Long Ltd., for every three shares of Tall Ltd., in lieu of the cash acquisition as per (i) above, what will be the net cost of acquisition?
- Calculate Gain from acquisition.

Answer:

WN 1: Computation of net cost of acquisition in case of cash consideration:

Particulars	Calculation	Amount
Consideration paid	18,00,000 × 60	10,80,00,000
Less: Value of Tall Limited	18,00,000 × 50	(9,00,00,000)
Net cost of acquisition		1,80,00,000

WN 2: Computation of net cost of acquisition in case of share consideration:

Note 1: Valuation of merged entity:

Particulars	Calculation	Amount
Value of Long Limited	30,00,000 × 180	54,00,00,000
Value of Tall Limited under new management	Note 2	13,50,00,000
Total value of merged entity		67,50,00,000
No of shares post-merger	30,00,000 + 6,00,000	36,00,000
Value per share	$\frac{67,50,00,000}{36,00,000}$	187.50
Amount of consideration paid	187.50 × 6,00,000	11,25,00,000

Note 2: Value of Tall Limited business with increase in growth rate:

Particulars	Calculation	Amount
Existing cost of equity	$\frac{3}{50} + 6\%$	12.00%
Growth rate under new management		8.00%
Value per share under new management	$\frac{3}{12\% - 8\%}$	75.00
No of shares		18,00,000
Value of Tall Limited		13,50,00,000

Note 3: Net cost of acquisition:

Particulars	Calculation	Amount
Consideration paid	Note 1	11,25,00,000
Less: Value of Tall Limited	18,00,000 × 50	(9,00,00,000)
Net cost of acquisition		2,25,00,000

WN 3: Gain from acquisition:

Particulars	Calculation	Amount
Post-merger Value	Note 1 of WN 2	67,50,00,000
Less: Pre-merger value	54,00,00,000 + 9,00,00,000	(63,00,00,000)

Gain from acquisition	4,50,00,000

3. Swap Ratio [May 2015 MTP]

ABC Limited is determined to report EPS of Rs.2.67. It is therefore acquires DEF Limited. You are given the following information:

Particulars	ABC Limited	DEF Limited	Merged Entity
EPS	2	2.50	2.67
Price per share	40	25	?
PE Multiple	20	10	?
Number of shares	1,00,000	2,00,000	?
Total earnings	2,00,000	5,00,000	?
Total market value	40,00,000	50,00,000	?

There are no gains from merger. In exchange for DEF Limited shares, ABC Limited issues just enough of its own shares to ensure its Rs.2.67 earnings per share objective.

- ❖ Complete the above table for the merged firm
- ❖ How many shares of ABC Limited are exchanged for each share of DEF Limited
- ❖ What is the cost of merger to ABC Limited?

Answer:

WN 1: Completion of merger table:

Particulars	ABC Limited	DEF Limited	Merged company
PAT/EAES	2,00,000	5,00,000	7,00,000
No of equity shares	1,00,000	2,00,000	2,62,172
EPS	2	2.50	2.67
PE Multiple	20	10	20
MPS	40	25	53.40
No of equity shares	1,00,000	2,00,000	2,62,172
Market value of firm	40,00,000	50,00,000	1,40,00,000

Note:

- Problem on swap ratio and synergy gain can be solved using the above format wherein various inter-linkages can be established and missing information can be calculated

WN 2: Solution table

No of shares of merged company	$\frac{\text{Total earnings}}{\text{EPS}} = \frac{7,00,000}{2.67}$	2,62,172
MPS of merged company	$\text{EPS} \times \text{PE Multiple} = 2.67 \times 20$	Rs.53.40
MV of merged company	$\text{MPS} \times \text{No of shares} = 53.40 \times 2,62,172$	Rs.1,39,99,985 ~ Rs.1,40,00,000
Shares issued to DEF Limited	$2,62,172 - 1,00,000$	1,62,172
Share exchange ratio	$1,61,172 \text{ shares for } 2,00,000 \text{ shares}$	0.81086:1
Gross Cost of merger	$\text{Shares issued} \times \text{Issue price}$ $1,62,172 \times 53.40$	Rs.86,59,985~ Rs.86,60,000
Net cost of merger	$\text{Consideration paid} - \text{Pre merger value}$ $86,60,000 - 50,00,000$	Rs.36,60,000

Note:

- Pre-merger PE Multiple and post-merger PE Multiple of acquiring company (ABC Limited) would remain same in the absence of information

4. Swap Ratio [May 2018, Nov 2007]

A Limited wants to acquire T Limited and has offered a swap ratio of 1:2 (0.5 shares for every one share of T Limited). Following information is provided:

Particulars	A Limited	T Limited
Profit after tax	18,00,000	3,60,000
Equity shares outstanding (Nos.)	6,00,000	1,80,000
EPS	3	2
PE ratio	10 Times	7 Times
Market price per share	Rs.30	Rs.14

Required:

- ❖ The number of equity shares to be issued by A Limited for acquisition of T Limited
- ❖ What is the EPS of A limited after the acquisition
- ❖ Determine the equivalent earnings per share of T Limited
- ❖ What is the expected market price per share of A Limited after the acquisition, assuming its PE multiple remains unchanged?
- ❖ Determine the market value of the merged firm
- ❖ What should be the exchange ratio to achieve EPS of Rs.3.5 in case post synergy benefits are expected to be 10% during post acquisition period

Answer:

WN 1: Completion of merger table:

Particulars	A Limited	T Limited	Merged company
PAT/EAES	18,00,000	3,60,000	21,60,000
No of equity shares	6,00,000	1,80,000	6,90,000
EPS	3	2	3.1304
PE Multiple	10	7	10
MPS	30	14	31.304
No of equity shares	6,00,000	1,80,000	6,90,000
Market value of firm	1,80,00,000	25,20,000	2,16,00,000

WN 2: Solution:

Shares issued	1,80,000 x 0.50	90,000
Post-merger EPS	$\frac{\text{Total earnings}}{\text{No of shares}} = \frac{21,60,000}{6,90,000}$	3.1304
Equivalent EPS of T Limited	3.1304×0.5	1.5652
MPS of merged company	$\text{EPS} \times \text{PE Multiple} = 3.1304 \times 10$	31.304
MV of merged company	$\text{MPS} \times \text{No of shares} = 31.304 \times 6,90,000$	Rs.2,15,99,760 ~ Rs.2,16,00,000
Exchange ratio to achieve EPS of Rs.3.5:		
Total earnings of merged company		21,60,000
Earnings with synergy gain	$21,60,000 + 10\%$	23,76,000
Target EPS		3.50
Target shares post-merger	$\frac{23,76,000}{3.50}$	6,78,857 Shares
Shares to be issued to T Limited	$6,78,857 - 6,00,000$	78,857 Shares
Share exchange ratio	78,857 shares for 1,80,000 shares	0.4381:1

5. Swap ratio [May 2005, May 2012, May 2014 MTP]

XYZ Ltd., is considering merger with ABC Ltd. XYZ Ltd.'s shares are currently traded at Rs. 20. It has 2,50,000 shares outstanding and its earnings after taxes (EAT) amount to Rs. 5,00,000. ABC Ltd., has 1,25,000 shares outstanding; its current market price is Rs. 10 and its EAT are Rs. 1,25,000. The merger will be effected by means of a stock swap (exchange). ABC Ltd., has agreed to a plan under which XYZ Ltd., will offer the current market value of ABC Ltd.'s shares:

- a) What is the pre-merger earnings per share (EPS) and P/E ratios of both the companies?
- b) If ABC Ltd.'s P/E ratio is 6.4, what is its current market price? What is the exchange ratio? What will XYZ Ltd.'s post-merger EPS be?
- c) What should be the exchange ratio; if XYZ Ltd.'s pre-merger and post-merger EPS are to be the same?

Answer:

WN 1: Computation of pre-merger EPS and PE Multiple of both companies:

Particulars	XYZ Limited	ABC Limited
PAT/EAES	5,00,000	1,25,000
No of equity shares	2,50,000	1,25,000
EPS	2	1
PE Multiple	10	10
MPS	20	10
No of equity shares	2,50,000	1,25,000
Market value of firm	50,00,000	12,50,000

WN 2: Computation of CMP, share exchange ratio and post-merger EPS:

MPS of ABC Limited	EPS x PE Multiple = 1 x 6.4	Rs.6.40
Exchange ratio		
Basis of exchange ratio		Market price
Base values	XYZ:ABC	20:6.40
Exchange ratio		6.40:20 (or) 0.32:1
Post-merger EPS:		
No of shares issued	1,25,000 x 0.32	40,000 shares
Post-merger EPS	$\frac{\text{Total earnings}}{\text{No of shares}} = \frac{5,00,000 + 1,25,000}{2,50,000 + 40,000}$	2.1552

WN 3: Exchange ratio to maintain the same EPS:

- If the company wants to maintain the same EPS, then the exchange ratio should be on the basis of EPS
- Base values = XYZ:ABC = 2:1
- **Exchange ratio = 1:2 (or) 0.5:1**

6. Swap ratio [Nov 2018 MTP, Nov 2004, May 2009, Nov 2014 MTP, May 2018 RTP, May 2018]

The following information is provided relating to the acquiring firm Mark Limited and the target firm Mask Limited:

	Mark Limited	Mask Limited
Earnings after tax	2000 lakhs	400 lakhs
Number of shares outstanding	200 lakhs	100 lakhs
PE ratio	10	5

Required:

- What is the swap ratio based on current market prices?
- What is the EPS of mark limited after acquisition?
- What is the expected market price per share of Mark Limited after acquisition, assuming PE ratio of Mark Limited remains unchanged?
- Determine the market value of the merged firm
- Calculate gain/loss for shareholders of the two independent companies after acquisition

Answer:

WN 1: Completion of merger table:

(in lacs)

Particulars	Mark Limited	Mask Limited	Merged
PAT/EAES	2,000	400	2,400
No of equity shares	200	100	220
EPS	10	4	10.9091
PE Multiple	10	5	10
MPS	100	20	109.09
No of equity shares	200	100	220
Market value of firm	20,000	2,000	24,000

WN 2: Solution (Part a to d)

Exchange ratio		
Basis of exchange ratio		Market price
Base values	Mark: Mask	100:20
Exchange ratio		20:100 (or) 1:5
Post-merger EPS:		
No of shares issued	100 lacs x (1/5)	20 lacs
Post-merger EPS	$\frac{\text{Total earnings}}{\text{No of shares}} = \frac{2,000 + 400}{200 + 20}$	10.9091
Expected market price	EPS x PE Multiple	109.09

	10.9091 × 10	
MV of merged firm	MPS × No of shares 109.09 × 220	23,999.80 lacs ~ 24,000 lacs

WN 3: Computation of gain/loss for shareholders:

(in lacs)

Particulars	Mark Limited	Mask Limited
Pre-merger value	20,000	2,000
Post-merger value	21,818 (109.09 × 200)	2,182 (109.09 × 20)
Overall gain/loss (A)	1,818	182
Pre-merger no of shares (B)	200	100
Gain per share (A/B)	9.09	1.82

7. Calculation of true cost of merger [May 2016 MTP, Nov 2014]

Elrond Limited plans to acquire Doom Limited. The relevant financial details of the two firms prior to the merger announcement are:

Particulars	Elrond Limited	Doom Limited
Market price per share	Rs.50	Rs.25
Number of shares	20 lacs	10 lacs

The merger is expected to generate gains, which have a present value of Rs. 200 Lakhs. The exchange ratio agreed to is 0.5. What is the true cost of the merger from the point of view of Elrond Limited?

Answer:

Particulars	Calculation	Amount
Value of Elrond Limited	20 lacs × 50	1,000 lacs
Value of Doom Limited	10 lacs × 25	250 lacs
Synergy gain		200 lacs
Value of merged entity	1,000 lacs + 250 lacs + 200 lacs	1,450 lacs
No of shares issued to Doom Limited	10 lacs × 0.5	5 lacs
Post-merger share price	$\frac{1,450 \text{ lacs}}{20 \text{ lacs} + 5 \text{ lacs}}$	58
Consideration paid	5 lacs × 58	290 lacs
Gross cost of merger		290 lacs
True cost of merger	290 lacs – 250 lacs	40 lacs

8. Calculation of exchange ratio

If the cost of merger is Rs.277.5 lacs after acquiring DEF Limited, what is the exchange ratio worked out by the acquiring company ABC Limited from the following information

MPS of ABC Limited (Before acquisition)	Rs.192.50
MPS of DEF Limited (Before acquisition)	Rs.88
No of shares of ABC Limited (Before acquisition)	20 lacs
No of shares of DEF Limited (Before acquisition)	15 lacs

It is also estimated that the synergy value is measured at present value of Rs.687.5 lacs.

Answer:**Computation of exchange ratio:**

Let us assume shares allotted to DEF Limited to be Y

(in lacs)

Particulars	Calculation	Amount
Value of ABC Limited	20 lacs × 192.50	3,850
Value of DEF Limited	15 lacs × 88	1,320
Synergy gain		687.50
Value of merged entity	3,850 + 1,320 + 687.50	5,857.50
No of shares issued to DEF Limited		Y
Post-merger share price		$\frac{5,857.50}{20 + Y}$
Cost of merger		277.50
Value of DEF Limited before merger		1,320

Consideration paid	1,320 + 277.50	1,597.50

Consideration paid = MPS post merger x No of shares issued

$$1,597.50 = \frac{5,857.50}{20 + Y} \times Y; 1,597.50(20 + Y) = 5,857.50Y; 31,950 + 1,597.50Y = 5,857.50Y$$

$$31,950 = 5,857.50Y - 1,597.50Y; 31,950 = 4,260Y; Y = \frac{31,950}{4,260} = 7.5$$

- No of shares issued to DEF Limited = 7.5 lacs
- Share exchange ratio = (7.5 lacs/15 lacs) = 0.5:1

9. Consideration to maintain EPS [May 2016, Nov 2018 RTP]

The CEO of a company thinks that shareholders always look for EPS. Therefore, he considers maximization of EPS as his company's objective. His company's current Net Profits are Rs. 80.00 lakhs and P/E multiple is 10.5. He wants to buy another firm which has current income of Rs. 15.75 lakhs & P/E multiple of 10.

What is the maximum exchange ratio which the CEO should offer so that he could keep EPS at the current level, given that the current market price of both the acquirer and the target company are Rs. 42 and Rs. 105 respectively?

If the CEO borrows funds at 15% and buys out Target Company by paying cash, how much cash should he offer to maintain his EPS? Assume tax rate of 30%.

Answer:

WN 1: Computation of Exchange Ratio:

(in lacs)

Particulars	Acquirer Company	Target Company
PAT	80	15.75
No of shares	20	1.50
EPS [MPS/PE Multiple]	4	10.50
P/E Multiple	10.5	10
MPS	42	105

- The company wants to maintain same EPS and hence exchange ratio should be on the basis of EPS
- Base values for EPS = 4:10.50; Exchange ratio based on EPS = 10.50:4 (or) 2.625:1

WN 2: Computation of cash consideration:

Particulars	Amount (in lacs)
Profit after Tax	15.75
Cost of debt (after tax)	10.50%
Maximum consideration [15.75 lacs/10.50%]	150

10. Share exchange ratio [Nov 2019]:

ABC Ltd. is a company operating in the software industry. It is considering the acquisition of XYZ Ltd. which is also into software industry. The following information are available for the companies:

Particulars	ABC Limited	XYZ Limited
Earnings after tax	9,00,000	2,40,000
Number of equity shares	1,50,000	60,000
PE Ratio	14	10

ABC Ltd. is planning to offer a premium of 25% over the market price of XYZ Ltd.

Required:

- What is the swap ratio based on current market price?
- Find the number of shares to be issued by ABC Ltd. to the shareholders of XYZ Ltd.
- Compute the new EPS of ABC Ltd. after merger and comment on the impact of merger.
- Determine the market price of the share when P/E ratio remains unchanged.
- Compute the market price when P/E declines to 12 and comment on the results.

Figures are to be rounded off to 2 decimals.

Answer:

WN 1: Basic table:

Particulars	ABC Limited	XYZ Limited	Merged
Earnings after tax	9,00,000	2,40,000	11,40,000
Number of equity shares	1,50,000	60,000	1,85,714
EPS	6	4	6.14

PE Ratio	14	10	14
MPS	84	40	85.96

WN 2: Solution:**Swap ratio:**

- Base values on the basis of MPS is ABC Limited (84) & XYZ Limited (40)
- Premium of 25 percent is to be paid and hence revised price of XYZ Limited is 50
- Revised base values = 84 & 50
- Exchange ratio = 50:84

Number of shares to be issued:

Number of shares to be issued = $60,000 \times \left(\frac{50}{84}\right) = 35,714$ shares

Impact of merger on new EPS:

Particulars	ABC Limited	XYZ Limited
Old EPS	6	4
New EPS	6.14	3.65 $6.14 \times \left(\frac{50}{84}\right)$
Increase/decrease in EPS	0.14	(0.35)

New MPS if PE Multiple remains same:

New MPS = $6.14 \times 14 = \text{Rs.}85.96$

New MPS if PE Multiple falls to 12:

New MPS = $6.14 \times 12 = \text{Rs.}73.68$

Comments on MPS:

Particulars	ABC Limited	XYZ Limited
Old MPS	84	40
New MPS	73.68	43.86 $73.68 \times \left(\frac{50}{84}\right)$
Increase/decrease in MPS	(10.32)	3.86

Comments: With the merger there is a decrease in the market price of shares for the shareholders of ABC Ltd and a gain for shareholders of XYZ Ltd.

11. Determination of exchange ratio [May 2004, Nov 2008, Nov 2003]

A Limited is studying the possible acquisition of B Limited by way of merger. The following data are available:

Firm	After-tax earnings	No of equity shares	Market Price per share
A Limited	10,00,000	2,00,000	75
B Limited	3,00,000	50,000	60

- If the merger goes through by exchange of equity shares and the exchange ratio is set according to the current market prices, what is the new earnings per share for A Limited
- B Limited wants to be sure that its earning per share is not diminished by the merger. What exchange ratio is relevant to achieve the objective?

Answer:

WN 1: Valuation of A Limited, B Limited and Merged company:

Particulars	A Limited	B Limited	Merged Company
PAT	10,00,000	3,00,000	13,00,000
No of shares	2,00,000	50,000	2,40,000
EPS	5	6	5.42

Note:

- ❖ Shares to be issued are on market price basis. Base values are 75:60 and hence the swap ratio will be 60:75
- ❖ Shares to be issued = $50,000 \times (60/75) = 40,000$ shares

WN 2: Shares to be issued so that EPS is not diminished due to merger:

- ❖ The company should allot the shares in the ratio of EPS if it does not want EPS to be impacted by merger.
- ❖ The base values are 5:6 and hence the swap ratio will be 6:5

12. Determination of exchange ratio [May 2018 MTP, May 2019 RTP, May 2006, Nov 2012 RTP]

Reliable Industries Limited (RIL) is considering a takeover of Sunflower Industries Limited (SIL). The particulars of 2 companies are given below:

Particulars	Reliable Industries Limited	Sunflower Industries Limited
Earnings after Tax	20,00,000	10,00,000
Equity shares outstanding	10,00,000	10,00,000
EPS	2	1
PE Ratio	10	5

Required:

- i. What is the market value of each company before merger?
- ii. Assume that the management of RIL estimates that the shareholders of SIL will accept an offer of one share of RIL for four shares of SIL. IF there are no synergic effects, what is the market value of the post-merger RIL? What is the new price per share? Are the shareholders of RIL better or worse off than they were before the merger?
- iii. Due to synergic effects, the management of RIL estimates that the earnings will increase by 20%. What are the new post-merger EPS and price per share? Will the shareholders be better off or worse off than before the merger?

Answer:**WN 1: Valuation of RIL, SIL and merged entity:**

Particulars	RIL	SIL	Merged (part ii)	Merged (Part iii)
PAT	20,00,000	10,00,000	30,00,000	36,00,000
No of shares	10,00,000	10,00,000	12,50,000	12,50,000
EPS	2	1	2.4	2.88
PE Multiple	10	5	10	10
MPS	20	5	24	28.80
No of shares	10,00,000	10,00,000	12,50,000	12,50,000
Value of firm	2,00,00,000	50,00,000	3,00,00,000	3,60,00,000

WN 2: Computation of gains/loss to shareholders for Part (ii):

Particulars	RIL	SIL
Pre-merger value	2,00,00,000	50,00,000
Post-merger value	2,40,00,000 [10,00,000 × 24]	60,00,000 [2,50,000 × 24]
Gain to shareholders	40,00,000	10,00,000

Thus, the shareholders of RIL and SIL are better-off than before.

WN 3: Computation of gains/loss to shareholders for Part (iii):

Particulars	RIL	SIL
Pre-merger value	2,00,00,000	50,00,000
Post-merger value	2,88,00,000 [10,00,000 × 28.80]	72,00,000 [2,50,000 × 28.80]
Gain to shareholders	88,00,000	22,00,000

Thus, the shareholders of RIL and SIL are better-off than before.

13. Impact of merger on EPS [May 2015 MTP, Nov 2009]

B Ltd. is a highly successful company and wishes to expand by acquiring other firms. Its expected high growth in earnings and dividends is reflected in its PE ratio of 17. The Board of Directors of B Ltd. has been advised that if it were to take over firms with a lower PE ratio than it own, using a share-for-share exchange, then it could increase its reported earnings per share. C Ltd. has been suggested as a possible target for a takeover, which has a PE ratio of 10 and 1,00,000 shares in issue with a share price of Rs. 15. B Ltd. has 5,00,000 shares in issue with a share price of Rs. 12. Calculate the change in earnings per share of B Ltd. if it acquires

the whole of C Ltd. by issuing shares at its market price of Rs.12. Assume the price of B Ltd. shares remains constant.

Answer:

Particulars	B Limited	C Limited	Merged Entity
EAT [EPS x No of shares]	3,55,000	1,50,000	5,05,000
No of shares	5,00,000	1,00,000	6,25,000
EPS [MPS/PE Multiple]	0.71	1.50	0.808
PE Multiple	17	10	Not needed
MPS	12	15	Not needed

- ❖ EPS of B Limited has improved from 0.71 to 0.808 due to merger
- ❖ Shares issued in merger = $(1,00,000 \times 15) / 12 = 1,25,000$ shares. B Limited currently has 5,00,000 shares and hence post-merger there will be 6,25,000 shares

14. Synergy gain and swap ratio [Nov 2010, May 2019 RTP]

MK Limited is considering acquiring NN Limited. The following information is available:

Company	Earnings after Tax	No of equity shares	Market value per share
MK Limited	60,00,000	12,00,000	200.00
NN Limited	18,00,000	3,00,000	160.00

Exchange of equity shares for acquisition is based on current market value as above. There is no synergy advantage available.

- i. Find the earning per share for company MK Limited after merger and
- ii. Find the exchange ratio so that shareholders of NN Limited would not be at a loss

Answer:

WN 1: Computation of EPS after merger:

Particulars	MK Limited	NN Limited	Merged
Earnings after tax	60,00,000	18,00,000	78,00,000
No of shares	12,00,000	3,00,000	14,40,000
Earnings per share	5	6	5.42

- ❖ Shares issued to NN Limited = $3,00,000 \times (160/200) = 2,40,000$
- ❖ Shares post-merger = $12,00,000 + 2,40,000 = 14,40,000$

WN 2: Computation of exchange ratio so that shareholders of NN Limited would not be at a loss:

- ❖ EPS of Company MK Limited = Rs.5; EPS of NN Limited = Rs.6
- ❖ Exchange ratio should be on the basis of EPS so that shareholders are not a loss
- ❖ Base values are 5:6 and hence the exchange ratio should be 6:5

15. Synergy gain and swap ratio [May 2013, Nov 2015 MTP]

Longitude Limited is in the process of acquiring Latitude Limited on a share exchange basis. Following relevant data are available:

Particulars	Longitude Limited	Latitude Limited
PAT	140 lacs	60 lacs
Number of shares	15 lacs	16 lacs
Earnings per share	8	5
PE Multiple (ignore synergy)	15	10

You are required to determine:

- i. Pre-merger Market value per share, and
- ii. The maximum exchange ratio Longitude Limited can offer without the dilution of
 - a. EPS and
 - b. Market Value per share

Calculate Ratio/s up to four decimal points and amounts and number of shares up to two decimal points

Answer:

WN 1: Computation of pre-merger market value per share:

Particulars	Longitude Limited	Latitude Limited
Earnings per share	8	5
PE Multiple	15	10
MPS	120	50

Note: PAT given in the question does not match with EPS figure given in the question and the same looks to be a mistake

WN 2: Computation of exchange ratio:

Target	Swap ratio Basis	Base Value	Exchange Ratio
No dilution in EPS	Exchange ratio should be on the basis of EPS to have no impact on EPS	8:5	5:8 (or) 0.625:1
No dilution in MPS	Exchange ratio should be on the basis of MPS to have no impact on MPS	120:50	50:120 (or) 0.4167:1

16. Valuation for take-over:

Big Limited a chain of restaurants is considering going private limited. The president Rajan Baba believes that with the elimination of Shareholder servicing costs and other costs associated with public ownership, the company could save Rs. 8,00,000 per annum before taxes. In addition, the company believes management incentives and hence performance will be higher as a private company. As a result, annual profits are expected to be 10% greater than present after-tax profits of Rs 9 million. The effective tax rate is 30%, the price / earnings ratio of the Share is 12, and there are 10 million shares outstanding. What is the present market price per share? What is the maximum Rupees premium above this price that the company could pay in order to take the company into private Limited?

Answer:

WN 1: Computation of MPS as Public Limited and Private Limited

Particulars	Public Limited	Private Limited
PAT	90,00,000	1,04,60,000
No. of shares	1,00,00,000	1,00,00,000
EPS	0.90	1.046
PE Multiple	12	12
MPS	10.80	12.552

- ❖ PAT of Private Limited = 90,00,000 + 10% increase (9,00,000) + cost savings (5,60,000) = Rs.1,04,60,000
- ❖ The company can pay a premium of Rs.1.75 per share to take the company into private limited.

17. Post-merger MP for different PE Multiple:

Company Alpha is considering to acquire Company Beta. The financial data of the two companies are given in the following table:

Particulars	Company Alpha	Company Beta
PAT	40,000	8,000
Number of shares	10,000	4,000
EPS	4	2
Market value per share	60	15
PE Multiple	15	7.50
Total Market Capitalization	6,00,000	60,000

Company Alpha is considering to acquire Company Beta through exchange of shares in proportion to the market value per share.

If the price-earnings ratio is expected to be:

- (a) Pre-merger P/E ratio of Beta (7.50)
- (b) Pre-merger P/E ratio of Alpha (15)
- (c) Weighted average of Pre-merger P/E ratio of Alpha and Beta

What would be the impact on wealth of shareholders post-merger?

Answer:

WN 1: Computation of MPS post-merger for different scenarios:

Particulars	Alpha	Beta	Merged (PE of 7.50)	Merged (PE of 15)	Merged (Weighted average PE)
PAT	40,000	8,000	48,000	48,000	48,000
Number of shares	10,000	4,000	11,000	11,000	11,000
EPS	4	2	4.36	4.36	4.36

PE Multiple	15	7.50	7.50	15	13.75
Market value per share	60	15	32.70	65.40	60
Total Market Capitalization	6,00,000	60,000	3,59,700	7,19,400	6,60,000

Weighted average PE Multiple = $\frac{(40,000 \times 15) + (8,000 \times 7.50)}{48,000} = 13.75$

Shares to be issued to Beta = $(4,000 \times 15/60) = 1,000$ shares

WN 2: Computation of impact on shareholder's wealth for Part (a):

Particulars	Alpha	Beta
Pre-merger MPS	60	15
Post-merger MPS	32.70	8.175 [32.70 x 0.25]
Impact on MPS	(27.30)	(6.825)

WN 3: Computation of impact on shareholder's wealth for Part (b):

Particulars	Alpha	Beta
Pre-merger MPS	60	15
Post-merger MPS	65.40	16.35 [65.40 x 0.25]
Impact on MPS	5.40	1.35

WN 4: Computation of impact on shareholder's wealth for Part (c):

Particulars	Alpha	Beta
Pre-merger MPS	60	15
Post-merger MPS	60	15 [60 x 0.25]
Impact on MPS	0	0

18. Determination of exchange ratio [Nov 2019 RTP]:

XYZ Ltd. wants to purchase ABC Ltd. by exchanging 0.7 of its share for each share of ABC Ltd. Relevant financial data are as follows:

Particulars	XYZ Limited	ABC Limited
Equity shares outstanding	10,00,000	4,00,000
EPS	40	28
Market price per share	250	160

- Illustrate the impact of merger on EPS of both the companies.
- The management of ABC Ltd. has quoted a share exchange ratio of 1:1 for the merger. Assuming that P/E ratio of XYZ Ltd. will remain unchanged after the merger, what will be the gain from merger for ABC Ltd.?
- What will be the gain/loss to shareholders of XYZ Ltd.?
- Determine the maximum exchange ratio acceptable to shareholders of XYZ Ltd.

Answer:

WN 1: Valuation of XYZ, ABC and merged firm:

Particulars	XYZ	ABC	Merged (i)	Merged (ii)
PAT/EAES	4,00,00,000	1,12,00,000	5,12,00,000	5,12,00,000
No of equity shares	10,00,000	4,00,000	12,80,000	14,00,000
EPS	40	28	40	36.57
PE Multiple	6.25	5.71	6.25	6.25
MPS	250	160	250	228.56

Part (i):

Impact of merger on EPS:

Particulars	XYZ	ABC
Pre-merger EPS	40	28
Post-merger EPS	40	28 (40 x 0.7)
Gain/loss	-	-

Part (ii) & (iii)**Gain/loss from merger if ratio is 1:1**

Particulars	XYZ	ABC
Pre-merger MPS	250	160
Post-merger MPS	228.56	228.56
Gain/loss per share	(21.44)	68.56

Part (iv):

- Maximum exchange ratio should ensure that MPS remains Rs.250. MPS would remain at Rs.250 if EPS continues to be Rs.40
- EPS can be maintained if the exchange ratio is on the basis of EPS
- Base values = 40: 28
- **Exchange ratio = 28:40 (or) 0.70:1**

19. Exchange ratio and EPS:

Company A and Company B have the following financial data under consideration

Particulars	Company A	Company B
Present earnings (in lacs)	300	40
No of shares (thousands)	1,000	100
Price-earnings ratio	20	12

- In case, the company A and company B were to merge and exchange ratio were one share of company A for one share of company B, what would be the initial impact on earnings per share of the two companies. Shareholders of which company stand to gain?
- In case the exchange ratio was two shares of Company A for one share of Company B which company would find merger to be attractive
- Similarly, if the exchange ratio was 1.5 shares of Company A for one share of Company B what would happen?

Answer:**WN 1: Computation of EPS and MPS for different scenarios:**

Particulars	A	B	Merged (1:1)	Merged (2:1)	Merged (1.5:1)
PAT (lacs)	300	40	340	340	340
Number of shares (lacs)	10	1	11	12	11.5
EPS	30	40	30.91	28.33	29.57
PE Multiple	20	12	Not needed	Not needed	Not needed
Market value per share	600	480	Not needed	Not needed	Not needed

WN 2: Analysis of scenario 1(one share for every one share):

Particulars	A	B
Pre-merger EPS	30	40
Post-merger EPS	30.91	30.91 [30.91 x 1]
Impact of merger on EPS	0.91	(9.09)

Merger is favourable to company A as EPS increases from Rs.30 to Rs.30.91. However, the same will not be acceptable to company B as their EPS reduced from 40 to 30.91

WN 3: Analysis of scenario 2(two share for every one share):

Particulars	A	B
Pre-merger EPS	30	40
Post-merger EPS	28.33	56.66 [28.33 x 2]
Impact of merger on EPS	(1.67)	16.66

Swap ratio is favourable to company B but not acceptable to company A

WN 3: Analysis of scenario 3(1.5 shares for every one share):

Particulars	A	B

Pre-merger EPS	30	40
Post-merger EPS	29.57	44.35 [29.57 x 1.5]
Impact of merger on EPS	(0.43)	4.35

Swap ratio is favourable to company B but not acceptable to company A

20. Computation of maximum exchange ratio:

The share capital of Sun Ltd. consist of 3.5 lakhs Rs.10/- ordinary shares and that of Moon Ltd. consist of 2.2 lakh ordinary shares of Rs.10/- each.

Sun Ltd. is proposing to takeover Moon Ltd. The Pre-merger earnings are Rs.19 lakhs for Sun Ltd. and Rs.10 lakhs for Moon Ltd. The merger is expected to result into a synergy gains of Rs.4 lakhs in the form of Post tax cost savings. The Pre-merger P/E Ratios are 10 for Sun Ltd. and 8 for Moon Ltd. The possible combined P/E Ratios are 9 and 10.

You are required to calculate.

- Minimum combined P/E Ratio to justify the merger.
- Exchange ratio of shares if combined P/E ratio is 9.

Answer:

WN 1: Computation of minimum combined PE Multiple to justify the merger:

Particulars	Calculation	Amount
Pre-merger value of Sun Limited	19 lacs x 10	190 lacs
Pre-merger value of Moon Limited	10 lacs x 8	80 lacs
Total pre-merger value		270 lacs
Post-merger earnings	19 + 10 + 4	33 lacs
Minimum PE Multiple	$\frac{270 \text{ lacs}}{33 \text{ lacs}}$	8.18

WN 2: Computation of exchange ratio is combined PE Multiple is 9:

Particulars	Calculation	Amount
Post-merger value	33 lacs x 9	297 lacs
Minimum consideration (value of Moon Limited)		80 lacs
Maximum consideration (post-merger value - pre merger value)	297 - 190	107 lacs

Computation of minimum exchange ratio:

Particulars	Value	No of shares
Value of Moon Limited	80 lacs	1,29,032 $(3,50,000) \times \left(\frac{80}{217}\right)$
Value of Sun Limited	217 lacs	3,50,000
Value of merged entity	297 lacs	4,79,032

- ❖ No of shares allotted = 1,29,032
- ❖ Exchange ratio = 1,29,032:2,20,000 (or) 0.5865:1

Computation of maximum exchange ratio:

Particulars	Value	No of shares
Value of Moon Limited	107 lacs	1,97,105 $(3,50,000) \times \left(\frac{107}{190}\right)$
Value of Sun Limited	190 lacs	3,50,000
Value of merged entity	297 lacs	4,47,105

- ❖ No of shares allotted = 1,97,105
- ❖ Exchange ratio = 1,97,105: 2,20,000 (or) 0.8959:1

21. Computation of exchange ratio [May 2012 RTP]

AXE Ltd. is interested to acquire PB Ltd. AXE has 50,00,000 shares of Rs. 10 each, which are presently being quoted at Rs. 25 per share. On the other hand PB has 20,00,000 share of Rs. 10 each currently selling at Rs. 17. AXE and PB have EPS of Rs. 3.20 and Rs. 2.40 respectively.

You are required to:

- Show the impact of merger on EPS, in case if exchange ratio is based on relative proportion of EPS.

(b) Suppose, if AXE quote an offer of share exchange ratio of 1:1, then should PB accept the offer or not, assuming that there will be no change in PE ratio of AXE after the merger.

(c) The maximum ratio likely to acceptable to management of AXE.

Answer:

WN 1: Impact of merger on EPS:

- ❖ Swap ratio is based on EPS and hence the merger will have no impact on EPS. The same is being proved in the below calculation:

Particulars	AXE	PB	Merged (EPS Ratio)	Merged (1:1)
PAT	1,60,00,000	48,00,000	2,08,00,000	2,08,00,000
Number of shares	50,00,000	20,00,000	65,00,000	70,00,000
EPS	3.20	2.40	3.20	2.97
PE Multiple	7.8125	7.0833	7.8125	7.8125
Market value per share	25	17	25	23.20

- ❖ Base values for EPS 3.20:2.40; Swap ratio is 2.40:3.20. Hence shares allotted for part 1 is 20,00,000 x (2.40/3.20) = 15,00,000

Impact on merger:

Particulars	AXE	PB
Pre-merger EPS	3.20	2.40
Post-merger EPS	3.20	2.40
		[3.20 x 0.75]
Impact on EPS	-	-

WN 2: Impact of merger on PB Limited if the exchange ratio is 1:1:

Particulars	Calculation	Amount
Pre-merger Value	20,00,000 x 17	3,40,00,000
Post-merger value	20,00,000 x 23.20	4,64,00,000
Merger gain		1,24,00,000

- ❖ Merger will be acceptable to shareholders of PB Limited as there is synergy gain of Rs.124 lacs

WN 3: Maximum ratio acceptable to shareholders of AXE Limited:

Particulars	Calculation	Amount
Post-merger value	208 lacs x 7.8125	16,25,00,000
Target share price	MPS should remain same post-merger	25
Target shares post-merger	1625 lacs/25	65,00,000
Existing shares of AXE Limited		50,00,000
Maximum shares that can be allotted		15,00,000

- ❖ The company can issue 15,00,000 shares.

- ❖ Swap ratio = 15,00,000/20,00,000 = 0.75:1

22. Computation of minimum and maximum exchange ratio [Nov 2018, May 2021 MTP, May 2021 RTP]

C Limited and D Limited are contemplating a merger deal in which C Limited will acquire D Limited. The relevant information about the firms are given as follows:

Particulars	C Limited	D Limited
Total earnings (in millions)	Rs.96	Rs.30
No of shares	20	14
EPS	4.80	2.143
Price Earnings Ratio	8	7
Market price per share	38.40	15

- What is the maximum exchange ratio acceptable to the shareholders of C Limited, if the PE ratio of the combined firm is 7?
- What is the minimum exchange ratio acceptable to the shareholders of D Limited, if the PE ratio of the combined firm is 9?

Answer:

WN 1: Computation of market value of merged entity:

Particulars	C LTD	D Ltd	Merged firm (Part 1)	Merged Firm (Part 2)
PAT	96	30	126	126
PE Multiple	8	7	7	9
Value of firm (PAT x PE Multiple)	768	210	882	1134

WN 2: Computation of maximum exchange ratio acceptable to shareholders of C Limited:

Particulars	Calculation	Amount (in million)
Pre-merger value of C Limited		768
Post-merger value of C Limited		882
Maximum consideration to D Ltd shareholders	882 - 768	114
Shares to be issued: 768 million of C Limited = 20 million shares 114 million of D Limited = ? Shares	$\frac{114 \times 20}{768}$	2.96875 million
Existing shares of C Limited shareholders		14 million
Exchange ratio		2.96875: 14 (or) 0.212:1

WN 3: Computation of minimum exchange ratio acceptable to shareholders of D Limited:

Particulars	Calculation	Amount (in million)
Post-merger value of C Limited		1134
Minimum consideration to D Ltd shareholders (pre-merger value)		210
Value of C Limited shareholders	1134-210	924
Shares to be issued: 924 million of C Limited = 20 million shares 210 million of D Limited = ? Shares	$\frac{210 \times 20}{924}$	4.54545 million
Existing shares of C Limited shareholders		14 million
Exchange ratio		4.5454:14 (or) 0.325:1

23. Exchange ratio based on different basis:

A Limited want to take over B Limited and the financial details of both are as follows:

Particulars	A Limited	B Limited
Preference share capital	20,000	
Equity share capital of Rs.10 each	1,00,000	50,000
Share premium	-	2,000
Profit and Loss Account	38,000	4,000
10% Debentures	15,000	5,000
Total	1,73,000	61,000
Fixed assets	1,22,000	35,000
Current assets	51,000	26,000
Total	1,73,000	61,000
Profit after tax after preference dividend	24,000	15,000
Market Price	24	27

What should be share exchange ratio to be offered to the shareholders of B Limited based on

- net assets value
- EPS
- Market price

Which should be preferred from the point of view of A Limited.

Answer:**WN 1: Computation of exchange ratio based on net assets method:**

Particulars	A Limited	B Limited
Total assets	1,73,000	61,000
Less: 10% Debentures	(15,000)	(5,000)
Less: Preference share capital	(20,000)	-
Net Assets	1,38,000	56,000
No of shares	10,000	5,000

Value per share	13.80	11.20

- ❖ Base values = 13.80:11.20
- ❖ Exchange ratio = 11.20:13.80 (or) 0.812:1

WN 2: Computation of exchange ratio based on EPS:

Particulars	A Limited	B Limited
EAES	24,000	15,000
No of shares	10,000	5,000
EPS	2.40	3.00

- ❖ Base values = 2.40: 3.00
- ❖ Exchange ratio = 3:00:2.40 (or) 1.25:1

WN 3: Computation of exchange ratio based on MPS:

- ❖ Base values = 24:27
- ❖ Exchange ratio = 27:24 (or) 1.125:1

Preferred ratio:

- ❖ Company A would prefer exchange ratio on the basis of net assets method as the same will lead to allotment of lower number of shares.

24. Merger and synergy gain:

Company X plans to acquire Company Y. You are required to show merger gains using following data:

Particulars	X Limited	Y Limited
Pre-merger MPS	60	30
Number of shares	14 lacs	7 lacs

The merger gain is expected to be Rs.150 lacs. X Limited has offered 1 share for every 2 shares of Y Limited.

Answer:**WN 1: Computation of post-merger MPS:**

Particulars	Amount (in lacs)
Pre-merger Value of X Limited (60 x 14)	840
Pre-merger value of Y Limited (30 x 7)	210
Synergy gain	150
Total value	1,200
Number of shares (14 + 7 x 0.5)	17.50
Post-merger MPS	68.57

WN 2: Synergy gains for shareholders:

Particulars	X Limited	Y Limited
Pre-merger value	840	210
Post-merger value	960 [68.57 x 14]	240 [68.57 x 3.5]
Synergy gain	120	30

25. Computation of synergy gain:

Companies X and Y are in the same business line generating annual cash flows of Rs.15 lacs and Rs.8 lacs respectively. If the two firms decide to merge together, a post-tax cost saving of Rs.2 lacs every year is expected to occur. X Limited proposes to absorb Y Limited on paying a cash consideration of Rs.60 lacs. The cost of capital is 15%. What are the merger gains to be allocated to shareholders?

Answer:**WN 1: Computation of merger gain and post-merger value:**

Particulars	Amount (in lacs)
Pre-merger Value of X Limited (15 lacs/15%)	100
Pre-merger value of Y Limited (8 lacs/15%)	53.33
Synergy gain (2 lacs/15%)	13.33
Total value	166.66

WN 2: Synergy gains for shareholders:

Particulars	X Limited	Y Limited

Pre-merger value	100	53.33
Post-merger value/ Consideration paid	106.66	60
Synergy gain	6.66	6.67

26. Swap Ratio [May 2022, Nov 2010]

P Limited is considering take-over of R Limited by the exchange of five new shares in P Limited, for every eight shares in R Limited. The relevant financial details of the two companies prior to merger announcement are as follows:

	P Limited	R Limited
Profit before tax (Rs. Crores)	18	20.80
No of shares (Crores)	20	18
PE ratio	11	8
Corporate tax rate = 30%		

You are required to determine:

- Market value of both the company
- Value of original shareholders
- Price per share after merger
- Effect on share price of both the company if the Directors of P Limited expect their own pre-merger PE ratio to be applied to the combined earnings

Answer:

WN 1: Completion of merger table:

(in lacs)

Particulars	P Limited	R Limited	Merged Same PE
PBT	1,800	2,080	3,880
Less: Tax	-540	-624	-1,164
PAT	1,260	1,456	2,716
No of equity shares	2,000	1,800	3,125
EPS	0.63	0.81	0.87
PE Multiple	11	8	11
MPS	6.93	6.48	9.57
No of equity shares	2,000	1,800	Not reqd
Market value of firm	13,860	11,664	Not reqd

WN 2: Solution (part a to b)

(in lacs)

Market value of P Limited		13,860
Market value of R Limited		11,664
Value of combined firm for computation of original shareholders	13,860 + 11,664	25,524
Value of original shareholders:		
Original shareholders of P Ltd	$25,524 \times \left(\frac{2,000}{3,125}\right)$	16,335
Original shareholders of R Ltd	$25,524 \times \left(\frac{1,125}{3,125}\right)$	9,189

WN 3: Effect on share price and price after merger (Part c and d)

- Price after merger = Rs.9.57 (as per above table)

Particulars	P Limited	R Limited
Pre-merger price	6.93	6.48
Post-merger adjusted price	9.57	5.97 (9.57x (5/8))
Gain/loss per share	2.64	-0.51
% change	38.10% $\left[\frac{9.57 - 6.93}{6.93} \times 100\right]$	-7.87% $\left[\frac{5.97 - 6.48}{6.48} \times 100\right]$

27. Minimum and maximum exchange ratio

A Limited plan to acquire B Limited. The following information is provided:

Particulars	A Limited	B Limited
MPS	Rs.300	Rs.200
EPS	Rs.25	Rs.20
No of equity shares	20 lacs	10 lacs
PE Multiple	12	10

- ❖ What is the maximum exchange ratio acceptable to the shareholders of A Limited if the PE ratio after on acquisition is 11 with no synergy gain?
- ❖ What is the minimum exchange ratio acceptable if PE multiple is 11.50 and synergy is 5%?

Answer:

WN 1: Computation of maximum exchange ratio:

Completion of Merger table:

(in lacs)

Particulars	A Limited	B Limited	Merged
PAT/EAES	500	200	700
No of equity shares	20	10	25.66923
EPS	25	20	27.2727
PE Multiple	12	10	11
MPS	300	200	300
No of equity shares	20	10	25.66923
Market value of firm	6,000	2,000	7,700

- Maximum exchange ratio is computed from acquiring company point of view (A Limited)
- A Limited will accept an exchange ratio which leads to price being at minimum of Rs.300
- Merged table is filled in the following manner
 - $PAT = 500 + 200 = 700$ lacs
 - $PE \text{ Multiple} = 11$ Times
 - $MPS = 300$
 - $EPS = 300/11 = 27.2727$ Times
 - $No \text{ of equity shares} = 700/27.2727 = 25.66923$ lacs
- **No of shares to be issued in merger = 25.66923 lacs – 20 lacs = 5.66923 lacs**
- **Exchange ratio = 5.66923:10 (or) 0.566923:1**

WN 2: Computation of minimum exchange ratio:

- Minimum exchange ratio is computed from target company point of view (B Limited).
- B Limited will accept an exchange ratio which leads to purchase consideration of Rs.2,000 lacs
- **Post-merger value of Firm = PAT of merged entity x PE Multiple = (700 lacs + 5%) x 11.50 = Rs.8,452.50 lacs**
- No of shares to be issued is computed in the below table:

Particulars	Value in lacs	No of Shares
Existing shareholders of A Limited	6,452.50	20,00,000
Existing shareholders of B Limited	2,000.00	6,19,915
Merged Entity	8,452.50	26,19,915

- Merged entity has value of Rs.8,452.50 lacs. Of this Rs.2,000 lacs are to be given to shareholders of B Limited and balance 6,452.50 lacs will belong to shareholders of A Limited

• 20,00,000 shares = 6,452.50 lacs • ? Shares = 2,000 lacs
$No \text{ of shares to be issued} = \frac{2,000}{6,452.50} \times 20,00,000 = 6,19,915 \text{ shares}$

- **Minimum Exchange ratio = 6,19,915:10,00,000 (or) 0.619915:1**

28. Weighted swap ratio [May 2005, May 2011, May 2009, May 2017 MTP, May 2018 MTP, May 2020 RTP, Nov 2020]

The following information relating to the acquiring Company Abhiman Ltd. and the target Company Abhishek Ltd. are available. Both the Companies are promoted by Multinational Company, Trident Ltd. The promoter's holding is 50% and 60% respectively in Abhiman Ltd. and Abhishek Ltd. :

Particulars	Abhiman Limited	Abhishek Limited

Share capital	200 lakh	100 lakh
Free reserves and surplus	800 lakh	500 lakh
Paid up value per share	100	10
Free float market capitalization	400 lakh	128 lakh
PE ratio (times)	10	4

Trident Ltd. is interested to do justice to the shareholders of both the Companies. For the swap ratio weights are assigned to different parameters by the Board of Directors as follows:

- ❖ Book Value 25%
- ❖ EPS (Earning per share) 50%
- ❖ Market Price 25%

Required:

- a) What is the swap ratio based on above weights?
- b) What is the Book Value, EPS and expected Market price of Abhiman Ltd. After acquisition of Abhishek Ltd. (assuming P.E. ratio of Abhiman Ltd. remains unchanged and all assets and liabilities of Abhishek Ltd. are taken over at book value).
- c) **Calculate:**
 - a. Promoter's revised holding in the Abhiman Ltd.
 - b. Free float market capitalization.
 - c. Also calculate No. of Shares, Earning per Share (EPS) and Book Value (B.V.), if after acquisition of Abhishek Ltd., Abhiman Ltd. decided to :
 - i. Issue Bonus shares in the ratio of 1 : 2; and
 - ii. Split the stock (share) as Rs. 5 each fully paid.

Answer:

WN 1: Basic information:

(in lacs)

Particulars	Abhiman	Abhishek
PAT/EAES	80	80
No of equity shares	2	10
EPS	40	8
PE Multiple	10	4
MPS	400	32
No of equity shares	2	10
Market value of firm	800	320

Note:

- Free-float market capitalization refers to value of shareholding of non-promoters
- Total market value of firm for both companies is calculated as under:

Particulars	Abhiman	Abhishek
Free Float Market capitalization (A)	400	128
Non-promoter shareholding (B)	50%	40%
Total Value of firm (A/B)	800	320

- Based on total value of firm and no of equity shares we reverse work and get MPS. Based on MPS and PE Multiple, we get EPS. Based on EPS and no of shares we get PAT
- Book value per share for both companies is computed as under:

Particulars	Abhiman	Abhishek
Share capital	200	100
Reserves and surplus	800	500
Total Networth (A)	1,000	600
No of shares (B)	2	10
Book value per share (A/B)	500	60

WN 2: Computation of no of shares to be issued and exchange ratio:

Particulars	Base values	Swap Ratio	Shares to be allotted	Weight	Product
Book value	500:60	60:500	1,20,000 (10,00,000 × 60/500)	0.25	30,000
EPS	40:8	8:40	2,00,000 (10,00,000 × 8/40)	0.50	1,00,000
MPS	400:32	32:400	80,000	0.25	20,000

			(10,00,000 × 32/400)		
No of shares to be issued					1,50,000

- Exchange ratio = 1,50,000:10,00,000 (or) 0.15:1

WN 2: Computation of Book value, EPS and Market price post Acquisition:

Particulars	Amount (in lacs)
PAT/EAES (80 + 80)	160
No of equity shares (2 + 1.5)	3.5
EPS (160/3.50)	45.7143
PE Multiple	10
MPS (45.7143 × 10)	457.14
No of equity shares	3.5
Market value of firm (457.15 × 3.5)	1,600
Networth of merged entity (1,000 + 600)	1,600
No of shares of merged entity	3.5
Book value per share of merged entity	457.14

WN 3: Computation of revised holding of promoters and free-float market capitalization:**Revised holding of promoters:**

Particulars	Abhiman	Abhishek	Total
Shares held by original shareholders in merged entity	2,00,000	1,50,000	3,50,000
Promoter holding	50%	60%	54.29%
Shares held by promoters	1,00,000	90,000	1,90,000

- Promoter shareholding in merged entity = $(1,90,000/3,50,000) \times 100 = 54.29\%$

Free-float market capitalization:

- Free-float market capitalization = 1,600 lacs × (100% - 54.29%) = Rs.731.36 lacs

WN 4: Computation of revised No of shares, EPS and Book value per share post bonus and split:

- The merged entity currently has 3,50,000 shares. The company plans to make bonus issue in the ratio of 1:2. This will increase the no of shares to 5,25,000 (3,50,000 + 1,75,000 bonus shares)
- The company plans to split Rs.100 share into Rs.5 share. This will lead to one share becoming 20 shares. Hence 5,25,000 shares will become 105 lacs shares
- **No of shares post bonus and split = 105 lacs**
- **EPS = (160 lacs/105 lacs) = Rs.1.52381 per share**
- **Book value per share = (1,600 lacs/105 lacs) = Rs.15.2381**

29. Synergy gain [May 2007]

AFC Ltd. wishes to acquire BCD Ltd. The shares issued by the two companies are 10,00,000 and 5,00,000 respectively:

- Calculate the increase in the total value of BCD Ltd. resulting from the acquisition on the basis of the following conditions:
 - ❖ Current expected growth rate of BCD Ltd. = 7%
 - ❖ Expected growth rate under control of AFC Ltd., (without any additional capital investment and without any change in risk of operations) = 8%
 - ❖ Current Market price per share of AFC Ltd. = Rs.100
 - ❖ Current Market price per share of BCD Ltd. = Rs.20
 - ❖ Expected Dividend per share of BCD Ltd. = Rs.0.60
- On the basis of aforesaid conditions calculate the gain or loss to shareholders of both the companies, if AFC Ltd. were to offer one of its shares for every four shares of BCD Ltd.
- Calculate the gain to the shareholders of both the Companies, if AFC Ltd. pays Rs.22 for each share of BCD Ltd., assuming the P/E Ratio of AFC Ltd. does not change after the merger. EPS of AFC Ltd. is Rs.8 and that of BCD is Rs.2.50. It is assumed that AFC Ltd. invests its cash to earn 10%.

Answer:**WN 1: Computation of increase in value of BCD Limited due to merger:**

- Growth rate of BCD Limited will increase from 7% to 8%. This will lead to higher valuation for BCD Limited as it will grow at higher rate under AFC Limited

- Current cost of equity of BCD Limited is computed as per Gordon's model:

$$P_0 = \frac{D_1}{K_e - G}; 20 = \frac{0.60}{K_e - 7\%}; K_e - 0.07 = \frac{0.60}{20}; K_e = 0.03 + 0.07 = 10\%$$

- The cost of equity of BCD Limited is 10%. However now the growth rate has increased from 7% to 8% and this will lead to higher valuation of share

$$P_0 = \frac{D_1}{K_e - G}; P_0 = \frac{0.6}{10\% - 8\%} = \frac{0.6}{2\%} = \text{Rs. } 30$$

- Share price is expected to increase from Rs.20 per share to Rs.30 per share. **Hence increase in value of BCD Limited due to acquisition = 5,00,000 x (30 - 20) = Rs.50,00,000**

WN 2: Computation of gain or loss to shareholders of both companies:

$$\text{Post merger MP} = \frac{(10,00,000 \times 100) + (5,00,000 \times 30)}{10,00,000 + 1,25,000} = 102.22 \text{ per share}$$

Particulars	AFC Limited	BCD Limited
Pre-merger value		
No of shares	10,00,000	5,00,000
Market price per share	100	20
Value of shareholders	10,00,00,000	1,00,00,000
Post-merger value		
No of shares	10,00,000	1,25,000
Market price per share	102.22	102.22
Value of shareholders	10,22,20,000	1,27,77,500
Overall gain/loss (A)	22,20,000	27,77,500
Pre-merger no of shares (B)	10,00,000	5,00,000
Gain per share (A/B)	2.22	5.55

WN 3: Computation of gain or loss if cash consideration is paid:

BCD Limited:

- The company pays cash consideration of Rs.22 per share. Their existing market price is Rs.20 per share and hence shareholders have a net gain of Rs.2 per share
- Overall gain = 2 x 5,00,000 shares = Rs.10,00,000

AFC Limited:

- Company is paying cash consideration and hence there will be no change in the number of shares. We should compute revised EPS and based on that revised MPS can be calculated

Particulars	Amount
Total earnings of AFC Limited (8 x 10,00,000)	80,00,000
Total earnings of BCD Limited (2.5 x 5,00,000)	12,50,000
Less: Loss in interest income on consideration paid (5,00,000 x 22 x 10%)	-11,00,000
Revised earnings of AFC Limited post acquisition	81,50,000
No of shares	10,00,000
Post-acquisition EPS	8.15
PE Multiple (100/8)	12.50
Post-acquisition MPS	101.875

- Value of share increases from Rs.100 to Rs.101.875. Hence gain per share = Rs.1.875
- Total gain = 1.875 x 10,00,000 = Rs.18,75,000**

30. Synergy gains

A Limited is considering the purchase of B Limited. The cash inflow after taxes of B Limited is estimated to be Rs.5 lacs per year in the future. This forecast by A Limited does not include expected merger synergy gains. B Limited currently has total assets of Rs.50 lacs with 20% of the total assets being financed with debt funds. A Limited's pre-merger weighted average cost of capital is 15%.

- ❖ Based on A Limited pre-merger cost of capital, what is the maximum purchase price that A Limited would be willing to pay to acquire B Limited

- ❖ Assume that by acquiring B Ltd, A Ltd will move towards an optimal capital structure such that its WACC will be 12% post acquisition. Under these conditions, what would be the maximum price of A Limited should be willing to pay?
- ❖ Assume that cash flows for B Limited estimated at Rs.15 lacs for the coming year, will grow at a rate of 20% per year for the following two years, and will be on level thereafter. Each rupee increase in cash flows will require Re.0.7 incremental investment in assets. Estimated the maximum purchase price for B Limited based on 12% cost of capital.

Answer:

WN 1: Computation of maximum purchase price based on A Limited's per-merger cost of capital:

$$\text{Maximum Price} = \frac{\text{Annual cash flow}}{\text{Cost of capital}} = \frac{5,00,000}{15\%} = \text{Rs. } 33,33,333$$

WN 2: Computation of maximum price based on revised cost of capital:

$$\text{Maximum Price} = \frac{\text{Annual cash flow}}{\text{Cost of capital}} = \frac{5,00,000}{12\%} = \text{Rs. } 41,66,667$$

WN 3: Computation of maximum purchase price for scenario (iii):

Year	CF	PVF@ 12%	DCF
1	15,00,000	0.893	13,39,500
2	15,90,000	0.797	12,67,230
3	19,08,000	0.712	13,58,496
3	1,59,00,000	0.712	1,13,20,800
Maximum Purchase Price			1,52,86,026

Note:

- Cash flows of year 1 = Rs.15,00,000
- Cash flow of year 2 = 15,00,000 + (20% of 15,00,000) - (0.7 × 3,00,000) = Rs.15,90,000
- Cash flow of year 3 = 18,00,000 + (20% of 18,00,000) - (0.7 × 3,60,000) = Rs.19,08,000

$$\text{PV of perpetuity (Year 3)} = \frac{\text{CF of year 4 (19,08,000)}}{12\%} = \text{Rs. } 1,59,00,000$$

31. EPS/PE/ROE/Book value per share analysis [May 2018 MTP, Nov 2008, Nov 2018 MTP, May 2015, Jan 2021]

BA Limited and DA Limited both the companies operate in the same industry. The Financial statements of both the companies for the current financial year are as follows:

Particulars	BA Limited	DA Limited
Current Assets	14,00,000	10,00,000
Fixed Assets (net)	10,00,000	5,00,000
Total Assets	24,00,000	15,00,000
Equity capital (Rs.10 each)	10,00,000	8,00,000
Retained earnings	2,00,000	-
14% long-term debt	5,00,000	3,00,000
Current Liabilities	7,00,000	4,00,000
Total Liabilities	24,00,000	15,00,000

Income statement:

Particulars	BA Limited	DA Limited
Net sales	34,50,000	17,00,000
Cost of goods sold	27,60,000	13,60,000
Gross Profit	6,90,000	3,40,000
Operating expenses	2,00,000	1,00,000
Interest	70,000	42,000
Earnings before taxes	4,20,000	1,98,000
Taxes @ 50%	2,10,000	99,000
Earnings after taxes	2,10,000	99,000
No of equity shares	1,00,000	80,000
Dividend Payout Ratio	40%	60%
Market price per share	40	15

Assume that both companies are in the process of negotiating a merger through an exchange of equity shares. You have been asked to assist in establishing equitable exchange terms and are required to:

- (i) Decompose the share price of both the companies into EPS and P/E components; and also segregate their EPS figures into Return on Equity (ROE) and book value/intrinsic value per share components.
- (ii) Estimate future EPS growth rates for each company.
- (iii) Based on expected operating synergies BA Ltd. estimates that the intrinsic value of DA's equity share would be Rs.20 per share on its acquisition. You are required to develop a range of justifiable equity share exchange ratios that can be offered by BA Ltd. to the shareholders of DA Ltd. Based on your analysis in part (i) and (ii), would you expect the negotiated terms to be closer to the upper, or the lower exchange ratio limits and why?
- (iv) Calculate the post-merger EPS based on an exchange ratio of 0.4: 1 being offered by BA Ltd. and indicate the immediate EPS accretion or dilution, if any, that will occur for each group of shareholders.
- (v) Based on a 0.4: 1 exchange ratio and assuming that BA Ltd.'s pre-merger P/E ratio will continue after the merger, estimate the post-merger market price. Also show the resulting accretion or dilution in pre-merger market prices.

Answer:

WN 1: Computation of EPS, PE, ROE and Book value per share:

Particulars	BA Limited	DA Limited	Merged Entity
EAT	2,10,000	99,000	3,09,000
No of shares	1,00,000	80,000	1,32,000
EPS	2.10	1.2375	2.3409
PE Multiple (MPS/EPS)	19.05	12.12	19.05
MPS	40	15	44.59
Book value per share (Equity/No of shares)	12	10	Not needed
ROE (EPS/BVPS) x 100	17.50%	12.37%	Not needed

WN 2: Computation of growth rates:

Particulars	BA Limited	DA Limited
Dividend payout ratio	40%	60%
Retention ratio	60%	40%
ROE	17.50%	12.37%
Growth rate (ROE x Retention ratio)	10.50%	4.95%

WN 3: Identification of justifiable exchange ratio:

Basis	Base value	Swap Ratio	Limit
Intrinsic value	40:20	20:40 (or) 0.5:1	Upper Limit
Market value	40:15	15:40 (or) 0.375:1	Lower Limit

Since, BA Limited has a higher EPS, ROE, PE Multiple and higher EPS growth expectations, the negotiable terms would be expected to be closer to the lower limit, based on the existing share prices.

WN 4: Computation of EPS/MPS accretion or dilution due to merger:

Particulars	BA Limited	DA Limited
Existing EPS	2.1000	1.2375
New EPS	2.3409	0.9364 [2.3409 x 40%]
Impact on EPS	0.2409	(0.3011)
Existing MPS	40	15
New Price	44.59	17.84 [44.59 x 40%]
Impact on MPS	4.59	2.84

32. Fixing swap ratio [May 2015, May 2018]

Bank 'R' was established in 2005 and doing banking in India. The bank is facing DO OR DIE Situation There are problems of gross NPA(Non-performing Assets) at 40 % & CAR/CRAR (Capital Adequacy ratio/Capital risk weight asset ratio) at 4%.The net worth of the bank is not good. Shares are not traded regularly. Last week, it was traded @Rs.8 per share RBI Audit suggested that bank has either to liquidate or to merge with other bank. Bank 'P' is professionally managed bank with low gross NPA of 5%.It has Net NPA as 0% and CAR at 16%.Its Share is quoted in the market @Rs.128 per share. The Board of directors of bank 'P' has submitted a proposal to RBI for takeover of bank 'R' on the basis of share exchange ratio.

The balance sheet details of both the banks are as follows:

Particulars	Bank R Amount in lacs	Bank P Amount in lacs
Paid up share capital	140	500
Reserves & surplus	70	5,500
Deposits	4,000	40,000
Other liabilities	890	2,500
Total liabilities	5,100	48,500
Cash in hand & with RBI	400	2,500
Balance with other banks	-	2,000
Investments	1,100	15,000
Advances	3,500	27,000
Other assets	100	2,000
Total assets	5,100	48,500

It was decided to issue shares at Book value of bank 'P' to the shareholders of Bank 'R'. All assets and liabilities are to be taken over at book value. For the swap ratio, weights assigned to different parameters are as follows:

- ❖ Gross NPA - 30 %
- ❖ CAR - 20%
- ❖ Market Price - 40 %
- ❖ Book Value - 10 %

Required:

- a) What is the swap ratio based on above weights?
- b) How many shares are to be issued?
- c) Prepare Balance sheet after merger.
- d) Calculate CAR & Gross NPA% of Bank 'P' after merger.

Answer:

WN 1: Computation of shares to be issued and swap ratio:

Parameter	Base value	Swap Ratio	Shares to be issued (in lacs)	Weight	Product
Gross NPA	5:40	5:40	1.75	0.3	0.525
CAR	16:4	4:16	3.50	0.2	0.700
Market Price	128:8	8:128	0.875	0.4	0.350
Book value	120:15	15:120	1.75	0.1	0.175
Shares to be issued					1.75

Note:

- ❖ Swap Ratio is the swap of base values for all positive parameters like CAR, Market Price and Book value. However, for negative parameters like Gross NPA the base value and swap ratio would remain same
- ❖ Book value of Bank R = $(140+70)/14 = \text{Rs.15 per share}$
- ❖ Book value of Bank P = $(500 + 5,500)/50 = \text{Rs.120 per share}$
- ❖ **Final swap ratio = 1.75 lac shares for 14 lacs shares. Hence it will be 1 share for every 8 shares**
- ❖ **Swap ratio = 1:8 (or) 0.125:1**

Note: It is assumed that face value of share is Rs.10 for computing the no of shares.

WN 2: Computation of Goodwill/Capital Reserve on Acquisition:

Particulars	Amount (in lacs)
Shares issued	1.75
Issue price (par value)	10
Consideration paid	17.50

Assets taken over	210
Capital Reserve	192.50

WN 3: Balance Sheet post-merger:

Particulars	Bank R (in lacs)
Liabilities	
Paid up capital (500 + 1.75 x 10)	517.50
Capital Reserve	192.50
Other Reserves and surplus	5,500
Deposits (4,000 + 40,000)	44,000
Other liabilities (890 + 2,500)	3,390
Total Liabilities	53,600
Cash in hand and with RBI (400 + 2,500)	2,900
Balance with other banks	2,000
Investments (1,100 + 15,000)	16,100
Advances (3,500 + 27,000)	30,500
Other Assets (100 + 2,000)	2,100
Total Assets	53,600

WN 4: Computation of Gross NPA % of merged Bank:

(in lacs)

Particulars	Bank R	Bank P	Merged
Total Advances	3,500	27,000	30,500
GNPA %	40	5	9.02
GNPA (in Rs.)	1,400	1,350	2,750
Advances x GNPA %			

$$\text{GNPA \% of merged bank} = \frac{2,750}{30,500} \times 100 = 9.02\%$$

WN 5: Computation of Capital Adequacy Ratio of Merged Bank:

(in lacs)

Particulars	Bank R	Bank P	Merged
Capital	210	6,000	6,210
Capital Adequacy Ratio (5)	4	16	14.53
Risk weighted assets	5,250	37,500	42,750

$$\text{CAR} = \frac{\text{Capital}}{\text{Risk Weighted Assets}}; \text{Risk weighted assets} = \frac{\text{Capital}}{\text{CAR}}$$

- Risk weighted assets of Bank R = (210/4%) = Rs.5,250
- Risk weighted assets of Bank P = (6,000/16%) = Rs.37,500
- CAR of merged bank = (6,210/42,750) x 100 = 14.53%

33. Bank merger:

During the audit of the weak Bank (W), RBI has suggested that the Bank should either merger with another bank or may close down. Strong Bank (S) has submitted a proposal of merger of weak bank with itself. The relevant information and Balance Sheets of both the companies are as under:

Particulars	Weak Bank	Strong Bank	Assigned Weight
Gross NPA (%)	40	5	30
CAR (Total capital/Risk weighted assets)	5	16	28
MPS	12	96	32
Book value			10
Trading on stock exchange	Irregular	Frequent	

Balance Sheet (Amount in lacs)

Particulars	Weak Bank	Strong Bank
Paid up share capital (Rs.10 per share)	150	500
Reserves and surplus	80	5,500
Deposits	4,000	44,000

Other liabilities	890	2,500
Total Liabilities	5,120	52,500
Cash in hand and with RBI	400	2,500
Balance with other bank	-	2,000
Investments	1,100	19,000
Advances	3,500	27,000
Other Assets	70	2,000
Preliminary expenses	50	-
Total Assets	5,120	52,500

You are required to

- Calculate swap ratio based on the above weights
- Ascertain the number of shares to be issued to weak bank
- Prepare balance sheet after merger and
- Calculate CAR and Gross NPA of strong Bank after merger

Answer:

WN 1: Computation of shares to be issued and swap ratio:

Parameter	Base value	Swap Ratio	Shares to be issued	Weight	Product
Gross NPA	5:40	5:40	1,87,500	0.3	56,250
CAR	16:5	5:16	4,68,750	0.28	1,31,250
Market Price	96:12	12:96	1,87,500	0.32	60,000
Book value	120:12	12:120	1,50,000	0.1	15,000
Shares to be issued					2,62,500

Note:

- ❖ Swap Ratio is the swap of base values for all positive parameters like CAR, Market Price and Book value. However, for negative parameters like Gross NPA the base value and swap ratio would remain same
- ❖ Book value of Weak Bank = $(150 + 80 - 50)/15 = \text{Rs.12 per share}$
- ❖ Book value of Strong Bank = $(500 + 5,500)/50 = \text{Rs.120 per share}$
- ❖ **Final swap ratio = 2,62,500 for 15,00,000 shares. Hence it will be 0.175 shares for every one share.**
- ❖ **Swap ratio = 0.175:1**

WN 2: Computation of Goodwill/Capital Reserve on Acquisition:

Particulars	Amount (in lacs)
Shares issued	2.625
Issue price (par value)	10
Consideration paid	26.25
Assets taken over	180
Capital Reserve	153.75

WN 3: Balance Sheet post-merger:

Particulars	Merged Bank (in lacs)
Liabilities	
Paid up capital (Rs.10)	526.25
Capital Reserve	153.75
Other reserves and surplus	5,500
Deposits	48,000
Other liabilities	3,390
Total Liabilities	57,570
Cash in hand and with RBI	2,900
Balance with other banks	2,000
Investments	20,100
Advances	30,500
Other Assets	2,070
Total Assets	57,570

WN 4: Computation of Gross NPA post-merger:

Particulars	Weak Bank	Strong Bank	Merged Bank
Total Advances	3,500	27,000	30,500
GNPA (%)	40	5	9.02% [2,750/30,500]
GNPA (in lacs)	1,400 [3,500 × 40%]	1,350 [27,000 × 5%]	2,750 [1,400 + 1,350]

WN 5: Computation of CAR post-merger:

Particulars	Weak Bank	Strong Bank	Merged Bank
Total Capital	180	6,000	6,180
CAR (%)	5%	16%	15.04% [6,180/41,100]
Risk weighted assets (%)	3,600 [180/5%]	37,500 [6,000/16%]	41,100 [3,600 + 37,500]

34. Exchange ratio [May 2015 RTP, Nov 2017 MTP]

Hanky Limited and Shanky Limited operate in the same field, manufacturing newly born babies clothes. Although Shanky Limited also has interests in communication equipments, Hanky Limited is planning to take over Shanky Limited and the shareholders of Shanky Limited do not regard it as a hostile bid.

The following information is available about the two companies:

Particulars	Hanky Limited	Shanky Limited
Current earnings	6,50,00,000	2,40,00,000
Number of shares	50,00,000	15,00,000
Percentage of retained earnings	20%	80%
Return on new investment	15%	15%
Return required by equity shareholders	21%	24%

Dividends have just been paid and the retained earnings have already been reinvested in new projects. Hanky Limited plans to adopt a policy of retaining 35% of earnings after the takeover and expects to achieve a 17% return on investment. Savings due to economies of scale are expected to be Rs.85,00,000 per annum. Required return to equity shareholders will fall to 20% due to portfolio effects.

Required:

- Calculate the existing share prices of Hanky Limited and Shanky Limited
- Find the value of Hanky Limited after the takeover
- Advise Hanky Limited on the maximum amount it should pay for Shanky Limited

Answer:**WN 1: Computation of existing share prices:**

Particulars	Hanky Limited	Shanky Limited
PAT	6,50,00,000	2,40,00,000
Number of shares	50,00,000	15,00,000
EPS	13.00	16.00
Growth rate:		
Retention ratio	20%	80%
Return on new investment	15%	15%
Growth rate	3%	12%
DPS of next year:		
DPS (EPS × payout ratio)	10.40	3.20
DPS of next year (DPS + Growth)	10.712	3.584
Cost of equity	21%	24%
Existing price	59.51 10.712 21% – 3%	29.87 3.584 24% – 12%

WN 2: Value of Hanky Limited after takeover:**Note 1: Next year earnings of merged entity:**

Particulars	Amount
PAT of Hanky Limited	6,50,00,000
PAT of next year (6,50,00,000 x 1.03)	6,69,50,000
PAT of Shanky Limited	2,40,00,000
PAT of next year (2,40,00,000 x 1.12)	2,68,80,000
Cost savings	85,00,000
Next year earnings of merged entity [6,69,50,000 + 2,68,80,000 + 85,00,000]	10,23,30,000

- The company has already made invested in new projects and hence the next year PAT of individual entity has been computed based on individual growth rate and cost savings

Note 2: Valuation post-merger:

Particulars	Amount
PAT	10,23,30,000
Payout ratio	65%
Total Dividend	6,65,14,500
Growth rate:	
Retention ratio	35%
Return on new investment	17%
Growth rate	5.95%
Post-merger value 6,65,14,500 20% – 5.95%	Rs.47,34,12,811

WN 3: Computation of maximum consideration:

Particulars	Amount
Post-merger value	47,34,12,811
Pre-merger value (59.51 x 50,00,000)	29,75,50,000
Maximum consideration	17,58,62,811

35. Shares to be issued to comply with SEBI guidelines [Nov 2013, Nov 2016 MTP, May 2018]

Trupti Co. Ltd. promoted by a Multinational group "INTERNATIONAL INC" is listed on stock exchange holding 84% i.e. 63 lakhs shares.

- ❖ Profit after Tax is Rs. 4.80 crores.
- ❖ Free Float Market Capitalisation is Rs. 19.20 crores

As per the SEBI guidelines promoters have to restrict their holding to 75% to avoid delisting from the stock exchange. Board of Directors has decided not to delist the share but to comply with the SEBI guidelines by issuing Bonus shares to minority shareholders while maintaining the same P/E ratio. **Calculate**

- P/E Ratio
- Bonus Ratio
- Market price of share before and after the issue of bonus shares
- Free Float Market capitalization of the company after the bonus shares.

Answer:**WN 1: Computation of PE Multiple:**

Particulars	Amount (in lacs)
Profit after Tax	480
P/E Multiple [Total Market Cap/Profit after Tax] [Bal figure]	25 times [12,000/480]
Total Market Capitalization [Free Float Market Cap/Public holding%]	12,000 [1920/16%]

WN 2: Computation of Bonus Ratio:

Particulars	Amount
Existing shares by promoters	63 lacs
Existing shareholding of promoters	84%
Total Shares [63 lacs/84%]	75 lacs
Target shareholding of promoters	75%

Target total shares for 75% promoter holding [63 lacs/75%]	84 lacs
Bonus shares to be issued [84 lacs – 75 lacs]	9 lacs
Existing shares by public [75 lacs – 63 lacs]	12 lacs
Bonus Ratio	9:12 or 3:4

WN 3: Computation of Market Price before and after issue:

Particulars	Before issue	After Issue
Market capitalization	12,000	12,000
Number of shares	75 lacs	84 lacs
Market Price (Market cap/No of shares)	160	142.86

WN 4: Free Float Market Capitalization post bonus issue:

- ❖ Free Float market capitalization = Total market capitalization × % holding by public
- ❖ Free Float Market Capitalization = 12,000 lacs × 25% = Rs.3,000 lacs

36. Computation of available liquidity [Nov 2013 RTP, May 2015 RTP]

A Ltd.'s (Acquirer company) equity capital is Rs. 2,00,00,000. Both A Ltd. and T Ltd. (Target Company) have arrived at an understanding to maintain debt equity ratio at 0.30 : 1 of the merged company. Pre-merger debt outstanding of A Ltd. stood at Rs. 20,00,000 and T Ltd at Rs. 10,00,000 and marketable securities of both companies stood at Rs. 40,00,000. You are required to calculate total fund requirements of A Ltd. to acquire T Ltd. against cash payment at mutually agreed price of Rs. 65,00,000.

Answer:

Particulars	Amount
Debt capacity of merged company (2,00,00,000 × 0.30)	60,00,000
Less: Debt of A Limited and T Limited	30,00,000
Balance debt can be raised	30,00,000
Add: Marketable securities	40,00,000
Total fund available	70,00,000

Since the combined liquidity of merged company shall remain comfortable, it shall be feasible to pay cash for acquiring T Limited against cash consideration of Rs.65,00,000.

37. Return on shares pre and post-merger [Nov 2015 RTP]

Two companies Bull Ltd. and Bear Ltd. recently have been merged. The merger initiative has been taken by Bull Ltd. to achieve a lower risk profile for the combined firm in spite of fact that both companies belong to different industries and disclose a little co-movement in their profit earning streams. Though there is likely to synergy benefits to the tune of Rs. 7 crore from proposed merger. Further both companies are equity financed and other details are as follows:

Company	Market Capitalization	Beta
Bull Limited	1,000 Crores	1.50
Bear Limited	500 Crores	0.60

Expected Market Return and Risk Free Rate of Return are 13% and 8% respectively. Shares of merged entity have been distributed in the ratio of 2:1 i.e. market capitalization just before merger. You are required to:

- Calculate return on shares of both companies before merger and after merger.
- Calculate the impact of merger on Mr. X, a shareholder holding 4% shares in Bull Ltd. and 2% share of Bear Ltd.

Answer:**WN 1: Computation of return on shares before merger and after merger:**

Particulars	Beta	Calculation	Return on shares
Bull Limited (pre-merger)	1.50	$8\% + 1.50 \times (13\% - 8\%)$	15.50%
Bear Limited (pre-merger)	0.60	$8\% + 0.60 \times (13\% - 8\%)$	11.00%
Merged entity (post-merger)	1.20 (Note 1)	$8\% + 1.20 \times (13\% - 8\%)$	14.00%

Note 1: Computation of Beta of Merged Firm:

Security	Beta	Weight	Product
Bull Limited	1.50	1,000	1,500
Bear Limited	0.60	500	300
Merged Firm	1.20	1,500	1,800

WN 2: Impact of merger on Mr.X:**Note 1: Value of Mr.X holding pre-merger:**

Particulars	Calculation	Amount
Bull Limited	4% x 1,000 Crores	40 Crores
Bear Limited	2% x 500 Crores	10 Crores
Value of holding		50 Crores

Note 2: Value of merged entity:

Particulars	Calculation	Amount in crores
Earnings of Bull Limited	15.50% x 1,000 crores	155
Earnings of Bear Limited	11% x 500 Crores	55
Synergy gain		7
Earnings of merged entity		217
Cost/return on equity		14%
Value of merged firm	217/14%	1,550

Note 3: Value of Mr.X post-merger:

Particulars	Calculation	Amount
Shareholding in Bull Limited		4%
Shareholding in Bear Limited		2%
Shareholding in merged entity	$\left(4\% \times \left(\frac{2}{3}\right) + 2\% \times \left(\frac{1}{3}\right)\right)$	3.333333%
Value of holding	3.333333% x 1,550	51.67 Crores

Impact: Value of Mr.X holding increases by 1.67 Crores post-merger.

38. Computation of shares to be issued [Nov 2017, Nov 2006, Nov 2017 RTP]

AB Ltd., is planning to acquire and absorb the running business of XY Ltd. The valuation is to be based on the recommendation of merchant bankers and the consideration is to be discharged in the form of equity shares to be issued by AB Ltd. As on 31.3.2006, the paid up capital of AB Ltd. consists of 80 lakhs shares of Rs.10 each. The highest and the lowest market quotation during the last 6 months were Rs.570 and Rs.430. For the purpose of the exchange, the price per share is to be reckoned as the average of the highest and lowest market price during the last 6 months ended on 31.3.06.

XY Limited's Balance Sheet as at 31.03.2006 is summarized below:

Particulars	Amount in lacs
Sources	
Share capital	
20 lacs equity shares of Rs.10 each fully paid	200
10 lacs equity shares of Rs.10 each, Rs.5 paid	50
Loans	100
Total	350
Uses	
Fixed assets (net)	150
Net current assets	200
Total	350

An independent firm of merchant bankers engaged for the negotiation, have produced the following estimates of cash flows from the business of XY Ltd.:

Year ended	Amount in lacs
31.03.07	105
31.03.08	120
31.3.09	125
31.3.10	120
31.3.11	100
Terminal value estimate	200

It is the recommendation of the merchant banker that the business of XY Ltd. may be valued on the basis of the average of (i) Aggregate of discounted cash flows at 8% and (ii) Net assets value.

You are required to:

- (i) Calculate the total value of the business of XY Ltd.
- (ii) The number of shares to be issued by AB Ltd.; and
- (iii) The basis of allocation of the shares among the shareholders of XY Ltd.

Answer:

WN 1: Valuation of company on the basis of discounted cash flows:

Year	Cash flow	PVF @ 8%	DCF (in lacs)
1	105	0.93	97.65
2	120	0.86	103.20
3	125	0.79	98.75
4	120	0.74	88.80
5	300	0.68	204.00
Value of business			592.40

WN 2: Valuation of company on the basis of Net assets value:

Particulars	Amount (in lacs)
Fixed Assets	150
Current Assets	200
Less: Loans	(100)
Net Assets	250

WN 3: Computation of shares to be issued:

Particulars	Amount (in lacs)
Valuation on discounted cash flows	592.40
Valuation on net assets	250
Average value	421.20
Issue price (average of opening and closing)	500
No of shares to be issued $(421.20/500)$	84,240
Fully paid equivalent shares $(20 \text{ lacs} + 10 \text{ lacs} \times 50\%)$	25,00,000
Distribution of fully paid shareholders $(84,240 \times (20/25))$	67,392
Distribution of partly paid shareholders $(84,240 \times (5/25))$	16,848

39. Cash consideration and stock consideration [May 2019]

Given is the following information:

Particulars	Day Limited	Night Limited
Net earnings	Rs.5 Crores	Rs.3.5 Crores
No of equity shares	10,00,000	7,00,000

The shares of Day Limited and Night Limited trade at 20 and 15 times their respective P/E Ratios. Day Limited considers taking over Night Limited by paying Rs.55 Crores considering that the market price of Night Limited reflects its true value. It is considering both the following options:

- i. Takeover is funded entirely in cash
- ii. Takeover is funded entirely in stock

You are required to calculate the cost of the takeover and advise Day Limited on the best alternative.

Answer:

WN 1: Computation of value of Day Limited and Night Limited:

Particulars	Day Limited	Night Limited
PAT	Rs.5 Crores	Rs.3.5 Crores
No of equity shares	10,00,000	7,00,000
Earnings per share	50	50
PE Multiple	20	15
MPS	1,000	750
No of shares	10,00,000	7,00,000
Market value	Rs.100 Crores	Rs.52.50 Crores

WN 2: Computation of true cost of merger:

Situation 1: Takeover funded with cash:

- ❖ True cost of merger = Consideration paid - Value of Night Limited
- ❖ True cost of merger = Rs.55 Crores - Rs.52.50 Crores = Rs.2.50 Crores

Situation 2: Takeover funded with stock:

No of shares to be issued = 55 crores/1,000 = 5,50,000 shares
Post – merger MP = $\frac{\text{Value of company A} + \text{Value of company B}}{\text{No of shares}}$
Post – merger MP = $\frac{100 \text{ Crores} + 52.50 \text{ Crores}}{10,00,000 + 5,50,000} = \text{Rs. } 983.87$
Consideration for merger = Rs.983.07 x 5,50,000 shares = Rs.54.11 Crores
True cost of merger = Consideration paid -Value of Night Limited
True cost of merger = Rs.54.11 Crores – Rs.52.50 Crores = Rs.1.61 Crores

Conclusion: True cost of merger is lower in case of consideration in the form of stock and hence the takeover should be funded with stock.

Note: This is not a logical question as the consideration in both approaches should remain Rs.55 crores as form of consideration does not impact the overall consideration. The above solution has been presented in line with ICAI solution.

40. Swap ratio and merger gain [May 2020 MTP]:

X Ltd. is studying the possible acquisition of Y Ltd. by way of merger. The following data are available in respect of both the companies.

Particulars	X Limited	Y Limited
Market capitalization (Rs.)	75,00,000	90,00,000
Gross Profit Ratio	20%	20%
Inventory Turnover Ratio	5 Times	4 Times
Debtors Turnover Ratio	3 Times	5 Times
12% Debentures	10,00,000	-
10% Debentures	-	14,40,000
No of equity shares	1,00,000	60,000
Operating expenses	86%	78%
Corporate Tax rate	30%	30%
Closing stock	15,00,000	5,00,000
Debtors	10,00,000	8,00,000

You are required to calculate:

- Swap ratio based on EPS & MPS respectively as weightage of 40% and 60%.
- Post Merger EPS
- Post Merger market price assuming same PE Ratio of X Ltd.
- Post Merger gain or loss in EPS.

Answer:

WN 1: Computation of sales of X Limited and Y Limited:**Note 1: Computation of COGS:**

Particulars	X Limited	Y Limited
Closing stock	15,00,000	5,00,000
Inventory Turnover Ratio	5	4
COGS (Stock x Inventory Turnover Ratio)	75,00,000	20,00,000

Note 2: Computation of Sales:

Particulars	X Limited	Y Limited
COGS	75,00,000	20,00,000
GP Ratio	20%	20%
COGS Ratio	80%	80%
Sales (COGS/80%)	93,75,000	25,00,000

Note: Sales could have been calculated using Debtors Turnover Ratio and the same would lead to different answer. ICAI has used above approach and accordingly the data on sales and debtors is of no relevance to the question.

WN 2: Income statement:

Particulars	X Limited	Y Limited

Sales	93,75,000	25,00,000
Less: Operating expenses (sales x Operating expenses ratio)	80,62,500	19,50,000
EBIT	13,12,500	5,50,000
Less: Interest	1,20,000	1,44,000
EBT	11,92,500	4,06,000
Less: Tax @ 30%	3,57,750	1,21,800
EAT	8,34,750	2,84,200

WN 3: Basic data:

Particulars	X Limited	Y Limited	Merged
EAT	8,34,750	2,84,200	11,18,950
No of shares	1,00,000	60,000	1,85,624
EPS	8.35	4.74	6.03
PE Multiple	8.98	31.65	8.98
MPS	75	150	54.15
No of shares	1,00,000	60,000	Not reqd
Market capitalization	75,00,000	90,00,000	Not reqd

Note 1: Computation of shares to be issued:

Parameter	Base values	Exchange ratio	Shares to be issued	Weight	Product
EPS	8.35:4.74	4.74:8.35	34,060 (60,000 x (4.74/8.35))	0.40	13,624
MPS	75:150	150:75	1,20,000 (60,000 x (150/75))	0.60	72,000
Shares to be issued					85,624

Solution:

- Swap ratio = 85,624 shares for 60,000 shares = 1.427:1
- Post-merger EPS = 6.03
- Post-merger MPS = 54.15

Post-merger gain or loss in EPS:

Particulars	ABC Limited	XYZ Limited
Old EPS	8.35	4.74
New EPS	6.03	8.60 $6.03 \times \left(\frac{1.427}{1}\right)$
Gain/loss in EPS	(2.32)	3.86

41. Valuation of debt & equity [May 2011, Nov 2016 MTP, May 2013 RTP]

Centurion bank and Bank of Punjab are planning to merge. The total value of the companies is dependent on the fluctuating business conditions. The following information is given for the total value (debt + equity) structure of each of the two companies.

Business Condition	Probability	Centurion (in lacs)	Bank of Punjab (in lacs)
High growth	0.20	820	1050
Medium Growth	0.60	550	825
Slow growth	0.20	410	590

The current debt of Bank of Punjab is Rs.65 lacs and of Centurion bank is Rs.460 lacs. Calculate the expected value of debt and equity separately for the merged entity.

Answer:**WN 1: Computation of expected value of debt and equity of Centurion:**

(in lacs)

Business Condition	Probability	Total Value	Debt	Product	Equity	Product
High growth	0.20	820	460	92	360	72
Medium Growth	0.60	550	460	276	90	54
Slow growth	0.20	410	410	82	0	0

Total				450		126

Note:

- Total value will be first used for debt commitments and balance value will be for equity. Hence in case of slow growth scenario, total value of Rs.410 lacs is fully for debt as equity cannot be negative

WN 2: Computation of expected value of debt and equity of Bank of Punjab:

(in lacs)

Business Condition	Probability	Total Value	Debt	Product	Equity	Product
High growth	0.20	1,050	65	13	985	197
Medium Growth	0.60	825	65	39	760	456
Slow growth	0.20	590	65	13	525	105
Total				65		758

WN 3: Expected value of debt and equity of merged entity:

(in lacs)

Particulars	Debt	Equity	Total
Centurion	450	126	576
Bank of Punjab	65	758	823
Total	515	884	1,399

42. Evaluation of Merger [May 2021 MTP]

C Ltd. and P Ltd. both companies operating in the same industry decided to merge and form a new entity S Ltd. The relevant financial details of the two companies prior to merger announcement are as follows:

Particulars	C Limited	P Limited
Annual earnings after tax [Rs. Lacs]	10,000	5,800
No of shares outstanding [lacs]	4,000	1,000
PE Ratio [No. of times]	8	10

The merger will be affected by means of stock swap (exchange) of 3 shares of C Ltd. for 1 share of P Ltd. After the merger it is expected that due to synergy effects, Annual Earnings (Post Tax) are expected to be 8% higher than sum of the earnings of the two companies individually. Further, it is expected that P/E Ratio of S Ltd. shall be average of P/E Ratios of two companies before the merger.

Evaluate the extent to which shareholders of P Ltd. will be benefitted per share from the proposed merger.

Answer:**Valuation of individual and merged entity:**

Particulars	C Limited	P Limited	Merged
Annual earnings after tax [Rs. Lacs]	10,000	5,800	17,064 [15,800 x 1.08]
No of shares outstanding [lacs]	4,000	1,000	7,000 [4,000 + (1,000 x 3)]
Earnings per share	2.50	5.80	2.4377
PE Multiple	8	10	9
MPS	20.00	58.00	21.9393
No of shares (in lacs)	4,000	1,000	7,000
Value of firm (in lacs)	80,000	58,000	1,53,575

Gain to shareholders:

Particulars	P Limited
Post-merger value	65,818 [3,000 x 21.9393]
Pre-merger value	58,000
Amount of gain [A]	7,818
Pre-merger number of shares [B]	1,000
Gain per share [A/B]	7.82

43. Computation of sustainable growth rate [Nov 2020 Exam]

AB Industries has Equity Capital of Rs. 12 Lakhs, total Debt of Rs. 8 Lakhs, and annual sales of Rs. 30 Lakhs. Two mutually exclusive proposals are under consideration for the next year. The details of the proposals are as under:

Particulars	Proposal No.1	Proposal No.2
Target Assets to Sales Ratio	0.65	0.62
Target Net Profit Margin (%)	4	5
Target Debt Equity Ratio (DER)	2:3	4:1
Target Retention Ratio (of earnings) (%)	75	-
Annual dividend (in lacs)	-	0.30
New equity raised (in lacs)	-	1.00

You are required to calculate sustainable growth rate for both the proposals.

Answer:

WN 1: Computation of return on equity for both options:

Proposal 1:

ROE as per Dupont Model = Net profit margin x Asset Turnover x Equity Multiplier

$$\text{ROE as per Dupont Model} = 4\% \times \left(\frac{1}{0.65}\right) \times \left(\frac{\text{Equity} + \text{Debt}}{\text{Equity}}\right)$$

$$\text{ROE as per Dupont Model} = 4\% \times \left(\frac{1}{0.65}\right) \times \left(\frac{3 + 2}{3}\right) = 10.26\%$$

Proposal 2:

$$\text{ROE as per Dupont Model} = 5\% \times \left(\frac{1}{0.62}\right) \times \left(\frac{\text{Equity} + \text{Debt}}{\text{Equity}}\right)$$

$$\text{ROE as per Dupont Model} = 5\% \times \left(\frac{1}{0.62}\right) \times \left(\frac{1 + 4}{1}\right) = 40.32\%$$

Note:

- ICAI answer has incorrect ROE as the equity multiplier formula is incorrect in ICAI suggested answers

WN 2: Computation of sustainable growth rate:

Sustainable growth rate = ROE x Retention Ratio
Option 1: SGR = 10.26% x 75% = 7.70%
Option 2: SGR = 40.32% x 94.28% (Note 1) = 38.01%

Note 1: Retention ratio for option 2:

Particulars	Amount
EAES (Equity x ROE)	5,24,160 [13,00,000 x 40.32%]
Dividend	30,000
Payout ratio	5.72% [30,000/5,24,160] x 100
Retention ratio	94.28% [100 - 5.72%]

44. Evaluation of merger [Jan 2021]

B Ltd. wants to acquire S Ltd. and has offered a swap ratio of 2:3 (2 shares for every 3 share of S Ltd.) Following information is available:

Particulars	B Limited	S Limited
Profit after tax	21,00,000	4,50,000
Equity shares outstanding	6,00,000	1,80,000
EPS	3.50	2.50
PE Ratio	10 Times	7 Time
Price quoting per share before the merger announcement	35	17.50

Required:

- (i) The number of equity shares to be issued by B Ltd. for acquisition of S Ltd.

- (ii) What is the EPS of B Ltd. after the acquisition?
- (iii) Determine the equivalent earnings per share of S Ltd. and calculate per share gain or loss to shareholders of S Ltd.
- (iv) What is the expected market price per share of B Ltd. after the acquisition, assuming its PE Multiple remains unchanged?
- (v) Determine the market value of the merged firm.
- (vi) After the announcement of merger, price of shares of S Ltd. rose by 10% on BSE. Mr. X, an investor, having 10,000 shares of S Ltd. is having another investment opportunity, which yields annual return of 14% is seeking your advise whether he needs to offload the shares in the market or accept the shares from B Ltd

Answer:**Valuation of individual and merged entity:**

Particulars	B Limited	S Limited	Merged
Profit after tax	21,00,000	4,50,000	25,50,000
Equity shares outstanding	6,00,000	1,80,000	7,20,000
Earnings per share	3.50	2.50	3.54
PE Multiple	10	7	10
MPS	35	17.50	35.40
No of shares	6,00,000	1,80,000	7,20,000
Value of firm	2,10,00,000	31,50,000	2,54,88,000

Solution:

- No of shares issued = $1,80,000 \times (2/3) = 1,20,000$ shares
- EPS post acquisition = Rs.3.54 per share

Equivalent EPS and gain/loss to shareholders of S Limited:

Particulars	Amount
Pre-merger EPS	2.50
Post-merger equivalent EPS	2.36 [$3.54 \times 2/3$]
Loss in EPS per share	0.14

- New market price of B Limited = Rs.35.40
- Market value of merged firm = Rs.2,54,88,000

Decision on offloading the shares:

Particulars	Amount
Equivalent EPS per share for S Limited shareholders	2.36
Price per share of S Limited before merger announcement	17.50
Increase in price [17.50×105]	1.75
Price post-merger announcement	19.25
Return on market price per share [EPS/MPS $\times 100$] = [$2.36/19.25 \times 100$]	12.26%

As Mr. X is having another opportunity to earn 14% and expected return on S Ltd.'s share is 12.26%, it is advisable to offload in market.

45. Equivalent EPS/Decision on sale of shares [Nov 2022 SA]

A Limited wants to acquire T Limited and has offered a swap ratio of 1:2 (0.5 shares for every one share of T Limited). Following information is provided:

Particulars	A Limited	T Limited
Profit after tax	18,00,000	3,60,000
Equity shares outstanding (Nos.)	6,00,000	1,80,000
EPS	3	2
PE ratio	10 Times	7 Times
Market price per share	Rs.30	Rs.14

Required:

- ❖ The number of equity shares to be issued by A Limited for acquisition of T Limited
- ❖ What is the EPS of A limited after the acquisition
- ❖ Determine the equivalent earnings per share of T Limited

- ❖ What is the expected market price per share of A Limited after the acquisition, assuming its PE multiple remains unchanged?
- ❖ Determine the market value of the merged firm
- ❖ If you are the shareholder of T Limited and holding 100 shares, will you be interested to sell your stake? Why?

Answer:**WN 1: Completion of merger table:**

Particulars	A Limited	T Limited	Merged company
PAT/EAES	18,00,000	3,60,000	21,60,000
No of equity shares	6,00,000	1,80,000	6,90,000
EPS	3	2	3.1304
PE Multiple	10	7	10
MPS	30	14	31.304
No of equity shares	6,00,000	1,80,000	6,90,000
Market value of firm	1,80,00,000	25,20,000	2,16,00,000

WN 2: Solution:

Shares issued	$1,80,000 \times 0.50$	90,000
Post-merger EPS	$\frac{\text{Total earnings}}{\text{No of shares}} = \frac{21,60,000}{6,90,000}$	3.1304
Equivalent EPS of T Limited	3.1304×0.5	1.5652
MPS of merged company	$\text{EPS} \times \text{PE Multiple} = 3.1304 \times 10$	31.304
MV of merged company	$\text{MPS} \times \text{No of shares} = 31.304 \times 6,90,000$	Rs.2,15,99,760 ~ Rs.2,16,00,000

Decision on sale of shares:

Particulars	Calculation	Amount
Present market value of shares of T Limited	$100 \text{ shares} \times 14$	Rs.1,400
No of shares issued on merger	100×0.50	50
Value of shares post-merger	50×31.304	Rs.1,565
Increase in market value	1,565 – 1,400	Rs.165

No, I am not agreeing to sell the stake as there is increase in market value.

Chapter 15 – Startup Finance

1. What is a Startup to avail Government Schemes? (OR) Explain Startup India Initiative? [Nov 2018 RTP, Nov 2019, May 2021 MTP]

❖ Startup India scheme was initiated by the Government of India on 16 th of January, 2016.

Definition of Startup:

- ❖ Incorporated as either a Private Limited Company or a Registered Partnership Firm or a Limited Liability Partnership in India **not prior to 10 years**
- ❖ **Turnover** for any fiscal year has not exceeded INR **100 crores**
- ❖ Entity should not have been formed by splitting up or reconstruction a business already in Existence
- ❖ Working towards **innovation, development, deployment or commercialization of new product, processes or services driven by technology or intellectual property**

Additional conditions:

- ❖ Provided also that an entity shall cease to be a Startup if its turnover for the previous financial years has exceeded Rs. 100 crore or it has completed 10 years from the date of incorporation/ registration.
- ❖ Provided further that a Startup shall be eligible for tax benefits only after it has obtained certification from the Inter-Ministerial Board, setup for such purpose.

2. What are the major reasons for sustainable development of Startups in India?

- **Government support:** Government has supported the development of Startups with the launch of Startup Scheme
- **Pool of Talent:** India's talent pool, with millions of graduates, contributes to startup growth by leveraging their knowledge and skills to start their own ventures. Previously, this talent was primarily attracted to big companies.
- **Cost-effective workforce:** India is a young country with over 10 million people joining the workforce every year. The workforce is also cost effective. **So, compared to some other countries, the cost of setting up and running a business is comparatively lower**
- **Increasing use of internet:** India's second-highest population, with affordable telecom services, has significantly increased internet usage, reaching rural areas and becoming the second-largest internet user base after China.
- **Technology:** Technology has revolutionized business processes, enabling quick, simple, and efficient data storage and recording. Indian startups are focusing on artificial intelligence and blockchain technologies, boosting growth.
- **Variety of Funding Options:** Traditional methods for acquiring funds for new business models include **bank and family borrowing**. However, **new opportunities include angel investors, venture capitalists, and seed funding stage investors**. The easing of Foreign Direct Investment norms and automatic sector openings have increased foreign funding in the Indian start-up ecosystem.

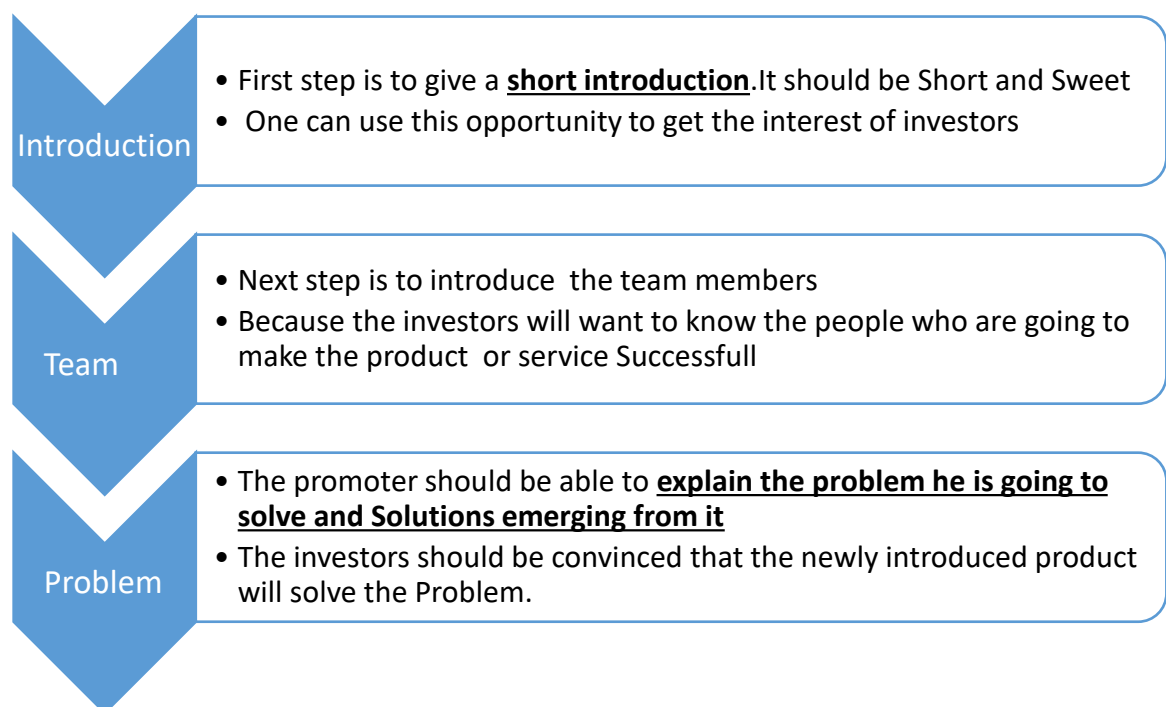
3. Explain some of the Sources for funding a start-up? (OR) What are some of the innovative ways of financing a start-up? (OR) Non-bank financial Sources are becoming popular to finance start-ups. Discuss [May 2020 RTP, May 2019 (exam), May 2019 MTP, Nov 2020 MTP, Jan 2021]

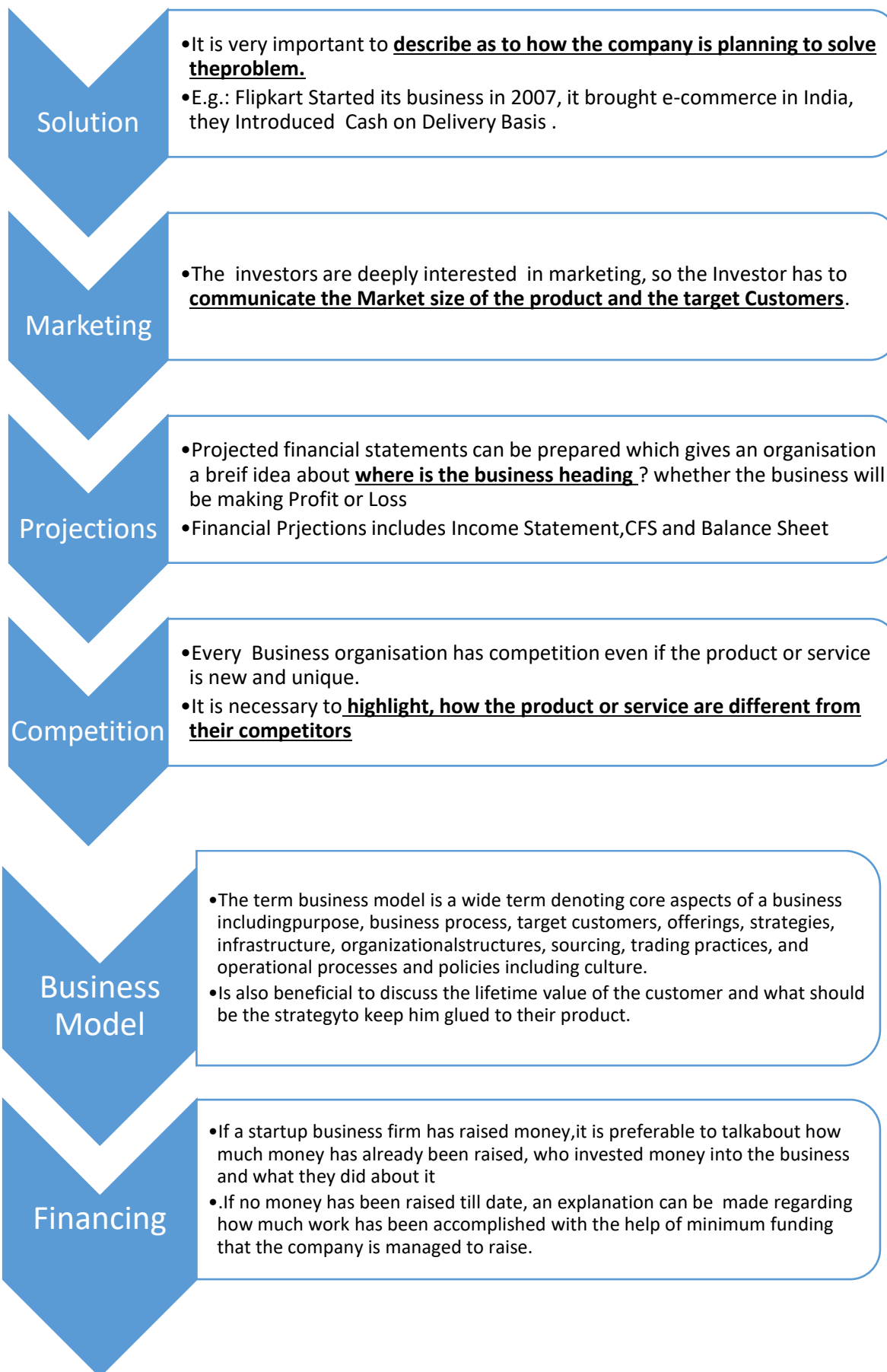
Personal Financing	It is important because most of the investors will not put money into a deal if <u>they see that the entrepreneurs have not contributed from their personal Source</u>
Personal Credit Lines	It is based on <u>one's Personal credit efforts</u> , Bank will provide this facility only when the business has enough cash flows to repay the line of credit. E.g. Credit Cards
Family and Friends	These people will generally fund, without even thinking whether the idea works or not, However, the <u>loan obligations</u> to friends and relatives should always be in writing as a <u>promissory note or otherwise</u> .
Peer-to-Peer Lending	In this group of <u>people come together and lend money</u> to each other. Many small and ethnic business groups having similar faith or interest generally support each other in their start up endeavours.
Crowd Funding	It uses <u>small amounts of capital from a large number of Individuals</u> , It makes use of the easy accessibility of vast networks of people through social media and crowdfunding websites to bring investors and entrepreneurs together.
Micro loans	A <u>small Loan given by Single individual or aggregated</u> at a lower Interest.

Vendor Financing	In this a <u>company lends money to its customers</u> so that they can buy products from the manufacturers. E.g. Extending credit period from 30 days to 45 days
Purchase order financing	Purchase order financing companies often advance the required funds directly to the supplier. This allows the transaction to complete and profit to flow up to the new business
Factoring Account receivables	<u>A facility is given to the seller who has sold the good on credit to fund his receivables till the amount is fully received</u>

4. What do you Mean by Pitch Presentation in context of Start-up Business? And Explain the methods to approach a pitch presentation? [Nov 2018 MTP]

- ❖ Pitch deck presentation is a **short and brief presentation** (<20Min) to investors explaining about the **prospects of the company** and why they should invest into the startup business.
- ❖ Pitch presentation can be made either during face to face meetings or online meetings with potential investors, customers, partners, and co-founders.





5. Explain the basic documents that are required to make up Financial Presentations during Pitch Presentation? [May 2020 MTP]

- ❖ **Income statement:** This projects how much money the business will generate by projecting income and expenses, such as sales, cost of goods sold, expenses and capital. For your first year in business, you'll want to create a monthly income statement. For the second year, quarterly statements will suffice. For the following years, you'll just need an annual income statement.
- ❖ **Cash flow statement:** A projected cash flow statement will depict how much cash will be coming into the business and out of that cash how much cash will be utilized into the business. At the end of each period (e.g. monthly, quarterly, annually), one can tally it all up to show either a profit or loss.
- ❖ **Balance sheet:** The balance sheet shows the business's overall finances including assets, liabilities and equity. Typically one will create an annual balance sheet for one's financial projections.

6. What are the modes of Financing for Startups? (OR) Explain Angel Investors? [Nov 2018 (exam), Nov 2019 MTP, Nov 2020 MTP, May 2021 MTP]

Bootstrapping	❖ An individual is said to be boot strapping <u>when he or she attempts to found and build a company from personal finances</u> or from the operating revenues of the new company ❖ On the other hand, investment by startups from their own savings leads to cautious approach.
Angel Investor	❖ Angel investors invest in small startups or entrepreneurs, they are among an entrepreneur's family and friends. ❖ The capital angel investors provide may be a <u>one-time investment to help the business propel or an ongoing injection of money to support and carry the company</u> through its difficult early stages. ❖ Angel investors are also called informal investors, angel funders, private investors, seed investors or business angels. ❖ Some angel investors invest through crowdfunding platforms online or build angel investor networks to pool in capital.
Venture Capital Funds	❖ Venture capital is money provided by <u>professionals who alongside management invest in young</u>, rapidly growing companies that have the potential to develop into significant economic contributors.

7. Define Angel Investors, are these only individuals? If not, list the entities [May 2022]

- Angel Investors invest in small startups or entrepreneurs. Often angel investors are among the entrepreneur's family and friends.
- Though angel investors usually represent individuals, the entity that actually provides the fund may be a limited liability company, a business, a trust or an investment fund, among many other kinds of vehicles.

8. Explain Venture capital Financing and their Characteristics? [May 2021 RTP]

- ❖ Venture capital means funds made available for startup firms and small businesses with exceptional growth potential.
- ❖ Venture capital is money provided by professionals who alongside management invest in young, rapidly growing companies that have the potential to develop into significant economic contributors.
- ❖ Venture Capitalists generally:
 - Finance new and rapidly growing companies
 - Purchase equity securities
 - Assist in the development of new products or services
 - Add value to the company through active participation.

Characteristics of Venture capital Financing :

Long time Horizon	❖ The fund will invest <u>minimum</u> period of investment of <u>3</u> years and the <u>maximum</u> period can be <u>10</u> years
Lack of Liquidity	❖ It assumes that there would be less liquidity on the equity it gets and accordingly it would be investing in that format.
High Risk	❖ It works on principle of <u>high risk and high return</u> . So, high risk would not eliminate the investment choice for a venture capital.
Equity participation	❖ VC would be investing in the <u>form of equity</u> of a company, it helps to <u>participate in the management and help the company grow</u> .

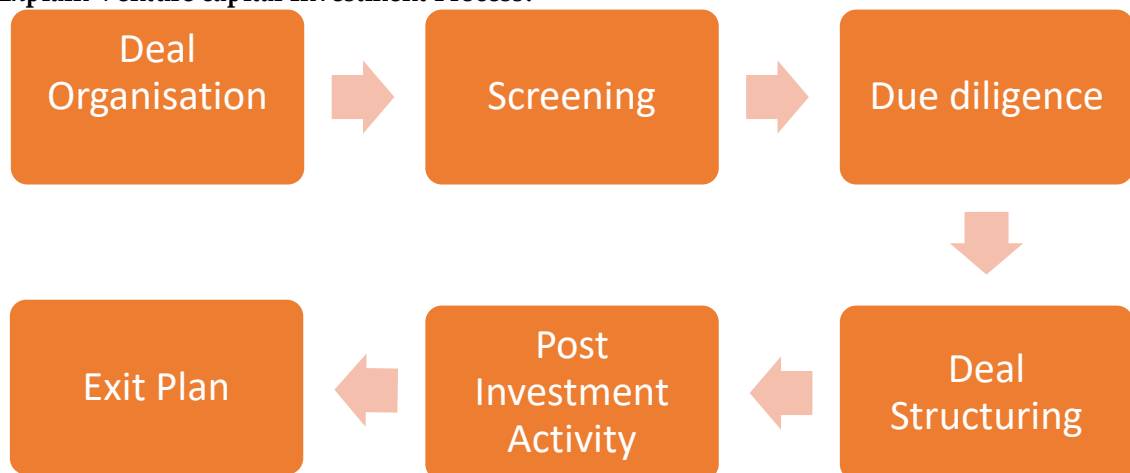
9. What are all the advantages of Bringing Venture Capital (VC) in the company?

- ❖ It injects **long- term equity finance** which provides a solid capital base for future growth.
- ❖ The venture capitalist is a business partner, **sharing both the risks and rewards**. Venture capitalists are rewarded with business success and capital gain.
- ❖ The venture capitalist is able to provide **practical advice and assistance to the company** based on past experience with other companies which were in similar situations.
- ❖ The venture capitalist also has a **network of contacts** in many areas that can add value to the company.
- ❖ The venture capitalist may be capable of **providing additional rounds of funding** should it be required to finance growth.
- ❖ Venture capitalists are **experienced** in the process of preparing a company for an **initial public offering** (IPO) of its shares onto the stock exchanges or overseas stock exchange such as NASDAQ (National Association of Securities Dealers Automated Quotations)
- ❖ They can also facilitate a **trade sale**.

10. What are the stages of funding VC? [Nov 2018 MTP, Jan 2021]

Financial stage	Periods (Lock-in Period)	Risk Perception	Activity to be financed
Seed Money	7-10	Extreme	For supporting a concept or idea or R&D for product Development
Start up	5-9	Very high	Initializing prototypes operations or developing
First stage	3-7	High	Start commercials marketing production
Second stage	3-5	Sufficiently high	Expand market and growing working capital need
Third stage	1-3	Medium	Expand market and growing working capital need
Fourth Stage	1-3	Low	Facilitating Public Issue

11. Explain Venture capital Investment Process?



Deal Organisation:

- ❖ VC operates Directly or through intermediaries,
- ❖ Before sourcing the deal, the VC would inform the intermediary or its employees about the following so that the sourcing entity does not waste time :
 - Sector focus
 - Stages of business focus
 - Promoter focus
 - Turn over focus

Screening:

- ❖ The screening is generally carried out by a **committee** consisting of senior level people of the VC. Once the screening happens, it would select the **company for further processing**. The decision would take place based on the information provided by the company.

Due Diligence:

- ❖ This is mainly the process by which the VC would try to verify the veracity of the documents taken. This is generally handled by external bodies, mainly renowned consultants.

Deal Structuring:

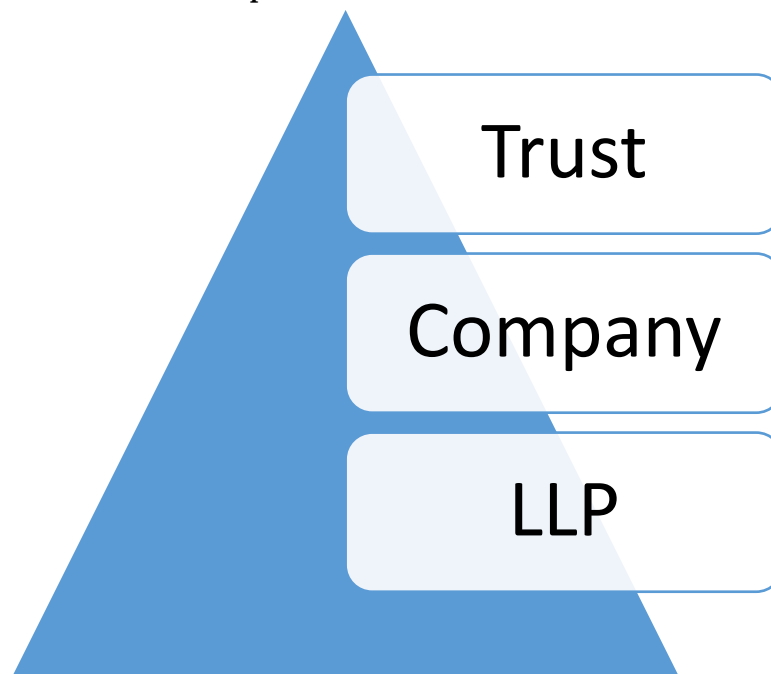
- ❖ The deal is structured in such a way that **both parties win**. In many cases, the convertible structure is brought in to ensure that the promoter retains the right to buy back the share.
- ❖ Besides, in many structures to facilitate the exit, the VC may put a condition that promoter has also to sell part of its stake along with the VC. Such a clause is called tag- along clause.

Post Investment Activity:

- ❖ The VC nominates its nominee in the board of the company. The company has to adhere to certain guidelines like strong MIS, strong budgeting system, strong corporate governance and other covenants of the VC and periodically keep the VC updated about certain mile-stones.

Exit Plan:

- ❖ The VC nominates its nominee in the board of the company. The company has to adhere to certain guidelines like strong MIS, strong budgeting system, strong corporate governance and other covenants of the VC and periodically keep the VC updated about certain mile-stones.
- ❖ Exit happens in two ways: one way is 'sell to third party(ies)'. This sale can be in the form of IPO or Private Placement to other VCs. The second way to exit is that promoter would give a buy back commitment at a pre agreed rate (generally between IRR of 18% to 25%)

12. Explain the structure of Venture Capital Fund in India?

Three main types of fund structure exist: one for domestic funds and two for offshore ones:

Domestic funds	❖ It is usually structured as a ○ Domestic vehicle for the pooling of funds from the investor and ○ a separate Investment adviser that carries those duties for asset manager. ❖ The choice of entity for the pooling vehicle falls between a trust and a company, with the trust form prevailing due to its operational flexibility
Offshore Funds	<u>Offshore Structure:</u> ❖ Under this structure, an <u>investment vehicle</u> (an <u>LLC</u> or an LP organized in a jurisdiction outside India) makes investments directly into <u>Indian portfolio companies</u>. ❖ Typically, the assets are managed by an offshore manager, while the investment advisor in India carries out the due diligence and identifies deals.

	Unified Structure: ❖ <u>Overseas investors pool their assets in an offshore vehicle that invests in a locally managed trust</u> , whereas domestic investors directly contribute to the trust.

13. Explain the concept of Bootstrapping and Explain some of the methods in which a Startup Firm can bootstrap? [May 2018 RTP, Nov 2020 RTP, May 2019 MTP, May 2021 MTP, Nov 2020]

Meaning	❖ An individual is said to be boot strapping <u>when he or she attempts to found and build a company from personal finances</u> or from the operating revenues of the new company ❖ On the other hand, investment by startups from their own savings leads to cautious approach.
Trade Credit	❖ When a person is starting his business, suppliers are reluctant to give trade credit. They will insist on payment of their goods supplied either by cash or by credit card. However, a way out in this situation is to prepare a well-crafted financial plan. ❖ The owner or the financial officer has to be explained about the business and the need to get the <u>first order on credit in order to launch the venture</u> .
Factoring	❖ This is a financing method where <u>accounts receivable</u> of a business organization is sold to a commercial finance company to raise capital. ❖ Factoring can be performed on a <u>non-notification</u> basis. It means customers may not be told that their accounts have been sold. ❖ It can actually <u>reduce costs</u> associated with maintaining accounts receivable such as bookkeeping, collections and credit verifications ❖ <u>Factoring can be a very useful tool for raising money and keeping cash flowing</u> .
Leasing	❖ Another popular method of bootstrapping is to <u>take the equipment on lease rather than purchasing it</u> . ❖ It will <u>reduce the capital cost</u> and also help lessee (person who take the asset on lease) to claim <u>tax exemption</u> . So, it is better to take a photocopy machine, an automobile or a van on lease to avoid paying out lump sum money which is not at all feasible for a startup organization.

14. Compare and contrast start-ups and entrepreneurship. Describe the priorities and challenges which start-ups in India are facing? [Nov 2019 RTP, May 2018 MTP, Nov 2019 MTP]

Differences between a start-up and entrepreneurship

Startups are different from entrepreneurship. The major differences between them have been discussed in the following paragraphs:

- ❖ Start up is a part of entrepreneurship. Entrepreneurship is a broader concept and it includes a startup firm.
- ❖ The main aim of startup is to build a concern, conceptualize the idea which it has developed into a reality and build a product or service. On the other hand, the major objective of an already established entrepreneurship concern is to attain opportunities with regard to the resources they currently control.
- ❖ A startup generally does not have a major financial motive whereas an established entrepreneurship concern mainly operates on financial motive

Priorities and challenges which start-ups in India are facing:

- ❖ The priority is on bringing more and more smaller firms into existence. So, the focus is on need based, instead of opportunity-based entrepreneurship. Moreover, the trend is to encourage self-employment rather than large, scalable concerns.
- ❖ The main challenge with the startup firms is getting the right talent. And, paucity of skilled workforce can hinder the chances of a startup organization's growth and development. Further, startups had to comply with numerous regulations which escalate its cost. It leads to further delaying the chances of a breakeven or even earning some amount of profit.

15. Explain the term Business Model with help of an example. [May 2021 MTP]

- The term business model is a wide term denoting core aspects of a business including purpose, business process, target customers, offerings, strategies, infrastructure, organizational structures, sourcing, trading practices, and operational processes and policies including culture.

- Further, as per Investopedia, a **business model is the way in which a company generates revenue and makes a profit from company operations.**
- Analysts use the term gross profit as a way to compare the efficiency and effectiveness of a firm's business model. Gross profit is calculated by subtracting the cost of goods sold from revenues. A business model can be illustrated with the help of an example.
- There are two companies – company A and company B. **Both the companies are engaged in the business of renting movies.** Prior to the advent of internet both the companies rent movies physically. Both the companies made Rs. 5 crore as revenues. Cost of goods sold was Rs. 4 crore. So, the companies made 1 crore as gross profit.
- After the introduction of internet, company A started to offer movies online instead of renting or selling it physically. **This change affected the business model of company A positively.** Revenue is still 5 crores. But the significant part is that cost of goods sold is now 2 crores. **This is because online sales lead to significant reduction of storage and distribution costs.** So, the gross profit increases from 20% to 60%. Therefore, Company A isn't making more in sales, but it figured out a way to revolutionize its business model, which greatly reduces costs.
- Managers at company A have an additional 40% more in margin to play with than managers at company B. Managers at company B have little room for error and they have to tread carefully. Hence, every investor wants to get his money back, so it's important to tell them in a pitch presentation as to how they should plan on generating revenue.
- **It is better to show the investors a list of the various revenue streams for a business model and the timeline for each of them.** Further, how to price the product and what does the competitor charge for the same or similar product shall also be highlighted. **It is also beneficial to discuss the lifetime value of the customer and what should be the strategy to keep him glued to their product.**

16. Peer – to – Peer Lending and Crowd funding are same and traditional methods of funding. Do you agree? Justify your stand [Nov 2020 Exam]

- No, **I do not agree with the given statement** because while peer-to-peer lending is in existence for many years the crowd funding is contemporary source of finance for Startup finance.
- Further in peer-to-peer lending **a group of people come together and lend money to each other.** Many small and ethnic business groups having similar faith or interest generally support each other in their start up endeavors.
- **On the other hand, Crowdfunding is the use of small amounts of capital from a large number of individuals to finance a new business initiative.** Crowdfunding makes use of the easy accessibility of vast networks of people through social media and crowdfunding websites to bring investors and entrepreneurs together.

17. Explain the concept of Unicorn?

- A Unicorn is a privately held start-up company which has achieved a **valuation of US\$ 1 billion.**
- A start-up is referred as a Unicorn if it has following features:
 - A privately held start-up
 - Valuation of start-up reaches US\$ 1 Billion
 - Emphasis is on the rarity of success of such start-up.
 - Other common features are new ideas, disruptive innovation, consumer focus, high on technology etc.
- However, it is important to note that in case **the valuation of any start -up slips below US\$ 1 billion** it can lose its status of 'Unicorn'
- The next milestone for a Unicorn to achieve **is to become a Decacorn**, i.e., a company which has attained a valuation of more than **US\$ 10 billion**

18. Explain the meaning of Succession Planning?

- Succession planning involves **identifying critical positions** within an organization and developing action plans for individuals to assume them.
- It is crucial for family-owned businesses, **as non-family leaders manage them.**
- This holistic approach ensures the right people are available for jobs and provides a liquidity event for ownership transfer to rising employees.
- Succession planning helps **companies promote and advance all employees**, not just those at management or executive levels.

19. Why should an organization plan for succession planning?

- **Risk mitigation:** If existing leader quits, then searches can take six-nine months for suitable candidate to close. Keeping an organization without leader can invite disruption, uncertainty, conflict and endangers future competitiveness
- **Cause removal:** If the existing leader is culpable of gross negligence, fraud, willful misconduct, or material breach while discharging duties and has been barred from undertaking further activities by court, arbitral tribunal, management, stakeholders or any other agency.
- **Talent pipeline:** Succession planning keep employees motivated and determined as it can help them obtaining more visibility around career paths expected, which would help in retaining the knowledge bank created by company over a period of time and leverage upon the same.
- **Conflict Resolution Mechanism:** This planning is very helpful in promoting open and transparent communication and settlement of conflicts
- **Aligning:** In family-owned business succession planning helps to align with the culture, vision, direction and values of the business.

20. Explain the steps in Business Succession Strategy?

- **Evaluate key leadership positions:** To evaluate which roles are critical, **risk or impact assessment can be performed**. Generally, these are such positions which would bring transformation to the entire business or create strategic direction for the organization
- **Map competencies required for above positions:** In this step, one needs to identify qualifications, behavioral and technical competencies required to perform the role successfully
- **Identify competencies of current workforce:** Identifying what are possible internal options that can deliver results as expected in Step-2, and also if there is a need for training and development of certain skills required. The organization should also place weight on whether is there a need to search outside the organization.
- **Bridge Leader:** In family-owned business appointment of an outsider as 'bridge leaders' will help to develop the business and prepare young family members for leadership role

21. Explain the challenges in implementing succession planning?

- **Founder mindset might be different than the corporate mindset:** The way founder's brains are wired is different from the way that a traditional corporate manager thinks, and this puts off seasoned corporate leaders from joining even matured start-ups.
- **Premature for startups to implement business succession:** Certain startups are at early growth stage and too much of processes would lead to growth slow-down and hence they are not in a current stage for implementing business succession planning.
- **Founders are the face of startups:** One cannot imagine a startup without a founder who initiated the idea and executed it and in his/ her absence succession planning can become difficult.

LAST DAY REVISION - THEORY AND IMPORTANT ADJUSTMENTS**Chapter 1 – Financial Policy and Corporate Strategy**

<u>Advanced Role of CFO:</u> • Supports strategic and operational decision making • <u>Emerging roles:</u> Risk management + Supply chain + Mergers acquisitions and corporate restructuring + Environmental, Social and Governance (ESG) Financing.
Fundamentals of Business = Strategy + Finance + Management
Strategy can be defined as the long-term direction and scope of an organization to achieve competitive advantage
<u>Functions of Strategic Financial Management:</u> • Takes care of investment and financing decisions + Focuses on Strategic, Operational and Tactical level • Search for investment + Selection of investment + optimal mix + Systems for internal control + Results for future decision making
<u>Key decisions within scope of financial strategy:</u> Financing decisions, Investment decisions, Dividend decisions and Portfolio Decisions.
<u>Different types of strategy:</u> Corporate Level Strategy, Business Unit Level Strategy and Functional Level Strategy
<u>Financial Planning:</u> • Financial Planning is the backbone of business planning and corporate planning • It defines the feasible area of operation • Three components of Financial Planning is summarized in the below equation: $\text{Financial Resources} + \text{Financial Tools} = \text{Financial Goals}$
<u>Outcome of financial planning:</u> • Financial objectives + Financial Decision making + Financial Measures
<u>Interface between financial policy and strategic management:</u> • Starting point of an organization is money and end-point is also money • Sources of finance and capital structure are the most important dimensions of a strategic plan • Another important dimension of interface between the two is investment and fund allocation decisions • Dividend decision is another financial decision which can affect the strategic performance of company • Hence financial policy cannot be worked out in isolation and it has closer link with overall organizational performance and growth
<u>Financial Goals and Sustainable Growth:</u> • Organization need to consider the financial consequences of sales increases and set sales growth targets consistent with firm's operating and financial policies • Organization should focus not only on current stakeholders but also on future stakeholders • Example of Fuel industry where there is demarketing campaign preaching customers about fuel conservation • Incremental growth strategy, profit strategy and pause strategy are other variants of stable growth strategy • Important for long-term development. Too fast or too slow growth can impact the company's performance in future
<u>What makes an organization financially sustainable:</u> • Have more than one source of income • Regular planning • have adequate financial systems • Good public image • Have clear values • Have financial autonomy
<u>Sustainable Growth Rate:</u> • Maximum rate of growth in sales that can be achieved with current profitability, asset utilization, dividend payout and leverage ratios • How much can an organization grow without borrowing money

- $SGR = ROE \times (1 - \text{Dividend Payout Ratio})$
- It assumes target capital structure and target dividend payment ratio and increase sales as rapidly as market conditions allow

What makes an organization sustainable:

- Clear strategic direction + Identify opportunities + Adequate administrative and financial infrastructure + Leverage further resources + Get community support

Chapter 2 – Risk Management

Strategic Risk: Company's strategy becomes less effective and it struggles to achieve its goal
Compliance Risk: Non-compliance with rules and regulations leading to penalties in the form of fine and imprisonment
Operational Risk: Failure to cope up with day-to-day operational problems
Financial Risk: Unexpected changes in financial conditions (Prices, Exchange Rate, Credit Rating, Interest rate)
Types of Financial Risk: • Counter-party risk: Non-honouring of obligations by counter-party • Political Risk: Normally faced by overseas investors, as the adverse action by the Government of the host country may lead to huge losses • Interest rate risk: Variation in cash flow due to change in interest rate. This risk is more important for banking companies • Currency risk: Variation in cash flow due to changes in exchange rates • Liquidity risk: Inability of the company to meet its liabilities.
Financial risk from different point of view: • Stakeholder's point of view: Equity shareholders view financial gearing and new lenders view existing gearing • Company's point of view: Excessive borrowing or lending to someone who defaults, can force company into liquidation • Government's point of view: Failure of bank or financial institution leading to spread of distrust among society at large
Value-at-risk: • Meaning: VAR answers two basic questions namely (i) what is the worst-case scenario and (ii) what will be the loss • Features: Components (Time Period, Confidence Interval and Percentage loss), Statistical method, Time Horizon (One day, one week, one month etc.), Probability (normal distribution), Control risk (control risk by setting limits), Z-score • Application: Measure maximum possible loss, benchmark for performance measurement, fix trading limits for front-office of treasury department, deciding trading strategies, tool for Asset and Liability Management in banks
Counter-party risk: • Hints: Regulatory restrictions, Insolvency, Hostile action of foreign Government, Failure to obtain necessary resources, Let down by third party • Measures to manage: Due-diligence, Exposure limits, Credit review and credit limits, performance guarantees, limiting exposure to a single company or group
Political risk: • How to assess: Political ranking, country's macro-economic conditions, Popularity and stability of current Government, Advise from embassies • Measures to manage: Local sourcing, Local financing, Prior negotiations, Entering into joint ventures
Interest rate risk: • How to assess: Monetary Policy, Government action, Economic growth, Industrial data, Stock market changes, Investment by Foreign investors • Measures to manage: Forward rate agreements, Interest rate options, Interest rate futures, Interest rate swaps
Currency risk: • How to assess: Government action, Nominal interest rates, Inflation rate, Natural calamities, Wars, Change of Government • Measures to manage: Currency invoicing, Forward contract, Currency futures, Currency options, Currency swaps, Leading and Lagging, Money Market Hedge
Practical areas:
How to calculate VAR: • Compute standard deviation of security/portfolio. We should ideally compute this for a single day from available information.

- **Daily VAR = Daily standard deviation (in Rs) x multiple for confidence interval.** The multiple for 95% and 99% confidence interval is 1.65 and 2.33 Times
- VAR for 10 days = Daily VAR $\times \sqrt{10}$
- VAR for 30 days = Daily VAR $\times \sqrt{30}$
- The above formula can be used to convert daily VAR into monthly VAR/weekly VAR. Same formula can also be used to reverse-work from monthly VAR to Daily VAR
- **Reverse working scenario:** Question can provide for the maximum possible loss in the question and based on that we can reverse work and get the amount of investment.

Important points:

- We should compute standard deviation of portfolio if the same is not given in the question. Standard deviation of portfolio is to be computed using the below formula of portfolio management
- $$\sqrt{(W_a\sigma_a)^2 + (W_b\sigma_b)^2 + 2W_aW_b\sigma_a\sigma_b\text{COR}_{ab}}$$
- We should ensure that while converting daily VAR into monthly VAR (or) vice versa, we multiply /divide with square-root of respective number and not the full number

Computation of Probability using normal distribution:

- We need to first compute Z value to compute the required probability
- $Z = (\text{Target value} - \text{Average value}) / \text{Standard Deviation}$
- Look at the probability value from Z tables and the same would provide the required probability

Chapter 3 – Advanced Capital Budgeting Decisions

<u>Impact of inflation:</u> • Inflation can impact cash flows – Cash flows including inflation are called nominal cash flows and excluding inflation are called real cash flows • Nominal cash flow needs to be discounted at Money Discount Rate and Real cash flows should be discounted at Real Discount Rate
<u>Impact of Technology Change:</u> • Technology can impact future cash flows and it may lead to replacement of machinery with improved technology • <u>Impact of technology on operations:</u> Alter production process, improved quality, delivery time, flexibility, shortening of product life cycle • <u>Incorporation of this risk in decision making:</u> Use techniques like sensitivity analysis, scenario analysis, simulation analysis – Check if company needs to pursue abandonment due to changed technology and also adjust discount rate to reflect technology risk
<u>Impact of change in Government Policies:</u> • Government policies can impact future cash flows - They can also impact company's customer, suppliers, service providers – Company should check for abandonment if operations are unviable • <u>Fiscal policy and monetary policies</u> are short-term policies which impact companies and we also have long-term policies (>5 years) impacting cash flows. • <u>Impact on domestic capital budgeting decision:</u> Revision in interest rates leading to change in cost of capital and fiscal policy changes (tax rates) can impact cash flows • <u>Impact on international capital budgeting decision:</u> Monetary policy (Changes in bank rates and money supply which impacts exchange rates) + Fiscal policy (Changes in tax rates relating to foreign income or revision in DTAA)
<u>Risk and uncertainty:</u> • Risk can be measured and uncertainty cannot be measured
<u>Adjustment of risk in capital budgeting:</u> • Risk adjustment is critical to know the real value of cash flows – Adjustment of risk helps in checking whether a project is earning adequate returns compensating the risk undertaken
<u>Sources of risk:</u> • <u>Internal Factors:</u> Project specific risk (Project completion, error in estimation) + Company specific risk (Downgrade of credit rating, changes in KMP) • <u>External Factors:</u> Industry specific risk + Market risk + Competition risk + Risks due to economic conditions + International risk
<u>Tools for incorporating risk:</u> • <u>Statistical techniques:</u> Probability + SD + Co-efficient of variation • <u>Conventional Techniques:</u> RADR + CEF • <u>Other Techniques:</u> Sensitivity Analysis + Scenario Analysis + Simulation Analysis + Decision Tree
<u>RADR Approach:</u> • Risky projects are evaluated at higher discount rate • <u>Advantages:</u> Easy + Discount factor incorporates risk • <u>Limitations:</u> Difficulty in finding RADR + NPV can be computed but SD cannot be calculated
<u>CEF Approach:</u> • Adjustment of cash flows based on certainty of cash flows • <u>Advantages:</u> Simple and easy + Different levels of risk can be attached to different years • <u>Disadvantages:</u> No objective method to ascertain certainty equivalent factor
<u>RADR vs CEF:</u> • CEF is superior to RADR as different levels of risk can be attached to different years – However RADR is mostly followed as it is easy to adjust discount rate than assigning CEF to each year Cash flow
<u>Sensitivity Analysis:</u> • Studies the impact of change in variables on project outcomes – It studies impact of only one variable at a time • <u>Advantages:</u> Simple and identifies critical issues

• Disadvantages: Assumes variables are independent (not related to each other which is unlikely in real life) + Does not look into probability of changes
Scenario Analysis: • Evaluates the impact of changes in multiple variables on NPV of the project – We start with analysis of base case NPV and then compute best case/worst case NPV with changes in multiple variables at a time
Scenario Analysis Vs Sensitivity Analysis: • Sensitivity analysis evaluates the impact of change in single variable whereas scenario analysis considers impact where multiple variable change together
Simulation: • Involves infinite calculations to obtain possible outcomes by modelling investment projects, cash flows and key factors affecting project • Advantages: Predicting market situations + Handling complex inter-relationships • Limitations: Specifying probability distribution of variable can be difficult + NPV is computed based on risk-free rate and the same may not give right view of final NPV
Decision-Tree Approach: • Handles scenario with sequential investment decisions • Handles two types of situations – Decision (manager has control) and Event (Manager has no control)

Practical Areas:

Special items impacting cash flows:		
Depreciation	Relevant item	Tax benefit on depreciation shield
Opportunity cost	Relevant item	Cost of benefit foregone
Sunk cost	Irrelevant item	Cost which has already been incurred
Working capital	Relevant item	Increase in working capital (outflow) Decrease in working capital (inflow)
Allocated/General/Corporate OH	Irrelevant item	Does not change due to project
Specific/Incremental OH	Relevant item	Changes due to project
Additional capital expenditure	Relevant item	Leads to incremental outflow
Financing costs	Irrelevant item	Ignored as discounting takes care of the same
Pre-tax vs post-tax cash flow		Tax is relevant outflow and hence we should consider post-tax cash flows
Total cash flow vs incremental CF		Incremental cash flow is change due to decision in hand and the same is relevant

Examples:

- Feasibility study/Market study is a sunk cost and an irrelevant expense.
- Head-office expenses is irrelevant cost as the same is a general OH

Steps for computation of cash flows:**Step 1: Initial Outflow**

Particulars	Amount
Capital expenditure	(XXX)
Working capital	(XXX)
Total outflow	(XXX)

Step 2: In-between cash flows:

Particulars	Amount
Revenues	XXX
Less: All costs other than depreciation	(XXX)
Profit before depreciation and tax (PBDT)	XXX
Less: Depreciation	(XXX)
Profit before Tax (PBT)	XXX
Less: Tax	(XXX)
Profit after Tax (PAT)	XXX
Add: Depreciation	XXX

Cash flow after tax (CFAT)	XXX
Add/Less: Increase/decrease in Working capital	XXX
Less: Purchase of additional machinery / payment for original machine	(XXX)
Revised CFAT	XXX

Step 3: Terminal flow:

Particulars	Amount
Net salvage value of capital expenditure (Note 1)	XXX
Recapture of working capital	XXX
Total terminal flow	XXX

Note 1: Calculation of Net Salvage Value:

Particulars	Amount
Sale value	XXX
Less: Book value	(XXX)
Capital gain/loss	XXX
Tax Paid/saved	XXX
Net salvage value (Sale value + Tax saved - Tax Paid)	XXX

Step 4: Consolidate the cash flows in the below format and calculate appropriate technique (assuming life of 5 years):

Year	Cash flow
0	Step 1
1	Step 2
2	Step 2
3	Step 2
4	Step 2
5	Step 2 + Step 3

Special points:

- Minimum volume of sales to justify the project is one which leads to zero NPV for the project
- **Cash flow at beginning of year:** Capital budgeting assumes cash flows to happen at end of the year. If cash flows happen at beginning of year, then we need to consider the cash flows to happen at end of earlier year. For example, if cash flow happens at beginning of year 3, then same would be considered as end of year 2.
- **Tax losses:** If a company has tax losses, then we can consider saving on tax loss with an assumption that this tax loss can be offset against profit of other businesses
- **Decline in profits of existing businesses:** If a new project leads to decline in profits of existing business, then the same is treated as opportunity cost. If the loss is given at pre-tax level, then we deduct before PBT and if the same is given at post-tax level, then the same is adjusted post PAT
- **Subsidy receipt:** Any subsidy received can be treated as revenue subsidy or capital subsidy. Revenue subsidy can be assumed either to be taxable or exempt. Capital subsidy can either be adjusted with cost of asset or ignored. If we adjust with cost of asset then we can claim depreciation on lower gross block
- **Saving in cost:** Any cost saving due to a project is similar to increase in revenues as the same would increase the net cash flow of the company. Hence any saving in cost is considered as positive item while computing cash flows
- **Relevance of interest cost:** Interest cost is normally considered as irrelevant due to reward exclusion principle. However, if there is any specific benefit of lower interest in two alternatives then we should follow equity shareholders approach (FCFE) and not long-term funds approach for computing NPV
- **Accounting book value vs Tax book value:** We should consider tax book value for computing capital gain as well as depreciation
- **Block of assets method of depreciation:** Under block of assets method of depreciation we will not be considering any capital gain/capital loss assuming company has other assets in the block.

Depreciation would be charged on net book value [Opening book value – Sale value of old asset + Capital expenditure of new asset]

- **Capital recovery factor:** Capital recovery factor is inverse of annuity factor

Capital budgeting techniques:

Payback	Base Year + $\frac{\text{Unrecovered cash flow of Base Year}}{\text{Cash flow of next year}}$ Note: Base year refer to the last year in which cumulative cash flow is negative
ARR	$\text{ARR} = \frac{\text{Average PAT}}{\text{Initial or Average Investment}} \times 100$ Initial investment = Initial outflow Average investment = Average of initial outflow and salvage value
Discounted Payback	Base year + $\frac{\text{Unrecovered discounted cash flow of base year}}{\text{Discounted cash flow of next year}}$ Note: Base year refer to the last year in which cumulative cash flow is negative
NPV	PV of cash inflows – PV of cash outflows
Profitability index	$\frac{\text{PV of cash inflows}}{\text{PV of cash outflows}}$
IRR	$L_1 + \frac{\text{NPV at } L_1}{\text{NPV at } L_1 - \text{NPV at } L_2} \times (L_2 - L_1)$ Where: L1 = Lower rate with + NPV L2 = Higher rate with - NPV

Equated Annual Benefit and Equated Annual Cost:

$$\text{EAB} = \frac{\text{NPV}}{\text{PVA}(r, \text{life})}$$

$$\text{EAC} = \frac{\text{PV of Outflow}}{\text{PVA}(r, \text{life})}$$

How to decide on abandonment of an asset?

Step 1: Initial outflow

Particulars	Amount
NSV of existing asset at year 0	(XXX)
Working capital	(XXX)
Total outflow	(XXX)

Step 2: In-between flows – No change

Step3: Terminal flow:

Particulars	Amount
NSV of existing asset at the end of life	XXX
Recapture of working capital	XXX
Total terminal flow	XXX

Step 4: Consolidation of cash flows and calculation of NPV – No change

Conclusion: If the NPV of the project is positive then we should continue with the asset. However if the same is negative then we have to abandon the asset

How to decide on replacement?

Method 1 : Total Approach:

- ❖ Step 1: Compute NPV of continuation option
- ❖ Step 2: Compute NPV of purchase option
- ❖ Step 3: Decide by comparing step 1 & step 2
 - If step 1 is greater than we should continue with existing asset
 - If step 2 is greater than we should replace the asset

Method 2: Incremental approach:

- ❖ Step 1: Compute incremental initial outflow
- ❖ Step 2: Compute incremental in between cash flows
- ❖ Step 3: Compute incremental terminal flow
- ❖ Step 4: If the NPV is positive then we should go ahead with replacement.

Optimal replacement cycle:

- An asset can have life of 5 years. However, as the life of the asset increases, we see an increase in maintenance and related cost. Optimal replacement cycle is one which leads to highest EAB/lowest EAC
- **Optimum abandonment decision:** Optimum replacement cycle is done with an objective of repeating this exercise and hence we go with EAB. However optimum abandonment decision can be done on the basis of highest absolute NPV
- **Replacing old asset with new asset:** A company may plan to replace an old asset with new asset and this replacement can happen at end of different years. Hence, we can have multiple options and each will have a different life. We can go ahead and computation EAB/EAC of new machine and then assume that old machine is replaced at end of year 0/year 1/year 2/year 3... and balance would be use of new machine (**we need to ensure life of all alternatives is same**). We can compute NPV/PV of outflow and choose the optimum replacement timeline

Project IRR vs Equity IRR:

- Project IRR is computed on the basis of FCFF approach and equity IRR is computed on the basis of FCFE approach
- Project NPV is FCFF discounted at cost of capital and equity NPV is FCFE discounted at cost of equity

Inflation:

- ❖ Inflation means “rise in prices”
- ❖ If cash flow includes inflation, they are said to be in money terms and if it excludes inflation they are said to be in real terms
- ❖ If discount rate include inflation it is said to be in money term and if it excludes inflation then it is said to be in real terms
- ❖ **(1 + Money Discount Rate) = (1 + Real Discount Rate) x (1 + Inflation rate)**
- ❖ **Different inflation rates for cost and sales:** In this case we can only adjust the cash flows and adjust of discount rate will not be possible
- ❖ **Different inflation rates for year 1 and year 2:** In this case we should consider both inflation rate while computing cash flow of year 2. **Inflation adjusted revenues of year 2 = Real cash flow x (1 + inflation rate of year 1) x (1 + inflation rate of year 2)**

Expected NPV:

- Expected NPV is the weighted average value of NPV with probability of occurrence being the assigned weight
- **Best case and worst case NPV:** Best case NPV is computed using best estimates (Highest units sold, highest SP, lowest VC and lowest fixed cost). Worst case NPV is computed using worst estimates (lowest units sold, lowest SP, highest VC and highest fixed cost)

Standard Deviation:

$$SD = \sqrt{pd^2}$$

$$d = X - (\text{Average of } X)$$

Standard Deviation for dependent and independent cash flows:

- ❖ **Dependent cash flow:** Cash flow of succeeding periods are perfectly correlated to earlier periods
- ❖ **Independent cash flow:** Cash flow of succeeding periods are not dependent on earlier years

Steps for computation of risk:

Independent cash flow	Dependent cash flow
1. Compute SD of each year	1. Compute SD of each year
2. Discount the SD and get the discounted SD	2. Discount the SD and get the discounted SD
3. Square and sum up the values of step 2	3. Sum the value of step 2
4. Extract the square root of step 3 value and arrive at standard deviation	4. The value in step 3 is the standard deviation

Co-efficient of variation:

$$CV = \frac{\text{Expected Value}}{\text{Standard Deviation}}$$

RADR:

- RADR = Risk-free rate + Risk-premium
- Discount rate for RADR can be computed based on CAPM equation (or) co-efficient of variation (or) other basis provided in question

Certainty equivalent approach:

- ❖ Convert uncertain cash flows into certain cash flows
 - $CCF = UCF \times CEF$
- ❖ The appropriate discount rate is risk-free rate of return
- ❖ Compute NPV
- ❖ **CEF and RADR approach:** Sum of CEF would give an indication on risk of project. If a project has lower CEF, then it would mean low certainty and high risk. This project would be discounted at higher RADR.

Sensitivity Analysis:

- It measures the percentage change in input parameters that would lead to a reversal in investment decision

$$\text{Sensitivity \%} = \frac{\text{Change}}{\text{Base}} \times 100$$

- We can also compute sensitivity by assuming 10 percent change in basic variable and find out the percentage change in NPV. Factor leading to maximum change in NPV is the most sensitive parameter

Simulation:

- **Step 1:** Identify parameters and variables
- **Step 2a:** For each variable, arrange the values in ascending order and calculate cumulative probability at the end of each value
- **Step 2b:** Construct random number class interval for each variable
- **Step 3:** Based on random number and class interval, select the values of various variables
- **Step 4:** Compute NPV of each set. The appropriate discount rate to be used is risk-free rate
- **Step 5:** The simple average of the computed NPV is the final NPV.

Decision Tree:

- **Rule 1:** A decision tree begins with a decision point. A decision point is represented by a rectangle
- **Rule 2:** An outcome point (also known as chance node) is denoted by a circle
- **Rule 3:** A decision tree is drawn from left to right whereas the evaluation is done from right to left
- **Rule 4:** The value of a chance node is the sum of expected values of the various branches emanating from the chance node
- **Rule 5:** The value of a decision node is the highest amongst the values of the various branches which arise from the decision node

Note:

- Joint probability of a particular stream of cash flow = Probability of year 1 x Probability of year 2 x Probability of year N

Adjusted Present Value:

- **Adjusted Present value = Base case NPV + PV of financing benefits - Issue costs**
- Base Case is calculating using the Unlevered Cost of Equity
- PV of tax benefit on interest is computed by discounting the tax saving at pre-tax cost of debt
- There can also be benefit of lower interest due to favourable funding and the same would also be considered in computation of financing benefits

Valuation of option:

- Value of base project is the PV of cash flows of base project discounted at cost of capital
- A company may have an option to expand/abandon and this can favorably impact the NPV of the project.
- **Value of option = NPV of option x Probability**
- Value of project with option = Value of base project $\pm$ Value of option

Chapter 4 – Security Analysis

<u>Security Analysis:</u> • Systematic analysis of risk and return profile to help a rational investor make a decision on purchase of security • Two approaches – Fundamental Analysis and Technical Analysis
<u>Fundamental Analysis:</u> • Objective is to find intrinsic value which is the present value of future dividends discounted at appropriate discount rate • Key variables = EIC Analysis – Economic, Industry and Company Analysis
<u>Economic Analysis:</u> • Forecast national income and its various components that will have a bearing on specific industry and the company • <u>Factors affecting economic Analysis:</u> Focus is on macro-economic factors such as growth rates of national income, growth rate of industrial sector, inflation and monsoon
<u>Techniques used for Economic Analysis:</u> • <u>Anticipatory Surveys:</u> Help investors form an opinion on future state of economy by getting expert opinion on various factors impacting economy • <u>Barometer/Indicator Approach:</u> Indicators to find how economy will perform in future. There are leading indicators, roughly coincidental indicators and lagging indicators • <u>Economic model building approach:</u> Developing a precise and clear relationship between dependent and independent variables. In this approach forecasting of GDP is done in two ways. One is by measuring individual components and then adding up to overall GNP. This is then compared with GNP prediction of independent agency to check for accuracy and consistency
<u>Industry Analysis:</u> • This is concerned with analysing the expected performance of the specific industry to which the company belongs. Demand, cost structure and other factors are analysed to identify the prospects of the company • <u>Factors:</u> Product life-cycle, Demand supply gap, barriers to entry, Government attitude, state of competition, cost conditions and profitability, Technology and research • <u>Techniques:</u> Regression Analysis (consider factors such as GNP, disposable income, per capita consumption, price elasticity to identify demand) and Input-output Analysis (track flow of goods across value chain to find changing trends indicating growth/decline of industries)
<u>Company Analysis:</u> • <u>Factors:</u> Networth/Book value, Sources and uses of funds, Cross-sectional and time series analysis, size and ranking, Growth record, Financial Analysis, Competitive advantage, Quality of management, corporate Governance, Regulation, Location and Labour-management relations, Pattern of existing stock holding, Marketability of shares • <u>Techniques:</u> Correlation and regression analysis, Trend Analysis and Decision Tree Analysis
<u>Technical Analysis:</u> • <u>Meaning:</u> Method of study of share price movements based on study of price graphs or charts to find future trends in share prices • <u>Assumption:</u> Price is dependent on supply and demand which are governed by several factors, stock prices move in trends, emphasis is on chart analysis rather than information in financial statements • <u>Principles:</u> The market discounts everything, Price moves in trends and History tends to repeat itself
<u>Dow Theory:</u> • <u>Two indices:</u> Dow Jones Industrial Average and Dow Jones Transportation Average • <u>Three classification:</u> Primary movement, secondary movement and daily fluctuations • <u>Primary movement:</u> Main trend usually for one year to 36 months – commonly called as bear or bull market • <u>Secondary movement:</u> Opposite to primary movement and is shorter in duration • <u>Daily fluctuations:</u> Not part of the interpretation • <u>Interpretation:</u> Successive highs and lows of stock market averages are higher, then the same would be bull market. If the successive highs and lows are lower than it is bear market

- **Three moves:** First one by far-sighted knowledgeable investors, second one by arrival of earnings numbers and the third one is of speculative.

Elliott Wave Theory:

- Market exhibited certain repeated patterns or waves. Depending on demand and supply, waves are generated in the prices
- **Types of waves:** Impulsive patterns and corrective patterns
- **Impulsive Patterns (Basic Waves):** 3 or 5 waves in a given direction (upward or downward) – also called as basis movements which indicates bull or bear phase
- **Corrective Patterns (reaction waves):** Moves against the basis direction
- One cycle consists of waves made up to two distinct phases (bullish and bearish). On completion of one cycle, fresh cycle will start with similar impulses

Random Walk Theory:

- This theory states that the behaviour of stock market prices is unpredictable and there is no relationship between present and future prices
- Change in security prices behave nearly as if they are generated by a suitably designed roulette wheel
- **Supporting arguments:** Price cannot be predicted, price trends are statistical expression of past data, Periodical ups and downs,

Charting techniques:

- **Line Chart:** Lines are used to connect successive day's prices. The closing price for each period is plotted as a point
- **Bar Chart:** Vertical line (Bar) represents the lowest to the highest price, with a short horizontal line protruding from the bar representing both the opening and closing prices for the period
- **Japanese Candlestick Chart:** The bar chart **displays stock opening, closing, and highs and lows, with the color of the candlestick indicating the trend.** A black candlestick indicates a lower closing price, while a white candlestick indicates a higher one. A Doji candlestick indicates no change or near-no change
- **Point and figure chart:** They are used to detect reversals in a trend. For plotting a point and figure chart, we have to first decide the box size and the reversal criterion. The box size is the value of each box on the chart, for example each box could be 1, 2 or 0.50. The smaller the box size, the more sensitive would the chart be to price change

Market Indicators:

- **Breadth Index:** This is computed by dividing the net advances or declines in the market by the number of shares traded
- **Volume of transactions:** Rising index/falling index with increasing volume would indicate bull and bear market respectively
- **Confidence Index:** Ratio of high-grade bond yields to low-bond grade yields – Explains how willing the investors are willing to take a change – Rising confidence index is a sign of bull market and vice versa
- **Relative strength Analysis:** Some securities generate higher returns in bull market or decline more slowly in bear market. These securities demonstrate relative strength in the past and this can be used to buy securities with high relative strength
- **Odd-lot theory or Contrary- opinion theory:** It assumes that the average person is usually wrong and the wise course of action is to pursue strategies contrary to popular opinion

Support and Resistance Level:

- When the index/price **goes down from a peak**, the peak becomes the **resistance level**. When the index/price **rebounds after reaching a trough** subsequently, the lowest value reached becomes the **support level**

Tools to interpret price patterns:

- **Channel:** Series of uniformly changing tops and bottoms gives rise to a channel
- **Wedge:** A wedge is formed when tops (resistance levels) and bottoms (support levels) change in opposite direction
- ❖ **Head and Shoulders:** It is a distorted drawing of a human form, **with a large lump (for head) in the middle of two smaller humps (for shoulders).** This is perhaps the single most important pattern to indicate a reversal of price trend.
- **Triangular or coil formation:** Pattern of uncertainty and hence difficult to predict which way price will break out

- **Flags and Pennants form:** Signifies a phase after which the previous price trend is likely to continue
- **Double Top Form:** Represents a bearish development – price likely to fall
- **Double bottom form:** Represents a bullish development – price likely to rise
- **Gap:** A gap is the **difference between the opening price on a trading day and the closing price of the previous trading day.**

Moving average Analysis:

- **Buy Signals:** Stock price line goes above moving average line when moving average line is flattening out, stock price falls below rising moving average line, Stock price line which is above moving average line falls and begins to rise again above moving average line
- **Sell Signals:** Stock price line goes below moving average line when moving average line is flattening out, stock price rises above falling moving average line, Stock price line which is below moving average line rises and begins to fall again below moving average line

Evaluation of Technical Analysis:

- **Supporters:** Trends persist for some time due to human psychology, shift in demand and supply are gradual and not instantaneous, information is factored in gradually in price and hence price movement continues in same direction till information is fully factored in
- **Detractors:** No convincing explanation, early identification of trends may not be possible, many people employing technical analysis will lead to decline in value of technical analysis, supporting random walk theory which is not feasible

Fundamental Analysis vs Technical Analysis:

- Fundamental analysis predicts prices based on economy, industry and company factors whereas technical analysis predicts future prices based on historical price movements
- Fundamental analysis believes price discounts every information and useful for long-term investing whereas technical analysis believes in price capturing everything and is useful for short-term investing

Efficient market theory:

- **Conclusion:** All available price sensitive information is fully factored in share prices
- **Reason why consistent outperformance cannot happen:** Free availability of information, keen competition among market participants and price change will only be on new information
- **Misconceptions:** Prices factor in all available information, Price will fluctuate but they cannot reflect fair value due to surprise element, Random movement of stock price indicating stock market is irrational
- **Level of market efficiency:** Weak form (Reflect information found in record of past prices and volumes), semi-strong (past prices + Volumes + Other public information), Strong form (Public as well as private information)
- **Challenges:** Limited information processing capabilities, irrational behaviour and monopolistic influence of powerful institutions and big operators

Tools available for equity research:

- Equity Research is a finance or investment banking field that analyzes a company's financial performance to determine whether to buy, sell, or hold equity shares
- **Available tools:** Bloomberg terminal, Businessquant, YCharts, MarketXLS

Practical areas:**Concept 1: How Exponential moving averages are calculated?**

- ❖ **Step 1:** Compute the difference between current index value and previous day EMA.
- ❖ **Step 2:** EMA Adjustment = Value of exponent x Value as per step 1
- ❖ **Step 3:** EMA of current day = EMA of previous day ± EMA Adjustment

$$\text{Value of Exponent} = \frac{2}{n + 1}$$

Concept 2: How to test market efficiency?

- ❖ Capture the closing index value for all days and mention the sign of price change. Sign of price change is +(positive) if index has moved up and it will be -(negative) if index has come down
- ❖ **Compute the no. of positive changes (n1) and no. of negative changes (n2). Also compute no of times sign has changed from positive to negative(r).** For example, the sign of price change is positive, negative, negative, positive, positive, positive, negative and positive. In this example r

will be taken as 5 (we started with positive and then it shifted to negative on day 2. It again got changed to positive on day 3. Then sign changed to negative on day 7 and it got changed to positive on day 8)

$$\text{Compute } \mu_r = \frac{2n_1n_2}{n_1 + n_2} + 1$$

$$\text{Compute } \sigma_r = \sqrt{\frac{2n_1n_2(2n_1n_2 - n_1 - n_2)}{(n_1 + n_2)^2(n_1 + n_2 - 1)}}$$

- ❖ Compute lower limit and upper limit for the given level of significance. We should apply t-test for n-1 degrees of freedom
 - Lower limit = $\mu_r - (\sigma_r \times t\text{-value})$
 - Upper limit = $\mu_r + (\sigma_r \times t\text{-value})$
- ❖ If the computer r lies between these limits then market exhibits weak form of efficiency

Concept 3: Auto-Correlation Test:

- This can be used to find whether market exhibits weak form of efficiency. We should first identify the two series of values which are to be compared for computing correlation co-efficient
- If the Correlation co-efficient is between 0 to 1, **then there would be a moderate degree of correlation and we can conclude that the market does not show weak form of efficiency.**
- If the correlation is 0, it means it is difficult to predict market based on earlier trends and hence this would mean that market is exhibiting strong form of efficiency.
- If the correction is +1 or -1, it means we can predict market based on past trends and hence the same would mean market is inefficient
- In short if we can estimate market based on past trends then it is inefficient and if we cannot predict then the same becomes efficient

Important Points:

- If the EMA is exhibiting increasing trend, then the market is said to be bullish and if the EMA is showing decreasing trend, then the market is said to be bearish
- Test of significance is to be checked for n-1 degree of freedom. n = No of positive changes + No of negative changes. If there are 10 data points, then n will be equal to 9 as we cannot find the sign of change for the first observation

$$\text{Breadth index} = \frac{\text{Net advances}}{\text{Total Securities}}$$

$$\text{Confidence index} = \frac{\text{Yield on high grade bond}}{\text{Yield on low grade bond}} \times 100$$

$$\text{Relative strength} = \frac{\text{Average gain of last 14 days}}{\text{Average loss of last 14 days}}$$

$$\text{Relative strength index} = 100 - \left(\frac{100}{1 + RS} \right)$$

Chapter 5 – Security Valuation

Expected return and required return: - Required return represents minimum rate of return which investor wants. This is also called as cost of capital - Expected return reflect the return likely to be earned by investors - Expected Alpha = Expected Return – Required Return
Equity risk premium: ❖ Equity risk premium is the excess return that investment in equity shares provides over a risk-free rate, such as return from tax free government bonds. This excess return compensates investors for taking on the relatively higher risk of investing in equity shares of a company.
Nominal cash flow and real cash flow: - Nominal cash flow is the amount of cash flow without any adjustments for inflation. Real cash flows are company's cash flow with adjustments for inflation - Nominal cash flow include inflation and is discounted with nominal discount rate whereas real cash flow exclude inflation and is discounted with real discount rate
Enterprise value: Meaning: Enterprise value is the true economic value of company. $EV = \text{Equity} + \text{Debt} + \text{Minority Interest} - \text{Cash and cash equivalents}$ Multiples in relation to EV: EV to sales and EV to EBITDA
Duration: - Duration is nothing but the average time taken by an investor to collect his/her investment. If an investor receives a part of his/her investment over the time on specific intervals before maturity, the investment will offer him the duration which would be lesser than the maturity of the instrument. Higher the coupon rate, lesser would be the duration. - Duration is impacted by time to maturity and coupon rate
Immunization: Immunization happens if the weighted duration of the portfolio is equal to the period for which investment is required to be made. This is a level where price risk and reinvestment risk will offset each other leading to no impact to the investor
Term structure Theory: - Explains the relationship between interest rates or bond yields and different terms/maturities Types of Yield curve: Upward sloping, Downward Sloping, Flat and Humped Expectation theory: Long-term interest rates can be used to forecast short-term interest rates Liquidity preference theory: Forward rates = Expected future spot rate + liquidity premium to compensate for exposure to interest rate risk Preferred habitat theory (Market Segmentation Theory): Premiums are related to supply and demand of funds at various maturities and not to the term of maturity
Convexity: - Duration can be used to find the percentage change in bond price for small change in interest rates. However, this cannot accurately measure the change - Accurate measurement can be done with the help of convexity adjustment $C \times (\Delta y)^2 \times 100$ Where $\Delta y = \text{Change in Yield}$ $C = \frac{V_+ + V_- - 2V_0}{2V_0(\Delta^2)}$ $V_+ = \text{Price of bond if yield increases by } \Delta y$ $V_- = \text{Price of bond if yield decreases by } \Delta y$
Modified duration: Volatility assumes linear relationship between yield and price change. However, the relationship is non-linear due to convexity adjustment. Hence, we can say that modified duration is only a proxy and not an accurate measure of change in price of bond due to change in interest rates
Reverse stock split: 'Reverse Stock Split' is a process whereby a company decreases the number of shares outstanding by combining current shares into fewer or lesser number of shares.

- **Reasons:** Avoiding delisting from stock exchanges, avoiding removal from constituents of index, to avoid the tag of Penny stock and to attract institutional investors and mutual funds

Zero Coupon Bond:

- ZCB do not pay interest during the life of the bonds. They are issued at discounted price and the amount will mature to face value by end of life

Arbitrage pricing theory:

- CAPM formula helps to calculate the market's expected return, APT uses the risky asset's expected return and the risk premium of a number of macroeconomic factors.
- Required return under APT = $R(f) + B_1(RP_1) + B_2(RP_2) + \dots B_j(RP_n)$

Money Market:

- Market for meeting short-term funding requirements of corporates and Banks
- **Features:** Short duration, Large volumes, De-regulated interest rates, highly liquid, safe investments

Different instruments:

- **Call/Notice Money:** Call money market is where scheduled commercial banks lend or borrow on call (overnight) or at short-notice. Under notice money market, funds are transacted for a period between two to 14 days
- **Treasury bills:** Short-term promissory notes issued by Government of India at a discount. These provide investor an opportunity to invest short-term surplus in instruments of varying maturities
- **Commercial bills:** A commercial bill is a bill of exchange containing a written order from the creditor to the debtor to pay a certain sum to a certain person after a specified period. The seller can get the bill discounted and use the same for meeting his working capital needs
- **Certificate of Deposit:** Term deposits accepted by commercial banks from bulk depositors. These are issued at discount and the face value is payable at maturity by the issuing bank
- **Commercial Paper:** Unsecured and negotiable promissory notes issued by high-rated corporate entities. These are issued directly to the market and used for funding working capital requirements. Generally, CP is issued at discount and yield is market determined
- **Repo and Reverse Repo:** Repo rate is the rate at which RBI lends to commercial banks and Reverse Repo rate is the rate at which Commercial banks lend to RBI. Repo and Reverse Repo refers to type of transaction in which money market participant raises funds by selling securities and simultaneously agreeing to repurchase the same along with interest in future

Valuers:

- **Purposes for which valuers are required:** Mergers/acquisitions/de-mergers/takeovers + Slump sale/Asset sale/IPR sale + Conversion of debt/security + Capital reduction + Strategic financial restructuring
- **Responsibilities:** Integrity and fairness + Professional competence and due care + Independence and disclosure of interest + Confidentiality + Information management + Not taking expensive gifts and hospitality + reasonable remuneration and cost reimbursement + Not accepting too many assignments which can impact execution
- **Precautions:** Spend adequate time in collecting data and understanding the firm + evaluate factors other than financial statements such as scalability, growth potential, cross-sell opportunities + Balance valuation based on numbers/story

Practical Areas:**Walter's Model**

$$P_0 = \left(\frac{D}{K_e} \right) + \frac{\left(\frac{r}{K_e} \right) \times (E - D)}{K_e}$$

Where:

Term	Meaning	Formula/other notes
P_0	Fair Market Price	
D	Dividend per share	$\frac{\text{Total Dividend}}{\text{Number of shares}}$ (or) $\text{EPS} \times \text{Payout ratio}$
R	Return on equity (or) Internal rate of return (or) Return on retained earnings (or) Return on investment	$\frac{\text{EAES}}{\text{Value of Equity}}$ (or) $\frac{\text{EPS}}{\text{Book value per share}}$

E	Earnings per share	EAES Number of shares EAES = PAT - Preference Dividend	(OR) Book value per share x ROE
K_e	Cost of equity	This is also called as: - Investor's required rate of return - Opportunity cost of capital - Rate of capitalization - Cost of capital (100% equity company) - Equity capitalization rate	

Important Points:

- Cost of equity will be computed as per CAPM model if data on risk-free rate, market return and beta is given. Cost of equity = $R_f + \text{Beta} \times (R_m - R_f)$
- Cost of equity can be sometimes expressed as inverse of PE Multiple ($K_e = 1/\text{PE Multiple}$).** This formula will work only when company follows 100% dividend payout. However, in few problems we will use this formula even for lower payout ratio due to lack of information to get cost of equity
- Question has asked for computing the payout ratio to achieve a target price. However, cost of equity is missing in the question.** We can do one of the following:
 - Assume cost of equity and proceed with the answer
 - Take cost of equity as inverse of PE Multiple. However, this approach will lead to payout ratio of 100%
- Cost of equity is required to be calculated in the question and PE Multiple is given in the question.** We will have all information and K_e would be computed through reverse working and forming quadratic equations.
- Cost of GDR:** Cost of GDR works in same manner as cost of equity. GDR will have underlying equity shares and we can compute the amount of dividend per GDR. Also, it can have floatation cost and hence Price (P_0) is replaced with net proceeds ($P_0 - F$) in the formula
- Multiple growth rates and cost of equity:** If there are multiple growth rates the Gordon's formula cannot be used to find cost of equity. In that scenario we need to assume discount rates and get NPV of the cash flows. Once we get one positive and one negative NPV we can calculate the IRR of the cash flows. The computed IRR would be taken as cost of equity. **We should take care of terminal cash flows while computing NPV as the terminal cash flows (perpetuity) valuation can change based on discount rate.**
- Optimum dividend payout ratio is dependent on return on equity and cost of equity. The same is summarized in the below table:

Scenario	Payout Ratio
$r > K_e$	0%
$r = K_e$	Indifferent (Any payout ratio)
$r < K_e$	100%

- Payout ratio will have impact on share price and the question can ask us to compute the payout ratio for a target share price. If the computed payout ratio is more than 100%, then the same is illogical and ICAI answer takes the payout ratio as 0%
- Limiting value is the minimum possible value of a share and same is calculated at a payout ratio which is opposite of optimum payout ratio.**

Gordon's Model:

$$P_0 = \frac{D_1}{K_e - G}$$

Where:

Term	Meaning	Formula/other notes
P_0	Fair Market Price	
D_1	Dividend of next year	- This is one important assumption as the question would not be clear whether it is nearby dividend (D_0) or Distant Dividend (D_1) - If the question is not clear, then we should write our assumption and also solve answer with both assumption (i.e. taking dividend as D_0 and D_1) Majority of ICAI answers we will have assumption of taking dividend as D_1 and hence that would be our primary answer and alternate answer would be by taking the dividend as D_0

K_e	Cost of equity	Same as per Walter's Model
G	Growth rate	This would represent the growth rate in dividends and can be computed based on the following approaches • Formula based: Growth rate = IRR/ROE x Retention Ratio • Based on past data: ○ Take the first available dividend as Present value and the latest available dividend as future value ○ Number of years gap will be taken as n ○ Use below formula and compute r as balancing figure. The computed r will be taken as growth rate ○ Future value = Present Value x $(1 + r)^n$

Important Points:

- **Price computed as per Gordon's model would be the ex-dividend price.** In case shares are quoting cum-dividend in the market then the fair cum-dividend price would be equal to ex-dividend price + Amount of dividend
- Share price will fall by the amount of dividend once the share goes ex-dividend
- Growth rate should be computed based on EPS. This is because EPS reflects real growth of company and DPS growth would mirror EPS growth unless there is a change in a payout ratio. This approach is followed in case growth is computed based on past data
- **Change in payout ratio:** In order to compute future DPS, we should first compute the EPS and based on EPS we should compute DPS. This approach will ensure correct DPS projection in case there is a change in Dividend Payout Ratio
- **Implied growth rate with current PE Multiple:** If the PE Multiple is given in the question and based on that, we can compute current market price. Current market price can be substituted in Gordon's formula to get implied growth rate.
- **Present value of Growth Opportunities [PVGO]:** PVGO basically represent extra price paid due to growth opportunities of the company. $PVGO = \text{Current market price} - \text{Price if there was no growth}$

Step-up Growth Model (or) Dividend Discount Model (or) Multi-growth model:

- This refers to a scenario where growth happens in multiple stages (initial stage, intermediate stage and final stage)
- **Step 1:** We should compute dividends till the first year of stabilization phase. Stabilization phase is reached where growth rate as well as cost of equity is stabilized and will remain same till perpetuity
- **Step 2:** We should value the perpetuity once stabilization is reached. We will use the Gordon's formula to value the growing perpetuity
- **Step 3:** Discount the above cash flows at cost of equity and arrive at fair value of the share

Important Points:

- **Linear fall in dividend growth rate:** This would mean that dividend growth rate will fall by same percentage every year. Annual fall in growth rate = $[\text{Total fall in growth rate} / \text{Number of years}]$. If the question does not specify the number of years, then we will take the same as 1 percent fall every year
- **Multiple cost of equity:** Question can give information to calculate multiple cost of equity. For instance, cost of equity can be 10% for year 1 to 4 and thereafter it can be 14%. We should use the respective discount rate for perpetuity valuation and PVF should be computed based on below rules:

$$\begin{aligned}
 \text{PVF of year 1} &= \frac{1}{1 + \text{Discount rate of year 1 (10\%)}} = 0.909 \\
 \text{PVF of year 2} &= \frac{0.909}{1 + \text{Discount rate of year 2 (10\%)}} = 0.826 \\
 \text{PVF of year 3} &= \frac{0.826}{1 + \text{Discount rate of year 3 (10\%)}} = 0.751 \\
 \text{PVF of year 4} &= \frac{0.751}{1 + \text{Discount rate of year 4 (10\%)}} = 0.683 \\
 \text{PVF of year 5} &= \frac{0.683}{1 + \text{Discount rate of year 5 (14\%)}} = 0.599
 \end{aligned}$$

- Care should be taken to take the previous year discount factor and then divide by (1 + Discount rate of next year)
- Impact of bonus issue:** Fair market price is the present value of future cash flows discounted at cost of equity. If a bonus issue is made then 1 share can get converted into 1.2 shares (or) 1.5 shares (or) any other number depending on bonus ratio. **Hence, we should consider the selling price of higher number of shares for last year cash flow.**

H Model for Three-Stage Dividend Discount Model:

- In the first stage dividend grows at high growth rate for a constant period, then in second stage it declines for some constant period and finally grow at sustainable growth rate.
- H Model is based on the assumption that before extraordinary growth rate reach to normal growth it declines lineally

$$P_0 = \frac{D_0(1 + g_n)}{r - g_n} + \frac{D_0 H_1 (g_c - g_n)}{r - g_n}$$

Where:

- Gn = Normal growth rate Long run
- Gc = Current growth rate i.e. initial short-term growth rate
- H1 = Half of duration of the transition growth period

Important points common to Walter's and Gordon's Model:

- We should ensure consistency in dividend and cost of equity.** If dividends are exempt in hands of shareholders then the cost of equity should be after tax. Conversely if dividends are taxable in hands of shareholders then the cost of equity should be before-tax
- Maintenance of Dividend Income:** An investor wants to maintain dividend income for meeting his regular expenses. However, the company may stop paying dividends due to growth opportunities. In that case, the investor can maintain the dividend income by partial sales of shares till company starts paying dividends again
- Which method to follow for valuation if the problem is silent:**
 - Most of the questions will be solved either under Walter's or Gordon's model
 - Walter's model will be followed if information on Dividend, EPS, return on equity and cost of equity is given.
 - Gordon's model can be followed if Dividend, Growth rate and Cost of equity is given
 - To conclude, if we have information for Walter's model then Gordon's approach will also be possible. This is because growth rate can be calculated with return on equity and retention ratio.**
- Total Dividends as per residual model = (Total earnings – equity needed for capex). Equity needed for capex would be computed as per the optimum debt-equity capex
- Radical approach:** A company can provide return to shareholders in form of dividends and capital gains. Company should declare dividends if tax rate on dividends is lower than tax rate on capital gain and vice versa

PE Multiple Approach:

- Fair Price of share = EPS × PE Multiple
- PE Multiple will be directly given in the question. If the same is not available, then we can compute PE Multiple as (1/ROE)**

Earning growth model:

$$P_0 = \frac{EPS_1}{K_e - G}$$

Free Cash flow Approach:

$$P_0 = \frac{FCFE_1}{K_e - G}$$

Where:

Term	Meaning	Formula/other notes
FCFE ₁	Free cash flow to equity shareholders of next year	- FCFE = PAT – Equity funding for net capex and working capital - Equity funding for net capex and working capital = Net Capex and Working Capital × (100 – Debt ratio%) - Debt ratio basically represent what percentage of capex and working capital will be funded with debt.

- This approach can be followed if the problem gives data on capital expenditure, depreciation, working capital change and debt ratio

Other important points on valuation:

- A share is said to be under-valued if current market price is lower than intrinsic value whereas a share is said to be over-valued if market price is higher than intrinsic value. Intrinsic value is basically computed as per any of the valuation models. **Investor should buy an under-valued security and sell an over-valued security**
- Inflation premium forms part of risk-free rate of return. Any increase in inflation premium will increase the risk-free rate and vice versa
- **Interest coverage ratio:** Interest coverage is normally computed using the below formula:

$$\text{Interest coverage ratio} = \frac{\text{EBIT}}{\text{Interest}}$$

- However, if the question states that PAT should cover fixed interest and fixed dividends xx times. In this case this ratio would be calculated as under:

$$\text{Interest and Dividend coverage ratio} = \frac{\text{PAT} + \text{Interest}}{\text{Interest} + \text{Preference Dividend}}$$

- **Capital gearing ratio:** Capital gearing ratio is computed using the below formula:

$$\text{Capital Gearing ratio} = \frac{\text{Debentures} + \text{Preference Capital}}{\text{Equity capital} + \text{Reserves and Surplus}}$$

- **Computation of Interest:** Question can give data on interest rates for different types of debt and also an effective interest rate for entire debt structure. If both are given, then overall interest cost = Total debt x Effective interest rate %
- **Asset Turnover ratio:** Asset turnover ratio can be used to compute the overall sales. The same is computed in the following manner:

$$\text{Asset Turnover ratio} = \frac{\text{Sales}}{\text{Total Assets}}$$

- **Operating margin:** Operating margin can be used to compute EBIT and the same can be used in the following manner:

$$\text{Operating margin} = \frac{\text{EBIT}}{\text{Total Sales}}$$

- **Operating profit and Net income:** The term operating profit is basically EBIT and net income is basically PAT
- **ROCE:** Return on capital employed can be used to compute EBIT and the same can be used in the following manner:

$$\text{ROCE} = \frac{\text{EBIT}}{\text{Capital Employed}} \times 100$$

- **Capital employed:** Capital employed = Equity capital + Reserves and Surplus + Preference capital + Debt – Fictitious assets

Rights Issue:

$$\text{Theoretical ex – rights price} = \frac{(\text{Existing shares} \times \text{Existing Price}) + (\text{New shares} \times \text{Rights Price})}{\text{Existing shares} + \text{New shares}}$$

Term	Meaning
Value of one right [per right]	Theoretical ex-rights price – Rights issue price
Value of one right [per share]	$\frac{\text{Value of one right}}{\text{Rights Ratio}}$

- If the expected post-rights price is given in the question, then the theoretical ex-rights price will be replaced with expected/actual post-rights price will be used in the above formula
- **Reverse working:** Question can provide ex-rights price and based on the rights price and current price we can find the rights ratio.
- Shareholder's wealth will not be impacted in case a shareholder subscribes to rights issue or sells the rights. However, the wealth will fall in case the shareholder ignores the rights issue
- **Information on rights issue proceeds utilization:** If the information on rights issue proceeds is available then we can compute the NPV of the project. Total NPV (positive/Negative) will have to be added to numerator to compute ex-rights price

Buyback:

- ❖ Buyback refer to repurchase of shares by companies for capital reduction

- ❖ Buyback can increase the EPS if the total earnings remain same and the number of shares reduce due to buyback of shares
- ❖ Buyback can impact the total earnings if buyback is funded with debt. Revised PAT = Existing PAT - [Interest cost x (1 - Tax rate)]. The question can also for reverse working to find the amount of acceptable interest expenditure and the amount of debt. This would help us in finding the buyback price per share and buyback premium.

Convertible instruments:

Term	Formula
Conversion Value (or) Stock Value	CMP of share x Conversion ratio
Conversion premium in Rs. (Per convertible instrument)	Current market price - Conversion value
Conversion premium in Rs. (Per equity share)	$\frac{\text{Conversion Premium in Rs.}}{\text{Conversion Ratio}}$
Conversion premium in %	$\frac{\text{Conversion Premium in Rs.}}{\text{Conversion value}} \times 100$
Straight value (or) Intrinsic value	PV of future interest and principal discounted at investor's required rate of return
Downside risk in Rs.	Current market price - Straight value
Downside risk in % (% of Straight value)	$\frac{\text{Downside Risk in Rs.}}{\text{Straight value}} \times 100$
Downside risk in % (% of CMP)	$\frac{\text{Downside Risk in Rs.}}{\text{Current Market Price}} \times 100$
Premium over straight value (in %)	$\frac{\text{CMP} - \text{Straight Value.}}{\text{Straight value}} \times 100$
Conversion parity Price (or) Market Conversion Price (or) Minimum market price at which conversion is to be exercised (or) Break-even price	$\frac{\text{CMP of convertible instrument}}{\text{Conversion Ratio}}$
Favourable income differential per bond.	Interest income per bond - Dividend income for equity shares
Favourable income differential per share	$\frac{\text{Favourable income differential per bond.}}{\text{Conversion ratio}} \times 100$
Premium payback period	$\frac{\text{Conversion premium per bond}}{\text{Favourable income differential per bond}}$ (OR) $\frac{\text{Conversion premium per Share}}{\text{Favourable income differential per Share}}$

Valuation of convertible bond:

- **Normal value:** Bond is present value of future cash flows discounted at investor's required rate of return. **We need to redemption cash flow as higher of conversion value of bond on maturity and redeemable value as debt.** However, in some questions the expected conversion value on maturity will not be available and hence redeemable value will be taken as redemption cash flow.
- **Floor value or Minimum Price:** This is computed by taking the bond's cash flow as a debt instrument. **Redeemable value is taken as principal redemption value of debt and not the higher value.** This is the minimum possible value of bond and is computed based on assured cash flows of bond
- **Decision on conversion:** A bond can be converted into equity share only if the conversion value (CMP of share x conversion ratio) is higher than current market price of bond. **If the value is less then we should continue the same as bond and not opt for conversion**

Stock lending:

- Income of person lending stock = Lending fees + Dividend income
- Income/loss of person borrowing stock = Profit/loss on price change - Lending fees- bank guarantee charges

Value of bond:

- **Value in year 0:** Value of bond is present value of future cash flows of bond discounted at investor's required rate of return.
- **Value at end of year 1:** Value in year 1 = [Value in year 0 + Discount rate] – Interest of year 1
- **Value at end of year 2:** Value in year 2 = [Value in year 1 + Discount rate] – Interest of year 2

Important points:

- **Half-yearly bond:** If a bond pays interest half-yearly then we should do half-yearly discounting and the discount rate should also be half-yearly yield
- **Step-up or down discount rate:** Follow the approach given in multiple cost of equity while doing share valuation. **We need to check whether given rates are forward rates/spot yield. If forward rates are given then we can follow the step-up or down discount rate approach. However, if spot yield is given then approach changes. PVF of year 2 would be computing by taking 2 year yield and discounting the same for two years.**
- **Discount rate:** Investor's required rate of return will be taken as discount rate. This can also be called as yield of comparable bond (or) going rate of interest. Sometimes the company may want to give a higher yield to investor. In this case, the issue price will be computed based on the yield proposed to be given by the company
- **Annuity Bond:** Annuity Bond is wherein annual inflow (interest + Principal) would be same every year. Annual inflow is calculated as under:

$$\text{Annual Inflow} = \frac{\text{FV of Bond}}{\text{PVAF}(r, n)}$$

- **Value of bond on a date on which interest is not paid:** Let us assume a bond pays interest in June and December. The above approach of valuation can help in valuing a bond on July 1 and January 1. However, we are required to calculate the value of bond on Sep 1. In such a scenario we will complete valuation like this:

Value as on September 1 = Value as on July 1 + Accrued interest for broken period [July 1 to August 1]

- **Yield of Treasury Bill:** The yield of treasury bill (short-term instrument) is computed with the below formula:

$$\text{Yield} = \frac{\text{Maturity value} - \text{investment value}}{\text{Investment value}} \times \frac{365}{\text{No of days}} \times 100$$

- **Interest rate and extension of duration:** A company can have an option of increasing the bond life as per the terms of the bond. **A company will increase life of bond if the interest rate on bond is lower than prevailing interest rate in market. Similarly, the company will not increase the life and redeem the bond if the interest rate on bond is higher than prevailing interest rate in the market**
- **Transaction cost:** Yield with transaction cost = Normal Yield $\times$ (1 – Transaction cost)
- Number of days to break-even transaction cost = (Transaction cost)/(normal YTM) $\times$ No of days

YTM of Bond:

Method 1	Calculate IRR of the bond considering the future cash flows
Method 2 (Short-cut method)	$\frac{\text{Post tax interest income} + \text{Average other income}}{\text{Average funds employed}}$ Where: $\text{Post tax interest income} = \text{Interest income} \times (1 - \text{Tax rate})$ $\text{Average other income} = \frac{\text{Redemption value} - \text{Net investment}}{\text{Life of instrument}}$ $\text{Average funds employed} = \frac{\text{Redemption value} + \text{Net investment}}{2}$

Important points:

- **Post-tax YTM:** In this case we should consider taxation on interest income and capital gain and consider net inflows of the investor for computing YTM
- **YTM and Interest rate:** If the bond is issued at par then YTM of the bond would be equal to interest rate of the bond
- **Increase/decrease in interest rate:** Any increase/decrease in interest rate will have to be taken as change in investor expectation (yield) and not as change in bond interest rate. This is because interest rate of a bond/debenture does not change and would remain as per original terms of debenture
- **Variable bond:** A variable bond is one whose interest rate changes with investor expectation. Interest rate on these bonds will always be equal to yield prevailing in the market

- **Computation of prevailing interest rate on similar bond:** If a question asks for computing prevailing interest rate of a similar bond, then we should compute YTM of the bond in question and the YTM of this bond will be taken as prevailing interest rate of similar bond
- **Spread of yield from comparable bond:** Spread of Bond X = YTM of Bond X – Yield of comparable bond
- Expected price of bond = Intrinsic value of bond x Beta [There is no logic for this formula. But this is frequently tested in exams and hence students are requested to remember and apply this]
- **YTM from company point of view:** Company will have inflow on day 0 and will have series of outflow over the life of the bond. Hence while calculating IRR, we should increase the discount rate if we get negative NPV and decrease the discount rate if we get positive NPV [Following an approach opposite of normal approach]

Current Yield of Bond:

$$\text{Current Yield} = \frac{\text{Interest}}{\text{Current Market Price}}$$

- **Yield and price relationship:** Any change in yield will impact the price of the bond. **For an irredeemable bond, the above formula will be used to find the revised price with the change in yield.** For a redeemable bond, the concept of volatility is used to find the revised price. Any increase in yield will reduce the CMP and any decrease in yield will increase the CMP

Realized Yield:

- ❖ Realized yield assumes that interim cash flows from a bond will be reinvested at a realistic reinvestment rate
- ❖ Terminal value of cash flows is calculated with the reinvestment rate and the same is compared with initial outflow
- ❖ The IRR of the revised cash flows is the realized yield

Steps:

- **Step 1:** Compute the normal cash flow of bond. Compound the cash flows to last year with reinvestment rate and re-investment period. Reinvestment rate would be given in question and if the same is not given it would be taken as cost of debt
- **Step 2:** Add up all maturity cash flows and this would give us the maturity cash flow. We will have single outflow on day 0 and a single inflow on maturity. IRR needs to be computed for this cash flow and the same would be called as realized YTM

Other concepts related to realized YTM:

- **Reinvested interest:** Maturity value of interest – normal interest earned
- **Intermediate cash flows are not reinvested:** If the intermediate cash flows are not re-invested then the maturity cash flows will be additional of all inflows. Hence maturity cash flows would be significantly less and based on that we should compute realized YTM.

Duration:**Duration of a redeemable bond:**

- ❖ Step 1: Compute cash flows of bond till maturity
- ❖ Step 2: Determine PVF using YTM
- ❖ Step 3: Market price is sum of present value of cash flow discounted at PVF of step 2
- ❖ Step 4: Divide each year's cash flow by market to get weights
- ❖ Step 5: Sum of (time x weights) is duration

Format for computation of duration (assuming a 5-year bond)

Year	Cash flow	PVF @ YTM	DCF	Weight	Year x Weight
1	Interest				
2	Interest				
3	Interest				
4	Interest				
5	Interest + Principal				
Total					Duration of bond

Duration of a perpetual bond:

$$\text{Duration of a perpetual bond} = \frac{1 + y}{y}$$

$$\text{Duration of zero-coupon bond} = \text{Life of bond}$$

Important points:

- In case of half-yearly bond, we should compute the duration in terms of number of half-years and the column for year will be replaced with half-year in above table. Similarly, the YTM would be half-yearly YTM

Volatility or modified duration:

$$\text{Volatility} = \frac{\text{Duration}}{1 + \text{YTM}}$$

Important points:

- Half-yearly bond:** In case of half-yearly bond, we should use half-yearly YTM in the above formula for computing volatility. **However, duration should be only in terms of years.** This will only ensure the price as per volatility formula matches with the price computed by discounting
- Duration and churning of portfolio:** If yields are expected to increase, **price of bond will fall. We should look at reducing the duration of portfolio** in this case and hence we should replace bond of higher duration with bond of lower duration. Lower duration would imply lower volatility and lower fall in price. The opposite will work if yields are expected to fall.

Volatility and change in price

- Yield and price of bond is inversely proportional. Price of a bond will fall if Yield increases and vice-versa
- Percentage change in bond price is computed with the help of volatility

$$\% \text{ change in bond price} = \text{Volatility} \times \% \text{ change in YTM}$$

Immunization:

- Immunization happens if the weighted duration of the portfolio is equal to the period for which investment is required to be made. This is a level where price risk and reinvestment risk will offset each other leading to no impact to the investor
- Investor needs money after xx years:** This should be interpreted as duration of investment should be equal to xx years
- Fund an outflow after xx years:** This would be interpreted as duration of investment should be equal to xx years

Bond refunding:

- Items related to old Bond:** Floatation cost, Discount on issue of debentures, call premium etc related to old bond has to be written off on day 0 because we are looking at replacing old bond with new bond
- Items related to new bond:** Floatation cost, discount on issue of new bond would be written off over the life of the new bond
- In-between cash flow:** After-tax outflow of old bond – after-tax outflow of new bond. We should work as if the old bond is continuing when we analyse the cash flows of old bond
- Overlapping interest:** This is the extra interest paid because old bond could not be redeemed on time. Overlapping interest outflow on day 0 = Extra interest paid on old bond $\times$ (1 – Tax rate)

Forward rates:

Forward rates work in the same manner as that of step-up or step-down discount rates. We will have the following two approaches to compute forward rates

Cash flows are given:

- First take one-year bond and find PVF of year 1 as balancing figure such that NPV of bond is zero. Forward rate of year 1 is computed as under:

$$\text{PVF of year 1} = \frac{1}{1 + \text{Forward rate of year 1}}$$
- Then analyse the 2-year bond and get PVF of year 2 as balancing figure such that NPV of bond is zero. Forward rate of year 2 is computed as under:

$$\text{PVF of year 2} = \frac{\text{PVF of year 1}}{1 + \text{Forward rate of year 2}}$$

Interest rates are given:

- We will use FRA formula to compute forward rates

$$\text{Forward rate for year 1 to year 2} = \frac{\text{FVF for year 2}}{\text{FVF for year 1}} - 1$$

Nature of Yield Curve:

- Normal yield curve/upward sloping = Interest rates for long-term instruments is higher than Interest rates for short-term instruments
- Inverted Yield Curve/downward sloping = Interest rates for short-term instruments is higher than Interest rates for long-term instruments
- Flat Yield Curve = Interest rates for short-term instruments = Interest rates for long-term instruments

Bond convexity:

- Duration can be used to find the new bond price when there are changes in YTM. However, duration assumes a linear relationship and assumes equal percentage change. But the change is not linear and can be adjusted using convexity adjustment
- New Price = Old Price $\pm$ % change as per duration + Convexity adjustment [Convexity adjustment will always be added even if there is an increase/decrease in Yield]

Computation of convexity:

Δy = Change in Yield

$$C = \frac{V_+ + V_- - 2V_0}{2V_0(\Delta y^2)}$$

V_+ = Price of bond if yield increases by Δy

V_- = Price of bond if yield decreases by Δy

- C = Convexity
- Convexity adjustment (in Rs.) = $C \times (\Delta y^2) \times V_0$

$$\text{Convexity Adjustment (\%)} = \frac{\text{Convexity Adjustment in Rs.}}{V_0} \times 100$$

Enterprise value:

- ❖ Total Enterprise value = Equity + Debt + Minority Interest – Cash and cash equivalents
- ❖ Operating Enterprise value = Total enterprise value – market value of non-operating assets such as investments in associates
- ❖ Core Enterprise value = Operating enterprise value – Value of non-core assets

Annual Yield of Money Market Instruments:

$$\text{Annual Yield} = \frac{\text{Maturity Value} - \text{Issue Price}}{\text{Issue Price}} \times \frac{365}{\text{No of days}} \times 100$$

Clean Price and Dirty Price:

- Dirty Price = Clean Price + Accrued Interest
- Accrued Interest should be computed based on the rate of interest of original instrument
- Start proceeds = Face value $\times$ (Dirty Price/Face value per instrument) $\times$ (100 – Margin %)
- Maturity proceeds = Start Proceeds + Rate of interest as per Repo Rate

Chapter 6 - Portfolio Management

<u>Activities in Portfolio Management:</u> • Security selection – construction of feasible portfolios – Deciding the weights/proportion of securities to form optimal portfolio
<u>Objectives of Portfolio Management:</u> • Security/safety of principal • Stability of Income • Capital Growth • Marketability (ease with which a security can be bought or sold) • Liquidity (nearness to money) • Diversification • Favourable tax status
<u>Five Phases of Portfolio Management:</u> • Security Analysis – Examining the risk and return of individual characteristics and correlation among them • Portfolio Analysis – Creation of large number of portfolios with the available securities • Portfolio Selection – Identification of efficient portfolio among various set of feasible portfolios • Portfolio Revision – Constantly monitor the selected portfolio to ensure it is optimal • Portfolio Evaluation – Assessing the performance of the portfolio over selected period of time
<u>Traditional Approach:</u> • Investor's study with an insight on age, health, need for income, attitude towards risk and taxation status • Portfolio Objectives – Maximizing investor's wealth which is subject to risk • Investment strategy – Balancing liquidity, return, dividends, capital gain etc • Diversification • Selection of individual investments – Intrinsic value analysis/expert advice/inside information/newspaper
<u>Elements of risk:</u> • Total Risk = Systematic Risk + Unsystematic Risk • Systematic risk comprises factors that are external to a company and affect a large number of securities. Systematic risk can be further subdivided into interest rate risk, purchasing power risk and market risk • Unsystematic risk includes those factors which are internal to companies and affect only those particular company. Unsystematic risk can be further subdivided into business and financial risk
<u>Assumptions of Markowitz Model:</u> • Return adequately summarizes the outcome – Investors visualize a probability distribution of rates of return – Return can be measured through measures such as NPV and Yield • Risk estimates are proportional to the variance of return – Investors are risk-averse • Investment decisions are based on expected return and variance • Investors are assumed to be rational
<u>Capital asset pricing model:</u> • Model explains the relationship between expected return, non-diversifiable risk and value of security • Systematic risk cannot be diversified and will continue to be there in portfolio – Systematic risk is measured through beta and it does not remain same for all • Expected return = $R_f + \text{Beta} \times (R_m - R_f)$
<u>Assumptions:</u> • Efficient market • Rational investment goals • Risk aversion is adhered to but sometimes risk seeking behaviour is also adopted • Assets are divisible and liquid • Investor can borrow at risk-free rate of interest • No transaction cost • No risk of insolvency or bankruptcy
<u>Advantages:</u>

- Measurement of risk-adjusted return
- Computation of cost of equity for no dividend company

Limitations:

- Reliable beta may not be measured
- Ignoring unsystematic risk – however investor having undiversified portfolio carry this risk
- Information on risk-free rate of interest and expected return of market

Active Portfolio Strategy:

- An APS is followed by most investment professionals and aggressive investors who strive to **earn superior return after adjustment for risk**
- **APS involves a great deal of time on researching individual companies, gathering extensive data** about financial performance, business strategies and management characteristics

Principles:

- Market timing
- Sector rotation
- Security selection
- Use of specialized investment concept

Passive Portfolio strategy:

- Passive strategy rests on the tenet that the **capital market is fairly efficient** with respect to the available information. Example: Index Funds

Guidelines:

- Create a well-diversified portfolio for a level of risk
- Hold the portfolio relatively unchanged over time

Criteria for Bond selection:

- YTM
- Risk of default
- Tax Shield
- Liquidity

Approaches for selection of stock:

- Technical Analysis
- Fundamental Analysis
- Random selection analysis

Level of Efficiency/Approach	Technical Analysis	Fundamental Analysis	Random Selection
Inefficiency	Best	Poor	Poor
Weak form efficiency	Poor	Best	Poor
Semi-strong efficiency	Poor	Good	Fair
Strong form efficiency	Poor	Fair	Best

Portfolio revision and re-balancing strategies:

- **Buy and Hold Policy:** Also known as 'do nothing policy' as no balancing is required
- **Constant mix policy:** Do something policy that maintains stock exposure at a constant percentage of total portfolio
- **Constant Proportion Portfolio Insurance:** Sets a floor value for an asset's value and this is invested in safe assets and the balance is invested in equity shares

Asset Allocation Strategies:

- **Integrated asset allocation:** Allocation that best serves the investor's needs while incorporating the capital market forecast is determined
- **Strategic Asset Allocation:** Optimal portfolio mix based on risk, returns and co-variances are generated and adjusted periodically to restore target allocation
- **Tactical asset allocation:** Investor risk tolerance is assumed constant and allocation is changed based on capital market conditions
- **Insured asset allocation:** Risk exposure based on portfolio values is adjusted and more value means more ability to take risk

Fixed Income Portfolio:

- **Process:** Set objective + Draft guidelines for investment policies + Selection of portfolio strategy (active/passive) + Selection of securities + Evaluation of performance
- **Return computation:** Arithmetic rate of return/Time weighted rate of return/Rupee weighted rate of return/Annualized return

- **Passive Strategies:** Buy and Hold Strategy + Indexation strategy + Immunization + Matching cash flows
- **Active Strategies:** Forecasting returns and Interest rates (Bullet Strategy + Barbell Strategy + Ladder Strategy) + Bond swaps (Pure Yield Pickup Swap + Substitution swap + International spread swap + Tax swap) + Interest rate swaps

Features of alternative investments:

- High fees
- Limited historical data
- Illiquidity
- Less transparency
- Need for extensive research
- Leveraged buying

Characteristics of real estate which makes valuation complex:

- Inefficient market – Illiquidity – Comparison (difficult to find exact comparable property) – High transaction cost – No organized market

Approaches to value real estate:

- Sales comparison approach – Value based on similar type of property
- Income approach – Perpetual cash flow is discounted at market required rate of return
- Cost approach – Value = Replacement cost of building + Estimated value of land
- Discounted After tax cash flow approach – PV of expected inflows at required rate of return

Gold:

- Popular mode of investment with Jewelry being the most common mode of purchase
- **Modes of investment:** Gold Bars + SGB + Gold Exchange Traded Funds(ETFs) + E-Gold

Distressed Securities:

- Purchasing the securities of companies that are in or near bankruptcy
- Purpose is to buy securities at low price and revive a sick company to make huge profits
- Arbitrage – Take a long position in debt and short position in equity
- Risks – Liquidity risk, Event Risk, Market Risk and Human Risk

Strategy of portfolio rebalancing where portfolio does not fall below specified value:

- Constant Proportion Portfolio Insurance (CPPI) policy can help in ensuring minimum portfolio value. We decide a floor value and the same is invested in safe assets such as treasury bill/bonds
- Investment in shares = (Portfolio value – Floor value) x Multiplier

Practical Areas:**Risk and Return of Single Security:**

Probability	Return	Product	Deviation	Pd ²

Note:

- Expected return = Sum of Products
- Standard Deviation = $\sqrt{pd^2}$
- Probability of security would be given in the question. **If the same is not given, then we assume equal probability for every observation**
- Return of security would be given in question. If the same is not given, then it would be computed using the below formula:

$$\text{Return} = \frac{D_1 + (P_1 - P_0)}{P_0}$$
- Product = Probability x Return
- Deviation = Return in % - Expected return (sum of product)
- Pd² = Probability x Deviation x Deviation

Important Points:

- Expected return and standard deviation can be computed in Rupees or in %. Preferable approach is to compute in %. In the above format, the return used is in %. Risk and Return in % can be converted into Risk and Return in Rupees using the below formulae:
- **Expected return in (Rs.) = Price x Expected Return in %**
- **Risk (in Rs.) = Price x Risk in %**

- Dividend rate is to be applied on face value and Dividend yield is to be applied on market price to get the Dividend Amount
- Different probabilities for Dividend and Capital Gain:** A question can have a different probability for dividend and different probability for price. Let us assume there are 3 possible dividends and 3 possible prices. This scenario will lead to nine different combinations and joint probability for each combination is to be calculated. **Joint Probability = Probability for Dividend x Probability for Capital Gain**

Portfolio Return and Risk:**Format:**

Prob	Security A				Security B				Pd _a d _b
	Return	Product	Deviation	Pd ²	Return	Product	Deviation	Pd ²	

Note:

- Portfolio Return = Weighted average of individual security return. This can be computed using the below format:

Security	Return	Weight	Product
A			
B			
Portfolio			

$$\text{Portfolio Return} = \frac{\text{Sum of Product}}{\text{Sum of weights}}$$

- Covariance of return between A and B = Sum of Pd_ad_b [OR]
- Co-variance of return between A and B = Beta of A x Beta of B x Variance of Market
- Co-relation coefficient is computed using the below formula:

$$\text{Correlation coefficient} = \frac{\text{CO - variance}_{AB}}{\sigma_A \sigma_B}$$

- Portfolio Variance between A and B = $(\sigma_a W_a)^2 + (\sigma_b W_b)^2 + 2\sigma_a W_a \sigma_b W_b \text{COR}_{ab}$

Important points:

- Correlation between a risk-free asset and risky asset is zero
- Portfolio of risky-asset and risk-free asset with maximum risk:** An investor can create a portfolio with a restriction on maximum risk. In this case, weight of risky asset would be as under:

$$\text{Weight of risky asset} = \frac{\text{Maximum risk}}{\text{SD of risky asset}}$$

$$\text{Weight of risk - free asset} = 1 - \text{weight of risky asset}$$
- Finding out how well the fund has been compensated for risk undertaken:** We are required to find out Sharpe Ratio for finding this. Any increase in Sharpe Ratio will indicate better returns for risk undertaken by the investor

$$\text{Sharpe Ratio} = \frac{\text{Expected return} - \text{Risk free return}}{\text{Standard Deviation}}$$
- Portfolio invested with margin of 40%:** This would mean that we have borrowed money to extent of 40% and hence the investment would be equal to 140% of portfolio value.

$$\text{Portfolio return} = [140\% \times \text{Portfolio return}] - [40\% \times \text{cost of borrowing}]$$

$$\text{Portfolio risk} = 140\% \text{ of portfolio risk}$$
- Co-variance between A and A:** Some question can give data on co-variance between security A and Security A. This basically would mean variance of A itself.

Efficient Securities:

Security A dominates Security B if

- Security A generates higher return for same risk
- Security A generates higher return for lower risk
- Security A generates same return for lower risk

Portfolio weights with target return:

- Use weighted average format to get the weights for two securities. Assume weights of security 1 as A and weight of security 2 as 1 - A. Solve the equations and get weights for both securities

Security	Return	Weight	Product

Security A			
Security B			
Total			

- Negative weights would mean borrowing/short-sell of shares

Minimum risk portfolio:**Optimum weights with 2 securities:**

$$\text{Weight of Security 1} = \frac{\text{Variance of Security 2} - \text{Covariance of 1 and 2}}{\text{Variance of security 1} + \text{Variance of Security 2} - 2\text{Covariance of 1 and 2}}$$

$$\text{Weight of security 2} = 1 - \text{weight of security 1}$$

Optimum weights with 3 securities:

- ❖ Critical line is calculated to get the weights of the individual securities in the minimum variance portfolio
- ❖ We would need combination of two minimum variance portfolio in order to arrive at the critical line

- Weight of security 1 = a + b (weight of security 2)
- Form two equations and get values of a and b
- The critical line will then be written as Weight of security 1 = a + b (weight of security 2)
- Substitute weight of one security in above equation and get weight of other security. Weight of third security will be balancing figure such that overall weights add upto 1

Optimum weights with more than 3 securities [Sharpe's optimal Portfolio]

- ❖ **Step 1:** Calculate excess return to Beta (Treynor Ratio) for all securities

$$\text{Treynor Ratio} = \frac{\text{Expected return} - \text{riskfree return}}{\text{Beta of security}}$$

- ❖ **Step 2:** Arrange the securities in the descending order of the variable computed in step 1
- ❖ **Step 3:** Calculate [(Excess return * Beta) / σ^2_{ci}] for all securities

$$\text{Variable for step 3} = \frac{\text{Excess return} \times \text{Beta}}{\sigma^2_{ci}}$$

- ❖ **Step 4:** Calculate cumulative values for the variable identified in step 3
- ❖ **Step 5:** Calculate [Beta² / σ^2_{ci}] for all securities

$$\text{Variable for step 5} = \frac{\text{Beta}^2}{\sigma^2_{ci}}$$

- ❖ **Step 6:** Calculate cumulative values for the variable identified in step 5
- ❖ **Step 7:** Calculate cut-off point for all securities:

$$\text{Cutoff point} = \frac{(\text{Market variance} \times \text{Step 4 value})}{(1 + (\text{Market variance} \times \text{Step 6 value}))}$$

- ❖ **Step 8:** Identify the maximum cut-off point. Securities till the maximum cut-off point will form part of optimum portfolio
- ❖ **Step 9:** Calculate Z-value for securities which have been selected to form part of optimum portfolio

$$\text{Z value} = \frac{\text{Beta}}{\sigma^2_{ci}} \times (\text{Treynor ratio} - \text{Maximum Cutoff Point})$$

- **Step 10:** Identify the proportion of securities in the final portfolio. The weights of the securities would be in the same proportion as their z-value

Format for computation:**Step 1:**

Security	Expected Return	Beta	σ^2_{ci}	Excess return [Expected - Risk free]	$\frac{\text{Excess return}}{\text{Beta}}$	Rank

Step 2 to Step 4:

Security	Beta	σ^2_{ci}	Excess return (ER)	$\frac{\text{ER}}{\text{Beta}}$	ER x Beta	$\frac{\text{ER} \times \text{Beta}}{\sigma^2_{ci}}$	Cum values

Step 5 to Step 8:

Security	Beta	$\sigma^2 ci$	$\frac{Beta^2}{\sigma^2 ci}$	Cum values	Cut-off point

Beta of security:**Probability is not given:**

$$\text{Formula 1: Beta} = \frac{(\sum XY - n(\text{Mean of X})(\text{Mean of Y}))}{\sum Y^2 - n(\text{Mean of Y})^2}$$

N = No. of observations; X = Rate of return of stock; Y = Rate of return of market

Format for computation:

Return of Security [X]	Return of Market [Y]	XY	Y ²

Probabilities are given:

$$\text{Formula 2: Beta} = \frac{\text{SD of Security}}{\text{SD of Market}} \times \text{Correlation coefficient}$$

$$\text{Formula 3: Beta} = \frac{\text{Covariance of Security and Market}}{\text{Variance of Market}}$$

Format for computation:

Prob	Security			Market			Pd ²	Pd _s d _m
	Return	Product	Deviation	Return	Product	Deviation		

Important Points:

- **Computation of return:** In few questions the return may not be given directly and the same should be computed using the below formula

$$\text{Return} = \frac{D_1 + (P_1 - P_0)}{P_0}$$

- **Dividend Yield is given:** In the above formula dividend yield can be sometimes given directly and hence return would be sum of dividend % and capital appreciation %. Formula for computation is as under

$$\text{Return} = \text{Dividend\%} + \left[\frac{(P_1 - P_0)}{P_0} \right] \times 100$$

- **Observation based on Beta Computation:** We should compute the required return as per CAPM for every year and compare the same with actual return of every year. Based on this, we can advise on whether to buy or sell the security in that year
- **Use of equilibrium return:** Based on equilibrium return of security, we can compute the Beta of security. Beta of security can help us in computing variance of market (formula 3) if Co-variance is given in question. Similarly, SD of security/market can be computed (formula 2) if correlation coefficient is given in question.
- **Computation of risk-free rate:** Treasury Bond/Government Bond will be taken as risk-free security and risk-free return can be computed using the below formula:

$$\text{Risk - free rate} = \frac{\text{Interest}}{\text{Value of Bond}}$$

- **Multiple risk-free rates given in question:** If there are multiple risk-free rates given in the question then we can follow one of the below approaches:
 - Aggressive approach: Take risk-free rate as higher rate
 - Conservative approach: Take risk-free rate as lower rate
 - Moderate approach: Take average as risk-free rates. Follow this approach if problem is silent

- **Decision on fresh buying/selling of security:** We can decide on making fresh investments/liquidity of security by computing Beta of security. Beta will help us in calculating required return and same can be compared with actual return. Positive Alpha [Actual return – required return] would mean fresh purchase and vice versa
- **Negative risk premium of market:** Return of market should always be higher than risk-free rate and hence risk premium of market will always be positive. However, some questions can give a scenario of negative risk premium and we should continue with same figures for solving the question
- **Rm and Rf from expected return of two security:** If expected return and Beta of 2 securities are given in question, then we can form two CAPM equations (SML equations). We should solve those 2 equations we will be able to calculate market return and risk-free rate of return.
- **Fully diversified portfolio:** If a portfolio is fully diversified then the standard deviation of security is equal to systematic risk. Based on systematic risk (formula shared below) we can reverse work and compute Beta
- **Sensitivity of returns to market:** This would basically mean Beta of Security
- **Increase/decrease in market return:** Let us assume existing market return is 12% and question specifies that market has gone up by 2.5% and this would mean that market return would be 14.5% and based on CAPM formula we can compute return of our portfolio. Similarly if market goes down by 2.5% then same would mean market return of 9.5%

Portfolio Beta:

- Portfolio Beta is weighted average of individual beta with amount invested being the weights

Format for computation of Beta:

Security	Beta	Weight	Product

Important Points:

- **Weights for target Beta:** If there is a target Beta given in question then we can use the above weighted-average format for computing the optimum weights of securities.
- **Expected return of portfolio:** Expected return of portfolio can be computed using CAPM equation. We will use portfolio Beta in CAPM equation [$R_f + \text{Beta} \times (R_m - R_f)$]
- **Replacing security with NIFTY/SENSEX:** An investor can replace a security with NIFTY/SENSEX if the beta of security is 1 time. This would ensure that overall beta would remain same
- **Risk of Portfolio relative to Market:** We are required to calculate actual beta and equilibrium beta. Equilibrium Beta is computed by substituting actual portfolio return in CAPM equation. Portfolio is more risky if actual beta is higher than equilibrium beta and vice versa
- **Change in composition of portfolio:** We should compare actual return of security with required return to decide on whether to buy/sell a security and consequently change the composition of portfolio
- **Increasing/reducing Beta through risk-free investment:** Beta can be increased or reduced through risk-free investment. We should borrow money if we have to increase Beta and invest in risk-free asset if we have to reduce risk. We should assume weight of risky portfolio as A and weight of risk-free asset to be (1-A) and get the required risk-free investment as balancing figure.
- **Hidden risk-free rate of return:** There could be a portfolio of securities given in the question and one of the securities can have a Beta of 0 times. If any security has Beta of 0 time, then the same will be taken as risk-free rate of return

Alpha:

- Alpha refers to excess/deficit return earned by security/portfolio. This is calculated by comparing the actual return with required return
- **Required return:** Required return can be computed using the following approaches:
 - **Diversified portfolio (CAPM Approach):** $R_f + \text{Beta} \times (R_m - R_f)$
 - **Undiversified portfolio (CML Approach):** Required return using the below formula

$$\text{Capital Market Line} = R_f + \frac{\text{SD of Security}}{\text{SD of Market}} \times (R_m - R_f)$$
 - **Characteristic Line Approach:** $\text{Beta} \times \text{Return of Market}$
- $\text{Alpha} = \text{Actual return} - \text{required return}$

Important Points:

- Return attributable to sheer skill of portfolio manager is basically computation of Alpha
- Return attributable to higher risk taken by portfolio manager = Required return of security as per CAPM – Required return of security if Beta is 1 time (this is basically market return). **We need to use required return as per CAPM and not the actual return in above formula.**

Systematic and Unsystematic Risk:

Particulars	Standard deviation approach	Variance approach
Systematic risk	$\left(\begin{array}{c} \text{SD of Security } x \\ \text{Correlation coefficient} \end{array} \right)$ (or) $\left(\begin{array}{c} \text{Beta of Security } x \\ \text{SD of Market} \end{array} \right)$	$\left(\begin{array}{c} \text{SD of Security } x \\ \text{Correlation coefficient} \end{array} \right)^2$ (or) $\left(\begin{array}{c} \text{Beta of Security } x \\ \text{SD of Market} \end{array} \right)^2$
Non-systematic risk ($\sigma^2 \epsilon_i$)	Total risk – Systematic risk	Total risk – Systematic risk

Important Points:

- Variance approach is preferred for doing systematic and unsystematic risk calculation
- **Co-efficient of determination:** Co-efficient of determination measures the ratio of systematic risk to total risk of security. It is denoted by r (or) r^2 . The formula for the same is provided below:

$$\text{Co-efficient of determination } (r^2) = \frac{\text{Systematic risk as per variance approach}}{\text{Total risk as per variance approach}}$$

$$\text{Co-efficient of determination } (r) = \frac{\text{Systematic risk as per SD approach}}{\text{Total risk as per SD approach}}$$

- **Portfolio risk as per Sharpe Approach:** Portfolio risk = Systematic risk as per variance approach + Unsystematic risk as per variance approach. Unsystematic risk is weighted average of individual unsystematic risk with weights² being the assigned weights. We use square of weights as the same is as per variance approach. Portfolio risk can be computed both under Sharpe and Markowitz approach and answer under both methods may not match
- **Residual variance:** The term residual variance would mean unsystematic risk as per variance approach
- **Random error:** Random error is denoted by $\sigma \epsilon_i$. It will be considered as unsystematic risk as per variance approach if $\sigma^2 \epsilon_i$ is given. Conversely it will be considered as unsystematic risk as per SD approach if $\sigma \epsilon_i$ is given. We can compute portfolio risk using below formula:
 Portfolio risk = Systematic Risk + Unsystematic risk
 Unsystematic risk = Weighted average of individual unsystematic risk
 Systematic risk = (Beta x SD of market)²
- **Specific SD of expected return:** Specific SD of expected return would refer to unsystematic risk

Portfolio Variance with 3 Securities [Markowitz Model]

- For 3 securities the formula of $(a + b + c)^2$ is to be used
- Portfolio Risk = $a^2 + b^2 + c^2 + 2ab + 2bc + 2ac$
- $a = \sigma_a w_a$; $b = \sigma_b w_b$; $c = \sigma_c w_c$
- With 2ab we need to add correlation of a and b; similarly for 2ac we need to add correlation of a and c; for 2bc we need to add correlation of b and c

Performance evaluation measures:

- **Sharpe Ratio (or) Reward to variability ratio:** This is used for undiversified portfolio

$$\text{Sharpe Ratio} = \frac{\text{Expected return} - \text{Risk free}}{\text{Standard Deviation}}$$
- **Treynor Ratio (or) Reward to Volatility ratio:** This is used for diversified portfolio

$$\text{Treynor Ratio} = \frac{\text{Expected return} - \text{Risk free}}{\text{Beta}}$$
- Alpha = Actual return – expected return as per CAPM/CML/Characteristic line

Characteristic Line:

- Characteristic line = Alpha + Beta x (R_m)
- Where Alpha = Actual return – Required return
- Required return = Beta x R_m

Capital Market Line:

$$\text{Return as per CML} = R_f + \left[\frac{\sigma_s}{\sigma_m} \times [R_m - R_f] \right]$$

Security Market Line:

$$\text{Return as per SML} = R_f + [\text{Beta} \times [R_m - R_f]]$$

Arbitrage Pricing Theory Model:

- Formula 1: Expected return = Risk free return + (Factor 1 Beta x Risk premium of factor 1) + (Factor 2 Beta x Risk premium of factor 2) + (Factor 3 Beta x Risk premium of factor 3) + (Factor 4 Beta x Risk premium of factor 4)
- Formula 2: Expected return = Risk free return + (Variation in factor 1 x Risk premium of factor 1) + (variation in factor 2 x Risk premium of factor 2) + (Variation in factor 3 x Risk premium of factor 3) + (variation in factor 4 x Risk premium of factor 4)

CAPM and gearing:

- Beta of assets side = Weighted average of Beta of various assets
- Beta of liabilities side = Weighted average of Beta of liabilities side
- Beta of assets side = Beta of liabilities side
- Asset Beta of Company A = Average assets beta of multiple proxy companies

Format for computation of Beta (Liabilities Side):

Source	Beta	Weight	Product
Equity			
Debt			
Total			

Format for computation of Beta (Assets Side):

Source	Beta	Weight	Product
Project 1			
Project 2			
Total			

Important Points:

- Debt beta will be taken as zero if the problem is silent. However, if cost of debt and risk-free rate is given then we can compute debt beta using the below formula:
Interest rate on debt = $R_f + \text{Debt Beta} \times (R_m - R_f)$
- **Weight of debt will be taken as Debt x (1 - Tax rate) in the above format if tax rates are given in question**
- Total Beta of the company will remain same if there is change in capital structure. This is because equity Beta will increase with increase in debt and same will reduce with decrease in debt. This will ensure that overall Beta would remain same

Portfolio strategies:

- **Buy and Hold Policy:** Under this policy the investment in debt and equity remain same. There is no rebalancing of investment done
- **Constant mix policy:** Under this policy the investment in debt and equity would be maintained at constant mix. At every reset date, some portion of debt and equity purchase/sales will be done to maintain the mix
- **Constant Proportion portfolio insurance policy:**
 - Investment in equity = Multiplier x [Portfolio value - Floor value]. Investment in equity will be rebalanced based on movement in equity markets
 - Investment in debt = Total portfolio value - Investment in equity

Important Points:

- Floor value = Portfolio value - Maximum % decline in NIFTY/SENSEX

Real Estate Valuation:

- **Discounted Cash flow after tax approach:** Value of property is PV of future cash flows discounted at required rate of return
- **Income approach:**
 - Value of property = Income / Capitalization Rate
 - Income = Rental income + Other income - Vacancy loss - Expenses
 - Capitalization rate = Average capitalization rate of comparable companies
- **Sales comparison approach:** Value of property = Adjusted selling price per square feet x Number of square feet
- **Cost based approach:** Value of property = Cost of Land + Cost of Building - Obsolescence

Chapter 7 – Securitization

<u>Concept of Securitization:</u> The process of securitization typically involves the <u>creation of pool of assets from the illiquid financial assets</u>, such as receivables or loans which are marketable
<u>Features of Securitization:</u> - Creation of financial instruments - Bundling and unbundling - Tool of risk management – Assets securitized on non-recourse basis then the risk of default is shifted - Structured finance – Financial instruments are structured to meet the risk return trade-off profile of investor - Trenching – Each part (Trenche) carries a different level of risk and return - Homogeneity – Even small investors can afford to invest in small amounts
<u>Securitization in India:</u> - Citi Bank had pioneered the concept of securitization in India - Securitization and Reconstruction of Financial Assets and Enforcement of Security Interest (SARFAESI) Act 2002 was introduced to encourage securitization - Initially it was started with auto loan receivables and gradually became a major source of funding for micro finance companies and NBFC
<u>Benefits of Securitization:</u> <u>From the angle of Originator:</u> - Off-balance sheet financing - More specialization in main business - Helps to improve financial ratios - Reduced borrowing cost <u>From the angle of investor:</u> - Diversification of risk - Regulatory requirement - Protection against default
<u>Participants in Securitization:</u> <u>Primary Participants:</u> <u>Originator:</u> It is the initiator of deal or can be termed as <u>securitizer</u>. It is an entity which sells the assets lying in its books and receives the funds generated through the sale of such assets <u>SPV:</u> SPV is created for the purpose of executing the deal. Since issuer/originator transfers all rights in assets to SPV, it holds the legal title of these assets. <u>SPV makes an upfront payment</u> to the originator, it holds the key position in the overall process of securitization <u>Investors:</u> Investors are the buyers of securitized papers <u>Secondary Participants:</u> <u>Obligor:</u> They are the parties who owe money to the firm and are assets in the Balance Sheet of Originator. The amount due from the obligor is transferred to SPV <u>Rating agency:</u> The assets have to be assessed in terms of its credit quality and credit support available <u>Receiving and Paying Agent (RPA):</u> Also, called Servicer or Administrator, it collects the payment due from obligor(s) and passes it to SPV. <u>Agent or Trustee:</u> Trustees are appointed to oversee that all parties to the deal perform in the true spirit of terms of agreement <u>Credit Enhancer:</u> Since investors in securitized instruments are directly exposed to performance of the underlying and sometime may have limited or no recourse to the originator, <u>they seek additional comfort in the form of credit enhancement</u> <u>Structurer:</u> It brings together the <u>originator, investors, credit enhancers and other parties to the deal of securitization</u>. Normally, these are <u>investment bankers</u>
<u>Mechanism or steps in Securitization:</u> - Creation of pool of assets - Transfer to SPV - Sale of Securitized Papers - Administration of assets

- Recourse to originator
- Repayment of funds
- Credit rating of instruments

Problems in securitization or factors impact growth of securitization in India:

- **Stamp duty:** Stamp duty even goes upto 12% in some states of India. However, PTC are exempted from stamp duty. Also, some states have reduced the stamp duty on securitized instruments
- **Taxation:** No specific provision leading to difference in opinion on taxation
- **Accounting:** Although securitization is slated to an off-balance sheet instrument but in true sense receivables are removed from originator's balance sheet
- **Lack of standardization:** Every originator follows own format for documentation and administration leading to lack of standardization
- **Inadequate debt market**
- **Ineffective foreclosure laws:** Foreclosure laws are not supportive to lending institutions and this makes securitized instruments especially mortgaged backed securities less attractive as lenders face difficulty in transfer of property in event of default by the borrower

Securitization instruments:

- **Pass Through Certificates (PTCs):** Originator transfers the entire receipt of cash in **form of interest or principal repayment from the assets sold**. Thus, these securities **represent direct claim of the investors** on all the assets that has been securitized through SPV. Since all cash flows are transferred **the investors carry proportional beneficial interest** in the asset held in the trust by SPV. It should be noted that since it is a **direct route any prepayment of principal is also proportionately distributed among the securities holders**.
- **Pay Through Security (PTS):** In contrast to PTC in PTS, SPV debt securities backed by the assets and **hence it can restructure different tranches from varying maturities of receivables**. This structure **permits desynchronization of servicing of securities issued from cash flow generating from the asset**. Further, this structure also **permits the SPV to reinvest surplus funds for short term as per their requirement**
- **Stripped Securities:** Stripped Securities are created by dividing the cash flows associated with underlying securities into two or more new securities. Those two securities are as follows: (i) Interest Only (IO) Securities and (ii) Principle Only (PO) Securities. The holder of IO securities receives only interest while PO security holder receives only principal

Pricing of Securitized Instruments:

- **From originator's point of view:** Instruments can be priced at a rate at which originator has to incur an outflow and **if that outflow can be amortized over a period of time by investing the amount** raised through securitization
- **From Investor's point of view:** Security price **can be determined by discounting best estimate of expected future cash flows using rate of yield to maturity of a security** of comparable security with respect to credit quality and average life of the securities

Risks in Securitization:

- Credit risk or counterparty risk
- Legal risks
- Market risks (Macroeconomic risk + Prepayment risk + Interest rate risks)

Blockchain Technology:

- Decentralized open ledger with permanent entries and irreversible changes - A blockchain uses a chain of blocks representing digital information stored in a public database - A simple example of a blockchain technology is Google Documents
- **Working:** Transaction initiated + Transaction broadcasted + Validation of transaction by Network + Block is added to existing block chain + Transaction is complete
- **Application:** Financial services + Healthcare + Government + Travel industry + Economic forecasts
- **Risks:** No single party is in-charge and hence managing risks can be a challenge + Reliability will be lost if underlying technology is tampered with + risk of information overload

Tokenization:

- Process of conversion of tangible and intangible assets into blockchain tokens
- **Tokenization vs Securitization:** Liquidity + Diversification + Trading + New opportunities

Chapter 8 – Mutual Funds**Meaning of Mutual Fund:**

- MF is a trust that pools together the resources of investors to make a foray into investment in capital market
- Managed by professional money manager

Classification:**Functional Classification:**

- Open-ended: Investor can make entry and exit at any time
- Close-ended: Can buy during initial offer or from stock market post listing. It has limited life and then the scheme is liquidated
- Interval: Combination of open-ended and close-ended

Portfolio Classification:

- **Equity fund:** Invest in stocks. Following types are there:
 - Growth fund – Objective to provide long term capital appreciation
 - Aggressive funds – Super normal returns by investing in risky investments like start-ups, IPOs and speculative shares
 - Income funds – Invest in safe stocks having high cash dividends and in high yield money market instruments
- Debt funds: Invest in debt. Following types are there:
 - Bond funds – Invest in fixed income securities
 - Gilt funds – Invest mainly in Government securities
- **Special Funds:**
 - Index funds – Invest in stock index (NIFTY/SENSEX)
 - International funds – MF raise money in India and investing globally
 - Offshore funds – MF raising money globally and investing in India
 - Sector funds – Invest in particular industry
 - Money market funds – Invest in short-term debt-oriented schemes
 - Fund of funds – Invest in other mutual fund schemes
 - Capital protection-oriented fund -Objective is to protect the capital invested by investing in highly rated debt instruments
 - Gold funds – Invest in Gold or Gold related instrument
 - Quant funds – Works on a data-driven approach for stock selection and investment decisions + Eliminates the human biasness and subjectivity

Ownership Classification:

- Public sector Mutual Funds
- Private Sector Mutual Funds
- Foreign Mutual Funds

Direct Plan:

- **Mutual fund direct plans are those plan where Asset Management Companies or mutual fund Houses do not charge distributor expenses, trail fees and transaction charges.** NAV of the direct plan are generally higher in comparison to a regular plan.

Types of schemes:

- Balanced fund – Debt portfolio provides stability and equity provides growth. Consist of both debt and equity
- Equity diversified funds – High level of diversification and ensures risk reduction involved in the fund
- Equity tax linked savings scheme - To get tax benefit under Section 80C
- Sector funds – Focus on a particular industry
- Thematic funds – Broader outlook than sector funds
- Arbitrage funds – Focus is to earn better return than debt funds and lower volatility than equity funds
- Hedge funds – Aggressively managed portfolio of investment with a goal of generating high returns
- Cash fund – Liquid scheme which aims to provide returns with low risk and ensure better liquidity

• Exchange Traded Fund - Funds are listed on stock exchanges and their prices are linked to the underlying securities. Following are the types of ETF Products available in the market: (i) Index EFTs (ii) Commodity ETFs (iii) Bond ETFs (iv) Currency ETFs • Fixed maturity plans – Close-ended mutual funds + Invests in CDs, commercial papers, money market instruments and Non-convertible debentures + it carries credit risk
<u>Advantages of Mutual Funds:</u> • Professional Management • Diversification • Convenient administration • Higher returns • Low cost of management • Liquidity • Transparency • Other Benefits – Regular withdrawal and systematic investment plan • Highly regulated • Economies of scale • Flexibility • Convenience
<u>Drawbacks of Mutual Funds:</u> • No guarantee of Return • Diversification – Diversification minimizes risk but it does not ensure maximizing returns • Selection of proper fund • Cost factor
<u>Trailing commission:</u> • Amount paid by MF investor to his advisor each year + It provides an incentive to the advisor to review their customer's holdings + It is calculated as a percentage of daily average AUM
<u>Expense Ratio:</u> • Percentage of assets spent on mutual fund operations + Needs to be monitored as high expense ratio can impact returns
<u>Side Pocketing:</u> • Separation of risky assets from other investments and cash holding. Money invested in MF linked to stressed assets gets locked, until the fund recovers the money from the company or could avoid distress selling of illiquid securities • Side Pocketing is beneficial for those investors who wish to hold on to the units of the main funds for long term. Therefore, the process of Side Pocketing ensures that liquidity is not the problem even in the circumstances of frequent allotments and redemptions.
<u>Tracking error:</u> • Divergence or deviation of fund's return from the benchmarks it is following – this is critical for passive mutual funds • Higher tracking error would indicate high risk profile • Tracking error can occur due to transaction cost, fees charged by AMCs, Fund expenses, Cash holdings and Sampling biasness
<u>Evaluation of MF performance:</u> • <u>Quantitative parameters:</u> Risk-adjusted returns + Benchmark returns + Comparison to peers + Comparison Returns of across different economic and market cycles + Financial measures (Expenses ratio + Sharpe Ratio + Treynor Ratio + Sortino Ratio) • <u>Qualitative parameters:</u> Quality of portfolio + Track record and competence of fund manager + Credibility of the fund house team
<u>Role of a fund manager:</u> • Good performance of the fund being managed • Role depends on whether it is <u>active fund or passive fund</u> + Active managed funds (Fund manager plays a crucial role and need to generates Alpha) + Passively Managed Funds (Minimum tracking error) • <u>Other key roles:</u> Compliances + Constant monitoring the performance of the fund + Creation of wealth and protection + Control over works outsourced to third parties
<u>Role of FII in Mutual Funds:</u>

- FII are large foreign groups with substantial investible funds and are registered abroad
- Strong research team and can buy domestic mutual funds directly from issuers or through registered stock brokers
- FII enhances corporate governance, improve market competition and improve capital flow

Practical Areas:**MF Return Vs Individual Return:**

$$\text{MF return} = \frac{\text{Own return}}{1 - \text{Initial expense ratio}} + \text{Annual expense ratio}$$

Important points:

- A person is required to spend time while investing on his own. However, investing through mutual fund will save this time and hence the same can give extra income to investor. If a question gives data on this, then we should prepare a cost-benefit analysis of own investing vs MF investing [Formula based calculation will not be possible]

MF Return:

$$\text{Holding period return} = \frac{(\text{NAV}_1 - \text{NAV}_0) + D_1 + \text{CG}_1}{\text{NAV}_0} \times 100$$

$$\text{Annual return} = \frac{(\text{NAV}_1 - \text{NAV}_0) + D_1 + \text{CG}_1}{\text{NAV}_0} \times \frac{12}{m} \times 100$$

Note:

- Opening and closing NAV will have to be adjusted for premium and discount in case of close ended fund. This is because NAV of close-ended fund can quote at premium/discount to normal NAV
- **Date of investment given in question:** If the date of investment is given in question, then we can compute the no of days of investment and use 365 in numerator for computing annual return. Date of investment may or may not be considered as part of number of days of holding depending on assumption
- **Total Yield:** An MF investor can invest in different schemes and returns for each investment can be computed using the above formula. For total yield we should consider the below formula:

$$\text{Total Yield} = \frac{\text{Capital Gain} + \text{Dividend}}{\text{Total Amount invested}} \times 100$$
- **Period of holding:** Period of holding can be computed using annual return and holding period return

$$\text{Period of Holding} = \frac{\text{Holding Period Return}}{\text{Annual Return}} \times 365 \text{ days (or) 12 months}$$

Dividend Payout vs Dividend reinvestment:

- In a dividend payout plan, the investor will get dividend in Rupees and in case of dividend reinvestment plan dividend will get reinvested and we will get additional units
- Return for dividend payout plan would be computed as per the above formula
- Return for dividend re-investment plan would be computed as per the below formula:

$$\text{Holding Period Return} = \frac{\text{Closing value} - \text{Opening investment}}{\text{Opening investment}} \times 100$$

$$\text{Annual Return} = \frac{\text{Closing value} - \text{Opening investment}}{\text{Opening investment}} \times \frac{12}{m} \times 100$$

Note:

- Dividend rate is to be applied on face value of unit to calculate dividend earned by the investor. This will also help in computing the number of units re-invested in dividend reinvestment plan

Taxation impact:

- Cost of acquisition of bonus units will be taken as zero
- Securities Transaction Tax is not allowed as tax deductible expense while computing long-term capital gain and short-term capital gain

Effective yield:

- Effective yield is normally computed using the below formula:

$$\text{Annual Return} = \frac{\text{Closing value} - \text{Opening investment}}{\text{Opening investment}} \times \frac{12}{m} \times 100$$

However, the same can also be computed using IRR method if there is a single inflow and single outflow scenario and number of years map to a whole number.

Front-end load and back-end load:**Formula for calculating front-end load:**

$$\text{Front – end Load} = \frac{\text{Public offer price} - \text{NAV}}{\text{NAV}}$$

Formula for calculating back-end load:

$$\text{Back – end Load} = \frac{\text{NAV} - \text{Redemption Price}}{\text{NAV}}$$

Note:

- Front-end load is otherwise called as entry load and is added to opening NAV
- Back-end load is otherwise called as exit load and is deducted from closing NAV

Computation of NAV:

$$\text{Closing NAV} = \frac{\text{Market value of assets} - \text{Value of liabilities}}{\text{Number of units}}$$

Note:

- **Opening net assets details are given and detailed break-up of assets and liabilities are not available:** In some question, we will not have information on assets and liabilities but details on opening net assets will be available. Net assets will increase by items like portfolio appreciation, dividend received, income earned, fresh inflow etc. Similarly, net assets will decrease by items like portfolio depreciation, expenses incurred, redemption. NAV will be computed in this manner:

$$\text{Closing NAV} = \frac{\text{Opening Network} + \text{Items increasing network} - \text{Items reducing network}}{\text{Opening units} + \text{New inflows} - \text{Redemptions}}$$

- **Impact of inflows/redemption on NAV:** NAV of mutual fund does not change due to fresh inflow/redemption. This is because units change proportionately with change in Network. NAV will change if there is a change in value of underlying assets of Mutual Fund
- **Declaration of dividend:** NAV will fall by the amount of dividend once the same is declared by Mutual Fund
- **Tracking of inflows and outflows:** If it is possible to track inflows and outflows of a mutual fund then we are required to compute closing cash balance by adding inflows and deducting outflows from opening cash balance. Closing cash balance will form part of assets for computing NAV
- **Valuation of equity shares:** Closing value of equity investments can be computed based on index value. It is computed using below formula:

$$\text{Closing value of equity} = \text{Amount invested} \times \frac{\text{Closing index value}}{\text{Index value on date of investment}}$$

- **Payment of dividends:** MF declares 80 percent of realized earnings as dividends. Realized earnings = Interest earned + Dividends earned + Realized capital gain. This amount will be deducted from cash balance
- **Net asset value of Fund vs NAV per unit:** Net asset value of fund represents overall value of fund. The same will be divided by number of units to get NAV per unit
- **Valuation of bonds:** We can use the formula of current yield to value the bond if the interest rate on bond and investor expectation (yield) is given in question

$$\text{Current yield} = \frac{\text{Interest of bond}}{\text{Value of bond}}$$

- **Cash and equity component of MF:** Cash component of MF will decline by expense per unit whereas equity component will change based on movement of market. Beta can be used to find the percentage change in equity component when NIFTY change is given.

$$\% \text{ change in equity} = \text{Beta} \times \% \text{ change in market}$$

Dividend equalization:

- **Adjustment in issue price:** An investor entering into a mutual fund has to pay a higher price if additional income has been earned by mutual fund and the NAV is not computed periodically.

$$\text{Issue price} = \text{Opening NAV} + \text{Dividend equalization adjustment} + \text{Entry load}$$
- **Adjustment in re-purchase Price:** Re-purchase price = Opening NAV + Dividend equalization – Exit Load.

Expense ratio:

$$\text{Expense ratio (based on closing NAV)} = \frac{\text{Annual expense per unit}}{\text{Closing NAV}} \times 100$$

$$\text{Expense ratio (based on opening NAV)} = \frac{\text{Annual expense per unit}}{\text{Opening NAV}} \times 100$$

Expense ratio (based on average NAV) = $\frac{\text{Annual expense per unit}}{\text{Average NAV}} \times 100$
Performance evaluation measures: • Sharpe Ratio (or) Reward to variability ratio: This is used for undiversified portfolio. Higher Sharpe Ratio is better. Sharpe Ratio = $\frac{\text{Expected return} - \text{Risk free}}{\text{Standard Deviation}}$ • Treynor Ratio (or) Reward to Volatility ratio: This is used for diversified portfolio. Higher Treynor Ratio is better. Treynor Ratio = $\frac{\text{Expected return} - \text{Risk free}}{\text{Beta}}$ • Alpha = Actual return - required return. Higher Positive Alpha is better • Negative values: Sharpe/Treynor/Alpha can be negative if the return of security is lower than risk-free return
Tracking error: • Standard deviation of differential return is called tracking error • Differential return = MF return - Benchmark return

Chapter 9 – Derivatives Analysis and Valuation

Meaning of Derivative Instrument: - Derivative is a product <u>whose value is to be derived from the value of one or more basic variables called bases</u> (underlying assets, index or reference rate). The underlying assets can be <u>Equity, Forex, and Commodity</u> - The value of derivative instrument changes with the change in value of underlying instrument
Users of derivatives: - Corporation - Individual investors - Institutional investors - Dealers
Cash market and derivatives market: - Cash market – Tangible assets are traded; Derivatives market = Contract based on tangible or intangible assets like index - We can purchase one share in cash market but there are minimum lots in derivative market - Cash market is for consumption/investment whereas derivatives market is for hedging, arbitrage and speculation - Buying securities in cash market involves putting up all money upfront whereas buying in futures market only involves margin money
Forward contract and Futures contract: - Forward contracts are traded on personal basis whereas futures contracts are traded in a competitive arena - Forward contracts have no standardized size whereas futures contracts are of standardized size - Forward contracts are traded in over the counter market whereas futures are traded in stock exchanges - Forward contracts are delivered whereas only net settlement happens in futures contract - Cost of forward contract is based on bid-ask spread whereas futures contracts involve brokerages - Forward contracts are not subject to mark to market and do not require margins. Futures contract are subject to mark to market and involves initial and maintenance margin - Forward contract has credit risk whereas futures contracts do not have credit risk
Marking to Market: It implies the <u>process of recording the investments</u> in traded securities (shares, debt-instruments, etc.) at a <u>value, which reflects the market value of securities</u> on the reporting date. In the context of <u>derivatives trading</u>, the futures contracts are marked to market on <u>periodic (or daily) basis</u>
Advantages of stock index futures vs stock futures: - Flexibility to investment portfolio - Possibility of speculative gains using leverage - Most cost-efficient hedging - Stock index futures cannot be easily manipulated - Less volatile - Cash settlement - Less regulatory complexity - Hedging or insurance protection for a stock portfolio in falling market
Uses/Advantages of stock index futures: - Changing weights or risk exposures of investment portfolio – Buying/selling index futures can increase/decrease risk - Separation of market timing from market selection decisions - Investors can make money through stock index futures through index arbitrage - Hedging the value of portfolio - Possibility of speculative gains through leverage - Possibility of doing short-sell during falling markets - Transfer risk quickly and efficiently
Options and Futures:

In options, the buyer of the options has the right but not the obligation to purchase or sell the stock. However, while going in for a long futures position, the investor is obligated to square off his position at or before the expiry date of the futures contract

Factors affecting value of an option:

- Price movement of the underlying instrument
- Time till expiry
- Volatility in stock prices
- Interest rates

Option Greeks:

- Delta - It is the degree to which an option price will move given a small change in the underlying stock price
- Gamma - It measures how fast the delta changes for small changes in the underlying stock price. i.e. the delta of the delta.
- Theta - The change in option price given a one day decrease in time to expiration
- Rho - The change in option price given a one percentage point change in the risk-free interest rate
- Vega - Sensitivity of option value to change in volatility

Exotic options:

- Exotic options are the classes of option contracts with structure and features different from plain vanilla options

Types:

- **Chooser option:** It gives a right to the buyer to decide whether purchased option is call option or put option
- **Compound options:** It is an option on option + Gives a right not an obligation to buy another option at specific price on the expiry of the first maturity date
- **Barrier option:** Contract will become activated only if the price of the underlying asset reaches a certain price
- **Binary option:** It is known as digital option + Pay-off depends on specific event + If event happens then specified payoff will happen + If even does not happen then payoff will be zero
- **Asian option:** Pay-off based on average prices of the underlying over a predetermined period and not the expiry price
- **Bermuda option:** It is between American and European option + Exercise of option can only be done on specific dates
- **Basket options:** Underlying asset is not a single security but depends on the value of portfolio (basket)
- **Spread options:** Payoff depends on difference between prices of two underlying
- **Look back options:** Holder of the option is given a choice to choose a most favourable strike price depending on the minimum and maximum prices of an underlying achieved during the lifetime of the option

Risks of financial products:

- **Market risk:** Risk due to adverse movement of stock market, interest rates and forex + can be hedged through normal derivatives
- **Credit risk:** Known as default risk + Can be hedged through credit derivatives

Working of Credit Default Swaps (CDS):

- Insurance against the risk of default + Credit protection buyer pays a regular premium to credit protection seller who in turn assumes credit risk

Features:

- Non-standardized contract between buyer and seller
- Normally not traded on any exchange
- International swap and Derivative Association (ISAD) publish the guidelines and rules for CDS contracts
- Cost of CDS (premium) has positive relationship with risk attached with loans
- Naked CDS - Buying a CDS without purchasing the underlying bonds

Applications:

- Hedging, Arbitrage and Speculation

Parties to CDS:

- Initial borrower + Protection buyer + Protection seller

Settlement in case of default:

- **Physical settlement:** Face value of bonds would be paid by protection seller and protection buyer will have to deliver bonds
- **Cash settlement:** Settlement amount to be paid by protection seller = Face value of bonds $\times$ (1 - Recovery rate)

Collateralized debt obligations (CDO):

- CDO pool together various debt instruments + Investors invest in CDO + CDO pays interest and principal to investors from the cash flows generated by the assets

Types:

- Cash flow CDO: Backed by cash market debt or securities having low risk
- Synthetic CDO: They do not hold actual debt instruments + However they take credit risk by taking exposure through CDS
 - **Unfunded:** Only consist of CDS
 - **Funded:** Consist of credit Linked Notes
 - **Partially Funded:** Partially through CLN and CDS
- **Arbitrage CDO:** Issuer captures spread between return realized collateral underlying the CDO and cost of borrowing to purchase the collaterals + Additionally fees is also collected for management of CDO

Risks in CDO:

- Default risk
- Interest rate risk
- Liquidity risk
- Prepayment risk
- Reinvestment risk
- Foreign exchange risk

Financial option and Real option:

- Financial options have underlying assets as financial securities (traded) whereas real options have underlying assets as projects that are not traded in market
- Pay-off structure of financial option is specified and fixed whereas pay-off structure of real option is varied
- Financial options are normally for a year whereas real options are for long period
- Financial options are traded and hence priced in market - Real options are not traded and hence needs to be valued

Key criteria for considering a commodity under commodity derivatives:

- Standardization
- Deliverability
- Liquidity
- Price volatility
- Market demand

Needs of users of commodity derivatives:

- Primary need (Hedger's need for price risk reduction) + Convenience needs (Flexibility in doing business + efficient clearing system)

Advantages of commodity market:

- Preference for derivatives as compared to tangible commodities + Less hassles + Indirect investment in real assets through derivatives

Advantages of commodity futures:

- Easy way to invest in commodities + Multiple categories (Agricultural products + Energy + metal)

Types of Commodity swaps:

- **Fixed-Floating Swaps:** They are just like the fixed-floating swaps in the interest rate swap market with the exception that both indices are commodity-based indices
- **Commodity-for-Interest Swaps:** They are similar to the equity swap in which a total return on the commodity in question is exchanged for some money market rate (plus or minus a spread)

<u>Peculiar characteristics of commodity swaps having a bearing on valuation:</u> • Cost of hedging + Institutional structure of particular commodity + Liquidity of underlying commodity + Seasonality + Variability of bid/offer spread + Brokerage fees + Credit risk
<u>Embedded Derivatives:</u> • An embedded derivative is a <u>derivative instrument that is embedded in another contract - the host contract</u>. The host contract might be a debt or equity instrument, a lease, an insurance contract or a sale or purchase contract. • Derivatives require to be <u>marked-to-market through the income statement</u>, other than qualifying hedging instruments. • <u>Example:</u> A coal purchase contract may <u>include a clause that links the price of the coal to a pricing formula</u> based on the prevailing electricity price or a related index at the date of delivery
<u>Weather derivatives:</u> • Protection against loss arising due to unfavourable weather patterns – It primarily helps in managing volume risk, rather than price risk, due to changes in demand of goods due to weather-related changes • <u>Underlying asset:</u> Weather which has several dimensions such as rainfall, temperature, humidity, wind speed • <u>Weather derivatives vs insurance:</u> Insurance provides protection only against extreme low probability weather events such as earthquake, floods whereas weather derivatives protect from all types of risks • Pricing of weather derivatives is challenging due to data reliability, forecasting difficulties and temperature modelling challenges.
<u>Electricity derivatives:</u> • <u>Need:</u> Electricity prices are volatile and hence hedging instruments are needed for generators, buyers and load-serving entities to reduce price risk • <u>Forms:</u> Forwards, Futures and Swaps • <u>Electricity locational basis swap:</u> Holder of the swap agrees to pay or receive the difference between a specified futures contract price and another locational spot price. This is used to lock-in a fixed price at a geographic location.
<u>Key lessons from derivatives mishaps:</u> • Don't buy any derivative product that you don't understand • Due diligence before making Treasury Department as a Profit Centre • Specify the risk limits • Separation of Front, Middle and Back Offices • Ensure that a hedger should not become a speculator • Carry out Stress Test, Scenario Analysis etc

Practical Areas:

<u>Valuation of futures:</u> <u>Situation 1: Non-dividend paying stock:</u> Fair futures price = Spot price $\times e^{rt}$ (or) Spot price $\times (1 + r)^t$ <u>Where:</u> • r = rate of interest • t = time period • Spot rate = Today's price • r and t should be for same time period (year, half-year, quarter, month and so on) • Formula 1 is used in case of continuous/daily compounding • Formula 2 is used in case of any other compounding frequency
<u>Situation 2: Dividend in Rupees:</u> • We will use the above formula but replace spot price with adjusted spot price • Adjusted spot price = Spot price – PV of dividend income PV of Dividend Income = $\frac{\text{Dividend Income}}{e^{rt}}$ (or) $\frac{\text{Dividend Income}}{(1 + r)^t}$
<u>Situation 3: Dividend Yield in percentage:</u> • We will use the formula of situation 1. We will replace r with $(r-y)$ in the formula • y = Dividend Yield %
<u>Situation 4: Storage cost in Rupees:</u>

- We will use formula of situation 1 but replace spot price with adjusted spot price
- Adjusted spot price = Spot price + PV of Storage costs

$$\text{PV of Storage costs} = \frac{\text{Storage costs}}{e^{rt}} \text{ (or) } \frac{\text{Storage costs}}{(1+r)^t}$$

Situation 5: Storage cost in percentage:

- We will use the formula of situation 1. We will replace r with (r+s) in the formula
- S = Storage cost %

Format for capturing basis information to compute Fair Futures Price:

Spot price	XX
Time period	XX months (or) XX quarters (or) XX half year (or) XX years
Rate of interest	XX% pa. (or) XX% per half year (or) XX percent per quarter (or) XX% per month
Dividend	XX
Storage cost	XX
Type of compounding	Continuous/half-yearly/annual/quarterly/once in time period of futures

Note:

- **Computation of e^{rt} :** e^{rt} can be computed using the below formula:

$$e^x = 1 + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots + \frac{x^n}{n!}$$

- **Interest rate of 8% per annum payable with monthly rest:** This would mean interest would be compounded monthly. Similarly if one month borrowing rate or interest rate per month is given in question then also we will go for monthly compounding
- **Dividend Yield available for all 12 months:** If a question gives dividend yield for all months then we should take dividend yield as average yield of those months covered in duration of futures contract
- **Daily compounding:** The term daily compounding would mean continuous compounding
- **Expected Futures and theoretical forward value:** Theoretical forward value would be same as fair futures price computed as per formula. Expected futures price is actual futures price. This would normally be given in question. If the same is not given, it can be computed based on below formula
Expected Futures Price = Spot Price + [% change in Index x Beta of share]
- **Implied risk-free rate:** Implied risk-free rate will be higher than normal risk-free rate if there are arbitrage opportunities.
$$\text{Implied risk - free rate} = \frac{\text{Total Profit}}{\text{Amount invested}} \times \frac{12}{m} \times 100$$
- **No of days specified as 365 or 360:** If a question specifies that year consist of xx days, then we should do all calculations based on number of days and not number of months. This concept is applicable in all chapters of SFM
- **Conversion of normal rate into CCRFI:** Normal discount rate can be converted into CCRFI by using natural log values. The same would be given in question

Arbitrage strategy:

- **Actual Futures Price > Fair Futures Price:** If Actual Futures price is higher than fair futures price, it would mean futures are overvalued. In this case we will sell in futures market and buy in spot market
- **Actual Futures Price < Fair Futures Price:** If Actual Futures price is lower than fair futures price, it would mean futures are undervalued. In this case we will buy in futures market and sell in spot market
- Final Arbitrage gain = Difference between Fair futures price and Actual Futures Price

Arbitrage steps if AFP > FFP:

Particulars	Amount
Day 0:	
• Take a loan for XX months @ XX	XX
• Buy share in spot market with proceeds from loan	XX
• Enter into futures contract to sell share at Rs.XX after XX months	XX
Month 6:	
• Sell share in futures market at agreed price of Rs.XX	XX

Repay loan along with interest	XX
Arbitrage gain	XX

Arbitrage steps if AFP < FFP:

Particulars	Amount
Day 0:	
Do a short-sell of share in spot market and receive XX	XX
Create a risk-free deposit of XX months @ CCRFI of XX% with sale proceeds	XX
Enter into futures contract to buy share at Rs.XX after XX months	XX
Month 6:	
Redeem fixed deposit along with interest	XX
Buy share in futures market at Rs.XX and provide delivery of share to buyer in spot market	XX
Arbitrage gain	XX

Note:

- Arbitrage steps will change slightly in case there is dividend in Rupees or Dividend in %

No Arbitrage boundary with transaction costs and multiple interest rates:

- Minimum FFP = Spot selling price + Interest earned on fixed deposit
- Maximum FFP = Spot purchase price + Interest paid on loan
- In case of short-sell, interest earned on fixed deposit will be less as we would not receive the entire sell proceeds on day 0

Convenience Yield:

- Fair Futures Price = Spot Price + Cost to Carry - Convenience yield
- Cost to carry = Fair futures price as per formula - Spot Price
- Convenience Yield will be computed in case question gives a fair futures price and the same does not match with FFP computed as per the formula
- PV of convenience Yield is convenience yield discounted to today's value. We can either do continuous discounting or normal discounting depending on data in question

Format for computing futures profit/loss:

Date	Position	Action	Reference Date	Rate
Day 1	Original Position	Buy/sell	Day 90	XX
Day 90	Opposite Position	Buy/sell	Day 90	XX
Gain per unit of NIFTY				
Gain per lot				

Note:

- In order to compute profit/loss we should consider an opposite position and calculate the amount of profit/loss. If the original position is buy, then opposite position will be sell and vice versa
- We should ensure that reference date remains same for original and opposite position. Additionally, the rates are to be taken from futures market and not cash market. If futures rate are not given, then the same should be computed using FFP formula

Contango and Backwardation:

- Contango and backwardation is determined with the help of basis
- Basis = Spot price - futures prices
- If Basis is negative the market is said to be in Contango and when it is positive the market is said to be Backwardation.

Hedging with futures:

- In order to hedge the position, we should take an opposite position for hedging
- A portfolio will be called as fully hedged if Beta of Portfolio is zero. We will use the below weighted average format for finding number of contracts for hedging.

Format for finding amount to be hedged:

Security	Beta	Weight	Product
Portfolio			
BSE futures	1.00		
Total	0.00		0

- Amount of BSE/NSE futures will have beta of 1 time and will not be considered in weights total
- No of contracts for hedging is computed with below formula:

$$\text{Number of contracts} = \frac{\text{Amount to be hedged (weight of BSE futures)}}{\text{Size of one contract}}$$

- Size of one contract = Actual Futures Price x Lot size. **We should ensure that actual futures price is used for finding size of one contract. Fair futures price should not be used.**

Note:

- Beta of A Limited is 1.2 times. This would mean that if index falls by 1 percent, share of A Limited will fall by 1.2 percent
- Beta of portfolio can be computed as under:

$$\text{Beta of portfolio} = \frac{\% \text{ change in portfolio}}{\% \text{ change in market}}$$
- Amount of hedge to be done = Investment in spot market x Stock Beta x Hedge needed %
- Beta can also be computed as under:

$$\text{Beta} = \frac{\text{SD of changes in spot market}}{\text{SD of changes in futures market}} \times \text{Correlation coefficient}$$
- Hedge%:**
 - Hedging full portfolio would mean Beta will become zero.
 - Protection by 80% would mean reduce Beta by 80% and new Beta will be equal to old Beta - 80%
 - Protection by 120% would mean reduce beta by 120% and new beta will be equal to old Beta - 120%
- Return on investment in futures:** Investment made = Margin deposited + Brokerage/ commission; Profit = Profit on futures position - Opportunity cost (dividend income) - brokerage expense. ROI is computed using below formula:

$$\text{ROI} = \frac{\text{Profit}}{\text{Investment}} \times 100$$

Effective realization/payment in futures:

- Effective realization = Realization as per spot rate ± Net settlement in futures

Net settlement can be computed as under:

Date	Position	Action	Reference Date	Rate
Day 0	Original Position	Sell	Day 180	XX
Day 180	Opposite Position	Buy	Day 180	XX
Net profit/loss per Kg in futures market				XX

Note:

- Realization/payment will always happen as per spot rate in cash market on maturity rate. Futures rate will be used for computing net settlement in futures

Swap Arrangement:

- In a swap arrangement the amount receivable and payable will be defined as per agreement. We could be paying/receiving fixed amount and similarly we could be paying/receiving a variable amount
- Net settlement of swap = Amount receivable - Amount payable

Maintenance Margin:

- Initial margin = Defined in question (or) Daily absolute change + (3 x Standard Deviation)
- Maintenance margin = Defined in question

Note:

- Margin balance needs to be replenished back to initial margin if it falls below maintenance margin. However, if the margin balance is between initial and maintenance margin, then it need not be replenished to initial margin

Open Interest

- Open interest = Total number of open or outstanding options and futures
- It is basically sum of total of minus contracts (or) plus contracts

Basics of options:

Term	Meaning
Holder	Buyer of the "Right to buy" or "Right to sell"
Writer	Person who sells the "Right to buy" or "Right to sell"
Exercise price / strike price	Price at which the underlying asset will be bought or sold
Expiry date	The date by which the option has to be exercised

Call option	This gives the buyer the right to buy
Put option	This gives the buyer the right to sell
Underlying asset	Asset against which the derivative instrument option is traded
American option	Right can be exercised at any time before the expiry date
European option	Right can be exercised only at the expiry date

Note:

- A person will be a holder if he wants to take low risk and would be a writer if he is willing to take high risk

In the Money/At the money/Out the money:

- An option is in the money if exercising the option at that point would give a gain
- An option is out the money if exercising the option at that point would lead to a loss
- An option is at the money if exercising the option at that point would lead to neither profit nor loss

Intrinsic value and Time value of option:

- Intrinsic value = Gross payoff of option if it is exercised
- Time value = Option premium - Intrinsic value. Time value cannot be negative

Payoff table and Payoff graph:

- GPO for call option = CMP - Exercise price. If this is negative, then option will not be exercised and hence GPO will be zero
- GPO for Put option = Exercise price - CMP. If this is negative, then option will not be exercised and hence GPO will be zero
- GPO will be positive for holder and negative for writer
- Premium will be negative for holder and positive for writer

Steps in preparing payoff table and payoff graph:

- Prepare relationship table
- Prepare break-even table
- Draw payoff graph

Important Points:

- Break-even price for call option = Strike Price + Premium
- Break-even price for put option = Strike Price - Premium
- We should assume a lot size for computing overall profits if the same is not given in question. We can take lot size as 100 shares
- **Premium and strike price:** Premium of call option decreases with increase in strike price. This is because we are increasing purchase price with increase in strike price and hence a lower premium will be paid. Conversely premium of put option increases with increase in strike price. This is because we are increasing selling price with increase in strike price and hence a higher premium will be paid.
- **Strategy to protect selling price/ provide for maximum purchase price:** If an investor wants a minimum selling price, then he should go for appropriate put option. Similarly, if we want a maximum purchase price then we should go for appropriate call option

Put-call Parity Theory of Option Valuation:

- **PCPT Equation:** Share + Put = Call + Present value of exercise price
- The above equation can help in valuing Call option or Put option if we have information about 3 out of 4 items
- Share price will be replaced with adjusted share price in case there is a dividend in rupees (similar to futures valuation) and r will be replaced with (r-y) in case there is a dividend yield
- **Arbitrage opportunity:** The above equation should hold good. If it doesn't then there will be arbitrage opportunity. We will assume portfolio 1 as Share + Put and will assume portfolio 2 as Call + PV of exercise price. We should buy under-valued portfolio and sell over-valued portfolio in case the values are not equal

Portfolio replication Model:

- This model will be used if we have 2 judgement prices

Approach 1: Stock equivalent Approach - we buy options:

- ❖ Compute intrinsic value at two judgement prices

- ❖ Compute no. of calls to be bought using

$$\text{No of calls} = \frac{\text{Spread in Stock Price}}{\text{Spread in IV}}$$

- ❖ Compute risk free investment = Present value of (Lower JP – IV at JP 1)
- ❖ Compute value of calls using
 - $S_0 = C_0 \times \text{No of calls} + R_f \text{ investment}$
- ❖ Compute value of put using PCPT

Approach 2: Option equivalent Approach – we buy shares:

- ❖ Compute intrinsic value at two judgement prices
- ❖ Compute the no. of shares to be bought using

$$\text{No of Shares} = \frac{\text{Spread in IV}}{\text{Spread in Stock Price}}$$

- ❖ Compute amount of borrowing using the following formula
 - $\text{Borrowing} = \text{PV of } [(\text{No. of shares} \times \text{Lower JP}) - \text{IV at JP}_1]$
- ❖ Compute value of call using
 - $\text{Call} = \text{share value bought} - \text{borrowing}$
- ❖ Compute value of put using PCPT

Risk Neutral Model:

- ❖ **Step 1:** Compute the intrinsic value at 2 judgement prices
- ❖ **Step 2:** Compute upside probability and downside probability by equating the weighted average of price with expected maturity price
- ❖ **Step 3:** Expected value of call on expiry date is the weighted average of the values in step 1 with probability computed in step 2 being the assigned weights
- ❖ **Step 4:** Compute the PV of expected value of step 3 by discounting at risk free rate. This gives the value of call
- ❖ **Step 5:** Use PCPT model to value the put

Binomial Model:

- ❖ **Step 1:** Draw decision diagram
- ❖ **Step 2:** Identify market price on expiry dates
- ❖ **Step 3:** Write intrinsic value at various judgement price on expiry date
- ❖ **Step 4:** Taking into account the previous probabilities roll back the IV to the base. This is the fair value of the option
- ❖ **Step 5:** Discount the value of step 4 to identify the fair value of option on day 0

Note:

- **Probabilities are not given:** If probabilities are not given in question then we have to compute the probability first using the steps of risk-neutral model

Valuation of American Option:

- ❖ **Step 1:** Draw decision diagram
- ❖ **Step 2:** Identify market price on expiry dates
- ❖ **Step 3:** Write intrinsic value at various judgement price on expiry date
- ❖ **Step 4:** The value of each previous node is higher of the following
 - Value of immediate exercise
 - Value of later exercise – Weighted average of intrinsic value of future prices
- ❖ **Step 5:** Roll back to get the option value at base node
- ❖ **Step 6:** Discount the value of step 4 to identify the fair value of option on day 0

Black-Scholes Model:

$$\text{Value of Call} = (S_0 \times N(d_1)) - (PV_{EP} \times N(d_2))$$

$$d_1 = \frac{\left(\text{Naturallog} \left(\frac{S_0}{E} \right) + (r + 0.5\sigma^2)t \right)}{\sigma\sqrt{t}}$$

$$d_2 = \frac{\left(\text{Naturallog} \left(\frac{S_0}{E} \right) + (r - 0.5\sigma^2)t \right)}{\sigma\sqrt{t}}$$

(or)

$$d_2 = d_1 - \sigma\sqrt{t}$$

Where:

S_0 =CMP; r =risk free rate per year; t =time in years and E =Exercise Price

Format for computing answer under Black-Scholes Model:

Term	Calculation	Amount
S_0 (CMP)		
Exercise Price		
$\frac{S_0}{E}$		
Naturallog $\left(\frac{S_0}{E}\right)$		
$r + 0.5\sigma^2$		
$(r + 0.5\sigma^2)t$		
$\sigma\sqrt{t}$		
d_1		
$r - 0.5\sigma^2$		
$(r - 0.5\sigma^2)t$		
d_2		
$N(d_1)$		
$N(d_2)$		
PV_{EP}		
Value of call		
Value of Put using PCPT		

Important points:

- Probabilities for d_1 and d_2 should be given in question. If the values are not exactly given, then we should use interpolation technique to get the desired probability
- Probability value should increase with increase in z-values. If they are not increasing then the given probabilities are residual probability and should be converted into normal probability.
- Final Probability = 1 - Given values (or) 0.50 - Given values. The computed answer should give us a probability greater than 0.5 for positive z values. So we should accordingly employ 1 or 0.50 in the formula and calculate residual probability.
- Dividend Yield in %:** In this question dividend yield is given in percentage. We should replace r with $(r-y)$ for computing d_1 and d_2 . We should not replace r with $r-y$ while calculating PV of exercise price. However, for put valuation in case of PCPT, we should compute PV of exercise price with $(r-y)$

Other points on valuation:

- Exercise price will prevail on maturity date would mean that market price on expiry date will be equal to exercise price. This will make the option at the money and the same will lapse. Value of such option will be zero on maturity date
- Expected value of option is the weighted average of various possible intrinsic values with probability being the assigned weights. This can also be called as fair value of option/break-even price

Delta:

- Delta of call option is positive and Delta of Put option is negative
- Riskless hedge portfolio will be computed with the help of Delta. Delta of call option is positive and Delta of Put option is negative.
- Delta can be computed with below formula:

$$\text{Delta} = \frac{\text{Spread in option price}}{\text{Spread in stock price}} \text{ (or)}$$

$$\text{Delta of call option} = N(D_1) \text{ of Black Scholes Model}$$

$$\text{Delta of Put option} = \text{Call Delta} - 1$$

Delta with dividend:

$$\text{Delta of call option} = N(D_1) \text{ of Black Scholes Model} \times e^{-yt}$$

$$\text{Delta of Put option} = \text{Call delta} - 1$$

Format for creating riskless portfolio:

- We can use below weighted average format to find the combination of option and shares:

Security	Delta	Weight	Product

Share	1.00	1.00	1.00
Call	XX		
Total	0.00		0.00

- Riskless hedge portfolio will be one with overall delta of zero.

Chapter 10 – Foreign Exchange Exposure and Risk ManagementTheory:Role of SWIFT in foreign exchange:

- SWIFT (Society for Worldwide Interbank Financial Communication) is a messaging system for business transactions
- SWIFT assigns 3 lettered codes to each country's currency + It is a standardized communication system for financial transactions
- **Importance of SWIFT:** Quick settlement + Reduces operational risk + Reduces costs + Operational efficiencies + Full backup and recovery system

Payment Gateway:

- Secure virtual mode for transferring cash, authenticating and routing payment details + It helps in collecting payments on e-commerce sites
- **Benefits:** Offers convenience, real-time card authorization, efficient transaction processing, multiple payment options, risk mitigation, real-time reports, customer refund facility and secure servers
- **Challenges:** Customer account not available with the bank supporting the payment gateway, limited bank networks, reliability and customer trust issues
- **International payment gateway:** Offers global/multi-currency payments and multiple-language payment interfaces

Nostro, Vostro and Loro Account:

- A bank's foreign currency account maintained by the bank in a foreign country and in the home currency of that country is known as **Nostro Account or "our account with you"**
- **Vostro account** is the local currency account maintained by a foreign bank/branch. It is also called **"your account with us"**.
- The **Loro account** is an account **wherein a bank remits funds in foreign currency to another bank for credit** to an account of a third bank.

Merchant rate and Interbank Rate:

- **Exchange rates applied to all types of customers** including that for converting inward remittance in USD to INR are called **merchant rates** as against the rates quoted to **each other by banks** in the interbank market, which are called **interbank rates**.
- Exchange margin will be added/subtracted to/from the interbank rate to arrive at the merchant rate for the customer

Techniques for exchange rate forecasting:

- Technical forecasting
- Fundamental forecasting
- Market-based forecasting - Using of market indicators to develop forecasts
- Mixed forecasting

Factors affecting exchange rates:

- Inflation rate
- Interest rate
- Deficit/surplus on capital/current account
- Trade barriers
- Intervention by Central Bank
- Government controls
- Expectations/speculations

Participants in Foreign Exchange Market:

- Non-bank entities - Individuals and corporates buying/selling foreign currency
- Bank
- Speculators - Commercial and investment banks, multinational companies and hedge funds
- Arbitrageurs
- Government

Types of exposure:

- Transaction exposure - Effect of exchange rate on outstanding obligations
- Translation exposure - Also called as Accounting exposure. Effect on owner's equity because of the need to translate foreign currency financial statements

Economic Exposure – Extent to which the value of a company declines due to changes in exchange rate
Foreign exchange risk management: Meaning: Protection against variation in exchange rates. Importance: Helps in reducing costs + Gains competitive advantages + Improve cash flow + Ensure compliance with regulations
Natural hedging strategy: - Exporters can use natural hedging strategy for reducing forex risk by availing short-term foreign currency loans (PCFC/FCNR) - PCFC is available at a cheaper rate and will also help in using export receivables for PCFC loans outstanding
Non-deliverable forward contract: A cash-settled, short-term forward contract on a thinly traded or non-convertible foreign currency, where the profit or loss at the time at the settlement date is calculated by taking the difference between the agreed upon exchange rate and the spot rate at the time of settlement, for an agreed upon notional amount of funds.
Options vs Futures: - Writer has obligation to perform in option whereas both parties have obligation in futures - Premium is to be paid in options. There is no premium in futures - Limited loss and unlimited gain for holder. Unlimited loss/gain for both parties - American option can be exercised on any date whereas futures have to be exercised only on maturity date
Currency Swap: - Currency swap involve an exchange of liabilities between currencies. It consists of spot exchange of principal, continuing exchange of interest payment during the term of the swap and re-exchange of principal on maturity Benefits: Hedging, cost savings, permits funding in different currencies, diversification of borrowings
Strategies for exposure management: - Low risk: Low reward – All exposures hedged - Low risk: Reasonable reward – Selective hedging - High risk: Low Reward – All exposures unhedged - High risk: High reward – Active trading
Netting: - Netting helps in minimizing the total value of inter-company fund flows Advantages: Reduces the number of cross-border transactions between subsidiaries + Reduces the need for foreign exchange and hence saved on transaction costs + Improves cash flow forecasting since cash transfers are made only at end of each period

Practical Areas:

Direct Quote and Indirect Quote: ❖ Direct quote expresses the exchange rate as home currency per unit of foreign currency. Rs.65 per dollar is the direct quote in India. ❖ Indirect quote expresses the exchange rate as foreign currency per unit of home currency. Rs.65/dollar is the indirect quote in USA. ❖ Direct quote and indirect quote are inverse to each other
Conversion of direct quote into Indirect: $\text{Direct Quote} = \frac{1}{\text{Indirect Quote}}$
Price and Product: In a quote the first currency is called as Price and second currency is called as product. Any appreciation/depreciation of currency is always applied to the product
Bid, Ask and Middle Rate: - Bid rate – The rate at which bank buys the product - Ask rate – The rate at which bank sells the product - Spread – Difference between Ask rate and Bid rate - Middle rate – Average of bid and ask rate

- Spread % - This is calculated using below formula:

$$\text{Spread \%} = \frac{\text{Ask rate} - \text{Bid rate}}{\text{Ask rate}} \times 100$$

Two-way quote:

- The numbers after the decimal in quote are called as PIPS
- If the numbers before the decimal in bid and ask is identical then while quoting the ASK portion of the two way quote only the PIP is quoted. Example: Rs.67.80 – 67.90 per USD is quoted as Rs.67.80-90.
- If the numbers in the PIP are same those numbers are not quoted in the two way quote in case of ASK. Example Rs.12.315-70 / rand mean 12.315-12.370.

Direct to indirect quote conversion for two-way quotes:

$$\text{Bid} \left(\frac{A}{B} \right) = \frac{1}{\text{ASK} \left(\frac{B}{A} \right)}$$

$$\text{Bid} \left(\frac{B}{A} \right) = \frac{1}{\text{ASK} \left(\frac{A}{B} \right)}$$

Note:

- If we want bid rate for a direct quote, we should use the ask rate of indirect quote. Similarly, if we want ask rate for a direct quote, we should use the bid rate of indirect quote

Finding Cross Rates:

$$\text{Bid} \left(\frac{A}{C} \right) = \text{Bid} \left(\frac{A}{B} \right) \times \text{Bid} \left(\frac{B}{C} \right)$$

$$\text{Ask} \left(\frac{A}{C} \right) = \text{Ask} \left(\frac{A}{B} \right) \times \text{Ask} \left(\frac{B}{C} \right)$$

Note:

- Technique of cross-multiplication can be used if we have a connecting currency and in this case currency B is connecting currency

Steps to solve basic problems:

- **Step 1:** Find known and unknown component
- **Step 2:** Identify the base formula: Unknown component = Known Component x ?
- **Step 3:** Find what the bank is doing with denominator currency in step 2. If Bank is buying denominator currency, then we should use Bid rate and if Bank is selling denominator currency, then we should use Ask rate
- **Step 4:** Expand the formula with usage of common connecting currency

Exchange margin:

- Exchange margin is extra profit for the banker. This is added to Ask rate and deducted from the bid rate
- We can apply exchange margin on final quote if exchange margin is applicable on all currencies of the quote. However, if it is not applicable to all quotes, then we should apply on individual quotes
- **Merchant rate vs Inter-bank rate:** Exchange margin is applicable only on inter-bank rate and is not applicable on merchant rate. This is because merchant rate will include exchange margin and hence, we need not apply it again.
- **Inter-bank market and Singapore market:** A question gives one rate for inter-bank market and another rate for Singapore market/USA market etc. We should apply exchange margin only for inter-bank market rate and not apply for Singapore market rate. This is because Singapore market rate will directly be the merchant rate.
- **Exchange margin on buying rate and selling rate:** If the question says exchange margin is xx on buying and xx on selling rate, it will not be clear whether it is banker's buying rate (bid rate) or customer's buying rate (ask rate). In such a scenario we can take assumption and move forward. ICAI solution has taken buying and selling rate as banker's buying rate (BID Rate) and banker's selling rate (ASK rate)
- **Exchange margin in Paise:** If the exchange margin is given in paise then the same should be considered only for the quote which is in INR and not considered for other quotes
- **Exchange margin to be taken on direct quote/indirect quote:** Sometime the quote will not be directly available and we will be using (1/ Ask rate) to get bid rate and (1/bid rate) to get ask rate. **In this scenario exchange margin can be applied either post conversion or before conversion.**

Both approaches will lead to small variation in answer and ICAI hasn't been consistent in this application.

Swap points:

- If the swap points are in ascending order, we add them to spot rate and calculate forward rate
- If the swap points are in descending order, we deduct them from spot rate and get forward rate
- **Swap premium in descending order:** If the question uses the word swap premium then the same needs to be added to spot rate. This is despite the fact that given points are in descending order. This is because the word used in question is swap premium.
- **Swap points for broken period:** If swap points for 1 month and 3 months is given, then we can identify swap points for 1.5 months, 2 months, 2.5 months or any other period between 1 month and 3 months using interpolation technique

Return in foreign currency:

$(1 + \text{Home currency return}) = (1 + \text{Foreign currency return}) \times (1 + \text{Appreciation/Depreciation})$

- **Data given on entry/exit price with Bid/ask rate:** We can compute home currency and foreign currency return separately. Convert all data into single currency (foreign currency) and get foreign currency return. Similarly have all data in home currency and get home currency return

$$\text{Return} = \frac{\text{Exit value} - \text{Entry Value}}{\text{Entry value}} \times 100$$

Important Points in basics:

- **Likely rate of YEN against USD:** This would mean YEN is the product and hence we should find (USD/YEN) Quote
- **Cover rate:** Covering a transaction would mean taking an opposite position of the original action. If we had sold HKD originally then we have to buy HKD to cover the transaction.
- **Banker dealing with another banker:** If a banker is buying/selling currency from another bank, then the banker initiating the transaction is like customer. Bid/Ask rate selection will depend on the action of the other banker
- **Cover transaction in multiple markets:** If there is a possibility of covering the transaction in multiple markets, we should cover the transaction in the market which has lower outflow of INR or higher inflow of INR
- **Squaring up of position:** Squaring up of position would mean taking an opposite transaction or taking a cover position. If there is a loss/profit in non-INR currency, then the same can be converted into INR losses if the INR exchange rates are there in question. If there is a loss we need to buy foreign currency and if there is a profit we will sell foreign currency
- **Interpretation of quotes:** In practical world quotes for INR/USD [INR per USD] is mentioned as USD-INR [USD Hyphen INR]. However, in most of the exam questions INR/USD would be given and we can directly interpret them as INR per USD. But few questions the quotes may not be logical and we should interpret the quote as per current exchange rates. We should clearly write in exam if we have interpreted the quote as per current exchange rates and not followed what is given in question
- **Interpretation of quotes:** If the question does not specify whether quote is (A/B) or (B/A), then we have to interpret one of the given quotes as per current exchange rates. Once one quote is interpreted, all other quotes will be interpreted in the same manner
- **Quotes from multiple banks:** If there are quotes from multiple banks then we should take the favourable exchange rate while doing the cross quote. We will take higher bid rate or lower ask rate in order to maximize the inflow (or) minimize the outflow

Appreciation/Depreciation:

- Currency which is appreciating is said to be at a premium and which is depreciating is said to be at a discount
- Appreciating currency is one which becomes more expensive
- Appreciation or depreciation percentage is computed with the help of below formula:
 For the product currency = $\frac{\text{Forward rate} - \text{Spot rate}}{\text{Spot rate}} \times \frac{12}{m} \times 100$
 For the price currency = $\frac{\text{Spot rate} - \text{Forward rate}}{\text{Forward rate}} \times \frac{12}{m} \times 100$
- Appreciation/depreciation percentage is to be separately computed for bid rate and ask rate. If the answer of the formula is negative, it would mean currency is depreciating and if the answer is positive, it would mean currency is appreciating

- **Appreciation/depreciation percentage for average rate:** In this case also we have to separately compute bid and ask percentage. However, the denominator in this case will be average of spot and forward rate.
- **Probable loss in operating Profit:**
 - **In case of payables:** Profit/Loss = Payment as per billed rate – Payment as per actual rate
 - **In case of receivables:** Profit/Loss = Realized as per actual rate – Realization as per billed rate
- **Interpretation of premium %:** USD premium on a six month forward is 3% will be interpreted as premium of 3% for the six-month period directly. This is not like interest rate and we should not make the same as proportionate premium. We can make it proportionate if the question specifically mentions USD premium on a six month forward is 3% **per annum**.
- **Real and Nominal Rate:** $(1 + \text{Nominal Return}) = (1 + \text{Inflation rate}) \times (1 + \text{Real rate})$. A question can ask for computing real appreciation/depreciation of currency. In order to compute the same, we should compute the forward rate adjusted for inflation.

$$\text{Adjusted forward rate (INR per USD)} = \text{Actual forward rate} \times \frac{1 + \text{USD Inflation}}{1 + \text{INR Inflation}}$$

- Post computation of adjusted forward rate, we can go ahead and compute the appreciation/depreciation using the normal formula. We should compare spot rate and adjusted forward rate in the formula

IRPT:

Formula	$\frac{1 + R_h}{1 + R_f} = \frac{F_1}{e_0}$
R_h = Risk free rate of home country R_f = Risk free rate of foreign country F_1 = Forward rate e_0 = Spot rate	

Note:

- **Home and Foreign Currency:** Home currency is always the first currency in the quote and foreign currency is always the second currency in the quote
- **Proportionate interest rate:** Interest rate should be for the time period of forward rate. If we are calculating 6-month forward rate, then we should compute interest rate for 6-month period
- **Interest rate impact:** A currency will depreciate if the interest rates in the country is higher and a currency will appreciate if the interest rates in country is lower
- **Continuous compounding:** If interest rates are compounded continuously then we should use e^x values for computing the relevant interest rate and use the same in formula.
- **Spot and Forward rate given in question:** If the spot and forward rate is given in question, then we can compute risk-free rate of home country or foreign country as balancing figure
- **Implied difference in interest rates:** Implied differential in interest rates would basically mean the appreciation/depreciation percentage of the currencies. We can compute the percentage for the product and mention the same as implied differential in interest rates

PPT/Law of one price:

Formula	$\frac{1 + I_h}{1 + I_f} = \frac{F_1}{e_0}$
I_h = Inflation rate of home country I_f = Inflation rate of foreign country F_1 = Forward rate e_0 = Spot rate	

Note:

- **Law of one Price:** Exchange rate can be computed by comparing the price of a product in one country with another country.

Space Arbitrage:

- Space arbitrage means buying and selling at the same time in two different markets (bank A and bank B) (or) (futures market and forward market)
- We should buy at lowest ask rate and sell at highest bid rate and see if we are able to make gain. This would be called as arbitrage gain
- **Different Exchange rates:** If one bank gives exchange rate as (A/B) and another gives exchange rate as (B/A), we should convert the quotes into common mode (either A/B or B/A) and then check for arbitrage opportunities

Covered Interest Rate Arbitrage:

- ❖ Step 1: Compute fair home interest rate using IRPT formula. Home in this would be the first currency in the pair of currencies.
- ❖ Step 2: Identify whether arbitrage exists and record the flow of money as per the following details:

Actual $R_h < \text{Fair } R_h$	Borrow in home country and invest in foreign country
Actual $R_h = \text{Fair } R_h$	No arbitrage
Actual $R_h > \text{Fair } R_h$	Invest in home country by borrowing from foreign country

- ❖ Show how arbitrage gain works
 - Borrow in the currency of the country from which money flow in
 - Convert @ spot rate into the other currency
 - Invest the converted amount
 - Take forward cover
 - Realize the investment along with the interest thereon
 - Reconvert @ the forward rate
 - Repay the principal along with the interest thereon
 - Compute arbitrage gain

Note:

- **Arbitrage strategy through fair and actual exchange rate:** If Actual Exchange rate is higher than Fair exchange rate, this would mean that product is going to be costlier than suggested by fair rate. We should therefore invest in product currency. Conversely if actual exchange rate is lower than fair exchange rate, we should borrow in product currency
- **Arbitrage strategy with BID and ASK Rate:** We cannot find arbitrage opportunity by calculating fair forward rate or fair risk-free rate of home country. In this case, we have to follow trial and error method. We should check if arbitrage is possible if we borrow in currency one and then check the same if we borrow in other currency

Triangular Arbitrage:**Multiple banks and Multiple quotes:**

(A/B) quote given in Bank A, (B/C) quote given in Bank B, (A/C) quote given in Bank C. In this scenario we can check for arbitrage below:

- Take one of the quotes as base quote and convert other two quotes in the same form as that of base rate
- We should buy from bank having lower ask rate and sell to bank having higher bid rate and check if arbitrage is possible

[OR]

Multiple quotes [Preferred approach and used in most questions]

(A/B) quote given in Bank A, (B/C) quote given in Bank B, (A/C) quote given in Bank C. In this scenario we can check for arbitrage below:

- Start with one currency (assume A) and this can either be converted into B or C and then finally reconverted back into A. We should use trial and error method and see if conversion into B or C gives arbitrage gain
- Two possible ways to check arbitrage:
 - A to B to C to A
 - A to C to B to A

Currency Invoicing:

- Currency invoicing refers to a technique of doing billing in home currency for both exports and imports to avoid currency risk
- If the company wants to take exchange rate risk, then we should bill in appreciating currency if you are exporter and should accept billing in depreciating currency if you are importer

Leading and Lagging:

- We should choose leading/lagging option which leads to higher inflow of INR/lower outflow of INR
- We should consider interest expense if we are making early payment. This is done to make the outflow comparable for both options (payment on day 0/payment as per normal credit period). Interest rate will be taken at borrowing rate if there is a cash deficit and it will be taken at investment rate (opportunity cost) if there is cash surplus

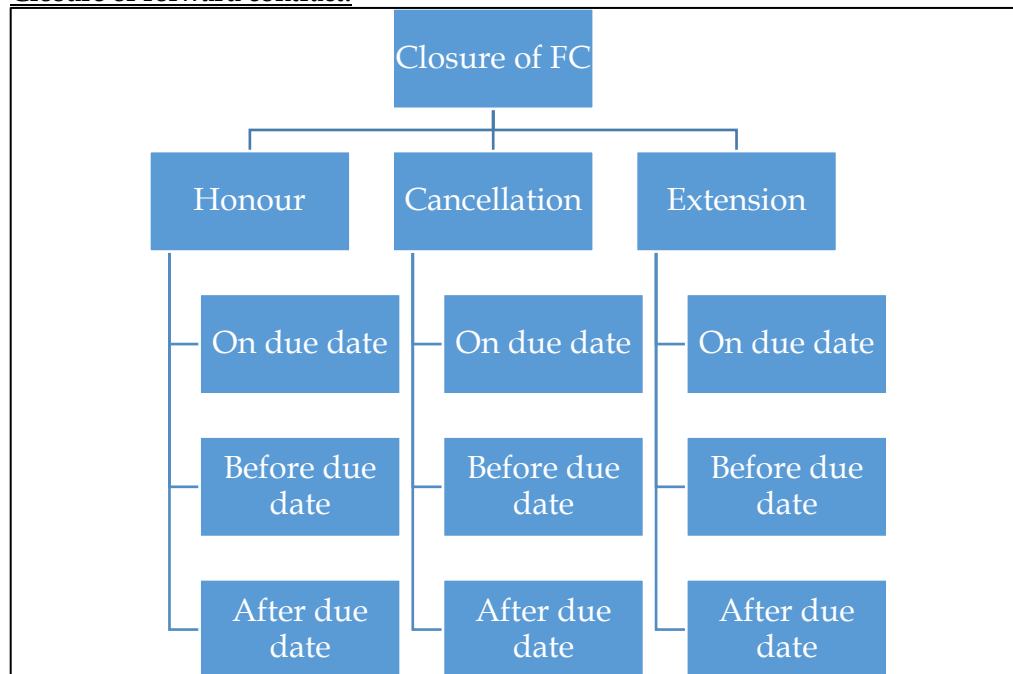
- **Early receipt:** Early receipt of receivables is not in exporter's hands and hence there can be some discounting charges for early receipt of receivables
- **Commission charges for Letter of Credit:** This is an extra expense if the company has to give letter of credit. Commission has to be paid on day zero and there will be interest expense on commission to take the same to maturity date
- **Interest income vs opportunity cost:** A firm is considering whether to lag receivables beyond normal credit period. Let us assume normal credit period is 2 months but we are planning to extend the same to 3 months. When we are comparing both options either we can consider interest income in option 1 (interest income from month 2 receipt for 1 month) or consider opportunity cost in option 2 (loss of same interest income). But we should never consider both as the same will lead to double counting of same adjustment

Netting:

- Netting refers to the process by which dues receivable and dues payable between two parties are set off against each other
- This helps in reducing forex risk as receivables and payables are netted off against each other
- Net exposure = Inflow - Outflow
- Net exposure can be multiplied with spot, forward rate and spread for computing the final exposure in INR.

Forward contract:

- Forward contract leads to freezing of outflow/inflow by fixing a future rate for foreign currency receivable/payable
- **Profit/Loss due to forward contract:**
 - Payable = Outflow if FC was not taken - Outflow due to FC hedging
 - Receivable = Inflow due to FC hedging - Inflow if FC was not taken
- Expected exchange loss = Difference between outflow as per exchange rate on invoice date and outflow as per expected exchange rate on maturity (or) Difference between inflow as per expected exchange rate on maturity and inflow as per exchange rate on invoice date
- Expected loss by hedging through a forward contract = Difference between outflow as per exchange rate on invoice date and outflow as per forward rate on maturity (or) Difference between inflow as per forward rate on maturity and exchange rate on invoice date
- **Relevant forward rate:** A company gets 60 days bill from customer. Transit period is 20 days. This would mean realization will happen after 80 days. Question gives data on 2 and 3 month period. Relevant period is 2.67 months and the same would be rounded-off to lower period and 2-month forward rate would be taken for realization.

Closure of forward contract:

- A forward contract can either be honoured, cancelled or extended. This can be done on due date, before date and after due date. Therefore, there are 9 possible scenarios to close a forward contract. 8 out of these 9 scenarios will involve cancellation of a forward contract and honour on due date is the only way of honouring the commitment

Cancellation and extension on due date:**Computation of cancellation gain/loss:**

Date	Position	Action	Reference Date	Rate
Original date	Original Position	Buy (ASK)	December 31	-68.00
December 31	Opposite Position	Sell (BID)	December 31	66.50
December 31	New Position	Buy (ASK)	March 31	-66.00
Effective rate (Addition of three rates)				-67.50
Loss on cancellation per USD			-68.00 + 66.50	-1.50
Total loss on cancellation			-1.50 x 1,00,000	-1,50,000
Effective gain per USD			-67.50 - (-68.00)	0.50
Total effective gain/loss			0.50 x 1,00,000	50,000

- This format is for extension. If there is no extension then third entry will not be there in above table

Cancellation, honour and extension before due date:**Computation of swap/cancellation gain/loss:**

Date	Position	Action	Reference Date	Rate
Oct 1	Original Position	Sell (BID)	December 31	65.40
Nov 28	Opposite Position	Buy (ASK)	December 31	-65.42
Nov 28	New position	Sell (BID)	Nov 28	65.22
Effective rate			65.40 - 65.42 + 65.22	65.20
Swap loss per USD			65.40 - 65.20	0.20
Total Swap loss			0.20 x 1,00,000	20,000

Computation of Interest cost/income:

Particulars	Amount
Nov 28 - Bank will buy from customer	-65.40
Nov 28 - Bank will sell at spot rate to some other Bank	65.22
Outflow for banker	0.18
Total outflow for banker (1,00,000 x 0.18)	18,000
Interest cost to be recovered (18,000 x 18% x 31/365)	275

Note:

- Final outflow/inflow = Inflow/outflow as per original contracted rate $\pm$ swap loss $\pm$ Interest cost
- Interest cost computation will not be done if the question does not give interest rate in the question and answer will be completed as per table 1 itself

Cancellation, honour and extension after due date:

Cancellation Rate	Spot rate + margin on the date on which customer appears for cancellation (Contract will be automatically cancelled 3 days post expiry if the customer does not appear for cancellation)
Amount payable by the customer	Difference between customer's original customer rate and cancellation rate as calculated above
Swap loss	It is an amount paid by bank due to cancellation by customer to another bank in the interbank channel. Bank generally does a swap by taking 1 transaction in spot and taking cover by a reverse position in the immediate forward rate. All this is done on due date
Interest on outlay of funds	Bank will charge interest to the customer on the cancellation charges paid by bank by cancelling contract on due date. It is calculated on banks original covered rate and the reverse rate on the maturity date. Interest is calculated till the date of cancellation of contract or 3 days whichever is later
Total cost to customer	Cancellation charges + Swap loss + Interest on outlay of funds

Format for computing cancellation rate and amount payable by customer:**Evaluation from importer point of view:**

Date	Position	Action	Reference Date	Rate
Apr 10	Original Position	Buy (ASK)	June 10	-64.4000
June 13	Opposite Position	Sell (BID)	June 13	63.6175
June 20	New Position	Buy (ASK)	Aug 10	-64.3150
Effective rate			-64.40+63.6175-64.3150	-65.0975
Loss on cancellation per USD			-64.40+63.6175	-0.7825
Total loss on cancellation			-0.7825 x 2,00,000	-1,56,500
Effective loss per USD			-65.0975 - (-64.40)	-0.6975
Total effective loss			-0.6975 x 2,00,000	-1,39,500

Format for computing swap loss (evaluation from banker point of view):

Date	Position	Action	Reference Date	Rate
Apr 10	Original Position	Buy (ASK)	June 10	-64.28
June 10	Opposite Position	Sell (BID)	June 10	63.80
June 10	New Position	Buy (ASK)	June 30	-63.95
Effective rate			-64.28+63.80-63.95	-64.43
Loss on cancellation per USD			-64.28+63.80	-0.48
Total loss on cancellation			-0.48 x 2,00,000	-96,000
Effective loss per USD			-64.43 - (-64.28)	-0.15
Total effective loss			-0.15 x 2,00,000	-30,000

- Swap loss = Effective loss
- Interest cost = Cancellation loss x (No of days customer has disappeared/365) x Rate of interest

Note:

- We should ensure reference date remain same as that of original position date for cancellation of forward contract
- We should be careful while reading the question. For instance, A customer with whom the bank had entered into a forward purchase contract. This would mean the original position of the customer is sell as the bank has entered into purchase contract and customer has entered into a sell contract
- There are two types of losses in forward contract:
 - Cancellation gain/loss = Comparison of original rate with cancellation rate
 - Effective gain/loss = Comparison of original rate with effective rate
- **Cost to company in respect of extension:** We should preferably answer both above losses as ICAI solution at few places have mentioned cancellation loss and at other places it is effective loss. We can answer like this "**Cost to the importer in respect of extension of forward contract = Rs.17,000 (Loss on cancellation). However, the effective loss for the importer is Rs.9,800**"
- **Flat cancellation charges:** Question can state some flat cancellation charges. This would be taken as outflow for customer irrespective of whether he is exporter or importer
- **Decision on hedging based on average contribution to sales ratio:** We should compute average contribution to sales ratio for all currencies together and compute this ratio. This ratio can also be separately computed for each currency but ICAI solution wants us to follow the approach of doing all currencies together

Time value component and currency fluctuation component:

- 2/10 net 90 would mean that you will get 2 percent discount if the payment is made in 10 days. If cash discount is not availed, then the payment is to be made in 90 days
- Time value of money component = [Normal USD Payment - Payment post discount] x Forward Rate
- Currency fluctuation component = Net payment post discount x [Forward rate - Spot rate]

Money Market Hedge:**Steps in case of exporter:**

Particulars	Calculation	Amount
Day 0:		
Identify a foreign currency asset/liability - Foreign currency Asset		USD 3,50,000.00

Create a matching liability – we will take a USD loan which will mature to USD 3,50,000	$\frac{3,50,000}{1 + 2.25\%}$	USD 3,42,298.29
Convert USD 3,42,298.29 into GBP at spot rate	$3,42,298.29 \times \left(\frac{1}{1.5905}\right)$	GBP 2,15,214.27
Invest GBP 2,15,214.27 for three months at the rate of 5%		GBP 2,15,214.27
Day 90:		
Receive USD 3,50,000 from customer and repay USD Loan		USD 3,50,000.00
Redeem GBP deposit along with interest	$2,15,214.27 + 1.25\%$	GBP 2,17,904.45

Steps in case of importer:

Particulars	Calculation	Amount
Day 0:		
Identify a foreign currency asset/liability – Foreign currency Liability		EUR 25,00,000
Create a matching asset– we need to create a EUR deposit which will mature to EUR 25,00,000 Deposit rate = 2.5% per quarter	$\frac{25,00,000}{1 + 2.50\%}$	EUR 24,39,024
Take a GBP loan at 2% per 3 months which will help in buying EUR 24,39,024	$24,39,024 \times \left(\frac{1}{1.25}\right)$	GBP 19,51,219
Convert GBP 19,51,219 into Euros and create Euro deposit		EUR 24,39,024
Day 90:		
Redeem Euro deposit along with interest	$24,39,024 + 2.5\%$	EUR 25,00,000
Pay supplier with deposit proceeds		EUR 25,00,000
Repay GBP loan along with interest of 2%	$19,51,219 + 2\%$	GBP 19,90,243

Note:

- In case taxes are there, we should use after-tax interest cost. After-tax interest cost/income = Interest x (1 – Tax Rate)
- Question does not specify the hedging mechanism and has data on interest rates. In this case the approach to hedging would be through money market hedge

Exchange Position Vs Cash Position:**Transaction affecting Exchange position and cash position:**

Transaction	Exchange position	Cash position
Immediate cash flow (Telegraphic transfer)	Yes	Yes
Demand draft	Yes – Sale Transaction	No. Will be impacted only when the draft is realized
Bills purchase	Yes – Buy Transaction	No. Will be impacted only when the bill is realized
Forward purchase/sale	Yes	No. Will be impacted only on delivery

Note:

- Exchange position records all purchase and sale of foreign currency irrespective of cash flow.
- Cash position is impacted only when the cash flow happens for a transaction

Format for recording exchange position:

Particulars	Purchase/ Inflow	Sales/ Outflow

- Exchange Position is more like stores ledger. It will record all inflows as purchases and record all outflows as sales

Format for recording cash position:

Particulars	Receipt/ Inflow	Payment/ Outflow

- Cash position is a cash book. It will record all cash inflows and cash outflows

Note:

- **Purchase in exchange position:** Purchase of bill, Cancellation of demand draft, spot purchase, DD Purchase, Purchase of cheques not credited to account, outstanding forward purchases, bills purchased in hand but not due for
- **Sales in exchange position:** Forward sales, cancellation of forward purchase, Remittance by TT, Sold forward TT, outstanding forward sales, DD issued but not yet presented for payment
- **Inflow in cash position:** Spot purchase
- **Outflow in cash position:** Remittance by TT
- If we want to increase/decrease cash balance then we should do spot purchase/sales. This will also impact the exchange position. If we also want to change the overbought and oversold position then we can go for forward purchase/sales. Forward purchase/sales will only impact exchange position

Transaction exposure

- Transaction exposure refers to gain/loss due to change in exchange rates
- Gain/loss due to transaction exposure = Profit as per spot rates – Profit as per future spot rates

Operating exposure:

- Operating exposure would be fall/increase in profits due to change in price of conditions and demand
- Gain/loss due to transaction exposure = Existing profit as per spot rates – revised profits as per spot rates

Note:

- Price elasticity of demand measures the percentage change in units sold for a percentage change in price. If price elasticity of demand is 1.5, then 1 percent increase in selling price will lead to 1.5 percent fall in units sold

Futures and Options:

- **Non-deliverable forward (NDF) contract would also work as similar to futures while computing realization/settlement. This is because NDF is also net-settled.**
- **Guaranteed minimum price and maximum purchase price:** We should buy a call option to restrict the maximum purchase price and write a put option to provide for minimum purchase price [writing an option would mean that holder can sell at minimum price and hence we have to buy at minimum price]
- Maximum purchase price in call option = Strike Price + Premium + Interest on Premium
- Minimum selling price in put option = Strike price – Premium – Interest on Premium
- Total realizations under futures = Realization as per spot rate $\pm$ Futures settlement (refer below format)

Format for computing futures settlement:

Date	Position	Action	Reference Date	Rate
Day 0	Original Position	Buy	Jan 31	(1.50 USD/GBP)
Jan 31	Opposite Position	Sell	Jan 31	1.47 USD/GBP
Profit per GBP				0.02 USD/GBP
Profit for 16,000 contracts (0.02 x 62.50 x 16,000)				USD 20,000

- **Hedge Efficiency:** Hedge efficiency of futures will not be normally at 100%. This is because of two reasons:
 - spot rate on maturity date may not exactly match futures date
 - Whole exposure may not get hedged due to standardized size of futures contract

$$\text{Hedge Efficiency} = \frac{\text{Profit (or) loss from futures position}}{\text{Profit (or) loss from spot position}} \times 100$$

- **Exposure currency vs contract currency:** We should ensure that exposure currency and contract currency is same for computing the number of contracts for both options and futures. In case they are not same, we should convert the exposure into the other currency by using futures rate or strike rate of options
- **Expiry month for hedging:** We should take closest available live contract for hedging

Currency swaps:**Cash flows for currency swap:**

- Let us assume company A will be paying USD and company B will be paying INR. We need to compute net cash flows and hence have to convert the cash flows into single currency
- Conversion of cash flows will be possible with future exchange rates. Future exchange rates can be computed with the help of IRPT/PPT

Structuring of swap arrangement:

- We need to add interest of both combinations and find the ideal combination. An ideal combination is one which has lower interest outflow
- If the Companies are opting for other combination then scope for swap will be possible. Benefit of swap arrangement = Difference between total interest of combination 1 and 2
- If the question is silent, we need to decide which of the parties will bear interest rate risk and accordingly complete the structuring of swap arrangement

Swap arrangement with intermediary:

Particulars	ABC Limited		DEF Limited	
	Currency	%	Currency	%
5. Payment to bank as per ideal scenario	USD	5%	AUD	13%
6. Receive from swap intermediary	USD	(5%)	AUD	(13%)
7. Pay to swap intermediary (balancing figure)	AUD	11.9%	USD	6.3%
8. Effective cost (original – swap gain)	AUD	11.9%	USD	6.3%

- We will be paying to bank as per ideal scenario and receive the same amount from swap intermediary.
- Effective cost = Original cost – swap gain
- Payment to swap intermediary will be taken as balancing figure

Swap arrangement without intermediary: [Firm B is taking exchange rate risk]

Particulars	Firm A		Firm B	
	Currency	%	Currency	%
5. Payment to bank as per ideal scenario	FFR	11%	USD	7%
6. Firm B to Firm A	FFR	(11%)	FFR	11%
7. Firm A to Firm B	USD	6.75%	USD	(6.75%)
8. Effective cost (original – swap gain)	USD	6.75%	FFR & USD	11% & 0.25%

- We will first pay to bank as per ideal scenario. Firm A will receive from firm B whatever has been paid. This is because Firm A is not taking exchange rate risk
- Next, we capture effective cost of firm A. Firm A to Firm B payment is balancing figure and same is copied to Firm B and finally effective cost of Firm B is total of first three items

Valuation:

- Value of currency swap is present value of future cash flows discounted at cost of capital
- We need to capture cash flows in both currencies. Convert cash flows into single currency using exchange rates based on IRPT
- Find the net cash flows and discount them to get value of currency swap

Multiple forex hedging strategies:**Available hedging tools:**

- Forward contract
- Futures contract [Two types of questions will be there – One in which exposure and contract currency matches and second in which currencies do not match]
- Options contract [Two types of questions will be there – One in which exposure and contract currency matches and second in which currencies do not match]
- Money market hedge [For a payable and a receivable]
- Currency invoicing
- No hedge

Important Points:

- **Interpretation of 180 days deposit/borrowing rate:** In practical world, interest rates are normally expressed for a year and we have 7 days FD rate, 14 days FD rate, 30 days FD rate, 180 days FD rate and so on. So normally the given interest rate is taken for a year and based on that we compute proportionate rate for MMH. However, in few places ICAI has directly used the given rate as the rate for the specific period and not for a year. Therefore, it is necessary for us to write our assumption on how we are interpreting the interest rates
- **Interest on option premium:** Option premium is paid on day 0. We should consider interest cost on option premium in case interest rate is available in question. If we are having cash deficit then interest will be considered as per borrowing rates and if we are having cash surplus then interest would be computed as per investment rates
- **Margin money in futures:** Margin money is not an expenditure for the company. However, margin money is deposited on day 0 and is returned back on maturity date. Hence, we have to consider interest cost on margin money
- **Unhedged exposure in options:** Example: A company needs 17.40 Contracts to hedge full exposure. However, we need to round off and this will become 17 contracts. So, there will be some unhedged exposure. Unhedged exposure can be paid/realized at forward rate/future spot rate depending on information in question
- **Currency invoicing:** Question can ask for converting the foreign currency exposure into home currency exposure and bill the same in home currency. Under this scenario the exposure needs to be converted and the same can happen at bid rate, ask rate or middle rate. This would depend on negotiation between the parties. In exam scenario we can take an assumption and proceed. We should prefer to make an assumption which leads to lower inflow of INR/higher outflow of INR
- **Selection of investment center:** The question will specify the currency in which net gain is to be computed. Following steps to be followed
 - We should invest the amount in different currencies and get the maturity amount.
 - Find how much currency is needed to pay back the amount invested + cost of fund thereon
 - Balance amount is net gain and this needs to be converted into the specified currency. We should select the currency which leads to maximum gain
- **Selection of investment option:** Sometimes multiple options may give almost the same result and hence we can be indifferent between two options. We should opt for investment in fixed income security (less risky) as compared to investment in equity option (riskier)
- **Netting of exposure before hedging:** If a company has payable and receivable exposure in same currency and at same time then we should go for netting of exposure before hedging the same with forward/futures/option/MMH
- **Use of tax rates:**
 - Net outflow under forward contract = Normal outflow - tax saving on expected loss [Expected loss = Outflow under forward contract - outflow at billed rate]
 - MMH: Use after-tax interest rates for calculating the new outflow
 - No hedge = Normal outflow - tax saving on expected loss [Expected loss = Outflow under no hedge - outflow at billed rate]
- Spot rate (€ per £): 1.998 ± 0.002 . This needs to be read as bid rate equal to 1.996 [$1.998 - 0.002$] and ask rate equal to 2.000 [$1.998 + 0.002$]
- Rate of interest after 3-months to make the company indifferent between 3-months borrowing and 6-months borrowing: This would basically mean computing a 3 x 6 FRA. The formula for the same is as under:

$$3 \times 6 \text{ FRA} = \frac{\text{FVF for 6 months}}{\text{FVF for 3 months}} - 1$$
- Exchange exposure risk = Realization using actual spot rates - Realization using expected spot rates [Forward rate]

Chapter 11 – International Financial ManagementTheory:Complexities in multinational capital budgeting:

- Conversion of cash flows of foreign projects
- Parent cash flows are different from project cash flows
- Taxation in home country and host country
- Exposure to exchange rate risk
- Impact of inflation
- Repatriation restrictions
- Political risk
- Concession/benefits by host country

Problems faced in international capital budgeting:

- Multinational companies investing elsewhere are subjected to foreign exchange risk
- Due to restrictions imposed on transfer of profits, depreciation charges and technical differences exist between project cash flows and cash flows obtained by the parent organization
- Presence of two tax regimes makes computation of after tax cash flows difficult

Project cash flows vs Parent cash flows:

- **Project cash flows:** Evaluation of a project on the basis of own cash flows entails that the project should compete favourably with domestic firms and earn a return higher than the local competitors
- **Parent cash flows:** For evaluation of foreign project from the parent firm's angle, both operating and financial cash flows actually remitted to it form the yardstick for the firm's performance

Foreign currency convertible Bonds (FCCBs):

- A type of convertible bond issued in a currency different than the issuer's domestic currency.
- The investors receive the safety of guaranteed payments on the bond and are also able to take advantage of any large price appreciation in the company's stock
- **Advantages:** Flexibility to convert the bond into equity or redeem it, Delayed dilution of equity for company, easily marketable
- **Disadvantages:** Exposure to exchange risk, creation of more debt, low interest rate leading to low income for investor

American Depository Receipts:

- Depository receipts issued by a company in the United States of America (USA) is known as American Depository Receipts (ADRs)
- An ADR is generally created by the deposit of the securities of a non-United States company with a custodian bank in the country of incorporation of the issuing company.
- The ADR holder is entitled to the same rights and advantages as owners of the underlying securities in the home country

Global Depository Receipts:

- A depository receipt is basically a negotiable certificate, denominated in a currency not native to the issuer, that represents the company's publicly - traded local currency equity shares.
- Depository Receipts issued in the US are called American Depository Receipts (ADRs), which anyway are denominated in USD and outside of USA, these are called GDRs

Impact of GDR on Indian Capital Market:

- Shifting of Indian Stock market from Bombay to Luxemburg
- Arbitrage possibility in GDR issues
- Indian market is no longer independent from the rest of the world
- Retail investors are completely side-lined

Characteristics of GDR issues:

- Holder gets same benefit as ordinary shareholders without voting rights
- Listed in Luxemburg stock exchange
- Trading happens on over the counter basis
- Freely traded and marketed globally
- Investor earn fixed income by way of dividends
- Liquidation by cancellation of GDR after a cooling off period of 45 days

Euro Convertible Bonds:

- A convertible bond is a **debt instrument which gives the holders of the bond an option to convert the bond into a predetermined number of equity shares** of the company.
- The bonds carry fixed rate of interest and has an option of conversion into equity. The issuer can also add a call and put option

Other sources of international finance:

- Euro-convertible zero-coupon bond
- Euro-bonds with equity warrants – Carries a coupon rate + Warrants are detachable + Pure bonds are traded at a discount
- Syndicated bank loans – Large loans from banks + Longer maturity of 5 to 10 years + Interest rate is generally set with reference to an index
- Euro bonds – Debt instruments denominated in a currency issued outside country of that currency
Example: Yen bond floated in France + It can be in the form of traditional fixed rate bonds (or) Floating rate notes (or) Convertible bond
- Foreign bonds – Denominated in a currency which is foreign to the borrower
- Euro Commercial papers
- Credit instruments – Multiple types of credit instruments used in effecting foreign remittances

International Financial Centre:

- Hub that deals with flow of funds, financial products and financial services + caters to the needs of customers outside their own jurisdiction + Provides flexibility in currency trading, banking and other financial services

Benefits:

- Opportunity for qualified professional to work and pursue global opportunities without leaving their homeland
- Stops brain drain
- Trading of complicated financial derivatives can be started from India
- Bringing back those financial services transactions presently carried out abroad by overseas financial institutions/entities or branches or subsidiaries of Indian Financial Market

Constituents:

- Highly developed infrastructure
- Stable Political Environment
- Strategic location
- Quality life
- Rationale regulatory framework
- Sustainable economy

GIFT City:

- GOI operationalized International Financial Services Centre (IFSC) at GIFT Multi-services SEZ in April 2015
- Single window clearance + Competitive cost of operations with a very competitive tax regime + Relaxed company law provisions + FEMA rules do not apply in GIFT City
- More and more financial institutions are setting up business units in GIFT due to lower tax rates and the same can help in provision of foreign currency loans to Indian companies

Sovereign funds:

- State-owned investment fund + Generating money from surplus reserves + Benefits economy and citizens
- These are created for targeted purposes aiming at protecting revenues, stabilizing exports, diversifying and earning better returns, funding social and economic development projects
- **Classification:** Stabilization funds, savings or future generation funds, public benefit pension funds, reserve investment funds and strategic development SWFs
- **Investment vehicles:** Sovereign wealth funds (SWF), Public pension funds, State-owned enterprises and Sovereign wealth enterprises (SWE)

Complexities in International working capital management:

- Wider financing option
- Multiple interest and tax rates
- Forex risk

- Restrictions
- Multiple countries
- **Full capital convertibility:** India is currently not under full capital convertibility and restrictions are there on investments/repatriation

Objectives of international cash management:

- Minimize currency risk
- Minimize cash requirements
- Minimize transaction costs
- Minimize political risk
- Take advantage of economies of scale

Benefits of centralized cash management:

- Maintenance of optimum cash balance
- Managing liquidity requirements
- Optimal usage of hedging strategies
- Generating maximum returns
- Get benefit of multinational netting
- Maximum utilization of transfer pricing mechanism

Ways to optimize cash flow movements:

- Accelerating cash inflows
- Managing blocked funds
- Leading and lagging
- Minimizing tax through transfer pricing mechanism
- Netting
- Investing excess cash

Practical Areas:**International capital budgeting:****Discount rate identification:**

- $(1 + \text{Risk free rate}) \times (1 + \text{Risk Premium}) = (1 + \text{Risky rate})$
- We should find risk premium of the project in one currency and use the same risk premium to use the risky rate of the other currency

NPV in home currency and foreign currency:

- We can find the NPV in one currency and NPV for the other currency can be find with the help of spot rate
- $\text{NPV in INR} = \text{NPV in USD} \times \text{Exchange Rate}$

Cash flows in different currencies:

- If cash flows are in multiple currencies, then we have to convert cash flows into a single currency. We should forecast exchange rates as per IRPT/PPT and use the same to convert cash flows into a single currency

Steps in case of capital budgeting:**WN 1: Initial outflow:**

Particulars	Amount (million USD)
Capital expenditure	
Working capital	
Initial outflow	

WN 2: In-between cash flows:

Particulars	Amount
Units sold	
Revenues	
Less: Variable cost	
Less: Fixed cost	
PBDT	

Less: Depreciation	
PBT	
Less: Tax	
PAT	
Add: Depreciation	
CFAT	

WN 3: Terminal flow:

Particulars	Amount (million USD)
Net salvage value	
Recapture of working capital	
Terminal flow	

WN 4: Consolidate the cash flows and compute NPV:

Year	Cash flow	PVF @ 12%	DCF
0			
1 to 5			
5			
Project NPV			

Important Points:

- **Withholding tax:** This is an extra tax deducted in host country before repatriating the profits to home country. Therefore, total cost = Cost incurred in host country + Tax paid in host country + Withholding tax paid in host country. Withholding tax will be taken at lower of DTAA rate and normal tax rate [OR] **Net inflow = CFAT earned – withholding tax**
- **Withholding tax eligible for credit:** In this case this will not be an extra tax and the company would first pay withholding tax on PBT. Additionally, the company will pay normal tax on PBT (however withholding tax will be eligible for tax credit and hence there will be lower tax payment). In short withholding tax will not be an extra expense and will not impact the cash flows.
- **Working capital requirements:** Only the incremental working capital requirements will be considered as part of initial outflow. This is applicable if company has existing operations and some working capital is already blocked.
- **Incremental CFAT:** We should consider only incremental CFAT as part of in-between cash flows. Incremental CFAT = CFAT of new operations – CFAT of existing operations
- **Expected share price:** Expected share price can be computed in below manner if a fresh issue is being made by the company.

$$\text{Expected share price} = \frac{\text{Existing Network} + \text{New issue} - \text{Issue expenses} + \text{NPV of new projects and bond refunding}}{\text{Existing shares} + \text{New shares}}$$

- **Change in working capital:** Any interim change in working capital will be adjusted as part of in-between cash flows. Increase in working capital will be shown as outflow and decrease in working capital will be shown as inflow. The final working capital will be part of terminal cash inflow
- **Net salvage value computation:** Net salvage value is salvage value adjusted for taxation and the same is computed as under:

Particulars	Amount
Sale value	
Less: Book value	
Gain/Loss	
Tax Paid/Saved	
Net salvage value [Sale value – Tax paid + Tax saved]	

- **Market survey cost:** Cost incurred for market survey is part of sunk cost and hence will not be a relevant cash flow.
- **Impact of exchange restrictions:** Exchange restrictions can impact repatriated cash flows and we should compute NPV based on repatriated cash flows. Cash flows which are not repatriated will normally be repatriated at end of the life of the project

- **Average loan maturity of 3.4 years with an overall tenure of 5 years:** This would mean that overall weighted average duration will be only 3.4 years and hence interest cost/ hedging cost would be computed for a period of 3.4 years. Similarly, items like upfront premium/initial floatation cost would be apportioned for a period of 3.4 years
- **Following an aggressive approach:** If the company follows an aggressive approach then there will not be any hedging done. Profit/loss due to aggressive approach = Saving in hedging cost $\pm$ profit/loss due to currency appreciation/depreciation

Computation of MIRR:

- MIRR is computed using a re-investment rate. Re-investment rate would be taken as cost of capital
- MIRR is computed in the same manner as that of realized YTM

Chapter 12 – Interest rate risk ManagementTheory:Factors determining interest rates:

- Supply and demand of money
- Inflation
- Government

Benchmark rates:

- Benchmark rates forms the basis for determination of other interest rates + It is also known as reference rates
- Benchmark rates are crucial in derivative transactions, floating rate loans and are determined by an independent body
- **Popular benchmarks:** Secured Overnight Financing Rate (SOFR in USA), Sterling Overnight Index Average (SONIA in USA), Euro-Short-Term Rate (€STER in Europe), Tokyo Overnight Average Rate (TONAR in Japan) and Swiss Average Rate Overnight (SARON in Switzerland)
- **Indian Benchmark rates:** Repo rate + Prime Lending rate + MCLR + MIBOR (Mumbai Interbank Offered Rate) + MIBID (Mumbai Interbank Bid rate)

Interest rate risk:

- **Gap Exposure:** Gap or mismatch risk arises from holding assets and liabilities of different maturity dates or repricing dates, thereby creating exposure to unexpected changes in market interest rates
- **Basis Risk:** Interest rate of different assets, liabilities and off-balance sheet items may change in different magnitude. If variation in interest rates cause net interest income to expand, the banks have experienced favourable basis shifts and if it causes net interest income to contract, the basis has moved against the banks
- **Embedded option risk:** Significant change in interest rates may encourage prepayment of debt and exercise of call/put option on bonds/debentures and/or premature withdrawal of fixed deposits.
- **Yield curve risk:** In a floating rate scenario, banks may price their assets and liabilities based on different benchmarks. If there is non-parallel movement in these benchmarks then the same would impact NII
- **Price Risk:** This occurs when assets are sold before their stated maturities. This is particularly relevant for trading book, which is created for making profit out of short-term movement in interest rates
- **Reinvestment risk:** Uncertainty with regard to interest rate at which the future cash flows could be reinvested is called reinvestment risk
- **Net interest position risk:** Size of non-paying liabilities supports profitability of banks. Interest rate risk arises when market interest rates are adjusted downwards and bank has more earning assets than paying liabilities

Methods to hedge interest rate risk:Traditional Methods:

- **Asset and Liability Management:** ALM is a **comprehensive and dynamic framework for measuring, monitoring and managing the market risk of a bank**. It is the management of structure of balance sheet (liabilities and assets) in such a way that the **net earnings from interest are maximized** within the overall risk preference (present and future) of the institutions.
- **Forward Rate Agreements (FRA):** Forward Rate Agreement (FRA) is an **agreement between two parties through which a borrower/ lender protects itself** from the unfavourable changes to the interest rate.

Modern Methods:

- **Interest Rate Futures (IRF):** An interest rate future is a contract between the buyer and seller **agreeing to the future delivery of any interest-bearing asset**. The interest rate future **allows the buyer and seller to lock** in the price of the interest-bearing asset for a future date
- **Interest Rate options:** Interest rate options (Interest Rate Guarantee (IRG)) is a right not an obligation and **acts as insurance by allowing businesses to protect themselves against adverse interest rate movements** while allowing them to benefit from favourable movements.
- **Interest Rate Swaps:** In an interest rate swap, the parties to the agreement, termed the swap counterparties, **agree to exchange payments indexed to two different interest rates**.

Types of Interest rate swaps:

- **Plain vanilla swap:** Also called as Generic swap and it involves exchange of a fixed rate loan to a floating rate loan
- **Basis Rate Swap:** Also called as non-generic swap and it involves exchange between two different variable rates
- **Asset Swap:** It is the exchange of fixed rate investments with a floating rate investment
- **Amortising Swap:** An interest rate swap in which the notional principal for the interest payment declines during the life of the swap

Swaptions:**Meaning:**

- An interest rate swaption is **simply an option on an interest rate swap**.

Types:

- A **fixed rate payer swaption** gives the owner of the swaption the right but not the obligation to enter into a swap where they pay the fixed leg and receive the floating leg
- A **fixed rate receiver swaption** gives the owner of the swaption the right but not the obligation to enter into a swap in which they will receive the fixed leg, and pay the floating leg

Uses:

- Useful for active traders as well as for corporate treasurers
- Swap traders can use them for speculation purposes
- Useful for hedging
- Useful for borrowers targeting an acceptable borrowing rate
- Protection against callable/puttable bond issues

Cheapest to Deliver in Interest rate futures:

- The CTD is the bond **that minimizes difference between the quoted Spot Price of bond and the Futures Settlement Price (adjusted by the conversion factor)**. It is called CTD bond because it is the least expensive bond in the basket of deliverable bonds.
- Profit of seller of futures = (Futures Settlement Price x Conversion factor) - Quoted Spot Price of Deliverable Bond
- Loss of Seller of futures = Quoted Spot Price of deliverable bond - (Futures Settlement Price x Conversion factor)

Practical Areas:**Interest Rate Caps:**

- Cap restricts the maximum interest outflow and will be exercised if the actual interest rate is higher than strike price. This is useful for borrower
- Payoff = Notional Amount x (Time period/12) x (Actual Rate - Strike Rate)

Interest Rate Floors:

- Floor provides for minimum interest inflow and will be exercised if actual interest rate is lower than strike price. This is useful for investor or lender
- Payoff = Notional Amount x (Time period/12) x (Strike Rate - Actual Rate)

Interest Rate Collars:

- Interest Rate collars = Buying a cap + Selling a Floor. This will provide for minimum interest outflow and restrict maximum interest outflow

Important Points:

- **Important assumption:** One important assumption in case of interest rate options is on strike rate. Strike rate can be assumed on benchmark rate (LIBOR or MIBOR) or our borrowing rate
- **Interest rate guarantee:** Interest rate guarantee is either a cap or floor option depending on whether we are borrower or lender
- **Lumpsum premium:** Lumpsum premium = Lumpsum premium % x Notional Amount
- **Amortized premium:** Amortized premium per reset period is computed with below formula:

$$\text{Amortized Premium} = \frac{\text{Lump Sum Premium}}{\text{PVAF (fixed rate of interest, no. of periods)}}$$

Interest rate futures:

- Interest rate futures of 93.5 would mean that rate of interest is 5.5% (100 - 93.50)
- Net outflow in interest rate futures = Interest expense as per spot rate $\pm$ net settlement in futures

- Net settlement in futures would be computed in same manner as that of forex futures
- No of futures contract is computed with the help of below formula:

$$\text{No of contracts} = \frac{\text{Amount of borrowing}}{\text{Size of one contract}} \times \frac{\text{Duration of borrowing}}{\text{Duration of futures contract}}$$
- **Short/long position:** We should take a short position if we are investing money and we should take a long position if we borrowing money

Forward Rate Agreements:

$$\text{Net settlement in FRA} = \frac{\text{Notional Principal} \times \text{Difference in interest rates} \times 100}{1 + \text{Actual Rate}}$$

- FRA is settled at the beginning of the borrowing period and hence the same needs to be discounted by the actual interest rate. Interest is normally paid at end of the tenor whereas FRA settlement happens at the beginning of the period and hence we do this discounting adjustment
- **FRA time period:** If the company needs money after 3 months, for a period of 4 months then borrowing period is basically end of month 3 to end of month 7. In this case we take 3 x 7 FRA for hedging the borrowing.
- FRA rate is computed using the below formula:

$$\text{FRA}_{2 \times 8} = \frac{\text{FVF for 8 months}}{\text{FVF for 2 months}} - 1$$
- In above formula, if the purpose is to borrow money then 8-month FVF will be based on borrowing rate and 2-month FVF will be based on investment rate. Similarly, if the purpose is to invest money then 8-month FVF will be based on investment rate and 2-month FVF will be based on borrowing rate

Arbitrage Opportunity:

- Arbitrage opportunity will arise if actual borrowing rate is lower than Fair FRA rate (or) if actual investment rate is higher than Fair FRA rate
- Let us assume we are analyzing 6 x 12 FRA.
 - **Actual borrowing rate is lower:** If actual borrowing rate is lower than fair FRA rate, then we should borrow for first 6 months at spot borrowing, next 6 months at actual FRA rate and invest for 12 months at spot investment rate
 - **Actual investment rate is higher:** If actual investment rate is higher than fair FRA rate, then we should invest for first 6 months at spot investment, next 6 months at actual FRA rate and borrow for 12 months at spot borrowing rate

Interest Rate Swap:

- **Floating rate of interest:** Floating rate of interest is on a benchmark and the same would get reset periodically. We can assume the reset rate to be applicable for the next period/previous period depending on assumption
- **View on interest rates:** Company paying fixed rate of interest expect interest rates to go up and company paying floating rate of interest expect interest rates to come down
- **Hardening and softening interest rates:** If interest rates are expected to harden, then it would mean interest rates will go up and we will go for fixed rate funding. If interest rates are expected to soften, then it would mean interest rates will come down and we will go for floating rate funding
- **Valuation of swap savings:** Swap savings in % will be converted as swap savings in Rupees by considering the notional principal. These savings will have to be discounted at actual interest rate (effective borrowing rate) to compute the present value of savings. We will normally consider pre-tax savings and pre-tax borrowing rate
- **Expectation theory:** Expectation theory holds good would mean computation of forward rates with the help of interest rates of different maturities. We can use FRA formula to compute forward rates
- **Fixed payment vs Floating Payment:** Fixed payment would be same for every reset period whereas interest under floating rate would be computed using the below formula:

$$\text{Interest under Floating leg} = \text{Notional Principal} \times \text{Floating rate} \times \frac{\text{Effective days}}{360 \text{ or } 365}$$
- If the Generic swap is valued on 30/360 days basis then the denominator for computation of interest would be 360 days

- **Fixed Payment vs Floating Payment:** Fixed rate of interest is computed on original principal whereas floating rate of interest can have an element of interest on interest. This is because in case of change in interest rate we will be computing the interest amount on opening principal which is equal to notional principal + Interest charged.

Structuring of swap arrangement:

- Find the total interest of both combinations and find the ideal combination. Swap will be possible if companies are looking for other combination
- Swap gain = Different in total interest of combination 1 and combination 2

IRS Structuring without swap intermediary:

Particulars	M Limited	S Limited
5. Pay to banker as per ideal rate	8%	T + 1.2%
6. M Limited to S Limited	T	(T)
7. S Limited to M Limited (b/f)	(7.7%)	7.7%
8. Effective borrowing rate	T + 0.3%	8.9%

- Payment to banker will be as per ideal rate. Company which has paid floating benchmark will receive the same (T). Payment by this company will be a balancing figure
- Effective borrowing rate = Original borrowing rate – share of swap gain

IRS structuring with swap intermediary:

Particulars	Company 1	Company 2
5. Pay to banker as per ideal rate	8%	T + 1.20%
6. Company to swap intermediary	T	7.75%
7. Intermediary to company (bal figure)	(7.65%)	(T)
8. Effective borrowing rate	T + 0.35%	8.95%

- Payment to banker will be as per ideal rate. Company which has paid floating benchmark will receive same from swap intermediary
- Company which want to pay floating rate will pay benchmark to swap intermediary
- Effective borrowing rate = Original borrowing rate – share of swap gain
- Other items will be balancing figure

Conventions for calculation of interest:

Interest on a money market instrument is paid on March 31 and September 30. Interest for the period April 1 to June 20 is to be calculated under the following conventions.

Conventions	Numerator days	Denominator days
30/360 basis	April and May will be taken as 30 days irrespective of the number of days. Hence the numerator will be taken as 79 days (19 clean days in June)	Denominator will be taken as 180 (360/2)
Actual days/ 360	April = 30 days ; May = 31 days; June = 19 days Denominator = 80 days	Denominator will be taken as 180 (360/2)
Actual days/ reference period	April = 30 days; May = 31 days; June = 19 days. Denominator = 80 days	April = 30 days; May = 31 days; June = 30 days; July = 31 days; August = 31 days; September = 30 days Denominator = 183 days

Effective borrowing rate:

$$\text{Effective borrowing rate} = \frac{\text{Interest rate}}{1 - \text{Withholding tax rate}} + \text{Premium} - \text{Discount}$$

Premium or discount of currency will be computed with below formula:

$$(1 + \text{Home Currency Rate}) = (1 + \text{Foreign Currency Rate}) \times (1 + \text{Premium (or) Discount})$$

Cheapest to Deliver in Interest rate futures:

- Cheapest to deliver bond is one which gives maximum profit
- Profit of seller of futures = (Futures Settlement Price x Conversion factor) – Quoted Spot Price of Deliverable Bond

- Loss of Seller of futures = Quoted Spot Price of deliverable bond - (Futures Settlement Price x Conversion factor)

Chapter 13 – Business Valuation**Theory:****Approaches of valuation:**

- **Asset base valuation models:** Valuation based on net assets. Variants of asset-based valuation models are Net asset value/Net realizable value/replaceable value
- **Earning based models:** Useful when acquiring company intends to continue business of target company. Valuation is based on income generated and variants of this model are PE ratio/Earning Yield multiplier/Capitalization of earning
- **Cash-flow based approach:** Under cash flow-based approach we determine the amount of free cash flows and discount them at required return to value the company

Steps for valuation of unlisted companies:

- Take the industry Beta and convert the levered beta into unlevered beta
- Adjustment for gaps in accounting policies and accounting adjustments
- Find cost of equity using CAPM
- Find WACC using target debt-equity mix
- Add Goodwill/sweeteners as additional return
- Discount the cash flows at cost of capital
- Sum of PV of cash flows will be the value of firm

Relative Valuation Method:

- Relative Valuation is the method to arrive at a '**relative**' value using a '**comparative**' analysis to its peers or similar enterprises. However, increasingly the contemporary financial analysts are using relative valuation in conjunction to the afore-stated approaches to validate the intrinsic value arrived earlier
- **Steps:** Find out the drivers that will be best representative and arrive at multiple, compute the same through financial ratios, find the ratio for comparable firms and then use the same to value the company

Chop-shop method of valuation:

- Useful for valuation of companies having multiple segments in different industries
- Compute the value of each segment using average capitalization ratios and sum of the values of all segments will be the value of the firm

EVA versus MVA:

- MVA is the true value added that is perceived by the market whereas EVA is a derived value added

Valuation of a company which is not a going concern:

- Valuation based on liquidation value
- Going concern value will generally be greater than its liquidation value + Going concern company will have terminal value as the company would continue to earn profits + non-going concern company implies high risk and creates bad reputation for the company

Why cash flow method cannot be used for valuation of distressed companies?

- Discounted cash flow method assumes terminal value based on perpetual cash flows. However, this will not be relevant for a distressed firm
- Discount rates used in valuation reflect companies which are operationally and financially sound. However, this cannot be work in distressed company

Why traditional method cannot be used for valuation of start-ups:

- **Income approach:** This approach will not work as majority of start-ups are reporting losses
- **Asset approach:** Startups have negligible assets because a large chunk of their assets are in the form of intellectual property and other intangible assets
- **Market approach:** Start-ups are normally disruptors and hence does not have an established competitor for doing valuation under this method.

Value drivers for start-ups:

- Product
- Management
- Traction (demand for product)
- Revenue
- Industry attractiveness
- Demand-supply
- Competitiveness

Methods of valuation of Start-ups:**Berkus approach:**

- Valuation based on assessment of basic value, technology, execution, strategic relationships, production and consequent sales + Method caps pre-revenue valuations at USD 2 million and post-revenue valuations at USD 2.5 million

Cost-to-duplicate approach:

- Valuation based on all costs and expenses associated with the start-up and its product development. Value of start-up = All expenses incurred

Comparable transactions method:

- Valuation based on valuation of similar start-ups in past

Scorecard valuation method:

- Based on assessment of qualitative parameters such as team, size of the opportunity, product/service, competitive environment, marketing, sales channels and partnerships + Score is assigned to each parameter based on comparison with competitor/industry + Value is arrived based on weighted score

First Chicago method:

- Value is the sum of weighted average of various valuation (best case/worst case and base case) with probability being the assigned weight

Venture capital method:

- Estimation of exit value – This value needs to be discounted to get today's post money valuation – Deduct amount invested and we can then compute pre-money valuation

Valuation of digital platforms:

- Income approach – based on cash flows
- Market approach – based on comparable multiples
- Cost approach – based on cost incurred

Valuation of professional/consultancy firms:

- Compute value based on normalized cash flows (adjust for non-recurring items) – Computed value can be adjusted based on the performance of the firm for various key performance indicators

Impact of ESG:

- Environmental, Social and Governance (ESG) aspects helps in creating sustainable value + Increasing focus of companies and now this has become must-to-have
- ESG can impact cash flows (Extra spending/saving to comply with ESG aspects) and can also impact discount rate (Lower discount rate for ESG compliant companies and vice versa)

Practical:**Economic Value Added:**

- Economic Value Added = {EBIT * (1-Tax rate)} – {Invested capital * WACC} [OR] NOPAT – {Invested capital * WACC}
- Market Value Added = Market Value of Firm – Book value of Firm
- Intrinsic value of equity = Intrinsic value of firm – Value of debt + Market value of non-core assets

Note:

- Capital Employed:** Capital Employed = Equity capital + Reserves and Surplus + Loans (or) Total Assets – Current Liabilities
- Value of Firm = Value of Debt + Value of Equity + Value of Preference
- Tax rates:** If tax rates are missing in the question, then the same can be assumed as 25% in line with prevailing corporate tax rates. We can alternatively ignore tax as well
- Advertisement expenditure:** Benefit of advertisement expenditure will be there for multiple years and hence the same needs to be added back to EBIT to compute adjusted EBIT. We should compute the proportionate write-off of advertisement expenditure
- Capital Employed:** Capital employed should be taken on the basis of replacement cost of assets

- **Net Income and Operating Income:** Net income would mean PAT and Operating income would mean EBIT
- **EVA per share:** EVA is the excess return earned by the company and the same can be distributed to shareholders. EVA per share = [Total EVA/Number of shares]. If the dividend is not distributed then the value of the company will increase by EVA per share
- **Computation of WACC:** WACC would be computed using the following format. Cost of debt should be after-tax cost of debt

Source	Cost	Weight	Product
Equity	20.74%	125	25.925
Debt	7.7%	40	3.08
Total	17.58%	165	29.005

- **PE Multiple Adjustment:** Companies having different capital structure should have different PE Multiple. Company having better capital structure will be less risky and will have a higher PE Multiple
- **Non-cash expenses:** Non-cash expenses like bad debt/provision for bad debt need to be added back to EBIT and also added to capital employed
- **Taxes:** We should add back the tax charged in Profit and Loss Account and deduct cash taxes for the computation of NOPAT.
- **Interest:** Interest will be added back as the same is not to be reduced for computing NOPAT
- **Financial leverage:** The term financial leverage can be used to compute EBIT from EBT/EAT.

$$\text{Financial Leverage} = \frac{\text{EBIT}}{\text{EBT} - \left(\frac{\text{PD}}{1 - \text{Tax}} \right)}$$
- **Patent:** If the patent is not recorded in books, the same would be added to capital employed and form part of equity capital
- **Valuation of company based on EVA:** We need to compute future EVA and discount the same and find the present value of future EVA. Value of company = Existing invested capital + Excess value due to EVA generation

Specific rules for EVA computation:

Adjustments to NOPAT and capital Employed:

- ❖ **For Advertising, Research and Development Items expensed, Staff Training**
 - **Impact on Profit:** Increase CY's profit, deduct economic depreciation on PY's EVA adjustment.
 - **Impact on Capital Employed:** Increase capital employed at the end of the year, increase capital employed in respect of similar add backs of PY's investments not treated as such in financial statements (net of economic depreciation)
- ❖ **For Depreciation**
 - **Impact on Profit:** Add accounting depreciation and subtract economic depreciation.
 - **Impact on Capital Employed:** Alter value of non-current assets (and capital employed) to reflect economic depreciation not accounting depreciation.
- ❖ **For Non- Cash Expenses**
 - **Impact on Profit:** Add back to profit.
 - **Impact on Capital Employed:** Add to retained profits at the end of the year.
- ❖ **For tax charge,** this will be based on 'cash taxes' rather than the accruals based methods used in financial reporting

Cash flow-based Valuation:

- Value of firm is present value of Free cash flow to Firm discounted at cost of capital
- Value of equity is present value of free cash flow to equity shareholders discounted at cost of equity
- **Preferred approach:** We should always adopt FCFF approach for valuation of firm. Post valuation of firm, value of equity is computed as Value of Firm – Amount of debt

Different formulae for computing FCFF and FCFE:

FCFF:

From Net Income	Net Income + Non-cash charges + Interest * (1 – Tax rate) – Fixed capital investment – working capital investment

From EBIT	$EBIT * (1 - \text{Tax rate}) + \text{Non-cash charges} - \text{Fixed capital investment} - \text{working capital investment}$
From EBITDA	$EBITDA * (1 - \text{Tax rate}) + (\text{Depreciation} * \text{Tax rate}) - \text{Fixed capital investment} - \text{working capital investment}$
From cash flow from operations (CFO)	$CFO + \text{Interest} * (1 - \text{Tax rate}) - \text{Fixed capital investment}$

FCFE:

From FCFF	$FCFF - \text{Interest} * (1 - \text{Tax rate}) + \text{Net borrowing}$
From Net Income	$\text{Net Income} + \text{Non-cash charges} - \text{Fixed capital investment} - \text{working capital investment} + \text{Net borrowing}$
From CFO	$CFO - \text{Fixed capital investment} + \text{Net borrowing}$
FCFE per share	$EPS - \text{Equity funding for next capex and working capital}$

Note:

- **Treatment of interest:** Interest should not be deducting while computing FCFF. It can be subtracted if we are computing FCFE
- **Repayment of debt:** Repayment of debt will have no impact on FCFF. The same will be considered as outflow while computing FCFE
- **Multiple growth rates:** In case of multiple growth rates we should compute cash flows till the first year of stabilization phase and using the same we can value the growing/normal perpetuity. Valuation of firm/equity would be as per the principles of dividend discount model
- **Net capex:** Net capex = Capex - Depreciation. We should show net capex as a deduction from cash flows
- **Valuation of strategy:** Value of strategy = Value of firm with strategy - Value of firm without strategy
- **Asset Turnover Ratio:** If Asset Turnover ratio remain same then every component of assets (Fixed assets and current assets) will grow at the same rate as that of revenues
- **Increase in fixed assets:** Increase in fixed assets should be understood as net capex of the company. Gross capex of the company would be higher than increase in fixed assets due to depreciation. Gross capex = Increase in fixed assets + Depreciation
- **Market value added:** Market value added = Value of firm as per FCFF - Invested capital. Invested capital basically would include debt and equity.
- **Value of acquisition:** Value of acquisition = Value post-merger - Value pre-merger
- **Gain to shareholders:** Target company = Consideration paid - Pre-merger value; Acquiring company = Value of acquisition - Consideration paid to target company
- **Valuation of perpetuity:** We should be cautious while valuing a perpetuity. Perpetuity will always be valued a year in advance. This is because investment made today will take a year to generate returns and hence perpetuity is always valued a year in advance
- **Acquisition of assets:** Initial outflow = Value of shares issued + Value of debt taken over + Settlement value of liabilities - realizable value of current assets
- **Capex at beginning of year:** Any capex done at beginning of year will come as outflow of previous year. For instance, capex at beginning of year 2 is similar to end of year 1 and the same will form part of year 1 outflow
- **Change in working capital:** Increase in working capital is treated as an outflow and decrease in working capital is treated as an inflow
- **Range of valuation:** Valuation of firm can be done on the basis of following methods:
 - Based on current market price
 - Discounted value of future cash flows - This is applicable if data on cash flow is available
 - Based on proxy entity multiple
 - Based on dividend yield = Dividend in Rupees/Dividend Yield %
 - Based on dividend discount model
 - Based on PE Multiple Approach
 - Based on book value approach
 - Based on realizable value approach = Book value $\pm$ Valuation adjustments
- **Cash in balance-sheet:** Availability of cash on valuation date does not impact the value of the firm. It will be assumed that this cash will be used for earning future cash flows and hence the

value of firm would be equal to PV of future cash flows. Value of equity = Value of firm – Amount of debt [Cash will not increase/decrease the value of firm or equity]

- **Condition of increase in book value of equity by xx%:** Compute book value of equity for all years. Book value of equity = Opening equity + Retained earnings. This will help us in answering whether we are able to increase equity by target xx%

Break-up value Approach:

- Value the firm using different capitalization basis given in question. Possible capitalization basis are sales, assets and operating income
- Final value of firm = Average value of firm using multiple basis

Proxy based valuation:

- Identify the various basis given in question for valuation
- Find the multiple for proxy entities and take average of multiple as relevant for the entity whose valuation is being done

Future Maintainable Profits approach of valuation:

- FMP = Profit adjusted for extraordinary incomes/expenses and profit/loss from new product
- **Existing profit from old operations:**
 - $\text{EPS} \times \text{PE Multiple}$ will give EAES
 - Add Preference dividend and get PAT
 - $\text{PBT} = \text{PAT} / (1 - \text{Tax rate})$
 - Add back extraordinary losses and deduct extraordinary income. This would give profit from existing operations
- **FMP**
 - Profit from existing operations + Profit from new product = Future maintainable PBT
 - Future maintainable PAT = PBT – Tax
- Value of business is computed using below formula:

$$\text{Value of business} = \frac{\text{Future maintainable PAT}}{\text{Capitalization factor}}$$
- Value of share based on PE Multiple approach with future maintainable PAT:

Particulars	Calculation	Amount (in lacs)
Future maintainable PAT		98
Less: Preference dividend	$1,00,000 \times 13$	(13)
Earnings available to equity shareholders		85
No of shares		50
EPS		1.7
P/E Multiple		10
Market price per equity share		17

Net Assets and Earnings capitalization method:

Value as per net assets method = $\frac{\text{Realizable value of assets} - \text{Settlement value of liabilities}}{\text{Number of shares}}$

Value as per earnings capitalization method = $\frac{\text{FMP}}{\text{Capitalization}}$

$$\text{Value as per earnings capitalization method} = \frac{\text{Capitalization}}{\text{Number of shares}}$$

Note:

- **Contingent liabilities:** We will have to assume whether these will crystallize or not and consider the same in net assets method of valuation

Minimum price for buying promoter stake = $\frac{\text{Value of shares} + \text{PV of extra benefits}}{\text{No of shares held by promoters}}$

Net cash flow and Book value approach with Floor Value:

Value as per net cash flow approach = $\frac{\text{Residual Net Cash flow}}{K_e - \text{Growth}}$

Value as per book value approach = Equity capital + Reserves and Surplus

Minimum and maximum price:

- Minimum price per share = Lower of value as per above two approaches
- Maximum Price is computed using below formula:

Maximum Price = $\frac{\text{Value of merged firm} - \text{Value before merger}}{\text{No of shares of target company}}$

- Floor value = CMP per share of target company

Internal reconstruction:**Step 1: Computation of capital reserve:**

- Capital reserve = Items increasing Network – Items reducing Network

Step 2: Prepare Balance Sheet giving effect to changes in various assets and liabilities**Wrong WACC and valuation:**

- Compute wrong WACC by using value of firm and free cash flow
- Find wrong weights used with WACC format
- Find correct weights and get correct WACC
- Get right value of firm with correct WACC and Free cash flow to firm

Methods of valuation of distress companies:

Modified Discounted Cash Flow Valuation	- We need to identify various possible cash flows (for different scenarios) with their probability and based on the compute the estimated cash flows - We should adjust cash flows and discount rate for the likelihood of default - In case we are not able to compute probability for entire distribution, the probability of distress is computed and the expected cash flows is computed as: <u>Expected cash flow = Cash flow x (1 - Probability of Distress)</u>
DCF Valuation + Distress Value	- Value the company as if it is a going concern and arrive at DCF valuation - Identify the probability of distress and compute the distress value Final value = DCF value of equity x (1 - Probability of Distress) + Distress value of equity x Probability of Distress
Adjusted Present value Model	Firm Value = Unlevered firm value + (Tax Benefits on debt - Expected Bankruptcy cost from the debt) - Unlevered firm value is computed by discounting cash flows at unlevered cost of equity - Present value of tax benefit on debt is computed by discounting the same at cost of debt Expected Bankruptcy Cost = [Unlevered Firm value - Distress sale value] x Probability of Distress
Relative Valuation	- Relative Valuation multiples such as <u>Revenue and EBITDA multiples are used more popular measures to value distressed firms</u> than healthy firms because multiples such as Price Earnings or Price to Book Value etc. often cannot even be used for a distressed firm. - However, the multiple <u>needs to be revised downwards to reflect the distress</u>. For example, assume that the average telecom firm trades at 2 times revenues. So, adjust this multiple down to 1.25 times revenues for a distressed telecom firm

Chapter 14 – Mergers, Acquisitions & Corporate Restructuring**Theory:****Rationale for M&A:**

- Synergistic operating economics
- Diversification
- Taxation
- Growth
- Consolidation of production capacities and increasing market power

Types of mergers:

- Horizontal Merger = Merger of two companies in the same industry
- Vertical merger = Two companies having buyer-seller relationship come together
- Conglomerate merger = Merger of firms engaged in unrelated type of business operations. However, there can still be some common factors such as unification of different kinds of businesses under one flagship company
- Congeneric merger = Acquirer and target companies are related through basic technologies, production processes or markets
- Reverse merger = Acquisition of a listed firm by a private company so that private company can go public
- Acquisition = Purchase of controlling interest by one company in the share capital of an existing company

Take-over strategies:

When the process of acquisition is unfriendly it is called as takeover. Following are takeover strategies:

- Street Sweep = Acquiring company accumulates larger number of shares before making an open offer
- Bear Hug = When the acquirer threatens the target company to make an offer, the board of target company agrees to a settlement
- Strategic Alliance = Offering a partnership rather than a buyout
- Brand Power = Alliance with powerful brands to make the target company brand weak and buyout the weakened company

Techniques to protect from hostile takeover:

- **Divestiture:** Target company divests or spins off some of its business. This will make the company less attractive for acquisition
- **Crown Jewels:** When a target company uses the tactic of divestiture **it is said to sell the crown jewels**
- **Poison pill:** Tactics used by the acquiring company to make itself unattractive to a potential bidder is called as Poison Pills
- **Poison Put:** Target company issue bonds that encourage holder to cash in at higher prices. Cash drainage will make the target company unattractive
- **Greenmail:** Incentive offered by the management of the target company to the potential bidder for not pursuing the takeover
- **White Knight:** Target company offers to be acquired by a friendly company to escape from a hostile takeover
- **White squire:** Selling out of shares to a company that is not interested in a takeover and hence management of target company will retain the control
- **Golden Parachutes:** When a company offers **hefty compensations to its managers** if they get ousted due to takeover, the company is said to offer golden parachutes
- **Pac-man defence:** This strategy aims at the target company **making a counter bid for the acquirer company.**

Reverse Merger:

- In a 'reverse takeover', a **smaller company gains control of a larger one.** This type of merger is also known as **'back door listing.**
- Three tests of reverse merger – Assets of transferor company are greater than the transferee company, equity capital to be issued by the transferee company pursuant to the acquisition exceeds its original issues capital and change in control

Divestiture:

- It means a **company selling one of the portions of its divisions or undertakings** to another company or creating an altogether separate company

• Reasons: Pay attention on core areas, division is not sufficiently contributing, size is too big to handle and urgent need of cash
Forms of divestiture/demerger: • Sell off/Partial Sell off: Sale of an asset, factory, division, product line or subsidiary by one entity to another • Spin-off: Part of the business is separated and created as a separate firm • Split-up: This involves breaking up of the entire firm into a series of spin off (by creating separate legal entities). • Equity Carve Outs: This is like spin off but some shares of the new company are sold in the market by making a public offer • Sale of a division: Seller company is demerging its business whereas the buyer company is acquiring a business • Demerger or division of family-managed business: Hiving off of unprofitable businesses or divisions with a view to meeting a variety of succession problems
Ways of doing Ownership Restructuring: • Going Private: This refers to the situation wherein a listed company is converted into a private company by buying back all the outstanding shares from the markets. • Management Buyout: Buyouts initiated by the management team of a company are known as management buyout. This is useful strategy for exiting those divisions that does not form part of core business • Leveraged buyout: Acquisition which is entirely or partially (50% or more) using borrowed funds • Equity Buyback: Situation wherein a company buys back its own shares from the market. This increases promoter's stake due to reduction in capital
Management Buyout Vs Leveraged Buyout: • MBO – Buyouts initiated by the management team • LBO – Buyouts primarily funded with debt • Purpose of LBO: Intention of LBO is to improve the operational efficiency of a firm and increase the cash flow. Extra cash flow will be used to pay back the debt. Example of LBO: Buyout of Corus by Tata Steel
How M&A and business restructuring helps in unlocking value: • Horizontal growth to achieve optimum size, enlarge market share • Vertical combination to economise costs and eliminate avoidable taxes/duties • Diversification • Mobilizing financial resources – Use of idle funds of one company to expand other company business • Merging subsidiary with parent company to improve cash flow • Taking over shell company which has some industrial license • Restructuring to enhance competitiveness, survival and provide new direction
Steps in successful M&A Programme: • Manage the pre-acquisition phase • Screen candidates • Eliminate those do not meet the criteria and value the rest • Negotiate • Post-merger integration
Reasons for failure of M&A: • Overpayment by acquirers • Over-estimation of value of synergy • Poor post-merger integration • Psychological barriers
Cross border M&A: • Cross-border M&A is one where target and acquiring company are based out of different countries • Factors contributing to cross border M&A: Globalization of production, Integration of global economy, Expansion of trade, privatisation of state-owned enterprises and consolidation of banking industry
IPO without commercial operations:

- **Special Purpose Acquisition Companies (SPACs)** has come into existence wherein an entity is set up with the objective to raise funds through an IPO to finance a merger or acquisition of an unidentified target within a specific time period. **It is commonly known as a blank cheque company**
- The main objective of SPAC is to raise money, despite not having any operations or revenues. **The money raised from the public is kept in an escrow account, which can be accessed while making the acquisition. However, in case the acquisition is not made within stipulated period of time of the IPO, the SPAC is delisted and the money is returned to the investors**

Practical:**Synergy gain:**

- Synergy gain = Value of merged entity - Value of entity A - Value of entity B
- Synergy gain will arise
 - if PE multiple post-merger is better than weighted average PE Multiple (OR)
 - Earning of merged firm > Earning of A + Earnings of B

Cost of merger:

- Gross cost of merger = Consideration paid
- True cost of merger = Consideration paid - Pre-merger value of target company
- NPV of merger = Synergy gain - True cost of merger

Consideration:

- Consideration of cash offer = Amount of cash paid
- Consideration of stock offer = No of shares issued x Post-merger price of merged firm

Format for doing merger Analysis:

Particulars	ABC Limited	DEF Limited	Merged company
PAT/EAES	2,00,000	5,00,000	7,00,000
No of equity shares	1,00,000	2,00,000	2,62,172
EPS [PAT/ No of shares]	2	2.50	2.67
PE Multiple	20	10	20
MPS [PAT x PE Multiple]	40	25	53.40
No of equity shares	1,00,000	2,00,000	2,62,172
Market value of firm [MPS x No of shares]	40,00,000	50,00,000	1,40,00,000

How exchange ratio is determined:

- Write the base values (based on which exchange ratio is computed)
- Switch it around. Example: EPS of Acquiring and Target are 10 & 5. The exchange ratio is 5:10

Important points:

- **PE Multiple:** In case the problem is silent, Post-merger PE Multiple would be equal to pre-merger PE Multiple of acquiring company.
- **Equivalent EPS of Target Company shareholders:** Equivalent EPS = Post-merger EPS x Exchange ratio
- **Exchange ratio to maintain EPS/EPS should not be diminished by merger:** If the company wants to maintain the same EPS, then the exchange ratio should be on the basis of EPS
- **Gain/loss of shareholders:** Gain/loss of shareholders is computed using the below table:

Particulars	Mark Limited	Mask Limited
Pre-merger value	20,000	2,000
Post-merger value	21,818 (109.09 x 200)	2,182 (109.09 x 20)
Overall gain/loss (A)	1,818	182
Pre-merger no of shares (B)	200	100
Gain per share (A/B)	9.09	1.82

- Value of merged entity = Value of Acquiring company + Value of target company + Synergy gain
- Consideration paid = Cost of merger + Value of target company
- **Cash consideration to maintain EPS:** In case of cash consideration shares are not issued and EPS will be maintained if pre-merger PAT of acquiring company equals to post-merger PAT of acquiring company. Pre-merger and post-merger PAT would be equal if after-tax interest cost on borrowing is equal to total PAT of target company.

Consideration payable = $\frac{\text{PAT of target company}}{\text{After – tax cost of debt}}$

- **Exchange ratio based on CMP:** Exchange ratio is based on CMP but the company wants to pay premium. We should add the amount of premium to CMP of target company and then swap the amounts to get exchange ratio
- **Impact of merger on EPS:** Impact of merger on EPS is computed using below format:

Particulars	ABC Limited	XYZ Limited
Pre-merger EPS	6	4
Post-merger EPS	6.14	3.65 $6.14 \times \left(\frac{50}{84}\right)$
Increase/decrease in EPS	0.14	(0.35)

- **Exchange ratio where shareholders would not be a loss:** Exchange ratio based on EPS is recommended
- **No dilution in MPS:** Exchange ratio based on MPS would be done. Basically, if a factor should not be impacted, then exchange ratio based on that factor would be recommended
- **Weighted average PE Multiple:** Weighted average PE Multiple of acquiring and target company is computed with the help of below formula:

$$\text{Weighted average PE Multiple} = \frac{(40,000 \times 15) + (8,000 \times 7.50)}{48,000} = 13.75$$

- Combined PE Multiple to justify merger is computed using below formula:

$$\text{Combined PE Multiple} = \frac{\text{Pre merger value of A Limited} + \text{B Limited}}{\text{Post merger earnings}}$$

- **Value of original shareholders:** This refers to value of shareholders in combined firm

$$\text{Value of acquiring company holders} = \text{Combined value} \times \frac{\text{Shares held by acquiring company shareholders}}{\text{Total Shares}}$$

$$\text{Value of Target company holders} = \text{Combined value} \times \frac{\text{Shares held by target company shareholders}}{\text{Total Shares}}$$

- **Free-float market capitalization:** Free-float market capitalization can help in computing total market value of firm using below formula:

$$\text{Total value of firm} = \frac{\text{Free Float Market Capitalization}}{\% \text{ Shareholding by non – promoters}}$$

- **Book value per share:** Book value per share is computed using below formula:

$$\text{Book value per share} = \frac{\text{Share capital} + \text{Reserves \& Surplus} - \text{Fictitious Assets}}{\text{Number of shares}}$$

- **Return on equity:** ROE is computed using the below formula:

$$\text{ROE} = \frac{\text{EAES}}{\text{Amount of equity}} \quad (\text{OR}) \quad \frac{\text{EPS}}{\text{Book value per share}}$$

- **Exchange ratio based on intrinsic value:** If data on intrinsic value is not available, then market price will be taken as fair indicator of intrinsic value
- **Negotiation:** Final exchange ratio will be closer to lower limit if the acquiring company is stronger and same will be closer to upper limit if the target company is stronger.
- **Retained earnings have already been invested:** In case of a merged firm, we can compute the growth rate of merged firm using ROE x Retention ratio formula. However, this growth rate will not be applicable for year 1 if the individual companies have already invested the retained earnings. Growth rate will be applicable from year 2 onwards.

$$\text{Combined PAT of year 1} = (\text{PAT of company 1} + \text{Company 1's growth rate}) + (\text{PAT of company 2} + \text{Company 2's growth rate}) + \text{Synergy gain}$$

$$\text{Combined PAT of year 2} = \text{Combined PAT of year 1} + \text{Merged company growth rate}$$

- **Bonus issue to reduce promoter holding:** If a bonus issue is made, the value of company will remain same, but number of shares will increase and hence price per share will decline
- **Fund available for merger:** Fund available = [Acquirer equity capital x Debt/equity ratio] - [Existing debt of two companies] + Cash available
- **Computation of earnings with rate of return:** Earnings of company = Value of company x Rate of Return
- **Distribution of shares if part of shares are partly paid-up:** If part of shares are partly paid-up, we should convert partly paid-up shares into equivalent fully paid shares and then decide the distribution of shares

- **Decision on offloading of shares:** Compare opportunity return with likely return from the acquiring company post-merger. If the return is higher than opportunity return then we shouldn't offload the shares in market

$$\text{Likely return from acquiring company} = \frac{\text{Equivalent EPS Post merger}}{\text{Price post merger announcement of target company}}$$

Minimum and Maximum Exchange ratio:

- **Maximum exchange ratio:** Maximum exchange ratio is from point of view of acquiring company. Maximum exchange ratio would be one which ensures MPS of acquiring company post-merger does not decline. Maximum consideration = Post-merger value of acquiring company - Pre-merger value of acquiring company
- **Minimum exchange ratio:** Minimum exchange ratio is from point of view of target company. Minimum exchange ratio is one where consideration paid is equal to pre-merger value of target company. Minimum consideration = Pre-merger value of target company

Format for computing Weighted Average Swap Ratio:

Particulars	Base values	Swap Ratio	Shares to be allotted	Weight	Product
Book value	500:60	60:500	1,20,000 (10,00,000 × 60/500)	0.25	30,000
EPS	40:8	8:40	2,00,000 (10,00,000 × 8/40)	0.50	1,00,000
MPS	400:32	32:400	80,000 (10,00,000 × 32/400)	0.25	20,000
No of shares to be issued					1,50,000

Bank Merger:

- **Exchange ratio based on negative parameters like GNPA ratio/Operating cost ratio:** We should not swap the base values and final exchange ratio will be same as base values
- **GNPA%:** GNPA% is computed with the help of below formula:

$$\text{GNPA \%} = \frac{\text{GNPA in Rupees}}{\text{Total Advances}} \times 100$$
- **CAR:** Capital adequacy ratio is computed with the help of below formula:

$$\text{CAR} = \frac{\text{Capital}}{\text{Risk weighted assets}} \times 100$$

$$\text{Capital} = \text{Equity capital} + \text{Reserves and surplus} - \text{Fictitious assets}$$

Chapter 15 – Startup FinanceTheory:Definition of Start-up:

- Incorporated as either private limited company or registered partnership or LLP in India **not prior to 5 years**
- **Turnover** in any fiscal year not to exceed **Rs.25 Crores**
- Should not have been formed by splitting up or reconstruction of business
- Working towards innovation, development, deployment or commercialization of new product, processes or services driven by technology or intellectual property

Additional Conditions:

- Cease to be a start-up on completion of 5 years or exceeding turnover of Rs.25 Crores
- Shall be eligible for tax benefits only after obtaining certification from the Inter-ministerial Board

Major reasons for sustainable development of start-ups in India:

- Government support
- Pool of talent
- Cost-effective workforce
- Increasing use of internet
- Technology
- Variety of funding options

Innovative ways of financing a start-up:

- **Personal Financing:** Investors will put money in a deal only if the entrepreneurs are contributing from their personal source
- **Personal credit lines:** Based on one's personal credit efforts. Example: Credit cards
- **Family and Friends:** These people will generally fund, without even thinking whether the idea works or not
- **Peer-to-peer lending:** In this group of people come together and lend money to each other
- **Crowd Funding:** Small amounts of capital from a large number of individuals
- **Micro Loans:** Small loan given by single individual or aggregated at a lower interest
- **Vendor financing:** Company lends money to its customers so that they can buy products from the manufacturers
- **Purchase order financing:** Purchase order financing companies often advance the required funds directly to the supplier.
- **Factoring account receivables:** Facility given to the seller who has sold the good on credit to fund his receivables

Pitch Presentation:

- Pitch deck presentation is a **short and brief presentation** (<20Min) to investors explaining about the **prospects of the company** and why they should invest into the startup business.

Steps:

- Introduction – Short introduction to attract the attention of investors
- Team – Introducing the team members
- Problem – Explain the problem that the start-up is going to solve
- Solution – Describing how the company will solve the problems
- Marketing – Explaining the market size of the product and target customers
- Projections – Projected financial statements
- Competition – Highlight the competition and how product/service is different from competitors
- Business model – Explaining the core aspects of the business
- Financing – Utilization of past money raised and an explanation on how much work has been done

Document that are required to make pitch presentations:

- Income statement
- Cash flow statement
- Balance sheet

Modes of financing startup:

- **Bootstrapping:** An individual is said to be boot strapping **when he or she attempts to found and build a company from personal finances** or from the operating revenues of the new company

- **Angel Investor:** Angel investors invest in small startups or entrepreneurs. They are among entrepreneur's family and friends. This can either be an one-time investment which can help the business propel or regular injection of money to support and carry the company through difficult early stages. Some investments can also be made through crowdfunding platforms or angel investor networks. **Angel investors normally represent individuals, but the entity that provides funds may be a limited liability company, a business, a trust or an investment fund**
- **Venture capital funds:** Money provided by **professionals who alongside management invest in young**, rapidly growing companies that have the potential to develop into significant economic contributors

Characteristics of venture capital financing:

- Long term horizon – Minimum of 3 years and maximum of 10 years
- Lack of liquidity – Less liquidity on the equity it gets and accordingly would be investing in that format
- High Risk – Works on principle of high risk and high return
- Equity participation – Investing in the form of equity so it helps to participate in the management and help the company grow

Advantages of bringing venture capital in the company:

- Injects long-term equity finance
- Shares both risks and rewards
- Practical advice and assistance to the company
- Network of contacts that can add value to the company
- Providing additional rounds of funding to finance growth
- Experiences in preparing a company for IPO
- Facilitate a trade sale

Stages of funding VC:

- Seed money - Start up - First stage - Second stage - Third stage - Fourth stage

Venture capital investment process:

- Deal organization
- Screening
- Due diligence
- Deal structuring
- Post investment activity
- Exit Plan

Structure of venture capital fund in India:

- **Domestic funds:** Structured as a domestic vehicle for pooling of funds from the investor and an investment advisor to carry the duties of asset manager
- **Offshore funds:**
 - **Offshore structure:** Investment vehicle directly makes investments in Indian Portfolio Companies. Assets are managed by an offshore manager and the investment advisor carries out due diligence and identifies deals
 - **Unified structure:** **Overseas investors pool their assets in an offshore vehicle that invests in a locally managed trust**, whereas domestic investors directly contribute to the trust.

Methods of Bootstrapping:

- **Trade Credit:** Credit received from suppliers will help in financing the startup. However, when a new business is started, suppliers are reluctant to give trade credit
- **Factoring:** This is a financing method where accounts receivables is sold to a commercial finance company to raise capital. It is a useful tool for raising money and keeping cash flowing
- **Leasing:** It will reduce the capital cost and also help lessee to claim tax exemption. It can be easy to take an asset on lease to avoid paying out lump sum money

Difference between startup and entrepreneurship:

- **Start up is a part of entrepreneurship.** Entrepreneurship is a broader concept and it includes a startup firm.
- Aim of startup is to **build a concern, conceptualize the idea which it has developed into a reality and build a product or service**. On the other hand, the major objective of an already established entrepreneurship concern is to attain opportunities with regard to the resources they currently control.

• <u>A startup generally does not have a major financial motive</u> whereas an established entrepreneurship concern mainly operates on financial motive
<u>Priorities and challenges which start-ups in India are facing:</u> • The priority is on bringing more and more smaller firms into existence • The main challenge with the startup firms is getting the right talent. Further startups <u>had to comply with numerous regulations which escalate its cost</u>
<u>Business Model:</u> • Denotes core aspects of business. It basically explains the way in which a company generates revenue and makes profit from company operations • It includes purpose, business process, target customers, offerings, strategies, infrastructure, organizational structures, sourcing, trading practices, and operational processes and policies including culture
<u>Peer-to-peer Lending vs Crowd Funding:</u> • Peer-to-peer lending is in existence for long period of time and crowd funding is a contemporary source of finance • In peer-to-peer lending group of people come together and lend money to each other • Crowdfunding is raising of small amounts of capital from a large number of individuals to finance a new business initiative.
<u>Unicorn:</u> • Privately held start-up company which has achieved valuation of USD 1 billion + It needs to have new ideas + Disruptive innovation + Consumer focus + technology focus • Next milestone is to become a decacorn which has valuation of USD 10 billion
<u>Succession planning:</u> • Identifying critical positions and having right individuals for those positions + This will ensure right people are available for jobs and provides a liquidity event for ownership transfer to rising employees • Helps companies promote and advance all employees
<u>Why should an organization go for succession planning?</u> • Risk Mitigation • Cause removal – If there are issues with existing leader then he may be barred by court/regulatory authorities and it would be easy to continue operations with succession planning • Talent Pipeline • Conflict resolution mechanism – Helps in promoting open and transparent communication • Aligning – Helps company to align with culture, vision, direction and values of the business
<u>Steps in business succession strategy:</u> • Evaluate key leadership positions • Map competencies required for above positions • Identify competencies of current workforce • Bridge leader – Appointment of outsider as a bridge leader in family-owned enterprises to develop business and prepare young family members into leadership role
<u>Challenges in implementing succession planning:</u> • Founder mindset might be different than the corporate mindset • Premature for startups to implement business succession – Startups at early growth stage should not implement succession planning as the same can slowdown growth • Founders are the face of startups

CA Inter Financial Management ConceptsWhy should we revise FM Concepts for CA Final AFM?

- CA Final AFM exam trends have shown one general exam question which needs understanding of CA Inter concepts and also application of many formulae of ratio Analysis
- These notes cover important formulae and other concepts learnt at CA Inter level
- These notes are not exhaustive and objective was to give the most important concepts
- If you feel these notes should include any other important formula/concept of CA Inter, then please drop a mail to dineshjain.r@gmail.com

RATIO ANALYSISROE Computation as per Dupont Model:

- ❖ There are various components in the calculation of return on equity using the traditional DuPont model- the net profit margin, asset turnover, and the equity multiplier. By examining each input individually, the sources of a company's return on equity can be discovered and compared to its competitors.
- ❖ **ROE = Net profit margin x Asset Turnover ratio x Equity Multiplier**

Net Profit Margin	$\frac{\text{Net Profit}}{\text{Sales}}$
Asset Turnover ratio	$\frac{\text{Sales}}{\text{Total Assets}}$
Equity Multiplier	$\frac{\text{Total Assets}}{\text{Equity (OR) Debt + Equity}}$

Example:

Net Profit = 500; Total turnover = 5000; Total assets = 1000; Equity shareholders' funds = 800. ROE as per Dupont model would be calculated as under:

Net Profit Margin = Net Profit / Total turnover = 500/5000 = 10%

Asset turnover = Total turnover / total assets = 5000/1000 = 5 times

Equity multiplier = Total assets / Equity shareholders' funds = 1000/800 = 1.25 times

Hence, ROE = 10% * 5 * 1.25 = 62.5 percent

Analysis:

- ROE of 62.5 percent is based on 10 percent net profit, 5 times asset turnover and equity multiplier of 1.25
- If the equity multiplier were excluded (to determine how much the company would earn if it were completely debt free), the ROE would be 0.10 * 5 = 50 percent. This means that the balance 12.5 percent is attributable to the debt employed in the business

Important ratios

	Ratio	Formula	Remarks
1	Current Ratio	$\frac{\text{Current Assets}}{\text{Current Liabilities}}$	
2	Quick ratio / liquid ratio / acid test ratio	$\frac{\text{Quick Assets}}{\text{Current Liabilities}}$	• Quick assets = Current Assets - Inventories - Prepaid expenses
3	Debt Ratio	$\frac{\text{Total Debt}}{\text{Capital Employed}}$	• Capital Employed = Equity capital + Reserves and Surplus + Preference capital + Debt - Fictitious assets [OR] • Capital Employed = Fixed assets + Current assets - Current liabilities
4	Equity Ratio	$\frac{\text{Total Equity}}{\text{Capital Employed}}$	• Equity = Equity capital + Reserves and Surplus - Fictitious assets
5	Debt to equity ratio	$\frac{\text{Total Debt}}{\text{Total Equity}}$	•
6	Capital gearing ratio	$\frac{\text{Total Debt + Preference}}{\text{Total Equity}}$	•

7	Proprietary ratio	$\frac{\text{Proprietary funds}}{\text{Total Assets}}$	Proprietary funds = Equity capital + Reserves – Fictitious assets	
8	Interest coverage	$\frac{\text{EBIT}}{\text{Interest}}$		
9	Preference Dividend coverage ratio	$\frac{\text{PAT}}{\text{Preference Dividend}}$		
10	Equity dividend coverage ratio	$\frac{\text{EAES}}{\text{Equity Dividend}}$		
11	Total assets turnover ratio	$\frac{\text{Sales}}{\text{Total Assets}}$	Other variants:	
			Variant	Denominator
			Fixed assets Turnover ratio	Fixed assets
			Current asset turnover ratio	Current assets
			Working capital turnover ratio	Working capital
			Capital turnover ratio	Capital Employed
12	Debtors turnover ratio	$\frac{\text{Credit Sales}}{\text{Debtors}}$		
13	Creditors turnover ratio	$\frac{\text{Credit Purchases}}{\text{Creditors}}$		
14	Inventory Turnover ratio	$\frac{\text{COGS}}{\text{Stock}}$		
15	Conversion of turnover ratios into days	$\frac{365}{\text{Turnover ratio}}$	For instance, debtor days = 365/Debtors turnover ratio	
16	Gross Profit ratio	$\frac{\text{Gross Profit}}{\text{Sales}} \times 100$	Other variants:	
			Variant	Numerator
			Net Profit ratio	Net Profit
			Operating profit ratio	EBIT
			COGS ratio	COGS
17	Pre-tax ROI/ROCE	$\frac{\text{EBIT}}{\text{Capital Employed}} \times 100$		
18	Post-tax ROI/ROCE	$\frac{\text{EBIT} \times (1 - \text{Tax rate})}{\text{Capital Employed}} \times 100$		
19	Return on equity	$\frac{\text{EAES}}{\text{Amount of equity}} \times 100$		
20	Dividend Yield	$\frac{\text{DPS}}{\text{MPS}} \times 100$		
21	Dividend Rate	$\frac{\text{DPS}}{\text{Face Value}} \times 100$		

COST OF CAPITAL

S.No	Ratio	Formula	Remarks
1	Cost of irredeemable debt	$\frac{\text{Interest} \times (1 - \text{Tax rate})}{\text{Net Proceeds}}$	- Net proceeds for new issue = Issue price - Floatation cost - Net proceeds for existing issue = Current market price
2	Cost of redeemable debt	$\frac{\text{Interest after tax} + \frac{\text{RV} - \text{NP}}{\text{Balance life}}}{\text{Average funds employed}}$	- RV = Redeemable value - NP = Net proceeds - Average funds employed is average of RV and NP
3	Cost of irredeemable preference	$\frac{\text{Preference Dividend}}{\text{Net Proceeds}}$	

4	Cost of redeemable preference	$\frac{\text{Preference Dividend} + \frac{\text{RV} - \text{NP}}{\text{Balance life}}}{\text{Average funds employed}}$	•
5	Cost of equity	$\frac{D_1}{P_0 - F} + \text{Growth rate}$	• D1 = Dividend of next year • P0 = Current market price/Issue price • F = Floatation cost per share

Format for computation of weighted average cost of capital:

Source	Cost	Weight		Product	
		Book Value	Market Value	Book value	Market Value
External equity					
Debt					
Preference					
Retained earnings					
Term Loan					
Total					

$$\text{WACC} = \frac{\text{Sum of Products}}{\text{Sum of weights}}$$

CAPITAL STRUCTURE**Format for calculation of EPS/ Market Value of Firm:**

Particulars	Amount
Earnings before interest and tax (EBIT)	XXX
Less: Interest	(XXX)
Earnings before Tax (EBT)	XXX
Less: Tax	(XXX)
Earnings after Tax (EAT)	XXX
Less: Preference Dividend	(XXX)
Earnings available to equity shareholders (EAES)	XXX
No of equity shares	XXX
Earnings Per share (EPS) [EAES / No of shares]	XXX
Price/earning multiple	XXX
Market price per share [EPS x PE Multiple]	XXX
No of shares	XXX
Market value of shares (MPS x No of shares)	X XX
Add: Market value of debt	XXX
Add: Market value of preference	XXX
Market value of Firm	XXX

S.No	Ratio	Formula	Remarks
1	Financial Break-even Point	$\text{Interest cost} + \frac{\text{Preference Dividend}}{1 - \text{Tax rate}}$	• Level of EBIT at which EPS is zero

LEVERAGES**Format for calculation of leverages:**

Particulars	Amount
Sales	XXX
Less: Variable costs	(XXX)
Contribution	XXX
Less: Fixed Costs	(XXX)
Earnings before interest and tax (EBIT)	XXX
Less: Interest	(XXX)
Earnings before Tax (EBT)	XXX
Less: Tax	(XXX)
Earnings after Tax (EAT)	XXX
Less: Preference Dividend	(XXX)

Earnings available to equity shareholders (EAES)	XXX
No of equity shares	XXX
Earnings Per share (EPS) [EAES / No of shares]	XXX

Formulae:

Type of Leverage	Formula
Operating Leverage	$\frac{\text{Contribution}}{\text{EBIT}}$ (or) $\frac{\% \text{ Change in EBIT}}{\% \text{ change in Sales}}$
Financial Leverage	$\frac{\text{EBIT}}{\text{EBT} - \frac{\text{PD}}{1 - \text{Tax rate}}}$ (or) $\frac{\% \text{ Change in EPS}}{\% \text{ change in EBIT}}$
Combined Leverage	$\frac{\text{Contribution}}{\text{EBT} - \frac{\text{PD}}{1 - \text{Tax rate}}}$ (or) $\frac{\% \text{ Change in EPS}}{\% \text{ change in sales}}$ (or) OL x FL

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Coverage in MCQ Book:

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Suggestions/Feedback:

- MCQ book comprehensively addresses a wide array of AFM concepts with primary focus on enhancing student's conceptual understanding. You can revise entire AFM by just solving this MCQ book
- If you come across any inaccuracies within the book, kindly reach out via WhatsApp at 9025640862. Your feedback will contribute in improving future editions. Additionally, if you identify specific concepts absent from the MCQ book that you believe should be included, please message us with your suggestions

AFM Google Drive Classes:

- You can get AFM Google Drive Classes from www.bharadwajinstitute.com

Chapter 1 – Financial Policy and Corporate Strategy

1. What is the expanded role of CFOs in modern times?
 - a. Wealth maximization for shareholders
 - b. Overseeing financial controls
 - c. Only contributing to strategic decision-making
 - d. Overseeing risk management, supply chain, mergers, acquisitions, and ESG financing
2. What does corporate level strategy primarily deal with?
 - a. Coordination of operating units
 - b. Short-term functional planning
 - c. Selection of businesses and portfolio development
 - d. Financial resource allocation
3. Financial planning helps in:
 - a. Identifying short-term goals
 - b. Meeting long-term objectives through financial tools
 - c. Maximizing profits without considering financial resources
 - d. Evaluating performance without setting financial objectives
4. Which is not a major component of financial planning?
 - a. Financial Resources (FR)
 - b. Financial Tools (FT)
 - c. Financial Goals (FG)
 - d. Financial Decision-making (FD)
5. What is an essential element of strategy at the corporate level?
 - a. A clear and realistic strategy
 - b. The right management team
 - c. Determination of optimal mix of funds
 - d. Tactical and operational planning
6. Financial planning is best described as:
 - a. Setting the right dividend policy for the company
 - b. Utilizing financial tools to maximize existing financial resources
 - c. Making tactical investment decisions for business expansion
 - d. Allocating funds between short-term and long-term investments
7. What level of strategy is concerned with practical coordination of operating units and competitive advantage for products and services?
 - a. Corporate Level Strategy
 - b. Business Unit Level Strategy
 - c. Functional Level Strategy
 - d. Operational Level Strategy
8. The strategic issues at the functional level are related to:
 - a. Corporate-level strategy development
 - b. Tactical decision-making
 - c. Business unit-level processes
 - d. Value chain activities
9. The evolving concept of ESG has shifted the CFO's role towards:
 - a. Traditional financing
 - b. Sustainability financing
 - c. Risk management
 - d. Cost reduction strategies
10. The sustainable growth model assumes that a firm wants to:

- a. Issue new equity regularly
 - b. Increase financial leverage continuously
 - c. Maintain a target dividend payment ratio
 - d. Reduce sales growth to conserve resources
11. Which combination forms the fundamental of business?
- a. Investment + Financial Resources + Clear Strategy
 - b. Strategy + Management + Investor Returns
 - c. Finance + Management + Capital Investment
 - d. Strategy + Finance + Management
12. Mature firms often have actual growth rates that are:
- a. Higher than the sustainable growth rate
 - b. Lower than the sustainable growth rate
 - c. Unrelated to the sustainable growth rate
 - d. Equal to the sustainable growth rate
13. How does inflation impact a firm's sustainable growth rate?
- a. It decreases the need for external financing
 - b. It reduces the debt-to-equity ratio
 - c. It lowers the retention rate of earnings
 - d. It increases the amount of external financing required
14. The sustainable growth rate indicates the maximum rate of growth in sales that a firm can achieve without:
- a. Adopting a pause strategy
 - b. Issuing new equity
 - c. Implementing a profit strategy
 - d. Borrowing more money

Case Scenario (Next three questions)

Company XYZ is a successful and established firm in the manufacturing industry. Over the past few years, it has experienced steady growth, and its management is now contemplating its future growth prospects. The Chief Financial Officer (CFO) has been asked to assess the company's sustainable growth rate to determine how much it can grow without relying on external financing. This analysis is critical for the company to maintain financial stability and avoid excessive debt. He has arrived at the following information about the company:

- Net profit margin = 10%
 - Asset Turnover ratio = 2 Times
 - Total Assets/Equity (Equity Multiplier) = 1.25 Times
 - Dividend payout ratio = 80%
15. How much is the sustainable growth rate of company XYZ?
- a. 8%
 - b. 5%
 - c. 20%
 - d. 2%
16. If Company XYZ's profit margin increases, how will it affect its sustainable growth rate?
- a. Sustainable growth rate will increase.
 - b. Sustainable growth rate will decrease.
 - c. Sustainable growth rate will remain unchanged.
 - d. It is not possible to determine the effect from the information provided.
17. A company's return on equity becomes 50% of the original ROE and the retention ratio of the company is doubled. How does this impact SGR of the company?
- a. Sustainable growth rate will increase.
 - b. Sustainable growth rate will decrease.

- c. Sustainable growth rate will remain unchanged.
- d. It is not possible to determine the effect from the information provided.

Answer:

1.	Overseeing risk management, supply chain, mergers, acquisitions, and ESG financing				
2.	Selection of businesses and portfolio development				
3.	Meeting long-term objectives through financial resources				
4.	Financial Decision-making				
5.	A clear and realistic strategy				
6.	Utilizing financial tools to maximize existing financial resources				
7.	Business unit level strategy				
8.	Value Chain Activities				
9.	Sustainability Financing				
10.	Maintain a target dividend payment ratio				
11.	Strategy + Finance + Management				
12.	Lower than the sustainable growth rate				
13.	It increases the amount of external financing required				
14.	Borrowing more money				
15.	Answer to the question is 5% ROE = Net profit margin x Asset Turnover x Equity Multiplier $ROE = \left(\frac{\text{Net Profit}}{\text{Sales}} \right) \times \left(\frac{\text{Sales}}{\text{Total Assets}} \right) \times \left(\frac{\text{Total Assets}}{\text{Equity}} \right) = 10 \times 2 \times 1.25 = 25\%$ SGR = ROE x Retention ratio = 25% x 20% = 5.00%				
16.	Sustainable growth rate will increase as increase in profit margin will lead to better ROE and which in turn would improve SGR				
17.	Sustainable growth rate will remain unchanged <table><tr><td>Original Situation: ROE (assumed) = 20% and Retention ratio (assumed) = 40%</td></tr><tr><td>SGR = 20% x 40% = 8.00%</td></tr><tr><td>Revised situation: ROE (becomes half) = 10% and Retention ratio (doubles) = 80%</td></tr><tr><td>SGR = 10% x 80% = 8.00%</td></tr></table>	Original Situation: ROE (assumed) = 20% and Retention ratio (assumed) = 40%	SGR = 20% x 40% = 8.00%	Revised situation: ROE (becomes half) = 10% and Retention ratio (doubles) = 80%	SGR = 10% x 80% = 8.00%
Original Situation: ROE (assumed) = 20% and Retention ratio (assumed) = 40%					
SGR = 20% x 40% = 8.00%					
Revised situation: ROE (becomes half) = 10% and Retention ratio (doubles) = 80%					
SGR = 10% x 80% = 8.00%					

Chapter 2 – Risk Management

1. Liquidity risk refers to:
 - a. Failure to comply with laws and regulations
 - b. Internal operational failures
 - c. Inability to meet liabilities when they become due
 - d. Financial losses due to interest rate changes
2. Financial risk can be divided into the following categories, except:
 - a. Counterparty risk
 - b. Compliance risk
 - c. Interest rate risk
 - d. Currency risk
3. VAR calculates the maximum possible loss at a given confidence level over a specific time horizon. What are the main components used in VAR calculation?
 - a. Risk Control, Risk Limit, and Risk Probability
 - b. Time Period, Risk Probability, and Loss in percentage or amount
 - c. Time Horizon, Risk Control, and Risk Limit
 - d. Risk Limit, Time Horizon, and Loss in percentage or amount
4. Political Risk mainly affects which of the following organizations?
 - a. Exporters
 - b. Importers
 - c. Banking Companies
 - d. Overseas Investors
5. Interest Rate Risk is more relevant for which type of companies?
 - a. Manufacturing Companies
 - b. Banking Companies
 - c. Service Companies
 - d. Retail Companies
6. An employee of the company paid Rs.1,00,000 to a vendor from the company account in place of Rs.10,000. This is an example of _____.
 - a. Operational risk
 - b. Liquidity risk
 - c. Compliance risk
 - d. Strategic risk
7. What is the multiple for 95 percent confidence level?
 - a. 0.95
 - b. 1.65
 - c. 2.33
 - d. 2.85
8. What is the formula for calculating Value at Risk?
 - a. Daily standard deviation x Square root of (No of days)
 - b. Daily standard deviation x No of days
 - c. Daily standard deviation x Multiple for confidence level x No of days
 - d. Daily standard deviation x Multiple for confidence level x Square root of (No of days)
9. _____ is a risk in which a company's strategy becomes less effective and it struggles to achieve its goal
 - a. Compliance risk
 - b. Strategic risk
 - c. Operational risk
 - d. Financial risk

10. You are holding portfolio of Rs.1,00,000. The standard deviation is 21% per annum. What is monthly VAR at 99% confidence level?
- Rs.1,750
 - Rs.4077.50
 - Rs.6,062
 - Rs.14,125
11. You own a portfolio of 10 crores. The daily standard deviation is 2%. What will be the loss for 10 days at 95 percent confidence interval?
- Rs.104.36 lacs
 - Rs.63.25 lacs
 - Rs.330 lacs
 - Rs.200 lacs
12. Acceptable loss = Rs.2,33,000. Standard deviation of the security is 1.5 percent per day. What is the maximum acceptable investment where VAR should not exceed acceptable loss? The required confidence level is 99 percent and the investment is to be done for 9 days.
- Rs.66,66,667
 - Rs.22,22,222
 - Rs.7,40,741
 - Rs.1,00,00,000
13. Which risk can be controlled by setting limits for maximum loss?
- Counter Party Risk
 - Political Risk
 - Interest Rate Risk
 - Liquidity Risk
14. Strategic Risk is a type of risk that arises due to:
- Failure to comply with regulations
 - Changes in interest rates
 - Shifts in customer demand and technological changes
 - Currency fluctuations
15. Which of the following is an example of financial risk?
- Changes in customer preferences
 - Failure to meet day-to-day operational challenges
 - Default by a counterparty
 - Failure to comply with regulations
16. Which of the following parameters can help identify currency risk?
- Government action
 - Nominal GDP
 - Population growth rate
 - Stock market performance
17. Which of the following best describes the interpretation of a VaR value of \$1 million at a 95% confidence level?
- There is a 95% chance of a loss exceeding \$1 million.
 - There is a 5% chance of a loss exceeding \$1 million.
 - There is a 5% chance of a loss equal to or less than \$1 million.
 - The expected loss is \$1 million.
18. Which of the following statistical distributions is often used to calculate VaR?
- Normal distribution
 - Uniform distribution
 - Exponential distribution

d. Poisson distribution

19. Which of the following is a measure of financial risk?

- a. Return on investment
- b. Profit margin
- c. Debt-to-equity ratio
- d. Gross revenue

Case Scenario (Next three questions)

HedgeFund X is a prominent investment firm specializing in managing alternative investments and providing superior risk-adjusted returns to its clients. The fund employs a diverse range of trading strategies across various asset classes, including equities, fixed income, derivatives, and commodities. To effectively manage risk and safeguard their clients' investments, HedgeFund X employs the Value at Risk (VAR) metric as a key risk management tool.

The Risk Management team then employs different statistical methods, such as historical simulation or Monte Carlo simulation, to compute VAR for each asset class and the overall portfolio. The company follows 95% confidence interval for computing the VAR.

After conducting the calculations, the team presents the following results to the senior management:

- The VAR of equities is Rs.165 lacs over the next one year. Standard deviation of equities is 10% per annum
- The VAR for the fixed income securities portfolio is Rs.50 lacs
- The VAR for the commodities portfolio is Rs.200 lacs
- The VAR for the foreign exchange portfolio is Rs.140 lacs

20. Compute the amount of equity portfolio of Hedgefund X?

- a. Rs.1000 lacs
- b. Rs.1,650 lacs
- c. Rs.2,722.50 lacs
- d. Rs.2,000 lacs

21. The company has a debt portfolio of Rs.2,000 lacs whereas it had a commodity portfolio of Rs.500 lacs. Which of these two assets classes have higher risk?

- a. Debt carries high risk
- b. Commodities carry high risk
- c. Both asset classes have same risk

22. Which of the following is a limitation of using VAR at HedgeFund X?

- a. VAR cannot capture potential losses in extreme market conditions.
- b. VAR is overly reliant on future market predictions.
- c. VAR is most suitable for measuring operational risks.
- d. VAR cannot calculate the fund's historical performance.

Answer:

1.	Inability to meet liabilities when they become due	
2.	Compliance risk	
3.	Time Period, Risk Probability, and Loss in percentage or amount	
4.	Overseas investors	
5.	Banking Companies	
6.	Operational risk	
7.	1.65	
8.	Daily standard deviation x Multiple for confidence level x Square root of (No of days)	
9.	Strategic risk	
10.	Annual SD = $1,00,000 \times 21\% = \text{Rs.}21,000$	
	Monthly SD = $21,000 \times \sqrt{12} = \text{Rs.} 6,062.18$	
	Monthly VAR = $6,062.18 \times 2.33 = \text{Rs.}14,125$	

11.	Portfolio = 1,000 lacs; Daily SD = 1,000 lacs x 2% = Rs.20 lacs	
	Daily loss = 20 lacs x 1.65 = Rs.33 lacs	
	Loss for ten days = Rs. 33 lacs x $\sqrt{10}$ = Rs. 104.36 lacs	
12.	Daily SD = 1.50%; SD for 9 days = 1.5% x $\sqrt{9}$ = 4.50%	
	Multiple for 99 percent confidence = 2.33	
	Value at risk = 4.5% x 2.33 x Amount of investment 2,33,000 = 4.5% x 2.33 x Amount of investment	
	Amount of investment = $\frac{1,00,000}{4.5\%}$ = Rs. 22,22,222	
13.	Counter Party Risk	
14.	Shifts in customer demand and technological changes	
15.	Default by a counterparty	
16.	Government Action	
17.	There is a 5% chance of a loss exceeding \$1 million.	
18.	Normal distribution	
19.	Debt-to-equity ratio	
20.	Answers to this question is Rs.1,000 lacs Value at risk = Multiple for 95% x Annual loss 165 lacs = 1.65 x (Portfolio x 10%) Portfolio = $\frac{165 \text{ lacs}}{1.65 \times 0.10}$ = Rs. 1,000 lacs	
21.	Commodities carry higher risk as they have VAR of Rs.200 lacs on a portfolio of Rs.500 lacs. Debt has a VAR of only Rs.50 lacs on overall portfolio of Rs.2,000 lacs. VAR % of debt on portfolio = $\frac{50}{2,000}$ = 2.50% VAR % of commodities on portfolio = $\frac{200}{500}$ = 40%	
22.	VAR cannot capture potential losses in extreme market conditions. VAR assumes that market conditions remain relatively stable, and it may not fully capture extreme events.	

Chapter 3 – Advanced Capital Budgeting Decisions

1. How does inflation impact the discount rate used in capital budgeting?
 - a. Inflation increases the discount rate
 - b. Inflation decreases the discount rate
 - c. Inflation has no effect on the discount rate
 - d. Inflation makes the discount rate irrelevant
2. Which of the following statements is/are true?
 - a. NPV is not useful for evaluating mutually exclusive projects.
 - b. The result of the NPV technique is not affected by the discount rate used.
 - c. Benefit-cost ratio helps in evaluating the projects which differ in initial outlays.
 - d. The advantage of NPV criteria is that it remains the same for all possible reinvestment rates of intermediate cash flows.
3. What is the impact of inflation on depreciation charges in capital budgeting?
 - a. Inflation increases the tax benefits from depreciation charges
 - b. Inflation decreases the tax benefits from depreciation charges
 - c. Inflation has no effect on the tax benefits from depreciation charges
 - d. Inflation increases the historical costs used for depreciation calculations
4. What adjustment can be made to incorporate the impact of change in technology in capital budgeting decisions?
 - a. Adjusting the risk factor.
 - b. Adjusting the discounting rate.
 - c. Adjusting the project timeline.
 - d. Adjusting the project team.
5. NPV at discounting rate of 10% = Rs.1,250 and NPV at discounting rate of 11% = -Rs.200. IRR of the proposal is _____
 - a. 11.86%
 - b. 10.86%
 - c. 9.87%
 - d. 11.96%
6. Which of the following statements about independent projects is least accurate?
 - a. The internal rate of return and net present value methods can yield different accept/reject decisions for independent projects.
 - b. If the internal rate of return is less than the cost of capital, reject the project.
 - c. The net present value indicates how much the value of the firm will change if the project is accepted
7. How can change in technology impact the anticipated life cycle of a product?
 - a. It has no impact on the product's life cycle.
 - b. It extends the product's life cycle.
 - c. It shortens the product's life cycle.
 - d. It increases consumer preference.
8. What is the ultimate goal of risk analysis in capital budgeting?
 - a. To eliminate all risks associated with a project.
 - b. To ensure a positive net present value.
 - c. To ignore potential risks and uncertainties.
 - d. To make informed decisions considering potential risks and their impact.
9. Which risk analysis technique helps identify the critical variables that have the most significant impact on project outcomes?
 - a. Sensitivity analysis.
 - b. Scenario analysis.

- c. Payback period analysis.
 - d. Decision tree analysis.
10. What is the purpose of decision tree analysis in risk analysis?
- a. To assess the impact of changing one variable at a time.
 - b. To evaluate various scenarios and their probabilities.
 - c. To calculate the payback period of a project.
 - d. To analyze sequential decisions and their outcomes.
11. Which risk analysis technique is useful for evaluating projects with complex interdependencies?
- a. Sensitivity analysis.
 - b. Scenario analysis.
 - c. Payback period analysis.
 - d. Monte Carlo simulation.
12. ABC Limited is currently investing in a hydel power project and the construction work for the same has commenced. There has been a change in key management personnel of the company and this would significantly impact project progress. This is an example of _____
- a. Project specific risk
 - b. Company specific risk
 - c. Industry specific risk
 - d. Market risk
13. When an event is certain to occur, the probability will be:
- a. 0
 - b. 0.5
 - c. 1
 - d. 2
14. The coefficient of variation is calculated as:
- a. Standard deviation / Expected cash flows
 - b. Variance / Discount rate
 - c. Expected cash flows / Standard deviation
 - d. Discount rate / Variance
15. Which of the following is an example of an irrelevant cash flow in a capital budgeting decision?
- a. Working capital requirements
 - b. Increased maintenance expenses
 - c. Changes in overhead costs
 - d. Financing costs
16. A company has currently invested in a thermal power project and is dependent on coal for generating power. However, the coal mines are currently unable to supply coal and same is impacting power generation. This is an example of _____?
- a. Industry specific risk
 - b. Market risk
 - c. Risks due to economic conditions
 - d. Company specific risk
17. A project is likely to generate following annual cash flows

Cash flow	Probability
10,000	0.25
20,000	0.45
30,000	0.30

The company has employed simulation technique to evaluate the project and has started the simulation exercise. Random number of 70 was generated in the first experiment and this would correspond to annual cash flow of _____

- a. Rs.10,000
 - b. Rs.20,000
 - c. Rs.30,000
18. Discount rate used in simulation exercise is _____
- a. Risk-free rate
 - b. Risk-free rate + Risk premium
 - c. Cost of capital
19. The Profitability index of a project is 1.20. Present value of cash inflows is Rs.2,40,000. How much is the NPV of the project?
- a. Rs.2,88,000
 - b. Rs.48,000
 - c. Rs.40,000
 - d. Rs.2,00,000
20. Inflation rate = 10%; Real discount rate = 4%. How much is nominal discount rate?
- a. 14%
 - b. 14.40%
 - c. 6%
 - d. 5.6%
21. Real revenues of year 2 is Rs.10,00,000. Inflation for year 1 is 10% and year 2 is 8%. How much is nominal revenues of year 2?
- a. Rs.11,00,000
 - b. Rs.10,80,000
 - c. Rs.11,88,000
 - d. Rs.11,66,400
22. Project cost = Rs.12,000; Annual cash flow = Rs.4,500; Cost of capital = 14%; Life = 4 years; PVIFA(14%,4) = 2.9137, then the sensitivity of the project with respect to project cost is
- a. 9.27%
 - b. 10.27%
 - c. 9.72%
 - d. 10.72%
23. A company has invested in a factory. It is evaluating the risk associated with cash inflows of the project. The company has entered into a contract of providing services in return of specified amount over the life of the project. How much is the variance of cash inflow?
- a. High variance as investing in factory carries huge risks due to inherent issues in operating a factory
 - b. Low variance as investment in a factory is less risky
 - c. No variance as the cash flow is certain
 - d. Variance cannot be computed with the given information
24. The most appropriate discount rate to be used for capital budgeting would be
- a. Firm's WACC
 - b. Project's hurdle rate
 - c. Cost of debt
 - d. Cost of equity
25. Company A is evaluating two mutually exclusive projects. Both projects can be repeated indefinitely. Project A has NPV of Rs.20,000 over three years and Project B has NPV of Rs.25,000 over five years. The cost of capital is 12%. Which project should the company select?
- a. Project A
 - b. Project B
 - c. Indifferent between Project A and B
 - d. Both projects to be rejected

26. ABC Limited is evaluating a new piece of equipment that will automatically install power windows in cars coming off the production line. The equipment cost is Rs.35,00,000, and the firm estimates that the present value of the annual cost savings from installing the equipment is Rs.28,00,000. The production manager is also considering purchasing a module that will allow the equipment to be used for company's SUV production. The additional module represents a real option with a cost of Rs.11,00,000. The production manager estimates that adding the module would give cost savings of an additional Rs.20,00,000. What is the NPV of the project before and after considering the real option?
- 7,00,000 and 2,00,000
 - 7,00,000 and 18,00,000
 - 13,00,000 and 2,00,000
 - 7,00,000 and 9,00,000
27. Which of the following statements about sensitivity analysis is least accurate?
- Sensitivity analysis alters a single independent variable to determine the impact on the output variable.
 - Sensitivity analysis starts with the best-case scenario.
 - The steeper the slope of the NPV versus the variable, the more sensitive the output variable is to a change in the input variable
28. A is working on a capital project valuation and needs to determine the appropriate discount rate. She has the following information available:
- Risk-free-rate = 8%
 Market Beta = 1.0
 Company Beta = 1.1
 Project Beta = 1.2
 Expected market return = 13%
 Trailing 12-months market return = 12%
- Which of the following is closest to the most appropriate discount rate?
- 13.5%
 - 13.0%
 - 14.0%
 - 12.8%
29. A company is considering replacement of an existing machine with a new machine. How much would be the initial outflow from following information?
- | | |
|--|----------|
| Purchase price of the new machine | Rs.8,000 |
| Shipping and Installation charge | Rs.2,000 |
| Sale price of old machine | Rs.6,000 |
| Book value of old machine | Rs.2,000 |
| Inventory increases if installed | Rs.3,000 |
| Accounts payable increase if installed | Rs.1,000 |
| Tax rate on capital gains | 25% |
- Rs.7,000
 - Rs.10,000
 - Rs.3,000
 - Rs.5,000
30. A project is likely to generate cash flows of Rs.1,00,000 (20% probability), 50,000 (40% probability) and -25,000 (40% probability). How much is the expected cash flow of the project?
- Rs.1,25,000
 - Rs.40,000
 - Rs.30,000
 - Rs.50,000

31. A project is likely to generate cash flows of Rs.1,00,000 (20% probability), 50,000 (40% probability) and -25,000 (40% probability). How much is the standard deviation?
- Rs.48,477
 - Rs.27,386
 - Rs.37,417
 - Rs.50,000
32. Project A generates NPV of Rs.10,00,000 and has standard deviation of Rs.5,00,000. Project B has NPV of Rs.14,00,000 and Standard deviation of Rs.8,00,000. Which project is to be selected if co-efficient of variation is used as a measure of risk?
- Project A
 - Project B
 - Indifferent
 - Both projects to be rejected
33. Company is evaluating an investment project whose risk is higher than risk involved in a normal project of the company. What should be the discount rate used for the project?
- Discount rate = Cost of capital
 - Discount rate > Cost of capital
 - Discount rate < Cost of capital
34. Project A and B are for a 3-year period. Certainty equivalent factor of project A is 0.80 and project B is 0.70. Which of these two projects should be discounted with a higher Risk-adjusted discount rate?
- Project A
 - Project B
 - Same rate for both projects
35. A project is being evaluated using certainty equivalent approach. Project's hurdle rate is 12% whereas the market return is 10%. Risk-free rate is 8%. What should be the discount rate under CEF approach?
- 12%
 - 10%
 - 8%
36. Certain cash flow of a project under CEF approach is Rs.2,00,000. CEF factor is 0.80. How much is the uncertain cash flow?
- Rs.1,60,000
 - Rs.2,00,000
 - Rs.2,50,000

37. Identify the factor which causes maximum sensitivity to the project from the following information:

Base NPV	Rs.200 lacs
NPV with 10% variation in Selling price	Rs.150 lacs
NPV with 10% variation in cost price	Rs.180 lacs
NPV with 10% variation in life	Rs.100 lacs
NPV with 10% variation in units sold	Rs.160 lacs

- Selling price
 - Cost price
 - Life
 - Units sold
38. A project currently has NPV of Rs.25 lacs. However, the project is sensitive to multiple factors with a significant variation in the factors causing reversal of investment decision. The analysis is summarized in the below table

Factor	% variation for reversal of decision
Selling price	25%
Cost price	45%

Units sold	70%
Fixed cost	10%

The project is most sensitive to which factor?

- Selling price
- Cost price
- Units sold
- Fixed cost

- The expected monetary value (EMV) at the chance node (decision tree) with branches emanating from a circle is the
 - highest amongst the expected values of the various branches that emanate from the decision node
 - aggregate of the expected values of the various branches that emanate from the chance node.
- The expected monetary value (EMV) at the decision node (decision tree) with branches emanating from a square is the
 - highest amongst the expected values of the various branches that emanate from the decision node
 - aggregate of the expected values of the various branches that emanate from the chance node.
- A company is re-evaluating the decision to continue with an existing machine. The machine was purchased for Rs.20,00,000 three years ago and is being depreciated based on an economic life of 8 years. The company is following SLM method of depreciation. The machine can be sold today for Rs.10,00,000. The tax rate on business profits and capital gains is 25% and 20%. How much is the opportunity outflow related to old machine today?
 - Rs.10,00,000
 - Rs.9,50,000
 - Rs.10,50,000
 - Rs.10,62,500
- Which of the following is/are not true regarding the risk adjusted investment appraisal techniques?
 - In the certainty equivalent method, if there is high degree of correlation between the cash flows over the entire project life the certainty equivalent coefficient is taken as one for all the years.
 - In sensitivity analysis, the impact of the changes in one or more variables on the criterion of merit is studied.
 - Simulation does not produce an optimal solution but the user of the technique has to generate all possible combinations of conditions and constraints to choose the optimal solution
 - Only (ii) above.
 - Only (iii) above.
 - Both (i) and (ii) above
 - Both (i) and (iii) above
- In adjusted present value approach, _____ and _____ is used as discount rate for compute base case NPV and PV of tax benefit on interest respectively
 - Cost of capital and pre-tax cost of debt
 - Cost of capital and post-tax cost of debt
 - Cost of equity and pre-tax cost of debt
 - Cost of equity and post-tax cost of debt
- A company is computing standard deviation of the project. Which of the following is accurate about standard deviation?
 - SD of independent cash flow is more than SD of dependent cash flow
 - SD of dependent cash flow is more than SD of independent cash flow
 - SD of independent cash flow is equal to SD of dependent cash flow
- Initial Outlay of Project = Rs.50,000, Cost of capital = 12.00%; Life of the project = 4 years. Aggregate future value of cash inflows = Rs.1,04,896.0. How much is the MIRR of the proposal?
 - 20.35%

- b. 21.53%
 - c. 31.25%
 - d. 12.25%
46. A project has life of 2 years. The probability of the best cash flow is 30% in each year. What would the probability of best case NPV if cash flows are (i) perfectly correlated and (ii) independent overtime.
- a. 30% and 30%
 - b. 30% and 60%
 - c. 30% and 9%
 - d. 9% and 30%
47. What is the major difference between risk and uncertainty?
- a. Risk can be measured whereas uncertainty cannot be measured
 - b. Risk cannot be measured whereas uncertainty can be measured
 - c. Both risk and uncertainty can be measured
 - d. Both risk and uncertainty cannot be measured
48. The present value of cash inflows is Rs.2,00,000 and the present value of cash outflow is Rs.1,50,000. How much is the sensitivity of the project with respect to outflow parameter?
- a. 25%
 - b. 33.33%
 - c. Cannot be computed
49. Cost of capital of the project is 12%. Cost of capital (discount rate) sensitivity is 5%. How much is the IRR of the project?
- a. 17%
 - b. 12.60%
 - c. 7%
 - d. 11.40%
50. A company has evaluated a project using certainty equivalent approach. The cost of capital is 10% and risk-free rate is 8%. IRR of the project is 9%. What should be the decision on the project?
- a. Accept the project
 - b. Reject the project
 - c. Indifferent on acceptance/rejection
51. Risk index of project is 2.00. Minimum required rate of return of the firm is 15% and the risk-free interest rate is 10%. How much is the RADR?
- a. 10%
 - b. 15%
 - c. 20%
52. Probability of cash flow of Rs.50,000 in year 1 is 40%. If the cash flow turns out to be 50,000 in year 1, then the probability of getting 24,000 in year 2 is 20%. What is the probability of getting cash flow of 24,000 in year 2?
- a. 20%
 - b. 80%
 - c. 8%
 - d. 40%
53. When evaluating investment projects in different countries with varying inflation rates, which of the following concepts is most appropriate for comparing the cash flows on an equal footing?
- a. Nominal cash flow.
 - b. Real cash flow.
 - c. Expected cash flow.
 - d. Discounted cash flow.

Answer:

1.	Inflation increases the discount rate																
2.	Benefit cost ratio helps in evaluating the projects which differ in initial outlays																
3.	Inflation decreases the tax benefits from depreciation charges. Note: This is because depreciation is based on historical cost and any increase in inflation will lead to higher discount rate reducing the tax benefit arising from depreciation																
4.	Adjusting the discounting rate																
5.	$IRR = 10 + \frac{1,250}{1,250 - (-200)} \times (11 - 10) = 10 + 0.86 = 10.86\%$																
6.	The internal rate of return and net present value methods can yield different accept/reject decisions for independent projects Explanation: For independent projects the IRR and NPV give the same accept/reject decision. For mutually exclusive projects the IRR and NPV techniques can yield different accept/reject decisions																
7.	It shortens the product's life cycle.																
8.	To make informed decisions considering potential risks and their impact.																
9.	Sensitivity Analysis																
10.	To analyze sequential decisions and their outcomes.																
11.	Monte Carlo Simulation																
12.	Company specific risk																
13.	1																
14.	Standard Deviation/Expected cash flows																
15.	Financing costs are ignored due to reward exclusion principle																
16.	Market Risk																
17.	Cash flow of Rs.30,000 <table><tr><th>Cash flow</th><th>Prob</th><th>Cum prob</th><th>RN</th></tr><tr><td>10,000</td><td>0.25</td><td>0.25</td><td>00-24</td></tr><tr><td>20,000</td><td>0.45</td><td>0.70</td><td>25-69</td></tr><tr><td>30,000</td><td>0.30</td><td>1.00</td><td>70-99</td></tr></table> RN of 70 would correspond to annual cash flow of Rs.30,000 as per above table	Cash flow	Prob	Cum prob	RN	10,000	0.25	0.25	00-24	20,000	0.45	0.70	25-69	30,000	0.30	1.00	70-99
Cash flow	Prob	Cum prob	RN														
10,000	0.25	0.25	00-24														
20,000	0.45	0.70	25-69														
30,000	0.30	1.00	70-99														
18.	Risk-free rate																
19.	<table><tr><td>NPV = PV of inflows - PV of outflows $NPV = 2,40,000 - \left(\frac{2,40,000}{1.20} \right) = 2,40,000 - 2,00,000 = \text{Rs. } 40,000$</td><td></td></tr></table>	NPV = PV of inflows - PV of outflows $NPV = 2,40,000 - \left(\frac{2,40,000}{1.20} \right) = 2,40,000 - 2,00,000 = \text{Rs. } 40,000$															
NPV = PV of inflows - PV of outflows $NPV = 2,40,000 - \left(\frac{2,40,000}{1.20} \right) = 2,40,000 - 2,00,000 = \text{Rs. } 40,000$																	
20.	$(1 + \text{Nominal Discount rate}) = (1 + \text{Inflation rate}) \times (1 + \text{Real discount rate})$ $(1 + \text{NDR}) = (1.10 \times 1.04)$ $\text{NDR} = 1.144 - 1 = 0.144 \text{ (or) } 14.40\%$																
21.	Nominal revenues = Real revenues $\times (1 + \text{Inflation rate of year 1}) \times (1 + \text{Inflation rate of year 2})$ Nominal revenues = $10,00,000 \times (1 + 10\%) \times (1 + 8\%) = \text{Rs. } 11,88,000$																
22.	<table><tr><td>PV of cash inflows = $4,500 \times 2.9137 = 13,111.65$</td></tr><tr><td>NPV of project = $13,111.65 - 12,000 = 1,111.65$</td></tr><tr><td>Project will have zero NPV if the outflow of the project increase by Rs.1,111.65</td></tr></table> $\text{Sensitivity \%} = \frac{\text{Change}}{\text{Base}} \times 100 = \frac{1,111.65}{12,000} \times 100 = 9.27\%$	PV of cash inflows = $4,500 \times 2.9137 = 13,111.65$	NPV of project = $13,111.65 - 12,000 = 1,111.65$	Project will have zero NPV if the outflow of the project increase by Rs.1,111.65													
PV of cash inflows = $4,500 \times 2.9137 = 13,111.65$																	
NPV of project = $13,111.65 - 12,000 = 1,111.65$																	
Project will have zero NPV if the outflow of the project increase by Rs.1,111.65																	
23.	No variance as the cash flow is certain. The company has entered into a contract in return of specified amount. Hence there cannot be any variance as the cash inflow is certain.																
24.	Project's hurdle rate is the appropriate discount rate reflecting the project's risk. Firm's WACC reflects the firm's risk and not the project's risk.																
25.	We need to compute EAB for selection of the project. $\text{EAB of Project A} = \frac{20,000}{\frac{2.402}{25,000}} = 8,326$ $\text{EAB of Project B} = \frac{25,000}{3.605} = 6,935$ We should go ahead with selection of Project A																
26.	NPV of base project = $28,00,000 - 35,00,000 = -7,00,000$ NPV of real option = $20,00,000 - 11,00,000 = 9,00,000$ Hence NPV of the project before is -7,00,000 and after the option is Rs.2,00,000 $[-7,00,000 + 9,00,000]$																

27.	Sensitivity analysis starts with a base case scenario and hence the option about the best case scenario is incorrect																													
28.	Discount rate = Risk-free rate + Project Beta x (Market return – Risk-free rate) Discount rate = 8% + 1.20 x (13.0% – 8%) = 14.00% We will have to use the expected market return as Return of market in the formula																													
29.	Initial outlay = Purchase cost of new machine (Rs.10,000) + WC increase (Rs.2,000) – Net salvage value of old machine (6,000 – 1,000) = Rs.7,000																													
30.	Expected cash flow = [1,00,000 x 20%] + [50,000 x 40%] + [-25,000 x 40%] = Rs.30,000																													
31.	<table><tr><th>CF</th><th>Prob</th><th>Product</th><th>Deviation</th><th>Pd^2</th></tr><tr><td>100</td><td>0.2</td><td>20</td><td>70</td><td>980</td></tr><tr><td>50</td><td>0.4</td><td>20</td><td>20</td><td>160</td></tr><tr><td>-25</td><td>0.4</td><td>-10</td><td>-55</td><td>1210</td></tr><tr><td>Total</td><td></td><td>30</td><td></td><td>2350</td></tr></table>	CF	Prob	Product	Deviation	Pd^2	100	0.2	20	70	980	50	0.4	20	20	160	-25	0.4	-10	-55	1210	Total		30		2350				
CF	Prob	Product	Deviation	Pd^2																										
100	0.2	20	70	980																										
50	0.4	20	20	160																										
-25	0.4	-10	-55	1210																										
Total		30		2350																										
	Standard deviation = $\sqrt{2350} = 48.477 \times 1,000 = \text{Rs.}48,477$																													
32.	Co-efficient of variation = Standard deviation/NPV Project A = 5,00,000/10,00,000 = 0.50 times Project B = 8,00,000/14,00,000 = 0.5714 times Project A is to be selected as the same has lower co-efficient of variation																													
33.	Discount rate > Cost of Capital Project carries more risk and hence the discount rate should be higher than cost of capital																													
34.	Project A has a higher CEF whereas Project B has a lower CEF. Higher CEF indicates more certainty and less risky. Hence Project A is less risky and Project B is riskier. We should therefore use a higher RADR for Project B.																													
35.	8% (Risk-free rate is to be used as discount rate under CEF approach)																													
36.	Certain cash flow = Uncertain cash flow x CEF 2,00,000 = Uncertain cash flow x 0.80 Uncertain cash flow = $\frac{2,00,000}{0.80} = \text{Rs.}2,50,000$																													
37.	Project is most sensitive to life factor as 10% variation in life has led to maximum impact on NPV																													
38.	Project is most sensitive to Fixed cost factor. This is because a small deviation of 10% in fixed cost will lead to rejection of the project																													
39.	aggregate of the expected values of the various branches that emanate from the chance node.																													
40.	highest amongst the expected values of the various branches that emanate from the decision node																													
41.	Opportunity outflow is equal to net salvage value of the machine today. <table><tr><th>Particulars</th><th>Amount</th></tr><tr><td>Sale Value</td><td>10,00,000</td></tr><tr><td>Less: Book value [20,00,000 – 3 x 2,50,000]</td><td>-12,50,000</td></tr><tr><td>Capital loss</td><td>2,50,000</td></tr><tr><td>Tax saved @ 20%</td><td>50,000</td></tr><tr><td>Net salvage value [SV + Tax Saved]</td><td>10,50,000</td></tr></table>					Particulars	Amount	Sale Value	10,00,000	Less: Book value [20,00,000 – 3 x 2,50,000]	-12,50,000	Capital loss	2,50,000	Tax saved @ 20%	50,000	Net salvage value [SV + Tax Saved]	10,50,000													
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42.	Both (i) and (ii) above																													
43.	Cost of equity and pre-tax cost of debt																													
44.	SD of dependent cash flow is more than SD of independent cash flow																													
45.	FV (inflow) = PV (outflow)x (1 + r) ⁿ 1,04,896.50 = 50,000 x (1 + r) ⁴ 2.09793 = (1 + r) ⁴ ; (1 + r) = 1.2035; Hence MIRR = 20.35%																													
46.	Probability of correlated cash flows = 30% Probability of independent cash flow = 30% x 30% = 9% Hence 30% and 9% is the answer																													
47.	Risk can be measured whereas uncertainty cannot be measured																													
48.	Sensitivity would basically lead to reversal of investment decision. Project currently has positive NPV of Rs.50,000 and the same will get rejected in case outflow increases by Rs.50,000 Sensitivity % of outflow = $\left(\frac{50,000}{1,50,000}\right) \times 100 = 33.33\%$																													

49.	Current cost of capital is 12%. If the cost of capital increases by 5% then decision will get reversed. That would basically mean that the project will have zero NPV. Discount rate at which project will have zero NPV = $12 + (5\% \text{ of } 12) = 12.60\%$. This would basically be the IRR of the project
50.	Accept the Project. The company is using certainty equivalent approach and hence the required return of the project is only risk-free return. $IRR > \text{risk-free rate}$ and hence the project is to be accepted
51.	Risk index is basically Beta. $RADR = 10 + 2 \times (15 - 10) = 20.00\%$
52.	Probability of earning 24,000 in year 2 = Probability of earning 50,000 in year 1 x Probability of earning 24,000 in year 2 Probability = $40\% \times 20\% = 8.00\%$
53.	Real cash flow. Explanation: When comparing cash flows across different countries with varying inflation rates, it is crucial to use real cash flows. Real cash flows adjust for inflation and provide a standardized measure that allows for an equal comparison of the economic value of the cash flows.

Chapter 4 – Security Analysis

1. The Relative Strength Index (RSI) is a popular technical indicator used in stock market analysis. Which of the following statements accurately describes the RSI?
 - a. The RSI measures the volatility of a stock's price.
 - b. The RSI indicates the level of buying or selling pressure in the market.
 - c. The RSI measures the rate of change in a stock's price.
 - d. The RSI predicts the future performance of a stock.
2. What is the primary objective of conducting fundamental analysis of a stock?
 - a. Predicting short-term price movements for short-term trading
 - b. Identifying undervalued stocks for potential long-term investments
 - c. Timing the market to maximize profits during bull runs
 - d. Analyzing technical patterns to execute swing trades
3. The Efficient Market Hypothesis (EMH) suggests that:
 - a. Stock prices are always perfectly predictable.
 - b. Investors can consistently outperform the market by identifying mispriced securities.
 - c. Historical price patterns can be used to predict future price movements.
 - d. Stock prices reflect all available information and are always fairly valued.
4. The Moving Average Convergence Divergence (MACD) is a technical indicator used in stock market analysis. What does a bullish crossover signal on the MACD chart indicate?
 - a. It suggests a potential buying opportunity.
 - b. It indicates that the stock is overvalued.
 - c. It signals a trend reversal to a bearish market.
 - d. It implies that the stock is experiencing high volatility.
5. In _____, factors affecting risk-return characteristics of securities are looked into while in _____, demand/ supply position of the securities along with prevalent share price trends are examined.
 - a. Fundamental Analysis and Technical Analysis
 - b. Technical Analysis and Fundamental Analysis
6. MBT Corporation recently announced a 15% increase in earnings per share (EPS) over the previous period. The consensus expectation of financial analysts had been an increase in EPS of 10%. After the earnings announcement the value of MBT common stock increased each day for the next five trading days, as analysts and investors gradually reacted to the better than expected news. This gradual change in the value of the stock is an example of:
 - a. Speculation
 - b. Efficient markets
 - c. Inefficient markets
7. Company XYZ recently announced a significant increase in its research and development (R&D) expenses. As an equity researcher, what effect would you expect this announcement to have on the company's future prospects?
 - a. It indicates a potential decline in innovation and technological advancements.
 - b. It suggests an improved competitive advantage and future growth potential.
 - c. It has no bearing on the company's financial performance or stock price.
 - d. It signals increased regulatory scrutiny and potential legal challenges.
8. In economic analysis, which technique involves using a set of selected economic indicators, such as stock market performance, unemployment rate, and consumer spending, to predict future economic conditions?

- a. Anticipatory Surveys
 - b. Barometer/Indicator Approach
 - c. Economic Model Building Approach
 - d. Time-Series Analysis
9. According to Dow theory, If the cyclical swings of the stock market averages are successively higher and the successive lows are higher,
- a. Market is in uptrend and is bullish
 - b. Market is in downtrend and is bearish
 - c. Market is in uptrend and is bearish
 - d. Market is in downtrend and is bullish
10. According to Elliott Wave Theory, one complete cycle consists of how many waves?
- a. 3 Waves
 - b. 5 Waves
 - c. 8 Waves
11. According to Elliott Wave Theory, _____ shall move in the direction of the basic movement
- a. Impulsive patterns
 - b. Corrective patterns
 - c. Reactive patterns
12. Which of the following factors do not form part of fundamental Analysis?
- a. Economy Analysis
 - b. Demand/Supply of stock
 - c. Industry Analysis
 - d. Company Analysis
13. What is the significance of "secondary movements" in Dow Theory?
- a. They indicate short-term price fluctuations that are irrelevant to the overall market trend.
 - b. They confirm the beginning of a new primary trend in the market.
 - c. They suggest potential reversals in the primary trend, lasting a few weeks to a few months.
 - d. They represent extreme market volatility and should be ignored in technical analysis.
14. In industry analysis, a high industry concentration ratio (percentage of market share held by the largest firms) is an indication of:
- a. Low competition with few dominant firms
 - b. High competition with many small firms
 - c. Balanced competition with equal market shares
 - d. Moderate competition with medium-sized firms
15. Which type of economic indicator is classified as a "lagging indicator" in the barometer/indicator approach and is used to confirm or validate trends in the economy?
- a. Consumer Confidence Index (CCI)
 - b. Gross Domestic Product (GDP)
 - c. Average Weekly Hours of Work
 - d. Retail Sales
16. In the context of the Random Walk Theory, which of the following concepts implies that stock prices reflect both current information and future expectations?
- a. Efficient Market Hypothesis
 - b. Behavioral Finance Theory
 - c. Mean Reversion

- d. Technical Analysis
17. Company ABC recently released its quarterly earnings report, surpassing market expectations. However, the stock price experienced a significant drop immediately after the announcement. What could be a possible explanation for this price movement?
- Investors anticipated the positive earnings and had already priced them into the stock.
 - The company's management provided a weak guidance for future earnings.
 - The stock market, in general, experienced a downturn at the same time.
 - The earnings report contained errors, leading to a loss of investor confidence.
18. The random walk theory is a key concept in the Efficient Market Hypothesis (EMH). According to this theory, which of the following statements is true?
- Future stock price movements can be predicted based on past price patterns.
 - Stock prices follow a predictable upward or downward trend.
 - Stock price movements are independent of each other and cannot be reliably predicted.
 - Stock prices fluctuate randomly, but with a clear underlying pattern.
19. Shares of certain business houses command a higher premium than those of similar companies managed by other business houses due to _____
- Competitive advantage
 - Growth record
 - Quality of management
 - Goodwill
20. Which of the following statements is consistent with the implications of the Random Walk Theory on investment strategies?
- Passive investing through index funds is more effective than active stock picking.
 - Fundamental analysis can reliably identify undervalued stocks with future price appreciation.
 - Technical analysis can predict future stock price movements based on historical price patterns.
 - Market timing strategies can outperform the market by predicting short-term price movements.
21. A company's financial statements show a significant increase in its accounts receivable balance compared to previous periods. What would be a prudent action for an analyst conducting fundamental analysis?
- Consider it a positive sign of increasing sales and future profitability.
 - Investigate further to determine if there are any underlying issues with revenue recognition or collection
 - Ignore the accounts receivable balance and focus on other financial ratios
 - Assume it is a temporary fluctuation and does not impact the company's financial health.
22. A technical analyst is using moving averages to identify potential buy or sell signals. The analyst observes that the stock price of Company XYZ has recently crossed above its 50-day moving average. Which interpretation is most likely based on this observation?
- Bullish signal indicating a potential uptrend in the stock.
 - Bearish signal indicating a potential downtrend in the stock.
 - Neutral signal indicating the stock is likely to trade sideways.
 - Inconclusive signal requiring further analysis of other indicators.
23. Technical analysis involves the study of price patterns and trends in historical stock data. Which assumption underlies the principles of technical analysis?

- a. The market is always efficient, and all available information is already priced into the stock.
 - b. Historical price and volume patterns can provide insights into future price movements.
 - c. Stocks with low price-to-earnings (P/E) ratios tend to outperform those with high P/E ratios.
 - d. Fundamental analysis is more reliable than technical analysis for predicting stock prices
24. Which chart type is the simplest and least informative, displaying only the closing prices of a security over time without showing any high, low, or open prices?
- a. Line chart
 - b. Bar chart
 - c. Japanese Candlestick Chart
 - d. Point and Figure Chart
25. An equity analyst is evaluating a company's financial performance using fundamental analysis. The analyst examines the company's income statement, balance sheet, and cash flow statement over the past five years. Additionally, the analyst analyzes the company's industry position, competitive advantage, and growth prospects. What tool or method is the analyst primarily using to assess the company's investment potential?
- a. Price-earnings (P/E) ratio and dividend yield analysis.
 - b. Discounted cash flow (DCF) valuation model.
 - c. Relative valuation by comparing the company's financial ratios to industry peers.
 - d. SWOT analysis (Strengths, Weaknesses, Opportunities, Threats).
26. In a Candlestick Chart, White Candlestick indicates a _____ trend and a black candlestick indicates a _____
- a. Bullish trend and no change
 - b. Bearish trend and no change
 - c. Bullish trend and bearish trend
 - d. Bearish trend and Bullish trend
27. Compute the Relative Strength index from the following information:
- | | |
|--------------------------------|-------|
| Average gain over last 14 days | 8.00 |
| Average loss over last 14 days | 10.00 |
- a. 55.56
 - b. 44.44
 - c. 100.00
 - d. 80.00
28. In a highly efficient market, such as the one described by the Efficient Market Hypothesis (EMH), what would be the most likely outcome for an investor attempting to consistently outperform the market?
- a. The investor will be able to identify undervalued stocks and generate abnormal returns.
 - b. The investor will achieve average market returns but not outperform the overall market.
 - c. The investor's portfolio will be in line with the market index and exhibit low volatility.
 - d. The investor will be unsuccessful in consistently outperforming the market due to market efficiency.
29. Simple moving average of Sensex for the month of December 2022 is 60,000. You are planning to evaluate the technical strength through EMA. The value of exponent is 0.125. Sensex for 1st trading day stood at 61,000. What would be the new EMA by end of 1st trading day?
- a. 61,000
 - b. 60,000
 - c. 60,125
 - d. 59,875

30. Fundamental analysis is useful for _____ and technical analysis is useful for _____
- Long-term investing and short-term investing
 - Short-term investing and long-term investing
31. Company XYZ is a well-established player in the technology sector. Recently, the company announced a breakthrough innovation in renewable energy technology, which has the potential to disrupt the industry. Analysts predict that this innovation will lead to a significant increase in the company's profits and market share. As an investor analyzing Company XYZ's stock, which approach is most appropriate?
- Fundamental analysis, focusing on the company's financial statements and industry trends.
 - Technical analysis, using charting techniques to identify price patterns and entry/exit points.
 - Efficient Market Hypothesis, assuming that the market has already priced in the impact of the innovation.
 - Equity research, examining analyst reports and consensus estimates for the company's future prospects.
32. Compute the confidence index from the following information:
- | | |
|---------------------------|------|
| Yield on high-grade bonds | 6.00 |
| Yield on low-grade bonds | 9.00 |
- 150%
 - 66.67%
 - 60.00%
 - 90.00%
33. Support and resistance levels are essential concepts in technical analysis, representing key price levels at which a stock's price often experiences a halt in its movement. Which of the following statements best describes support levels?
- Support levels are price levels where a stock tends to encounter selling pressure, preventing further upward movement.
 - Support levels are price levels where a stock tends to encounter buying interest, preventing further downward movement.
 - Support levels are price levels where a stock's trading volume is at its lowest, indicating a lack of market interest.
 - Support levels are price levels where a stock's price experiences significant volatility, making it challenging to predict future movements.
34. According to the efficient market hypothesis, which form of market efficiency suggests that even private information cannot be used to consistently earn abnormal returns?
- Weak form efficiency
 - Semi-strong form efficiency
 - Strong form efficiency
 - Adaptive form efficiency
35. When analyzing a company's financial statements, which of the following ratios would provide insights into its profitability and operational efficiency?
- Return on assets (ROA)
 - Price-earnings (P/E) ratio
 - Debt-to-equity ratio
 - Moving average convergence divergence (MACD)
36. Which of the following statements best describes the Breadth Index in the context of the stock market?

- a. The Breadth Index is a technical indicator that measures the strength of a specific sector within the stock market.
- b. The Breadth Index is a fundamental analysis tool that evaluates the financial health of individual companies.
- c. The Breadth Index is a sentiment indicator that measures the overall optimism or pessimism of investors in the market.
- d. The Breadth Index is a breadth indicator that gauges the participation of individual stocks in a market advance or decline.
37. An investor is using exponential moving average for the purpose of technical analysis. What is the value of exponent for 10 days EMA?
- a. 0.2000
- b. 0.1818
- c. 0.2222
- d. 0.4000
38. You have decided to do run-test to check the weak form of efficiency. Number of positive changes = 8 and Number of negative changes = 6. How much is the expected mean of runs?
- a. 7
- b. 7.86
- c. 7.58
- d. 8.00
39. A technical analyst is analyzing a stock's price movements using various technical indicators and chart patterns. Which principle suggests that the stock's price already reflects all available information and, therefore, no further analysis is required?
- a. The Dow Theory
- b. The Random Walk Theory
- c. The Efficient Market Hypothesis
- d. The Elliot Wave Theory
40. A company's stock price has experienced a sudden and significant increase in volume accompanied by a sharp decline in price. What can this combination of price and volume indicate?
- a. Bullish signal
- b. Bearish signal
- c. Trend reversal
- d. Price consolidation
41. Compute breadth index from the following information
- | | |
|--------------------------------|----|
| Number of securities advanced | 25 |
| Number of securities declined | 20 |
| Number of securities unchanged | 5 |
- a. 0.11
- b. 0.10
- c. 0.50
- d. 5.00
42. Which chart type is specifically designed to filter out minor price movements and focuses solely on significant price changes to reveal clear trend directions?
- a. Line Chart
- b. Bar Chart
- c. Japanese Candlestick Chart
- d. Point and figure chart

43. According to the efficient market hypothesis, which form of market efficiency suggests that all publicly available information, including historical price data and fundamental analysis, is already reflected in the current stock prices?
- Weak form efficiency
 - Semi-strong form efficiency
 - Strong form efficiency
 - Adaptive form efficiency
44. Which of the following factors could weaken a resistance level and increase the likelihood of a breakout in a stock's price?
- The stock's trading volume decreases significantly around the resistance level.
 - Positive news or strong earnings reports are released, boosting investor confidence.
 - The stock price approaches the resistance level with a sharp uptrend.
 - Technical indicators show the stock is overbought and due for a correction.
45. According to the efficient market hypothesis, which form of market efficiency suggests that all relevant information, whether public or private, is already incorporated into stock prices?
- Weak form efficiency
 - Semi-strong form efficiency
 - Strong form efficiency
 - Adaptive form efficiency
46. Which of the following statements about market efficiency is least accurate?
- The strong-form EMH assumes cost free availability of all information, both public and private.
 - The semi-strong form EMH addresses market and non-market public information
 - The weak-form EMH suggests that fundamental analysis will not provide excess returns while the semi-strong form suggests that technical analysis cannot achieve excess returns.
47. Which of the following would be inconsistent with an efficient market?
- Price changes are independent
 - Price adjustments are biased
 - Stock prices adjust rapidly to new information
48. Which of the following forms of the EMH assumes that no group of investors has monopolistic access to relevant information?
- Weak-form
 - Strong-form
 - Semi-strong form
 - Both weak and semi-strong form
49. A support level is the price range at which a technical analyst would expect the:
- supply of a stock to decrease substantially
 - demand for a stock to decrease substantially
 - demand for a stock to increase substantially
50. Elliott wave theory describes the typical pattern of price movements as:
- five waves with the direction of the trend, followed by four waves against the direction of the trend
 - five waves with the direction of the trend, followed by three waves against the direction of the trend
 - four waves with the direction of the trend, followed by three waves against the direction of the trend.

- d. Three waves with the direction of the trend, followed by five waves against the direction of the trend.

51. A technical analysis chart that illustrates only the closing prices of a security on each trading day is best described as a:
- Line Chart
 - Bar Chart
 - Point and Figure Chart
 - Candlestick Chart

Answer:

1.	The RSI indicates the level of buying or selling pressure in the market
2.	Identifying undervalued stocks for potential long-term investments
3.	Stock prices reflect all available information and are always fairly valued
4.	It suggests a potential buying opportunity
5.	Fundamental Analysis and Technical Analysis
6.	Inefficient markets Explanation: A critical element of efficient markets is that asset prices respond immediately to any new information that will affect their value. Large numbers of traders responding in similar fashion to the new information will create a temporary imbalance in supply and demand, and this will adjust asset market values
7.	It suggests an improved competitive advantage and future growth potential
8.	Barometer/Indicator Approach
9.	Market is in uptrend and is bullish
10.	8 Waves
11.	Impulsive patterns
12.	Demand/Supply of stock
13.	They suggest potential reversals in the primary trend, lasting a few weeks to a few months.
14.	Low competition with few dominant firms
15.	Retail sales. Explanation: Retail Sales is classified as a lagging indicator in the barometer/indicator approach. Lagging indicators reflect changes that have already occurred in the economy and are used to confirm or validate trends. Retail sales data measures the total sales of goods and services by retailers and provides insights into consumer spending behavior. As consumer spending is a significant driver of economic growth, changes in retail sales can be used to validate or confirm the current state of the economy. For example, a decline in retail sales may confirm a period of economic slowdown or recession that has already occurred.
16.	Efficient Market Hypothesis
17.	Investors anticipated the positive earnings and had already priced them into the stock.
18.	Stock price movements are independent of each other and cannot be reliably predicted.
19.	Quality of management – This is an intangible factor and the most important factor in company analysis
20.	Passive investing through index funds is more effective than active stock picking Explanation: The Random Walk Theory suggests that stock prices are random and cannot be predicted with a high degree of accuracy. As a result, passive investing through index funds, which aim to replicate the performance of a specific market index, is considered more effective than active stock picking
21.	Investigate further to determine if there are any underlying issues with revenue recognition or collection
22.	Bullish signal indicating a potential uptrend in the stock.
23.	Historical price and volume patterns can provide insights into future price movements.
24.	Line Chart
25.	Discounted cash flow (DCF) valuation model
26.	Bullish trend and bearish trend
27.	Relative Strength = $\frac{\text{Average gain}}{\text{Average loss}} = \frac{8}{10} = 0.80$

	Relative Strength Index = $100 - \left(\frac{100}{1 + RS} \right) = 100 - \left(\frac{100}{1 + 0.80} \right) = 100 - 55.56 = 44.44$
28.	The investor will be unsuccessful in consistently outperforming the market due to market efficiency
29.	EMA Adjustment = [Sensex on day 1 - old EMA] x EMA exponent EMA Adjustment = [61,000 - 60,000] x 0.125 = 125 New EMA = Old EMA + EMA Adjustment = 60,000 + 125 = 60,125
30.	Long-term investing and short-term investing
31.	Fundamental analysis, focusing on the company's financial statements and industry trends
32.	Confidence index = $\frac{\text{Yield on high grade bonds}}{\text{Yield on low grade bonds}} \times 100 = \frac{6}{9} \times 100 = 66.67\%$
33.	Support levels are price levels where a stock tends to encounter buying interest, preventing further downward movement
34.	Strong Form Efficiency
35.	Return on assets (ROA)
36.	The Breadth Index is a breadth indicator that gauges the participation of individual stocks in a market advance or decline.
37.	Exponent = $\frac{2}{n+1} = \frac{2}{10+1} = 0.1818$
38.	Expected mean of runs = $\frac{2n_1n_2}{n_1+n_2} + 1 = \frac{2 \times 8 \times 6}{8+6} + 1 = 7.86$
39.	Efficient market Hypothesis
40.	Bearish signal
41.	Breadth index = $\frac{\text{Number of securities advanced} - \text{Number of securities declined}}{\text{Total number of securities}} = \frac{25 - 20}{25 + 20 + 5}$ Breadth index = 0.10
42.	Point and figure chart Explanation: Point and figure charts are specifically designed to filter out minor price movements and focus solely on significant price changes. These charts represent price movements as "X" and "O" columns, where "X" represents upward price movements, and "O" represents downward price movements. The chart ignores the time axis and plots only when a predefined price movement occurs. This filtering technique helps traders identify clear trend directions and significant price levels without the noise of minor fluctuations. Point and figure charts are popular among technical analysts who prioritize trend analysis and wish to avoid unnecessary distractions from minor price movements.
43.	Semi-strong form efficiency
44.	Positive news or strong earnings reports are released, boosting investor confidence
45.	Strong form efficiency
46.	The weak-form EMH suggests that fundamental analysis will not provide excess returns while the semi-strong form suggests that technical analysis cannot achieve excess returns. Explanation: The weak-form EMH suggests that technical analysis will not provide excess returns while the semi-strong form suggests that fundamental analysis cannot achieve excess returns. The weak-form EMH assumes the price of a security reflects all currently available historical information. Thus, the past price and volume of trading has no relationship with the future, hence technical analysis is not useful in achieving superior returns.
47.	Price adjustments are biased Explanation: Market efficiency assumes that investors adjust their estimates of security prices rapidly to reflect their unbiased interpretation of the new information. New information arrives randomly and independently. Therefore, price changes are independent
48.	Strong-form Explanation: According to the strong-form EMH, security prices reflect all information, which includes the privately available (monopolistic) information.
49.	Demand for a stock to increase substantially Explanation: Most stock prices remain relatively stable and fluctuate up and down from their true value. The lower limit to these fluctuations is called a support level - the price range where a stock appears cheap and attracts buyers. The upper limit is called a resistance level - the price range where a stock appears expensive and initiates selling

50.	According to Elliott wave theory, prices tend to move in five waves with the direction of the trend and three waves against the direction of the trend
51.	Line chart

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Chapter 5 – Security Valuation

1. Share price on January 1 (Purchase date) = Rs.40; Share price on December 31 = Rs.45; Dividend paid (December 31) = Rs.5; Cost of equity = 11%; Cost of debt = 8%; Debt: Equity = 1:3. What is the holding period return (ignore taxes)?
 - a. 25.00%
 - b. 12.50%
 - c. 22.50%
 - d. 14.00%
2. Total earnings = 1,00,000; No of equity shares = 1,00,000 of Rs.10 each; Price Earning Multiple = 8 times. The company is currently following 100% payout ratio. What should be the optimum payout ratio as per Walter's Model?
 - a. 0%
 - b. 100%
 - c. Indifferent
3. You want to deposit Rs.10,000 in a bank certificate of deposit (CD). You are considering the following banks:
 - Bank A offers 5.85% annual interest compounded annually
 - Bank B offers 5.75% annual interest rate compounded monthly
 - Bank C offers 5.70% annual interest compounded daily

Which bank offers the highest effective annual interest rate and how much?

- a) Bank C, 5.87%
 - b) Bank A, 5.85%
 - c) Bank B, 5.90%
 - d) Bank B, 5.80%
4. Profit before Tax = 10,00,000; Tax Rate = 50%; No of equity shares of Rs.10 each = 50,000; 10% Preference capital = 10,00,000; Reserves and Surplus = Rs.45,00,000; Fictitious assets = 10,00,000. How much is ROE?
 - a. 80%
 - b. 8%
 - c. 40%
 - d. 10%
 5. Compute the value of a perpetual bond which would pay Rs.100 beginning four years from now. Required return is 10%.
 - a. Rs.751
 - b. Rs.1,000
 - c. Rs.683
 - d. Rs.909
 6. The company has paid out Dividend of Rs.3 per share based on payout ratio of 50%. Earnings and Dividend will grow at 20 percent for four years. Growth will fall to 10 percent in year 5 and dividend payout ratio will increase to 60%. Cost of equity of the company is 20%. What should be the MPS at the end of year 5?
 - a. Rs.90.30
 - b. Rs.75.20
 - c. Rs.82.10
 - d. Rs.68.40

7. Investors' required rate of return is _____?
 - a. Cost of equity

- b. Return on equity
 - c. Internal Rate of Return
8. EPS = Rs.10; Payout ratio = 25%; Cost of equity = 10%; Return on equity = 5%. What is the price of share as per Walter's model?
- a. Rs.100
 - b. Rs.200
 - c. Rs.175
 - d. Rs.62.50
9. The current share price is Rs.100. Long term growth of 8% is expected. Company is expected to pay a dividend of Rs.4 per share next year. What rate of return does an investor expect?
- a. 8%
 - b. 12%
 - c. 12.32%
 - d. 4.32%
10. Book value per share = Rs.100; DPS = Rs.4; Payout ratio = 25%. How much is ROE?
- a. 4%
 - b. 1%
 - c. 16%
 - d. 8%
11. The share price of ABC Limited is Rs.5 per share. There are 50 lac shares outstanding and the company has a book value of Rs.900 lacs. What is the book value per share (BVPS) after the share buyback of Rs.10 lacs?
- a. Rs.18.54
 - b. Rs.21.24
 - c. Rs.14.76
 - d. Rs.18.00
12. The company is paying Dividend of Rs.2 per share. Dividends are currently taxable and investor expects return of 10%. Tax rate is 20%. Dividends have now become exempt but due to imposition of DDT dividend is expected to be 1.80. What will be the price before and after imposition of DDT?
- a. Rs.20 and Rs.18
 - b. Rs.16 and Rs.18
 - c. Rs.20 and Rs.22.5
 - d. Rs.16 and Rs.22.5
13. EPS (100% payout) = Rs.10; MPS = Rs.100. The company is fully equity financed. The company plans to do a project Rs.1 Cr at end of year 1. It will generate Rs.21 lacs from year 2 onwards. How much is project NPV?
- a. Rs.1.1 Crores
 - b. Rs.1 Crores
 - c. Negative 79 lacs
 - d. None of the above
14. Dividend per share is Rs.2. An investor owns 500 shares of company. He wants to continue to earn same amount of dividend income ever year. Dividends will not be paid for next three years. Dividend of year 4 is likely to be Rs.2.50. Growth rate is 7% and cost of equity is 8%. How many shares are to be sold in year 2 to get the minimum amount?
- a. 4 shares
 - b. 3 shares

- c. 8 shares
 - d. 5 shares
15. IRR of company = 20%; Investor's required rate of return = 15%; Dividend = Rs.2 per share; EPS = Rs.5 per share. What will be the growth rate?
- a. 8%
 - b. 12%
 - c. 6%
 - d. 9%
16. Return on equity = 20%; Cost of equity = 15%; EPS = 10. What will be the limiting value as per walter's model?
- a. 50
 - b. 66.67
 - c. 88.89
 - d. 60
17. MPS of company = Rs.100; EPS of company = Rs.8; Cost of equity = 10%. What is present value of growth opportunities?
- a. 80
 - b. 20
 - c. 100
 - d. 50
18. CMP = 100; Existing shares = 1,00,000; Rights ratio = 1:4; Rights price = 60. What will be the ex-rights price?
- a. 100
 - b. 92
 - c. 80
 - d. 160
19. Existing EPS = 10; No of shares = 1,00,000. PE Multiple = 20. The company does buyback of 20 percent of shares at a premium of 50% to CMP. The same is funded with 10% debt. Tax rate is 30%. What will be the new EPS?
- a. 5
 - b. 7.25
 - c. 10
 - d. 12.50
20. CMP of stock = 50; Rights issue price = 40; Rights ratio = 1:5; what is the value of a right when the stock sells ex-rights at 50?
- a. 8.33
 - b. 10
 - c. None of the above
21. CMP = Rs.130; No of shares outstanding = 10 lacs; Company needs to raise 2 Crores for a new project. What will be the ex-rights price if the firm offers rights in the ratio of 1:2?
- a. 130
 - b. 93.33
 - c. 100
 - d. 150

22. The current share price is Rs.100. The rights ratio is 1:4. Rights price is 80. Mr.A hold 1,000 shares and has neither subscribed nor sold rights? What will be the change in networth of Mr A?
- No Change
 - Networth to improve by Rs.1,00,000
 - Networth to fall by Rs.1,00,000
 - Networth to fall by Rs.4,000
23. No of shares = 10,000; Share price = Rs.100; Buyback size = 50,000; Current EPS = 3; What will be the post-buyback EPS if the PAT is maintained?
- 3
 - 3.16
 - 2.85
 - 3.30
24. PE Multiple of company = 12 times. Company does a project which cost 200 lacs. Company is expected to earn 8 percent on the project. What will be the project NPV?
- 192 lacs
 - 16 lacs
 - Negative 8 lacs
 - 8 Lacs
25. Surplus cash = 10 lacs; Buyback size = 30 percent of surplus cash. Current EPS = Rs.10; Current PE multiple = 15 Times. The company plans to do buyback at 20 times of current EPS. How many shares will be bought back?
- 2,000 shares
 - 6,667 shares
 - 1,500 shares
 - 5,000 shares
26. Rights issue is made to _____ shareholders and is normally made at price which is _____ than current market price.
- New; higher
 - New; lower
 - Existing; higher
 - Existing; lower
27. The cum dividend price of share is Rs.11 (including dividend of Rs.1). Growth rate is 5%. What is cost of equity?
- 15.5%
 - 14.55%
 - 15%
 - 14.09%
28. Current market price = Rs.100; Ex-rights price = 80; Rights issue price = Rs.40. What is the rights ratio?
- One right share for every one share held
 - One right share for every two shares held
 - Two rights share for every one share held
 - None of the above
29. The current share price is Rs.100. Investor required rate of return is 15 percent. Company plans to pay a Dividend of Rs.25. What is the likely price at end of year?
- 100

- b. 115
c. 90
d. 125
30. Dividends will grow at 20 percent for four years. Growth will have a linear fall and stabilize at 14 percent. What will be the dividend growth in 6th year?
a. 20 percent
b. 14 percent
c. 19 percent
d. 18 percent
31. Dividends will grow at 20 percent for four years. Growth will have a linear fall and stabilize at 14 percent in year 7. What will be the dividend growth in 6th year?
a. 20 percent
b. 18 percent
c. 16 percent
d. 14 percent
32. Dividend of 1996 = Rs.2.115; Dividend of 2002 = Rs.3. The company's earnings and dividend have experience constant growth. What will be the growth rate in dividends using below information?
PVF of 5% for 6 years = 0.746; PVF of 6% for 6 years = 0.705; PVF of 7% for 6 years = 0.666
a. 5%
b. 6%
c. 7%
d. None of the above
33. Beta of company = 1.5; Beta will increase to 2 times after 5 years. $R_f = 5\%$; $R_m = 11\%$. Last year dividend = 10. DPS will grow at 10 percent for 5 years and DPS will grow at 4 percent after 6th year. What will be the value of the share at end of year 5?
a. 167.40
b. 128.77
c. 115
d. 161
34. Capital gearing ratio of industry = 0.75; Equity share capital of company A = 100; R&S of company = 50; Preference capital = 100; Debt = 200; Required return of industry = 10%. Required return is to be changed by 2 bps for every 1 bps deviation in capital gearing. What is the required return for company A?
a. 12.50%
b. 11.25%
c. 8.75%
d. 7.50%
35. Mr.A plans to buy shares of company A. The company is expected to give bonus of 1:5 in fourth year. The share is expected to be sold in 7th year at expected price of Rs.900 each. Incidental expense on sale of share is 5%. What will be the net realization per share on sale?
a. 855
b. 900
c. 1080
d. 1026
36. Present value of future cash inflows = 525. The investor has to be pay 5 percent brokerage on purchase of share. What shall be the maximum purchase price of share?

- a. 525
b. 500
c. 498.75
d. 551.25
37. EPS = 10; Depreciation per share = 20; Capex per share = 30; WC increase per share = 2; Debt ratio = 0.60. What will be FCFE per share?
a. 10
b. -2
c. 5.2
d. 2.8
38. Beta of company is 1.50 Times. Risk free rate = 10%; Risk premium of market = 20%. Beta will increase to 1.75 Times. How much is the increase in cost of equity due to increase in Beta?
a. 2.50%
b. 5.00%
c. 7.50%
d. 10.00%
39. Inflation rate = 6%; Real rate of return on investment in A Limited (risky asset) = 10%; Risk premium of A Limited = 4%. What is the risk-free rate of return?
a. 6%
b. 16%
c. 10%
d. 12%
40. The company has paid a dividend of Rs.10 per share. It was at a payout ratio of 25%. Earnings will grow at 20%. Payout ratio will increase to 60% in year 7. What would be the dividend per share in year 5?
a. 24.88
b. 6.22
c. 49.77
d. 99.53
41. DPS (D0) = Rs.10; Payout ratio = 50%; Current PE Multiple = 10 Times. What is the implied growth rate if cost of equity is 20%?
a. 14.92%
b. 15.00%
c. 14.29%
d. None of the above
42. Cum-dividend price of share = Rs.400; Dividend = Rs.20. Five shares underly each GDR. Shares will be priced at discount of 20%. Exchange rate is Rs.100/USD. what is the net realization (in USD) per GDR if floatation cost is 5%?
a. 16
b. 15.20
c. 14.44
d. None of the above
43. Net Amount to be raised = 10,00,000; Issue expenses = 5%. What is the gross amount to be raised?
a. 9,50,000
b. 10,50,000
c. 10,52,632

- d. 9,52,381
44. Earnings of previous year = Rs.10; Earnings growth of year 1 = 10% and growth rate will decrease by 1% per year. PE Multiple of year 5 = 20 Times. What is the likely price at end of year 5?
- 293.80
 - 322
 - 200
 - 250
45. Current capital employed = 2,000 lacs; Current EBIT = 200 lacs. The company plans to raise Rs.400 lacs in the form of debt or equity. Return is expected to increase by 2%. What will be the new EBIT of next year?
- 200 lacs
 - 240 lacs
 - 288 lacs
 - 204 lacs
46. Industry sales = 2,000 lacs; ABC's market share = 25%; GP margin = 40%; Expenses other than COGS is half of COGS. For the next year industry will grow by 10% and ABC's market share will increase to 30%. What will be the PAT of next year?
- 50 lacs
 - 66 lacs
 - 200 lacs
 - 264 lacs
47. Dividends are likely to grow at around 20 percent. Current market price of share is Rs.68.20. Share is likely to quote at Rs.100 in year 4. Return required by shareholders is 20%. Compute Current dividend per share (D₀). PVF of year 1 is 0.833; PVF of year 2 is 0.94; PVF of year 3 is 0.579; PVF of year 4 is 0.482.
- 7.95
 - 3.84
 - 5.00
 - None of the above
48. Face value of bond = Rs.100; Rate of interest on bond = 8%; Return on similar bonds = 9.5%. Term = 4 years. Bond is convertible into 5 shares. CMP of equity share = 15. What is bond's conversion value?
- 100
 - 95.24
 - 75
 - 15
49. Face value of bond = Rs.100; CMP of bond = Rs.100 Rate of interest on bond = 8%; Return on similar bonds = 9.5%. Term = 4 years. Bond is convertible into 5 shares. CMP of equity share = 15. What is bond's conversion premium per share?
- 20
 - 15
 - 5
 - 25
50. Face value of bond = Rs.100; CMP of bond = Rs.100; Rate of interest on bond = 8%; Return on similar bonds = 9.5%. Term = 4 years. Bond is convertible into 5 shares. CMP of equity share = 15. What is conversion parity price?
- 20

- b. 15
 - c. 100
 - d. 10
51. Face value of bond = Rs.100; Rate of interest on bond = 8%; Return on similar bonds = 9.5%. Term = 4 years. Bond is convertible into 5 shares. CMP of equity share = 15. What is bond's straight value?
- a. 100
 - b. 75
 - c. 95.26
 - d. 89.67
52. Face value of bond = Rs.100; CMP of bond = Rs.100; Rate of interest on bond = 8%; Return on similar bonds = 9.5%. Term = 4 years. Bond is convertible into 5 shares. CMP of equity share = 15. What is downside risk (in Rs.)?
- a. 0
 - b. 10.33
 - c. 5.78
 - d. 25
53. Face value of bond = Rs.100; Interest rate on bond = 10%. Bond is convertible into 10 shares. Likely dividend per share is Rs.0.2. What is favorable income differential per share?
- a. 9.80
 - b. 0.20
 - c. 0.80
 - d. 8.00
54. Existing EPS = Rs.2; Existing no of shares = 1,00,000. Company plans to issue 7% preference capital of Rs.10,00,000. What should be the increase in earnings post preference issue to maintain EPS?
- a. No change required
 - b. Increase by 7%
 - c. Increase by 35%
 - d. Increase by 70%
55. Conversion premium per bond = Rs.100. One bond is convertible into 10 shares. Favorable income differential per share = Rs.4. How much is the premium payback period?
- a. 25 years
 - b. 2.5 years
 - c. 10 years
 - d. None of the above
56. Face value = Rs.1,000; Rate of interest = 10%. The bond is convertible into 10 equity shares whose current market price is Rs.80. Growth rate in equity share is 10%. What will be the terminal cash flow at end of year 5?
- a. 800
 - b. 1,000
 - c. 1,288.41
 - d. None of the above
57. CMP of bond = Rs.1,200. One bond is convertible into 10 shares. CMP of share is Rs.125. Should the investor opt for conversion?
- a. Yes
 - b. No
 - c. Investor would be indifferent on conversion

58. The nominal value of 10% bond is Rs.100. The redeemable value is Rs.120 in two years. Investor's expected rate of return is 14%. What should be the value of bond?
- 140
 - 71.43
 - 108.74
 - 104
59. The company needs to earn income of Rs.7.38 crores on 100 crores to earn its target return after paying management expenses of 10% of amount of income generated. What is the gross amount to be earned?
- 7.38 crores
 - 6.64 crores
 - 8.20 crores
 - None of the above
60. YTM of convertible bond = 10.76%. Yield of comparable bond is 9%. What is the spread of yield of convertible bond from that of comparable bond?
- 10.76%
 - 9.00%
 - +1.76%
 - 1.76%
61. A company issues a variable bond where interest rate changes based on prevailing interest rates. Bond was issued when interest rate was 10%. It has remaining life of two years and the interest rate is now 8%. What will be the value of bond today if face value is Rs.1000?
- 1,000
 - 1,035.30
 - 900
 - None of the above
62. You have invested in 8.5% bond with face value of Rs.1,000. Reinvestment rate is 10 percent and has 3 years to maturity. What is the reinvested interest on this bond
- 26.35
 - 54.48
 - 309.48
 - 281.35
63. Duration of portfolio is 8 years. Yield is expected to increase in current year. Which action should be taken by the investor?
- No action to be taken
 - Increase investment in lower duration bonds by selling higher duration bonds
 - Increase investment in higher duration bonds by selling lower duration bonds
 - Increase investment in both higher and lower duration bonds
64. The current market price of bond is Rs.140. Bond is convertible into 20 shares. At what price should the investor opt for conversion?
- 5
 - 6
 - 8
 - None of the above

65. 11% preference shares of Rs.100 is currently quoted at yield of 13%. What should be the current market price?
- 100
 - 84.62
 - 118.18
 - None of the above
66. Net depreciated value of mortgage assets should be twice the value of debt. Company currently has debt of Rs.8 Crores and mortgaged assets of Rs.30 Crores. New debt taken will be deployed 50 percent towards purchase of mortgaged assets. How much debt can the company raise?
- 7 Crores
 - 9.33 Crores
 - 52 crores
 - None of the above
67. 10% bond was issued with life of 10 years. There was a clause to redeem/extend the bond by 5 years at the end of year 5. Interest rates at end of year 5 is 12%. What action will be taken by company at end of year 5?
- Company will extend the bond by 5 years
 - Company will redeem the bond
68. 10% bond pays interest in September and March of every year. Face value is Rs.100. YTM is 12%. What will be current market price with balance life of 2 years?
- 96.6
 - 107.33
 - 96.53
 - 109.89
69. Duration of half-yearly bond = 5.85 years; YTM = 10%. What will be the volatility of bond?
- 5.32
 - 5.57
 - 6.44
 - 6.14
70. Volatility = 4.5. Yield is expected to increase by 25 bps. What will be the effect on current market price?
- Price will increase by 4.5%
 - Price will increase by 1.125%
 - Price will decrease by 4.5%
 - Price will decrease by 1.125%
71. Bond was issued 5 years ago with flotation cost of Rs.30 lacs. It has balance life of 25 years. Tax rate is 30%. Bond is to be replaced with new bond. What will be tax benefit on flotation cost?
- 9 lacs in day 0
 - 7.5 lacs in day 0
 - 30,000 for year 1 to year 30
 - 30,000 for year 1 to year 25
72. Face value of bond = Rs.200 lacs; Call premium = 10%. Balance life = 10 years. Tax rate = 20%. What will be the tax benefit on call premium?
- Rs.4 lacs in day 0
 - Rs.40,000 from year 1 to year 10
 - Rs.40 lacs in day 0

- d. Rs.4 lacs from Year 1 to Year 10
73. 10% Govt of India security is quoted at 125 (Face value of Rs.100). Yield is expected to go up by 1 percent. What will be the revised price?
- 90.91
 - 111.11
 - 100
 - None of the above
74. MP as on Jan 1, 2019 = Rs.100. Face value of Rs.100 and interest rate is 10%. Interest is payable half-yearly on June 30 and December 31. What will be price of the bond on Oct 1, 2019?
- 107.50
 - 100
 - 102.50
75. Treasury bill rate = 9%; Discount rate for A rated bond = T bill rate + 3%; Discount rate for AA rated bond = AAA rate + 1%; Discount rate for AAA rated bond = A rated bond - 2%. What should be the discount rate for AA rated bond?
- 9%
 - 12%
 - 11%
 - 10%
76. YTM of perpetual bond = 8%. What is its duration?
- 12.5 years
 - 8 years
 - 9 years
 - 13.5 years
77. Life of annuity bond = 4 years; Interest rate = 12%; Face value = Rs.1,000. What will be the annual cash flow?
- 250
 - 329.27
 - 370
78. 1 year interest rate = 10 percent; 2 year interest rate = 12 percent; What will be the forward rate of year 1?
- 14%
 - 11%
 - 14.04%
79. CMP of T-bill on March 31 = 95,000. Maturity date = July 20; Face value = 1,00,000. What is the yield on treasury bill?
- 5%
 - 5.26%
 - 16.44%
 - 17.30%
80. Duration of Bond A = 4 years; Duration of Bond B = 10 years; Investor needs money after 6 years. What should be the investment in Bond A and Bond B?
- 50% and 50%
 - 100% in Bond A
 - 66.67% in A and 33.33% in B

- d. 66.67% in B and 33.33% in A
81. Interest rate on Bond = 10%; YTM of bond = 12%; what will the bond quote at?
- Bond will quote at premium
 - Bond will quote at discount
 - Bond will quote at par
82. A security has required return of 25% and the expected return of the security is 20%. Identify the alpha of security and decide the action to be taken by investor.
- Positive Alpha and Buy security
 - Positive Alpha and Sell security
 - Negative Alpha and Buy security
 - Negative Alpha and sell security
83. 14% bond is quoted at Rs.90. what is current yield if interest is payable half-yearly?
- 14%
 - 7%
 - 7.78%
 - 15.56%
84. CMP of bond = Rs.1,000; Face value of bond = Rs.1,000; Interest rate on bond = 12%; YTM of bond = 15%. What will be the price at end of year 2?
- 1,000
 - 1064.50
 - 1,060
 - 940
85. Discount rate for year 1 = 10%. Discount rate increases by 2% per year. What will be the PVF for year 3?
- 0.751
 - 0.675
 - 0.712
 - None of the above
86. The company plans to issue 10% debentures. Yield on similar debenture is 15%. The company plans to issue in such a manner it gives 18% return to investors. What should be the discount rate for valuation of bond?
- 10%
 - 15%
 - 18%
87. Issue price of bond = Rs.80; Redemption value in year 5 = Rs.120; Face value of bond = Rs.100; Interest rate on bond = 10%; Tax rate on interest = 30%; Tax rate on capital gain = 20%. What will be the post-tax cash flow of year 5?
- 130
 - 120
 - 119
 - 123
88. Current interest coverage = 4 Times. EBIT will increase by 20% and interest will increase by 40%. What will be the revised interest coverage?
- Cannot be calculated
 - 4 Times

- c. 3.43 Times
 - d. 2.88 Times
89. You are investing money in Security X which has Beta of 2 Times. You are trying to assess the required return of Security X and want to compute the equity risk premium of Security X. What is the likely risk premium of Security X?
- a. Nil
 - b. Greater than market risk premium
 - c. Lower than market risk premium
 - d. Equal to market risk premium
90. Enterprise value of Infosys - 1,000 Crores. EBITDA of Infosys - 250 Crores. What should be the enterprise valuation of TCS if EBITDA of TCS is 50 Crores?
- a. 1000 Crores
 - b. 50 Crores
 - c. 200 Crores
 - d. 250 Crores
91. Core enterprise value is equal to _____?
- a. Total enterprise value - value of non-core assets
 - b. Operating enterprise value - investment in associates
 - c. Total enterprise value - value of non-core assets - investment in associates
92. TCS has preferred stock outstanding that pays an annual dividend of Rs.3.75 per share. If an investor wants to earn a rate of return of 8.5%, how much should he be willing to pay for a share of TCS?
- a. Rs.31.88
 - b. Rs.44.12
 - c. Rs.42.10
 - d. Rs.50.00
93. Book value of equity = 1000; Market value of equity = 2000; Reserves and surplus = 200; Value of debt = 800; Cash and cash equivalents = 400. How much is enterprise value?
- a. 1600
 - b. 2400
 - c. 2600
 - d. 1800
94. YTM of a bond instrument is 20% and the re-investment rate is 15%. What is the likely realized Yield of the bond?
- a. 20%
 - b. Greater than 20%
 - c. Less than 20%
95. EV to sales multiple of industry = 1.5 times; EV to EBITDA multiple of industry = 5 times; Sales of ABC Limited = 5,000; EBITDA of ABC Limited = 2,000; What should be the value of ABC Limited?
- a. 7,500
 - b. 10,000
 - c. 8,750
 - d. None of the above
96. PAT = 280 Crores; Tax Rate = 30%; Depreciation = 100 Crores; Interest = 500 Crores. Industry has EV to EBITDA multiple of 5 times. How much should be the enterprise value?
- a. 4,400 Crores

- b. 1,400 Crores
 - c. 5,000 Crores
 - d. 3,000 crores
97. Which of the following points is/are true about duration of bonds?
- (i) The shorter-maturity bond would have a lower duration and vice versa
 - (ii) The higher the coupon, the lower is the duration and vice versa
 - (iii) Higher YTM would lead to higher duration and lower YTM would lead to lower duration
- a) (i) and (ii) is correct
 - b) (i), (ii) and (iii) is correct
 - c) (i) and (iii) is correct
 - d) (ii) and (iii) is correct
98. Bank A entered into repo transaction at the rate of 8% on 12% GOI Bond, 2021. Clean price of the instrument is Rs.95 and face value is Rs.100. 240 days of accrued interest is applicable and number of days in a year is 360. What is the dirty price?
- a. 95
 - b. 100
 - c. 100.33
 - d. 103
99. Under an _____ yield curve, long-term interest rates will be lower than short-term interest rates
- a. Upward sloping
 - b. Downward sloping
 - c. Flat
 - d. Humped
100. Investment in A Limited earns return of 2% per quarter. The company has Rs.40,00,000 to invest and cost of making an investment is Rs.40,000. How much should be the investment period to break-even?
- a. 1.5 months
 - b. 3 months
 - c. 6 months
 - d. 12 months
101. Amount of face value for repo transaction = 4 crores. Initial margin = 5%. Clean price = Rs.98. Accrued interest = Rs.4. what is the first leg proceeds?
- a. 3.80 crores
 - b. 3.724 crores
 - c. 3.876 crores
 - d. None of the above
102. Interest cost of CP = 2.5 percent per quarter; Issue period of CP = 6 months; Stamp duty = 0.5 percent of issue size; Rating charges = 1 percent per annum; Other charges = 0.1 percent per month. How much is the overall annual cost of CP issue?
- a. 13.2 percent
 - b. 14.2 percent
 - c. 8.2 percent
 - d. 9.2 percent
103. An increase in interest rate in the market will have _____ impact on reinvestment and _____ impact on price
- a. Adverse and Adverse

- b. Favourable and Favourable
 - c. Favourable and Adverse
 - d. Adverse and Favourable
104. RBI Sold 91 days treasury bill of Rs.100 with yield of 12 percent. What is the issue price?
- a. 97.01
 - b. 97.10
 - c. 98.00
 - d. None of the above
105. ABC Limited has a leading price-to-earnings (P/E) ratio of 28 while the median leading P/E of a peer group of companies within the industry is 38. Based on the method of comparables, an analyst would most likely conclude that ABC Limited should be:
- a. bought as an undervalued stock
 - b. sold short as an overvalued stock
 - c. sold as an overvalued stock
 - d. bought as an overvalued stock
106. Face value of CP = 100 lacs; Interest expense on CP = 4 lacs; The firm is required to keep balance of Rs.5 lacs in line of credit. Issue period of CP = 6 months. What is the annual cost of CP?
- a. 8 percent
 - b. 8.33 percent
 - c. 8.79 percent
 - d. 19.78 percent
107. Bank A entered into repo on 12% GOI Bond. Initial proceeds is Rs.7,95,20,000. Repo period was for 14 days and rate of interest on repo is 5%. What is the amount to be repaid?
- a. 7,96,72,504
 - b. 7,98,86,010
 - c. 7,98,90,093
 - d. 7,96,74,622
108. Valuation is an essential process used in finance to determine the intrinsic value of an asset. It involves assessing various factors and methodologies to estimate the worth of the asset. Which of the following statements best describes the purpose of valuation?
- a. Valuation aims to determine the historical cost of an asset.
 - b. Valuation provides an accurate prediction of an asset's future market price.
 - c. Valuation aims to estimate the fair value of an asset based on its characteristics and market conditions.
 - d. Valuation focuses on calculating the present value of an asset's future cash flows.
109. A bond is quoting at premium today. The bond will be redeemed after 10 years at par value. What is the likely price at end of year 1?
- a. No change in bond price
 - b. Fall in bond price as compared to today price
 - c. Increase in bond price as compared to today price
 - d. Cannot be ascertained
110. In finance, return concepts play a crucial role in assessing investment performance and decision-making. Which of the following statements accurately defines the concept of total return?
- a. Total return measures the percentage increase in an investment's market value.
 - b. Total return includes only the income generated from an investment, such as dividends or interest.

- c. Total return combines the capital appreciation or depreciation of an investment with the income generated over a specific period.
 - d. Total return represents the risk-adjusted return of an investment compared to a benchmark index.
111. The required return on equity is a crucial concept in finance that helps investors and analysts evaluate the attractiveness of equity investments. What factors contribute to determining the required return on equity?
- a. The company's cost of debt and its interest coverage ratio.
 - b. The company's market capitalization and share price volatility.
 - c. The company's beta, risk-free rate, and equity risk premium.
 - d. The company's dividend payout ratio and earnings per share.
112. What is one precaution a valuer should take before accepting a valuation assignment?
- a. Conducting independent research on the asset being valued
 - b. Assuring a high profit margin from the assignment
 - c. Accepting the assignment without considering potential conflicts of interest
 - d. Guaranteeing the accuracy of the valuation result
113. EV to EBITDA multiple of Company A is 5 Times. How much is the cash return on total investment?
- a. 5%
 - b. 10%
 - c. 20%
 - d. 25%
114. When valuing debentures/bonds, which of the following factors has the most significant impact on their value?
- a. Maturity date of the debentures/bonds
 - b. Coupon rate of the debentures/bonds
 - c. Credit rating of the issuing company
 - d. Market interest rate
115. When valuing preference shares, which of the following factors is most important in determining the value?
- a. Dividend yield of the preference shares
 - b. Conversion feature of the preference shares
 - c. Face value of the preference shares
 - d. Credit rating of the issuing company
116. _____ can be used for valuation of a company which has negative cash flows or negative earnings.
- a. EV to EBITDA
 - b. PE Multiple
 - c. EV to Sales
117. What is one precaution a valuer should take to ensure independence in the valuation process?
- a. Avoiding conflicts of interest with the client
 - b. Guaranteeing a minimum value for the asset
 - c. Relying solely on the client's provided data and information
 - d. Establishing personal relationships with the client
118. A company is evaluating the value of its equity shares using the Return on Equity (ROE) analysis. The company has a net income of Rs.10,00,000 and shareholders' equity of Rs.1,00,00,000. The

industry average ROE is 15%. What is the estimated value of the company's equity shares based on the ROE analysis?

- a. Rs.66,66,667
- b. Rs.83,33,333
- c. Rs.1,00,00,000
- d. Rs.1,25,00,000

119. A company has generated an operating cash flow of Rs.20,00,000, incurred a capital expenditure of Rs.5,00,000, and paid dividends of Rs.3,00,000 to equity shareholders. The interest expense on debt is Rs.1,00,000, and the principal repayment is Rs.2,00,000. What is the Free Cash Flow to Firm (FCFF) for the company?

- a. Rs.25,00,000
- b. Rs.14,00,000
- c. Rs.15,00,000
- d. Rs.18,00,000

120. An equity share can be valued using dividend discount model and cash flow-based model. Which of the models provide a better measure of valuation?

- a. Dividend discount model
- b. Cash flow-based model
- c. Both models are similar

121. A company is considering a major expansion project and wants to evaluate the cash flows available to both debt and equity stakeholders. Which of the following components is included in the calculation of Free Cash Flow to Firm (FCFF)?

- a. Dividends paid to equity shareholders
- b. Interest expenses on debt
- c. Principal repayments on debt
- d. Capital expenditures

122. A company is planning to acquire a target company that has a substantial amount of cash and cash equivalents on its balance sheet. How should the cash and cash equivalents be treated when calculating the enterprise value?

- a. Deduct the value of cash and cash equivalents from the enterprise value.
- b. Add the value of cash and cash equivalents to the enterprise value.
- c. Ignore the value of cash and cash equivalents when calculating the enterprise value.
- d. Consider the value of cash and cash equivalents separately from the enterprise value.

123. A company has issued a warrant which can be converted into 10 equity shares by paying Rs.50 per share. The current market price of the share is Rs.80. How much is the value of warrant?

- a. 0
- b. Rs.800
- c. Rs.500
- d. Rs.300

124. _____ is the rate at which RBI lends to commercial bank and _____ is the rate at which commercial bank lends to RBI

- a. Repo rate and Bank rate
- b. Reverse repo rate and Bank rate
- c. Reverse repo rate and Repo Rate
- d. Repo Rate and Reverse Repo Rate

125. A seller discounted a commercial bill (2 months maturity) at 15% per annum. How much would be the effective yield of the bank?
- 15%
 - More than 15%
 - Less than 15%
126. A company has issued a warrant which can be converted into 10 equity shares by paying Rs.50 per share. The current market price of the share is Rs.40. How much is the value of warrant?
- 0
 - 100
 - 400
 - 500
127. A company is considering acquiring another firm to expand its operations. The target company has a significant amount of debt. Which of the following valuation methods would be most appropriate to determine the enterprise value of the target company?
- Dividend Discount Model (DDM)
 - Price/Earnings (P/E) Ratio Method
 - Discounted Cash Flow (DCF) Analysis
 - Market Capitalization Method
128. XYZ Corporation has issued a zero-coupon bond with a face value of Rs.1,000 and a maturity period of 5 years. The current market interest rate is 8%. Calculate the fair price of the bond?
- Rs.680.58
 - Rs.735.03
 - Rs.793.83
 - Rs.857.34
129. Which of the following statements about bond immunization is true?
- Bond immunization eliminates the risk of default associated with bonds.
 - Immunization involves matching the duration of a bond portfolio with the investment time horizon.
 - The primary goal of immunization is to maximize the bond portfolio's total return.
 - Immunization strategies are effective only for short-term bonds.
130. Calculate value of equity share using H Model from the following information:
- | | |
|--|---------|
| Dividend paid in last year | Rs.25 |
| Cost of equity | 8% |
| High-growth rate (short-term growth) | 12% |
| Long-term growth rate | 5% |
| Number of years for transition from high-growth to normal rate | 5 years |
- 875
 - 1020.83
 - 1025
 - 1,000
131. Which of the following statements about bond duration is true?
- Bond duration measures the time it takes to recoup the initial investment in a bond.
 - The duration of a bond is always shorter than its maturity period.
 - Longer-term bonds have higher durations than shorter-term bonds.
 - The duration of a zero-coupon bond is always zero.
132. Which of the following yield curve shapes is often associated with a period of economic stability and balanced growth?

- a. Steep yield curve
 - b. Flat yield curve
 - c. Inverted yield curve
 - d. Humped yield curve
133. Which of the following term structure theories incorporates both expectations about future interest rates and market segmentation?
- a. Expectations Theory
 - b. Liquidity Preference Theory
 - c. Preferred Habitat Theory
134. Which of the following Yield Curve will exist under the Liquidity Preference Theory of the term structure of interest rates?
- a. Downward Sloping
 - b. Upward Sloping
 - c. Flat
 - d. Humped
135. Which of the following factors does not affect the price of a zero-coupon bond?
- a. Yield to maturity
 - b. Maturity period
 - c. Credit rating of the issuer
 - d. Coupon rate
136. Duration/volatility assumed a _____ relationship between Yield change on price
- a. Exponential
 - b. Random
 - c. Linear
 - d. Flat
137. For valuing an equity share, Which discount rate is to be used?
- a. Nominal cost of equity
 - b. Real cost of equity
138. Which of the following statements best describes the components of the required interest rate on a security?
- a. The real risk-free rate, the default risk premium, a liquidity premium and a premium to reflect the risk associated with the maturity of the security
 - b. The real risk-free rate, expected inflation rate, the default risk premium, a liquidity premium and a premium to reflect the risk associated with the maturity of the security
 - c. The nominal risk-free rate, expected inflation rate, the default risk premium, a liquidity premium and a premium to reflect the risk associated with the maturity of the security
 - d. a liquidity premium and a premium to reflect the risk associated with the maturity of the security
139. Which of the following statements is true regarding the impact of bond refunding on the company's cash flows?
- a. Bond refunding increases the company's cash outflows in the short term.
 - b. Bond refunding decreases the company's cash outflows in the short term.
 - c. Bond refunding does not impact the company's cash flows.
 - d. Bond refunding increases the company's cash inflows in the short term.
140. Compute Convexity of bond based on the following information:

Fair value of bond at 10% YTM	100.00
Fair value of bond at 9% YTM	103.89
Fair value of bond at 11% YTM	96.30

- a. 9.50
- b. 0.095
- c. 0.19
- d. 19.00

141. XYZ Corporation issued a bond with a coupon rate of 7% and a maturity of 20 years. However, due to declining interest rates, the company decides to refund the bond by issuing a new bond at a lower coupon rate. Which of the following statements is true regarding bond refunding?

- a. Bond refunding increases the company's overall interest expense.
- b. Bond refunding reduces the company's future interest payments.
- c. Bond refunding requires the company to retire the existing bond before issuing a new one.
- d. Bond refunding increases the credit risk of the company.

142. Nominal and real cash flows will be same _____

- a. In the short run and under conditions of high inflation
- b. In the short run and under conditions of low inflation
- c. In the long run and under conditions of high inflation
- d. In the long run and under conditions of low inflation

143. A company is considering investing its surplus funds in money market instruments. Which of the following money market instruments offers the highest level of liquidity and safety?

- a. Treasury bills
- b. Commercial paper
- c. Certificate of deposit
- d. Repurchase agreements

144. Which of the following money market instruments is typically issued by large, creditworthy corporations to meet their short-term funding needs?

- a. Treasury bills
- b. Commercial paper
- c. Banker's acceptances
- d. Negotiable certificates of deposit

145. A company currently has a required return on equity of 14% and an ROE of 12%. All else equal, if there is an increase in a firm's dividend payout ratio, the stock's value will most likely:

- a. Increase
- b. Either increase or decrease
- c. No effect
- d. Decrease

146. The six-year spot rate is 7% and the five-year spot rate is 6%. The implied one-year forward rate five years from now is:

- a. 6.50%
- b. 12.14%
- c. 5.00%
- d. 12.00%

147. A bond portfolio consists of a AAA bond, a AA bond, and an A bond. The prices of the bonds are Rs.1,050, Rs.1,000, and Rs.950 respectively. The durations are 8, 6, and 4 respectively. What is the duration of the portfolio?

- a. 6.00

- b. 6.07
c. 6.67
d. 18.00

Answer:

1.	Holding period return = $\frac{(45 - 40) + 5}{40} \times 100 = 25.00\%$																						
2.	$\text{ROE} = \frac{\text{Total earnings}}{\text{Value of equity}} = \frac{1,00,000}{10,00,000} = 10.00\%$ $\text{Cost of equity} = \frac{1}{\text{PE Multiple}} = \frac{1}{8} = 12.50\%$ Optimum payout ratio for the company would be 100% as cost of equity is higher than ROE																						
3.	Answer to this is Bank B and 5.90% <table><tr><td colspan="3">Effective rate of Bank A = 5.85%</td></tr><tr><td colspan="3">Effective rate of Bank B = $\left(1 + \frac{5.75\%}{12}\right)^{12} - 1 = 5.90\%$</td></tr><tr><td colspan="3">Effective rate of Bank C = $e^{rt} - 1 = e^{0.057} - 1 = 1.0587 - 1 = 5.87\%$</td></tr></table>			Effective rate of Bank A = 5.85%			Effective rate of Bank B = $\left(1 + \frac{5.75\%}{12}\right)^{12} - 1 = 5.90\%$			Effective rate of Bank C = $e^{rt} - 1 = e^{0.057} - 1 = 1.0587 - 1 = 5.87\%$													
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4.	<table><tr><th>Particulars</th><th>Amount</th></tr><tr><td>Profit before tax</td><td>10,00,000</td></tr><tr><td>Less: Tax @ 50%</td><td>-5,00,000</td></tr><tr><td>Profit after tax</td><td>5,00,000</td></tr><tr><td>Less: Preference dividend (10,00,000 x 10%)</td><td>-1,00,000</td></tr><tr><td>EAES</td><td>4,00,000</td></tr><tr><td>Amount of equity</td><td>40,00,000</td></tr><tr><td>[Equity share capital + Reserves - Fictitious assets]</td><td></td></tr><tr><td>ROE [EAES/Amount of equity]</td><td>10.00%</td></tr></table>	Particulars	Amount	Profit before tax	10,00,000	Less: Tax @ 50%	-5,00,000	Profit after tax	5,00,000	Less: Preference dividend (10,00,000 x 10%)	-1,00,000	EAES	4,00,000	Amount of equity	40,00,000	[Equity share capital + Reserves - Fictitious assets]		ROE [EAES/Amount of equity]	10.00%				
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ROE [EAES/Amount of equity]	10.00%																						
5.	Answer to the question is Rs.751 $P_3 = \frac{CF_4}{RR} = \frac{100}{10\%} = \text{RS. } 1,000$ $P_0 = 1,000 \times \text{PVF} (10\%, 3) = 1,000 \times 0.751 = \text{Rs. } 751$																						
6.	<table><tr><th>Particulars</th><th>Amount</th></tr><tr><td>EPS of last (DPS/Payout ratio)</td><td>6.00</td></tr><tr><td>EPS of year 1 (6 + 20%)</td><td>7.20</td></tr><tr><td>EPS of year 2 (7.20 + 20%)</td><td>8.64</td></tr><tr><td>EPS of year 3 (8.64 + 20%)</td><td>10.37</td></tr><tr><td>EPS of year 4 (10.37 + 20%)</td><td>12.44</td></tr><tr><td>EPS of year 5 (12.44 + 10%)</td><td>13.68</td></tr><tr><td>EPS of year 6 (13.68 + 10%)</td><td>15.05</td></tr><tr><td>DPS of year 6 (15.05 x 60%)</td><td>9.03</td></tr><tr><td>Price of year 5 = $\left(\frac{D_6}{K_e - G}\right) = \left(\frac{9.03}{20\% - 10\%}\right)$</td><td>90.30</td></tr></table>	Particulars	Amount	EPS of last (DPS/Payout ratio)	6.00	EPS of year 1 (6 + 20%)	7.20	EPS of year 2 (7.20 + 20%)	8.64	EPS of year 3 (8.64 + 20%)	10.37	EPS of year 4 (10.37 + 20%)	12.44	EPS of year 5 (12.44 + 10%)	13.68	EPS of year 6 (13.68 + 10%)	15.05	DPS of year 6 (15.05 x 60%)	9.03	Price of year 5 = $\left(\frac{D_6}{K_e - G}\right) = \left(\frac{9.03}{20\% - 10\%}\right)$	90.30		
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7.	Cost of equity																						
8.	$P_0 = \left(\frac{D}{K_e}\right) + \frac{\left(\frac{r}{K_e}\right) \times (E - D)}{K_e} = \left(\frac{2.50}{10\%}\right) + \frac{\left(\frac{0.05}{0.10}\right) \times (10 - 2.50)}{10\%} = \text{Rs. } 62.50$																						
9.	$K_e = \left(\frac{D_1}{P_0}\right) + G = \frac{4}{100} + 0.08 = 0.12 \text{ or } 12\%$																						
10.	<table><tr><th>Particulars</th><th>Amount</th></tr><tr><td>EPS (DPS/Payout ratio)</td><td>16.00</td></tr><tr><td>Book value per share</td><td>100</td></tr><tr><td>ROE (EPS/BVPS x 100)</td><td>16.00%</td></tr></table>	Particulars	Amount	EPS (DPS/Payout ratio)	16.00	Book value per share	100	ROE (EPS/BVPS x 100)	16.00%														
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11.	Book value per share = $\frac{900 \text{ lacs} - 10 \text{ lacs}}{50 \text{ lacs} - 2 \text{ lacs}} = \text{Rs. } 18.54 \text{ per share}$ Note: Networth will decline by Rs.10 lacs on buyback. It is assumed that buyback is happening at current market price and hence number of shares bought back is 2 lacs.																						
12.	If dividends are taxable then we should take cost of equity as pre-tax (10%) and if dividends are exempted (after-tax) then we should take cost of equity as post-tax																						

	Price before DDT = $\left(\frac{2}{10\% - 0\%}\right) = \text{Rs. 20}$ Price after DDT = $\left(\frac{1.80}{8\% - 0\%}\right) = \text{Rs. 22.50}$																														
13.	Company is following 100% payout ratio and hence EPS = DPS. Additionally, growth rate will also be zero. $K_e = \left(\frac{10}{100}\right) + 0 = 10\%$ <table><tr><th>Year</th><th>Cash flow</th><th>PVF @ 10%</th><th>DCF</th></tr><tr><td>1</td><td>-1.00</td><td>0.909</td><td>-0.909</td></tr><tr><td>1</td><td>2.10 [21/10%]</td><td>0.909</td><td>1.909</td></tr><tr><td colspan="3">NPV of project</td><td>1.000</td></tr></table> Note: Perpetual cash flow is received from year 2 and it is to be valued a year in advance (year 1)	Year	Cash flow	PVF @ 10%	DCF	1	-1.00	0.909	-0.909	1	2.10 [21/10%]	0.909	1.909	NPV of project			1.000														
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14.	$P_3 = \frac{D_4}{K_e - G} = \frac{2.50}{8\% - 7\%} = \text{Rs. 250}$ $P_2 = \frac{P_3}{1 + K_e} = \frac{250}{1 + 8\%} = \text{Rs. 231.48}$ No of shares to be sold in year 2 = $\frac{\text{Amount needed}}{\text{Price}} = \frac{1,000}{231.48} = 4.32 \text{ shares}$ 4.32 shares will be rounded off to 5 as investor needs minimum 1,000. Sales of 4 shares will not give Rs.1,000																														
15.	<table><tr><th>Particulars</th><th>Amount</th></tr><tr><td>Payout ratio (DPS/EPS)</td><td>40.00%</td></tr><tr><td>Retention ratio (100% - Payout ratio%)</td><td>60.00%</td></tr><tr><td>Growth rate (IRR x Retention ratio)</td><td>12.00%</td></tr></table>	Particulars	Amount	Payout ratio (DPS/EPS)	40.00%	Retention ratio (100% - Payout ratio%)	60.00%	Growth rate (IRR x Retention ratio)	12.00%																						
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16.	The return on equity is 20% whereas cost of equity is 15%. This is a case of declining firm and hence optimum payout ratio is 0%. Limiting value is minimum possible value of a share and is computed by following a payout ratio which is opposite of optimum payout ratio. Hence, we will work with 100% (opposite of 0%) and compute the answer. EPS is Rs.10 and hence DPS will also be Rs.10 considering 100% payout ratio. $P_0 = \left(\frac{D}{K_e}\right) = \frac{10}{15\%} = \text{Rs. 66.67}$																														
17.	PVGO = CMP - Fair price with no growth = 100 - 80 = Rs.20 Fair price with no growth would be computed with company having a payout ratio of 100%. This is because payout will be 100% (retention of 0%) and the same would lead to no growth. Fair price with no growth = $\left(\frac{D}{K_e}\right) = \frac{8}{10\%} = \text{Rs. 80}$																														
18.	Theoretical ex – rights price = $\frac{(\text{Existing shares} \times \text{Existing Price}) + (\text{New shares} \times \text{Rights Price})}{\text{Existing shares} + \text{New shares}}$ Theoretical ex – rights price = $\frac{(1,00,000 \times 100) + (25,000 \times 60)}{1,00,000 + 25,000} = \text{Rs. 92}$																														
19.	<table><tr><th>Particulars</th><th>Calculation</th><th>Amount</th></tr><tr><td>Existing PAT (EPS x No of shares)</td><td>10 x 1,00,000</td><td>10,00,000</td></tr><tr><td>Existing MPS (EPS x PE Multiple)</td><td>10 x 20</td><td>200.00</td></tr><tr><td>Buyback price per share</td><td>200 + 50%</td><td>300.00</td></tr><tr><td>Amount of buyback (Price x No of shares)</td><td>300 x 20,000</td><td>60 lacs</td></tr><tr><td>Interest paid on loan</td><td>60 lacs x 10%</td><td>6,00,000</td></tr><tr><td>After-tax cost of interest</td><td>6,00,000 x 70%</td><td>4,20,000</td></tr><tr><td>New PAT post buyback</td><td>10,00,000 - 4,20,000</td><td>5,80,000</td></tr><tr><td>No of shares post buyback</td><td>1,00,000 - 20,000</td><td>80,000</td></tr><tr><td>Post-buyback EPS</td><td>5,80,000/80,000</td><td>7.25</td></tr></table>	Particulars	Calculation	Amount	Existing PAT (EPS x No of shares)	10 x 1,00,000	10,00,000	Existing MPS (EPS x PE Multiple)	10 x 20	200.00	Buyback price per share	200 + 50%	300.00	Amount of buyback (Price x No of shares)	300 x 20,000	60 lacs	Interest paid on loan	60 lacs x 10%	6,00,000	After-tax cost of interest	6,00,000 x 70%	4,20,000	New PAT post buyback	10,00,000 - 4,20,000	5,80,000	No of shares post buyback	1,00,000 - 20,000	80,000	Post-buyback EPS	5,80,000/80,000	7.25
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20.	Theoretical value of right = Ex-rights price - Rights issue price Theoretical value of right = 50 - 40 = 10																														
21.	Theoretical ex – rights price = $\frac{(\text{Existing shares} \times \text{Existing Price}) + (\text{New shares} \times \text{Rights Price})}{\text{Existing shares} + \text{New shares}}$																														

	Theoretical ex – rights price = $\frac{(10 \text{ lacs} \times 130) + (5 \text{ lacs} \times 40)}{10 \text{ lacs} + 5 \text{ lacs}} = \text{Rs. } 100$ Note: New shares issued = $10,00,000 \times \frac{1}{2} = 5,00,000$ Issue price = $\frac{200 \text{ lacs}}{5 \text{ lacs}} = \text{Rs. } 40$																							
22.	Theoretical ex – rights price = $\frac{(4 \text{ shares} \times 100) + (1 \text{ share} \times 80)}{4 + 1} = \text{Rs. } 96$ Share price will fall by Rs.4 due to rights issue and hence the investor will have loss of Rs.4,000 (1,000 shares x 4) as he has neither subscribed nor sold rights																							
23.	<table><tr><th>Particulars</th><th>Calculation</th><th>Amount</th></tr><tr><td>Existing PAT (EPS x No of shares)</td><td>3 x 10,000</td><td>30,000</td></tr><tr><td>Buyback size</td><td>Given</td><td>50,000</td></tr><tr><td>Buyback price</td><td></td><td>100</td></tr><tr><td>No of shares bought back</td><td>50,000/100</td><td>500</td></tr><tr><td>No of shares post buy-back</td><td>10,000 – 500</td><td>9,500</td></tr><tr><td>Post-buyback EPS</td><td>30,000/9,500</td><td>3.16</td></tr></table>	Particulars	Calculation	Amount	Existing PAT (EPS x No of shares)	3 x 10,000	30,000	Buyback size	Given	50,000	Buyback price		100	No of shares bought back	50,000/100	500	No of shares post buy-back	10,000 – 500	9,500	Post-buyback EPS	30,000/9,500	3.16		
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24.	<table><tr><th>Particulars</th><th>Calculation</th><th>Amount</th></tr><tr><td>Earnings from project</td><td>200 lacs x 8%</td><td>16 lacs</td></tr><tr><td>Value of project (Earnings x PE Multiple)</td><td>16 lacs x 12</td><td>192 lacs</td></tr><tr><td>Cost of project</td><td></td><td>200 lacs</td></tr><tr><td>NPV of project</td><td>192 lacs – 200 lacs</td><td>-8 lacs</td></tr></table>	Particulars	Calculation	Amount	Earnings from project	200 lacs x 8%	16 lacs	Value of project (Earnings x PE Multiple)	16 lacs x 12	192 lacs	Cost of project		200 lacs	NPV of project	192 lacs – 200 lacs	-8 lacs								
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25.	<table><tr><th>Particulars</th><th>Calculation</th><th>Amount</th></tr><tr><td>Buyback price (EPS x Target PE Multiple)</td><td>10 x 20</td><td>200</td></tr><tr><td>Buyback size (Surplus cash x specified %)</td><td>10,00,000 x 30%</td><td>3,00,000</td></tr><tr><td>No of shares bought back</td><td>3,00,000/200</td><td>1,500 shares</td></tr></table>	Particulars	Calculation	Amount	Buyback price (EPS x Target PE Multiple)	10 x 20	200	Buyback size (Surplus cash x specified %)	10,00,000 x 30%	3,00,000	No of shares bought back	3,00,000/200	1,500 shares											
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26.	Existing, Lower																							
27.	$K_e = \left(\frac{D_1}{P_0}\right) + G = \frac{1.05}{10} + 0.05 = 0.155 \text{ or } 15.50\%$ Note: Next-year dividend = 1 + 5% = Rs.1.05 Price in the above formula is ex-dividend price and the same would be Rs.10 (11 – 1)																							
28.	Let us assume existing shares to be 10 shares and let us assume the rights issue shares to be A $80 = \frac{(10 \times 100) + (A \times 40)}{10 + A}$; $800 + 80A = 1,000 + 40A$; $A = 5$ Hence 5 new shares will be issued for 10 shares and we can say that one right share issued for every two shares held.																							
29.	$P_1 = P_0 \times (1 + K_e) - D_1 = 100 \times (1 + 15\%) - 25 = \text{Rs. } 90$																							
30.	Growth will have a linear fall and stabilize at 14 percent. It has not been mentioned that fall is for how many years and hence it will be taken as 1 percent fall every year. Growth rate of year 5 is 19 percent and growth rate of year 6 is 18 percent																							
31.	Annual fall in growth rate = $\frac{20 - 14}{3} = 2\%$ Hence Growth rate of year 5 is 18% (20% – 2%) and growth rate of year 6 is 16% (18% – 2%)																							
32.	Dividend of 1996 = PV = 2.115; Dividend of 2002 = FV = Rs.3; Present value = Future value x Present Value Factor $2.115 = 3 \times \text{Present Value Factor}$; Present value factor = $\frac{2.115}{3} = 0.705$ PVF of 0.705 correspond to 6 years and 6 percent. Hence growth rate of the company is 6 percent																							
33.	<table><tr><th>Particulars</th><th>Amount</th></tr><tr><td>DPS of year 1 (10 + 10%)</td><td>11.00</td></tr><tr><td>DPS of year 2 (11 + 10%)</td><td>12.10</td></tr><tr><td>DPS of year 3 (12.10 + 10%)</td><td>13.31</td></tr><tr><td>DPS of year 4 (13.31 + 10%)</td><td>14.64</td></tr><tr><td>DPS of year 5 (14.64 + 10%)</td><td>16.10</td></tr><tr><td>DPS of year 6 (16.10 + 4%)</td><td>16.74</td></tr></table>	Particulars	Amount	DPS of year 1 (10 + 10%)	11.00	DPS of year 2 (11 + 10%)	12.10	DPS of year 3 (12.10 + 10%)	13.31	DPS of year 4 (13.31 + 10%)	14.64	DPS of year 5 (14.64 + 10%)	16.10	DPS of year 6 (16.10 + 4%)	16.74									
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DPS of year 6 (16.10 + 4%)	16.74																							

	<table><tr><td>Cost of equity of year 6</td><td>17.00%</td></tr><tr><td>$R_f + \text{Beta} \times (R_m - R_f)$</td><td></td></tr></table> $P_5 = \frac{D_6}{K_e - G} = \frac{16.74}{17\% - 4\%} = \text{Rs. } 128.77$	Cost of equity of year 6	17.00%	$R_f + \text{Beta} \times (R_m - R_f)$																	
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34.	$\text{Capital gearing} = \frac{\text{Debt} + \text{Preference}}{\text{ESC} + \text{Reserves}} = \frac{100 + 200}{50 + 100} = 2 \text{ Times}$ Gearing of company is 1.25 times higher than that of industry. The company is riskier than industry and hence will need higher return. Higher gearing of 1.25 times will be compensated by higher return of 2.50 % (1.25 x 2) and hence the required return of company A is 12.50%																				
35.	The investor will get 1.2 shares for every 1 share due to bonus issue. Sale value of 1.2 shares = 900 x 1.20 = 1080 and net realization = 1080 - 5% expenses = 1080 - 54 = Rs.1026																				
36.	PV of cash inflows = 525. Hence the maximum outflow has to be Rs.525. The investor has to pay 5 percent brokerage and hence the maximum purchase price = 525/105% = Rs.500																				
37.	<table><tr><th>Particulars</th><th>Amount</th></tr><tr><td>Net Capex (30 - 20)</td><td>10.00</td></tr><tr><td>WC increase per share</td><td>2.00</td></tr><tr><td>Net capex and WC requirement</td><td>12.00</td></tr><tr><td>Funded with debt (12.00 x 60%)</td><td>7.20</td></tr><tr><td>Funded with equity (12.00 x 40%)</td><td>4.80</td></tr><tr><td>FCFE (EPS - Equity needed for capex and WC)</td><td>5.20</td></tr></table>	Particulars	Amount	Net Capex (30 - 20)	10.00	WC increase per share	2.00	Net capex and WC requirement	12.00	Funded with debt (12.00 x 60%)	7.20	Funded with equity (12.00 x 40%)	4.80	FCFE (EPS - Equity needed for capex and WC)	5.20						
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39.	Inflation rate = 6%. Real rate of return on risky asset is 10%. This would mean the return of A Limited is 16% (Inflation + Real rate). Risk Premium of A Limited is 4%. Hence risk-free rate of return = 16% - risk premium of 4% = 12%																				
40.	<table><tr><th>Particulars</th><th>Amount</th></tr><tr><td>Dividend of current year</td><td>10.00</td></tr><tr><td>EPS of current year (10/25%)</td><td>40.00</td></tr><tr><td>Earnings of year 5 (40 x 1.2⁵)</td><td>99.53</td></tr><tr><td>Current payout ratio</td><td>25.00%</td></tr><tr><td>Likely payout ratio of year 7</td><td>60.00%</td></tr><tr><td>Increase in payout ratio for 7 years</td><td>35.00%</td></tr><tr><td>Annual increase in payout ratio (35.00%/7)</td><td>5.00%</td></tr><tr><td>Payout ratio of year 5 (25% + (5% x 5 years))</td><td>50.00%</td></tr><tr><td>Dividend of year 5 (99.53 x 50%)</td><td>Rs.49.77</td></tr></table>	Particulars	Amount	Dividend of current year	10.00	EPS of current year (10/25%)	40.00	Earnings of year 5 (40 x 1.2 ⁵)	99.53	Current payout ratio	25.00%	Likely payout ratio of year 7	60.00%	Increase in payout ratio for 7 years	35.00%	Annual increase in payout ratio (35.00%/7)	5.00%	Payout ratio of year 5 (25% + (5% x 5 years))	50.00%	Dividend of year 5 (99.53 x 50%)	Rs.49.77
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41.	$P_0 = \frac{D_1}{K_e - G}; 200 = \frac{10 \times (1 + G)}{0.20 - G}; 40 - 200G = 10 + 10G; 30 = 210G; G = \frac{30}{210} = 14.29\%$ Note: DPS = Rs.10; Payout ratio is 50% and hence EPS is Rs.20 (10/50%). PE Multiple is 10 times and hence the current market price is Rs.200 (20 x 10)																				
42.	<table><tr><th>Particulars</th><th>Calculation</th><th>Amount</th></tr><tr><td>Ex-Dividend price per share</td><td>400 - 20</td><td>380.00</td></tr><tr><td>Value of 5 shares</td><td>380 x 5</td><td>1,900.00</td></tr><tr><td>Issue price per GDR (in INR)</td><td>1,900 - 20%</td><td>1,520</td></tr><tr><td>Net realization post FC (in INR)</td><td>1,520 - 5%</td><td>1,444</td></tr><tr><td>Net realization in USD</td><td>1,444/100</td><td>14.44</td></tr></table>	Particulars	Calculation	Amount	Ex-Dividend price per share	400 - 20	380.00	Value of 5 shares	380 x 5	1,900.00	Issue price per GDR (in INR)	1,900 - 20%	1,520	Net realization post FC (in INR)	1,520 - 5%	1,444	Net realization in USD	1,444/100	14.44		
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43.	$\text{Gross Amount} = \frac{\text{Net Amount}}{1 - \text{Issue expenses\%}} = \frac{10,00,000}{1 - 0.05} = \text{Rs. } 10,52,632$																				
44.	<table><tr><th>Particulars</th><th>Calculation</th><th>Amount</th></tr><tr><td>EPS of year 1</td><td>10 + 10%</td><td>11.00</td></tr><tr><td>EPS of year 2</td><td>11 + 9%</td><td>11.99</td></tr><tr><td>EPS of year 3</td><td>11.99 + 8%</td><td>12.95</td></tr><tr><td>EPS of year 4</td><td>12.95 + 7%</td><td>13.86</td></tr></table>	Particulars	Calculation	Amount	EPS of year 1	10 + 10%	11.00	EPS of year 2	11 + 9%	11.99	EPS of year 3	11.99 + 8%	12.95	EPS of year 4	12.95 + 7%	13.86					
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	EPS of year 5	13.86 + 6%	14.69																																
	MPS of year 5	14.69 x 20	293.80																																
45.	Current ROCE = $\frac{\text{EBIT}}{\text{Capital Employed}} = \frac{200}{2,000} = 10\%$ Revised ROCE = 10% + 2% = 12% and the revised capital employed is 2,000 + 400 = 2,400 lacs New EBIT = 2,400 lacs x 12% = Rs.288 lacs																																		
46.	Particulars	Calculation	Amount																																
	Next year industry sales	2,000 + 10%	2,200																																
	Next year ABC sales	2,200 x 30%	660																																
	Less: COGS	660 x 60%	-396																																
	Gross Profit	660 x 40%	264																																
	Less: Other expenses	396/2	-198																																
	PAT of next year		66																																
47.	Current price of share = PV of future cash flows. Let us assume last year dividend as A <table> <tr> <th>Year</th><th>Cash flow</th><th>PVF @ 20%</th><th>DCF</th></tr> <tr> <td>1</td><td>1.20A [A + 20%]</td><td>0.833</td><td>A</td></tr> <tr> <td>2</td><td>1.44A</td><td>0.94</td><td>A</td></tr> <tr> <td>3</td><td>1.728A</td><td>0.579</td><td>A</td></tr> <tr> <td>4</td><td>2.074</td><td>0.482</td><td>A</td></tr> <tr> <td>4</td><td>100</td><td>0.482</td><td>48.20</td></tr> <tr> <td colspan="3">Total</td><td>4A + 48.20 = 68.20</td></tr> <tr> <td colspan="3">Dividend per share (A)</td><td>Rs.5.00</td></tr> </table>			Year	Cash flow	PVF @ 20%	DCF	1	1.20A [A + 20%]	0.833	A	2	1.44A	0.94	A	3	1.728A	0.579	A	4	2.074	0.482	A	4	100	0.482	48.20	Total			4A + 48.20 = 68.20	Dividend per share (A)			Rs.5.00
Year	Cash flow	PVF @ 20%	DCF																																
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Dividend per share (A)			Rs.5.00																																
48.	Conversion value = CMP of equity shares x NO of shares post conversion = 15 x 5 = Rs.75																																		
49.	Conversion premium = CMP - Conversion value; 100 - 75 = Rs.25 per bond (or) Rs.5 per share																																		
50.	Conversion parity price = $\frac{\text{CMP of bond}}{\text{Conversion ratio}} = 100/5 = \text{Rs. 20}$																																		
51.	Straight value is present value of bond's cash flows discounted at required rate of return. Required rate of return in this case will be 9.5% as that is the return on similar bonds Straight value of bond = (8 x 0.913) + (8 x 0.834) + (8 x 0.762) + (108 x 0.696) = 95.26																																		
52.	Downside risk = Current Market price - Straight value Downside risk = 100 - 94.22 = 5.78 Note: Straight value = (8 x 3.840) + (100 x 0.635) = Rs.94.22																																		
53.	Particulars	Calculation	Amount																																
	Interest income of bond	100 x 10%	10.00																																
	Dividend income per 10 shares	0.20 x 10	2.00																																
	Favorable income differential per bond	10 - 2	8.00																																
	Favorable income differential per share	8/10	0.80																																
54.	Particulars	Existing	Revised																																
	PAT	2,00,000	2,70,000																																
	Less: Preference dividend	0	70,000																																
	EAES	2,00,000	2,00,000																																
	No of equity shares	1,00,000	1,00,000																																
	EPS	2.00	2.00																																
	Earnings need to increase by Rs.70,000 to meet preference dividend. Hence there should be 35 percent increase in overall earnings.																																		
55.	Particulars	Calculation	Amount																																
	Conversion premium per bond		Rs.100																																
	Favorable income differential per share		Rs.10																																
	Favorable income differential per bond	10 x 4	Rs.40																																
	Premium payback period	100/40	2.50 years																																
56.	Particulars	Calculation	Amount																																
	Conversion value at end of year 4	10x(80 x 1.1 ⁵)	1,288.41																																
	Redeemable value		1,000																																
	Terminal value (Higher of two)		1,288.41																																

57.	Value if conversion is done = $125 \times 10 = \text{Rs.}1,250$ whereas the CMP of bond = Rs.1,200. We should therefore go ahead with conversion as the value of bond is higher post conversion				
58.	Year	Cash flow	PVF @ 14%	DCF	
	1	10	0.877	8.77	
	2	130	0.769	99.97	
	Value of Bond			108.74	
59.	$\text{Gross Amount} = \frac{\text{Net Amount}}{1 - \text{Expenses}} = \frac{7.38}{1 - 0.10} = 8.20 \text{ Crores}$				
60.	Spread of bond = YTM of convertible bond - YTM of comparable bond Spread of bond = $10.76\% - 9\% = +1.76\%$				
61.	Variable bond is one where prevailing interest rate and interest rate paid on bond will be same. Hence this bond will always be meeting expectation of bond holders. Hence it will always quote at par value which in this case is Rs.1,000				
62.	Year	Cash flow	Reinvestment period	FVF	FCF
	1	85	2	1.21	102.85
	2	85	1	1.1	93.50
	3	1,085	0	1.00	1,085
	Total	1,255			1,281.35
	Reinvested interest = $1,281.35 - 1,255 = \text{Rs.}26.35$				
63.	Yield is expected to increase and hence value of portfolio will decline. We should work on reducing the duration of the portfolio as lower duration will lead to lower volatility. Hence in this case we should increase investment in lower duration bonds and sell higher duration bonds				
64.	Bond is convertible into 20 shares. Conversion parity price = $140/20 = \text{Rs.}7$. Investor should opt for conversion if the current market price is Rs.8 (more than Rs.7)				
65.	$\text{Value of share} = \frac{\text{Dividend}}{\text{Current yield}} = \frac{11}{13\%} = 84.62$				
66.	Let us assume new debt to be X. Debt post raising $8 + X$ Current mortgaged assets = 30 Crores; Mortgaged assets post raising = $30 + 0.5X$ $\frac{(30 + 0.5X)}{8 + X} = 2; \text{ We will get } X = 9.33 \text{ crores}$				
67.	Interest rates in the economy is of 12 percent. The company has issued 10 percent bond. The company will continue with 10 percent bond for another five years as they can pay interest of 10 percent as compared to prevailing rates of 12 percent				
68.	It is a half-yearly bond and hence we should opt for half-yearly discounting. Cash flow will be 5 in period 1, 5 in period 2, 5 in period 3 and 105 in period 4 . Cash flows will be discounted at half-yearly YTM of 6 percent Market price = $(5 \times 0.943) + (5 \times 0.890) + (5 \times 0.840) + (105 \times 0.792) = \text{Rs.}96.53$				
69.	$\text{Volatility} = \frac{\text{Duration in years}}{1 + \text{Relevant YTM}} = \frac{5.85}{1 + 5\%} = 5.57$ Bond is paying half-yearly interest and hence we need to use half-yearly YTM to compute volatility				
70.	Yield is expected to increase and hence price will fall; % Fall in price = $4.5 \times 0.25 = 1.125\%$				
71.	Particulars		Calculation	Amount	
	Total Floatation Cost			30,00,000	
	Un-amortized Floatation cost		$30,00,000 \times (25/30)$	25,00,000	
	Tax benefit on write-off		$25,00,000 \times 30\%$	7,50,000	
	Tax benefit will be taken on day 0 as the old bond will be refunded and closed. Hence all tax benefit of Rs.7.5 lacs will arise in year 0				
72.	Call premium = $200 \text{ lacs} \times 10\% = 20 \text{ lacs}$; Tax benefit = $20 \text{ lacs} \times 20\% = \text{Rs.}4 \text{ lacs}$; Tax benefit will be taken immediately as the old bond is redeemed				
73.	$\text{Current yield} = \frac{\text{Interest}}{\text{CMP}} = \frac{10}{125} = 8\%$ Yield will go up by 1 percent and hence it will become 9 percent $\text{Revised price} = \left(\frac{10}{9\%}\right) = \text{Rs.}111.11$				

74.	Current market price is equal to face value and hence interest rate and YTM will be same. This would mean that bond will quote at par value of Rs.100 once interest is paid out Price as on October 1, 2019 = Price as on June 30, 2019 + Accrued interest Price as on October 1, 2019 = 100 + (100 × 10% × (3/12)) = 100 + 2.50 = 102.50																		
75.	<table><tr><th>Particulars</th><th>Amount</th></tr><tr><td>Discount rate for A rated bond (9 + 3)</td><td>12.00%</td></tr><tr><td>Discount rate for AAA rated bond (12% - 2%)</td><td>10.00%</td></tr><tr><td>Discount rate for AA rated bond (10 + 1)</td><td>11.00%</td></tr></table>	Particulars	Amount	Discount rate for A rated bond (9 + 3)	12.00%	Discount rate for AAA rated bond (12% - 2%)	10.00%	Discount rate for AA rated bond (10 + 1)	11.00%										
Particulars	Amount																		
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Discount rate for AA rated bond (10 + 1)	11.00%																		
76.	Duration = $\left(\frac{1}{\text{YTM}}\right) + 1 = \left(\frac{1}{8\%}\right) + 1 = 12.5 + 1 = 13.5$																		
77.	Annual cash flow = $\frac{\text{CMP}}{\text{PVAF (4 years, 12\%)}}} = \frac{1,000}{3.037} = \text{Rs. } 329.27$																		
78.	Forward rate of Year 1 = $\left[\frac{\text{FVF of year 2}}{\text{FVF of year 1}}\right] - 1 = \left(\frac{1.2544}{1.10}\right) - 1 = 14.04\%$																		
79.	95,000 will become 1,00,000 in 111 days (30 + 31+ 30 + 20) Yield = $\left(\frac{5,000}{95,000}\right) \times \left(\frac{365}{111}\right) \times 100 = 17.30\%$																		
80.	Investment in Bond A = X; Investment in Bond B = 1 - x <table><tr><th>Bond</th><th>Duration</th><th>Weight</th><th>Product</th></tr><tr><td>A</td><td>4</td><td>X</td><td>4X</td></tr><tr><td>B</td><td>10</td><td>1-X</td><td>10-10X</td></tr><tr><td>Total</td><td></td><td></td><td>4X + 10 - 10X = 6</td></tr></table> Solving we get X as 66.67% and hence 66.67% is investment in Bond A and Balance 33.33% is investment in Bond B			Bond	Duration	Weight	Product	A	4	X	4X	B	10	1-X	10-10X	Total			4X + 10 - 10X = 6
Bond	Duration	Weight	Product																
A	4	X	4X																
B	10	1-X	10-10X																
Total			4X + 10 - 10X = 6																
81.	Bond will quote at discount as the company is not able to meet investor expectations of 12 percent																		
82.	Negative Alpha and sell security Security is going to earn a return lower than required return and hence it has negative Alpha. We should sell Negative Alpha Securities as they are overvalued.																		
83.	Current yield = $\frac{14}{90} = 15.56\%$																		
84.	<table><tr><th>Particulars</th><th>Amount</th></tr><tr><td>CMP (Day 0)</td><td>1,000.00</td></tr><tr><td>Add: Required return of year 1 (1,000 × 15%)</td><td>150.00</td></tr><tr><td>Less: Interest paid in year 1 (1,000 × 12%)</td><td>-120.00</td></tr><tr><td>Fair price at end of year 1</td><td>1,030</td></tr><tr><td>Add: Required return of year 2 (1,030 × 15%)</td><td>154.50</td></tr><tr><td>Less: Interest paid in year 2 (1,000 × 12%)</td><td>-120.00</td></tr><tr><td>Fair price at end of year 2</td><td>1,064.50</td></tr></table>	Particulars	Amount	CMP (Day 0)	1,000.00	Add: Required return of year 1 (1,000 × 15%)	150.00	Less: Interest paid in year 1 (1,000 × 12%)	-120.00	Fair price at end of year 1	1,030	Add: Required return of year 2 (1,030 × 15%)	154.50	Less: Interest paid in year 2 (1,000 × 12%)	-120.00	Fair price at end of year 2	1,064.50		
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85.	PVF of year 1 = $\frac{1}{1.10} = 0.909$ PVF of year 2 = $\frac{\text{PVF of year 1}}{1 + \text{DR of year 2}} = \frac{0.909}{1.12} = 0.812$ PVF of year 3 = $\frac{\text{PVF of year 2}}{1 + \text{DR of year 2}} = \frac{0.812}{1.14} = 0.712$																		
86.	Normally the discount rate would be rate on similar debentures. However, company wants to give return of 18% and hence the same will be taken as discount rate																		
87.	<table><tr><th>Particulars</th><th>Amount</th></tr><tr><td>Post-tax interest outflow (10 × 70%)</td><td>7.00</td></tr><tr><td>Capital gain in year 5 (120 - 80)</td><td>40.00</td></tr><tr><td>Tax on capital gain (40.00 × 20%)</td><td>8.00</td></tr><tr><td>Net realization post capital gain (120 - 8)</td><td>112.00</td></tr><tr><td>Overall realization (Interest (7) + RV(112))</td><td>119.00</td></tr></table>	Particulars	Amount	Post-tax interest outflow (10 × 70%)	7.00	Capital gain in year 5 (120 - 80)	40.00	Tax on capital gain (40.00 × 20%)	8.00	Net realization post capital gain (120 - 8)	112.00	Overall realization (Interest (7) + RV(112))	119.00						
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88.	<table><tr><th>Particulars</th><th>Existing</th><th>Revised</th></tr><tr><td>EBIT</td><td>400.00</td><td>480.00</td></tr><tr><td>Interest</td><td>100.00</td><td>140.00</td></tr><tr><td>Interest coverage</td><td>4.00</td><td>3.43</td></tr></table> Note:	Particulars	Existing	Revised	EBIT	400.00	480.00	Interest	100.00	140.00	Interest coverage	4.00	3.43						
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Interest	100.00	140.00																	
Interest coverage	4.00	3.43																	

	• Let us assume existing interest to be Rs.100 and EBIT will therefore be Rs.400												
89.	Risk premium will be greater than market as the security carries more risk than market. This is reflected in security Beta of 2 times as compared to market Beta of 1 time												
90.	EV/EBITDA multiple of Infosys = 1000 crores/250 crores = 4 Times; EV of TCS = EBITDA x 4 times = 50 Cr x 4 = 200 Crores												
91.	Total enterprise value - value of non-core assets - investment in associates												
92.	Value of share = $\frac{3.75}{8.5\%}$ = Rs.44.12												
93.	EV = Market value of equity + Debt - Cash and cash equivalents EV = 2000 + 800 - 400 = 2,400												
94.	We have data to calculate Enterprise value on the basis of sales and EBITDA. Final enterprise value will be average based on sales and EBITDA EV based on sales = 5,000 x 1.5 = 7,500 EV based on EBITDA = 2,000 x 5 = 10,000 Average Enterprise value = $\frac{7,500 + 10,000}{2}$ = 8,750												
95.	Less than 20% Re-investment has been done at lower than YTM and hence realized YTM would be lower than normal YTM												
96.	$PBT = \frac{PAT}{1 - \text{Tax rate}} = \frac{280}{70\%} = 400$ crores EBITDA = 400 Crores of PBT + 100 Crores of Depreciation + 500 crores of interest = 1,000 crores EV = 1,000 x 5 = 5,000												
97.	(i), (ii) is correct Explanation: Shorter-maturity bonds have lower life and accordingly lower duration. Higher coupon will lead to higher cash flow during initial years and hence will have lower duration. High discount rate will lead to lower duration and low discount rate will lead to higher duration												
98.	Accrued interest = Face value of Rs.100 x 12% x (240/360) = Rs.8.00 Dirty price = Clean price of Rs.95 + Accrued interest of Rs.8 = Rs.103.00												
99.	Downward Sloping												
100.	Cost of investment = $\frac{40,000}{40,00,000}$ = 1% Return of 2 percent per quarter and hence it will take 1.5 months to earn 1 percent return. Break-even period is 1.5 months												
101.	Dirty price = 98 + 4 = 102 Value of security = $\left(\frac{4 \text{ crores}}{100}\right) \times 102$ = 4.08 crores Initial proceeds = 4.08 crores - 5% margin = Rs.3.876 Crores												
102.	<table><tr><th>Particulars</th><th>Amount</th></tr><tr><td>Interest cost (2.50 x 4)</td><td>10.00</td></tr><tr><td>Stamp duty (0.5 x 2)</td><td>1.00</td></tr><tr><td>Rating charges</td><td>1.00</td></tr><tr><td>Other cost (0.1 x 12)</td><td>1.20</td></tr><tr><td>Overall cost</td><td>13.20</td></tr></table>	Particulars	Amount	Interest cost (2.50 x 4)	10.00	Stamp duty (0.5 x 2)	1.00	Rating charges	1.00	Other cost (0.1 x 12)	1.20	Overall cost	13.20
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103.	Favourable impact on re-investment (higher interest rate will lead to higher re-investment rate) and adverse impact on price (increase in interest rate will lead to decrease in price)												
104.	Let us assume Issue price to be Y $12 = \frac{100 - Y}{Y} \times \left(\frac{365}{91}\right) \times 100$ $1092Y = 36,50,000 - 36500Y$ $Y = \frac{36,50,000}{37,592}$ = Rs.97.10												
105.	Answer to this is bought as an undervalued stock. The PE ratio is considerably lower than that for the median of the peer group, which implies that it may well be undervalued												
106.	Amount realized on issue of CP = 100 - 4 = 96 lacs; Net amount available = 96 lacs - 5 lacs = 91 lacs Cost of CP = $\left(\frac{4 \text{ lacs}}{91 \text{ lacs}}\right) \times \left(\frac{6}{12}\right) \times 100$ = 8.79 percent												

107.	Interest on repo = $7,95,20,000 \times 5\% \times \frac{14}{365} = 1,52,504$ Amount to be repaid = $7,95,20,000 + 1,52,504 = 7,96,72,504$
108.	Valuation aims to estimate the fair value of an asset based on its characteristics and market conditions.
109.	Fall in bond price as compared to today price. Bond is quoting at premium today. This would mean that coupon paid on bond is more than investor expectation. In this case the bond price will consistently fall and reach par value by year 10.
110.	Total return combines the capital appreciation or depreciation of an investment with the income generated over a specific period
111.	The company's beta, risk-free rate, and equity risk premium.
112.	Conducting independent research on the asset being valued
113.	Cash return on total investment can be computed as inverse of EV to EBITDA multiple and the same in this case would be 20% (1/5)
114.	Market interest rate Explanation: The value of debentures/bonds is primarily influenced by the market interest rate. When the market interest rate rises above the coupon rate of the debentures/bonds, their value decreases as the fixed coupon payments become less attractive compared to alternative investments. Conversely, when the market interest rate falls below the coupon rate, the value of the debentures/bonds increases
115.	Dividend yield of the preference shares Explanation: The primary factor in determining the value of preference shares is the dividend yield. Preference shares provide fixed dividends, typically expressed as a percentage of their face value. The higher the dividend yield, the more valuable the preference shares are to investors seeking stable income. Other factors such as conversion features and credit ratings may also impact the value but are secondary to the dividend yield.
116.	EV to sales
117.	Avoiding conflicts of interest with the client
118.	Value of company as per ROE = $\frac{10,00,000}{15\%} = \text{Rs. } 66,66,667$
119.	Free cash flow to firm = Operating cash flow - Capital expenditure Free cash flow to firm = $20,00,000 - 5,00,000 = \text{Rs. } 15,00,000$
120.	Cash flow models are considered superior to dividend models. This is because a company may have surplus cash but the same has not been paid out as dividend and hence dividend discount model will not factor the same. On the other side, cash flow based model values the company on the basis of free cash flow available (whether distributed or not)
121.	Capital expenditure
122.	Deduct the value of cash and cash equivalents from the enterprise value. Cash and cash equivalents are readily available to pay off debt or distribute to equity holders. Therefore, when calculating the enterprise value, the value of cash and cash equivalents should be deducted
123.	Value of warrant = $(\text{CMP} - \text{EP}) \times \text{Ratio} = (80 - 50) \times 10 = \text{Rs. } 300$
124.	Repo rate and Reverse Repo Rate
125.	Yield is going to be more than 15% as the discounted charges are collected immediately. Calculation: Discounting charges = $100 \times 15\% \times (2/12) = \text{Rs. } 2.50$. Hence bank will be paying Rs.97.50 to seller today and would collect Rs.100 from the buyer. Yield = $\frac{100 - 97.50}{97.50} \times \frac{12}{2} \times 100 = 15.39\%$
126.	Value of share is lower than exercise price of Rs.50. In this case warrant will not be utilized and hence the value of warrant is 0 Note: Warrant cannot have negative value as we will not use the same in case current market price of share is less than exercise price.
127.	Discounted Cash Flow (DCF) Analysis DCF method takes into account the projected future cash flows of the target company and discounts them to their present value using an appropriate discount rate. DCF analysis considers

	the cash flows available to both debt and equity holders and provides a comprehensive valuation of the company, including its debt obligations.			
128.	Fair value of bond = $\frac{1,000}{(1 + 8\%)^5} = \text{Rs. } 680.58$			
129.	Immunization involves matching the duration of a bond portfolio with the investment time horizon.			
130.	$P_0 = \frac{D_0(1 + g_n)}{r - g_n} + \frac{D_0 H_1 (g_c - g_n)}{r - g_n}$ $P_0 = \frac{25(1 + 0.05)}{0.08 - 0.05} + \frac{25 \times 2.5 (0.12 - 0.05)}{0.08 - 0.05} = 875 + 145.83 = \text{Rs. } 1,020.83$			
131.	Longer-term bonds have higher durations than shorter-term bonds.			
132.	Flat Yield Curve Explanation: A flat yield curve, where long-term and short-term interest rates are relatively similar, is often associated with a period of economic stability and balanced growth. It suggests that the market does not anticipate significant changes in interest rates in the near future. This can indicate a well-functioning economy without strong inflationary pressures or recessionary risks.			
133.	Preferred Habitat Theory			
134.	Upward Sloping People prefer liquidity and if they are forced to sacrifice the same for a longer period, they need a higher compensation for the same. Hence, as per this theory, the normal shape of a yield curve is Positive sloped one			
135.	Coupon Rate			
136.	Linear			
137.	Nominal cost of equity because the cash flows available to equity shareholders will be nominal cash flows. The reason is that the tax applying to corporate earnings is generally stated in nominal terms			
138.	Answer is Option B The required interest rate on a security is made up of the nominal rate which is in turn made up of real risk-free interest rate plus the expected inflation rate. It should also contain a liquidity premium as well as a premium related to the maturity of the security.			
139.	Bond refunding increases the company's cash outflows in the short term. Bond refunding typically involves the payment of call premiums, transaction costs, and possibly retiring the existing bond before issuing a new one. These activities result in increased cash outflows for the company in the short term			
140.	$\text{Convexity} = \frac{V_+ + V_- - 2V_0}{2V_0(\Delta y^2)} = \frac{96.30 + 103.89 - 2(100)}{2(100)(0.01)(0.01)} = 9.50$			
141.	Bond refunding reduces the company's future interest payments			
142.	In the short run and under conditions of low inflation			
143.	Treasury Bills			
144.	Commercial Paper			
145.	Increase Explanation: Cost of equity is higher than ROE. This is a case of declining firm and it should have 100% payout ratio. Hence any increase in payout ratio will lead to improvement in price			
146.	$\text{FRA}_{5 \times 6} = \frac{\text{FVF for six years}}{\text{FVF for five years}} - 1 = \frac{(1 + 0.07)^6}{(1 + 0.06)^5} - 1 = 12.14\%$			
147.	Security	Duration	Weight	Product
	AAA Bond	8	1,050	8,400
	AA Bond	6	1,000	6,000
	A Bond	4	950	3,800
	Total	6.07	3,000	18,200

Chapter 6 - Portfolio Management

1. Demand for which real estate type is most affected by foreign trade
 - a. Retail
 - b. Office
 - c. Industrial
2. Stock market is expected to be in bullish phase. You have shortlisted 5 securities from the market and want to invest in 3 with a minimum of 20% in each of the securities to diversify the risk. Identify the securities and proportion of investment.

Company	Beta
S Limited	1.60
K Limited	1.00
P Limited	-0.30
D Limited	2.00
C Limited	0.60

- a. S Limited (60%), D Limited (20%) and K Limited (20%)
 - b. D Limited (60%), S Limited (20%) and K Limited (20%)
 - c. D Limited (33.33%), S Limited (33.33%) and K Limited (33.33%)
 - d. D Limited (50%), S Limited (25%) and K Limited (25%)
3. An investor in a hotel property is evaluating the acquisition of an old hotel building. He is interested in this property as the land prices in the locality have held up pretty well during the last downturn. He contacts the builder for a new hotel in the area and obtains the estimate per square foot if the property is newly constructed. In valuing the subject property, he is most likely using the:
 - a. Sales comparison approach
 - b. Cost approach
 - c. Income approach
 - d. Discounted after tax cash flow approach
4. Assume that a property has a gross annual income equal to Rs.150,000, and that comparable properties have a gross income multiplier equal to 11.25. The gross income multiplier approach provides a market value for this property that is closest to:
 - a. 16,25,000
 - b. 13,33,333
 - c. 16,87,500
 - d. 20,00,000
5. Which of the following statements about the steps in the portfolio management process is NOT correct?
 - a. Rebalancing the investor's portfolio is done on an as-needed basis, and should be reviewed on a regular schedule.
 - b. Implementing the plan is based on an analysis of the current and future forecast of financial and economic conditions.
 - c. Developing an investment strategy is based on an analysis of historical performance in financial markets and economic conditions.
6. An investor has decided to follow 'Buy and Hold' strategy. He wants to create a portfolio of Rs.10,00,000. He does not want the portfolio to go below Rs.4,00,000. How much should the investment be in Bond and equity?
 - a. 5,00,000 and 5,00,000
 - b. 6,00,000 and 4,00,000
 - c. 4,00,000 and 6,00,000
 - d. 10,00,000 and 0

7. Affluence Inc. is considering whether to expand its recreational sports division by embarking on a new project. Affluence's capital structure consists of 75% debt and 25% equity and its marginal tax rate is 30%. Aspire Brands is a publicly traded firm that specializes in recreational sports products. Aspire has a debt-to-equity ratio of 1.7, a beta of 0.8, and a marginal tax rate of 35%. Using the pure-play method with Aspire as the comparable firm, the project beta Affluence should use to calculate the cost of equity capital for this project is closest to:
- 0.58
 - 1.18
 - 0.38
 - 1.12
8. If the costs of debt financing are greater than the return on a real estate investment, then it is most likely that the:
- discount rate is less than the cap rate.
 - value of the property is lower.
 - use of leverage decreases equity returns
 - Discount rate is incorrect
9. Assume you are attempting to estimate the equilibrium expected return for a portfolio using a two-factor arbitrage pricing theory (APT) model. One factor is changes in the 30-year T-bond rate and the other factor is the percentage growth in gross national product (GNP). Assume that you have estimated the risk premium for the interest rate factor to be 0.02, and the risk premium on the GNP factor to be 0.03. The sensitivity of the portfolio to the interest rate factor is -1.2 and the portfolios sensitivity to the GNP factor is 0.80. Given a risk free rate equal to 0.03, what is the expected return for the asset?
- 5.0%.
 - 7.0%
 - 2.4%.
 - 3.0%.

10. An analyst has used Security Market Line to determine if the securities are undervalued/overvalued. He has determined the following forecast about ABC Limited

Forecast returns of ABC Limited	10.00%
Standard deviation of ABC Limited	15.00%
Expected return of stock market index	12.00%
Standard deviation of stock market index	20.00%
Correlation between ABC Limited and stock market index	0.60
Risk-free rate	6.00%

To determine the fair value of ABC, analyst should use the following risk value and should make the following valuation decision

- 0.45 and undervalued
 - 0.15 and overvalued
 - 0.45 and overvalued
 - 0.15 and undervalued
11. Compute the Standard Deviation of Security from following information

Year	Return
1	10
2	20
3	-10
4	-20

- 20%
- 10%

- c. 15.81%
- d. 18.25%

12. Compute the Standard Deviation of Security from the following information

Probability	Return
0.20	10
0.30	20
0.40	-10
0.10	-20

- a. 20%
 - b. 10%
 - c. 14.70%
 - d. 16.70%
13. Which of the following statements about systematic and unsystematic risk is most accurate?
- a. Total risk equals market risk plus firm-specific risk.
 - b. The unsystematic risk for a specific firm is similar to the unsystematic risk for other firms in the same industry.
 - c. As an investor increases the number of stocks in a portfolio, the systematic risk will remain constant.
14. Which of the following statements accurately represents a key difference between Active and Passive Portfolio Strategies?
- a. Active Portfolio Strategy seeks to minimize portfolio turnover, while Passive Portfolio Strategy encourages frequent trading.
 - b. Active Portfolio Strategy emphasizes lower management fees and operating expenses, while Passive Portfolio Strategy often incurs higher costs.
 - c. Active Portfolio Strategy relies on diversification across various asset classes, while Passive Portfolio Strategy typically focuses on investing in individual stocks.
 - d. Active Portfolio Strategy aims to outperform the market through active management, while Passive Portfolio Strategy aims to match the market returns
15. Which of the following is least likely considered a source of systematic risk for bonds?
- a. Purchasing power risk.
 - b. Default risk
 - c. Market risk
16. According to the capital asset pricing model (CAPM), if the expected return on an asset is too low given its beta, investors will:
- a. buy the stock until the price rises to the point where the expected return is again equal to that predicted by the security market line.
 - b. buy the stock until the price falls to the point where the expected return is again equal to that predicted by the security market line.
 - c. sell the stock until the price rises to the point where the expected return is again equal to that predicted by the security market line.
 - d. sell the stock until the price falls to the point where the expected return is again equal to that predicted by the security market line.
17. What is the risk measure associated with the CML?
- a. Beta
 - b. Standard Deviation
 - c. Market risk
 - d. Portfolio return

18. Kaskin, Inc., stock has a beta of 1.2 and Quinn, Inc., stock has a beta of 0.6. Which of the following statements is most accurate?
- The stock of Kaskin, Inc., has more total risk than Quinn, Inc.
 - The expected rate of return will be higher for the stock of Kaskin, Inc., than that of Quinn, Inc.
 - The stock of Quinn, Inc., has more systematic risk than that of Kaskin, Inc.
19. Correlation co-efficient of security A and Market = 0.80; SD of Security A = 20%; SD of market = 25%. How much is the Beta of Security A?
- 0.80 Times
 - 0.64 Times
 - 1 Time
 - 1.25 Times
20. Which of the following factors are not part of systematic risk?
- Interest rate risk
 - Purchasing Power risk
 - Market risk
 - Financial risk
21. Co-variance of Security A and B = 0.0200; SD of Security A = 0.40 and SD of Security B = 0.20. How much is correlation co-efficient between A and B?
- +0.10
 - +0.05
 - +0.50
 - +0.25
22. What is the beta of Hamburg Corp.'s stock if the covariance of the stock with the market portfolio is 0.23, and the standard deviation of the market returns is 32%?
- 1.65
 - 0.72
 - 1.40
 - 2.25
23. An active manager will most likely short a security with an expected Jensen's alpha that is:
- Negative
 - Positive
 - Zero
24. SD of Security A = 10%; Weight of Security A in portfolio = 60%; SD of Security B = 20%; Weight of Security B = 40%; Correlation co-efficient between Security A and B is 0.50. How much is the portfolio SD?
- 14%
 - 15%
 - 12.17%
 - 14.25%
25. In the Markowitz framework, an investor should most appropriately evaluate a potential investment based on its:
- intrinsic value compared to market value
 - expected return
 - effect on portfolio risk and return.

26. Security A has Beta of 1.50 Times and required return of 15.00%. Security B has Beta of 0.50 Times and required return of 10.00%. How much is the risk-free rate and market return?
- 5% and 10%
 - 8% and 13%
 - 7.5% and 12.50%
27. Which of the following is the risk that disappears in the portfolio construction process?
- Unsystematic risk
 - Systematic risk
 - Interest rate risk
 - Market risk
28. During inflationary conditions, a security gets exposed to purchasing power risk. Which of the following statements is true about purchasing power risk?
- PP risk has higher impact on fixed income securities as compared to flexible income securities
 - PP risk has equal impact on both fixed income securities and flexible income securities
 - PP risk has higher impact on flexible income securities as compared to fixed income securities
29. The expected rate of return is 1.5 times the 16% expected rate of return from the market. What is the beta if the risk free rate is 8%?
- 3 Times
 - 4 Times
 - 2 Times
 - 1.5 Times
30. _____ measures total risk whereas _____ measures systematic risk
- SD and Variance
 - SD and Beta
 - Beta and SD
 - Beta and Variance
31. _____ indicates that the security's return is dependent on the market return but moves in the opposite direction in which the market moves
- Positive Beta
 - Zero Beta
 - Negative Beta
32. A portfolio has Beta of 1.5 Times. Risk-free rate is 6% and market return is 9%. How much of the portfolio return is attributable to the higher risk assumed by portfolio manager?
- 3%
 - 4.50%
 - 1.50%
 - 9.00%

33. Compute Co-variance between Security A and B with the help of following information

Year	Return on A (%)	Return on B (%)
2006	10	12
2007	16	18

- 3
- 9
- 36
- 6

34. Given the following risky securities

Particulars	A	B	C	D	E	F	G	H
Return %	10	12.5	15	16	17	18	18	20
Risk %	23	21	25	29	29	32	35	45

Identify the inefficient securities in the given list?

- B, C, E and F
 - A and D
 - A, D, G and H
 - A, D and G
35. Consider a stock selling for Rs.23 that is expected to increase in price to Rs.27 by the end of the year and pay a Rs.0.50 dividend. If the risk-free rate is 4%, the expected return on the market is 8.5%, and the stock's beta is 1.9, what is the current valuation of the stock? The stock:
- Is undervalued
 - Is correctly valued
 - Is overvalued
36. SD of Portfolio A = 2.6250; SD of market is 1.0000. Portfolio A is fully diversified. How much is the Beta of Portfolio A?
- 1 Times
 - 2 Times
 - 2.6250 Times
 - 1.62 Times
37. A portfolio manager adds a new stock that has the same standard deviation of returns as the existing portfolio but has a correlation coefficient with the existing portfolio that is less than +1. Adding this stock will have what effect on the standard deviation of the revised portfolio's returns? The standard deviation will:
- decrease only if the correlation is negative
 - decrease
 - increase
 - increase only if the correlation is positive
38. Which of the following statements best describes the Active Portfolio Strategy in portfolio management?
- The Active Portfolio Strategy aims to replicate the performance of a specific market index or benchmark.
 - The Active Portfolio Strategy involves frequent buying and selling of securities with the goal of outperforming the market.
 - The Active Portfolio Strategy primarily focuses on long-term capital appreciation through diversified investments.
 - The Active Portfolio Strategy relies on low-cost index funds to achieve consistent returns over time.
39. The rate of return of Market is 8% and risk-free rate of return is 5%. You are currently holding Rs.1,00,000. How much should be the investment in market and risk-free asset to get return of 10%?
- 1,66,667 and 66,667
 - 1,66,667 and -66,667
 - 66,667 and 1,66,667
 - 66,667 and 1,66,667

40. RBI has closed the latest auction for Rs.2,500 crores of 182 days bills for the lowest bid of 4.3% although there were bidders at a higher rate of 4.6% also for lots less than Rs.10 Crores. What should be taken as risk-free rate if you want to follow an aggressive approach?
- 4.45%
 - 4.60%
 - 4.30%
41. If two stocks have positive covariance, which of the following statements is CORRECT?
- The rates of return tend to move in the same direction relative to their individual means.
 - The two stocks must be in the same industry
 - If one stock doubles in price, the other will also double in price.
42. What is the expected rate of return for a stock that has a beta of 0.8 if the risk-free rate is 5%, and the market risk premium is 7%?
- 6.6%.
 - 8.0%.
 - 10.6%.
 - 12.6%
43. Sensitivity of return of each with respect to market is called as _____
- Beta
 - Standard Deviation
 - None of the above
44. A security moved up by 12% when the market moved down by 6%. How much is the beta of the security?
- 2 times
 - 2 times
 - 0.5 times
 - 0.5 times
45. Beta of Company A = 1.50 Times; Beta of Company B = 2 Times; SD of market = 0.10. How much is covariance between Security A and Security B?
- 0.30
 - 0.03
 - 0.01
46. Variance of Security 1 = 167.75; Variance of security 2 = 126.98; Covariance between Security A and B is -144.25; How much should be the investment in Security 1 to formulate a minimum risk portfolio?
- 0.50
 - 0.4650
 - 0.5350
 - 0.75
47. Stock A has a standard deviation of 0.5 and Stock B has a standard deviation of 0.3. Stock A and Stock B are perfectly positively correlated. According to Markowitz portfolio theory how much should be invested in each stock to minimize the portfolio's standard deviation?
- 50% in Stock A and 50% in Stock B
 - 100% in Stock B
 - 30% in Stock A and 70% in Stock B
 - 100% in Stock A

48. A portfolio's excess return per unit of systematic risk is known as its:
- Jensen's Alpha
 - Treynor ratio
 - Sharpe Ratio
49. Which investment strategy, often utilized to protect the downside risk of a portfolio, involves dynamically adjusting the asset allocation based on a specified formula tied to the portfolio's value?
- Buy and Hold Policy
 - Constant mix policy
 - Constant Proportion Portfolio Insurance (CPPI) Policy
 - Dynamic Asset Allocation Strategy
50. Total risk of security (SD) = 0.20. Security has perfect positive correlation with market. How much is the unsystematic risk as per SD approach?
- 0.20
 - 0
 - 0.10
51. Co-efficient of determination (r) = 0.80; Total variance = 400. How much is the unsystematic risk as per variance approach?
- 80
 - 320
 - 256
 - 144
52. Which of the following statements is true regarding the Passive Portfolio Strategy in portfolio management?
- The Passive Portfolio Strategy aims to actively manage the portfolio to beat market benchmarks.
 - The Passive Portfolio Strategy relies on a buy-and-hold approach without frequent rebalancing.
 - The Passive Portfolio Strategy involves constant adjustments of asset allocation based on market conditions.
 - The Passive Portfolio Strategy seeks to generate higher returns through aggressive trading of individual stocks.
53. The beta of stock D is -0.5. If the expected return of Stock D is 8%, and the risk-free rate of return is 5%, what is the expected return of the market?
- 1.0%
 - +3.0%
 - +3.5%
 - 2.5%
54. Residual variance is also known as _____
- Total Risk
 - Unsystematic risk
 - Systematic Risk
55. Which of the following statements regarding efficient/inefficient portfolio is true?
- A portfolio is said to be efficient if we cannot increase the expected return without increasing risk
 - A portfolio is said to be efficient if we can increase the return without increasing the risk
 - A portfolio is said to be efficient if risk can be reduced without decreasing the return

- d. A portfolio is said to be efficient if we can increase the return while decreasing the risk
56. Unsystematic risk as per variance approach of Security A = 0.02; Unsystematic risk as per variance approach of Security B = 0.05; Weight of security A = 80%; Weight of Security B = 20%. How much is portfolio unsystematic risk?
- 0.026
 - 0.035
 - 0.0148
 - None of the above
57. Which investment policy is best described as a passive strategy where investors buy a diversified portfolio of assets and hold them over an extended period, with minimal trading or adjustments?
- Buy and Hold Policy
 - Constant mix policy
 - Constant Proportion Portfolio Insurance (CPPI) Policy
 - Tactical Asset Allocation Strategy
58. Which of the following investment strategies involves maintaining a predetermined asset allocation mix and periodic rebalancing to original proportions, ensuring disciplined risk management and potential long-term growth?
- Buy and Hold Policy
 - Constant mix policy
 - Constant Proportion Portfolio Insurance (CPPI) Policy
 - Tactical Asset Allocation Strategy
59. Variance of Portfolio is 200.22. SD of market is 15 and Beta of Portfolio is 0.8467. How much is the unsystematic risk of portfolio as per variance approach?
- 200.22
 - 161.29
 - 1.45
 - 38.93
60. Which of the following statements accurately reflects the relationship between inflation and Bond Security selection?
- Rising inflation generally increases the demand for long-term bonds with fixed interest rates.
 - Inflation has no direct impact on bond prices, making it an insignificant factor for investors.
 - High inflation rates lead to lower interest rates, making short-term bonds more attractive.
 - Inflation erodes the purchasing power of bond yields, making bonds less desirable during inflationary periods.
61. Which of these strategies provides protection during down markets?
- Buy and Hold Policy
 - Constant Mix Policy
 - Constant Proportion Portfolio Insurance
62. Efficient frontier contains all possible efficient portfolios and any point on the frontier dominates any point to the _____
- Right of it and below it
 - Right of it and above it
 - Left of it and above it
 - Left of it and below it
63. Random error is also known as _____

- a. Total risk
- b. Systematic Risk
- c. Unsystematic Risk

64. Risk-free rate = 4%; Risk premium of market = 8%. What is the expected return of a security having Beta of 2 Times?

- a. 16.00%
- b. 24.00%
- c. 12.00%
- d. 20.00%

65. Portfolio risk is the weighted average of risks of the securities forming part of portfolio in case of

- a. Perfectly negative correlation between securities
- b. No correlation between securities
- c. Perfectly positive correlation between securities
- d. Positive correlation between securities

66. Mr. Tamarind intends to invest in equity shares of a company the value of which depends upon various parameters as mentioned below:

Factor	Beta	Expected Value %	Actual Value %
GNP	1.20	7.70	7.70
Inflation	1.75	5.50	7.00

If the risk free rate of interest be 9.25%, how much is the return of the share under Arbitrage Pricing Theory?

- a. 9.25%
- b. 11.88%
- c. 6.63%
- d. 17.40%

67. SD of Security A = 12%; Beta of Security A = 1.5 Times; SD of market = 6%; Risk-free rate = 6%. Return of Market = 10%. How much is the required return as per Security Market Line and Capital Market Line?

- a. 14% and 12%
- b. 12% and 14%
- c. 10% and 14%
- d. 14% and 10%

68. The correlation of returns on the risk-free asset with returns on a portfolio of risky assets is:

- a. Positive
- b. Zero
- c. Negative

69. A firm has an equity beta of 1.30 and is currently financed by 25% debt and 75% equity. What will be the beta of company's assets? Assume corporation tax to stand at 35%.

- a. 0.975 Times
- b. 1.0685 Times
- c. 0.9125 Times
- d. 1.30 Times

70. Return of risky portfolio = 20%. You have invested with a margin of 50% and cost of borrowing is 10%. How much is the return of investor?

- a. 20%
- b. 10%
- c. 30%
- d. 25%

71. An investor is forming a portfolio of two securities. The correlation between two securities is -1. What will be the impact on portfolio risk as correlation coefficient gradually changes from -1 to 1?
- Portfolio risk has no impact
 - Portfolio risk will decrease
 - Portfolio risk will increase
72. Correlation co-efficient between Security X and Security X is _____
- No correlation
 - Correlation of +1
 - Correlation of -1
73. You have created a portfolio of Rs.2,00,000 with equal investment in debt and equity. Equity market has declined from 100 to 80 and revived from 80 to 125. How much is the maturity value under buy and hold policy?
- 2,00,000
 - 1,80,000
 - 2,25,000
 - 2,30,625
74. You have created a portfolio of Rs.2,00,000 with equal investment in debt and equity. Equity market has declined from 100 to 80 and revived from 80 to 125. How much is the maturity value under constant mix policy?
- 2,00,000
 - 1,80,000
 - 2,25,000
 - 2,30,625
75. Equity of A Limited = Rs.2 crores and Debt of A Limited is Rs.2 Crores. Beta of equity shares of A Limited is 2 Times. How much is the Beta of the existing assets of A Limited?
- 2 Times
 - 4 Times
 - 1 Time
76. Levered Beta is _____ and unlevered beta is _____
- Equity Beta and Asset Beta
 - Asset Beta and equity Beta
 - Debt beta and equity beta
 - Equity beta and debt beta
77. SD of risky portfolio = 20%. You have invested with a margin of 50% and cost of borrowing is 10%. Risk-free rate is 10%. How much is the risk of investor?
- 30%
 - 20%
 - 10%
 - 25%
78. Expected Maximum decline in stock market = 10%; Value of portfolio = 10,00,000. How much can be the investment in equity with a multiplier of '2' as per constant proportion portfolio insurance policy?
- 1,00,000
 - 2,00,000
 - 9,00,000
 - 8,00,000

79. Two companies are identical in all aspects except capital structure. ABC Limited has a debt-equity ratio of 1:4 and its equity has beta of 1.1. XYZ Limited has a debt-equity ratio of 3:4. Income tax is 30%. Estimate equity beta of XYZ Limited?
- 0.9362 Times
 - 1.4277 Times
 - 1.10 Times
 - 3.30 Times
80. Return of Security A = 12%; Beta of Security A = 2 Times; Return of market = 8%; Risk-free rate = 6%. What is the characteristic line of Security A?
- $+4\% + (2 \times \text{Return of market})$
 - $-4\% + (2 \times \text{Return of Market})$
 - $+2\% + (1 \times \text{Return of Market})$
 - $-2\% + (1 \times \text{Return of Market})$
81. Which of the following is NOT an assumption of capital market theory?
- Interest rates never change from period to period
 - Investors can lend at the risk-free rate, but borrow at a higher rate
 - The capital markets are in equilibrium.
82. Specific SD of a security is also known as _____
- Unsystematic Risk
 - Systematic Risk
 - Total Risk
83. Which asset allocation strategy emphasizes maintaining a fixed allocation mix across different asset classes for an extended period, regardless of short-term market fluctuations?
- Strategic Asset Allocation
 - Tactical Asset Allocation
 - Constant Proportion Portfolio Insurance (CPPI) Strategy
 - Dynamic Asset Allocation
84. Co-variance between security X and Security X = 4.80; Co-variance between Security X and Security Y = 4.30; Co-variance between Security Y and Security Y = 4.25. How much is the Standard deviation of Security X?
- 4.80
 - 4.30
 - 2.19
 - 2.07
85. Which alternative investment provides investors with partial ownership of a pool of real estate assets, offering potential income through rental payments and the potential for capital appreciation?
- Hedge Funds
 - Private Equity
 - Real Estate Investment Trusts (REITs)
 - Venture Capital
86. A portfolio currently holds TCS and the portfolio manager is thinking of adding either WIPRO or Ashok Leyland to the portfolio. All three stocks offer the same expected return and total risk. The covariance of returns between TCS and WIPRO is +0.5 and the covariance between TCS and Ashok Leyland is -0.5. The portfolio's risk would decrease:
- most if she put half your money in WIPRO and half in Ashok Leyland
 - more if she bought WIPRO

- c. more if she bought Ashok Leyland
87. Which of the bond swap strategy involves switch from a lower yield bond to a higher yield bond of almost identical quantity and maturity?
- Pure Yield Pickup Swap
 - Substitution swap
 - International Spread Swap
 - Tax Swap
88. Which form of gold investment is issued by the government and allows investors to buy gold in a paper form without the need for physical possession, while also earning fixed interest over time?
- Physical Gold
 - Gold Bars
 - Sovereign Gold Bonds
 - E-Gold
89. Which alternative investment involves investing in early-stage companies with high growth potential, often in technology or innovative industries?
- Hedge Funds
 - Private Equity
 - Real Estate Investment Trusts (REITs)
 - Venture Capital
90. Which Active Strategy involves investment of equal amount in bonds with different maturity periods?
- Bullet Strategy
 - Barbell Strategy
 - Ladder Strategy
91. Which of the following best describes the objective of investing in distressed securities?
- To invest in high-risk securities that offer potential for significant returns in stable market conditions.
 - To invest in low-risk securities issued by financially stable companies with high credit ratings.
 - To take advantage of undervalued securities of companies facing financial difficulties, with the expectation of high returns in case of successful restructuring.
 - To diversify the investment portfolio with securities from different industries and sectors.
92. Which of these strategies are useful in case of investing in distressed companies?
- Long position in debt and long position in equity
 - Long position in debt and short position in equity
 - Not taking any position
93. As the correlation between the returns of two assets becomes lower, the risk reduction potential becomes
- Decreased by the same level
 - Greater
 - Smaller
94. Which of the following asset allocation strategies involves dynamically adjusting the portfolio's asset allocation based on market conditions and economic outlook to capitalize on short-term opportunities?
- Strategic Asset Allocation

- b. Tactical Asset Allocation
 - c. Constant Proportion Portfolio Insurance (CPPI) Strategy
 - d. Dynamic Asset Allocation
95. Reward to variability ratio is basically _____
- a. Sharpe Ratio
 - b. Treynor Ratio
96. Ashwin, CA, examines data for two computer stocks, AAA and BBB, and derives the following results: Standard deviation for AAA is 0.50. Standard deviation for BBB is 0.50. Standard deviation for the Nifty is 0.20. Correlation between AAA and the Nifty is 0.60. Beta for BBB is 1.00. Ashwin wants you to identify the stock with the highest systematic and unsystematic risk. _____ has the highest systematic risk and _____ has the highest unsystematic risk
- a. AAA and AAA
 - b. AAA and BBB
 - c. BBB and BBB
 - d. BBB and AAA
97. The security market line (SML) is a graphical representation of the relationship between return and
- a. total risk
 - b. unsystematic risk
 - c. systematic risk
 - d. Residual risk
98. Examples of macroeconomic variables that create systematic risk include:
- a. variability in the growth of the money supply.
 - b. changes in GDP growth rates.
 - c. all of these choices are correct.
99. Figment, Inc., stock has a beta of 1.0 and a forecast return of 14%. The expected return on the market portfolio is 14%, and the long-run inflationary expectation is 3%. Which of the following statements is most accurate? Figment, Inc.'s stock:
- a. valuation relative to the market cannot be determined.
 - b. is overvalued.
 - c. is properly valued
100. ABC Wealth Management is establishing a new portfolio for a client. They aim to understand the client's risk tolerance, investment goals, and time horizon to make informed investment decisions. Which of the following phases of portfolio management is focused on gathering relevant information about the client's investment objectives?
- a. Portfolio Construction Phase
 - b. Portfolio Analysis Phase
 - c. Portfolio Planning Phase
 - d. Portfolio Monitoring Phase
101. XYZ Investments, a leading financial firm, is implementing a disciplined approach to portfolio management. They want to ensure a thorough analysis of investment opportunities and regular monitoring of the portfolio's performance. Which of the following phases of portfolio management is concerned with the ongoing review and assessment of the portfolio's performance?
- a. Portfolio Analysis Phase
 - b. Portfolio Construction Phase
 - c. Portfolio Evaluation Phase
 - d. Portfolio Monitoring Phase

102. LMN Capital is managing a portfolio for a client who seeks to minimize the impact of systematic risk on their investments. Which of the following portfolio theories would be most suitable for guiding LMN Capital in managing the client's portfolio to minimize systematic risk?
- Capital Asset Pricing Model (CAPM)
 - Modern Portfolio Theory (MPT)
 - Arbitrage Pricing Theory (APT)
 - Black-Scholes Model
103. ABC Investments is analyzing a stock for potential inclusion in their portfolio. They want to assess the risk associated with the stock. Which of the following risks is most likely to be classified as systematic risk for the stock in consideration?
- Regulatory risk specific to the industry
 - Company-specific operational risk
 - Currency exchange rate risk
 - Management risk related to the company's leadership
104. An efficient portfolio has the _____ risk among all feasible portfolio having same or high return
- Lowest
 - Highest
 - Moderate
105. In order to construct a well-diversified portfolio, an investor should eliminate _____
- Systematic risk
 - Unsystematic risk
 - Total risk
106. LMN Investments is evaluating a stock for potential investment. They want to assess the risk associated with the stock. Which of the following risks is most likely to be classified as unsystematic risk for the stock in consideration?
- Market-wide recessionary conditions
 - Fluctuations in the exchange rate between two currencies
 - Changes in government regulations impacting the industry
 - Industry-wide competitive pressures
107. You are required to assess the past performance of sector specific funds. Which of these ratios can be used to better assess the performance?
- Sharpe Ratio
 - Treynor Ratio
 - Both can be used
108. Required return as per CAPM is 18% whereas the security is likely to give return of 16%. In this case, the security is _____
- Undervalued
 - Overvalued
 - Correctly valued
109. Compute Beta of Security A with the help of following information:

	Year 2007	Year 2008	Year 2009
Market (%)	12.0	11.0	9.0
Company A (%)	13.0	11.5	9.8

- 2 Times
- 1.2536 times

- c. 0.9250 times
- d. 1.0836 Times

110. Risk-free rate of return is 6% whereas market return is 10%. Security X is 40% more riskier than the market. How much is the required return of Security X?

- a. 10.00%
- b. 14.00%
- c. 11.60%
- d. 6.00%

111. PQR Investments is constructing a portfolio and wants to select assets that are positively correlated to maximize portfolio returns. Which of the following correlation coefficients indicates the weakest positive linear relationship between the returns of two assets?

- a. 0.10
- b. 0.40
- c. 0.60
- d. 0.80

112. Risk for capital market line is measured through _____ and risk for security market line is measured through _____

- a. Beta and Standard Deviation
- b. Standard Deviation and Beta

113. An investor has found two portfolio which are on minimum risk.

Portfolio	Weight of A	Weight of B	Weight of C
1	0.50	0.25	0.25
2	0.70	0.20	0.10

He has decided to invest 20% of funds in Security A. How much should he invest in B and C to have a minimum risk portfolio?

- a. 0.475 and 0.325
- b. 0.325 and 0.475
- c. 0.40 and 0.40
- d. 0.25 and 0.55

114. XYZ Asset Management is constructing a portfolio for a client with a specific target return. They want to determine the optimal asset allocation. According to the Markowitz model, which of the following factors is crucial for determining the optimal asset allocation?

- a. Maximizing the expected return of each individual asset
- b. Minimizing the standard deviation of each individual asset
- c. Assessing the correlation between different assets
- d. Considering the market capitalization of each individual asset

115. PQR Investments is constructing a portfolio and wants to allocate assets in a manner that maximizes return for a given level of risk. According to the Markowitz model, which of the following concepts is essential for achieving an optimal risk-return trade-off?

- a. Beta coefficient of individual assets
- b. Sharpe ratio of individual assets
- c. Efficient frontier of asset combinations
- d. Treynor ratio of individual assets

116. Holding all else equal, if the beta of a stock increases, the stock's price will:

- a. Decrease
- b. Increase
- c. Be unaffected

d. Become zero

117. A 5-year bond with a 10% coupon has a present yield to maturity of 8%. If interest rates remain constant one year from now, the price of the bond will be:

- The same
- Higher
- Lower
- Impact cannot be assessed

Answer:

1.	Industrial																																				
2.	We should invest maximum in securities having higher Beta to maximize returns in bull phase. We are required to invest in three securities with minimum investment of 20%. Hence, we can invest 60% in highest Beta Security, 20% in next security and balance 20% in third security.																																				
3.	Cost approach																																				
4.	Value of property = 1,50,000 x 11.25 = Rs.16,87,500																																				
5.	Developing an investment strategy is based on an analysis of historical performance in financial markets and economic conditions Explanation: Developing an investment strategy is based primarily on an analysis of the current and future financial market and economic conditions. Historical analysis serves to help develop an expectation for future conditions																																				
6.	Under this strategy investors set a limit (floor) below which he does not wish the value of portfolio should go. Therefore, he invests an amount equal to floor value in non-fluctuating assets (Bonds). Hence in this case 4,00,000 would be invested in Bonds and balance 6,00,000 will be invested in equity																																				
7.	Computation of Asset Beta of Proxy Entity: <table><tr><th>Source</th><th>Beta</th><th>Weight</th><th>Product</th></tr><tr><td>Debt</td><td>0.00</td><td>1.105 [1.7 x 65%]</td><td>0.00</td></tr><tr><td>Equity</td><td>0.80</td><td>1.00</td><td>0.80</td></tr><tr><td>Overall</td><td>0.38</td><td>2.105</td><td>0.80</td></tr></table> Computation of equity Beta of Affluence: <table><tr><th>Source</th><th>Beta</th><th>Weight</th><th>Product</th></tr><tr><td>Debt</td><td>0.00</td><td>52.50 [75 x 70%]</td><td>0.00</td></tr><tr><td>Equity</td><td>1.18</td><td>25</td><td>29.45</td></tr><tr><td>Overall</td><td>0.38</td><td>77.50</td><td>29.45</td></tr></table> Equity Beta of Affluence = 1.18 Times	Source	Beta	Weight	Product	Debt	0.00	1.105 [1.7 x 65%]	0.00	Equity	0.80	1.00	0.80	Overall	0.38	2.105	0.80	Source	Beta	Weight	Product	Debt	0.00	52.50 [75 x 70%]	0.00	Equity	1.18	25	29.45	Overall	0.38	77.50	29.45				
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Overall	0.38	77.50	29.45																																		
8.	Use of leverage reduces equity returns as usage of debt is not beneficial																																				
9.	Return under APT = Risk-free rate + [Factor 1 Beta x Risk premium] + [Factor 2 Beta x Risk premium] Return under APT = 3% + [-1.20 x 2%] + [0.80 x 3%] = 3.00%																																				
10.	Beta is used as a measure of risk under SML approach $\text{Beta} = \left(\frac{\text{SD of Security}}{\text{SD of Market}}\right) \times \text{correlation coefficient} = \left(\frac{15}{20} \times 0.60\right) = 0.45 \text{ Times}$ Expected return = 6 + 0.45 x (12 - 6) = 8.70% Security is generating a return higher than required return and hence it is under-valued. So answer is 0.45 times and undervalued																																				
11.	<table><tr><th>Year</th><th>Prob</th><th>Return</th><th>Product</th><th>Deviation</th><th>Pd²</th></tr><tr><td>1</td><td>0.25</td><td>10</td><td>2.5</td><td>10</td><td>25</td></tr><tr><td>2</td><td>0.25</td><td>20</td><td>5</td><td>20</td><td>100</td></tr><tr><td>3</td><td>0.25</td><td>-10</td><td>-2.5</td><td>-10</td><td>25</td></tr><tr><td>4</td><td>0.25</td><td>-20</td><td>-5</td><td>-20</td><td>100</td></tr><tr><td></td><td></td><td></td><td>0</td><td></td><td>250</td></tr></table> Standard Deviation (%) = $\sqrt{250}$ = 15.81%	Year	Prob	Return	Product	Deviation	Pd ²	1	0.25	10	2.5	10	25	2	0.25	20	5	20	100	3	0.25	-10	-2.5	-10	25	4	0.25	-20	-5	-20	100				0		250
Year	Prob	Return	Product	Deviation	Pd ²																																
1	0.25	10	2.5	10	25																																
2	0.25	20	5	20	100																																
3	0.25	-10	-2.5	-10	25																																
4	0.25	-20	-5	-20	100																																
			0		250																																

12.	<table><tr><th>Prob</th><th>Return</th><th>Product</th><th>Deviation</th><th>Pd²</th></tr><tr><td>0.20</td><td>10</td><td>2.0</td><td>8.0</td><td>12.80</td></tr><tr><td>0.30</td><td>20</td><td>6.0</td><td>18.0</td><td>97.20</td></tr><tr><td>0.40</td><td>-10</td><td>-4.0</td><td>-12.0</td><td>57.60</td></tr><tr><td>0.10</td><td>-20</td><td>-2.0</td><td>-22.0</td><td>48.40</td></tr><tr><td></td><td></td><td>2.0</td><td></td><td>216</td></tr></table> Standard Deviation (%) = $\sqrt{216} = 14.70\%$	Prob	Return	Product	Deviation	Pd ²	0.20	10	2.0	8.0	12.80	0.30	20	6.0	18.0	97.20	0.40	-10	-4.0	-12.0	57.60	0.10	-20	-2.0	-22.0	48.40			2.0		216	
Prob	Return	Product	Deviation	Pd ²																												
0.20	10	2.0	8.0	12.80																												
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0.40	-10	-4.0	-12.0	57.60																												
0.10	-20	-2.0	-22.0	48.40																												
		2.0		216																												
13.	Total risk equals market risk plus firm-specific risk Explanation: The unsystematic risk for a specific firm is not similar to the unsystematic risk for other firms in the same industry. Unsystematic risk is firm-specific or unique risk. Systematic risk of a portfolio can be changed by adding high-beta or low-beta stocks.																															
14.	Active Portfolio Strategy aims to outperform the market through active management, while Passive Portfolio Strategy aims to match the market returns.																															
15.	Default risk is based on company-specific or unsystematic risk																															
16.	The CAPM is an equilibrium model: its predictions result from market forces acting to return the market to equilibrium. If the expected return on an asset is temporarily too low given its beta according to the SML (which means the market price is too high), investors will sell the stock until the price falls to the point where the expected return is again equal to that predicted by the SML																															
17.	Standard Deviation																															
18.	The expected rate of return will be higher for the stock of Kaskin, Inc., than that of Quinn, Inc.																															
19.	$\text{Beta} = \frac{\text{SD of Security}}{\text{SD of Market}} \times \text{Correlation coefficient} = \frac{0.20}{0.25} \times 0.80 = 0.64 \text{ Times}$																															
20.	Financial risk																															
21.	$\text{Correlation coefficient} = \frac{\text{Co - variance of security A and B}}{\text{SD of A} \times \text{SD of B}} = \frac{0.0200}{0.40 \times 0.20} = +0.25$																															
22.	$\text{Beta} = \frac{\text{Co - variance of security and market}}{\text{Variance of market}}$ $\text{Beta} = \frac{0.23}{0.32 \times 0.32} = 2.25$																															
23.	Negative Alpha Securities are overvalued and hence should be sold																															
24.	Variance of Portfolio = $(\sigma_a W_a)^2 + (\sigma_b W_b)^2 + 2\sigma_a W_a \sigma_b W_b \text{COR}_{ab}$ Variance of Portfolio = $(10 \times 0.60)^2 + (20 \times 0.40)^2 + 2(10)(0.60)(20)(0.40)(0.50) = 148$ Variance of Portfolio = $\sqrt{148} = 12.17\%$																															
25.	Effect on portfolio risk and return Explanation: Modern portfolio theory concludes that an investor should evaluate potential investments from a portfolio perspective and consider how the investment will affect the risk and return characteristics of an investor's portfolio as a whole.																															
26.	Required Return = $R_f + \text{Beta} \times (R_m - R_f)$ $15.00\% = R_f + (1.50 \times R_p)$ $10.00\% = R_f + (0.50 \times R_p)$ Solving the equation, we get risk premium as 5.00% and get risk-free rate as 7.50% Hence risk-free rate is 7.50% and return of market is 12.50%																															
27.	Unsystematic risk (diversifiable risk) is the risk that is eliminated when the investor builds a well-diversified portfolio																															
28.	Answer is option A Explanation: Fixed income securities will pay fixed interest and hence will have higher impact of inflation. However flexible income securities like equity shares will see an increase in dividend income which can partly offset the impact of inflation																															
29.	Expected return = $R_f + \text{Beta} \times (R_m - R_f)$ $24\% = 8\% + (\text{Beta} \times 8\%); \text{Beta} = \frac{16\%}{8\%} = 2 \text{ Times}$																															
30.	SD measures total risk whereas Beta measures systematic risk																															
31.	Negative Beta																															
32.	<table><tr><th rowspan="2">Year</th><th rowspan="2">Prob</th><th colspan="3">Security A</th><th colspan="3">Security B</th><th rowspan="2">Pd_ad_b</th></tr><tr><th>Return</th><th>Product</th><th>Deviation</th><th>Return</th><th>Product</th><th>Deviation</th></tr><tr><td>2006</td><td>0.5</td><td>10</td><td>5</td><td>-3</td><td>12</td><td>6</td><td>-3</td><td>4.5</td></tr></table>	Year	Prob	Security A			Security B			Pd _a d _b	Return	Product	Deviation	Return	Product	Deviation	2006	0.5	10	5	-3	12	6	-3	4.5							
Year	Prob			Security A			Security B				Pd _a d _b																					
		Return	Product	Deviation	Return	Product	Deviation																									
2006	0.5	10	5	-3	12	6	-3	4.5																								

	2007	0.5	16	8	3	18	9	3	4.5																
	Total			13			15		9																
Co-variance of stocks = Sum of $Pd_a d_b = 9$																									
33.	Required return for Beta of 1.5 Times = $6 + 1.50 \times (9 - 6) = 10.50\%$ Return of market is 9% for Beta of 1 Time. Required return of portfolio A is 10.50% for Beta of 1.50 Times Excess return due to higher risk = $10.50\% - 9.00\% = 1.50\%$																								
34.	Security A, D and G are inefficient securities Security B dominates Security A as it generates higher return with lower risk. Hence Security A is inefficient. Security E dominates Security D as it generates higher return with same risk. Hence Security D is inefficient Security F dominates Security G as it generates same return with lower risk. Hence Security G is inefficient																								
35.	Required return as per CAPM = $4 + 1.90 \times (8.5 - 4) = 12.55\%$ Expected return = $\frac{(27 - 23) + 0.50}{23} \times 100 = 19.57\%$ Security is likely to generate more return than needed and hence it is undervalued security																								
36.	Portfolio is fully diversified and hence total risk is equal to systematic risk $2.6250^2 = (\text{Beta} \times \text{SD of market})^2$; $2.6250 = \text{Beta} \times 1$; Beta of security = 2.6250 Times																								
37.	Decrease Explanation: If the correlation coefficient is less than 1, there are benefits to diversification. Thus, adding the stock will reduce the portfolio's standard deviation																								
38.	The Active Portfolio Strategy involves frequent buying and selling of securities with the goal of outperforming the market																								
39.	Let us assume X to be the proportion of investment in market and (1-X) to be the proportion of investment in Risk-free security <table border="1"><thead><tr><th>Security</th><th>Return</th><th>Weight</th><th>Product</th></tr></thead><tbody><tr><td>Market</td><td>8</td><td>X</td><td>8X</td></tr><tr><td>Risk-free</td><td>5</td><td>1-X</td><td>5-5X</td></tr><tr><td>Total</td><td>10</td><td>1</td><td>8X + 5 -5X = 10</td></tr></tbody></table> $8X + 5 - 5X = 10$; $3X = 5$; $X = 166.67\%$; Hence investor should invest 166.67% in market portfolio and borrow 66.67% from risk-free security. Investment in market security = Rs.1,66,667; Borrowing from market = Rs.66,667									Security	Return	Weight	Product	Market	8	X	8X	Risk-free	5	1-X	5-5X	Total	10	1	8X + 5 -5X = 10
Security	Return	Weight	Product																						
Market	8	X	8X																						
Risk-free	5	1-X	5-5X																						
Total	10	1	8X + 5 -5X = 10																						
40.	Aggressive approach is to consider higher rate of 4.60%																								
41.	The rates of return tend to move in the same direction relative to their individual means																								
42.	Expected return = $5 + 0.80 \times 7 = 10.60\%$																								
43.	Beta																								
44.	$\text{Beta} = \frac{\% \text{ change in security}}{\% \text{ change in market}} = \frac{12}{-6} = -2 \text{ Times}$																								
45.	Covariance between A and B = Beta of company A x Beta of Company B x Variance of market = $1.50 \times 2 \times 0.1 \times 0.1 = 0.03$																								
46.	$\text{Weight of Security 1} = \frac{\text{Variance of Security 2} - \text{Covariance of 1 \& 2}}{\text{Variance of Security 1} + \text{Variance of Security 2} - 2\text{Covariance of 1 \& 2}}$ $\text{Weight of Security 1} = \frac{126.98 + 144.25}{167.75 + 126.98 + 2(144.25)} = \frac{271.23}{583.23} = 0.4650$																								
47.	100% in Stock B Explanation: Since the stocks are perfectly correlated, there is no benefit from diversification. So, invest in the stock with the lowest risk																								
48.	Treyner Ratio																								
49.	Constant Proportion Portfolio Insurance (CPPI) Policy																								
50.	Security has perfect positive correlation and hence has correlation coefficient of +1 Systematic risk = SD of security x Correlation = $0.20 \times 1 = 0.20$ Unsystematic risk = $0.20 - 0.20 = 0$																								
51.	Coefficient of determination as per variance approach (r^2) = $0.80 \times 0.80 = 0.64$ Systematic risk = $400 \times 0.64 = 256$ Unsystematic risk = $400 - 256 = 144$																								

52.	The Passive Portfolio Strategy relies on a buy-and-hold approach without frequent rebalancing.					
53.	Return of security = $R_f + \text{Beta} \times (R_m - R_f)$ $8\% = 5\% - 0.5 \times (R_m - 5\%); 3\% = -0.5R_m + 2.5\%; 0.5\% = -0.5R_m; \mathbf{R_m} = -1\%$					
54.	Unsystematic risk					
55.	A portfolio is said to be efficient if we cannot increase the expected return without increasing risk. In all other situation it was possible to improve returns without increasing risk (or) reduce risk without impact on returns. All other situations are inefficient portfolio as the company is yet to attain the stage of optimal portfolio					
56.	Unsystematic risk = Weighted average of individual unsystematic risk with weights square being the assigned weights Unsystematic risk = $[0.02 \times 0.80 \times 0.80] + [0.05 \times 0.20 \times 0.20] = 0.0148$					
57.	Buy and Hold Policy					
58.	Constant Mix Policy					
59.	Particulars		Variance Approach			
	Total Risk		200.22			
	Systematic risk		161.29			
	$[\text{SD of Market} \times \text{Beta of Portfolio}]^2$		$(0.8467 \times 15)^2$			
	Unsystematic risk (bal figure)		38.93			
60.	Inflation erodes the purchasing power of bond yields, making bonds less desirable during inflationary periods					
61.	Constant Proportion Portfolio Insurance					
62.	Right of it and below it. If a point in the frontier is to right of it then it would mean that security carries more risk for same level of return. If a point in the frontier is below of it then it would mean that it is earning lower return for same amount of risk.					
63.	Unsystematic risk					
64.	$\text{Return} = R_f + \text{Beta} \times (\text{Risk premium of market}) = 4\% + (2 \times 8\%) = 20.00\%$					
65.	Perfectly positive correlation between securities					
66.	$\text{Return under APT} = \text{Risk free rate} + (\text{Factor 1 Beta} \times \text{Change in Factor 1}) + (\text{Factor 2 Beta} \times \text{Change in Factor 2})$ $\text{Return under APT} = 9.25 + (1.20 \times 0) + (1.75 \times 1.50) = 11.88\%$					
67.	$\text{Required return as per SML} = R_f + \text{Beta} \times (R_m - R_f) = 6 + 1.50 \times (10 - 6) = 12.00\%$ $\text{Required return as per CML} = R_f + \frac{\text{SD of Security}}{\text{SD of Market}} \times (R_m - R_f) = 6 + \left(\frac{0.12}{0.06} \times (10 - 6)\right) = 14.00\%$ Hence answer is 12% and 14%					
68.	Zero					
69.	Security	Beta	Weight	Product	Beta of debt will be zero in the absence of information; Weight of debt = $0.25 \times (1 - \text{Tax rate}) = 0.25 \times 0.65 = 0.1625$ Beta of Assets = $\frac{\text{Sum of Product}}{\text{Sum of weight}} = \frac{0.975}{0.9125} = 1.0685$	
	Equity	1.30	0.75	0.975		
	Debt	0.00	0.1625	0		
	Firm	1.0685	0.9125	0.975		
70.	$\text{Investment in risky portfolio} = 1.5 \text{ Times}; \text{Borrowing} = -0.5 \text{ times}$ $\text{Return} = [20\% \times 1.5] + [10\% \times -0.5] = 25\%$					
71.	Portfolio risk will increase if the correlation co-efficient moves gradually from -1 to 1.					
72.	Correlation of +1					
73.	$\text{Maturity value of equity} = \frac{1,00,000}{100} \times 125 = 1,25,000$ Maturity value of debt = 1,00,000 Total maturity value = $1,25,000 + 1,00,000 = \text{Rs.} 2,25,000$					
74.	Particulars	Day 1	Fall before	Fall after	Maturity	
			80,000		1,40,625	
	Equity	1,00,000	$[1,00,000 \times 80/100]$	90,000	$[90,000 \times 125/80]$	
	Bond	1,00,000	1,00,000	90,000	90,000	

	Total Value	2,00,000	1,80,000	1,80,000	2,30,625																																	
75.	Beta of Assets = Beta of Liabilities Beta of Assets = $\frac{(2 \times 2cr) + (0 \times 2cr)}{2cr + 2cr} = \frac{4cr}{4cr} = 1$ Time																																					
76.	Equity Beta and Asset Beta																																					
77.	SD of combination of risky portfolio and risk-free asset = [SD of risky portfolio x weight of risky portfolio] = [20 x 1.50] = 30%																																					
78.	Floor value = Investment - Maximum decline = 10,00,000 - 10% = Rs.9,00,000 Investment in equity = 2 x [Portfolio value - Floor value] = 2 x [10,00,000 - 9,00,000] = 2,00,000																																					
79.	Computation of overall Beta of ABC Limited <table><tr><th>Source</th><th>Beta</th><th>Weight</th><th>Product</th></tr><tr><td>Equity</td><td>1.10</td><td>4</td><td>4.40</td></tr><tr><td>Debt</td><td>0</td><td>0.7</td><td>0</td></tr><tr><td>Overall</td><td>0.9362</td><td>4.70</td><td>4.40</td></tr></table> Computation of Equity Beta of XYZ Limited Let us assume equity beta of XYZ Limited to be A <table><tr><th>Source</th><th>Beta</th><th>Weight</th><th>Product</th></tr><tr><td>Equity</td><td>A</td><td>4</td><td>4A</td></tr><tr><td>Debt</td><td>0</td><td>2.1</td><td>0</td></tr><tr><td>Overall</td><td>0.9362</td><td>6.1</td><td>5.7108 [0.9362 x 6.10]</td></tr></table> $4A = 5.7108; A = \frac{5.7108}{4} = 1.4277 \text{ Times}$ Equity Beta of XYZ Limited = 1.4277 Times						Source	Beta	Weight	Product	Equity	1.10	4	4.40	Debt	0	0.7	0	Overall	0.9362	4.70	4.40	Source	Beta	Weight	Product	Equity	A	4	4A	Debt	0	2.1	0	Overall	0.9362	6.1	5.7108 [0.9362 x 6.10]
Source	Beta	Weight	Product																																			
Equity	1.10	4	4.40																																			
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Debt	0	2.1	0																																			
Overall	0.9362	6.1	5.7108 [0.9362 x 6.10]																																			
80.	Required return as per characteristic line = Beta x Return of Market = 2 x 8% = 16% Alpha = Actual return - required return = 12% - 16% = -4.00% Characteristic Line = Alpha + (Beta x Return of Market) Characteristic Line = -4.00% +(2 x Rm)																																					
81.	Investors can lend at the risk-free rate, but borrow at a higher rate Explanation: Capital market theory assumes that investors can borrow or lend at the risk-free rate. The other statements are basic assumptions of capital market theory.																																					
82.	Unsystematic risk																																					
83.	Strategic Asset Allocation Explanation: Strategic Asset Allocation is a passive investment approach where investors set a target asset allocation mix based on their financial goals, risk tolerance, and time horizon. Once the allocation is determined, it remains fixed for the long term, and no attempt is made to time the market or make short-term adjustments.																																					
84.	Covariance between security X and Security X is basically variance of Security X $SD = \sqrt{4.80} = 2.19$																																					
85.	Real Estate Investment Trusts (REITs)																																					
86.	More if she bought Ashok Leyland. Explanation: Covariance between TCS and Ashok Leyland is negative and hence will provide scope for more cost reduction.																																					
87.	Pure Yield Pickup swap																																					
88.	Sovereign Gold Bonds																																					
89.	Venture Capital																																					
90.	Ladder Strategy																																					
91.	To take advantage of undervalued securities of companies facing financial difficulties, with the expectation of high returns in case of successful restructuring																																					
92.	Long Position in debt and short position in equity Explanation: In case company's condition improves because of priority, the investor will get his interest payment which shall be more than the dividend on his short position in equity shares. If company's condition further deteriorates the value of both share and debenture goes down. He will make good profit from his short position.																																					
93.	Greater Explanation: Perfect positive correlation (r = +1) of the returns of two assets offers no risk reduction, whereas perfect negative correlation (r = -1) offers the greatest risk reduction																																					

94.	Tactical Asset Allocation Explanation: Tactical Asset Allocation is an active investment strategy where portfolio managers make short-term adjustments to the asset allocation based on their market forecasts and economic analysis. Unlike Strategic Asset Allocation (Option A), which maintains a fixed long-term asset mix, Tactical Asset Allocation aims to capitalize on perceived market opportunities																														
95.	Sharpe Ratio																														
96.	Beta of AAA = $\left(\frac{0.50}{0.20}\right) \times 0.60 = 1.50$. Hence AAA has highest Beta (systematic risk) Unsystematic risk of AAA = $0.50 - (1.50 \times 0.20) = 0.20$ Unsystematic risk of BBB = $0.50 - (1 \times 0.20) = 0.30$ Hence BBB has highest unsystematic risk. So AAA has highest systematic risk and BBB has highest unsystematic risk																														
97.	Systematic risk																														
98.	All of these choices are correct																														
99.	Is correctly Valued. Beta of security is same as market and return of security is also same as that of market																														
100.	The portfolio planning phase is concerned with gathering relevant information about the client's investment objectives, risk tolerance, and time horizon. It involves conducting a thorough assessment of the client's financial situation, investment goals, and constraints.																														
101.	The portfolio monitoring phase involves the continuous review and assessment of the portfolio's performance. It includes monitoring the individual investments, tracking their performance, and making necessary adjustments to maintain alignment with the investment objectives.																														
102.	The Capital Asset Pricing Model (CAPM) would be most suitable for guiding LMN Capital in managing the client's portfolio to minimize systematic risk. CAPM provides a framework for determining the expected return of an asset based on its systematic risk (beta)																														
103.	Currency exchange rate risk falls under systematic risk as it is influenced by macroeconomic factors such as interest rates, inflation, and global economic conditions																														
104.	Lowest																														
105.	Unsystematic risk. Unsystematic risk (diversifiable risk) can be eliminated through the process of diversification																														
106.	Industry-wide competitive pressures fall under unsystematic risk as they are specific to the industry in which the company operates. These pressures may include pricing competition, new entrants, or changes in consumer preferences. Such risks can be mitigated through diversification by including stocks from different industries in the portfolio.																														
107.	Sharpe Ratio. Sharpe ratio is useful for undiversified portfolio and sector specific funds will carry unsystematic risk																														
108.	Overvalued. Security is not able to generate the required return and hence we would be selling such securities (overvalued)																														
109.	<table><tr><th>Year</th><th>Company A return (X)</th><th>Market return (Y)</th><th>XY</th><th>Y²</th></tr><tr><td>2007</td><td>13</td><td>12</td><td>156</td><td>144</td></tr><tr><td>2008</td><td>11.5</td><td>11</td><td>126.5</td><td>121</td></tr><tr><td>2009</td><td>9.8</td><td>9</td><td>88.2</td><td>81</td></tr><tr><td>Sum</td><td>34.3</td><td>32</td><td>370.7</td><td>346</td></tr><tr><td>Average</td><td>11.43</td><td>10.67</td><td></td><td></td></tr></table> $\text{Beta} = \frac{(\sum XY - n(\text{Mean of X})(\text{Mean of Y}))}{\sum Y^2 - n(\text{Mean of Y})^2}$ $\text{Beta} = \frac{(370.7 - 3(11.43)(10.67))}{346 - 3(10.67^2)} = \frac{4.8257}{4.4533} = 1.0836 \text{ Times}$	Year	Company A return (X)	Market return (Y)	XY	Y ²	2007	13	12	156	144	2008	11.5	11	126.5	121	2009	9.8	9	88.2	81	Sum	34.3	32	370.7	346	Average	11.43	10.67		
Year	Company A return (X)	Market return (Y)	XY	Y ²																											
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2009	9.8	9	88.2	81																											
Sum	34.3	32	370.7	346																											
Average	11.43	10.67																													
110.	Required return = $R_f + \text{Beta} \times (R_m - R_f)$ Required return = $6 + 1.40 \times (10 - 6) = 11.60\%$ Note: Security is 40% more riskier than the market and hence the same will have Beta of 1.4 Times																														
111.	The correlation coefficient ranges from -1 to +1. A correlation coefficient of 0.10 indicates a weak positive linear relationship between the returns of two assets.																														
112.	Capital market line (Standard deviation) and Security market line (Beta)																														

113.	According to the Markowitz model, determining the optimal asset allocation involves assessing the correlation between different assets. By selecting assets that have low or negative correlations, the portfolio can achieve diversification benefits
114.	Weight of Security A = a + b (weight of Security B) $0.50 = a + 0.25b$ (Equation 1) $0.70 = a + 0.20b$ (Equation 2) Solving equations, we get $b = -4$ and $a = 1.5$ Critical line: Weight of Security A = $1.50 - 4(\text{Weight of Security B})$ $0.20 = 1.50 - 4(\text{Weight of Security B})$ $4(\text{Weight of Security B}) = 1.30$ Weight of Security B = $1.30/4 = 0.325$ Weight of Security C = $1 - 0.325 - 0.20 = 0.475$
115.	According to the Markowitz model, an optimal risk-return trade-off can be achieved by selecting asset combinations that lie on the efficient frontier. The efficient frontier represents the set of portfolios that offer the highest return for a given level of risk or the lowest risk for a given level of return
116.	Decrease Explanation: When the beta of a stock increases, its required return will increase. This increases the discount rate investors use to estimate the present value of the stock's future cash flows, which decreases the value of the stock.
117.	Lower Explanation: A premium bond sells at more than face value, thus as time passes the bond value will converge upon the face value

Chapter 7 – Securitization

1. Which of the following is NOT a key characteristic of a pass-through certificate (PTC) issued in a securitization transaction in India?
 - a. PTCs offer credit risk exposure to the investors.
 - b. PTCs provide a pro-rata share in the cash flows from the underlying pool of assets.
 - c. PTCs can be traded on the stock exchanges, facilitating liquidity.
 - d. PTCs do not require a credit rating from a recognized credit rating agency.
2. Which of the following statements best describes the concept of "tranching" in securitization?
 - a. Tranching is the process of segregating securitized assets based on their maturity dates to align with investor preferences.
 - b. Tranching refers to the division of securitized assets into different classes of securities, each with varying risk and return profiles.
 - c. Tranching involves the creation of a secondary market for the securitized assets to increase their liquidity.
 - d. Tranching allows investors to transfer their rights and interests in the securitized assets to third parties
3. Which of the following statements is true regarding the role of a trustee in a securitization transaction in India?
 - a. The trustee acts as an intermediary between the originator and the investors.
 - b. The trustee is responsible for originating the underlying pool of assets.
 - c. The trustee is exempt from any fiduciary responsibilities towards the investors.
 - d. The trustee is not involved in the enforcement of security interests on behalf of the investors.
4. In a securitization transaction, which of the following statements accurately describes the role of the "special purpose vehicle (SPV)"?
 - a. The SPV acts as the originator of the securitized assets and is responsible for their collection and management.
 - b. The SPV is an intermediary that evaluates the creditworthiness of the investors before allowing them to purchase the securitized securities.
 - c. The SPV is a legal entity created solely for the purpose of holding and managing the securitized assets on behalf of the investors.
 - d. The SPV provides credit enhancement to the originator, ensuring a higher credit rating for the securitized securities
5. _____ represent the portion of the securitized assets where the interest payments are separated and sold as a distinct security
 - a. PTC
 - b. PTS
 - c. Interest only strips
 - d. Principal only strips
6. Who is responsible for collecting cash flows from the underlying assets and initiate legal action in case of default?
 - a. Investor
 - b. Servicer
 - c. Trustee
 - d. SPV
7. _____ provide investors with ownership rights to the underlying securitized assets, allowing them to participate in the cash flows directly
 - a. PTC

- b. PTS
 - c. Stripped Securities
8. Which of the following statements accurately differentiates between "tokenization" and "securitization"?
- a. Tokenization and securitization are interchangeable terms used to describe the process of converting physical assets into digital tokens for trading purposes.
 - b. Tokenization involves the bundling of multiple financial assets into tradable securities, while securitization refers to the conversion of physical assets into digital tokens.
 - c. Tokenization is limited to the financial industry, primarily focusing on converting real estate assets into digital tokens, whereas securitization covers a broader range of assets.
 - d. Tokenization and securitization both involve converting assets into tradable forms, but tokenization specifically refers to the process in the context of blockchain technology.
9. _____ is the party who owe money and form the basis of securitization transaction
- a. Obligor
 - b. Originator
 - c. Investor
 - d. SPV
10. Which of the following accurately defines "credit risk" in securitization?
- a. Credit risk refers to the potential loss of value in securitized instruments due to fluctuations in interest rates.
 - b. Credit risk represents the uncertainty of receiving expected cash flows from the underlying securitized assets due to borrower defaults.
 - c. Credit risk pertains to the possibility of the originator repurchasing the securitized assets at a lower price during the transaction.
 - d. Credit risk involves the legal uncertainties related to the enforceability of the securitization transaction contracts.
11. Which of the following statements accurately describes the concept of "tokenization" in the context of blockchain technology?
- a. Tokenization is the process of converting physical assets, such as real estate or precious metals, into digital tokens for ease of trading.
 - b. Tokenization refers to the encryption of sensitive data using cryptographic techniques to protect it from unauthorized access.
 - c. Tokenization is the creation of a new cryptocurrency by forking an existing blockchain network and introducing new features.
 - d. Tokenization is the process of breaking down a large transaction into smaller units to enhance its efficiency and speed on the blockchain.
12. Which of the following factors significantly impacts the pricing of securitized instruments in the secondary market?
- a. The credit rating assigned by the credit rating agencies to the securitized instruments, reflecting their creditworthiness.
 - b. The interest rate set by the central bank, influencing the overall cost of borrowing in the economy.
 - c. The maturity period of the securitized instruments, affecting their sensitivity to interest rate fluctuations.
 - d. The originator's reputation and track record, indicating the likelihood of timely cash flows from the underlying assets.
13. How does "interest rate risk" impact the pricing of securitized instruments?

- a. As market interest rates rise, the prices of fixed-rate securitized instruments increase, providing higher yields for investors.
 - b. As market interest rates rise, the prices of fixed-rate securitized instruments decrease, resulting in higher yields for investors.
 - c. As market interest rates rise, the prices of floating-rate securitized instruments decrease, reducing yields for investors.
 - d. As market interest rates rise, the prices of floating-rate securitized instruments increase, providing higher yields for investors.
14. In _____ in case of early retirement of receivables the surplus cash can be used for short-term yield
- a. PTC
 - b. PTS
15. _____ refer to a type of asset-backed security where the principal and interest payments are separated and sold as distinct securities
- a. PTC
 - b. PTS
 - c. Stripped Securities
16. Which of the following is not a primary participant in a securitization transaction?
- a. Originator
 - b. SPV
 - c. Obligor
 - d. Investors
17. Which of the following statements accurately describes the tradability of tokenized assets compared to securitized assets?
- a. Tokenized assets are typically less tradable compared to securitized assets, as tokenization involves dividing physical assets into illiquid digital tokens.
 - b. Tokenized assets and securitized assets offer similar levels of tradability, both being easily exchangeable in the secondary market.
 - c. Tokenized assets are more tradable than securitized assets, as they are easily divisible into smaller units and can be traded on various blockchain platforms.
 - d. Tokenized assets are only tradable on specific cryptocurrency exchanges, while securitized assets are freely tradable on conventional financial markets.
18. Which of the following options accurately describes the "credit enhancement" feature in a securitization transaction?
- a. Credit enhancement is a process of obtaining a higher credit rating for the securities issued in the transaction.
 - b. Credit enhancement involves reducing the credit risk associated with the underlying assets by diversifying the asset pool.
 - c. Credit enhancement is a mechanism to provide additional protection to the investors by enhancing the creditworthiness of the issuer.
 - d. Credit enhancement refers to the use of financial derivatives to hedge against potential credit losses in the securitized assets

Answer:

1.	PTCs do not require a credit rating from a recognized credit rating agency
2.	Tranching refers to the division of securitized assets into different classes of securities, each with varying risk and return profiles.
3.	The trustee acts as an intermediary between the originator and the investors.

4.	The SPV is a legal entity created solely for the purpose of holding and managing the securitized assets on behalf of the investors
5.	Interest only strips
6.	Servicer
7.	PTC
8.	Tokenization and securitization both involve converting assets into tradable forms, but tokenization specifically refers to the process in the context of blockchain technology Explanation: While both tokenization and securitization involve converting assets into tradable forms, the key difference lies in the context of the process. Tokenization specifically refers to the conversion of real-world assets into digital tokens using blockchain technology, enabling fractional ownership and improved liquidity. On the other hand, securitization involves bundling financial assets, such as loans or mortgages, into tradable securities to be sold to investors. Option A is incorrect because tokenization and securitization are not interchangeable terms. Option B is incorrect because it inaccurately describes the difference between the two concepts. Option C is incorrect because it does not accurately differentiate the scope of tokenization and securitization
9.	Obligor
10.	Credit risk represents the uncertainty of receiving expected cash flows from the underlying securitized assets due to borrower defaults
11.	Tokenization is the process of converting physical assets, such as real estate or precious metals, into digital tokens for ease of trading.
12.	The credit rating assigned by the credit rating agencies to the securitized instruments, reflecting their creditworthiness.
13.	As market interest rates rise, the prices of fixed-rate securitized instruments decrease, resulting in higher yields for investors. Explanation: Interest rate risk in securitization refers to the impact of changes in market interest rates on the pricing of securitized instruments. When market interest rates rise, the fixed interest rates on fixed-rate securitized instruments become less attractive to new investors seeking higher yields. As a result, the prices of existing fixed-rate securitized instruments decrease in the secondary market to align with the prevailing market interest rates. This decrease in prices leads to higher yields for investors who purchased the securities before the interest rate increase
14.	PTS
15.	Stripped Securities
16.	Obligor
17.	Tokenized assets are more tradable than securitized assets, as they are easily divisible into smaller units and can be traded on various blockchain platforms.
18.	Credit enhancement is a mechanism to provide additional protection to the investors by enhancing the creditworthiness of the issuer. Explanation: Tokenized assets offer higher tradability compared to securitized assets due to their divisibility into smaller units. Digital tokens can be easily fractionalized, enabling investors to buy and sell even tiny portions of the asset. This enhances liquidity and allows for broader market participation.

Chapter 8 – Mutual Funds

- Mr.X invested Rs.1,00,000 on 1.4.2010 (NAV of Rs.20; Face value of Rs.10). MF declared dividend of 20% on 1.4.2011 (Nav of Rs.25) and it declared dividend of 50% on 1.3.2012 (NAV of Rs.50). How many units will be allotted on 1.3.2012 due to dividend reinvestment?
 - 400 units
 - 500 units
 - 540 units
 - 1000 units
- _____ Schemes are open for both purchase and redemption at pre-specified intervals (monthly, quarterly and annually)
 - Open-ended
 - Close-ended
 - Interval
- Equity shares were purchased when index was 1,000. Amount of shares purchased is Rs.20 lacs. Index value on NAV valuation date is 1,500. What will be the value of shares if underlying shares have appreciated at double the rate of index appreciation?
 - 30 lacs
 - 60 lacs
 - 20 lacs
 - 40 lacs
- Unit price of MF is Rs.20. The public offer price is Rs.21. How much is the front-end load percent?
 - 1 percent
 - 5 percent
 - 10 percent
 - None of the above
- Compute tracking error of an index MF from following information

Month	XYZ Nifty Index Fund Return	Nifty 50 return
1	4%	3.7%
2	2%	2.5%
3	-4%	-3.2%
4	1%	1.8%
5	6%	7.2%

- 0.315
 - 0.5652
 - 1.26
 - 0.6
- Mr.X invested Rs.1,00,000 on 1.4.2015 when NAV was Rs.25 per unit. Bonus ratio was 1:4 on 1.10.2015, 1:5 on 1.4.2017, 2:5 on 1.4.2018. How many units will the investor have on 1.4.2018?
 - 4,000 units
 - 6,000 units
 - 8,400 units
 - 10,000 units
 - A pooled investment with a share price significantly different from its net asset value (NAV) per share is most likely
 - Open-ended fund
 - Close-ended fund

8. Maturity period is defined in case of _____
- Open-ended
 - Close-ended
 - Interval
9. Holding period return = 2.5%. Annual return = 12%. No of days in year = 365; What is the period of holding of investment?
- 76 days
 - 75 days
 - 1,752 days
 - None of the above
10. A mutual fund has invested in 10,000 shares (FV of Rs.10 and CMP of Rs.20) of XYZ Limited. XYZ Ltd., on 15th December 2021 in its AGM declared the interim dividend of 10% and bonus shares at 1:10 with the record date of 28th December 2021. How much is the dividend received by MF from XYZ Limited?
- Rs.10,000
 - Rs.11,000
 - Rs.20,000
 - Rs.22,000
11. Holding period return for 6 months is 8%. How much is annualized return?
- 8%
 - 16%
 - 4%
12. Mr. X can earn return of 10 percent on own. Initial expense ratio is 5% and annual expense ratio is 2%. How much should the MF earn to give investor return of 12%?
- 12.53
 - 12
 - 14
 - 14.63
13. Opening NAV in April = Rs.20. Dividend equalization for the month of April = Rs.1.00. An investor invested in MF on May 1 at opening NAV(April) + 5% and adjusted for dividend equalization. What is the purchase price of the investor?
- Rs.20.40
 - Rs.21.40
 - Rs.19.40
 - Rs.21.00
14. MF X has given annualized return of 9.733%, MF Y has given annualized return of -11.185% and MF Z has given annualized return of 15%. Period of holding in MF X, MF Y and MFZ is 300 days, 124 days and 195 days respectively. Assuming past performance of all three schemes will continue for next one year, what action the investor should take?
- Sell holding of MF Y and invest partly in MF X and MF Z
 - Sell holdings of MF X and MF Y and invest in MF Z
 - Sell holdings of MF Y and invest in MF Z
 - Sell holdings of MF Y and invest in MF X
15. MF X has given annualized return of 9.733%, MF Y has given annualized return of -11.185% and MF Z has given annualized return of 15%. Period of holding in MF X, MF Y and MFZ is 300 days, 124

days and 195 days respectively. Mutual fund is charging an exit load of 5% for redemption within one year. What action should investor take in MF X and MF Y?

- a. Redeem both MF X and MF Y
 - b. Redeem MF X and don't redeem MF Y
 - c. Redeem MF Y and don't redeem MF X
 - d. Continue with both MF X and MF Y
16. Opening NAV in April = Rs.20. Dividend equalization for the month of April and May = Rs.1.00 and Rs.2.00 respectively. An investor exited in MF on June 1 at opening NAV(April) - 3% and adjusted for dividend equalization. What is the redemption price of the investor?
- a. Rs.19.40
 - b. Rs.16.40
 - c. Rs.22.40
 - d. Rs.17.00
17. Fund manages Rs.100 crores of funds. They charge fixed fee of 1%. In addition an incentive of 2 percent is paid in excess of 12 percent returns. The fund has earned returns of 20 percent. How much would be the fee paid to the fund manager?
- a. 1 Crores
 - b. 0.84 Crores
 - c. 1.40 crores
 - d. 1.16 crores
18. Which category of equity funds looks for super normal returns for which investment is made in start-ups, IPO and speculative shares?
- a. Growth
 - b. Balanced
 - c. Aggressive
 - d. Income
19. Which type of investor is likely to find sector funds more suitable for their investment needs?
- a. Investors seeking long-term capital appreciation with a willingness to take on higher industry-specific risk and volatility.
 - b. Investors looking for a diversified portfolio with exposure to various thematic trends and an active investment approach.
 - c. Investors with a conservative risk appetite who prioritize regular income and dividend payments.
 - d. Investors seeking a mix of domestic and international exposure through a broad range of industries.
20. Opening NAV = Rs.20; Closing NAV at end of Month 3 = 21. Dividend paid in month 1 = Rs.2; Dividend paid in Month 2 = 0.50; Dividend declared but not yet paid in month 3 = 0.50. What is annualized return of investor?
- a. 20%
 - b. 80%
 - c. 17.5%
 - d. 70%
21. Under what circumstances does a mutual fund implement side pocketing?
- a. Side pocketing is implemented when the fund's net asset value (NAV) experiences a significant increase due to a sudden surge in the market.
 - b. Side pocketing is triggered when a mutual fund faces a liquidity crisis, and it aims to separate illiquid assets from the main portfolio to protect investors.

- c. Side pocketing is automatically activated when the fund's benchmark index outperforms its expected returns for consecutive quarters.
 - d. Side pocketing is applied when the fund manager intends to reallocate the portfolio to optimize performance.
22. Under _____, the Fund Manager is mandated to invest at least 25% each into Large, Mid & Small cap stocks and remaining 25% can be invested at the discretion of the Fund Manager
- a. Flexi-cap
 - b. Multi-cap
 - c. Small-cap
 - d. Mega-cap
23. What is the primary difference between sector funds and thematic funds in terms of their investment focus?
- a. Sector funds focus on long-term capital appreciation by investing in growth-oriented companies, whereas thematic funds prioritize generating regular income through dividend-paying stocks.
 - b. Both sector funds and thematic funds invest exclusively in companies with strong environmental, social, and governance (ESG) practices, aiming for sustainable and responsible investing.
 - c. Sector funds concentrate on investing in multinational companies with global operations, while thematic funds prioritize domestic companies contributing to the country's economic growth.
 - d. Sector funds invest in specific industries or sectors of the economy, while thematic funds invest in a diverse range of companies with common themes or trends.
24. Asset value at beginning of month = Rs.65.78; Annualized return =15%; Distribution made in the form of Dividend and Capital gain is Rs.0.82. How much is the closing NAV of MF?
- a. 66.60
 - b. 65.78
 - c. 64.96
 - d. 67.42
25. For an actively managed mutual funds the role of the fund manager is to _____ whereas for a passively managed mutual funds the role of the fund manager is to _____
- a. Have minimum tracking error and have maximum tracking error
 - b. Have minimum tracking error and generate Alpha
 - c. Generate Alpha and have maximum tracking error
 - d. Generate Alpha and have minimum tracking error
26. How does tracking error impact the performance of ETFs compared to their benchmark indices?
- a. Tracking error refers to the difference in performance between ETFs and their benchmark indices, with a lower tracking error indicating better performance.
 - b. ETFs with higher tracking error consistently outperform their benchmark indices due to their active management strategies and ability to generate alpha.
 - c. Tracking error arises from the fees and expenses charged by ETFs, and a lower tracking error signifies higher costs for investors.
 - d. ETFs with lower tracking error exactly replicate the performance of their benchmark indices, eliminating the potential for generating excess returns.
27. What makes offshore funds unique compared to other mutual funds?
- a. Offshore funds are mutual funds that invest exclusively in overseas companies and are not accessible to domestic investors.

- b. Offshore funds are structured as open-end investment companies that offer daily liquidity to investors.
 - c. Offshore funds are tax-efficient investment vehicles as they are domiciled in tax havens, where there are no capital gains or dividend taxes.
 - d. Offshore funds charge lower management fees compared to onshore mutual funds due to their international investment focus.
28. _____ is charged at the time an investor purchases the units of a scheme whereas _____ is charged at the time of redeeming the fund
- a. Entry load and no-load
 - b. Exit load and no-load
 - c. Entry load and exit load
 - d. Exit load and entry load
29. _____ are _____ mutual funds in which an investor can invest during a New Fund Offer (NFO). They usually invest in Certificates of Deposits (CDs), Commercial Papers (CPs), Money Market Instruments and Non-Convertible Debentures over fixed investment period
- a. FMP and open-ended
 - b. FMP and close-ended
 - c. ETF and open-ended
 - d. ETF and close-ended
30. What differentiates a direct plan from a regular plan in a mutual fund?
- a. Direct plans have higher expense ratios compared to regular plans due to their direct purchase option from the asset management company, whereas regular plans involve intermediaries that charge additional fees.
 - b. Direct plans are designed for retail investors, while regular plans are targeted at institutional investors and high net worth individuals.
 - c. Direct plans offer personalized investment advice and portfolio management services, whereas regular plans do not provide such individualized services.
 - d. Direct plans do not involve distributors or intermediaries, allowing investors to invest directly with the asset management company, while regular plans involve intermediaries who distribute the fund and charge commissions.
31. Mr. X can earn 15 percent on own. The MF will give him return of 13 percent. Mr.X portfolio value is Rs.100 lacs. Mr.X is a chartered accountant and is currently earned professional income of Rs.45 lacs. Mr. X is spending 10 percent of time in managing his portfolio. If he spends this time on profession, his professional income will increase proportionately. What is the net gain/loss in investing in MF?
- a. Net loss of Rs.2 lacs
 - b. Net gain of Rs.3 lacs
 - c. Net gain of Rs.5 lacs
 - d. Net gain of Rs.2 lacs
32. What differentiates the investment strategies of Hedge Funds from traditional mutual funds and index funds?
- a. Hedge Funds primarily focus on passive investing, aiming to replicate specific market indices, whereas traditional mutual funds and index funds employ active trading strategies to generate alpha.
 - b. Hedge Funds utilize leverage and derivatives extensively to amplify returns and manage risk, whereas traditional mutual funds and index funds do not engage in such advanced strategies.

- c. Both Hedge Funds and traditional mutual funds follow a long-only investment approach, while index funds adopt a short-selling strategy to profit from declining markets.
 - d. Hedge Funds exclusively invest in high-risk assets, such as cryptocurrencies and startup companies, while traditional mutual funds and index funds prioritize low-risk securities
33. How do performance fees in Hedge Funds differ from management fees?
- a. Hedge Funds charge performance fees as a fixed percentage of assets under management, whereas management fees are based on the fund's returns.
 - b. Performance fees are charged based on the fund's absolute returns, while management fees are calculated as a percentage of the fund's net asset value.
 - c. Hedge Funds impose performance fees when the fund outperforms a specified benchmark or target, while management fees are charged regardless of the fund's performance.
 - d. Performance fees are charged as a percentage of the fund's profits, whereas management fees are a percentage of the fund's total assets.
34. How does the portfolio turnover of quant funds differ from traditional mutual funds?
- a. Quant funds have a higher portfolio turnover compared to traditional mutual funds, as they frequently rebalance their portfolios based on quantitative signals.
 - b. Both quant funds and traditional mutual funds have similar portfolio turnover rates, as they both adjust their portfolios regularly to respond to market changes.
 - c. Quant funds have a lower portfolio turnover compared to traditional mutual funds, as their quantitative models aim to minimize frequent trades and transaction costs.
 - d. Portfolio turnover is not a relevant factor for quant funds, as their investment approach relies on long-term buy-and-hold strategies.
35. Total number of units on day 0 - 1,00,000; NAV on day 0 - 50; New units allotted on day 60 - 20,000 @ NAV of Rs.60; Portfolio appreciation for full year = 60 lacs; Units redeemed on day 120 - 10,000 @ NAV of Rs.120. What will be the closing NAV on day 365 post dividend payout of Rs.1 per unit?
- a. 100
 - b. 120
 - c. 99
 - d. 119
36. How do fund of funds differentiate from other mutual funds?
- a. Fund of funds invest in a single asset class, such as equities or fixed-income, while other mutual funds offer diversified portfolios.
 - b. Fund of funds pool assets from various investors and use the proceeds to directly invest in specific companies or projects.
 - c. Fund of funds invest exclusively in index funds, while other mutual funds may include actively managed funds in their portfolio.
 - d. Fund of funds are mutual funds that invest in other mutual funds, providing investors with broader diversification across different asset classes and investment strategies
37. Value of 14 percent listed bonds = 20 crores (Face value is Rs.15 crores whereas market value is Rs.20 crores). Market expectation on listed bonds is 7 percent. What will be the value of listed bonds for computation of NAV?
- a. 30 Crores
 - b. 20 crores
 - c. 15 crores
 - d. 40 crores

38. NAV as on 1.1.2014 was Rs.10. NAV as on 31.12.2014 is Rs.12. Dividend and capital gain distribution is Rs.0.50 and 1.50. On 31.12.2014 the unit was trading at discount of 2 percent whereas on 1.1.2014 it was trading at premium of 2 percent. How much is the annual return?
- 20%
 - 40%
 - 35.60%
 - 34.90%
39. Sharpe Ratio of A = 1.5; Sharpe Ratio of B = 1.65; Sharpe Ratio of C = 1.25; Treynor ratio of A = 8; Treynor Ratio of B = 9; Treynor Ratio of C = 10; The above funds are undiversified. Rank the above three funds in terms of preference?
- C, A and B
 - B, A and C
 - A, B and C
 - C, A and B
40. Mutual fund acquired fixed interest securities of Rs.12 crores (Market price = Rs.120 and Face value = Rs.100). The current market price of fixed interest securities is Rs.90. what will be the value of fixed interest securities for computation of NAV?
- 12 Crores
 - 9 Crores
 - 10.80 Crores
 - 10 Crores
41. Mr. X invested Rs.1,00,000 when NAV was Rs.10 per unit. The fund declared income distribution of Rs.2 per unit and capital gain distribution of Rs.3 per unit. These amounts were re-invested at NAV of Rs.20 per unit. Closing NAV was Rs.30. What is the rate of return earned by the investor?
- 250%
 - 275%
 - 200%
 - 100%
42. Total expenses paid = Rs.800 lacs; Outstanding expenses at end of year = Rs.200 lacs; Outstanding expenses at beginning of year = Rs.500 lacs; No of units outstanding = 100 lacs. What is the expense per unit?
- 8.00
 - 10.00
 - 5.00
 - 15.00
43. Sharpe Ratio of MF = 1.5 Times; SD of MF = 15%, Treynor Ratio = 10. What is Beta of MF?
- 1.5 Times
 - 1.5 percent
 - 2.25 Times
 - 2.25 percent
44. Units as on 31.03.2020 = 30,000 units. Bonus on 31.03.2016 = 1:4, Bonus on 31.03.2018 = 1:5. Find the number of units allotted on 31.03.2015 (entry date)?
- 20,000
 - 18,000
 - 15,000
 - 22,000

45. Risk-free rate of return = 10%; Beta of MF (A) = 1 Times; Jensen's Alpha of MF (A) = 4%; Market return = 14%; SD of MF (A) = 10%. What is reward to volatility ratio of MF (A)?
- 8
 - 0.80
 - 18
 - 14
46. Average yield = 6.40%; Period of investment = 5 years; Investment made = Rs.10,00,000; Closing value = ?
- 64,000
 - 10,64,000
 - 3,20,000
 - 13,20,000
47. Annual expenses = 20 lacs; No of units = 1 crore; NAV on closing date = 20. What is the annual expense ratio?
- 1%
 - 0.2%
 - 10%
48. A mutual fund sold shares worth Rs.80 lacs for Rs.88 lacs. It also sold another lot of shares worth Rs.75 lacs for Rs.72 lacs. It earned dividend income of Rs.4 lacs. It has decided to distribute 60% of realized earnings. How much is the overall dividend paid?
- 9 lacs
 - 8 lacs
 - 7.2 lacs
 - 5.4 lacs
49. What is the formula to calculate reward to volatility ratio?
- Expected return/SD
 - Expected return/Beta
 - (Expected return - Risk free return)/SD
 - (Expected return - Risk free return)/Beta
50. What will be Jensen's Alpha of Sensex/Nifty Index?
- 0%
 - 1%
 - Cannot be calculated with given information

Answer:

1.	Particulars	Calculation	Amount
	Units allotted on 1.4.2010	1,00,000/20	5,000
	Dividend on 1.4.2011	5,000 x 10 x 20%	10,000
	Units allotted on 1.4.2011	10,000/25	400
	Dividend on 1.3.2012	5,400 x 10 x 50%	27,000
	Units allotted on 1.3.2012	27,000/50	540
2.	Interval		
3.	Index is 1,000 on purchase date and the same has appreciated by 50 percent as the closing index is 1,500. Shares will appreciate at double the rate and hence shares will appreciate by 100 percent. Closing shares value = 20 lacs + 100% = 40 lacs		
4.	Particulars	Calculation	Amount
	Front end load	Public offer price - unit price	1.00
	Front end load %	(1/20) x 100	5.00%

5.	<table><tr><th>Month</th><th>XYZ Nifty Index Fund Return</th><th>Nifty 50 return</th><th>Differential return</th><th>Deviation</th><th>Deviation^2</th></tr><tr><td>1</td><td>4</td><td>3.7</td><td>0.3</td><td>0.9</td><td>0.81</td></tr><tr><td>2</td><td>2</td><td>2.5</td><td>-0.5</td><td>0.1</td><td>0.01</td></tr><tr><td>3</td><td>-4</td><td>-3.2</td><td>-0.8</td><td>-0.2</td><td>0.04</td></tr><tr><td>4</td><td>1</td><td>1.8</td><td>-0.8</td><td>-0.2</td><td>0.04</td></tr><tr><td>5</td><td>6</td><td>7.2</td><td>-1.2</td><td>-0.6</td><td>0.36</td></tr><tr><td>Average/Total</td><td></td><td></td><td>-0.6</td><td></td><td>1.26</td></tr><tr><td>Variance</td><td colspan="4">$\frac{1.26}{n-1} = \frac{1.26}{5-1}$</td><td>0.315</td></tr><tr><td>SD</td><td colspan="4">$\sqrt{0.315}$</td><td>0.5612</td></tr></table>	Month	XYZ Nifty Index Fund Return	Nifty 50 return	Differential return	Deviation	Deviation^2	1	4	3.7	0.3	0.9	0.81	2	2	2.5	-0.5	0.1	0.01	3	-4	-3.2	-0.8	-0.2	0.04	4	1	1.8	-0.8	-0.2	0.04	5	6	7.2	-1.2	-0.6	0.36	Average/Total			-0.6		1.26	Variance	$\frac{1.26}{n-1} = \frac{1.26}{5-1}$				0.315	SD	$\sqrt{0.315}$				0.5612	
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7.	Close-ended fund Explanation: Close-ended funds' share prices can differ significantly from their NAVs. Open-ended fund shares can be purchased and redeemed at their NAVs.																																																							
8.	Close-ended																																																							
9.	$\text{Period of Holding} = \frac{\text{Holding Period Return}}{\text{Annual Return}} \times 365 = \frac{2.5}{12} \times 365 = 76 \text{ days}$																																																							
10.	Dividend per share = 10 x 10% = Rs.1.00. Interim dividend will be received only on original shares as the bonus shares are allotted post dividend declaration. Hence Dividend received is equal to Rs.10,000 (10,000 shares x Rs.1.00)																																																							
11.	Return for 6 months is 8%. Annualized return for 12 months is 8% x (12/6) = 16%																																																							
12.	$\text{MF Return} = \frac{\text{Own return}}{1 - \text{IER}} + \text{AER} = \frac{0.12}{1 - 0.05} + 0.02 = 0.1263 + 0.02 = 0.1463 \text{ or } 14.63\%$ Note: Investor needs a return of 12 percent. Information on return which investor earns is of no use in this question as question clearly tells that he wants to earn 12 percent																																																							
13.	Entry price = Opening NAV + 2% + Dividend equalization Entry price = (20 +2%) + 1 = Rs.21.40																																																							
14.	If past returns of all three schemes will continue for next one year, the investor should redeem the units of MFs 'X' and 'Y' and invest the proceeds in MF 'Z'.																																																							
15.	Decision on MF X: - Redemption of MF X would be invested in MF Z and this would give additional annualized return of 5.27% (15 - 9.733). The investor has currently held this for 300 days and holding this for another 65 days can help investor in saving exit load of 5%. - Return loss in 65 days = 5.27 x (65/365) = 0.94%. - Investor will loss return of only 0.94% and save exit load of 5% and hence he should continue holding this for another 65 days. Hence MF X is not to be redeemed. Decision on MF Y: - Redemption of MF Y would be invested in MF Z and this would give additional annualized return of 26.19% (15 -(- 11.185)). The investor has currently held this for 195 days and holding this for another 170 days can help investor in saving exit load of 5%. - Return loss in 170 days = 26.19 x (170/365) = 12.20%. - Investor will loss return of 12.20% and save exit load of 5% and hence he should redeem MF Y immediately Final answer:																																																							

	• Redeem MF Y and don't redeem MF X		
16.	Redemption price = Opening NAV - 3% + Dividend equalization Redemption price = (20 - 3%) + 3.00 = Rs.22.40		
17.	Particulars	Calculation	Amount (in Cr)
	Fixed Fees	100 crores x 1%	1.00
	Return earned	100 crores x 20%	20.00
	Less: Return of 12%	100 crores x 12%	-12.00
	Excess return		8.00
	Variable incentive	8 cr x 0.02	0.16
	Total Fees	1 cr + 0.16 cr	1.16
18.	Aggressive		
19.	Investors seeking long-term capital appreciation with a willingness to take on higher industry-specific risk and volatility		
20.	$\text{Annual return} = \frac{\text{NAV}_1 - \text{NAV}_0 + D_1}{\text{NAV}_0} \times \frac{12}{m} \times 100 = \frac{21 - 20 + 3}{20} \times \frac{12}{3} \times 100 = 80\%$ Note: Investor has earned dividends of Rs.3. It does not matter whether dividend is paid or not as the same would be paid over the near term and it would have impacted the NAV downwards		
21.	Side pocketing is triggered when a mutual fund faces a liquidity crisis, and it aims to separate illiquid assets from the main portfolio to protect investors.		
22.	Multi-cap		
23.	Sector funds invest in specific industries or sectors of the economy, while thematic funds invest in a diverse range of companies with common themes or trends.		
24.	Particulars	Amount	
	Holding period return [15 x (1/12)]	1.25%	
	Return earned in Rs. [65.78 x 1.25%]	0.82	
	Less: Dividend	-0.82	
	NAV appreciation	0.00	
	Closing NAV = Opening NAV	65.78	
25.	Generate Alpha and have minimum tracking error		
26.	Tracking error refers to the difference in performance between ETFs and their benchmark indices, with a lower tracking error indicating better performance		
27.	Offshore funds are tax-efficient investment vehicles as they are domiciled in tax havens, where there are no capital gains or dividend taxes.		
28.	Entry load and Exit Load		
29.	FMP and close-ended		
30.	Direct plans do not involve distributors or intermediaries, allowing investors to invest directly with the asset management company, while regular plans involve intermediaries who distribute the fund and charge commissions.		
31.	Particulars	Calculation	Amount
	Net loss in MF investment	100 lacs x 2%	(2,00,000)
	Increase in professional income	90 = 45 lacs 10 = ?	5,00,000
	Net benefit of investing in MF		3,00,000
32.	Hedge Funds utilize leverage and derivatives extensively to amplify returns and manage risk, whereas traditional mutual funds and index funds do not engage in such advanced strategies		
33.	Performance fees are charged as a percentage of the fund's profits, whereas management fees are a percentage of the fund's total assets		
34.	Quant funds have a higher portfolio turnover compared to traditional mutual funds, as they frequently rebalance their portfolios based on quantitative signals. Explanation: Quant funds often have higher portfolio turnover compared to traditional mutual funds because their investment approach involves frequent rebalancing and adjustments based on the signals generated by their mathematical models		
35.	Particulars	Calculation	Amount
	Opening net assets	1,00,000 x 50	50,00,000

	Add: Fresh Allotment	20,000 x 60	12,00,000	
	Add: Portfolio appreciation		60,00,000	
	Less: Redemption	10,000 x 120	-12,00,000	
	Closing net assets		1,10,00,000	
	Closing units	1,00,000 + 20,000 - 10,000	1,10,000	
	Closing NAV before dividend		100.00	
	Less: Dividend		-1.00	
	Closing NAV post dividend		99.00	
36.	Fund of funds are mutual funds that invest in other mutual funds, providing investors with broader diversification across different asset classes and investment strategies			
37.	Particulars	Calculation	Amount (in cr)	
	Interest on listed bonds	15 crores x 14%	2.10	
	Value of bonds	$\frac{\text{Interest}}{\text{Investor expectation}} = \frac{2.10}{7\%}$	30.00	
38.	Particulars	Calculation	Amount	
	Unit price as on 1.1.2014	10 + 2%	10.20	
	Unit price as on 31.12.2014	12 - 2%	11.76	
	Dividend and capital gain		2.00	
	Annual return	$\frac{(11.76 - 10.20) + 2.00}{10.20} \times 100$	34.90%	
39.	The funds are undiversified and hence we should do ranking as per Sharpe Ratio. It is better to have higher Sharpe Ratio. Hence the ranking as per Sharpe Ratio is B, A and C			
40.	Particulars	Calculation	Amount (in cr)	
	No of securities	12 crores/120	0.10	
	Value of securities	0.10 x 90	9.00	
41.	Particulars	Calculation	Amount	
	Units purchased on day 0	1,00,000/10	10,000	
	Amount of dividend	5 x 10,000	50,000	
	Re-investment NAV		20.00	
	Dividend in units	50,000/20	2,500	
	Closing units	10,000 + 2,500	12,500	
	Closing value	12,500 x 30	3,75,000	
	Less: Investment		-1,00,000	
	Return in Rs.		2,75,000	
	Return in %	$\frac{2,75,000}{1,00,000} \times 100$	275.00%	
42.	Particulars	Calculation	Amount	
	Total Expenses	Paid + Closing O/s - Opening O/s	500	
	No of units		100	
	Expense per unit	500/100	5.00	
43.	Sharpe Ratio = $\frac{\text{Excess Return}}{\text{SD}}$; $1.50 = \frac{\text{Excess return}}{0.15}$; Excess return = 0.225 or 22.50% Treynor Ratio = $\frac{\text{Excess Return}}{\text{Beta}}$; $10 = \frac{22.50}{\text{Beta}}$; Beta = $\frac{22.50}{10} = 2.25$ Times Beta is expressed in Times and not percentage. Hence answer is 2.25 times			
44.	Bonus on 31.03.2018: Closing units = 30,000; Latest bonus date = 31.03.2018; Bonus Ratio = 1:5; Hence closing units as on 31.03.2018 will be 120% of opening units. Opening units = 30,000/120% = 25,000 units Bonus on 31.03.2016: Bonus ratio = 1:4. Closing units as on 31.03.2016 will be 125% of opening units. Opening units = 25,000/125% = 20,000 units. Hence units as on 31.03.2015 is 20,000 units			
45.	Particulars	Amount		
	Required return of MF 'A' [10 + 1 x [14 - 10]]	14.00		
	Jensen's Alpha	4.00		
	Actual return of MF 'A' [14 + 4]	18.00		

	Excess return of MF 'A' [18.00 – 10.00]		8.00
	Beta of MF 'A'		1.00
	Reward to Volatility Ratio [Treynor Ratio]		8.00
46.	Particulars	Calculation	Amount
	Return per year	10,00,000 x 6.40%	64,000
	Return for 5 years	64,000 x 5	3,20,000
	Closing value	10,00,000 + 3,20,000	13,20,000
47.	Particulars	Calculation	Amount
	Expenses per unit	20 lacs/1 crore	0.20
	Closing NAV		20
	Expense ratio	0.20/20 x 100	1.00%
48.	Particulars	Calculation	Amount
	Total Capital gain	8 lacs on lot 1 – 3 lacs on lot 2	5,00,000
	Total realized gain	5,00,000 + 4,00,000	9,00,000
	Dividends paid	9,00,000 x 60%	5,40,000
49.	(Expected return - Risk free return)/Beta		
50.	Jensen's Alpha is calculated by comparing CAPM return with Actual return. CAPM return = Rf + Beta x (Rm - Rf). CAPM return will be calculated with help of actual market return. Hence Jensen's Alpha for market will always be zero percent as actual return will be equal to CAPM return		

Chapter 9 – Derivatives Analysis and Valuation

1. Which of the following is a major risk associated with forward contracts?
 - a. Counterparty risk
 - b. Market risk
 - c. Operational risk
 - d. Credit risk
2. Exercise price of call option = 200; Exercise price of Put option = 220; Premium paid/received on call and put option = Rs.6 and Rs.4; You have bought one call option and sold one put option. How much will be the net profit/loss if actual price is Rs.240 on expiry date?
 - a. Profit of Rs.40
 - b. Profit of Rs.38
 - c. Profit of Rs.42
 - d. Loss of Rs.42
3. You have purchased 2000 shares of ABC Limited. ABC has a beta of 1.1 with the sensex. You have sold one contract of sensex worth Rs.2,20,000. You have done a perfect hedge with above transactions. What is the current market price of ABC Limited?
 - a. 100
 - b. 110
4. In a forward contract, if the forward price is higher than the spot price at the contract's inception, what can be said about the market expectation?
 - a. The market expects the asset's price to decrease.
 - b. The market expects no change in the asset's price.
 - c. The market expectation cannot be determined from the forward and spot price
 - d. The market expects the asset's price to increase.
5. You have purchased one lot of Nifty at 10,000. Lot size = 100 units. Initial margin = 8% of contract value. Nifty has moved to 9,800 on next day. What will be the balance in margin account post profit/loss?
 - a. 80,000
 - b. 1,00,000
 - c. 60,000
 - d. 40,000
6. Which of the following is a difference between futures and forward contracts? Futures contracts are:
 - a. Larger than forward contracts
 - b. Over-the counter instruments
 - c. Standardized
7. Rolling of a futures contract to the next trading day with a new price is called as _____
 - a. Physical Settlement
 - b. Cash settlement
 - c. Mark-to-Market
 - d. Margin Settlement
8. Purchased one 3-month call option with a premium of Rs. 30 and an exercise price of Rs. 550. Purchased one 3-month put option with a premium of Rs. 5 and an exercise price of Rs. 450. Price on expiry date is Rs.600. How much is the profit/loss if lot size is 100 shares?
 - a. Profit of Rs.5,000
 - b. Loss of Rs.3,500
 - c. Profit of Rs.1,500

- d. Loss of Rs.1,500
9. You bought a CDS contract from Axis Bank on bonds of A Limited by paying annual premium of 1%. The annual premium has now increased to 3%. What inference does this have on credit quality of Bonds of A Limited?
- No change in credit quality
 - Improvement in credit quality
 - Deterioration in credit quality
10. Spot price of Gold is Rs.40,000 whereas futures price is Rs.42,000. How much is basis?
- +2,000
 - 2,000
 - 40,000
 - 42,000
11. Basis is _____ in contango market and _____ in backwardation market
- Positive and Negative
 - Positive and Zero
 - Zero and Positive
 - Negative and Positive
12. What is an "in-the-money" option?
- An option that has a high premium.
 - An option with a strike price equal to the current market price of the underlying asset.
 - An option that has significant potential for profit.
 - An option that has expired.
13. A basket option
- Provides the right to exchange one asset for another asset
 - Has multiple strike prices
 - Offers the right to buy or sell a specific amount of an asset at a specified price
 - Pays out based on the performance of a group of underlying assets
14. Which of the following statements about options is most accurate?
- The holder of a put option has the right to sell to the writer of the option.
 - The holder of a call option has the obligation to sell to the option writer if the stock's price rises above the strike price.
 - The writer of a put option has the obligation to sell the asset to the holder of the put option
15. Spot price = Rs.1,000; Life of futures = 6 months; Rate of interest = 6% per half year; Actual futures price = Rs.1,100; How much is the possible arbitrage gain?
- Rs.40
 - Rs.20
 - Rs.70
 - Arbitrage not possible
16. A European option can be exercised by:
- Its holder, only at the expiration of the contract
 - Its holder, anytime during the term of the contract
 - Either party, at contract expiration
 - Either party, anytime during the term of the contract

17. You plan to buy shares of TCS Limited. CMP of TCS is Rs.1,000. You currently don't have money and also intend to pay a maximum of 5 percent more than CMP. What action can be taken in option market to achieve this?
- Buy Put option of Exercise price of Rs.1,050
 - Buy call option of Exercise price of Rs.1,050
 - Buy Put option of Exercise price of Rs.950
 - Buy call option of Exercise price of Rs.950
18. Which exotic option has the potential for the largest payout?
- Lookback option
 - Chooser option
 - Asian option
 - Binary option
19. Which of the following is least likely a characteristic of futures contracts? Futures contracts
- Are backed by the clearinghouse
 - Require weekly settlement of gains and losses
 - Are traded in the active secondary market
 - Are standardized in nature
20. Company A has issued 10% bonds of Rs.50,00,000. Investor A has purchased bonds worth Rs.10,00,000 but is worried about the risk of default. He therefore wants protection against the risk of default and hence has purchased protection from Axis Bank in terms of CDS contract. Company A has defaulted and the recovery rate is 25%. How much is the cash settlement amount to be paid by Axis Bank to Investor A?
- Rs.37,50,000
 - Rs.10,00,000
 - Rs.50,00,000
 - Rs.7,50,000
21. _____ can be exercised at any time between the purchase date and expiration date
_____ can be exercised on the expiration date
- American option and European option
 - European option and American option
22. Exercise price of put option = 1,000; Price of underlying asset on expiry date = 800; Premium received/paid on put option = 45; How much is the net pay-off of Put writer?
- Profit of Rs.45
 - Loss of Rs.200
 - Loss of Rs.155
 - Profit of Rs.155
23. A spread option is an exotic option that allows the holder to:
- Choose the spread between the option strike price and the underlying asset price
 - Profit from the difference between two underlying assets' prices
 - Exchange the option for another financial instrument
 - Exercise the option multiple times before expiration
24. Black Scholes Model assumes that the underlying asset will give a rate of return equal to _____
- Market rate
 - CAPM return
 - Risk-free rate
 - Between risk-free rate and market rate

25. Delta of call option = 0.3333 Times. What should be the combination of option and share to create risk-less hedge portfolio?
- Buy 1 share and Buy 3 call options
 - Buy 3 shares and Buy 1 call options
 - Buy 1 share and Sell 3 call options
 - Buy 3 shares and Sell 1 call options
26. In which situation is the Black-Scholes option pricing model less suitable?
- When valuing European-style options with fixed expiration dates.
 - When the underlying asset's price follows a continuous random walk.
 - When interest rates and dividend yields are constant over the option's life.
 - When valuing options with early exercise features.
27. Spot price = 2,400; Fair futures price = 2,300; How much is contango/backwardation?
- Contango of 100
 - Backwardation of 100
 - Neither contango nor backwardation
28. Exercise price of Put option = Rs.120; Likely intrinsic value on maturity date = Rs.20. Find out the price of the shares quoted at the stock exchange to get the value of the put option as shown above.
- Rs.140.00
 - Rs.100.00
 - Rs.80.00
 - Rs.120.00
29. _____ is the degree to which an option price will move given a small change in the underlying stock price
- Beta
 - Delta
 - Gamma
 - Theta
30. _____ measures the change in delta for small changes in the underlying asset
- Theta
 - Rho
 - Gamma
 - Vega
31. The current price of a flat is Rs.100 lacs. The price can either go up to Rs.110 lacs or Rs.95 lacs by end of one year. Expected annual rental income of flat is 2 lacs. Risk-free rate of return is 8% per annum. What is the probability of price increasing to Rs.110 lacs?
- 86.67%
 - 73.33%
 - 50.00%
 - 80.00%
32. ABC Limited has entered into a swap agreement on notional principal of Rs.200 crores. ABC Limited would pay 1% per quarter and receive the quarterly return of sensx. Sensx value on day 0 and day 90 is 20,000 and 21,000. How much is the net cash flow of ABC Limited?
- Receive Rs.10 crores
 - Receive Rs.8 crores
 - Pay Rs.10 Crores

d. Pay Rs.8 crores

33. Stock is currently trading at Rs.100. One-month interest rate is 12% per annum. What is the fair futures price for 3-month expiry?

- a. Rs.103
- b. Rs.103.03
- c. Rs.103.05

34. You as an investor had purchased a 3 month call option on the equity shares of X Ltd. of Rs.30, of which the current market price is Rs. 560 and the exercise price Rs. 590. You expect the price to range between Rs.540 to Rs.640. The expected share price of X Ltd. and related probability is given below:

Expected Price	540	560	580	600	620	640
Probability	0.10	0.15	0.05	0.35	0.20	0.15

How much is the likely value of call option after three months if the exercise price prevails?

- a. Rs.17.00
- b. Rs.7.00
- c. Rs.50.00
- d. Rs.0.00

35. What feature makes a compound option different from a standard option?

- a. Compound options have an additional cost called the "premium."
- b. Compound options have multiple expiration dates.
- c. Compound options have different underlying assets.
- d. Compound options provide the holder the right to buy or sell another option at a future date.

36. Fair futures price = Rs.1,000; Actual futures price = Rs.1,010; What strategy can help in exploiting arbitrage opportunity and how much will be arbitrage gain/loss?

- a. Buy spot and sell futures; Profit of Rs.10
- b. Buy spot and sell futures; loss of Rs.10
- c. Sell spot and buy futures; Profit of Rs.10
- d. Sell spot and buy futures; Loss of Rs.10

37. A binary option has a fixed payout of Rs.1000 if it finishes "in the money" and a premium of Rs.200. The option has a 70% chance of finishing "in the money" based on market conditions. If a trader buys 10 binary options, what is the expected payoff?

- a. Rs.3,000
- b. -2,000
- c. Rs.10,000
- d. Rs.5,000

38. An investor goes long on two puts of EP of Rs.60 (premium of Rs.5) and goes short on one call each of EP of Rs.55 (premium of Rs.2) and EP of Rs.65 (premium of Rs.7). What will be the net profit/loss if stock closes at Rs.62 on expiry date?

- a. Profit of Rs.3
- b. Profit of Rs.4
- c. Loss of Rs.1
- d. Loss of Rs.4

39. Which of the following statements is true?

- a. Margin requirement on index futures will be same as margin requirement on stock futures
- b. Margin requirement on index futures will be less than margin requirement on stock futures
- c. Margin requirement on index futures will be more than margin requirement on stock futures

40. In a synthetic collateralized debt obligation (CDO), the CDO issuer:
- Holds the actual underlying assets as collateral
 - Issues bonds backed by cash reserves
 - Transfers the credit risk using credit default swaps (CDS)
 - Utilizes a special purpose vehicle (SPV) to pool the assets
41. A stock is currently priced at Rs.50. It is known that in the first 6 months of current year from now prices will either rise by 20% or go down by 20%, further in the later half of the year prices may again up by 20% or go down by 20%. Suppose risk free rate is 5% continuous compounded and strike rate is Rs.52. How much is the downside probability?
- 45.00%
 - 56.35%
 - 43.65%
 - 50.00%
42. ABC Ltd. is a pharmaceutical company possessing a patent of a drug called 'Aidrex', a medicine for aids patient. Being an approach drug ABC Ltd. holds the right of production of drugs and its marketing. The period of patent is 15 years after which any other pharmaceutical company produce the drug with same formula. It is estimated that company shall require to incur \$ 12.5 million for development and market of the drug. As per a survey conducted the expected present value of cashflows from the sale of drug during the period of 15 years shall be \$ 16.7 million. Cash flow from the previous similar type of drug have exhibited a variance of 26.8% of the present value of cashflows. The current yield on Treasury Bonds of similar duration (15 years) is 7.8%. How much is the dividend yield in black scholes model for valuation of option?
- No dividend
 - 15%
 - 6.67%
 - 10.00%
43. An Asian call option has a strike price of Rs.50 and is based on the average price of the underlying asset over the last three months. The average asset price in the first month is Rs.48, in the second month is Rs.52, and in the third month is Rs.55. How much is the gross payoff to the option buyer on expiration date?
- Rs.5.00
 - Nil
 - Rs.1.67
 - Rs.2
44. You have bought protection using a 2-year CDS on CDX-IG (125 constituent) index. The notional is Rs.200 crores. Company X, an index constituent defaults and trades at 25% of par. Compute the payoff on the CDS on account of default of X?
- 1.6 crores
 - 150 crores
 - 1.2 crores
 - 200 crores
45. A stock is currently trading at Rs.100. It will pay dividend of Rs.2 in one month. Interest rate = 12 percent per annum. Time period = 3 months. What is fair futures price? $e^{0.01} = 1.01005$; $e^{0.02} = 1.02020$; $e^{0.03} = 1.03045$
- Rs.102.02
 - Rs.103.05
 - Rs.104.09
 - Rs.101.00

46. Three month forward price is Rs.206. Interest rate is 12% per annum. What is the spot price if the company is likely to pay dividend of Rs.2 today?
- Rs.208
 - Rs.200
 - Rs.198
 - Rs.202
47. Which party typically pays the periodic premium in a credit default swap agreement?
- Buyer of the CDS
 - Seller of the CDS
 - Underlying asset issuer
 - Regulatory authority
48. You deposited a margin of Rs.10,000 for entering a futures contract. You also paid a commission of Rs.1,000 to broker. You made a gross profit of Rs.5,000 on futures and paid a commission of Rs.1,000 for exit. How much is the rate of return earned?
- 50%
 - 30%
 - 33.33%
 - 27.27%
49. A lookback option provides the holder with the:
- Right to exchange one asset for another asset
 - Right to buy or sell a specific amount of an asset at a specified price
 - Right to receive the highest (for call) or lowest (for put) asset price during the option's life
 - Right to exercise the option at any time before expiration
50. Spot price of Gold is Rs.800. Interest rate is 12% per annum. What is the fair price of 3 month futures if storage cost of Rs.5 is to be paid in month 3?
- Rs.805
 - Rs.824
 - Rs.829
 - Rs.819
51. Which option valuation model can be used to value an American option?
- Black Scholes Model
 - Put call parity theory
 - Binomial Model
52. In an arbitrage collateralized debt obligation (CDO), the objective is to:
- Transfer credit risk from the CDO issuer to investors
 - Generate profits from price discrepancies in underlying assets
 - Hedge against currency fluctuations in international CDOs
 - Ensure stable and consistent cash flow for the CDO investors
53. A lookback call option has a strike price of Rs.80, and the underlying asset's prices during the option's life are as follows: Rs.75, Rs.82, Rs.78 and Rs.85. The closing price on expiration is Rs.80. What is the profit for the option holder?
- Nil
 - Rs.5
 - Rs.2
 - Rs.3.50

54. A deeply out of the money option will have delta closer to _____ and a deeply in the money option will have delta closer to _____
- 0 and 0
 - 1 and 1
 - 1 and 0
 - 0 and 1
55. What lesson do derivatives mishaps teach regarding hedging and speculation?
- A hedger should not use derivatives for risk management purposes
 - Speculation with derivatives is always profitable
 - Ensure that a hedger does not become a speculator
 - Derivatives are only suitable for speculative purposes
56. Spot price = Rs.800; Cost to carry = Rs.20; You need to consider Rs.810 as the fair futures price. How much is the convenience Yield?
- No convenience yield
 - Rs.20
 - Rs.10
57. A Rice Trader has planned to sell 22000 kg of Rice after 3 months from now. Interpret his current position in cash market?
- Short Position
 - Long Position
 - No Position
58. The current share price of Infosys Limited is Rs.100. Price can either go up to Rs.120 and decrease to Rs.90 at end of 6 months. CCRFI is 10% per annum. What is the probability of price increasing to Rs.120?
- 50%
 - 66.67%
 - 50.43%
 - 68.40%
59. What happens to the value of an option as the expiration date approaches?
- The value of both call and put options increases.
 - The value of both call and put options decreases.
 - The value of call options increases, and the value of put options decreases.
 - The value of call options decreases, and the value of put options increases.
60. Dividend Yield = 4% per annum. 75% of stock will pay dividend over next 6 months. ; Spot price = Rs.1,000; Risk-free rate = 12% per annum; Life of futures = 6 months; What is fair futures price? Note: Use normal compounding
- Rs.1060
 - Rs.1040
 - Rs.1030
 - Rs.1050
61. Timing option (part of real option) falls under the category of _____
- American call option
 - European call option
 - American put option
 - European put option

62. In a credit default swap, the protection buyer benefits when:
- The credit rating of the reference asset improves
 - The credit spread of the reference asset widens
 - The price of the reference asset increases
 - The reference asset matures
63. Which of the following is a key difference between a forward contract and a futures contract?
- Futures contracts are standardized, while forward contracts are not.
 - Futures contracts are only used for financial assets, while forward contracts are used for physical assets.
 - Forward contracts are exchange-traded, while futures contracts are over-the-counter (OTC) instruments.
 - Forward contracts have daily settlement, while futures contracts have no daily settlement.
64. The premium of CDS has _____ with risk attached with loans
- No relationship
 - Positive relationship
 - Negative relationship
65. Current market price of share is Rs.930; Exercise price of share is Rs.900; Present value of exercise price as per BS Model is Rs.888.08; $N(d1) = 0.7069$; $N(d2) = 0.6783$; Dividend yield on index is 3% per annum and life of option is 2 months. How much is the value of call option as per BS model?
- Rs.55.03
 - Rs.51.78
 - Rs.43.69
 - Rs.46.95
66. Value of portfolio held = Rs.20,00,000. You have decided to sell 30% of your portfolio and replace the same with risk-free asset to reduce Beta. You are holding shares of multiple companies and one of them is ABC Limited (5,000 shares). How many shares of ABC Limited will be held by the investor in new portfolio post risk reduction?
- 3,500 shares
 - 1,500 shares
 - 5,000 shares
 - Nil
67. You buy 10,000 shares of ABC Limited at a price of Rs.20 per share. You got a perfect hedge with position in Nifty futures. Nifty fell by 2% and shares of ABC Limited increased by 5%. You made overall profit of Rs.12,000. How much is the Beta of ABC Limited?
- 2.50 Times
 - 2.50 Times
 - 0.50 Times
 - 2 Times
68. An investor has used delta hedging technique to hedge his portfolio. What is necessary for success of delta-hedging technique?
- High Gamma
 - Low Gamma
 - High exercise price
 - Low exercise price

69. A CDS has balance duration of 10 years. The original premium was 500 bps and now the premium has widened to 700 bps. Notional amount of principal of Rs.10,00,000. How much is the gain/loss to protection buyer?
- Rs.20,000 (Profit)
 - Rs.20,000 (loss)
 - Rs.2,00,000 (Profit)
 - Rs.2,00,000 (loss)
70. What happens to the value of a long forward contract on an asset as the asset's price increases?
- The value of the forward contract decreases.
 - The value of the forward contract increases.
 - The value of the forward contract remains unchanged.
 - The value of the forward contract depends on interest rates.
71. A stock is currently trading at Rs.125 and is likely to pay annual dividend of Rs.4 after one year. Risk-free interest rate is 8% per annum. Lot size of contract is 2,000 shares. An investor took short position on futures and the spot price fell by 6%. How much is the profit or loss on the position taken by the investor?
- Rs.15,000 (profit)
 - Rs.15,000 (loss)
 - Rs.16,200 (profit)
 - Rs.16,200 (loss)
72. One of the crucial lessons from derivatives mishaps is:
- Avoid using derivatives altogether
 - Delegate all derivative-related decision-making to the Treasury Department
 - Specify risk limits and ensure separation of front, middle, and back offices
 - Only buy complex derivatives to maximize potential profits
73. What is short call in the context of a real option?
- Any flexibility to invest, to enter a business, to expand a business
 - Any flexibility to disinvest or to exit from a business
 - Any commitment to disinvest upon the action of another party.
 - Any commitment to invest upon the action of another party
74. You have bought a call option with exercise price of Rs.100. You have sold a call option with exercise price of Rs.80. Premium on Rs.100 option was Rs.10 and Premium on Rs.80 option was Rs.25. What will be the break-even price?
- 100
 - 80
 - 115
 - 95
75. You have created a perfect hedge for your investment. You have a share portfolio of Rs.10,00,000 which has Beta of 2 Times. You have entered into short position in futures for perfect hedge. Compute profit/loss if share portfolio increased by 10% and Nifty increased by 8%
- Rs.1,00,000 (profit)
 - Rs.60,000 (profit)
 - Rs.1,00,000 (loss)
 - Rs.60,000 (loss)
76. _____ occurs due to the different between existing price in the futures market and the cash price of the underlying securities

- a. Price risk
 - b. Default risk
 - c. Basis risk
 - d. Timing risk
77. Current market price of Share = Rs.415; Exercise price of share = Rs.400; Present value of exercise price = Rs.395.03; $N(d_1) = 0.6926$; $N(d_2) = 0.6529$. How much is the value of call option?
- a. Rs.26.27
 - b. Rs.29.51
 - c. Rs.19.12
 - d. Rs.15.00
78. Spot price of shares = Rs.100; CCRFI = 12% per annum; Dividend of Rs.2 would be paid in 2 months; Life of option = 3 Months. Value of Put of an in-the-money option is Rs.10. How much is the value of an in-the-money Call option?
- a. Rs.8.04
 - b. Rs.12.96
 - c. Rs.11.00
 - d. Rs.13.00
79. An electricity locational basis swap allows market participants to:
- a. Swap electricity prices between different delivery locations
 - b. Swap electricity for other commodities
 - c. Hedge against currency exchange rate fluctuations
 - d. Obtain physical delivery of electricity at a specific location
80. A company issues one-year bond and the same has a probability of default of 2%. The expected recovery rate is 20%. How much would the CDS spread for this bond?
- a. 2.00%
 - b. 1.60%
 - c. 4.00%
 - d. 3.20%
81. What is the primary purpose of using real options in investment decisions?
- a. Risk reduction
 - b. Portfolio diversification
 - c. Capital budgeting
 - d. Speculative trading
82. Spot price = Rs.20,000; Fair Futures Price = Rs.24,000; Actual Futures Price = Rs.25,000; Life of futures = 6 months. How much is the implied risk-free rate assuming no dividend on futures contract?
- a. 20%
 - b. 25%
 - c. 40%
 - d. 50%
83. ICICI bank is quoting at Rs.1,100. CCRFI is 12 percent per annum and the continuously yield on share is 4 percent per annum. How much is the fair futures price of three-month contract?
- a. Rs.1,122
 - b. Rs.1,133
 - c. Rs.1,122.22
 - d. Rs.1,133.33

84. Option Vega is 8.02. Current call and put premium is Rs.88.53 and Rs.253.67. How much would be the revised premium if there is 1 percent increase in volatility?
- Rs.80.51 and Rs.245.65
 - Rs.96.55 and Rs.245.65
 - Rs.80.51 and Rs.261.69
 - Rs.96.55 and Rs.261.69
85. Mr. X purchased Nifty futures of Rs.2,00,000 on Jan 1. Lot size of Nifty = 10. Nifty spot on expiry was 20,800 whereas futures was 20,805. How much is the profit/loss?
- Profit of Rs.8,000
 - Loss of Rs.8,000
 - Profit of Rs.8,050
 - Loss of Rs.8,050
86. Investment in R&D Activities is an example of which category of real option
- Abandonment option
 - Timing option
 - Growth option
87. The variance of spot and futures is 144% and 324%. The correlation co-efficient is 0.75. What is the hedge ratio?
- 0.66
 - 0.50
 - 0.33
 - 1.125
88. ABC Limited has entered into an Electricity forward contract to buy 1 million units of power over the next three months at a specified price. What should be the settlement price in case the company opts for net settlement?
- Spot price on expiry date
 - Spot price on entry date
 - Average price of power over next three months
89. BSE sensx on 1st Jan 2022 (Anticipated on 1st Sep 2021) = 58,580; Dividend Yield of index = 6% per annum; 181 days treasury bill rate = 9% per annum; How much is the present value of sensx as on 1st Sep 2021?
- 58,580
 - 58,000
 - 59,160
 - 60,000
90. What is the impact of increase in risk-free rate on premium of call and put option?
- Both call and put premium will decrease
 - Call option premium will increase and put option premium will decrease
 - Call option premium will decrease and put option premium will increase
 - Both call and put premium will increase
91. On 15th September, the index closed at 1195, and December futures (last trading day December 15) were trading at 1225. The historical dividend yield on the index has been 3% per annum and the borrowing rate was 9.5% per annum. How much is the fair futures price assuming one year consist of 365 days?
- Rs.1,225
 - Rs.1,195

- c. Rs.1,214.37
 - d. Rs.1,223.30
92. How are weather derivatives different from traditional insurance contracts for protection against unforeseen weather events?
- a. Both are similar
 - b. Insurance provides protection for extreme events whereas derivatives can be used to cover all types of risks including uncertainty in weather impacting cash flow
 - c. Derivatives protection for extreme events whereas insurance can be used to cover all types of risks including uncertainty in weather impacting cash flow
93. Fair futures price of Nifty = 20,000; Actual Futures price of Nifty = 19,800; Lot size = 100. How much is the value of one futures contract?
- a. 20,00,000
 - b. 19,80,000
94. Put option Rho is -3.86 and current put premium is Rs.20. Risk-free interest rate has decreased by 1 percent. What would be the new put price post revision in risk-free rate?
- a. Rs.20.00
 - b. Rs.23.86
 - c. Rs.16.14
95. Value of portfolio held = 20,20,000; Beta of portfolio = 2; BSE futures = 10,100; Lot size = 10; How many contracts should be bought/sold for perfect hedge?
- a. Buy 40 contracts
 - b. Sell 40 contracts
 - c. Buy 20 contracts
 - d. Sell 20 contracts
96. The primary objective of weather derivatives is to hedge against
- a. Volume risk
 - b. Price risk
 - c. Both volume risk and price risk
 - d. Neither volume risk nor price risk
97. Beta of share = 2 Times. Share has increased by 20 percent. How much would be the change in market?
- a. Increase of 40 percent
 - b. Decrease of 40 percent
 - c. Increase of 10 percent
 - d. Decrease of 10 percent
98. Call option Delta = 0.60 Times; Option Gamma is 0.0010. How much would be the new Put Delta if the price of the underlying asset decline by Rs.1?
- a. -0.3990 Times
 - b. 0.6010 Times
 - c. 0.5990 Times
 - d. -0.4010 Times
99. Spot price of shares = Rs.100; CCRFI = 12% per annum; Life of option = 3 Months. Value of call of an in-the-money option is Rs.10. How much is the value of an in-the-money put option?
- a. Rs.10
 - b. Rs.12.96
 - c. Rs.7.04

- d. Rs.100
100. Beta of portfolio of investor = 2 Times. He is targeting 120% protection of his portfolio through Nifty Futures. How much is the target beta of the investor post protection?
- 4.40 Times
 - 0 Time
 - 2.4 Times
 - 0.40 Times
101. A company enters into a commodity swap where it receives the price appreciation of gold and pays a fixed interest rate. What type of swap is this?
- Commodity for interest swap
 - Amortizing swap
 - Commodity-for-commodity swap
 - Price-indexed swap
102. What is the impact of increase in exercise price on premium of call and put option?
- No impact on premium
 - Call option premium will increase and put option premium will decrease
 - Call option premium will decrease and put option premium will increase
103. Growth option (part of real option) falls under the category of _____
- American call option
 - European call option
 - American put option
 - European put option
104. Investor has entered into a long position of Rs.100 lacs in Nifty futures. He also has a share portfolio which has Beta of 1.5 times. His share portfolio declined by 4.5 percent. How much would be the profit/loss only in Nifty futures?
- Loss of 4.5 lacs
 - Profit of 4.5 lacs
 - Loss of 3 lacs
 - Profit of 3 lacs
105. Sale of shares of A Limited = Rs.2,00,000; Beta of A Limited = 1.5 times; The investor wants 50 percent hedge and hence wants to position to be taken in index futures?
- Purchase index futures of Rs.1,50,000
 - Purchase index futures of Rs.1,00,000
 - Sell index futures of Rs.1,50,000
 - Sell index futures of Rs.1,00,000
106. Normal cost of capital is 10.5%; Natural log (1.1050) = 0.0998; What will be the CCRFI rate of interest for normal cost of capital of 10.5%?
- Cannot be calculated with given information
 - 10.5%
 - 9.98%
107. Current value of call option of strike price Rs.600 is Rs.60.00. There is 60% probability of price reaching Rs.800 and 40% probability of price reaching Rs.500. Life of option = 6 months. How much is expected rate of return of option?
- 100%
 - 0%

- c. 200%
- d. 50%

108. _____ is the change in option price upon one day decrease in time to expiration

- a. Theta
- b. Rho
- c. Gamma
- d. Vega

109. Call option Theta is -3.45. Value of call option today is Rs.100. What would be the value of call option next day assuming other things remain constant?

- a. Rs.103.45
- b. Rs.100.00
- c. Rs.96.55

110. Value of portfolio held = 10,00,000; Beta of portfolio = 2 times; Size of one futures contract (index) = Rs.2,00,000; How many contracts to be bought/sold if we want to reduce Beta to 0.6 Times?

- a. Sell 7 Contracts
- b. Buy 10 contracts
- c. Sell 10 contracts
- d. Buy 7 contracts

111. Spot position of wheat = Rs.20; You have entered into futures contract to sell wheat at Rs.21. What will be the net realization if wheat price on maturity date is 25 in spot market and 25.10 in futures market?

- a. 25.10
- b. 21.00
- c. 20.90
- d. 21.10

112. A farmer uses a commodity futures contract to lock in the selling price of corn before the harvest. This is an example of:

- a. Income generation
- b. Convenience need
- c. Speculative trading
- d. Hedging

113. Value of portfolio = 20,00,000; Beta of portfolio = 2 Times; How much fresh risk-free investment can be brought in if you want to reduce risk to 0.5 Times? Note: You are not planning to sell shares and bring in additional money

- a. Buy Risk-free investment of Rs.40,00,000
- b. Buy Risk-free investment of Rs.60,00,000
- c. Buy Risk-free investment of Rs.20,00,000

114. Abandonment option (part of real option) falls under the category of _____

- a. American call option
- b. European call option
- c. American put option
- d. European put option

115. The average daily absolute change in the value of the contract is Rs.8,000 and standard deviation of these changes is Rs.4,000. How much should the initial margin be?

- a. 12,000

- b. 8,000
- c. 20,000
- d. 16,000

116. Which of these conditions are not necessary for a product to be included under commodity derivatives?

- a. Product must be durable
- b. Product must be homogenous
- c. There should not be major price volatility in the commodity
- d. Supply should flow naturally to market

117. Dividend yield for different months is as under: Jan = 2%; Feb = 4%; Mar = 6%; Apr = 4%; May = 5%; June = 9%; July = 4%; Aug = 2%; Sep = 1%; Oct = 7%; Nov = 9%; Dec = 10%; What should be taken as dividend yield for valuing a 4-month futures which expired on Nov 30?

- a. 5.25%
- b. 8%
- c. 4.75%

118. Initial margin = 50,000; Maintenance margin = 40,000; Margin account reached balance of Rs.38,000. How much would be the margin replenishment needed?

- a. No replenishment needed
- b. Rs.2,000
- c. Rs.12,000

119. Initial margin = 50,000; Maintenance margin = 40,000; Margin account reached balance of Rs.43,000. How much would be the margin replenishment needed?

- a. No replenishment needed
- b. Rs.3,000
- c. Rs.7,000

120. You have sold one lot of Nifty at 10,000. Lot size = 100 units. Initial margin = 8% of contract value. Nifty has moved to 9,400 on next day. What will be the balance in margin account post profit/loss?

- a. 80,000
- b. 60,000
- c. 1,40,000
- d. 20,000

121. Initial margin = 50,000; Maintenance margin = 40,000; Margin balance post profit/loss = 70,000; Investor withdraws 60% of maximum allowed withdrawal. How much was the withdrawal?

- a. 18,000
- b. 12,000
- c. 20,000
- d. 30,000

122. Which type of option has a fixed payoff if it finishes "in the money" at expiration, regardless of the underlying asset's path?

- a. Asian option
- b. Lookback option
- c. Binary option
- d. Bermuda option

123. An investor expects two prices Rs.100 and Rs.80 for shares of TCS Limited. The exercise price of the call option is Rs.90. How much is the delta of the put option?

- a. 1 time
- b. 0.50 time
- c. -1 time
- d. 0 time

124. Exercise price = 1,000; CMP = 1,200. What is the intrinsic value of call option and Put option?

- a. 200 & 0
- b. 0 & 200
- c. 200 & -200
- d. -200 & 200

125. Value of underlying asset has gone up. What will happen to an in-the-money call option?

- a. Value of call option will decrease
- b. Value of call option will increase
- c. No impact

126. Exercise price of option = 1,000 and 1,100; Premium of above option = 200 and 175; What will be the nature of above options?

- a. Call option
- b. Put option
- c. Cannot be said with given information

127. Holder carries _____ and writer carries _____?

- a. Limited risk and Limited risk
- b. Limited risk and unlimited risk
- c. Unlimited risk and limited risk
- d. Unlimited risk and unlimited risk

128. Chooser options allow the holder to:

- a. Choose between call and put options
- b. Choose the underlying asset
- c. Choose the option strike price

129. Exercise price of put option = 100; CMP of underlying asset = 80; CMP of put option = 45; How much is the time value of option?

- a. 20
- b. 25
- c. 45
- d. 0

130. CMP of underlying asset = 400; Exercise price of call option = 450; What is the status of call option?

- a. In the money
- b. At the money
- c. Out the money

131. Exercise price of call option = Rs.100; Premium paid/received = Rs.10; What will be the break-even price?

- a. 100
- b. 110
- c. 90

132. A call option that is in the money:

- a. has a value greater than its purchase price.

- b. has an exercise price less than the market price of the asset
- c. has an exercise price greater than the market price of the asset
- d. has an exercise price equal to the market price of the asset

133. Other things equal, the fair futures price of an asset will be higher if the asset has

- a. Dividend payments
- b. Convenience Yield
- c. Storage costs

134. Which of the following will increase the value of a put option?

- a. An increase in volatility
- b. A decrease in exercise price
- c. An increase in current market price
- d. A dividend on the underlying asset

135. Which of the following statements about the potential profits and losses from selling a call is most accurate?

- a. Losses are limited to the strike price plus the premium
- b. Losses are theoretically unlimited
- c. Profits are theoretically unlimited

136. A stock is trading at Rs.18 per share. An investor believes that the stock will move either up or down. He buys a call option on the stock with an exercise price of Rs.20. He also buys two put options on the same stock each with an exercise price of Rs.25. The call option costs Rs.2 and the put options cost Rs.9 each. The stock falls to Rs.17 per share at the expiration date and the investor closes his entire position. The investor's net gain or loss is:

- a. Rs.4 (Loss)
- b. Rs.3 (Loss)
- c. Rs.4 (Gain)
- d. Rs.3 (Gain)

Answer:

1.	Counterparty risk			
2.	Call option will be exercised and GPO will be Rs.40; Put option will not be exercised; Total GPO = Rs.40; Net premium paid = Rs.2; Final Profit = 40 - 2 = Rs.38			
3.	Security	Beta	Weight	Product
	ABC Limited	1.10	2,00,000	2,20,000
	Sensex	1.00	-2,20,000	-2,20,000
	Total	0.00	2,00,000	0
	Value of one share = $\frac{2,00,000}{2,000} = 100$			
4.	The market expects the asset's price to increase			
5.	Initial margin = 8 % of contract value = 8% of (100 x 10,000) = 80,000 Profit/loss = 100 x (9800 - 10,000) = Loss of Rs.20,000 Margin balance post loss = 80,000 - 20,000 = Rs.60,000			
6.	Standardized			
7.	Mark-to-Market			
8.	• Premium paid on call option = 3,000 [30 x 100] • Premium paid on put option = 500 [5 x 100] • Call option will not be exercised. Put option will be exercised and will have GPO of Rs.50 and we will receive Rs.5,000 • Net payoff = 5,000 - 3,500 = Rs.1,500			
9.	Premium percentage has increased from 1% to 3.00%. Higher premium basically indicates deterioration in credit quality of underlying asset (Bonds of Company A)			
10.	Basis = Spot price - Futures price = 40,000 - 42,000 = -2,000			

11.	Negative and Positive																
12.	An option with a strike price equal to the current market price of the underlying asset																
13.	Pays out based on the performance of a group of underlying assets																
14.	The holder of a put option has the right to sell to the writer of the option Explanation: The holder of a put option has the right to sell to the writer of the option. The writer of the put option has the obligation to buy, and the holder of the call option has the right, but not the obligation to buy.																
15.	Fair futures price = Spot price $\times (1 + r)^n = 1,000 \times (1 + 6\%) = \text{Rs. } 1,060$ Arbitrage gain = Difference between AFP and FFP = $1,100 - 1,060 = \text{Rs. } 40$																
16.	Maximum purchase price = $1,000 + 5\% = 1,050$; We can cap the maximum purchase price by taking a call option. Exercise price of call option would be Rs.1,050																
17.	A European option can be exercised by its holder only at contract expiration																
18.	Lookback option Explanation: Lookback options can offer significant payouts because they allow the holder to exercise at the asset's most favorable price during the option's life.																
19.	Amount paid by Axis Bank = Default amount $\times (1 - \text{Recovery rate})$ Amount paid by Axis Bank = $10,00,000 \times (1 - 25\%) = \text{Rs. } 7,50,000$																
20.	Require weekly settlement of gains and losses Explanation: Futures contracts require daily settlement of gains and losses. The other statements are accurate																
21.	American option and European option																
22.	Put option will be exercised and hence gross payoff is negative 200; Premium received is Rs.45; Net payoff = Negative 200 + 45 = Negative 155																
23.	Profit from the difference between two underlying assets' prices																
24.	Risk-free rate																
25.	<table><tr><th>Security</th><th>Delta</th><th>Weight</th><th>Product</th></tr><tr><td>Shares</td><td>1.00</td><td>1.00</td><td>1.00</td></tr><tr><td>Call option</td><td>0.3333</td><td>-3.00</td><td>-1.00</td></tr><tr><td>Total</td><td></td><td></td><td>0.00</td></tr></table> Risk-less hedge portfolio would mean overall delta of 0. We should buy 1 shares and sell 3 call options to create risk-less hedge portfolio	Security	Delta	Weight	Product	Shares	1.00	1.00	1.00	Call option	0.3333	-3.00	-1.00	Total			0.00
Security	Delta	Weight	Product														
Shares	1.00	1.00	1.00														
Call option	0.3333	-3.00	-1.00														
Total			0.00														
26.	When valuing options with early exercise features																
27.	Futures is lower than spot and hence it is backwardation market Backwardation = Difference between FFP and Spot = 100																
28.	Intrinsic value on maturity = Rs.20. Put option will have intrinsic value if the actual market price is lower than exercise price. Hence value on maturity date = Rs.100.00																
29.	Delta																
30.	Gamma																
31.	Expected price of flat = $100 \times (1 + 8\%) - 2 \text{ lacs} = 106 \text{ lacs}$ <table><tr><th>Price</th><th>Probability</th><th>Product</th></tr><tr><td>110</td><td>P</td><td>110P</td></tr><tr><td>95</td><td>1-P</td><td>95-95P</td></tr><tr><td>Total</td><td></td><td>110P + 95 - 95P = 106</td></tr></table> $15P = 11$; $P = \frac{11}{15} = 0.7333$ (or) 73.33%	Price	Probability	Product	110	P	110P	95	1-P	95-95P	Total		110P + 95 - 95P = 106				
Price	Probability	Product															
110	P	110P															
95	1-P	95-95P															
Total		110P + 95 - 95P = 106															
32.	<table><tr><td>Amount payable [200 crores $\times$ 1%]</td><td>2 crores</td></tr><tr><td>Change in sensex</td><td>$\frac{21,000 - 20,000}{20,000} \times 100 = 5.00\%$</td></tr><tr><td>Amount receivable [20 crores $\times$ 5%]</td><td>10 crores</td></tr><tr><td>Net receipt</td><td>8 crores</td></tr></table>	Amount payable [200 crores $\times$ 1%]	2 crores	Change in sensex	$\frac{21,000 - 20,000}{20,000} \times 100 = 5.00\%$	Amount receivable [20 crores $\times$ 5%]	10 crores	Net receipt	8 crores								
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Amount receivable [20 crores $\times$ 5%]	10 crores																
Net receipt	8 crores																
33.	We will do monthly compounding as the monthly interest rates are given in question FFP = $100 \times (1.01)^3 = \text{Rs. } 103.03$																
34.	Exercise price prevails would mean that market price on maturity would be equal to exercise price. The option will lapse and hence the likely value of call option on maturity is 0.																
35.	Compound options provide the holder the right to buy or sell another option at a future date																
36.	Buy spot and sell futures; Profit of Rs.10																

37.	Rs.5,000 he expected payoff is calculated as the probability of finishing "in the money" multiplied by the fixed payout, minus the premium. Expected payoff = $(0.70 \times \text{Rs.1,000}) - \text{Rs.200} = \text{Rs.700} - \text{Rs.200} = \text{Rs.500}$. Total payoff = $500 \times 10 \text{ options} = \text{Rs.5,000}$												
38.	Premium paid = Rs.9; Premium received = Rs.10 (5 x 2); Net premium income = Rs.1 Option of EP of 55 and 60 will lapse. Option of EP of 65 will have GPO of Rs.3 and the same would be our income as we have purchased the same; Total profit = 1 + 3 = Rs.4												
39.	Margin requirement on index futures will be less than margin requirement on stock futures. This is because index carries less risk than individual stocks and hence will have lower margin requirement												
40.	Transfers the credit risk using credit default swaps (CDS)												
41.	Let us assume P to be the probability of price increase by 20% and 1-P to be the probability of price fall by 20%. Risk-free rate of interest is 5% per annum CCRFI Expected price at end of month 6 = $50 \times e^{(0.05)(0.5)} = 50 \times e^{0.025} = 50 \times 1.0253 = 51.27$ <table border="1"><thead><tr><th>Price</th><th>Probability</th><th>Product</th></tr></thead><tbody><tr><td>60</td><td>P</td><td>60P</td></tr><tr><td>40</td><td>1-P</td><td>40-40P</td></tr><tr><td>Total</td><td></td><td>60P+40-40P=51.27</td></tr></tbody></table> $60P + 40 - 40P = 51.27; 20P = 11.27; P = \frac{11.27}{20} = 0.5635$ Hence probability of price raise is 56.35% and probability of price fall is 43.65%	Price	Probability	Product	60	P	60P	40	1-P	40-40P	Total		60P+40-40P=51.27
Price	Probability	Product											
60	P	60P											
40	1-P	40-40P											
Total		60P+40-40P=51.27											
42.	Benefit of patent will be earned over 15 years and hence annual cash inflow/dividend yield is 6.67% (1/15 years)												
43.	We need to compare strike price with average closing price in case of an Asian option. The average price is Rs.51.67. Current market price is higher than strike price and hence option will be exercised and the gross pay-off to option buyer is Rs.1.67												
44.	<table border="1"><tr><td>Notional principal of company X = $200 \text{ crores}/125 = \text{Rs.1.6 crores}$</td></tr><tr><td>Settlement amount = $1.6 \text{ crores} - 25\% = \text{Rs.1.2 crores}$</td></tr></table>	Notional principal of company X = $200 \text{ crores}/125 = \text{Rs.1.6 crores}$	Settlement amount = $1.6 \text{ crores} - 25\% = \text{Rs.1.2 crores}$										
Notional principal of company X = $200 \text{ crores}/125 = \text{Rs.1.6 crores}$													
Settlement amount = $1.6 \text{ crores} - 25\% = \text{Rs.1.2 crores}$													
45.	$\text{PV of dividend income} = \frac{1}{e^{0.01}} = 0.99$ Adjusted spot price = Spot price - PV of dividend income = $100 - 0.99 = \text{Rs.99.01}$ Fair futures price = Adjusted spot price $\times e^{rt} = 99.01 \times e^{0.03} = 99.01 \times 1.03045 = 102.02$												
46.	Forward price = Adjusted spot price $\times (1 + r)^n$ $206 = \text{Adjusted spot price} \times (1+3\%)$ Adjusted spot price = Rs.200 Adjusted spot price = Spot price - PV of dividend income $200 = \text{Spot price} - 2$; Spot price = Rs.202												
47.	Buyer of the CDS												
48.	Initial outflow (investment) = $10,000 + 1,000 = \text{Rs.11,000}$ Net Profit = $5,000 - \text{entry commission (1,000)} - \text{exit commission (1,000)} = 3,000$ Rate of return = $\frac{3,000}{11,000} \times 100 = 27.27\%$												
49.	Right to receive the highest (for call) or lowest (for put) asset price during the option's life												
50.	Adjusted spot price = Spot price + PV of storage costs $\text{PV of storage costs} = \frac{5}{1 + 3\%} = \text{Rs.4.85}$ Adjusted spot price = $800 + 4.85 = \text{Rs.804.85}$ Fair futures price = $804.85 \times (1+3\%) = \text{Rs.829}$												
51.	Binomial model												
52.	Generate profits from price discrepancies in underlying assets												
53.	Under a lookback option the option holder can choose the most favorable price for deciding on exercise. Hence the exercise price of Rs.80 can be compared with most favorable price of Rs.85 (highest price) and the option holder will have a pay-off of Rs.5.00												
54.	0 and 1												
55.	Ensure that a hedger does not become a speculator												
56.	Convenience yield = FFP as per formula - FFP as per question FFP as per formula = Spot price + Cost to carry = $800 + 20 = 820$												

	Convenience yield = 820 - 810 = Rs.10																								
57.	Since trader has planned to sell after 3 months, now it implies, he is in Long Position in Cash or Spot Market.																								
58.	Expected share price = $PV \times e^{rt}$ Expected share price = $100 \times e^{(0.10)(0.50)} = 100 \times e^{0.05} = 100 \times 1.051271 = \text{Rs. } 105.13$ Let us assume p to be the probability of price reaching Rs.120 and 1-p to be the probability of price reaching Rs.90 <table><tr><th>Price</th><th>Probability</th><th>Product</th></tr><tr><td>120</td><td>P</td><td>120P</td></tr><tr><td>90</td><td>1-P</td><td>90-90P</td></tr><tr><td>Total</td><td></td><td>90-30P=105.13</td></tr></table> $90 - 30P = 105.13; -30P = -15.13; P = \frac{15.13}{30.00} = 0.5043 \text{ (or) } 50.43\%$	Price	Probability	Product	120	P	120P	90	1-P	90-90P	Total		90-30P=105.13												
Price	Probability	Product																							
120	P	120P																							
90	1-P	90-90P																							
Total		90-30P=105.13																							
59.	The value of both call and put option decreases Explanation: As the expiration date approaches, the time value of the option decreases. Time value is the premium that an option buyer pays for the possibility of the option moving in-the-money before expiration. As there is less time for the option to move in-the-money, the value of both call and put options decreases.																								
60.	FFP = Spot price $\times [1 + (r - y)^t]$ FFP = $1,000 \times (1 + (6\% - 3\%)^1) = 1,030$ Note: Dividend yield is 4 percent per annum. Proportionate yield for next 6 months is 3 percent as 75 percent of stock would pay dividend in next 6 months																								
61.	American call option																								
62.	The credit spread of the reference asset widens Explanation: The protection buyer benefits when the credit spread of the reference asset widens, indicating a higher probability of default, leading to a higher payout in case of default.																								
63.	Futures contracts are standardized, while forward contracts are not.																								
64.	Positive relationship Explanation: Higher the risk attached to Bonds or loans, higher will be premium or cost of CDS																								
65.	$N(d1) \times e^{-yt} = 0.7069 \times e^{-0.03 \times (\frac{2}{12})} = 0.7034$ Value of call = $(S_0 \times N(d1) \times e^{-yt}) - (PV_{EP} \times N(d2))$ Value of call = $(930 \times 0.7034) - (888.08 \times 0.6783) = \text{Rs. } 51.78$																								
66.	No of shares to be sold = $5,000 \times 30\% = 1,500$ shares Shares held post sale = $5,000 - 1,500 = 3,500$ shares																								
67.	<table><tr><th>Particulars</th><th>Amount</th></tr><tr><td>Profit in ABC Limited $[2,00,000 \times 5\%]$</td><td>10,000</td></tr><tr><td>Profit in Nifty futures $[12,000 - 10,000]$</td><td>2,000</td></tr><tr><td>Position in nifty futures $[2,000/-2\%]$</td><td>-1,00,000</td></tr></table> Beta computation: <table><tr><th>Security</th><th>Beta</th><th>Weight</th><th>Product</th></tr><tr><td>ABC Limited</td><td>0.50</td><td>2,00,000</td><td>1,00,00</td></tr><tr><td>Nifty Futures</td><td>1.00</td><td>-1,00,00</td><td>-1,00,00</td></tr><tr><td>Total</td><td>0</td><td>2,00,000</td><td>0</td></tr></table> • Nifty of ABC Limited = 0.50 Times	Particulars	Amount	Profit in ABC Limited $[2,00,000 \times 5\%]$	10,000	Profit in Nifty futures $[12,000 - 10,000]$	2,000	Position in nifty futures $[2,000/-2\%]$	-1,00,000	Security	Beta	Weight	Product	ABC Limited	0.50	2,00,000	1,00,00	Nifty Futures	1.00	-1,00,00	-1,00,00	Total	0	2,00,000	0
Particulars	Amount																								
Profit in ABC Limited $[2,00,000 \times 5\%]$	10,000																								
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Nifty Futures	1.00	-1,00,00	-1,00,00																						
Total	0	2,00,000	0																						
68.	If you are hedging a portfolio using the Delta-hedge technique then you will want to keep gamma as small as possible , the smaller it is the less often you will have to adjust the hedge to maintain a delta neutral position																								
69.	CDS spread has widened and hence the same indicates deterioration in credit quality. Deterioration in credit quality will lead to profit for the protection buyer. Profit of protection buyer = $10,00,000 \times 2\% \times 10 \text{ years} = \text{Rs. } 2,00,000$																								
70.	The value of long forward contract increases (Buyer will make profit)																								
71.	Original futures price: $PV \text{ of dividend} = \frac{4}{1.08} = 3.70$ Adjusted spot price = $125 - 3.70 = 121.30$ Fair futures price = $121.30 \times 1.08 = \text{Rs. } 131 \text{ (or) Rs. } 2,62,000 \text{ per contract}$																								

	Revised futures price: Revised spot price = $125 - 6\% = \text{Rs. } 117.50$ Adjusted spot price = $117.50 - 3.70 = 113.80$ Fair futures price = $113.80 \times 1.08 = \text{Rs. } 122.90$ (or) Rs. 2,45,800 per contract Profit/loss: Investor originally sold futures for Rs.2,62,000. Now the opposite position (purchase) will be at Rs.2,45,800. Hence profit = $2,62,000 - 2,45,800 = \text{Rs. } 16,200$												
72.	Specify risk limits and ensure separation of front, middle, and back offices												
73.	Any commitment to disinvest upon the action of another party												
74.	Break-even price is where premium is equal to gross payoff; Net premium received = $25 - 10 = 15$. Hence at break-even gross payoff should be negative Rs.15. This would mean we would lose money on option written and don't earn anything on option bought We will lose Rs.15 on Rs.80 option if the actual market price is Rs.95. At Rs.95, EP of Rs.100 option would not get exercised and hence we will lose Rs.15 at GPO level												
75.	Spot market: Profit in spot market = $10,00,000 \times 10\% = \text{Rs. } 1,00,000$ Futures Market: Short position in futures market = $10,00,000 \times 2 = 20,00,000$ Loss in futures market = $20,00,000 \times 8\% = 1,60,000$ Overall Position: Overall loss = $1,00,000 - 1,60,000 = \text{Rs. } 60,000$ (Loss)												
76.	Basis risk												
77.	Value of call = $(S_0 \times N(d1)) - (PV_{EP} \times N(d2)) = (415 \times 0.6926) - (395.03 \times 0.6529) = \text{Rs. } 29.51$												
78.	Share + Put = Call + PV of EP Adjusted share price = Share price - PV of dividend = $100 - \frac{2}{e^{0.02}} = 100 - 1.96 = 98.04$ $98.04 + 10 = \text{Call} + \frac{100}{e^{0.03}}$; $108.04 = \text{Call} + 97.04$; Call = 11.00												
79.	Swap electricity prices between different delivery locations												
80.	CDS spread = Probability of default x (1 - Recovery rate) CDS spread = $2\% \times (1 - 20\%) = 1.60\%$												
81.	Risk Reduction Explanation: Real options provide flexibility and allow decision-makers to adapt to changing market conditions, reducing the risk associated with long-term investments.												
82.	Fair Futures Price = Spot price x (1 + r) $24,000 = 20,000 \times (1 + r)$; r = 20% per 6 months (or) 40% per year Actual risk-free rate is Rs.20,000. However, the implied risk-free rate is more than actual risk-free rate due to arbitrage gain. Investor will earn arbitrage gain of Rs.1,000 (Difference between FFP and AFP) and the same would translate into gain of 5% per half year (or) 10% per year. Hence implied risk-free rate = $40\% + 10\% = 50\%$ per annum												
83.	Fair Futures Price = Spot Price x $e^{(r-y)t} = 1,100 \times e^{(0.12-0.04)(0.25)}$ Fair Futures Price = $1,100 \times e^{0.02} = 1,100 \times 1.0202 = \text{Rs. } 1,122.22$												
84.	Volatility has increased and hence both call and put premium will increase. Option Vega is 8.02 and hence both call and put premium will increase New call premium = $\text{Rs. } 88.53 + 8.02 = \text{Rs. } 96.55$ New put premium = $\text{Rs. } 253.67 + 8.02 = \text{Rs. } 261.69$												
85.	Profit/loss will be computed using futures price on expiry date <table><tr><th>Particulars</th><th>Calculation</th><th>Amount</th></tr><tr><td>Purchase price</td><td>$2,00,000/10$</td><td>20,000</td></tr><tr><td>Opposite cancellation rate (SP)</td><td></td><td>20,805</td></tr><tr><td>Profit</td><td>$10 \times (20,805 - 20,000)$</td><td>8,050</td></tr></table>	Particulars	Calculation	Amount	Purchase price	$2,00,000/10$	20,000	Opposite cancellation rate (SP)		20,805	Profit	$10 \times (20,805 - 20,000)$	8,050
Particulars	Calculation	Amount											
Purchase price	$2,00,000/10$	20,000											
Opposite cancellation rate (SP)		20,805											
Profit	$10 \times (20,805 - 20,000)$	8,050											
86.	Growth option Explanation: Investment in R&D activities will provide the flexibility to make higher investment depending on the success of R&D.												
87.	Hedge ratio is also known as Beta.												

	$\text{Beta} = \frac{\text{SD of spot price}}{\text{SD of future price}} \times \text{Correlation co-efficient}$ $\text{Beta} = \left(\frac{12}{18}\right) \times 0.75 = 0.50 \text{ Times}$	
88.	Average price of power over next three months Explanation: The settlement price ST is usually calculated based on the average price of electricity over the delivery period at the maturity day. This is because the underlying electricity is a different commodity at different times.	
89.	Present value of sensex as on 1 st Sep 2021 (Spot price)	??
	BSE sensex on 1 st Jan 2022 (anticipated on 1 st Sep 2021) [Futures price]	58,580
	Time period	4 months
	Risk-free rate	9% p.a. (or) 3% per 4M
	Dividend Yield	6% p.a. (or) 2% per 4M
	Fair Futures Price = Spot Price $\times (1 + (r - y))^t$ $58,580 = \text{Spot price} \times (1 + (0.03 - 0.02))^1$ $\text{Spot price} = \frac{58,580}{1.01} = 58,000$	
90.	Call option premium will increase and put option premium will decrease Explanation: Increase in risk-free rate will lead to an expectation of higher price on maturity date. This is favourable for call option and adverse for put option.	
91.	No of days = 15 days of Sep + 31 days + 30 days + 15 days = 91 days Rate of interest = 9.5% per year (or) 2.3685% per 91 days Dividend Yield = 3% per year (or) 0.7479% per 91 days $\text{FFP} = \text{Spot Price} \times (1 + (r - y)) = 1195 \times (1 + (2.3685\% - 0.7479\%)) = 1,214.37$	
92.	Insurance provides protection for extreme events whereas derivatives can be used to cover all types of risks including uncertainty in weather impacting cash flow	
93.	Value of one contract = Actual Futures price $\times$ Lot size Value of one contract = 19,800 $\times$ 100 = Rs.19,80,000 Note: We will use fair futures price as actual futures price if there is no information on AFP in question	
94.	Put Rho is -3.86. This would mean that put premium will decrease if there is an increase in interest rate and vice versa. Risk-free interest rate has declined by 1 percent and hence put premium will increase. New Put premium = 20 + 3.86 = Rs.23.86	
95.	We need to sell futures to hedge as we have a long position in spot market $\text{No of contracts to be sold} = \frac{\text{Exposure value} \times \text{Beta}}{\text{Value of one contract}} = \frac{20,20,000 \times 2}{10,100 \times 10} = 40 \text{ contracts}$	
96.	Volume risk Explanation: The primary objective of weather derivatives is to hedge volume risk, rather than price risk, that results from a change in the demand for goods due to a change in weather	
97.	Change in share = Change in market $\times$ Beta 20 percent = Change in market $\times$ 2 $\text{Change in market} = \frac{20}{2} = 10 \text{ percent (increase)}$	
98.	Original Call Delta = 0.60 Times; Option Gamma is 0.0010 and this would mean that call delta will increase by 0.0010 for Rs.1 increase in share price and will decline by 0.0010 for Rs.1 decline in share price. New call delta with Rs.1 decrease in price = 0.60 Times - 0.0010 Time = 0.5990 Times Put delta = Call delta - 1 = 0.5990 - 1 = -0.401 Times	
99.	Share + Put = Call + PV of EP $100 + \text{Put} = 10 + \frac{100}{e^{0.03}}$; $100 + \text{Put} = 10 + 97.04$; $\text{Put} = 7.04$	
100.	Target Beta = Existing Beta - Protection % = 2 - (120% of 2) = -0.40 Times	
101.	Commodity for interest swap	
102.	Call option premium will decrease and put option premium will increase Explanation: Higher exercise price is adverse for a call option and favourable for put option	
103.	European call option	

104.	Share has beta of 1.5 times and has declined by 4.5 percent. Hence market would have fallen by 3 percent. We are holding Nifty futures of 100 lacs and Nifty has fallen by 3 percent. Hence loss in Nifty futures is Rs.3 lacs																								
105.	We have sold in spot market and hence we should purchase in futures market. Amount of futures to be purchased = Exposure value x Beta x Protection % Amount of futures to be purchased = 2,00,000 x 1.50 x 50% = Rs. 1,50,000																								
106.	Natural log can help in converting the normal rate to CCRFI. In this case Natural log (1.105) is 0.0998. Hence, we can say that normal rate of 10.5% is equivalent of CCRFI 9.98%																								
107.	Expected value on maturity = [200 x 60%] + [0 x 40%] = Rs. 120.00 Rate of return = $\frac{120 - 60}{60} \times \frac{12}{6} \times 100 = 200.00\%$																								
108.	Theta																								
109.	Call theta of -3.45 would mean decline in call option price by 3.45 for one day decrease in time to expiration. In this case other things have remained constant and hence the new call option price is Rs.96.55 (100 - 3.45)																								
110.	<table><tr><th>Security</th><th>Beta</th><th>Weight</th><th>Product</th></tr><tr><td>Portfolio</td><td>2.00</td><td>10,00,000</td><td>20,00,000</td></tr><tr><td>Index futures</td><td>1.00</td><td>-14,00,000</td><td>-14,00,000</td></tr><tr><td>Total</td><td>0.60</td><td>10,00,000</td><td>6,00,000</td></tr></table>	Security	Beta	Weight	Product	Portfolio	2.00	10,00,000	20,00,000	Index futures	1.00	-14,00,000	-14,00,000	Total	0.60	10,00,000	6,00,000								
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Index futures	1.00	-14,00,000	-14,00,000																						
Total	0.60	10,00,000	6,00,000																						
No of contracts to be sold = $\frac{14,00,000}{2,00,000} = 7$ contracts																									
111.	<table><tr><th>Date</th><th>Position</th><th>Action</th><th>Reference Date</th><th>Rate</th></tr><tr><td>Day 0</td><td>Original Position</td><td>Sell</td><td>Maturity</td><td>21.00</td></tr><tr><td>Maturity</td><td>Opposite Position</td><td>Buy</td><td>Maturity</td><td>-25.10</td></tr><tr><td colspan="4">Loss in futures</td><td>-4.10</td></tr></table>	Date	Position	Action	Reference Date	Rate	Day 0	Original Position	Sell	Maturity	21.00	Maturity	Opposite Position	Buy	Maturity	-25.10	Loss in futures				-4.10				
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Day 0	Original Position	Sell	Maturity	21.00																					
Maturity	Opposite Position	Buy	Maturity	-25.10																					
Loss in futures				-4.10																					
Net realization = Spot realization (25) - Loss of Rs.4.10 = 20.90																									
112.	Hedging																								
113.	<table><tr><th>Security</th><th>Beta</th><th>Weight</th><th>Product</th></tr><tr><td>Portfolio</td><td>2.00</td><td>20,00,000</td><td>40,00,000</td></tr><tr><td>Risk-free investment</td><td>0.00</td><td>60,00,000</td><td>0</td></tr><tr><td>Total</td><td>0.50</td><td>80,00,000</td><td>40,00,000</td></tr></table>	Security	Beta	Weight	Product	Portfolio	2.00	20,00,000	40,00,000	Risk-free investment	0.00	60,00,000	0	Total	0.50	80,00,000	40,00,000								
Security	Beta	Weight	Product																						
Portfolio	2.00	20,00,000	40,00,000																						
Risk-free investment	0.00	60,00,000	0																						
Total	0.50	80,00,000	40,00,000																						
Hence the investor needs to have a portfolio value of Rs.80,00,000 to reduce beta to 0.5 Times. This will be possible by having share portfolio of Rs.20,00,000 and balance risk-free investment of Rs.60,00,000																									
114.	American Put option																								
115.	Initial margin = Daily absolute change + (3 x Standard Deviation) Initial Margin = 8,000 + (3 x 4,000) = Rs.20,000																								
116.	There should not be major volatility in the commodity Explanation: The commodity needs to have high volatility and then only buyer/seller would want to hedge the same. If the commodity is not volatile then there will be no need for commodity derivatives																								
117.	Dividend yield = Average dividend yield of 4 months ending Nov 30 = $\frac{2 + 1 + 7 + 9}{4} = 4.75\%$																								
118.	Margin account has fallen below the maintenance margin and hence we are required to replenish this back to the level of initial margin (50,000). Replenishment needed = 50,000 - 38,000 = 12,000																								
119.	Margin balance has not gone below maintenance margin and hence no replenishment is needed																								
120.	Initial margin = 8% of 10,000 x 100 = 80,000 Profit/loss = 100 x (10,000 - 9,400) = Rs.60,000 Value in margin account post profit = 80,000 + 60,000 = 1,40,000																								
121.	Maximum allowed withdrawal = Margin balance - Initial margin = 70,000 - 50,000 = Rs.20,000 Amount withdrawn = 60% of 20,000 = Rs.12,000																								
122.	Binary option																								
123.	Delta of call option = $\frac{\text{Spread in stock price}}{\text{Spread in IV}} = \frac{100 - 80}{10 - 0} = 0.50$ Times Delta of Put option = Call delta - 1 = 0.50 - 1 = -0.50 Times																								

124.	Call option is exercised when actual market price is higher than exercise price. In the given situation it would be exercised and has intrinsic value of Rs.200. Put option will not be exercised and hence intrinsic value of 0
125.	Value of call option will increase with the increase in value of underlying asset
126.	Premium for call option will reduce with the increase in exercise price (purchase price is going up). This is because increased exercise price would reduce the probability of exercising call option. In the given question, premium reduces with increase in exercise price and hence the same is a call option
127.	Limited risk and unlimited risk
128.	Choose between call and put options
129.	Time value = Option price - Intrinsic value = 45 - 20 = 25
130.	OTM options are those which won't be exercised. Exercise price of call option is Rs.450 whereas CMP is Rs.400. Hence this option won't be exercised currently and so this is an out the money options
131.	Call option will get exercised if actual price is higher than exercise price. Break-even will happen when Gross pay-off is equal to premium and hence GPO should be Rs.10. GPO would be Rs.10 if the actual market price on expiry date is Rs.110
132.	Has an exercise price less than the market price of the asset
133.	Storage costs Explanation: Costs of holding an asset increase its fair futures price. Benefits from holding the asset, such as dividends or convenience yield, decrease its fair futures price.
134.	An increase in Volatility
135.	Losses are theoretically unlimited
136.	Premium paid = 2 + (9 x 2) = Rs.20. Call option will not be exercised and put option will be exercised on maturity date. Gross payoff from put option will be Rs.16 (8 x 2) and hence the investor will have a net loss of Rs.4.00

Chapter 10 – Foreign Exchange Exposure and Risk Management

1. Investment on day 0 = USD 100; Interest earned = USD 10; Value on day 365 = USD 105; USD has depreciated by 5 percent. What is the return in terms of home currency?
 - a. 15%
 - b. 10%
 - c. 20.75%
 - d. 9.25%
2. Spot rate INR/USD = 65.20/80. What will be BID rate for USD/INR?
 - a. 0.015337
 - b. 0.015198
 - c. 0.0125
3. Spot rate is USD 1.5606 - 950/GBP. What will be the Ask rate for USD/GBP?
 - a. 1.9500
 - b. 1.5695
 - c. 1.5950
 - d. 950
4. Spot rate is the rate paid for delivery within _____ business days after the day the transaction takes place
 - a. One
 - b. Two
 - c. Three
 - d. Same
5. USD/GBP rate = 1.5606 - 50; USD/EURO rate = 1.2456 - 600; What will be the bid Euro/GBP rate?
 - a. 1.2386
 - b. 1.9439
 - c. 1.9719
 - d. 0.7959
6. A bank sold HKD 10,00,000 at the rate of Rs.6.5/HKD. He closes the position on the same day when rates are: INR/USD = 62 - 65; HKD/USD = 7.80 - 8; What will be the profit/loss in this transaction?
 - a. Loss of Rs.18,33,333
 - b. Loss of Rs.12,50,000
 - c. Loss of Rs.13,68,020
 - d. None of the above
7. CFO of a company has surplus funds and he can invest the same either in index fund of Japan or USA treasury bills. The maturity amount in INR would remain same for both investments. Where should the investment be done?
 - a. Invest in Japan
 - b. Invest in USA
 - c. Indifferent between investment in Japan and USA
 - d. 50% in Japan and 50% in USA
8. What is the relationship between spread of spot rate and spread of forward rate?
 - a. Spread of forward rate is always higher than spread of spot rate
 - b. Spread of forward rate is always same as spread of spot rate
 - c. Spread of forward rate is always lower than spread of spot rate
 - d. Spread of forward rate may be same/higher/lower than spread of spot rate

9. You have sold 10,00,000 USD at the rate of Rs.65/USD. You plan to cover the same and the rates are as under: JPY/INR = 2.05 - 10; JPY/USD = 130.50 - 132.50; How much is the profit/loss?
- Profit of Rs.13.41 lacs
 - Profit of Rs.28.57 lacs
 - Profit of Rs.19.05 lacs
 - Profit of Rs.3.66 lacs
10. ICL an Indian MNC is executing a plant in Sri Lanka. It has raised Rs. 400 billion. 60% of the amount will be required after six months' time. ICL is looking an opportunity to invest this amount on 1st April,2020 for a period of six months. How much is the investible amount as of now?
- Rs.400 billion
 - Rs.160 billion
 - Rs.240 billion
 - Rs.200 billion
11. Spot INR/USD = 65 - 66; Spot INR/GBP = 80 - 81. Exchange margin is 0.5% for BID rate and 1% for Ask Rate. What will be Bid and Ask rate for USD/GBP?
- 1.2061 - 1.2587
 - 1.2109 - 1.2399
 - 1.2133 - 1.2399
 - 1.2109 - 1.2524
12. Which of the following is not a technique for exchange rate forecasting?
- Technical Forecasting
 - Fundamental Forecasting
 - Market-based Forecasting
 - Scientific Forecasting
13. USD/INR rate = 70.85/73; We plan to buy 1,000 USD. Exchange margin is 0.5%.; How much will be the INR outflow?
- INR 73,365
 - INR 71,084
 - INR 14.07
 - INR 13.63
14. If a country experiences a sudden increase in inflation while its trading partners maintain stable inflation rates, what effect is this likely to have on the country's currency value, according to the Purchasing Power Parity Theory?
- The currency will appreciate.
 - The currency will depreciate.
 - The currency's value will remain unchanged.
 - The theory does not offer any prediction about currency value changes.
15. XYZ an Indian firm, will need to pay JAPANESE YEN (JY) 5, 00,000 on 30th June. Spot JPY/INR is 1.9516/1.9711. The prices for forex currency option on purchase are as follows:
- | | | |
|--------------------|---|----------|
| Strike Price | = | JY 2.125 |
| Call option (June) | = | JY 0.047 |
| Put option (June) | = | JY 0.098 |
- How much is the premium to be paid on hedging the exposure through option route?
- INR 23,059
 - INR 11,815
 - INR 11,699
 - JPY 11,699

16. The spot exchange rate is USD 2 per GBP. USD has appreciated by 10 percent. What will be the forward rate?
- USD 2.2 per GBP
 - USD 1.8 per GBP
 - USD 1.82 per GBP
17. Spot rate is Rs.50/USD. 3-month forward rate is Rs.52/USD. How much is the appreciation/depreciation of INR?
- Appreciation of 4%
 - Appreciation of 16%
 - Depreciation of 3.85%
 - Depreciation of 15.40%
18. Swap points for 1 month is 100/150; Swap points for 3 months is 300/400; How much will be the swap points for 2.5 months?
- 200/275
 - 250/337.50
 - 150/212.50
 - 250/350
19. India Imports co., purchased USD 100,000 worth of machines from a firm in New York, USA. The value of the rupee in terms of the Dollar has been decreasing. The firm in New York offers 2/10, net 90 terms. The spot rate for the USD is Rs. 55; the 90 days forward rate is Rs. 56. How much is time value of money component (discount for prepayment) and protection from currency fluctuation if the company decides to make payment today?
- Rs.1,10,000 and Rs.1,00,000
 - Rs.1,12,000 and Rs.98,000
 - Rs.1,00,000 and Rs.1,10,000
20. Spot rate for INR/USD= 66.50/90. Swap points = 140/120. What will be forward ask rate for INR/USD?
- 65.70
 - 210
 - 91.20
 - 68.10
21. A multinational company based in the United States has entered into a contract to purchase raw materials from a supplier in Japan. The payment is due in Japanese Yen (JPY) three months from now. What type of foreign exchange risk exposure is the company facing?
- Transaction Exposure
 - Translation Exposure
 - Economic Exposure
 - Contingent Exposure
22. Spot rate is Rs.50/USD. 6-month interest rate in India = 12%; 6-month interest rate in USA = 4%. What will be the forward rate after 6 months?
- Rs.46.43/USD
 - Rs.48.11/USD
 - Rs.53.85/USD
 - Rs.51.96/USD

23. On 1st October, 2020 Mr. Guru, an exporter, enters into a forward contract with the Bank to sell USD 1,00,000 on 31st December 2020 at INR/USD 75.40. However, at the request of the importer, Mr. Guru received the amount on 30th November, 2020. Mr. Guru requested the bank take delivery of the remittance on 30th November, 2020 i.e. before due date. The inter-bank rate on 30th November 2020 was as follows:
- Spot INR/USD 75.22-75.27
 - One Month Premium 10/15
- Assume 365 days in a year.
- How much would be the interest charged/paid by the bank for early remittance?
- a. Rs.197 (customer will pay bank)
 - b. Rs.197 (bank will pay customer)
 - c. Rs.275 (Customer will pay bank)
 - d. Rs.275 (Bank will pay customer)
 - e.
24. Foreign Exchange Dealers/Traders use a network of communication to carry out their business transactions called _____
- a. VISA
 - b. SMS
 - c. SWIFT
 - d. MASTER
25. USD return = 6.00%; Appreciation of INR = 5%. How much is the INR return?
- a. 11.00%
 - b. 1.00%
 - c. 11.30%
 - d. 0.95%
26. Spot rate = Rs.60 per GBP. Inflation in India = 10% per annum; Inflation in UK = 3% per half year. What will be the forward rate for 3 months?
- a. Rs.60 per GBP
 - b. Rs.64.08 per GBP
 - c. Rs.60.59 per GBP
 - d. Rs.61.17 per GBP
27. A US-based multinational company owns a subsidiary in the Eurozone. The financial statements of the subsidiary are to be considered for consolidation purposes. What type of foreign exchange risk exposure is the company having?
- a. Transaction Exposure
 - b. Translation Exposure
 - c. Economic Exposure
 - d. Accounting Exposure
28. Government of India has put restrictions on import of Goods from China. This will lead to _____ over long run
- a. Appreciation of INR
 - b. Depreciation of INR
 - c. No impact
29. A Ltd. of U.K. has imported some chemical worth of USD 3,64,897 from one of the U.S. suppliers. The amount is payable in six months time. Currency options are available under which one option contract is for GBP 12,500. The option premium for GBP at a strike price of USD

1.70/GBP is USD 0.037 (call option) and USD 0.096 (put option) for 6 months period. Which type of option should we take for hedging?

- Call option
- Put option

30. T & L Ltd has submitted its bid along with bid bond guarantee of its bank for Green-house gas construction project in Australia with expected cash flows spread over next 3 years. Though its pricing is very competitive, it is not sure of securing it due to other factors. But if secured, it has a huge exchange risk in the invoicing currency viz.: AUD. It can opt for the following derivative product to protect itself.

- Forward contract
- Futures contract
- Option contract
- Swaps

31. Not hedging all foreign exchange exposures is an example of _____

- Low risk reasonable reward strategy
- Low risk low reward strategy
- High risk low reward strategy
- High risk high reward strategy

32. Spot rate is 1.40 USD/GBP. Interest rate in USA = 5% per annum. Interest rate in London = 10% per annum. What will be the forward rate of year 2?

- 1.5273 USD/GBP
- 1.2833 USD/GBP
- 1.2756 USD/GBP
- 1.5365 USD/GBP

33. You have following quotes from Bank A and Bank B:

	Bank A	Bank B
SPOT	CHF/USD 1.4650/55	CHF/USD 1.4653/60
SPOT	USD/GBP 1.7645/60	USD/GBP 1.7640/50

How much minimum CHF amount you have to pay for 1 Million GBP spot?

- CHF 25,88,073
- CHF 25,87,490
- CHF 25,86,608
- CHF 25,88,956

34. INR/USD in bank A = 65.40 - 67.40; INR/USD in bank B = 68.40 - 70.00; How much will be the arbitrage gain if the investor can buy/sell 1,00,000 USD?

- 4,60,000
- 1,00,000
- 3,00,000
- 2,60,000

35. _____ and _____ are two major factors impacting foreign exchange rate

- Export and import
- Investment and Financing
- Demand and Supply
- Interest rate and Inflation rate

36. Spot rate = INR 40/USD; 6-month borrowing rate in India = 10%; 6-month borrowing rate in USA = 4%; Forward rate = INR 41.50/USD; What will be the arbitrage strategy?

- Borrow in India and invest in USA

- b. Borrow in USA and invest in India
 - c. Arbitrage is not possible
37. USD is likely to depreciate by 2.50% against DM (German Currency). Which of the following information is true about interest rates?
- a. Interest rates in USA and Germany is same
 - b. Interest rates in Germany is 2.50% more than that of USA
 - c. Interest rates in Germany is 2.50% lower than that of USA
 - d. We cannot conclude about interest rates based on the given information
38. $\text{INR/USD} = 48.30$; $\text{INR/GBP} = 77.52$; $\text{USD/GBP} = 1.6231$; How much arbitrage gain be made if investor has 1,00,000 USD?
- a. No arbitrage gain
 - b. Gain of 1,129.70
 - c. Gain of 1,054.70
 - d. Gain of 2,154.34
 - e. None of the above
39. SWIFT is a _____
- a. Transaction settlement system
 - b. Standardized communication system
 - c. Transaction execution system
40. An Indian firm is exporting goods to USA. What should be the billing currency if the firm opts for currency invoicing technique to hedge transaction?
- a. INR
 - b. USD
 - c. GBP
 - d. EURO
41. How can expectations affect the exchange rate of a currency?
- a. Speculators can have a substantial impact on exchange rate through speculations.
 - b. The current spot/forward rates are often used to develop forecasts.
 - c. A combination of forecasting techniques is used to develop forecasts.
 - d. Historical data is used to predict future values
42. What is the major disadvantage of currency invoicing technique?
- a. Currency invoicing is costly
 - b. Insistence on currency invoicing can give repeat business
 - c. Insistence on currency invoicing can lead to loss of business
43. Spot exchange rate EUR 0.8006 per USD. Forward discount on EURO is 4 percent per year. What is the expected 6-month forward rate of EUR/USD?
- a. EUR 0.8166 per USD
 - b. EUR 0.8326 per USD
 - c. EUR 0.8169 per USD
 - d. EUR 0.8339 per USD
44. Selective hedging of all foreign exchange exposures is an example of _____
- a. Low risk reasonable reward strategy
 - b. Low risk low reward strategy
 - c. High risk low reward strategy
 - d. High risk high reward strategy

45. Deficit in current account will lead to _____ while negative net inflow in capital account leads to _____
- Appreciation of Home currency and Appreciation of home currency
 - Appreciation of Home currency and Depreciation of home currency
 - Depreciation of Home currency and Appreciation of home currency
 - Depreciation of Home currency and Depreciation of home currency
46. The spot rate for INR/AUD is 29.45 – 29.90 and the three-month forward rate is 29.36 – 29.80. How much is the appreciation/depreciation of INR bid rate?
- Appreciation of 1.23 %
 - Depreciation of 1.22 %
 - Appreciation of 0.31 %
 - Depreciation of 0.31 %
47. XYZ Ltd. is an export-oriented business house based in Mumbai. The Company invoices in customers' currency. Its receipt of US \$ 1,00,000 is due on September 1, 2009. Contract size of currency futures is Rs.4,72,000 and September futures rate is USD0.02118 per INR. On September 1, 2009 the spot rate US\$/Re. is 0.02133 and currency future rate is 0.02134. How much would be the futures profit/loss on maturity date?
- INR 755.20 (Profit)
 - USD 755.20 (Profit)
 - INR 755.20 (Loss)
 - USD 755.20 (Loss)
48. INR is going to depreciate 5 percent against USD. INR is going to depreciate 3 percent against GBP. Counterparty is willing to have the billing either in USD or GBP. What should be the billing currency in case of Indian importer?
- GBP
 - USD
 - INR
49. An importer booked a forward contract with his bank on 10th April for USD 2,00,000 due on 10th June @ Rs. 64.4000. The bank covered its position in the market at Rs.64.2800. On June 10 the customer did not appear when spot rate was INR 63.8000/8200 per USD and the forward rate for next available contract is INR 63.9200/9500 per USD. Interest rate is 12.00% per annum. Compute swap loss and interest payable to bank if the customer appeared on June 13?
- Rs.24,000 and Rs.30
 - Rs.20,000 and Rs.95
 - Rs.30,000 and Rs.95
 - Rs.56,000 and Rs.30
50. The following is the interest rates at which ABC Limited and DEF Limited can borrow in two currencies:

Company	USD	AUD
ABC Limited	5%	12.6%
DEF Limited	7%	13%

ABC Limited wants to borrow in AUD and DEF wants to borrow in USD. A financial institution has offered to arrange for a currency swap with dealers margin of 0.2% and has agreed to bear exchange risk. How much would be the effective borrowing rate of ABC Limited through IRS?

- AUD 12.60%
- AUD 11.90%
- USD 5.00%
- USD 4.30%

51. A company has payable of YEN 10,00,000 after three months. YEN is likely to appreciate by 5% against INR over next three months. The company is thinking whether to pay this money today or after three months. It is having cash deficit and borrowing rate in bank is 10 percent per annum. Should the company make the payment now or wait for three months?
- Make payment today
 - Make payment after three months
 - Indifferent between two choices
52. In case of cash surplus appreciation percentage is to be compared with _____ and in case of cash deficit appreciation percentage is to be compared with _____ for deciding lead/lag?
- Investment rate and Investment rate
 - Borrowing rate and Investment rate
 - Investment rate and borrowing rate
 - Borrowing rate and borrowing rate
53. The company has payable of USD 10,00,000 after three months. USD is expected to depreciate against INR. Should the company lead or lag the payment?
- Lead the payment
 - Lag the payment
54. _____ refers to the process by which receivables and payable dues are set-off against each other
- Currency invoicing
 - Leading and Lagging
 - Netting
55. A _____ is a virtual mode equivalent to physical mode of transfer of cash that authenticates and routes payment details in an extremely secure environment
- Cash transfer
 - Cheque settlement
 - Payment Gateway
56. Combination of two fixed floating currency swaps to fixed to fixed currency swap is called?
- Vanilla swap
 - Circus swap
 - Extendible swap
 - Roller-coaster swaps
57. On January 5, an Indian firm exported goods to an US firm for a consideration of USD 4,00,000 receivable on 15th of February. The spot exchange rate is Rs.44/USD and a March dollar future is trading at Rs.45/USD. You have taken march futures for hedging the receivable. On 15th February if the exchange rate in cash market drops to Rs.39/USD and in the futures markets it is trading at Rs.41/USD. How much is the futures profit/loss?
- Rs.16,00,000 (loss)
 - Rs.16,00,000 (profit)
 - Rs.20,00,000 (loss)
 - Rs.20,00,000 (profit)
58. US entity has cash surplus of USD 200 million. Interest rates are 1.5%/1.7%. How much cash will it have in hand after one month?
- USD 200 million
 - USD 200.25 million

- c. USD 200.2833 million
59. You have sold goods worth 1,00,000 USD and the same was priced at an exchange rate of Rs.70 per USD. Current spot rate is Rs.68 per USD and the bankers have indicated a forward rate of Rs.67 per USD. How much is the profit/loss in operating profit if forward sale is agreed to?
- INR 1,00,000 (Loss)
 - INR 3,00,000 (Loss)
 - INR 1,00,000 (Profit)
 - INR 3,00,000 (Profit)
60. The corporate treasurer of a US multinational receives a fax on 21st February from its European subsidiary. The subsidiary will transfer Euro 10 million to the parent company on 16th August. If the corporate treasurer plans to hedge through futures in the dollar market, will he buy or sell dollar futures?
- Long in USD futures
 - Short in USD futures
61. Indian entity has deficit of Rs.1,000 lacs. Rate of interest in India is 6%/9%. How much will be the Indian entity deficit after 2 months with financing operations?
- INR 1,000 lacs
 - INR 1,010 lacs
 - INR 1,015 lacs
 - INR 1,007.50 lacs
62. Hedging of all foreign exchange exposures is an example of _____
- Low risk reasonable reward strategy
 - Low risk low reward strategy
 - High risk low reward strategy
 - High risk high reward strategy
63. US Subsidiary has payable of USD 2,00,000 and receivable of USD 4,00,000. USD has appreciated in the interim. What would be the impact on US subsidiary?
- Favorable impact
 - Negative impact
 - No impact
64. Spot rate = Rs.40/USD; Forward rate = Rs.45/USD Upfront premium to be paid for hedging = 2%. Tenor of contract = 6 months. Rate of interest = 12% per annum. How much is the effective cover rate for an importer?
- Rs.40.80
 - Rs.45.90
 - Rs.40.848
 - Rs.45.954
 - Rs.45.948
65. Gupta Garments exports goods to US. It can elect to bill either in Dollars or in Euro. Payment terms are 90 days. The 90 dollar swap is 1 - 0.5 and for Euro is 1.5 - 2. Which option is advisable?
- Billing in USD
 - Billing in Euros
 - Indifferent between billing in USD and Euros
66. Forward rate = USD 1.43/GBP; Expected spot rate = USD 1.41/GBP. Should we take a forward cover for dollar receivables?

- a. We should take forward contract
 - b. We should leave it open
 - c. Indifferent
67. An Indian Company buys a 6 month put on 10 lakh USD with a strike price of Rs. 55/\$ and a premium of Re. 2/\$. The opportunity cost of money is 6% p.a. If the forward rate when the option was bought was Rs. 55 under what future spots rates would this have proved better than the option contract?
- a. <Rs.57.06 per USD
 - b. >Rs.57.06 per USD
 - c. <Rs.55.00 per USD
 - d. >Rs.55.00 per USD
68. Cover rate of USD receivable = Rs.45/USD; Actual spot rate on maturity date = Rs.46/USD; Transaction amount = USD 1,00,000.; How much is the profit/loss by taking forward contract?
- a. Loss of 1,00,000
 - b. Profit of 1,00,000
 - c. No profit/loss
69. M/s. Sky products Ltd., of Mumbai, an exporter of sea foods has submitted a 60 days bill for EUR 5,00,000 drawn under an irrevocable Letter of Credit for negotiation. The company has desired to keep 50% of the bill amount under the Exchange Earners Foreign Currency Account (EEFC). Transit period is 20 days. Interest on post shipment credit is 8% per annum. The inflow will be realized at an effective rate of INR 80/USD. How much would be the interest paid by the company? Assume 360 days in a year for computing interest
- a. Rs.3,55,556
 - b. Rs.2,66,667
 - c. Rs.7,11,111
 - d. Rs.5,33,333
70. Cover rate of USD payable = Rs.45/USD; Actual spot rate on maturity date = Rs.46/USD; Transaction amount = USD 1,00,000.; How much is the profit/loss by taking forward contract?
- a. Profit of Rs.1,00,000
 - b. Loss of Rs.1,00,000
 - c. No profit/loss
71. In case of non-deliverable forward contract, _____ is the date at which the difference between the prevailing market exchange rate and the agreed upon exchange rate is calculated
- a. Settlement date
 - b. Target date
 - c. Fixing date
 - d. Entry date
72. A company has imported goods worth 1,00,000 USD. Spot rate is INR 74/USD and forward rate is INR 73.50/USD. Current interest rates in India are higher than USA. What is your advise to the company on taking forward contract?
- a. We should take forward contract
 - b. We should keep the exposure open
 - c. We are indifferent on taking forward cover
73. Citi Bank quotes JPY/ USD 105.00 -106.50 and Honk Kong Bank quotes USD/JPY 0.0090 - 0.0093. How much is the arbitrage gain if you have USD 1,000.
- a. Arbitrage is not possible
 - b. USD 11.67

- c. USD 9.67
 - d. USD 8.00
74. The company has submitted a 60 days bill of USD 5,00,000 to bank. Transit period of shipment is of 20 days. Forward rates available with the bank are of 1,2 and 3 months. What is the relevant exchange rate for clearance of bill?
- a. 1 month forward rate
 - b. 2 month forward rate
 - c. 3 month forward rate
75. Current spot rate is INR 50/USD. 6-month Forward rate is INR 55/USD. The company took a forward contract for 1,00,000 USD payable. Compute the amount of profit/loss if INR depreciated by 4 percent? (Please work with four decimals)
- a. Profit of Rs.3,00,000
 - b. Loss of Rs.3,00,000
 - c. Profit of Rs.2,91,667
 - d. Loss of Rs.2,91,667
76. An Indian company has imported goods from Japan for 36 lacs YEN. The amount is equivalent to INR 10 lacs today. It is anticipated that exchange rate will change by 10 percent over the medium term. Indian company promises to take appropriate action in foreign exchange market in order to protect YEN payments. What is the expected exchange rate after 3 months?
- a. YEN 3.60/INR
 - b. YEN 3.24/INR
 - c. YEN 3.96/INR
77. As per FEDAI Rule 6, a forward contract which remains overdue without any instructions from the customers on or before due date shall stand automatically cancelled within _____ days after the maturity date.
- a. Three calendar
 - b. Three working
 - c. 15 calendar
 - d. 15 working
78. A has imported goods worth 1 lac euros payable on 31st December and entered into forward contract when exchange rate was INR 66-68/EURO. Today is November 30 and the importer wants to honor contract today. Spot rate is INR 65.50-66.50/EURO and one month forward contract is INR 67.50-68/EURO. How much would be the total outflow by the importer?
- a. Rs.69,00,000
 - b. Rs.68,00,000
 - c. Rs.66,50,000
 - d. Rs.67,00,000
79. Bid rate = Rs.10 per USD; Ask Rate = Rs.11 per USD; How much is the spread %?
- a. 10.00%
 - b. 9.09%
 - c. 9.52%
 - d. 8.00%
80. A customer with whom the Bank had entered into 3 months' forward purchase contract for Swiss France 10,000 at the rate of Rs. 27.25 comes to the bank after 2 months and request cancellation of the contract. One-month forward rate on date of cancellation is INR 27.45-27.52 per swiss franc. How much is the cancellation gain/loss?

- a. Loss of Rs.2700
 - b. Profit of Rs.2700
 - c. Loss of Rs.2000
 - d. Profit of Rs.2000
81. An importer booked a forward contract on 10th April with delivery being on 10th June. The customer appears on June 17 and asks for extension of contract to August 10. What will be the date of cancellation of contract?
- a. June 10
 - b. June 17
 - c. June 13
82. In case of early delivery, Interest on outlay of funds is charged for _____
- a. Period of original contract
 - b. Period of early delivery to the original due date
 - c. No of days from the date of original contract to the early delivery date
83. Quotes in _____ are the rates quoted in amount of USD per unit of foreign currency
- a. American Terms
 - b. European Terms
 - c. Non-American Terms
 - d. Non-European Terms
84. Spot rate: Rs.46.00/46.25 per USD; Assume the firm has USD 69,000 in current account earning no interest. ROI on rupee investment is 12% p.a. What should be the forward rate (INR/USD) for the firm to be indifferent between converting 69,000 USD into INR today or wait and convert after two months?
- a. Rs.47.175 per USD
 - b. Rs.46 per USD
 - c. Rs.46.92 per USD
 - d. Rs.47 per USD
85. ABC Limited based out of India has exported goods to USA. It is going to receive 3,50,000 USD in 6 months. It plans to hedge exposure through money market. Interest rates in USA are 6%/8% per annum. Compute the deposit/borrowing in USD?
- a. Loan of USD 3,24,074
 - b. Deposit of USD 3,24,074
 - c. Loan of USD 3,36,539
 - d. Deposit of USD 3,36,539
86. USD has appreciated by 10% against INR. How much is the likely depreciation of INR?
- a. Equal to 10%
 - b. Greater than 10%
 - c. Less than 10%
87. ABC Limited of India has imported goods worth USD 10,00,000 payable in 6 months. Interest rates in USA are 4%/6% per annum. The spot exchange rate is Rs.81.20-60 per USD. How much is the loan to be taken to cover this transaction in MMH?
- a. USD 9,70,874
 - b. INR 7.96 crores
 - c. INR 8.00 Crores
 - d. None of the above

88. ABC Limited (exporter) needs to decide the currency for invoicing. He has choice of home currency (INR) and two foreign currencies (USD and GBP). Seller is not willing to accept INR and ABC Limited may lose business opportunity. USD has a deep forward market with lot of buyers and sellers whereas GBP does not have an active forward market. Which currency should the seller opt for billing?
- INR
 - GBP
 - USD
 - Either of the currencies
89. An Indian Company buys a 6 month call on 10 lakh USD with a strike price of Rs. 50/\$ and a premium of Re. 1/\$. The opportunity cost of money is 12% p.a. At what spot rate on the date of maturity of options contract would the Indian Company gain?
- > Rs.50 per USD
 - < Rs.50 per USD
 - > Rs.51.06 per USD
 - < Rs.51.06 per USD
90. A UK Company owes a German Company 25 lakhs Euros payable in 3 months. The spot rate EURO/GBP is 1.25-1.27. The company can borrow pounds @ 8% and deposit pounds @6%. It can borrow Euro @12% and deposit Euro@10%. How much is the deposit to be created today?
- EUR 25,00,000
 - EUR 24,39,024
 - GBP 19,51,219
 - EUR 24,27,184
91. _____ is referred to as total of purchase and sale commitments of a bank to purchase or sale foreign exchange whether actual delivery has taken place or not
- Cash Position
 - Bank Position
 - Exchange Position
 - Forward Position
92. A Limited of India has sold goods to USA. It wants to hedge the exposure through Money market hedge. It should borrow in _____ and create a deposit in _____ to complete MMH.
- INR and USD
 - INR and INR
 - USD and INR
 - USD and USD
93. A company has a payable exposure of EUR 25,00,000. The final amount paid under MMH is GBP 20,00,000. The forward contract today is EUR 1.20 - 1.22 per GBP. What should the company do for hedging?
- Go ahead with MMH
 - Go ahead with forward contract
 - Indifferent between MMH and FC
 - Do not hedge the exposure
94. A company can make a profit of Rs.10,00,000 if exports and import settlement is done as per spot rates. However, the same would decline to Rs.4,00,000 if they are realized and paid as per the due date. How much is the transaction exposure?
- 10,00,000
 - 14,00,000

- c. 6,00,000
d. 4,00,000
95. Exporter has availed short-term foreign currency loans. This is an example of which hedging strategy?
- Currency Invoicing
 - Netting
 - Leading and lagging
 - Natural hedge strategy
96. A bank has an overbought position of USD 1,00,000 and cash balance of USD 25,000. It wants a cash balance of USD 40,000. What action should be taken?
- Buy USD 15,000 in spot market
 - Sell USD 15,000 in spot market
 - Buy USD 15,000 in forward market
 - Sell USD 15,000 in forward market
97. A bank has an overbought position of USD 1,00,000 and cash balance of USD 25,000. It wants a cash balance of USD 80,000 and overbought position of USD 1,50,000. What action should be taken?
- Spot purchase of USD 55,000 and forward sell of USD 5,000
 - Spot purchase of USD 55,000 and forward purchase of USD 50,000
 - Forward purchase of USD 50,000
 - Spot purchase of USD 55,000 and forward purchase of USD 5,000
98. Cancellation of DD issued is recorded as _____
- Purchase in exchange position
 - Sale in exchange position
 - Outflow in cash position
 - Inflow in cash position
99. Spot rate (€ per £) = 1.998 ± 0.002 ; Forward rate (€ per £) = 1.979 ± 0.004 . You need to pay EUR 2,50,000 in six months. How much would be the GBP outflow if you take forward contract?
- GBP 1,26,326
 - GBP 1,26,839
 - GBP 1,26,072
 - GBP 1,26,582
100. Nostro account would mean _____
- Our account with you
 - Your account with us
101. What type of foreign exchange risk exposure measures the impact on company's competitive position?
- Transaction exposure
 - Translation exposure
 - Economic exposure
102. Spot sale of foreign currency is recorded as _____
- Sale in Exchange position and inflow in cash position
 - Sale in Exchange position and outflow in cash position
 - Purchase in Exchange position and outflow in cash position
 - Purchase in Exchange position and inflow in cash position

103. How is forward purchase recorded in cash position?

- Inflow
- Outflow
- Not recorded

104. Quote 1: EUR 1.24-1.40 per GBP; Quote 2: INR 75.25-35 per GBP. How many GBP can be purchased with INR 1,20,000?

- 1,977.41
- 1,974.78
- 2,232.56
- 2,229.60

105. Purchase of bill is recorded as _____

- Purchase in Exchange position
- Sale in exchange position
- Inflow in cash position
- Outflow in cash position

Answer:

1.	$\text{USD Return} = \frac{105 - 100 + 10}{100} \times 100 = 15.00\%$ USD has depreciated by 5 percent $(1 + \text{HCR}) = (1 + \text{FCR}) \times (1 - \text{Depreciation percentage});$ $(1 + \text{HCR}) = (1 + 15\%) \times (1 - 5\%);$ $(1 + \text{HCR}) = 1.15 \times 0.95;$ $(1 + \text{HCR}) = 1.0925$ Home currency return = 9.25%
2.	$\text{BID} \left(\frac{\text{USD}}{\text{INR}} \right) = \frac{1}{\text{ASK} \left(\frac{\text{INR}}{\text{USD}} \right)}$ $\text{BID} \left(\frac{\text{USD}}{\text{INR}} \right) = \frac{1}{65.80} = 0.015198$
3.	950 will be the last three digits of PIPS portion of the ask rate. Hence Ask rate will be 1.5950.
4.	Two
5.	$\left(\frac{\text{EURO}}{\text{GBP}} \right) = \left(\frac{\text{EURO}}{\text{USD}} \right) \times \left(\frac{\text{USD}}{\text{GBP}} \right)$ $\text{BID} \left(\frac{\text{EURO}}{\text{GBP}} \right) = \text{BID} \left(\frac{\text{EURO}}{\text{USD}} \right) \times \text{BID} \left(\frac{\text{USD}}{\text{GBP}} \right)$ $\text{BID} \left(\frac{\text{EURO}}{\text{GBP}} \right) = \left(\frac{1}{1.2600} \right) \times (1.5606)$ $\text{BID} \left(\frac{\text{EURO}}{\text{GBP}} \right) = 1.2386$
6.	KC = 10,00,000 HKD; UKC = ? INR $\text{INR} = \text{HKD} \times \left(\frac{\text{INR}}{\text{HKD}} \right)$ $\text{INR} = \text{HKD} \times \text{ASK} \left(\frac{\text{INR}}{\text{HKD}} \right)$ $\text{INR} = \text{HKD} \times \text{ASK} \left(\frac{\text{INR}}{\text{USD}} \right) \times \text{ASK} \left(\frac{\text{USD}}{\text{HKD}} \right)$ $\text{INR} = 10,00,000 \times 65 \times \left(\frac{1}{7.80} \right)$ $\text{INR} = 83,33,333$ Profit = Sales proceeds - purchase cost = 65,00,000 - 83,33,333 = Loss of 18,33,333
7.	Return is same for both options. However, from risk perspective, the investment in fixed income desk of US is more beneficial as the chance of variation in fixed income securities is less as compared to Equity Desk. Hence investment should be done in USA.
8.	Spread of forward rate is always higher than spread of spot rate. This is because spot market always has the lowest bid- ask spread and the spread will steadily widen as the duration

	lengthens. This is because the uncertainty and the liquidity concerns increase as we go forward in time																		
9.	Known component = 10,00,000 USD; Unknown component = ? INR $\text{INR} = \text{USD} \times \left(\frac{\text{INR}}{\text{USD}} \right)$ We are going to buy USD and banker would sell it. Banker will sell the same at Ask rate $\text{INR} = \text{USD} \times \text{ASK} \left(\frac{\text{INR}}{\text{JPY}} \right) \times \text{ASK} \left(\frac{\text{JPY}}{\text{USD}} \right);$ $\text{INR} = 10 \text{ lacs} \times \left(\frac{1}{2.05} \right) \times 132.50 = \text{INR } 646.34 \text{ lacs}$ Sell proceeds = 10 lacs x 65 = 650 lacs Profit = 650 lacs - 646.34 lacs = 3.66 lacs																		
10.	Amount that can be invested today is the money which is not needed now. Hence 60% of Rs.400 billion can be invested today.																		
11.	$\text{BID} \left(\frac{\text{USD}}{\text{GBP}} \right) = \text{BID} \left(\frac{\text{USD}}{\text{INR}} \right) \times \text{BID} \left(\frac{\text{INR}}{\text{GBP}} \right) = \left(\frac{1}{66} \right) \times 80 = 1.2121$ Exchange margin needs to be deducted and 0.5% is 0.0061 and revised bid rate will be 1.2061 $\text{ASK} \left(\frac{\text{USD}}{\text{GBP}} \right) = \left(\frac{1}{65} \right) \times 81 = 1.2462$ Exchange margin needs to be added and 1% is 0.0125. Revised ask rate will be 1.2587																		
12.	Scientific Forecasting																		
13.	The given rate has been interpreted as INR/USD based on current exchange rates $\text{INR outflow} = \text{USD} \times \left(\frac{\text{INR}}{\text{USD}} \right)$ $\text{INR Outflow} = \text{USD} \times \text{Ask} \left(\frac{\text{INR}}{\text{USD}} \right)$ Ask rate given in question is 73.00. We cannot take 73 as pips as the same will make the ask rate lower than bid rate. That scenario is not possible and hence given 73 is taken as outright forward rate - Relevant ask rate = 73 + 0.5% = INR 73.365/USD - Total outflow = 1,000 x 73.365 = INR 73,365																		
14.	The currency will depreciate																		
15.	- Amount of exposure = JPY 5,00,000 (or) Rs.2,35,294 (5,00,000/2.125) - Relevant strike price = JPY 2.125/INR. Product currency is INR and this is a contract to buy/sell INR. The company has to sell INR and hence we should go for put option - Premium amount = INR 2,35,294 x JPY 0.098 = JPY 23,059 Premium in INR = 23,059/1.9516 = INR 11,815																		
16.	Any appreciation or depreciation can be added or subtracted to the product. Current quote is USD 2 per GBP. The quote will be converted as GBP 0.5 per USD. Appreciation of 10 percent will make it GBP 0.55 per USD. This quote will be converted back and it will become USD 1.82 per GBP																		
17.	INR is the price in this question and hence the formula is $\frac{\text{SR} - \text{FR}}{\text{FR}} \times \left(\frac{12}{m} \right) \times 100$ $\text{INR change} = \frac{50 - 52}{52} \times \left(\frac{12}{3} \right) \times 100 = -15.40\%$ We are getting negative answer and hence INR has depreciated by 15.40%																		
18.	<table><tr><th>Particulars</th><th>Bid rate</th><th>Ask rate</th></tr><tr><td>Swap points for 1 month</td><td>100</td><td>150</td></tr><tr><td>Swap points for 3 months</td><td>300</td><td>400</td></tr><tr><td>Differential points for 2 months</td><td>200</td><td>250</td></tr><tr><td>Proportionate points for 1.5 months</td><td>150 [200 x 1.5/2]</td><td>187.50 [250 x 1.5/2]</td></tr><tr><td>Swap points for 2.5 months [1 month + Proportionate of 1.5 month]</td><td>250</td><td>337.50</td></tr></table>	Particulars	Bid rate	Ask rate	Swap points for 1 month	100	150	Swap points for 3 months	300	400	Differential points for 2 months	200	250	Proportionate points for 1.5 months	150 [200 x 1.5/2]	187.50 [250 x 1.5/2]	Swap points for 2.5 months [1 month + Proportionate of 1.5 month]	250	337.50
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19.	2/10 net 90 would mean that the company will get 2 percent discount if the payment is done in 10 days. Hence the company will be making a payment of only 98,000 USD - Rupee cost of paying the account within 10 days = 98,000 USD x Rs.55 = Rs.53,90,000 - Rupee cost of paying in 90 days = 1,00,000 USD x 56 = Rs.56,00,000																		

	- Saving in payment if early payment is made = 56,00,000 – 53,90,000 = Rs.2,10,000 - Time value of money component = [1,00,000 – 98,000] x Rs.56.00 = Rs.1,12,000 - Currency value fluctuation component = 98,000 x [56 – 55] = Rs.98,000												
20.	Spot Ask rate = 66.90. Swap points are in descending order and same needs to be deducted. Swap points are 1.40/1.20. Forward ask rate = 66.90 - 1.20 = 65.70												
21.	Transaction Exposure												
22.	Spot rate = Rs.50/USD; Risk free rate in home country = 12% per annum (or) 6% per half year; Risk free rate in foreign country = 4% per annum (or) 2% per half year Forward rate = $50 \times \frac{1.06}{1.02} = \text{Rs. } 51.96$												
23.	Computation of interest: <table border="1"> <thead> <tr> <th>Particulars</th><th>Amount</th></tr> </thead> <tbody> <tr> <td>Nov 30 – Bank will buy from customer</td><td>-75.40</td></tr> <tr> <td>Nov 30 – Bank will sell at spot rate to some other Bank</td><td>75.22</td></tr> <tr> <td>Outflow for banker</td><td>0.18</td></tr> <tr> <td>Total outflow for banker (1,00,000 x 0.18)</td><td>18,000</td></tr> <tr> <td>Interest cost to be recovered (18,000 x 18% x 31/365)</td><td>275</td></tr> </tbody> </table> Hence customer will pay Rs.275 to Bank	Particulars	Amount	Nov 30 – Bank will buy from customer	-75.40	Nov 30 – Bank will sell at spot rate to some other Bank	75.22	Outflow for banker	0.18	Total outflow for banker (1,00,000 x 0.18)	18,000	Interest cost to be recovered (18,000 x 18% x 31/365)	275
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24.	SWIFT												
25.	$(1 + \text{USD return}) = (1 + \text{INR return}) \times (1 + \text{INR Appreciation \%})$ $(1 + 0.06) = (1 + \text{INR return}) \times (1 + 0.05); (1 + \text{INR return}) = \frac{1.06}{1.05}; \text{INR return} = 0.95\%$												
26.	Spot rate = Rs.60 per GBP; Inflation for 3 months in India = 2.5%; Inflation in UK for 3 months = 1.5% Forward rate = $60 \times \frac{1.025}{1.015} = \text{Rs. } 60.59 \text{ per GBP}$												
27.	Translation exposure												
28.	Appreciation of INR as demand for foreign currency will reduce due to lower imports												
29.	The strike price of option is USD 1.70/GBP. Product currency is GBP and hence we can buy/sell GBP with option contract. The company needs to buy USD. This can also be considered as selling GBP. The company plans to sell GBP and hence we should opt for Put option												
30.	Option contract Explanation: In case if contract is not secured even then will not be bound by the contract in AUD												
31.	High risk low reward strategy												
32.	Spot rate = 1.40 USD per GBP; Rh (USA rate) = 5% per annum; Rf (UK rate) = 10% per annum Forward rate = $\frac{1.40 \times 1.05 \times 1.05}{(1.10 \times 1.10)} = 1.2756 \text{ USD/GBP}$												
33.	$\text{CHF} = \text{GBP} \times \text{ASK} \left(\frac{\text{CHF}}{\text{GBP}} \right)$ $\text{CHF} = \text{GBP} \times \text{ASK} \left(\frac{\text{CHF}}{\text{USD}} \times \frac{\text{USD}}{\text{GBP}} \right)$ $\text{CHF} = 10,00,000 \times (1.4655 \times 1.7650)$ CHF outflow = CHF 25,86,608 Note: - Since there are two banks, the customer can choose either of the two banks. The customer should choose a bank which leads to lower outflow and higher inflow - For CHF/USD we are using Bank A as it has lower ASK rate and for USD/GBP we are using Bank B as it has lower ASK rate												
34.	Investor can buy 1,00,000 at lower ask rate of 67.40 from Bank A. Investor can sell 1,00,000 USD to Bank B at higher bid rate of 68.40. Investor will make gain of Rs.1,00,000 (68,40,000 - 67,40,000)												
35.	Interest rate and Inflation rate												
36.	Spot rate = Rs.40/USD; Actual Rh(India) = 10% per annum or 5% per half year; Actual Rf(USA) = 4% per annum or 2% per half year Fair Rh calculation $\frac{1 + \text{Rh}}{1 + 2\%} = \frac{41.50}{40}; (1 + \text{rh}) = 1.05825; \text{Rh} = 5.83\%$												

	Fair Rh in India is higher than actual Rh and hence we should borrow in India and invest in USA																																													
37.	USD currency has depreciated and this would mean interest rates in USA is more than that of Germany. Hence, we can conclude that interest rates in Germany is 2.50% lower than that of USA																																													
38.	1,00,000 USD can be converted into INR and the same will be Rs.48,30,000. Rs.48,30,000 will be converted into GBP and the same will be GBP 62,306.50. GBP 62,306.50 will be converted into USD and the same will be USD 1,01,129.70. Arbitrage gain = 1,01,129.70 - 1,00,000 = 1,129.70 USD																																													
39.	Standardized communication system																																													
40.	Indian firm should opt for home currency invoicing to hedge transaction. Hence export should be billed in INR																																													
41.	Speculators can have a substantial impact on exchange rate through speculations Explanation: A lot of speculation activities results in unanticipated demand and supply of foreign currencies																																													
42.	Insistence on currency invoicing can lead to loss of business																																													
43.	Spot exchange rate = 0.8006 EURO per USD; Forward discount on EURO is 4% per year and the same would be 2% for 6 months. Forward discount/premium can be applied only to the product only to get the forward rate. In the above quote USD is the product and hence we should convert this into the other quote; 0.8006 EURO per USD = 1.2491 USD/EURO Forward rate = 1.2491 - 2% = 1.2241 USD/EURO (or) 0.8169 EURO/USD																																													
44.	Low risk reasonable reward strategy																																													
45.	Depreciation of Home currency and Depreciation of home currency																																													
46.	INR is the product currency in the quote <table><tr><td>Premium or discount %</td><td>$\frac{\text{Spot rate} - \text{Forward rate}}{\text{Forward rate}} \times \frac{12}{m} \times 100$</td><td></td></tr><tr><td>Using BID Rate</td><td>$\frac{29.45 - 29.36}{29.36} \times \frac{12}{3} \times 100$</td><td>1.23% (appreciation)</td></tr></table>	Premium or discount %	$\frac{\text{Spot rate} - \text{Forward rate}}{\text{Forward rate}} \times \frac{12}{m} \times 100$		Using BID Rate	$\frac{29.45 - 29.36}{29.36} \times \frac{12}{3} \times 100$	1.23% (appreciation)																																							
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47.	Number of contracts: <table><tr><th>Particulars</th><th>Amount</th></tr><tr><td>Amount of exposure</td><td>USD 1,00,000</td></tr><tr><td>Amount of exposure in INR (1,00,000/0.02118)</td><td>INR 47,21,435</td></tr><tr><td>Size of one contract</td><td>INR 4,72,000</td></tr><tr><td>No of contracts</td><td>10</td></tr></table> Futures settlement: <table><tr><th>Date</th><th>Position</th><th>Action</th><th>Reference Date</th><th>Rate</th></tr><tr><td>June 1</td><td>Original Position</td><td>Buy</td><td>Sep 01</td><td>(USD 0.02118/INR)</td></tr><tr><td>Sep 1</td><td>Opposite Position</td><td>Sell</td><td>Sep 01</td><td>USD 0.02134/INR</td></tr><tr><td colspan="4">Profit per INR</td><td>USD 0.00016/INR</td></tr><tr><td colspan="4">Total Profit (0.00016 x 10 x 4,72,000)</td><td>USD 755.20</td></tr></table>	Particulars	Amount	Amount of exposure	USD 1,00,000	Amount of exposure in INR (1,00,000/0.02118)	INR 47,21,435	Size of one contract	INR 4,72,000	No of contracts	10	Date	Position	Action	Reference Date	Rate	June 1	Original Position	Buy	Sep 01	(USD 0.02118/INR)	Sep 1	Opposite Position	Sell	Sep 01	USD 0.02134/INR	Profit per INR				USD 0.00016/INR	Total Profit (0.00016 x 10 x 4,72,000)				USD 755.20										
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48.	Import of goods will lead to foreign currency liability. We should go for billing in depreciating currency. Hence INR is preferable. However, counterparty will prefer either in USD or GBP. We should therefore accept a currency which will have lower appreciation and hence we should prefer GBP																																													
49.	Swap loss: <table><tr><th>Date</th><th>Position</th><th>Action</th><th>Reference Date</th><th>Rate</th></tr><tr><td>Apr 10</td><td>Original Position</td><td>Buy (ASK)</td><td>June 10</td><td>-64.28</td></tr><tr><td>June 10</td><td>Opposite Position</td><td>Sell (BID)</td><td>June 10</td><td>63.80</td></tr><tr><td>June 10</td><td>New Position</td><td>Buy (ASK)</td><td>Next contract</td><td>-63.95</td></tr><tr><td colspan="3">Effective rate</td><td>-64.28+63.80-63.95</td><td>-64.43</td></tr><tr><td colspan="3">Loss on cancellation per USD</td><td>-64.28+63.80</td><td>-0.48</td></tr><tr><td colspan="3">Total loss on cancellation</td><td>-0.48 x 2,00,000</td><td>-96,000</td></tr><tr><td colspan="3">Effective loss per USD</td><td>-64.43 - (-64.28)</td><td>-0.15</td></tr><tr><td colspan="3">Total effective loss</td><td>-0.15 x 2,00,000</td><td>-30,000</td></tr></table>	Date	Position	Action	Reference Date	Rate	Apr 10	Original Position	Buy (ASK)	June 10	-64.28	June 10	Opposite Position	Sell (BID)	June 10	63.80	June 10	New Position	Buy (ASK)	Next contract	-63.95	Effective rate			-64.28+63.80-63.95	-64.43	Loss on cancellation per USD			-64.28+63.80	-0.48	Total loss on cancellation			-0.48 x 2,00,000	-96,000	Effective loss per USD			-64.43 - (-64.28)	-0.15	Total effective loss			-0.15 x 2,00,000	-30,000
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	- Swap loss = Rs.30,000 - Interest amount = Cancellation loss x 12% x 3/365 = 96,000 x 12% x 3/365 = Rs.95																									
50.	WN 1: Structure of interest rates: <table><tr><th>Particulars</th><th>USD</th><th>AUD</th></tr><tr><td>ABC Limited</td><td>5%</td><td>12.6%</td></tr><tr><td>DEF Limited</td><td>7%</td><td>13%</td></tr></table> - Total interest rate of combination 1 [ABC Limited (USD) & DEF Limited (AUD)] = 5% + 13% = 18% - Total interest rate of combination 2 [ABC Limited (AUD) & DEF Limited (USD)] = 12.6% + 7% = 19.6% Ideal combination: Combination 1 - ABC Limited should borrow in USD and DEF Limited should borrow in AUD Actual scenario: Combination 2 - ABC Limited wants to borrow in AUD and DEF Limited wants to borrow in USD - Scope for Currency cum interest rate swap exist as the actual scenario does not match with ideal scenario Amount of swap gain = 19.6% - 18% = 1.6% Share of swap gain: - Dealer's margin (Share) = 0.2% - ABC Limited's share = 0.7% - DEF Limited's share = 0.7% - Effective borrowing rate of ABC Limited = Original rate - share of swap gain = 12.60% - 0.70% = 11.90%	Particulars	USD	AUD	ABC Limited	5%	12.6%	DEF Limited	7%	13%																
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51.	Yen (liability) will appreciate by 5 percent over three months. The same would correspond to 20 percent for a year. Interest rate for borrowing is 10 percent per annum. Hence it is beneficial to borrow money at 10 percent and pay liability today. Else liability will appreciate by 20 percent leading to higher INR outflow.																									
52.	Investment rate and borrowing rate																									
53.	The company should make the payment after three months as the liability (USD) is expected to depreciate over the next three months																									
54.	Netting																									
55.	Payment Gateway																									
56.	Circus swap which stands for Combined Interest Rate and Currency Swap																									
57.	<table><tr><th>Date</th><th>Position</th><th>Action</th><th>Reference Date</th><th>Rate</th></tr><tr><td>Jan 5</td><td>Original Position</td><td>Sell</td><td>March 31</td><td>Rs.45/USD</td></tr><tr><td>Feb 15</td><td>Opposite Position</td><td>Buy</td><td>March 31</td><td>(Rs.41/USD)</td></tr><tr><td colspan="4">Profit per USD</td><td>Rs.4/USD</td></tr><tr><td colspan="4">Profit for USD 4,00,000 [4,00,000 x 4]</td><td>Rs.16,00,000</td></tr></table>	Date	Position	Action	Reference Date	Rate	Jan 5	Original Position	Sell	March 31	Rs.45/USD	Feb 15	Opposite Position	Buy	March 31	(Rs.41/USD)	Profit per USD				Rs.4/USD	Profit for USD 4,00,000 [4,00,000 x 4]				Rs.16,00,000
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58.	Entity has cash surplus and hence investment will be done. The same would be done at lower rate of 1.5% Interest earned = 200 million x 1.5% x $\frac{1}{12}$ = 0.25 million Surplus after one month = USD 200 million + USD 0.25 million = USD 200.25 million																									
59.	Loss/gain in operating profit is computed by comparing the billed rate with realization rate. Billed rate is Rs.70 per USD and the realization rate will be Rs.67 per USD if the forward sale is agreed to. Hence overall impact in operating profit = 1,00,000 x (70 - 67) = Rs.3,00,000 (loss)																									
60.	The company plans to sell EUROS and hence it would be buying USD. Hence, we should go long (buy) USD futures for hedging.																									
61.	There is a deficit and hence the amount is to be borrowed. Borrowing will happen at 9% Interest expense for two months = 1000 lacs x 9% x $\left(\frac{2}{12}\right)$ = Rs. 15 lacs Balance at end of month 2 = 1,000 lacs + 15 lacs = 1,015 lacs																									
62.	Low risk low reward strategy																									
63.	US Entity has net receivable of USD 2,00,000. This is their home currency. Hence any appreciation/depreciation of home currency will not impact them as their final realization will continue to be USD 2,00,000. In this scenario only the counterparty (its customers) will be impacted																									

64.	Cover rate = Forward rate + Premium + Interest on premium Cover rate = $45 + 0.90 + \left[0.90 \times 12\% \times \frac{6}{12}\right] = 45.90 + 0.054 = \text{Rs. } 45.954/\text{USD}$																		
65.	Gupta Garments should choose a currency which is expected to appreciate (assets should appreciate). The 90-day dollar swap is in descending order and hence dollar is expected to depreciate. Similarly, 90-day euro swap is in ascending order and hence Euro is expected to appreciate. The company should opt for billing in Euros (appreciating currency)																		
66.	Let us assume that we have receivable of 100 USD GBP realization if we cover through Forward Contract = $\frac{100}{1.43} = \text{GBP } 69.93$ GBP Realization if we keep it open = $\frac{100}{1.41} = \text{GBP } 70.92$ We have higher realization if the exposure is open and hence we should keep the exposure open																		
67.	Premium of put option = $\text{Rs. } 2.00 + (2 \times 6\% \times 6/12) = \text{Rs. } 2.06$; Minimum inflow under option contract = $\text{Rs. } 55.00 - 2.06 = \text{Rs. } 52.94$ per USD. Under option contract the minimum selling price will be $\text{Rs. } 52.94/\text{USD}$. However, if the future spot rate is higher than Rs.55/USD, then inflow will be Spot rate - 2.06. Under forward option, the company will receive $\text{Rs. } 55/\text{USD}$ irrespective of future spot rates. Hence option contract can be beneficial if the inflow under option contract is higher than $\text{Rs. } 55/\text{USD}$. Inflow will be $\text{Rs. } 55/\text{USD}$ if spot rate is $\text{Rs. } 57.06/\text{USD}$ ($57.06 - 2.06 = 55$). Hence option contract will be beneficial if future spot rates are higher than Rs.57.06/USD																		
68.	- Realization if FC was not taken = $1,00,000 \times 46 = \text{Rs. } 46,00,000$ - Realization by taking FC = $1,00,000 \times 45 = \text{Rs. } 45,00,000$ - Loss of $\text{Rs. } 1,00,000$ due to forward contract as the net realization is on lower side																		
69.	The company would have taken post-shipment credit at 8% for a period of 80 days as the realization will happen after 80 days (60 days credit + 20 days transit). Company plans to keep 50% funds in EEFC account and hence balance 50% it will convert in INR and repay the loan. Hence loan taken by the company will be equal to the planned realization in INR. Loan taken = $2,50,000 \times 80 = \text{Rs. } 2,00,00,000$ Interest to be paid = $2,00,00,000 \times 8\% \times \frac{80}{360} = \text{Rs. } 3,55,556$																		
70.	- INR outflow under FC = $45,00,000$ - INR outflow if cover was not taken = $46,00,000$ - Net saving/profit by taking FC = $1,00,000$																		
71.	Fixing date Note: Settlement date is the date on which the profit/loss would be paid whereas profit/loss is computed on the basis of the rate prevailing on fixing date. Both dates can be same day as well																		
72.	Interest rates in India are higher than USA and hence INR will depreciate and USD will appreciate. So as per IRPT we expected USD liability to appreciate. However, the current exchange rates are indicating USD depreciation and hence we should go ahead and take forward cover. Outflow under forward contract = $\text{Rs. } 73,50,000$. Expected outflow if exposure is kept open = $>74,00,000$ (as USD will appreciate)																		
73.	Quote in Citi bank = $\text{JPY } 105.00 - 106.50$ per USD Quote in Hong Kong Bank: <table border="1"><tr><td>BID $\left(\frac{\text{JPY}}{\text{USD}}\right)$</td><td>$= \frac{1}{0.0093}$</td><td>$\text{JPY } 107.53/\text{USD}$</td></tr><tr><td>BID $\left(\frac{\text{USD}}{\text{JPY}}\right)$</td><td>$= \frac{1}{0.0090}$</td><td>$\text{JPY } 111.11/\text{USD}$</td></tr></table> Arbitrage opportunity can arise if we sell USD at higher bid rate of $\text{JPY } 107.53/\text{USD}$ and buy USD at lower ask rate of $\text{JPY } 106.50$ per USD <table border="1"><thead><tr><th>Particulars</th><th>Calculation</th><th>Amount</th></tr></thead><tbody><tr><td>Sell 1,000 USD in Hong Kong Market</td><td>$1,000 \times 107.53$</td><td>$\text{JPY } 1,07,530$</td></tr><tr><td>Sell $\text{JPY } 1,07,530$ in Citi Bank</td><td>$\frac{1,07,530}{106.50}$</td><td>$\text{USD } 1,009.67$</td></tr><tr><td>Arbitrage gain</td><td>$1,009.67 - 1,000$</td><td>$\text{USD } 9.67$</td></tr></tbody></table>	BID $\left(\frac{\text{JPY}}{\text{USD}}\right)$	$= \frac{1}{0.0093}$	$\text{JPY } 107.53/\text{USD}$	BID $\left(\frac{\text{USD}}{\text{JPY}}\right)$	$= \frac{1}{0.0090}$	$\text{JPY } 111.11/\text{USD}$	Particulars	Calculation	Amount	Sell 1,000 USD in Hong Kong Market	$1,000 \times 107.53$	$\text{JPY } 1,07,530$	Sell $\text{JPY } 1,07,530$ in Citi Bank	$\frac{1,07,530}{106.50}$	$\text{USD } 1,009.67$	Arbitrage gain	$1,009.67 - 1,000$	$\text{USD } 9.67$
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74.	The money will be realized in 80 days (60 days bill + 20 days transit period). It will have to be rounded off to the lower of months (2.67 months) and hence 2 months forward rate is to be taken																	
75.	- Outflow under forward contract = 1,00,000 x 55 = Rs.55,00,000 - Outflow if forward contract was not taken: - Spot rate = INR 50/USD (or) USD 0.02 per INR - INR depreciation = 4%; Actual spot rate = 0.02 - 4% = USD 0.0192/INR (or) INR 52.0833/USD - Outflow if forward contract was not taken = 1,00,000 x 52.0833 = Rs.52,08,333 - We have paid more by taking forward contract and hence there is a loss. Amount of loss = 55,00,000 - 52,08,333 = Rs.2,91,667																	
76.	Current spot rate = $\frac{\text{YEN 108 lacs}}{\text{INR 30 lacs}} = \text{YEN 3.60/INR}$ Exchange rate will change by 10 percent and an Indian importer would be worried about depreciation of INR. Hence exchange rate change of 10 percent will be interpreted as depreciation of INR. New exchange rate = YEN 3.60/INR - 10% = YEN 3.24/INR																	
77.	Three working																	
78.	- Contract will get honored at spot ASK rate of November 30. Outflow towards honor of contract = 1,00,000 x 66.50 = Rs.66,50,000 - Cancellation gain/loss: Original contract was taken at ASK rate of Rs.68 and opposite cancellation rate is 67.50. Net loss on cancellation = 0.50/USD (or) Rs.50,000 - Total outflow = 66,50,000 + 50,000 = Rs.67,00,000																	
79.	Spread % = $\frac{\text{Ask rate} - \text{Bid rate}}{\text{Ask rate}} \times 100 = \frac{11 - 10}{11} \times 100 = 9.09\%$																	
80.	Original contracted rate = INR 27.25/Swiss franc. The bank has entered into forward purchase and hence the customer has entered into sale contract. Hence contract will get cancelled at opposite Ask rate of Rs.27.52/Swiss franc. Loss on cancellation = INR 0.27/Swiss franc (or) Rs.2,700																	
81.	Due date of forward contract = June 10; Grace period of honoring the contract = 3 days; Date of cancellation of contract = Date on which customer appears or 3 days whichever is earlier and hence contract will get cancelled on June 13																	
82.	Period of early delivery to the original due date																	
83.	American Terms																	
84.	<table><tr><th>Particulars</th><th>Redeem today</th><th>Redeem after 2 months</th></tr><tr><td>INR receipt today on conversion</td><td>31,74,000 (69,000 x 46)</td><td>-</td></tr><tr><td>Interest income for 2 months</td><td>63,480 (31,74,000 x 12% x 2/12)</td><td>-</td></tr><tr><td>INR receipt on conversion in M2</td><td>-</td><td>32,37,480 (69,000 x 46.92)</td></tr><tr><td>Total inflow in INR</td><td>32,37,480</td><td>32,37,480</td></tr></table> Hence the indifferent forward rate is Rs.46.92 per USD as the same would lead to same inflow in INR whether we convert today or wait and convert after two months.			Particulars	Redeem today	Redeem after 2 months	INR receipt today on conversion	31,74,000 (69,000 x 46)	-	Interest income for 2 months	63,480 (31,74,000 x 12% x 2/12)	-	INR receipt on conversion in M2	-	32,37,480 (69,000 x 46.92)	Total inflow in INR	32,37,480	32,37,480
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85.	We have foreign currency asset (receivable) and hence we need to create a matching liability. We will take a loan in USD. Proportionate borrowing rate for 6 months is 4% Loan to be taken = $\frac{3,50,000}{1 + 4\%} = \text{USD } 3,36,539$																	
86.	Less than 10% Example: Spot rate = USD 0.20 per INR Forward rate = USD 0.22 per INR Depreciation of INR = $\frac{0.20 - 0.22}{0.22} \times 100 = -9.09\%$																	
87.	We have USD liability and hence we need to create matching USD asset Amount of USD deposit to be created = $\frac{10,00,000}{1 + 2\%} = \text{USD } 9,80,392$ INR needed to purchase 9,80,392 USD = 9,80,392 x 81.60 = INR 8.00 Crores																	

88.	USD Explanation: Seller cannot choose INR as he would lose the business opportunity. He should therefore choose a currency which has deep forward market. Hence billing should be in USD.
89.	Maximum outflow under option contract = $50 + (50 \times 2\%) + (1 \times 12\% \times 6/12) = \text{Rs.}51.06/\text{USD}$ Any spot rates above Rs.51.06/USD, the outflow under option contract will be lower than that of spot contract. Hence option contract is beneficial above Rs.51.06/USD while comparing option and spot alternative
90.	We have a foreign currency liability of EUR 25,00,000 and we should create a matching deposit that will mature to EUR 25,00,000 Amount of deposit to be created = $\frac{25,00,000}{1 + 2.5\%} = \text{EUR } 24,39,024$
91.	It has exported goods and hence has foreign currency asset (USD). It should create a matching liability and hence borrow in USD . The borrowed amount should be converted into INR and deposited
92.	Exchange
93.	Payable under forward contract: $\text{GBP} = \text{EUR} \times \text{ASK} \left(\frac{\text{GBP}}{\text{EUR}} \right)$ $\text{GBP} = 25,00,000 \times \left(\frac{1}{1.20} \right) = \text{GBP } 20,83,333$ Outflow under forward contract is higher and hence the company should go for MMH to cover the exposure
94.	Transaction exposure = Profit as per spot rates - Profit as per forward rates Transaction exposure = $10,00,000 - 4,00,000 = \text{Rs.}6,00,000$
95.	Natural hedge strategy
96.	It has balance of USD 25,000 and should do a spot purchase of USD 15,000 to make the balance USD 40,000
97.	First we should adjust the cash balance and hence we will do spot purchase of USD 55,000. This will increase the cash balance to USD 80,000. This transaction will also increase overbought position as USD 1,55,000. We need an over-bought position of USD 1,55,000 and hence we should do forward sell of USD 5,000 to make the final position as USD 1,50,000
98.	Draft issue is recorded as sale transaction in exchange position. Cancellation of same will reverse the transaction and the same would be recorded as purchase in exchange position
99.	$\text{GBP} = \text{EURO} \times \text{ASK} \left(\frac{\text{GBP}}{\text{EUR}} \right)$; $\text{GBP} = 2,50,000 \times \left(\frac{1}{\text{BID} \left(\frac{\text{EUR}}{\text{GBP}} \right)} \right) = \frac{2,50,000}{1.975} = \text{GBP } 1,26,582$ BID rate = $1.979 - 0.004 = 1.975$
100.	Our account with you
101.	Economic Exposure
102.	Sale in Exchange position and outflow in cash position
103.	Not recorded
104.	Known component = Rs.1,20,000; Unknown component = ? EUR $\text{Euro} = \text{INR} \times \left(\frac{\text{Euro}}{\text{INR}} \right)$ $\text{Euro} = \text{INR} \times \text{BID} \left(\frac{\text{Euro}}{\text{INR}} \right)$ $\text{Euro} = \text{INR} \times \text{BID} \left(\frac{\text{Euro}}{\text{GBP}} \right) \times \text{BID} \left(\frac{\text{GBP}}{\text{INR}} \right)$ $\text{Euro} = 1,20,000 \times 1.24 \times \frac{1}{75.35} = \text{EUR } 1,974.78$
105.	Purchase in Exchange position

Chapter 11 – International Financial Management

1. In international capital budgeting, _____ is used for computing after tax cash flow accruing to the parent firm
 - a. Home country tax rate
 - b. Host country tax rate
 - c. Higher of home/host country tax rate
 - d. Lower of home/host country tax rate
2. PBT of the project = Rs.100 crores; Tax rates in India = 30% corporate tax and 10% with-holding tax. Taxes paid in India will not be eligible for tax credit in USA. How much is the repatriable amount?
 - a. Rs.70 crores
 - b. Rs.60 Crores
 - c. Rs.63 crores
 - d. Rs.77 crores
3. Which of the following scenarios best represents the concept of American Depository Receipts (ADRs)?
 - a. A French company lists its shares on the New York Stock Exchange (NYSE).
 - b. A U.S. company issues bonds denominated in Euros to European investors.
 - c. A German company issues bonds that can be converted into U.S. dollar-denominated equity shares.
 - d. A Japanese company issues bonds in Japanese Yen that can be converted into Japanese equity shares.
4. Required return in INR is 12% per annum. Risk-free rate in India and USA is 8% and 4%. How much is the required rate of return in USD?
 - a. 8.00%
 - b. 16.00%
 - c. 7.86%
 - d. 16.31%
5. A company is considering an overseas expansion project. Which of the following would likely require additional analysis in international capital budgeting compared to domestic capital budgeting?
 - a. Regulatory compliance
 - b. Local competitors
 - c. Labor market trends
 - d. Domestic interest rates
6. K Ltd. currently operates from 4 different buildings and wants to consolidate its operations into one building which is expected to cost Rs. 90 crores. The Board of K Ltd. had approved the above plan and to fund the above cost, agreed to avail an External Commercial Borrowing (ECB) of GBP 10 m from G Bank Ltd. Interest Cost is GBP 6 months LIBOR + Margin of 2.50%. The 6-month LIBOR is expected to be 1.05%. Average Loan Maturity life will be 3.4 years with an overall tenure of 5 years. How much is the expected interest cost assuming LIBOR remains at 1.05%?
 - a. GBP 0.8875 million
 - b. GBP 1.775 million
 - c. GBP 1.207 million
 - d. GBP 0.6035 million
7. Which of the following factors are crucial in multinational capital budgeting?
 - a. Cash flows from domestic projects.
 - b. Profits remitted to the host country.

- c. Effect of foreign exchange risk on the parent firm's cash flow.
 - d. Changes in rates of inflation in the parent country
8. An Indian company is setting up a project in USA. It currently has operations in USA which has surplus funds of USD 20,00,000. These funds cannot be repatriated to India due to restrictions. New project will cost USD 50,00,000 and the company would partly fund the investment project with the available surplus of USD 20,00,000. How much should be the initial outflow for evaluating the project?
 - a. USD 50,00,000
 - b. USD 70,00,000
 - c. USD 30,00,000
 9. NPV of project is Rs.10,00,000. Spot exchange rate is Rs.50 per USD. How much would be the NPV in USD?
 - a. Cannot be calculated with given information
 - b. USD 5 crores
 - c. USD 20,000
 - d. USD 10,000
 10. What is the primary objective of an International Financial Centre (IFC)?
 - a. Providing tax incentives to local businesses
 - b. Facilitating cross-border financial transactions
 - c. Promoting agricultural development
 - d. Regulating local retail markets
 11. An Indian company is planning to do a project in Nepal. The company can raise loan for theme park in Nepal @ 9%. The tax rate in India is 30% and in Nepal it is 20%. The current WACC of the company is 12%. The company's current equity beta is 0.45. The company's funding ratio for the Water Park would be 55% equity and 45% debt. The company has gathered the relevant information about its nearest competitor in Nepal. The competitor's market value of the equity is NPR 1850 crores and the debt is NPR 510 crores and the equity beta is 1.35. How much is the asset beta and equity beta of the project?
 - a. 1.132 Times and 1.873 Times
 - b. 1.132 Times and 1.780 Times
 - c. 1.106 Times and 1.830 Times
 - d. 1.106 Times and 1.739 Times
 12. An MNC company in USA has surplus funds to the tune of USD 10 million for six months. The finance director of the company is interested in investing in EURO for higher returns. There is DTAA in force between USA and Germany. Following are the details of the investment

Particulars	Amount
EURO/USD Spot	0.4040/41
6 months forward	67/65
Rate of interest for 6 months (p.a.)	5.95%-6.15%
Withholding tax applicable for interest income	22%
Tax as per DTAA	10%

How much would be the withholding tax on interest income?

- a. EUR 12,019.00
 - b. EUR 26,441.80
 - c. EUR 12,120.00
 - d. EUR 26,664.00
13. What distinguishes Global Depository Receipts (GDRs) from American Depository Receipts (ADRs)?
 - a. GDRs are issued by U.S. companies, while ADRs are issued by non-U.S. companies.

- b. GDRs are traded on domestic stock exchanges, while ADRs are traded on international stock exchanges.
 - c. GDRs are denominated in U.S. dollars, while ADRs are denominated in the issuer's home currency.
 - d. GDRs represent ownership in a foreign company and are traded on international stock exchanges, while ADRs represent ownership in a foreign company and are traded on U.S. stock exchanges
14. A proposed foreign investment involves creation of a plant with an annual output of 1 million units. The entire production will be exported at a selling price of USD 10 per unit. The plant at the current rate of exchange will have a depreciation of USD 1 million annually. There is a likely decline in value of USD by 10 percent. How much would be the selling price and depreciation in USD post decline in value of USD?
- a. USD 10 and USD 0.9 million
 - b. USD 10 and USD 1 million
 - c. USD 9 and USD 0.9 million
 - d. USD 9 and USD 1 million
15. PBT of the project = Rs.100 crores; The US based company will be subjected to corporate tax of 30 per cent and with – holding tax of 10% in India and will be eligible for tax credit in India. How much is the repatriable amount?
- a. Rs.70 crores
 - b. Rs.60 Crores
 - c. Rs.63 crores
 - d. Rs.77 crores
16. A company is making a new issue of equity shares to refund existing bonds. The existing bonds carry interest rate of 15% and current outstanding is 6 million. Life of the bond is 5 years. For early redemption there is prepayment penalty of USD 3,50,000 to be paid. Cost of capital is 10%. How much is the NPV of bond refunding?
- a. USD 11,37,900
 - b. USD 7,87,900
 - c. USD 4,37,900
 - d. NPV is negative
17. A project will generate cash flows of USD 20,00,000 in year 1, USD 40,00,000 in year 2 and USD 60,00,000 in year 3. Initial investment is USD 80,00,000. There are restrictions on repatriation of funds and only 50% of profits can be repatriated in each year and the balance cash flows can be repatriated on completion of project. Non-repatriated amount can be invested in fixed deposit giving return of 2%. Cost of capital is 10%. How much is the NPV of the project?
- a. USD 16,28,000 (Positive)
 - b. USD 13,20,000 (Positive)
 - c. USD 13,80,380 (Positive)
 - d. Negative NPV
18. What is the primary difference between Foreign Currency Convertible Bonds (FCCBs) and Euro Convertible Bonds?
- a. FCCBs are issued by European governments, while Euro Convertible Bonds are issued by non-European governments.
 - b. FCCBs can be converted into equity shares denominated in any foreign currency, while Euro Convertible Bonds can only be converted into Euro-denominated equity shares.
 - c. FCCBs are designed exclusively for domestic investors, while Euro Convertible Bonds are targeted at international investors.

- d. FCCBs can only be issued by financial institutions, while Euro Convertible Bonds can be issued by any type of corporation.
19. What does full capital convertibility mean?
- Transfer of funds from one country to another country with restrictions
 - Transfer of funds from one country to another country is not allowed
 - No restriction on transfer of funds from one country to another country
20. A US based company is setting up a subsidiary in USA. The project will involve Additional cash fixed cost of US \$ 30 million p.a. and project's share of allocated fixed cost will be US \$ 3 million p.a. based on principle of ability to share. How much should be taken as fixed cost while evaluating the capital budgeting decision?
- USD 30 million
 - USD 33 million
 - USD 27 million
21. An Indian company has issued GDR. It has now declared dividends and the same is denominated in INR. Who would bear the exchange risk on dividends paid to GDR holders?
- Company
 - Depository
 - Custodian Bank
 - Investor
22. A pool of investment assets owned by a government is best described as:
- state managed fund.
 - official reserve fund.
 - sovereign wealth fund
23. An Indian company is planning to set-up a plant in Sri Lanka. It needs to factor risks specific to international projects. Which is better approach to factor in risk?
- Adjust discount rate
 - Adjust cash flows
 - Adjust both discount rate and cash flows
 - Indifferent between adjustment of discount rate/cash flows
24. Which type of Sovereign Wealth Fund (SWF) is established to save excess revenues for future generations and act as a stabilizing force for the economy?
- Reserve Fund
 - Development Fund
 - Heritage Fund
 - Stabilization Fund
25. Which working capital component is most affected by cross-border currency fluctuations?
- Inventory
 - Short-term investments
 - Accounts Receivable
 - Cash Reserves
26. An issuer of Euro Convertible bond has an option of calling (buying) the bonds for redemption before the date of maturity of the bonds. This is an example of
- Call option
 - Put option

27. What is the difference between evaluating a project-based cash flows and parent firms cash flows?
- Evaluation based on parent firms cash flows requires competition with existing local firms.
 - Evaluation based on parent firms cash flows involves financial cash flows only.
 - Evaluation based on parent firms cash flows eliminates problems associated with fluctuating exchange rate changes.
 - Evaluation based on parent firms cash flows involves operating and financial cash flows.
28. Which risk factor poses a specific challenge in international capital budgeting when compared to domestic capital budgeting?
- Interest rate risk
 - Political risk
 - Market demand risk
 - Supplier reliability risk
29. _____ is raising funds in the form of large loans from banks with good credit rating
- Euro bonds
 - Convertible bonds
 - Syndicated bank loans
 - Hypothecated bank loans
30. What is the primary source of funding for most Sovereign Wealth Funds (SWFs)?
- International grants and aid
 - Foreign direct investment
 - Export earnings from natural resources
 - Domestic taxation
31. An exporter may decide to bill the receivables in a depreciating currency due to
- Exporters always aim for billing in depreciating currency
 - Exporter has short term debt in depreciating currency
 - Exporter has given longer credit period to customer
 - Exporter is the market leader
32. Which of the following techniques does not help in optimizing cash flow movements in international cash management?
- Leading and Lagging
 - Netting
 - Management of Blocked Funds
 - Taking a forward contract
33. Which factor contributes to the complexity of working capital management in multinational corporations?
- Homogeneous regulatory environments
 - Uniform economic conditions across countries
 - Consistent currency exchange rates
 - Diverse tax and legal frameworks
34. Which of the following does not reduce forex risk?
- Payables & receivables in different currencies having positive correlations
 - Payables of different currencies having negative correlations
 - Payables and receivables in different currencies having negative correlations
35. Firms _____ payments of hard currency payables and _____ payments of soft currency payables in order to reduce foreign exchange exposure

- Accelerate and Accelerate
- Delay and Delay
- Accelerate and Delay
- Delay and Accelerate

Answer:

1.	Higher of home/host country tax rate																																		
2.	<table><tr><th>Particulars</th><th>Calculation</th><th>Amount (in Crores)</th></tr><tr><td>Profit before tax</td><td></td><td>100.00</td></tr><tr><td>Less: Tax @ 30%</td><td>100.00 x 30%</td><td>-30.00</td></tr><tr><td>Profit after tax</td><td></td><td>70.00</td></tr><tr><td>Less: Withholding tax @ 10%</td><td>70.00 x 10%</td><td>-7.00</td></tr><tr><td>Amount repatriated</td><td></td><td>63.00</td></tr></table>	Particulars	Calculation	Amount (in Crores)	Profit before tax		100.00	Less: Tax @ 30%	100.00 x 30%	-30.00	Profit after tax		70.00	Less: Withholding tax @ 10%	70.00 x 10%	-7.00	Amount repatriated		63.00																
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3.	A French company lists its shares on the New York Stock Exchange (NYSE)																																		
4.	INR rate analysis: $(1 + R_f) \times (1 + \text{risk premium}) = (1 + \text{risky rate})$ $(1 + 0.08) \times (1 + \text{risk premium}) = (1 + 0.12)$; Risk Premium = 3.71% USD discount rate: $(1 + R_f) \times (1 + \text{risk premium}) = (1 + \text{risky rate})$ $(1 + 0.04) \times (1 + 0.0371) = (1 + 0.12)$; Risky Rate = 7.86%																																		
5.	Regulatory compliance																																		
6.	Interest cost = 10 million x 3.55% x 3.4 years = GBP 1.207 million																																		
7.	Effect of foreign exchange risk on the parent firm's cash flow Explanation: More or less first two options are based on third option. Changes in rates in inflation in parent country indirectly impacts the capital budgeting decision.																																		
8.	USD 30,00,000 Explanation: Blocked funds will be used for setting up the project and these blocked funds should be reduced from the initial outlay to find the real outflow towards the project																																		
9.	NPV in INR = NPV in USD x Spot rate 10,00,000 = NPV in USD x 50; NPV in USD = 10,00,000/50 = USD 20,000																																		
10.	Facilitating cross-border financial transactions																																		
11.	Computation of Asset Beta of project based on Competitor: <table><tr><th>Security</th><th>Beta</th><th>Weight</th><th>Product</th></tr><tr><td>Equity</td><td>1.35</td><td>1850</td><td>2,497.50</td></tr><tr><td>Debt</td><td>0</td><td>408 [510 x 0.80]</td><td>0</td></tr><tr><td>Firm</td><td>1.106</td><td>2,258</td><td>2,497.50</td></tr></table> Note: We have used tax rate of Nepal for computing weight of debt in Nepal. This is because the competitor is based out of Nepal Computation of Equity Beta: <table><tr><th>Security</th><th>Beta</th><th>Weight</th><th>Product</th></tr><tr><td>Equity</td><td>1.83</td><td>0.55</td><td>1.006</td></tr><tr><td>Debt</td><td>0</td><td>0.36 [0.45 x 0.80]</td><td>0</td></tr><tr><td>Firm</td><td>1.106</td><td>0.910</td><td>1.006</td></tr></table> Note: Weight for Debt is taken as Debt x (1 – Tax rate of India) Final answer is 1.106 Times and 1.830 Times			Security	Beta	Weight	Product	Equity	1.35	1850	2,497.50	Debt	0	408 [510 x 0.80]	0	Firm	1.106	2,258	2,497.50	Security	Beta	Weight	Product	Equity	1.83	0.55	1.006	Debt	0	0.36 [0.45 x 0.80]	0	Firm	1.106	0.910	1.006
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13.	GDRs represent ownership in a foreign company and are traded on international stock exchanges, while ADRs represent ownership in a foreign company and are traded on U.S. stock exchanges				
14.	- Current selling price is in USD and hence there will be no impact on selling price with decline in value of USD. Selling price will continue to be USD 10 - Depreciation is USD 1 million as per the current rate of exchange. Decline in value of USD will lead to lower equivalent depreciation of USD 0.9 million [1 million – 10%] - Hence answer is USD 10 and USD 0.9 million				
15.	Particulars		Calculation		Amount (in Crores)
	Profit before tax				100.00
	Less: Withholding tax @ 10%		100.00 x 10%		-10.00
	Earnings after withholding tax				90.00
	Less: Tax @ 30%		100 x 30% - 10 (with-holding tax eligible for tax credit)		-20.00
	Amount repatriated				70.00
16.	Year	Cash flow ('000s)	PVF @ 10%	DCF	
	0	-6,350	1.000	-6,350.00	
	1 to 5	900	3.791	3,411.90	
	5	6,000	0.621	3,726.00	
	NPV of bond refunding			787.90	
	- The company will have to pay 6,350 today for bond refunding (6 million + 3,50,000) - The company will save interest of 900 for a period of 5 years and will save principal payment of 6,000 at end of five years - NPV of bond refunding = USD 7,87,900				
17.	Year	Cash flow	PVF @ 10%	DCF	
	0	-80,00,000	1.000	-80,00,000	
	1	10,00,000	0.909	9,09,000	
	2	20,00,000	0.826	16,52,000	
	3	90,80,400	0.751	68,19,380	
	NPV			13,80,380	
- Cash flow of year 1 = 20,00,000 x 50% = 10,00,000 - Cash flow of year 2 = 40,00,000 x 50% = 20,00,000 - Cash flow of year 3 = [10,00,000 x 1.02 x 1.02] + [20,00,000 x 1.02] + 60,00,000 = 90,80,400					
18.	FCCBs can be converted into equity shares denominated in any foreign currency, while Euro Convertible Bonds can only be converted into Euro-denominated equity shares				
19.	No restriction on transfer of funds from one country to another country				
20.	USD 30 million. Project’s share of allocated fixed cost is irrelevant as the same is not related to the project.				
21.	Investor Explanation: Investors earn fixed income by way of dividends which are paid in issuer currency converted into dollars by depository and paid to investors and hence exchange risk is with investor				
22.	A sovereign wealth fund is a pool of investment assets owned by a government				
23.	Adjust cash flows Explanation: Adjusting cash flows is better than adjusting discount rate. Adjusting discount rate would not be proper as we are combining all risks into a single discount rate				
24.	Stabilization Fund Explanation: Stabilization Funds are designed to mitigate economic volatility by saving excess revenues during periods of high resource prices and using them during periods of low prices.				
25.	Accounts receivables Explanation: Cross-border currency fluctuations can impact the value of accounts receivable, affecting the value of payments received from foreign customers. This is primary component in balance sheet of most companies				

26.	Call option. This is also known as issuer's option
27.	Evaluation based on parent firms cash flows involves operating and financial cash flows Explanation: In case of evaluation of foreign projects the actual cash remitted plays a big role
28.	Political risk
29.	Syndicated bank loans
30.	Export earnings from natural resources Explanation: Sovereign Wealth Funds often accumulate funds from excess revenues generated by the export of natural resources like oil, gas, minerals, etc
31.	Exporter has short term debt in depreciating currency Explanation: Exporter would normally bill in appreciating currency. However due to natural hedge (loan in foreign currency offset with receivables), they would be ok to do billing in depreciating currency.
32.	Taking a forward contract does not help in optimizing cash flows. It can help in reducing exchange rate risk. Other techniques help in optimizing cash flows
33.	Diverse tax and legal frameworks
34.	Payables and receivables in different currencies having negative correlations Explanation: A company cannot reduce risk by having payables and receivables in different currencies having negative correlation. This is because an appreciation of one currency (example: payable currency) will be leading to depreciation of other currency (receivable currency). Hence it would have either profits or losses in both transactions and hence this would not lead to risk reduction.
35.	Accelerate and Delay Explanation: Hard currency payables are payables in currencies which are likely to appreciate. Hence, we should make early payment. Soft currency payables are payables in currencies which are likely to depreciate. Hence, we should delay making those payments.

Chapter 12 – Interest rate risk Management

1. ABC Limited will receive Rs.50,00,000 in two months and the same should be deposited for a period of three months. Three-month futures are currently priced at 93 and the size of one contract is Rs.5,00,000. If after two months, the futures are priced at 90.75 and interest rate increases to 10.5%, what would be the effective interest income earned by ABC Limited due to adoption of this strategy?
 - a. Rs.1,31,250
 - b. Rs.1,59,375
 - c. Rs.1,03,125
 - d. Rs.5,25,000
2. Which economic condition is likely to lead to a decrease in interest costs for borrowers?
 - a. High unemployment rate
 - b. Rapid economic growth
 - c. High consumer spending
 - d. Rising inflation
3. In a plain vanilla interest rate swap:
 - a. one party pays a floating rate and the other pays a fixed rate, both based on the notional amount
 - b. each party pays a fixed rate of interest on a notional amount
 - c. payments equal to the notional principal amount are exchanged at the initiation of the swap.
4. Firm A has invested Rs.100 million in fixed rate bonds yielding 8.5 percent. Firm A has raised its loan for funding its assets through floating rate loan from bank at an interest rate of LIBOR + 0.50%. There is a big bank which offers interest rate swap. It has quoted rate of 6.40%-6.50% against LIBOR. How much would be the locked in spread of Firm A if it enters into interest rate swap?
 - a. 1.50%
 - b. 1.60%
 - c. 2.10%
 - d. 2.00%
5. You have purchased one year cap on notional amount of Rs.100 crores. The strike rate of cap option is 8%. Interest rate for first quarter is 8.5% and second quarter is 7.5%. How much is the payoff for first and second quarter?
 - a. 50,00,000 and 50,00,000
 - b. 12,50,000 and 12,50,000
 - c. 12,50,000 and 0
 - d. 50,00,000 and 0
6. What does "basis risk" refer to in the context of interest rate risk?
 - a. The risk of changes in the yield curve
 - b. The risk of embedded options in bonds
 - c. The risk of a mismatch between two related interest rates
 - d. The risk of fluctuating market prices for fixed-income securities
7. _____ is that interest rate at which bank will charge from borrower, the _____ is that rate at which bank would like to borrow from another bank
 - a. MIBID and MIBOR
 - b. MIBOR and MIBID
8. M Limited and S Limited are looking at borrowing a loan and given below is the interest rate offered to them.

Particulars	Fixed rate	Floating rate	Preference

M Limited	8%	T+0.6%	Floating
S Limited	9.2%	T+1.2%	Fixed

There is no swap intermediary in the transaction. Swap gains will be shared equally between two parties. How much would be the effective borrowing rate of Madagascar Limited?

- T + 0.60%
 - T + 0.90%
 - T + 0.30%
 - T
9. The treasurer of a company expects to receive a cash inflow of \$15,000,000 in 90 days. The treasurer expects short-term interest rates to fall during the next 90 days. What action should he take in FRA to hedge interest rate risk?
- Take long position in FRA
 - Take short position in FRA
10. Which type of interest rate risk is particularly relevant to callable bonds?
- Gap exposure risk
 - Reinvestment risk
 - Yield curve risk
 - Embedded option risk
11. Three-month futures are currently quoted at 95. How much is the interest rate indicated by the futures?
- 95.00%
 - 5.00%
 - 5.00%
 - 20.00%
12. ABC Limited has taken a floating rate loan. They have used interest rate swaps and converted the same into a fixed rate loan. What is the view of ABC Limited on interest rates?
- No view on interest rates
 - Interest rates will increase
 - Interest rates will decrease
13. Which technique provides protection against rising interest rates by allowing the holder to lock in a maximum interest rate while benefiting from lower rates?
- Interest Rate Swap
 - Interest Rate Future
 - Interest Rate Collar
 - Interest Rate Cap
14. XYZ Limited borrows £15 Million of six months LIBOR + 10.00% for a period of 24 months. The company anticipates a rise in LIBOR, hence it proposes to buy a Cap Option from its Bankers at the strike rate of 8.00%. The lumpsum premium is 1.00% for the entire reset periods and the fixed rate of interest is 7.00% per annum. How much would be the amortized premium per reset period?
- GBP 1,50,000
 - GBP 40,839
 - GBP 37,500
 - GBP 41,323
15. 3-month interest rate is 4.50% per annum and 6-month interest rate is 5.00% per annum. What should be the 3 months FRA rate at 3 months forward?
- 8.00%
 - 1.36%

- c. 5.44%
d. 2.72%
16. In an Interest Rate Swap, Fixed interest payments on a generic swap are calculated assuming each year consist of _____
a. 366 days
b. 365 days
c. 360 days
17. You are planning to borrow Rs.100 crores after 3 months. Which of these actions can help in hedging interest rate risk?
a. Buy interest rate futures
b. Sell Interest Rate futures
18. Bank's interest-sensitive assets = Rs.100 Crores; Bank's interest sensitive liabilities = Rs.80 Crores. Interest rates will increase by 1%. How much is the impact on earnings of bank?
a. Increase in NII by Rs.1 crore
b. Decrease in NII by Rs.1 crore
c. Increase in NII by Rs.20 lacs
d. Decrease in NII by Rs.20 lacs
19. ABC Limited plans to borrow Rs.50 Crores for a period of 3 months after 6 months. The Bank has quoted FRA rate as follows:
- | | |
|-----------------|-------|
| 3 x 6 FRA Rate | 8.20% |
| 3 x 9 FRA Rate | 8.50% |
| 6 x 9 FRA Rate | 8.00% |
| 6 x 12 FRA Rate | 8.60% |
- The actual interest rate on borrowing date turns out to be 10.00%. How much would be the FRA Settlement?
a. Rs.25,00,000 (Receipt for ABC Limited)
b. Rs.24,39,024 (Receipt for ABC Limited)
c. Rs.25,00,000 (Payment by ABC Limited)
d. Rs.24,39,024 (Payment by ABC Limited)
20. An interest rate swap where the payments are based on the difference between two different variable rates is called as _____
a. Generic swap
b. Plain vanilla swap
c. Basis rate swap
d. Asset swap
21. Secured Overnight Financing Rate (SOFR) is the reference rate of which region?
a. Europe
b. UK
c. USA
d. Japan
22. The 6-month and 12-month LIBOR is 9.60% per annum and 9% per annum. Fair FRA rate for month 6 to 12 is 8.00% per annum and actual FRA rate for month 6 to 12 is 10.50%-11.00%. How can you exploit the arbitrage opportunity?
a. Borrow for 12 months at 9% per annum and invest for 6 months at 9.60% and balance 6 months at actual FRA rate of 11.00%
b. Borrow for 12 months at 9% per annum and invest for 6 months at 9.60% and balance 6 months at actual FRA rate of 10.50%

- c. Invest for 12 months at 9% per annum and borrow for 6 months at 9.60% and balance 6 months at actual FRA rate of 11.00%
 - d. Invest for 12 months at 9% per annum and borrow for 6 months at 9.60% and balance 6 months at actual FRA rate of 10.50%
23. XYZ Limited issues a GBP 10 million floating rate loan with resetting of coupon rate every 6 months equal to LIBOR + 0.50%. XYZ is interested in a collar strategy by selling a floor and buying a cap. Strike rate for cap is 7.00% and collar is 4%. How much is the effective interest cost if LIBOR is 3% on reset date?
- a. GBP 3,50,000
 - b. GBP 1,75,000
 - c. GBP 4,50,000
 - d. GBP 2,25,000
24. You have purchased one year floor on notional amount of Rs.100 crores. The strike rate of floor option is 8%. Interest rate for first quarter is 8.5% and second quarter is 7.5%. How much is the payoff for first and second quarter?
- a. 50,00,000 and 50,00,000
 - b. 12,50,000 and 12,50,000
 - c. 0 and 50,00,000
 - d. 0 and 12,50,000
25. Which interest rate option provides the holder with the right, but not the obligation, to enter into an interest rate swap at a future date?
- a. Call Option
 - b. Put Option
 - c. Caps Option
 - d. Swaption
26. Fixed rate payer swaption is also called as _____
- a. Put swaption
 - b. Call swaption
27. Which financial instrument allows a company to exchange fixed-rate payments for floating-rate payments without exchanging the underlying principal amounts?
- a. Forward Rate Agreement (FRA)
 - b. Interest Rate Swap
 - c. Interest Rate Option
 - d. Interest Rate Future
28. In March 2020, XYZ Bank sold some 7% Interest Rate Futures underlying Notional 7.50% Coupon Bonds. 6.80 GOI 2029 is an eligible security whose quoted price is 877.50 and conversion factor is 0.9195. Futures settlement price is 1,000. How much is the profit/loss of XYZ Bank?
- a. Rs.122.50 (Profit)
 - b. Rs.42.00 (Profit)
 - c. Rs.122.50 (Loss)
 - d. Rs.42.00 (Loss)
29. Suppose a dealer quotes 'All-in-cost' for a generic swap at 8% against six months LIBOR flat. If the notional principal amount of swap is Rs.50,00,000. The six-month period from the effective date of swap to the settlement date comprise of 181 days and that the corresponding LIBOR was 6% on the effective date of swap. Generic swap is valued based on 30/360 days basis. How much is the semi-annual fixed payment and floating payment?
- a. Rs.4,00,000 and 3,00,000

- b. Rs.3,00,000 and 1,50,000
 c. Rs.2,00,000 and 1,50,833
 d. Rs.1,50,000 and 3,01,666
30. A swaption with a longer time to expiration is likely to have a higher premium because:
 a. It is less risky
 b. It has a higher notional amount
 c. There is greater uncertainty in future interest rates
 d. It can only be exercised on specific dates
31. Which swaption can help an investor to protect against the risk of callable bonds?
 a. Fixed rate payer swaption
 b. Fixed rate receiver swaption
32. XYZ Limited issues a GBP 10 million floating rate loan with resetting of coupon rate every 6 months equal to LIBOR + 0.50%. XYZ is interested in a collar strategy by selling a floor and buying a cap. Strike rate for cap is 7.00% and collar is 4%. How much is the cap receipt and floor payment if Libor is 10% on reset date?
 a. Cap receipt of GBP 3,00,000 and floor payment of GBP 6,00,000
 b. Cap receipt of GBP 3,00,000 and no floor payment
 c. Cap receipt of GBP 1,50,000 and floor payment of GBP 3,00,000
 d. Cap receipt of GBP 1,50,000 and no floor payment
33. An amortising swap is a derivative contract where:
 a. Both parties exchange fixed interest rates
 b. Fixed interest rate is exchanged for a floating interest rate
 c. Notional amount decreases over time
 d. Parties exchange interest payments without underlying assets
34. Which type of interest rate risk is associated with the potential for changes in market interest rates to affect the value of a fixed-rate bond?
 a. Basis risk
 b. Reinvestment risk
 c. Embedded option risk
 d. Price risk
35. ABC Limited wants to borrow Rs.30 lacs for a period of 5 months after 2 months. Three-month futures are currently quoted at 93 and value of one contract is 5 lacs. How many contracts are needed for hedging?
 a. Buy 6 contracts
 b. Sell 6 contracts
 c. Buy 10 contracts
 d. Sell 10 contracts
36. Which interest rate management technique involves combining an interest rate cap and an interest rate floor?
 a. Interest Rate Swap
 b. Interest Rate Collar
 c. Forward Rate Agreement (FRA)
 d. Interest Rate Option

Answer:

1.	No of contracts = $\frac{50,00,000}{5,00,000} = 10$ Contracts

	<u>Futures settlement:</u>				
	Date	Position	Action	Ref date	Rate
	Day 0	Original	Lend	Day 60	7.00% [100 – 93]
	Day 60	Opposite	Borrow	Day 60	-9.25% [100 – 90.75]
	Loss in %				-2.25%
	Loss in rupees (5,00,000 x 10 x 2.25% x 3/12)				-28,125
	<u>Effective interest income:</u>				
	Particulars		Calculation	Amount	
	Interest income		50,00,000 x 10.5% x (3/12)	1,31,250	
	Loss in futures			-28,125	
	Effective interest income			1,03,125	
2.	High Unemployment rate				
3.	one party pays a floating rate and the other pays a fixed rate, both based on the notional amount				
4.	Particulars		Amount		
	Investment rate		8.5%		
	Borrowing Rate		(LIBOR + 0.50%)		
	Firm to Big Bank		(6.5%)		
	Big Bank to Firm		LIBOR		
	Locked in spread		1.50%		
	The company can lock in spread by receiving LIBOR from Big Bank. This will help them in offsetting the floating LIBOR being paid by them. Big Bank will pay LIBOR to Firm A and against higher rate of 6.50% from Firm A.				
5.	Option will get exercised in the first quarter as the actual interest is higher than cap rate. Payoff of first quarter = 100 crores x 0.5% x 3/12 = Rs.12,50,000. Option will not be exercised in second quarter and hence payoff for second quarter is 0				
6.	The risk of a mismatch between two related interest rates <u>Explanation:</u> Basis risk is the risk that the relationship between two interest rates, such as the benchmark rate and a floating rate, may deviate and create uncertainties for hedging or financial instruments.				
7.	MIBOR and MIBID				
8.	• Total interest rate of combination 1 [M limited (fixed) & S Limited (Floating)] = 8% + T + 1.2% = T+9.2% • Total interest rate of combination 2 [M limited (floating) & S Limited (fixed)] = T + 0.6% + 9.2% = T+9.8% • Ideal combination = Combination 1; This would mean that M Limited should borrow at fixed rate and S Limited should borrow at floating rate • <u>Actual scenario:</u> M Limited plans to borrow at floating rate and S Limited plans to borrow at fixed rate • Scope for Interest rate swap exist as the ideal and actual scenario does not match • Swap gain = Difference in total interest of combination 1 & 2 = (T + 9.8%) – (T + 9.2%) = 0.6% • Share of Gain for M Limited = 0.6/2 = 0.3% • Effective borrowing rate = T + 0.6% - 0.3% = T + 0.3%				
9.	The company needs to invest money and hence they should take a short position in FRA. <u>Note:</u> FRA should not be confused with IRF. In case of FRA we buy FRA if we are borrowing and sell FRA if we are investing. On the contrary the action taken is buy IRF if we are investors and sell IRF if we are borrowers.				
10.	Embedded option risk <u>Explanation:</u> Callable bonds have embedded options that allow the issuer to call (redeem) the bond before maturity. This introduces embedded option risk, as changes in interest rates may impact the issuer's decision to call the bond				
11.	Futures of 95 would mean interest rate of 5.00% (100 – 95)				

12.	A company will convert a floating loan into fixed loan if they expect interest rates to increase. Conversion of loan will ensure that they are not affected by increase in interest rates
13.	Interest Rate Cap
14.	$\text{Lump-sum Premium} = 1,50,00,000 \times 1\% = \text{GBP } 1,50,000$ $\text{Premium per reset period} = \frac{\text{Total premium}}{\text{PVAF}(r, n)} = \frac{1,50,000}{\text{PVAF}(3.5\%, 4)} = \frac{1,50,000}{3.673} = 40,839$ Note: - Premium will be amortized based on the fixed rate of interest. Fixed rate of interest is 7% per annum and the same will be 3.5% per half-year (reset period). Reset period is taken as six months as the borrowing is at six-month LIBOR - Option is for a period of 24 months and hence the same will have 4 reset periods of 6 months
15.	The company wants 3 months FRA rate at 3 months forward. This would technically mean 3x6 FRA $3 \times 6 \text{ FRA} = \frac{\text{Future value factor for 6 months}}{\text{Future value factor for 3 months}} - 1$ $3 \times 6 \text{ FRA} = \frac{1 + 2.50\%}{1 + 1.125\%} - 1 = 1.0136 - 1 = 1.36\% \text{ per 3 months (or) } \mathbf{5.44\% \text{ per annum}}$
16.	360 days
17.	A borrower has to sell interest rate futures whereas lender would buy interest rate futures
18.	Gap exposure = 100 crores – 80 crores = Rs.20 crores (Positive gap) Interest rates have increased by 1 percent and this would lead to improvement in net interest income of Rs.20 lacs (20 crores x 1%)
19.	The company plans to borrow for 3 months after a period of six months. Hence the borrowing period is month 6 to month 9 and hence ABC Limited would have entered into 6X9 FRA (8.00%) for hedging. Interest rates have increased to 10.00% and hence ABC Limited will receive FRA settlement $\text{FRA Settlement receipt} = \frac{50 \text{ crores} \times 2\% \times \frac{3}{12}}{1 + \left(\frac{0.10}{4}\right)} = \text{Rs. } 24,39,024$
20.	Basis Rate Swap
21.	USA
22.	Fair FRA rate is 8.00%. This would mean that arbitrage is possible if we can borrow at rate lower than 8.00% (or) invest at rate higher than 8.00%. In this case we will be able to invest at FRA rate of 10.50%. Hence Arbitrage is possible by doing the following: Borrow for 12 months at 9% per annum and invest for 6 months at 9.60% and balance 6 months at actual FRA rate of 10.50%
23.	- Interest paid on base loan = $1,00,00,000 \times 3.5\% \times 6/12 = \text{GBP } 1,75,000$ - No receipt on cap option as the same would not be exercised - Floor payment = $1,00,00,000 \times 1\% \times 6/12 = \text{GBP } 50,000$ - Total outflow = $1,75,000 - 0 + 50,000 = \text{GBP } 2,25,000$
24.	Option will not get exercised in the first quarter as the actual interest is higher than floor rate. Hence payoff for first quarter is 0. Option will be exercised in second quarter as the actual rate is lower than strike rate. Payoff for second quarter is 12,50,000 [$100 \text{ crores} \times 0.5\% \times 3/12$]
25.	Swaption
26.	Call swaption
27.	Interest Rate Swap
28.	We have sold 7.50% coupon bonds but are not able to deliver the same. Hence futures settlement price will be adjusted based on conversion factor. Final inflow for XYZ Bank = $1,000 \times 0.9195 = \text{Rs. } 919.50$. Outflow to buy 6.80 GOI 2029 is 877.50 and hence net profit of XYZ Bank = $919.50 - 877.50 = \text{Rs. } 42.00$
29.	Semi – annual fixed payment = $50,00,000 \times 8\% \times \left(\frac{1}{2}\right) = 2,00,000$ Floating payment = $50,00,000 \times 6\% \times \left(\frac{181}{360}\right) = 1,50,833$
30.	There is greater uncertainty in future interest rates
31.	Fixed rate receiver swaption

	Explanation: A bond could be redeemed by the company if interest rates decline in economy as they would plan to issue new bonds at lower interest. If this happens, then a fixed rate receiver swaption will help the investor as they can enter into IRS where they would receive fixed rate and pay floating rate (lower rate). This would compensate them for the reduction in interest rate
32.	Strike rate of cap option is 7% and actual LIBOR is more than 7%. Hence cap option will be exercised and there will be a receipt of GBP 1,50,000 [$1,00,00,000 \times 3\% \times 6/12$]. There will be no payment on floor option as the same won't be exercised
33.	Notional amount decreases over time
34.	Price risk, also known as market risk, refers to the risk that changes in market interest rates can lead to fluctuations in the value of fixed-rate securities such as bonds
35.	ABC Limited wants to borrow and hence they should sell interest rate futures $\text{No of contracts} = \frac{30 \text{ lacs}}{5 \text{ lacs}} \times \frac{5}{3} = 10 \text{ Contracts}$ Hence, we should sell 10 contracts for hedging
36.	Interest Rate Collar

Chapter 13 – Business Valuation

1. Market capitalization of firm = 10,000 lacs; Book value of equity = 4,000 lacs; Book value of debt = 2,000 lacs. How much is market value added?
 - a. 4,000 lacs
 - b. 6,000 lacs
 - c. 2,000 lacs
 - d. 16,000 lacs
2. Total Assets of the company = Rs.25,00,000; P&L debit balance (part of total assets) = Rs.5,00,000; Sundry creditors = Rs.2,00,000; Short-term debt = Rs.1,00,000; Long-term debt = Rs.2,00,000; Preference capital = Rs.4,00,000; No of equity shares = 1,00,000. How much is the net asset value per share?
 - a. Rs.16.00
 - b. Rs.11.00
 - c. Rs.15.00
 - d. Rs.20.00
3. Which of the following valuation methods is least dependent on future earnings or cash flows?
 - a. Discounted Cash Flow (DCF) Analysis
 - b. Comparable Transaction Analysis
 - c. Dividend Discount Model (DDM)
 - d. Price-to-Earnings (P/E) Ratio Method
4. In the Berkus Method of startup valuation, what is the purpose of assigning a value to each key risk factor?
 - a. To determine the startup's current market value
 - b. To estimate the startup's future earnings potential
 - c. To assess the management team's capabilities
 - d. To calculate the startup's total assets
5. Opening value of investment = Rs.1,00,000. You had made additional investment of Rs.20,000 during the year and ending value of investment is Rs.1,50,000. How much is the return on investment?
 - a. 50.00%
 - b. 30.00%
 - c. 27.27%
 - d. 25.00%
6. EBIT = Rs.200 lacs; The company has 10% debt of Rs.1,500 lacs. PAT is Rs.30 lacs. How much is the tax rate?
 - a. 15.00%
 - b. 85.00%
 - c. 60.00%
 - d. 40.00%
7. Equity share capital = Rs.10,00,000 (1,00,000 shares of Rs.10); Reserves and surplus = Rs.40,00,000; Share is quoted in the market at Rs.80. How much is market value added?
 - a. 70,00,000
 - b. 30,00,000
 - c. 1,30,00,000
 - d. 40,00,000
8. What should be the value of C Limited based on Market to sales approach? Company A - Market value = 400; Sales = 500; Company B - Market value = 450; sales = 600; Sales of Company C = 800

- a. 620
 - b. 640
 - c. 600
 - d. 680
9. Company A has Debt/Assets ratio of 0.80 Times whereas company B has Debt/Assets ratio of 0.20 Times. Both companies are identical except for capital structure. Industry PE Multiple is 15 Times. What should be the likely PE Multiple of Company A and Company P?
- a. Both companies can have same PE Multiple
 - b. PE Multiple of A Limited will be higher than PE Multiple of B Limited
 - c. PE Multiple of B Limited will be higher than PE Multiple of A Limited
10. Revenues of the company = 4,000 lacs. Working capital is 25 percent of revenues. Revenues will increase by 20 percent for 2 years and thereafter by 10 percent from third year. What is the change in working capital for year 3?
- a. 200 lacs
 - b. 144 lacs
 - c. 264 lacs
 - d. 120 lacs
11. EBIT of Year 1 = 200 lacs; Interest of Year 1 = 40 lacs; Tax rate = 30%; Depreciation of year 1 = 20 lacs; Capital expenditure of year 1 is 40 lacs and year 2 is 50 lacs; Decrease in working capital in year 1 is 20 lacs. Capital expenditure is incurred at the start of the year. How much is the FCFF of year 1?
- a. 140 lacs
 - b. 130 lacs
 - c. 90 lacs
 - d. 100 lacs
12. Which value driver for startups refers to the ability of the company to demonstrate increasing interest and adoption of its product or service among its target audience?
- a. Management
 - b. Traction
 - c. Revenue
 - d. Competitiveness
13. A Limited plans to acquire B Limited. Both are into same industry. B Limited earned a profit of Rs.13,00,000 in last year and had depreciation of Rs.6,00,000. B Limited is no longer required to maintain its own production facilities and hence it can be assumed that only a minimal amount of cash will have to be reinvested to keep its equipment current and for future growth. This amount is estimated at Rs. 1,00,000 per year. The acquisition has synergy gain (post-tax) of Rs.6,00,000. Determine the annual cash flow expected by A Limited from B Limited if the acquisition is made
- a. Rs.19,00,000
 - b. Rs.18,00,000
 - c. Rs.25,00,000
 - d. Rs.24,00,000
14. What does the term "Terminal Value" refer to in a Discounted Cash Flow (DCF) Analysis?
- a. The final year of projected cash flows
 - b. The present value of historical earnings
 - c. The residual value of a company beyond the forecast period
 - d. The sum of all future cash flows

15. Which of the following statements is true regarding the Scorecard Valuation Method of valuing startups?
- It relies solely on projected cash flows to estimate valuation.
 - It assigns equal weights to all startup characteristics.
 - It is primarily used for established and mature startups.
 - It provides a structured framework for assessing startup value.
16. Opening fixed assets = 10,000 lacs. Revenues will increase by 20 percent and fixed asset turnover ratio is maintained. The depreciation is 10% of opening WDV. How much is the gross capital expenditure of the year?
- 2,000 lacs
 - 1,000 lacs
 - 3,000 lacs
17. Value of firm is arrived by discounting _____ at _____ whereas value of equity is arrived by discounting _____ at _____.
- FCFF, Cost of equity, FCFE and cost of capital
 - FCFF, cost of capital, FCFE and cost of equity
 - FCFE, cost of equity, FCFF and cost of capital
 - FCFE, cost of capital and FCFF and cost of equity
18. Which method values the company on the basis of historical costs?
- Net realizable value method
 - Replaceable value method
 - Net assets value method
19. H Limited has total assets of Rs.1,000 Crores. It has preference capital of Rs.100 crores, Long-term debt of Rs.200 crores and current liabilities of Rs.300 crores. Contingent liability of Rs.200 crores is likely to crystallize to the extent of 25%. Land is 20% of total assets and its current value is 4 times of book value. How much is the value of equity as per net assets method?
- Rs.400 crores
 - Rs.350 crores
 - Rs.950 Crores
 - Rs.1,000 Crores
20. Value of acquiring company before merger = 4,000 lacs; Value of acquiring company after merger = 10,000 lacs; Pre-merger no of Shares in both companies are same. The company has allotted 0.5 share for every 1 share of target company. How much is the purchase consideration paid?
- 5,000 lacs
 - 3,333 lacs
 - 2,000 lacs
 - 1,333 lacs
21. A company has total assets of Rs.20,00,000 and outside liabilities of Rs.4,00,000. Assets have realizable value equivalent to 80% of the book value and there will also be liquidation expenses of Rs.1,00,000. How much is the net realizable value per share?
- Rs.16.00 per share
 - Rs.15.00 per share
 - Rs.12.00 per share
 - Rs.11.00 per share
22. R Limited and S Limited are operating in same industry. S Limited is planning to acquire R Limited. How much should be the maximum consideration payable?

Particulars	R Limited	S Limited	Combined Entity
Profit after tax	86,50,000	49,72,000	1,21,85,000
Residual net cash flows per year	90,10,000	54,87,000	1,85,00,000
Required return on equity	13.75%	13.05%	12.50%

- Rs.14.80 crores
- Rs.10.60 crores
- Rs.8.25 crores
- Rs.6.55 crores

23. Which limitation of the Replacement Cost Method makes it less suitable for valuing startups?
- Replacement Cost Method does not consider a startup's liabilities.
 - Startups often have unique and irreplaceable assets.
 - Replacement Cost Method is more suitable for service-based startups.
 - Startups do not have any fixed assets to evaluate.
24. Fragrance Ltd. has reported a Net Operating Profit after Tax (NOPAT) to Capital Employed as 2.5% plus Weighted Average Cost of Capital (WACC) for the year 31st March 2021. Economic Value added is Rs. 4 crore as on 31st March 2021. How much is the NOPAT if WACC is 7.5%?
- Rs.12 crores
 - Rs.8 crores
 - Rs.16 crores
 - Rs.40 crores
25. Value of Going Concern = Rs.100 Crores. Distress value = Rs.50 Crores. The probability of survival is 40%. How much is the fair value of the company?
- Rs.150 Crores
 - Rs.75 Crores
 - Rs.70 crores
 - Rs.80 crores
26. How does a company's strong commitment to environmental sustainability (ESG) typically impact its valuation?
- It has no impact on valuation as ESG is not financially relevant
 - It leads to a lower valuation due to increased operating costs.
 - It positively impacts valuation by attracting socially responsible investors and reducing risk.
 - It negatively impacts valuation by limiting growth opportunities.
27. Reliance Limited has three Divisions. Division A is to be valued based on capitalization/sales, Division B is to be valued based on capitalization/EBITDA and Division C is to be valued based on capitalization/operating income. Data of three division is as under:
- | Particulars | Division A | Division B | Division C |
|------------------|------------|------------|------------|
| Sales | 4,00,000 | 5,00,000 | 6,00,000 |
| EBITDA | 2,00,000 | 1,50,000 | 2,00,000 |
| Operating income | 1,00,000 | 1,20,000 | 1,50,000 |
- Capitalization/sales multiple for industry is 10 times, Capitalization/EBITDA multiple for industry is 20 times and capitalization/operating income for industry is 25 times. How much is the fair value of Reliance Limited?
- 1,50,00,000
 - 1,10,00,000
 - 1,20,00,000
 - 92,50,000
28. ABC Limited has automobile division whose value of business is Rs.1,000 Crores. It has liabilities of Rs.500 Crores. The settlement value of liabilities is 20% more than book value. The company plans

- to sell this division and has received a quote of Rs.450 Crores to acquire the division. The buyer of the division will take over all liabilities. What should be the decision of ABC Limited?
- It can sell automobile division
 - It should not sell automobile division
29. A Limited has acquired business of B Limited. It has issued 40,000 equity shares at Rs.20 each. It has issued 12% debentures of Rs.4,00,000 to debenture holders. It has made payment of Rs.6,00,000 to creditors. How much is the initial outflow for the purpose of computing merger NPV?
- 8,00,000
 - 6,00,000
 - 12,00,000
 - 18,00,000
30. Eagle Limited reported a profit of Rs.77 lacs after 30% tax for the financial year 2011-12. An analysis of the accounts revealed that the income included extraordinary items of Rs.8 lacs and an extraordinary loss of Rs.10 lacs. New product will lead to profit of Rs.28 lacs. How much is the future maintainable PAT?
- Rs.140 lacs
 - Rs.98 lacs
 - Rs.107 lacs
 - Rs.136 lacs
31. EPS = Rs.10 per share; Capital expenditure = Rs.5 per share; Depreciation = Rs.4 per share; Working capital = Rs.4 per share. Debt ratio = 30%. How much is FCFE per share?
- 10 per share
 - 5 per share
 - 7.2 per share
 - 8 per share
32. Compute the value of company under capitalization of earning method using the following information: EPS = Rs.10.00 per share; Share price = Rs.100 per share; Expected annual maintainable profit = Rs.20,00,000
- Rs.2,00,000
 - Rs.2,00,00,000
 - Rs.20,00,000
 - Rs.20,00,00,000
33. In the Venture Capital Method, the "exit multiple" is typically based on:
- The startup's current revenue
 - The average industry growth rate
 - Comparable public company valuations
 - The cost of capital
34. A manufacturing company with underutilized factory space and outdated equipment is best valued using which method?
- Realizable value method
 - Capitalization of Earnings Method
 - Cash Flow Based Approach
 - Relative Company Valuation
35. Value of firm arrived by discounting cash flows of core operations = Rs.1,000 lacs; Value of debt = Rs.200 lacs; Market value of non-core assets = Rs.100 lacs. How much is the intrinsic value of equity?
- Rs.900 lacs

- b. Rs.700 lacs
 - c. Rs.800 lacs
 - d. Rs.1,100 lacs
36. PAT = 10,000 lacs; Interest paid = 4,000 lacs; Tax rate = 40%; Capital expenditure is offset by depreciation and there is no change in working capital. Debt repayment = 2,000 lacs. How much is FCFE?
- a. 8,000 lacs
 - b. 10,000 lacs
 - c. 12,400 lacs
 - d. 10,400 lacs
37. Existing PAT of company = 10,00,000; Tax rate = 50%; Extraordinary income included in profit computation = 5,00,000; Profit of new product = 20,00,000; How much is the future maintainable profit after tax?
- a. 20,00,000
 - b. 22,50,000
 - c. 17,50,000
 - d. 15,00,000
38. The founders of a small technology firm are seeking a \$3 million venture capital investment from prospective investors. The founders project that their firm could be sold for \$25 million in 4 years. The private equity investors deem a discount rate of 25% to be appropriate, but believe there is a 20% chance of failure in any year. The adjusted pre-money valuation (PRE) of the technology firm is closest to (in millions):
- a. 7.24 million
 - b. 1.19 million
 - c. 4.19 million
 - d. 7.19 million
39. Which valuation method is most appropriate for a startup company that has not yet generated consistent earnings but has a disruptive technology?
- a. Net Realizable Value Method
 - b. Replaceable Value Method
 - c. Cash Flow Based Approach
 - d. Relative Company Valuation
40. ABC Limited is currently going through financial distress. Value of ABC Limited (if it was unlevered) = Rs.100 crores; Amount of debt = Rs.50 crores; Tax rate = 30%; Distress sale value = Rs.40 crores; Probability of distress = 40%. How much is the fair value of equity of ABC Limited using APV approach?
- a. Rs.91 crores
 - b. Rs.41 crores
 - c. Rs.76 crores
 - d. Rs.26 crores
41. A Limited made a gross profit of Rs.10,00,000 and incurred indirect expenses of Rs.4,00,000. The number of issued equity shares is 1,00,000. The company has a debt of Rs.3,00,000 and Reserves to the tune of Rs.5,00,000. Capitalization rate is 11.25%. Compute the per share earning value of company?
- a. Rs.53.33 per share
 - b. Rs.50.33 per share
 - c. Rs.55.33 per share
 - d. Rs.6.00 per share

42. The cost of equity is 20 percent and cost of debt is 10 percent. WACC based on book value weights is 12 percent. The value of equity is thrice its book value, whereas the market value of its debt is nine-tenths of its book value. What is WACC based on market value weights?
- 12 percent
 - 15 percent
 - 14.55 percent
 - 16 percent
43. Earning after tax = Rs.600 lacs; One-time incomes after tax = Rs.200 lacs; One-time expenses = Rs.100 lacs; Depreciation = Rs.50 lacs. How much is the free cash flow for valuation under cash flow-based approach of valuation?
- Rs.650 lacs
 - Rs.450 lacs
 - Rs.550 lacs
 - Rs.750 lacs
44. Current market capitalization of company = 40,00,000. Promoters hold 40 percent of the company. No of shares of the company = 1,00,000. Promoters and their family members are part of top management and are currently over-paid. They had received excess remuneration of Rs.2,00,000 per year and the present value of these remuneration for infinite period is Rs.15,00,000. How much should be the minimum price per share paid by target company for the promoters to relinquish their controlling interest?
- Rs.40 per share
 - Rs.45 per share
 - Rs.77.50 per share
 - Rs.80.00 per share
45. When using the Venture Capital Method, which factor contributes to a higher valuation for the startup?
- Higher risk associated with the startup's industry
 - Lower expected future earnings
 - Longer time to exit
 - Higher projected exit multiple
46. In a rapidly changing industry with significant technological advancements, which valuation method is likely to be less reliable due to difficulties in accurately estimating future cash flows?
- Net Asset Value Method
 - Net Realizable Value Method
 - Replaceable Value Method
 - PE Ratio Method
47. Enterprise value = Rs.40,00,000; Value of debt = Rs.10,00,000; Value of cash and cash equivalents = Rs.5,00,000. How much is the value of equity?
- 45,00,000
 - 35,00,000
 - 55,00,000
 - 25,00,000
48. T Ltd. Recently made a profit of Rs. 50 crore and paid out Rs. 40 crore (slightly higher than the average paid in the industry to which it pertains). The average PE ratio of this industry is 9. As per Balance Sheet of T Ltd., the shareholder's fund is Rs. 225 crore and number of shares is 10 crore. In case company is liquidated, building would fetch Rs. 100 crore more than book value and stock would realize Rs. 25 crore less. What would be the value of company as per Net realizable value method?

- a. Rs.225 Crores
 - b. Rs.350 Crores
 - c. Rs.325 Crores
 - d. Rs.300 Crores
49. Total assets = 4,000 lacs; Current liabilities = 1,000 lacs; Revenues of the company will grow at 20 percent. How much would be the overall funding requirement to finance growth?
- a. 800 lacs
 - b. 1,000 lacs
 - c. 600 lacs
 - d. 1,200 lacs
50. A private equity investor makes a \$5 million investment in a venture capital firm today. The investor expects to sell the firm in four years. He believes there are three equally possible scenarios at termination:
- Expected earnings will be \$20 million, and the expected P/E will be 10.
Expected earnings will be \$7 million, and the expected P/E will be 6
Expected earnings will be zero if the firm fails.
- The investor believes an IRR of 25% is appropriate. The expected terminal value and the investor's pre-money valuation, respectively, are closest to (in \$ million):
- a. 80.67 and 33.04
 - b. 80.67 and 28.04
 - c. 9.00 and 3.67
 - d. 80.67 and 38.04
51. Which of the following reasons makes the Discounted Cash Flow (DCF) method less suitable for valuing startups?
- a. DCF method assumes stable and predictable cash flows.
 - b. DCF method does not consider a startup's risk profile.
 - c. Startups often have negative cash flows in their early stages.
 - d. DCF method is only applicable to small businesses.
52. Monika is trying to value ChatApp, a Chat messaging app that currently has 16 million users but does not generate any revenues. She has identified that WhatsApp was recently valued at USD 450 Billion while having 450 million users. Considering the difference in size, Monika believes that a size discount of 95 percent should be applied while valuing ChatApp.
- a. USD 800 million
 - b. USD 16 Billion
 - c. USD 15.2 Billion
 - d. USD 450 Billion
53. Financial Leverage = 3 Times; The company has 11% debentures of Rs.400 lacs. How much is the EBIT of the company?
- a. 44 lacs
 - b. 132 lacs
 - c. 66 lacs
 - d. 88 lacs
54. Book value of equity capital = 200 lacs; Reserves and surplus = 400 lacs; Amount of debt = 150 lacs. Face value of each share is Rs.10 and MPS is Rs.50. How much is market value added?
- a. 750 lacs
 - b. 400 lacs
 - c. 800 lacs
 - d. 650 lacs

55. Pre-tax cost of debt = 12%; Cost of equity = 16%; Debt/assets ratio = 0.4 Times. Compute WACC if tax rate is 25%?
- 14.40 percent
 - 13.20 percent
 - 14.86 percent
 - 14 percent
56. Book value of assets = 2,000 lacs; Replacement cost of assets = 6,000 lacs. What is capital employed for the purpose of EVA computation?
- 6,000 lacs
 - 2,000 lacs
 - 4,000 lacs
57. Which parameter can help in assessing the performance of the management of the company?
- EPS
 - MPS
 - EVA
58. The company reported EBIT of 2,000 lacs. The same has been after writing off training expense of 500 lacs. The benefit of training will be there for five years. What is the adjusted EBIT for computing EVA?
- 2000 lacs
 - 2500 lacs
 - 2400 lacs
 - 1900 lacs
59. The company has reported EVA of Rs.20,00,000 and has 5,00,000 equity shares. How much the company can declare as dividend per share before the value of the company would start to decrease?
- Company cannot declare any extra dividend
 - Rs.2 per share
 - Rs.8 per share
 - Rs.4 per share
60. What is the major issue in valuation of start-up?
- Non-availability of historical data for doing valuation
 - Most of the start-ups are not having positive cash flows
 - Unique value driver for each start-up
 - All of the above
61. A private equity firm is guaranteed to receive 80% of the residual value of a leveraged buyout investment, with the remaining 20% owing to management. The initial investment is Rs.500 crores, and the deal is financed with 70% debt and 30% equity. The projected multiple is 2.0. The equity component consists of: Rs.120 crores preference shares. Rs.25 crores private equity firm equity and Rs.5 crores management equity.
At exit in 5 years the value of debt is Rs.150 crores and the value of preference shares is Rs.300 crores. The payoff multiple for the private equity firm and for management, respectively, is closest to:
- 3.03 and 11
 - 6.34 and 46
 - 4.23 and 24
 - 5.10 and 22

62. Pre-tax cost of debt = 12%; Cost of equity = 16%; Debt/equity ratio = 0.4 Times. Compute WACC if tax rate is 25%?
- 14.40 percent
 - 13.20 percent
 - 14 percent
 - 14.86 percent
63. Which of the following statements is true regarding the concept of going concern and non-going concern valuations?
- Going concern valuation ignores the company's intangible assets.
 - Non-going concern valuation places more emphasis on the company's current liabilities
 - Generally, the going-concern value of a firm will be greater than non-going concern value
64. The company has equity share capital of Rs.100 lacs. It has debt of Rs.200 lacs. The company has patent of Rs.100 which is not recorded in books. Cost of debt after tax is 8% and cost of equity is 14%. how much is WACC?
- 11%
 - 14%
 - 10%
 - 8%
65. When comparing valuation multiples of companies, which of the following factors should be taken into consideration to ensure accurate relative valuation analysis?
- Size of the target company's board of directors
 - Market capitalization of the benchmark index
 - Industry-specific characteristics and trends
 - Number of patents held by the target company
66. Current invested capital = Rs.80,00,000. Present value of future EVA = Rs.1,20,00,000. What is the value of the firm?
- 80 lacs
 - 120 lacs
 - 200 lacs
 - 40 lacs
67. Value of EBIT = 2,000 lacs; Tax Rate = 40%; Capital employed = 8,000 lacs; WACC = 10%.; How much is EVA?
- 2000 lacs
 - 800 lacs
 - 400 lacs
 - 1200 lacs
68. A private equity firm is considering an investment of Rs.17 crores in ABC Limited. ABC Limited's owners firmly believe that with PE investment they could develop their "wonder" drug and sell the firm in six years for Rs.120 crores. Given the project's risk, P&H believes a discount rate of 30% is reasonable. The pre-money valuation and PE's ownership is equal to:
- Rs.7.86 crores and 68%
 - Rs.24.86 crores and 68%
 - Rs.7.86 crores and 14%
 - Rs.24.86 crores and 14%
69. An asset-based valuation model is most appropriate for a company that:
- Is likely to be liquidated

- b. has a high proportion of intangible assets among its total assets
 c. is expected to remain profitable for the foreseeable future

Answer:

1.	Market value added = Market value of firm - Book value of firm - Market value of firm = Market value of equity (1,000 lacs) + Market value of debt (2,000 lacs) = 12,000 lacs - Book value of firm = Book value of equity (4,000 lacs) + Book value of debt (2,000 lacs) = 6,000 lacs - Market value added = 12,000 lacs - 6,000 lacs = Rs.6,000 lacs																
2.	- Networth = Total assets - Fictitious assets - Sundry creditors - Short-term debt - long-term debt - Preference capital - Networth = 25,00,000 - 5,00,000 - 2,00,000 - 1,00,000 - 2,00,000 - 4,00,000 = Rs.11,00,000 Net asset value per share = $\frac{\text{Networth}}{\text{Number of shares}} = \frac{11,00,000}{1,00,000} = \text{Rs. 11.00 per share}$																
3.	Comparable Transaction Analysis																
4.	To determine the startup's current market value																
5.	$\text{ROI} = \frac{\text{Closing value} - \text{Amount invested}}{\text{Average investment}} = \frac{1,50,000 - 1,20,000}{\frac{1,00,000 + 1,20,000}{2}} = \frac{30,000}{1,10,000} = 27.27\%$																
6.	PBT = 200 lacs - 150 lacs = 50 lacs Tax = PBT - PAT = 50 lacs - 30 lacs = 20 lacs Tax rate = $\frac{\text{Tax}}{\text{PBT}} = \frac{20 \text{ lacs}}{50 \text{ lacs}} = 40.00\%$																
7.	Book value of firm = 10,00,000 + 40,00,000 = Rs.50,00,000 Market value of firm = 1,00,000 shares x 80 = Rs.80,00,000 Market value added = 80,00,000 - 50,00,000 = Rs.30,00,000																
8.	Market value to sales ratio for Company A = $\frac{400}{500} = 0.80$ Times Market value to sales ratio for company B = $\frac{450}{600} = 0.75$ Times Market value to sales ratio for company C = $\frac{0.80 \text{ and } 0.75}{2} = 0.775$ Times Market value of company C = 800 x 0.775 = 620																
9.	Company A carries more risk as reflected in higher debt. Company B carries less risk and hence PE Multiple of B Limited will be higher than PE Multiple of A Limited																
10.	Revenues of year 1, 2 and 3 = Rs.4800, Rs.5760 and Rs.6336 lacs. Working capital of year 1, 2 and 3 = Rs.1200, Rs.1440 and Rs.1584 lacs [25% of revenues]; Increase in working capital of year 3 = 1584 lacs - 1440 lacs = 144 lacs																
11.	Computation of FCFF: <table border="1"> <thead> <tr> <th>Particulars</th><th>Amount (in lacs)</th></tr> </thead> <tbody> <tr> <td>EBIT/EBT</td><td>200.00</td></tr> <tr> <td>Less: Interest</td><td>-60.00</td></tr> <tr> <td>EAT</td><td>140.00</td></tr> <tr> <td>Add: Depreciation</td><td>20.00</td></tr> <tr> <td>Less: Capital expenditure (Beginning of year 2 is end of year 1)</td><td>-50.00</td></tr> <tr> <td>Add: Decrease in working capital</td><td>20.00</td></tr> <tr> <td>FCFF</td><td>130.00</td></tr> </tbody> </table>	Particulars	Amount (in lacs)	EBIT/EBT	200.00	Less: Interest	-60.00	EAT	140.00	Add: Depreciation	20.00	Less: Capital expenditure (Beginning of year 2 is end of year 1)	-50.00	Add: Decrease in working capital	20.00	FCFF	130.00
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14.	The residual value of a company beyond the forecast period																

15.	It provides a structured framework for assessing startup value																										
16.	Fixed asset turnover ratio is maintained and hence if revenues go up by 20 percent, then fixed assets will also increase by 20 percent; Closing fixed assets = 10,000 lacs + 20% = 12,000 lacs; Gross capex = 12,000 lacs - 9,000 lacs (opening WDV - Depreciation) = 3,000 lacs																										
17.	FCFF, cost of capital, FCFE and cost of equity																										
18.	Net assets value method																										
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20.	Let us assume no of shares of both companies to be 100 Shares issued as consideration = $100 \times \frac{1}{2} = 50$ Consideration paid = 10,000 lacs x $\left(\frac{50}{150}\right) = 3,333$ lacs																										
21.	Value per share = $\frac{\text{Realizable value of assets} - \text{liquidation expenses} - \text{liabilities}}{\text{Number of shares}}$ Value per share = $\frac{16,00,000 - 1,00,000 - 4,00,000}{1,00,000} = 11.00$ per share																										
22.	<table><tr><th>Particulars</th><th>R Limited</th><th>S Limited</th><th>Combined entity</th></tr><tr><td>Residual net cash flow</td><td>90,10,000</td><td>54,87,000</td><td>1,85,00,000</td></tr><tr><td>Cost of equity</td><td>13.75%</td><td>13.05%</td><td>12.50%</td></tr><tr><td>Growth rate</td><td>0%</td><td>0%</td><td>0%</td></tr><tr><td>Value of company $\left[\frac{\text{Net cash flow}}{K_e - G}\right]$</td><td>6.55 cr</td><td>4.20 cr</td><td>14.80 cr</td></tr></table> Consideration payable = Post-merger value of merged firm - Pre-merger value of S Limited Consideration payable = 14.80 crores - 4.20 crores = Rs.10.60 Crores	Particulars	R Limited	S Limited	Combined entity	Residual net cash flow	90,10,000	54,87,000	1,85,00,000	Cost of equity	13.75%	13.05%	12.50%	Growth rate	0%	0%	0%	Value of company $\left[\frac{\text{Net cash flow}}{K_e - G}\right]$	6.55 cr	4.20 cr	14.80 cr						
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23.	Startups often have unique and irreplaceable assets																										
24.	EVA = 2.5% of capital employed; 4 crores = 2.5% of CE; $CE = \frac{4 \text{ crores}}{2.50\%} = 160$ crores WACC = 7.50%; Hence NOPAT = 10% of CE = 10% x 160 crores = 16 Crores																										
25.	Value = [Going concern value x Probability of survival] + [Distress value x Probability of default] Value = [100 x 40%] + [50 x 60%] = Rs. 70 crores																										
26.	It positively impacts valuation by attracting socially responsible investors and reducing risk																										
27.	<table><tr><th>Particulars</th><th>Division A</th><th>Division B</th><th>Division C</th></tr><tr><td>Sales/EBITDA/OI</td><td>4,00,000</td><td>1,50,000</td><td>2,00,000</td></tr><tr><td>Relevant multiple</td><td>10.00</td><td>20.00</td><td>25.00</td></tr><tr><td>Value of Division</td><td>40,00,000</td><td>30,00,000</td><td>50,00,000</td></tr></table> Value of Reliance Limited = 40,00,000 + 30,00,000 + 50,00,000 = Rs.1,20,00,000	Particulars	Division A	Division B	Division C	Sales/EBITDA/OI	4,00,000	1,50,000	2,00,000	Relevant multiple	10.00	20.00	25.00	Value of Division	40,00,000	30,00,000	50,00,000										
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28.	Value of equity of automobile division = 1,000 crores - 600 crores = Rs.400 crores. The company is receiving consideration of Rs.450 crores and hence ABC Limited can go ahead with automobile division.																										
29.	Initial outflow = Share issued + debentures issued + cash paid = 8,00,000 + 4,00,000 + 6,00,000 = Rs.18,00,000																										
30.	<table><tr><th>Particulars</th><th>Calculation</th><th>Amount (in lacs)</th></tr><tr><td>Existing PAT</td><td></td><td>77</td></tr><tr><td>Existing PBT</td><td>77 lacs/(1-0.3)</td><td>110</td></tr><tr><td>Less: Extraordinary income</td><td></td><td>(8)</td></tr><tr><td>Add: Extraordinary loss</td><td></td><td>10</td></tr><tr><td>Profit from new product</td><td>70 - 20 - 12 - 10</td><td>28</td></tr><tr><td>Future maintainable PBT</td><td></td><td>140</td></tr><tr><td>Future maintainable PAT</td><td>140 x 70%</td><td>98</td></tr></table>	Particulars	Calculation	Amount (in lacs)	Existing PAT		77	Existing PBT	77 lacs/(1-0.3)	110	Less: Extraordinary income		(8)	Add: Extraordinary loss		10	Profit from new product	70 - 20 - 12 - 10	28	Future maintainable PBT		140	Future maintainable PAT	140 x 70%	98		
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31.	FCFF = EPS + Depreciation - Capital expenditure - Working capital																										

	FCFF = 10 + 4 - 5 - 4 = 5 per share																																		
32.	Capitalization rate = $\frac{\text{EPS}}{\text{Share price}} = \frac{10}{100} = 10.00\%$ Value of business = $\frac{\text{Expected Annual Maintainable Profit}}{\text{Capitalization rate}} = \frac{20,00,000}{10\%} = 2,00,00,000$																																		
33.	Comparable public company valuations																																		
34.	Realizable value method																																		
35.	Intrinsic value of equity = Value of firm - value of debt + Value of non-core assets Intrinsic value of equity = 1,000 - 200 + 100 = Rs.900 lacs																																		
36.	FCFE = PAT + Depreciation - Capex - working capital - repayment of loan FCFE = 10,000 + 0 - 0 - 0 - 2,000 = 8,000 lacs																																		
37.	Existing PBT = $\frac{10,00,000}{50\%} = 20,00,000$ Extraordinary income will not continue and hence the same is removed. Revised PBT is Rs.15,00,000. New product will make profits of Rs.20,00,000 and hence FMP (before tax) is Rs.35,00,000. Future maintainable profit (after tax) = Rs.17,50,000																																		
38.	Expected cash flow in year 4 = 25 million x 0.8 ⁴ = 10.24 million Current post – money valuation = $\frac{10.24}{1.25^4} = 4.19$ million Pre – money valuation = 4.19 million – 3 million = 1.19 million																																		
39.	Cash Flow Based Approach Explanation: The Cash Flow Based Approach focuses on the company's expected future cash flows. For a startup with disruptive technology, projecting future cash flows is essential to determine its potential value, making this approach suitable.																																		
40.	Expected bankruptcy cost = [100 crores - 40 crores] x 40% = Rs.24 crores Value of ABC Limited = Unlevered firm + Tax benefit on debt - Bankruptcy cost Value of ABC Limited = 100 crores + (50 crores x 30%) - 24 Crores = Rs.91 Crores Value of equity = 91 crores - 50 crores = Rs.41 Crores																																		
41.	<table><tr><th>Particulars</th><th>Amount</th></tr><tr><td>Gross profit</td><td>10,00,000</td></tr><tr><td>Less: Indirect expenses</td><td>-4,00,000</td></tr><tr><td>EBITDA</td><td>6,00,000</td></tr><tr><td>Earning value of company (6,00,000/11.25%)</td><td>53,33,333</td></tr><tr><td>Number of shares</td><td>1,00,000</td></tr><tr><td>Earning value per share</td><td>53.33</td></tr></table>	Particulars	Amount	Gross profit	10,00,000	Less: Indirect expenses	-4,00,000	EBITDA	6,00,000	Earning value of company (6,00,000/11.25%)	53,33,333	Number of shares	1,00,000	Earning value per share	53.33																				
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42.	Identification of book value weights: <table><tr><th>Source</th><th>cost</th><th>Weight</th><th>Product</th></tr><tr><td>Equity</td><td>20</td><td>X</td><td>20X</td></tr><tr><td>Debt</td><td>10</td><td>1-X</td><td>10-10X</td></tr><tr><td>Total</td><td>12</td><td>1</td><td>20X+10-10X = 12</td></tr></table> 20X + 10 – 10X = 12; 10X = 2; X = 0.2 Times - Hence the weight of equity is 20% and weight of debt is 80% Computation of WACC with market value weights: - Weight of equity = 0.20 x 3 = 0.60 Times - Weight of debt = 0.80 x (9/10) = 0.72 Times <table><tr><th>Source</th><th>cost</th><th>Weight</th><th>Product</th></tr><tr><td>Equity</td><td>20</td><td>0.60</td><td>12.00</td></tr><tr><td>Debt</td><td>10</td><td>0.72</td><td>7.20</td></tr><tr><td>Total</td><td></td><td>1.32</td><td>19.20</td></tr></table> WACC = $\frac{19.20}{1.32} = 14.55\%$			Source	cost	Weight	Product	Equity	20	X	20X	Debt	10	1-X	10-10X	Total	12	1	20X+10-10X = 12	Source	cost	Weight	Product	Equity	20	0.60	12.00	Debt	10	0.72	7.20	Total		1.32	19.20
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43.	Free cash flow needs to adjusted for one-off items which are not likely to recur in future Free cash flow = 600 lacs – 200 lacs + 100 lacs + 50 lacs = Rs.550 lacs																																		
44.	Minimum compensation for promoters = Value of shares held (16,00,000) + Value of excess remuneration (15,00,000) = Rs.31,00,000																																		

	Minimum price per share = $\frac{31,00,000}{40,000 \text{ shares}}$ = Rs. 77.50 per share																						
45.	Higher projected exit multiple																						
46.	PE Ratio Method																						
47.	Enterprise value = Value of equity + Value of debt - Amount of cash 40,00,000 = Value of equity + 10,00,000 - 5,00,000 35,00,000 = Value of equity																						
48.	Net realizable value = Rs.225 Crores + 100 Crores - 25 Crores = Rs.300 Crores																						
49.	Revenue increased by 20 percent and hence company will need additional assets to fund growth. Capital employed of company will increase by 20 percent to fund this growth. Capital employed = 4,000 lacs - 1,000 lacs = 3,000 lacs; Fund required = Increase in capital employed = 3,000 lacs x 20% = Rs.600 lacs																						
50.	Terminal value = $\frac{(20 \times 10) + (7 \times 6) + 0}{3}$ = 80.67 Post-money value = $\frac{80.67}{1.25^4}$ = 33.04 Pre-money value = 33.04 - 5.00 = 28.04 Hence answer is 80.67 million and 28.04 million																						
51.	Startups often have negative cash flows in their early stages.																						
52.	Value of one user of whatsapp = $\frac{450 \text{ billion}}{450 \text{ million}}$ = USD 1,000 per user Relevant multiple for chatapp = 1,000 - 95% = USD 50 per user Value of chatapp = 16 million x 50 = USD 800 million																						
53.	Financial leverage = $\frac{\text{EBIT}}{\text{EBT}}$ EBIT is taken as X; Interest = 400 x 11% = 44 lacs; EBT = X - 44 lacs 3 Times = $\frac{X}{X - 44}$; 3X - 132 = X; 2X = 132; X = 66 lacs. Hence EBIT is equal to 66 lacs																						
54.	- Market value added = Market value of firm - Book value of firm - Market value of firm = (200/10 x 50) + 150 = 1,150 lacs - Book value of firm = 200 + 400 + 150 = 750 lacs - Market value added = 1,150 lacs - 750 lacs = 400 lacs																						
55.	Cost of debt = 12 x (1 - 25%) = 9%; Cost of equity = 16% WACC = [9% x 40%] + [16% x 60%] = 13.20%																						
56.	Capital employed has to be on the basis of economic value of assets and the same would be equal to replacement cost of assets of 6,000 lacs																						
57.	EVA. Positive EVA would indicate good performance of management and vice versa																						
58.	Adjusted EBIT = 2,000 lacs + 500 lacs (Training added back as the same is an asset) - 100 (economic depreciation as the life is 5 years) = 2,400 lacs																						
59.	EVA amount can be declared as dividend without any impact on the valuation of the company EVA Dividend = $\frac{20,00,000}{5,00,000 \text{ shares}}$ = Rs. 4 per share																						
60.	All of the above																						
61.	Answer is 5.10 and 22.0 <table border="1"> <thead> <tr> <th>Particulars</th><th>Amount</th></tr> </thead> <tbody> <tr> <td>Expected exit value (500 crores x 2)</td><td>1,000.00</td></tr> <tr> <td>Less: Payment of debt</td><td>-150.00</td></tr> <tr> <td>Less: Payment of preference</td><td>-300.00</td></tr> <tr> <td>Balance amount for management and PE</td><td>550.00</td></tr> <tr> <td>Amount payable to PE [550.00 x 80%]</td><td>440.00</td></tr> <tr> <td>Amount payable to management [550 x 20%]</td><td>110.00</td></tr> <tr> <td>Total consideration to PE [440 + 300 preference]</td><td>740.00</td></tr> <tr> <td>Amount contributed by PE [25 + 120]</td><td>145.00</td></tr> <tr> <td>Exit Multiple for PE [740/145]</td><td>5.10</td></tr> <tr> <td>Exit multiple for management [110/5]</td><td>22.00</td></tr> </tbody> </table>	Particulars	Amount	Expected exit value (500 crores x 2)	1,000.00	Less: Payment of debt	-150.00	Less: Payment of preference	-300.00	Balance amount for management and PE	550.00	Amount payable to PE [550.00 x 80%]	440.00	Amount payable to management [550 x 20%]	110.00	Total consideration to PE [440 + 300 preference]	740.00	Amount contributed by PE [25 + 120]	145.00	Exit Multiple for PE [740/145]	5.10	Exit multiple for management [110/5]	22.00
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62.	Cost of debt = 9 percent; Cost of equity = 16 percent WACC = $\frac{[9 \times 0.4] + [16 \times 1]}{0.4 + 1}$ = 14 percent																						

63.	Generally, the going-concern value of a firm will be greater than non-going concern value
64.	The company has equity capital of Rs.100 lacs. Value of equity will go up by Rs.100 lacs as the patent hasn't been recorded in books and hence revised equity value is Rs.200 lacs. The company has debt of Rs.200 lacs $WACC = \frac{8\% \times 200 + 14\% \times 200}{200 + 200} = 11\%$
65.	Industry-specific characteristics and trends
66.	Value of firm = Invested capital + Present value of future EVA = 80 lacs + 120 lacs = 200 lacs
67.	EVA = (EBIT × (1 - Tax Rate)) - (Capital employed × WACC) EVA = [2,000 × 60%] - [8,000 × 10%] = Rs.400 lacs
68.	Answer is Rs.7.86 Crores and 68% Post – money valuation of ABC Limited = $\frac{120 \text{ crores}}{(1 + 30\%)^6} = \text{Rs. 24.86 Crores}$ Pre-money valuation = 24.86 crores – 17 crores = Rs.7.86 Crores % stake acquired = $\frac{17}{24.86} \times 100 = 68.00\%$
69.	Is likely to be liquidated Explanation: For companies that are likely to be liquidated, the asset-based approach may be the most appropriate value as the assets may be worth more to another entity. Asset-based valuation models do not work well for companies that have large amounts of intangible assets. Because asset-based valuation is not forward-looking, an asset-based approach may underestimate the value of companies that are expected to be profitable.

Chapter 14 – Mergers, Acquisitions and Corporate Restructuring

1. Fixed Assets = 20,00,000; Current Assets = 30,00,000; 10% Loan = 2,00,000; Current liabilities = 8,00,000; P&L Debit Balance = 5,00,000; No of shares = 2,00,000. What is book value per share?
 - a. 20
 - b. 17.50
 - c. 25.00
 - d. 22.50
2. MPS of company A = 50; MPS of Company B = 20. Company A wants to acquire company B by paying premium of 25%. What is swap ratio based on market prices?
 - a. 50:20
 - b. 20:50
 - c. 25:50
 - d. 20:62.50
3. Which of the following statements accurately differentiates between a merger and an acquisition?
 - a. In a merger, two companies combine to form a new entity, while in an acquisition, one company absorbs another.
 - b. In a merger, one company acquires another, while in an acquisition, two companies combine to form a new entity.
 - c. Mergers and acquisitions are interchangeable terms and have the same meaning.
 - d. Mergers and acquisitions both involve the complete dissolution of one company.
4. Networth of Bank A = 100 lacs; CAR = 16%; Networth of Bank B = 200 lacs; CAR = 6%; What is Capital Adequacy Ratio of merged Bank?
 - a. 9.33%
 - b. 12.67%
 - c. 7.58%
 - d. None of the above
5. Advances of Bank A = 1000 lacs; GNPA (%) of Bank A = 20%; Advances of Bank B = 2,000 lacs; GNPA of Bank B = 100 lacs; What will be GNPA (%) of merged Bank?
 - a. 20%
 - b. 15%
 - c. 12.50%
 - d. 10.00%
6. A merger between a telecommunications company and a media company is an example of which type of merger?
 - a. Horizontal merger
 - b. Vertical merger
 - c. Conglomerate merger
 - d. Concentric merger
7. The primary rationale behind Company A's acquisition of Company B, a leading supplier of critical components, is to ensure a stable and uninterrupted supply chain. This rationale aligns with which aspect of M&A?
 - a. Consolidation of production capacities
 - b. Operating synergies
 - c. Diversification
 - d. Increasing market power

8. Cash flows of Company A = 25 lacs; Cash flows of company B = 20 lacs; Merger will lead to annual cash flows of 60 lacs due to synergy gain. Pre-merger cost of capital of A Limited = 10%; Pre-merger cost of capital of B Limited = 20%; Post-merger cost of Capital of merged entity = 8%. How much is the gain from merger?
- 400 lacs
 - 750 lacs
 - 75 lacs
 - 150 lacs
9. Cash flows of Company A = 25 lacs; Cash flows of company B = 20 lacs; Merger will lead to annual cash flows of 60 lacs due to synergy gain. Pre-merger cost of capital of A Limited = 10%; Pre-merger cost of capital of B Limited = 20%; Post-merger cost of Capital of merged entity = 8%. A Limited has acquired B Limited. Consideration paid for acquisition is Rs.150 lacs. How much is the gain for shareholders of B Limited?
- 150 lacs
 - 130 lacs
 - 50 lacs
 - 80 lacs
10. Company P, a leading pharmaceutical company, acquires Company Q, a smaller biotech firm, to gain access to its promising drug pipeline. This acquisition aligns with which rationale for M&A?
- Financial synergies
 - Increasing market power
 - Growth
 - Consolidation of production capacities
11. Cash flows of Company A = 40 lacs; Expected Cash flows of Company B for next year = 80 lacs; Valuation of Company B presently is Rs.800 lacs and company B is likely to grow at 10 percent. Post merger Company B will grow at 15 percent. How much should be the revised value for business of Company B?
- Rs.800 lacs
 - Rs.1,200 lacs
 - Rs.1,600 lacs
 - Rs.400 lacs
12. When a steel manufacturer acquires an iron ore mining company, what type of merger is this?
- Horizontal merger
 - Vertical merger
 - Conglomerate merger
 - Market extension merger
13. Existing MPS of A Limited = Rs.40; PE Multiple of A Limited = 20 Times; No of shares of A Limited = 1,00,000; Existing EPS of B Limited = Rs.10; No of shares of B Limited = 40,000. A Limited is acquiring B Limited by issue of shares and wants to report post-merger EPS of Rs.4. How many shares must A Limited issue to B Limited.
- 40,000 shares
 - 50,000 shares
 - 1,50,000 shares
 - 70,000 shares
14. A Limited is planning to acquire B Limited. Current share price of B Limited is Rs.10 and the same got increased by 20% on merger announcement. Post-merger EPS and MPS will be Rs.2 and Rs.25. Exchange ratio offered in merger is 0.8:1. Mr. X, an investor, having 10,000 shares of B Ltd. is having

another investment opportunity, which yields annual return of 12% is seeking your advise whether he needs to offload the shares in the market or accept the shares from A Limited.

- a. He should sell shares in market
 - b. He should accept merger offer
 - c. Indifferent between sales of shares and acceptance of merger offer
15. PE Multiple of A Limited = 20 Times; No of shares of A Limited = 1,00,000; PAT of A Limited = 25,00,000. PE Multiple of B Limited = 40 Times; No of shares of B Limited = 50,000; PAT of B Limited = 50,00,000. What is the weighted average PE Multiple if these two entities merge together?
- a. 30 Times
 - b. 26.67 Times
 - c. 33.33 Times
16. A Limited has acquired B Limited with a swap ratio of 1:2. Post-merger EPS is likely to be Rs.40. What is the equivalent EPS for shareholders of B Limited?
- a. Rs.20
 - b. Rs.40
 - c. Rs.80
17. Net profit margin = 4%; Assets to sales ratio = 0.80; Debt to assets ratio = 40%. How much is the ROE?
- a. 12.50%
 - b. 8.00%
 - c. 8.33%
 - d. 5.33%
18. A is acquiring B Limited. Pre-merger EPS of B Limited is Rs.10. Post-merger EPS of combined entity is Rs.25. The merger was done by issuing 4,00,000 shares to B Limited shareholders. Existing shares of B Limited is 10,00,000. What is the impact of merger on EPS for B Limited shareholders?
- a. Gain of Rs.15 per share
 - b. No gain or no loss
 - c. Gain of Rs.52.50 per share
 - d. Loss of RS.15 per share
19. _____ refers to the technique where the acquiring company accumulates larger number of shares in a target before making an open offer
- a. Brand Power
 - b. Street sweep
 - c. Bear Hug
 - d. Strategic Alliance
20. Value of acquiring company = Rs.1,000 lacs; Value of target company = Rs.600 lacs. Value of merged entity = Rs.2,000 lacs. The number of shares in both companies are same and exchange ratio offered is 1:2. How much is the NPV of stock offer?
- a. Rs.666.67 lacs
 - b. Rs.400 lacs
 - c. Rs.333.33 lacs
 - d. Rs.66.67 lacs
21. Gross NPA of Bank A = 40%; Gross NPA of Bank B = 20%. Number of shares of Bank A = 40,00,000. Bank B plans to acquire Bank A and exchange ratio is based on GNPA. How many shares are to be issued?
- a. 20,00,000
 - b. 40,00,000

- c. 80,00,000
22. Free float market cap = Rs.400 lacs. Promoters hold 80% of the company. There are total 10,00,000 shares in company. What will be the MPS?
- Rs.40
 - Rs.32
 - Rs.200
 - Rs.100
23. Company X, a conglomerate, decides to sell a significant portion of its shares in one of its subsidiaries to the public through an initial public offering (IPO). This form of divestiture is known as:
- Spin-off
 - Equity carve out
 - Demerger
 - Partial sell off
24. Gross profit = 20%. Inventory Turnover Ratio = 10 Times; Inventory = 2,00,000. How much is the sales of the company?
- Rs.20,00,000
 - Rs.16,00,000
 - Rs.25,00,000
 - Rs.24,00,000
25. A Limited is planning to acquire B Limited. MPS of A Limited and B Limited is 40 and 20. A Limited has estimated the intrinsic value of B Limited to be 30. What should be the exchange ratio on the basis of intrinsic value?
- 2:1
 - 1:2
 - 1.33:1
 - 1:1.33
26. EPS of company A = Rs.10; MPS of company A = Rs.100; EPS of company B = Rs.20; MPS of Company B = Rs.100; Company A plans to acquire company B and wants to maintain its EPS. What should be the exchange ratio.
- 1:1
 - 1:2
 - 2:1
27. A publicly traded company's board of directors, along with a private equity firm, decides to acquire all outstanding shares of the company's stock and take it off the stock exchange. This process is known as:
- Leveraged buyout
 - Equity buyback
 - Management buyout
 - Going private
28. What is the primary purpose of a Special Purpose Acquisition Company (SPAC)?
- To engage in any business activity specified in its memorandum of association.
 - To raise funds through an initial public offering (IPO) and subsequently identify and acquire target companies.
 - To provide venture capital to startups and emerging businesses.
 - To merge with an existing publicly traded company.

29. A Limited is acquiring B Limited. B Limited currently has 10 crores shares of Rs.50 each. A Limited plans to pay cash consideration of Rs.60 per share. How much is the gross cost and net cost of merger?
- Rs.500 crores and 0
 - Rs.600 crores and 0
 - Rs.600 crores and Rs.100 crores
 - Rs.500 crores and Rs.100 crores
30. A Limited will issue 1,00,000 shares as consideration to B Limited. B Limited currently has 30,00,000 shares comprising of 20,00,000 shares of Rs.10 each (fully paid) and 10,00,000 shares of Rs.10 each (partly paid of Rs.5). How many shares will be issued to Mr.A who holds 1,00,000 fully paid shares and 1,00,000 partly paid shares?
- 8,000 shares
 - 6,000 shares
 - 6,667 shares
 - 10,000 shares
31. Pre-merger MPS of A Limited = Rs.100; Pre-merger MPS of B Limited = Rs.200; A is acquiring B Limited and the expected post-merger MPS is Rs.150. Exchange ratio agreed is 2:1. What is the gain/loss per share for A Limited and B Limited shareholders?
- Gain of Rs.50 and Gain of Rs.100
 - Gain of Rs.50 and loss of Rs.50
 - Gain of Rs.50 and loss of Rs.100
 - Gain of Rs.100 and Gain of Rs.50
32. A Limited (Acquiring company) and B Limited (Target company) are negotiating a merger deal. Two ER are currently under negotiation 1:2 and 1:3. Acquiring company is stronger and would be able to get a better deal in negotiation. The final exchange ratio is likely to be closer to:
- 1:2
 - 1:3
 - 1:2.50
33. _____ is a tactic in which a target company offers to be acquired by a friendly company
- Poison Put
 - Poison Pill
 - White Knight
 - Greenmail
34. When two competing software companies in the same industry merge to enhance their market dominance, what type of merger is this?
- Horizontal merger
 - Vertical merger
 - Conglomerate merger
 - Market extension merger
35. A Limited is acquire B Limited. Exchange ratio offered is 1:2. Mr.X holds 10% of A Limited and 5% of B Limited. A Limited shareholders hold 60% of merged firm. What will be X's shareholding in merged firm?
- 7.50%
 - 8.00%
 - 8.33%
 - 15.00%

36. Company Z, a retail conglomerate, intends to separate its fashion brand subsidiary into a new, standalone company by distributing its shares to existing shareholders. This form of divestiture is known as:
- Spin-off
 - Demerger
 - Equity carve out
 - Partial sell off
37. Value of Acquiring Company = 1,000 lacs (10 lac shares x 100); Value of Target company = 500 lacs (50 lac shares x 10); Merger gain = 500 lacs. What is acceptable minimum and maximum exchange ratio?
- 0.0667:1 and 0.2000:1
 - 5:1 and 10:1
 - 0.5:1 and 1:1
38. Value of A Limited = 1000 lacs; Value of B Limited = 500 lacs; Synergy gain = 500 lacs; A is acquiring B Limited and exchange ratio agreed is 1:3. No of shares in both companies are same before merger. How much is the gross consideration paid?
- 500 lacs
 - 1000 lacs
 - 1500 lacs
 - 2000 lacs
39. Net cost of merger = 300 lacs; Pre-merger value of Acquiring company = 1500 lacs; Pre-merger value of Target company = 700 lacs. Number of shares both acquiring and target before merger is same. Synergy gain from merger is 300 lacs. What is the swap ratio agreed during merger?
- 0.8:1
 - 1:1
 - 0.67:1
 - 2:1
40. A private equity firm acquires a controlling stake in a company by using a combination of its own funds and borrowed money. This type of transaction is an example of a:
- Leveraged buyout
 - Equity buyback
 - Management buyout
 - Going private
41. Earnings of Target Company = Rs.75,00,000. Acquiring company plans to give cash consideration which will be funded with 15% loan. Tax rate is 30%. How much is the maximum consideration payable so the overall EPS of acquiring company is maintained?
- 500 lacs
 - 714.29 lacs
 - 1000 lacs
 - 250 lacs
42. Value of Acquiring Company (A Limited) = Rs.540 lacs; Value of Target Company (B Limited) = Rs.90 lacs. Synergy gain from merger = Rs.45 lacs; No of shares of A Limited = 30 lacs; No of shares of B Limited = 18 lacs; Exchange ratio = 1:3. How much is the consideration paid?
- Rs.180 lacs
 - Rs.225 lacs
 - Rs.112.50 lacs
 - Rs.90 lacs

43. A reverse merger is often used as a strategy for:
- Reducing competition in the industry
 - Expanding into new markets
 - Going public quickly and cost-effectively
 - Achieving economies of scale
44. A Limited plans to acquire B Limited. There is no synergy gain. A Limited wants to ensure that its earnings are not diminished by merger. What should be the basis of merger?
- EPS
 - MPS
 - BVPS
45. A Limited plans to acquire B Limited. There is no synergy gain. A Limited wants to ensure that its shareholders are not at loss in the merger. What should be the basis of merger?
- EPS
 - MPS
 - BVPS
46. Earnings of A Limited = 20,00,000; PE Multiple of A Limited = 10 Times; Earnings of B Limited = 40,00,000; PE Multiple of B Limited = 7.5 Times; Combined earnings will increase by 2,50,000 due to synergy gain benefits. What should be the minimum combined PE Multiple to justify the merger?
- 10 Times
 - 8.75 Times
 - 8.33 Times
 - 8 Times
47. No of shares of A Limited = 20,00,000; No of shares issued to B Limited shareholders in merger = 10,00,000; Post-merger value A Limited = Rs.300 lacs; What are the value of original shareholders of A Limited and B Limited?
- 150 lacs and 150 lacs
 - 200 lacs and 100 lacs
 - 100 lacs and 200 lacs
48. A company's board of directors decides to repurchase a portion of its own shares from the open market as part of a strategy to enhance shareholder value. This is an example of:
- Leveraged buyout
 - Equity buyback
 - Management buyout
 - Going private
49. Current book value per share = Rs.150. The company plans to make bonus issue of 2:1 and then split 100 rupees shares into 20 shares of 5 rupees each. What will be the book value per share post bonus issue and split respectively?
- 100 and 5
 - 50 and 2.5
 - 150 and 7.5
 - 20 and 1
50. _____ is a strategy aims at the target company making a counter bid for the acquirer company
- White squire
 - White knight

- c. Golden parachutes
- d. Pac-man defense

51. Last year earning of Acquiring company = 100 lacs; Growth rate = 10%; Last year earning of Target company = 50 lacs; Growth rate = 6%; Synergy gain due to merger = 10 lacs and the likely growth rate post merger is 12%. The companies have just paid dividends and retained earnings have already been re-invested in new projects. What is the likely PAT of merged firm for year 1?
- a. 178 lacs
 - b. 179.2 lacs
 - c. 173 lacs
 - d. 163 lacs
52. Promoters hold 90 percent of a company. They are planning to issue bonus shares to minority shareholders to bring holding down to 75 percent. What is the bonus ratio?
- a. 2:1
 - b. 1:2
 - c. 1.5:1
 - d. 1:1.5

Answer:

1.	Value of equity = Total assets - Outside liabilities Value of equity = 50,00,000 - 10,00,000 = 40,00,000 Book value per share = $\frac{40,00,000}{2,00,000} = 20$ per share Note: P&L debit balance is not considered as part of total assets in above computation and hence the same is not required to be deducted
2.	Base values = 50:20. The company wants to pay a premium of 25 percent and hence the base value for company B changes as 25 Swap ratio = 25:50
3.	In a merger, two companies combine to form a new entity, while in an acquisition, one company absorbs another
4.	Networth of Bank A = 100 lacs; CAR = 16%; Risk weighted assets = $\frac{100}{16\%} = 625$ lacs Networth of Bank B = 200 lacs; CAR = 6%; Risk weighted assets = $\frac{200}{6\%} = 3,333.33$ lacs Total Networth of merged bank = 300 lacs; Total risk weighted assets = Rs.3,958.33 lacs CAR = $\left(\frac{300}{3,958.33}\right) \times 100 = 7.58\%$
5.	GNPA of Bank A = 1000 lacs x 20% = Rs.200 lacs GNPA of Bank B = Rs.100 lacs GNPA (%) of merged Bank = $\frac{300 \text{ lacs}}{3,000 \text{ lacs}} = 10\%$
6.	Conglomerate merger Explanation: A conglomerate merger involves the combination of companies from different industries or sectors. In this case, the telecommunications company and media company operate in unrelated industries, making it a conglomerate merger
7.	Operating synergies
8.	Value of A Limited before merger = $\frac{25 \text{ lacs}}{10\%} = \text{Rs. } 250$ lacs Value of B Limited before merger = $\frac{20 \text{ lacs}}{20\%} = \text{Rs. } 100$ lacs Value of merged entity = $\frac{60 \text{ lacs}}{8\%} = \text{Rs. } 750$ lacs Merger gain = 750 lacs - 350 lacs = 400 lacs
9.	Value of B Limited before merger = $\frac{20 \text{ lacs}}{20\%} = \text{Rs. } 100$ lacs Consideration paid in merger = Rs.150 lacs

	Gain to shareholders of B Limited = 150 lacs - 100 lacs = Rs.50 lacs
10.	Growth
11.	Cost of equity of Company B = $\frac{80 \text{ lacs}}{800 \text{ lacs}} + 10\% = 20\%$ Revised growth rate = 15% Revised value = $\frac{80 \text{ lacs}}{20\% - 15\%} = \text{Rs. 1,600 lacs}$
12.	Vertical merger Explanation: A vertical merger occurs between companies at different stages of the same supply chain. In this case, the steel manufacturer (downstream) acquiring the iron ore mining company (upstream) is an example of a vertical merger.
13.	Current EPS of A Limited = $\frac{\text{MPS}}{\text{PE Multiple}} = \frac{40}{20} = \text{Rs. 2 per share}$ Current PAT of A Limited = 2 per share x 1,00,000 = Rs.2,00,000 Current PAT of B Limited = 10 x 40,000 = Rs.4,00,000 Post-merger PAT = 2,00,000 + 4,00,000 = Rs.6,00,000 Maximum shares for EPS of Rs. 4 = $\frac{6,00,000}{4} = 1,50,000$ Shares that can be issued in merger = 1,50,000 - 1,00,000 = 50,000 shares
14.	Earning yield of A Limited = $\frac{\text{Equivalent EPS}}{\text{CMP}} \times 100 = \frac{2 \times 0.8}{12} \times 100 = 13.33\%$ Earning Yield from A Limited is better than alternative investment opportunity and hence Mr.X should accept to merger offer
15.	Weighted average PE Multiple is to be computed on the basis of PAT of company Weighted average PE Multiple = $\frac{[20 \times 25,00,000 + 40 \times 50,00,000]}{[25,00,000 + 50,00,000]} = 33.33 \text{ Times}$
16.	Equivalent EPS = Post – merger EPS x Exchange ratio = $40 \times \left(\frac{1}{2}\right) = \text{Rs. 20 per share}$
17.	$\text{ROE} = \frac{\text{Net Profit}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Assets}} \times \frac{\text{Assets}}{\text{Equity}} = 4 \times \frac{1}{0.80} \times \frac{100}{60} = 8.33\%$ Debt is 40% of assets and hence equity will be 60% of assets. Therefore, we can say that equity is Rs.60 if assets is Rs.100. The same has been used in above formula to compute ROE.
18.	Equivalent EPS = $25 \times \left(\frac{4,00,000}{10,00,000}\right) = \text{Rs. 10 per share}$ Pre-merger EPS = Rs.10 per share Impact of merger on EPS = No gain or no loss
19.	Street Sweep
20.	Let us assume both companies are having 100 shares and hence the number of shares offered to target company is 50 ($100 \times \frac{1}{2}$). Consideration paid = 2,000 lacs x $\left(\frac{50}{150}\right) = \text{Rs. 666.67 lacs}$ True cost of merger = 666.67 lacs – 600 lacs = Rs. 66.67 lacs Gain from merger = 2,000 – (1,000 + 600) = Rs. 400 lacs NPV of merger = 400 – 66.67 = Rs. 333.33 lacs
21.	Base values = 20:40. Swapping is not required for negative parameter Shares to be issued = $40,00,000 \times \left(\frac{20}{40}\right) = 20,00,000 \text{ shares}$
22.	Free float market cap = 400 lacs; Shareholding by public = 20% Total market cap of company = $\frac{400 \text{ lacs}}{20\%} = \text{Rs. 2,000 lacs}$ MPS = $\frac{2,000 \text{ lacs}}{10 \text{ lacs}} = \text{Rs. 200 per share}$
23.	Equity carve out
24.	Inventory Turnover Ratio = $\frac{\text{COGS}}{\text{Inventory}}$; $10 = \frac{\text{COGS}}{2,00,000}$; COGS = 20,00,000 GP is 20% of sales and hence COGS is 80% of sales 20,00,000 = 80% of sales; Sales = $\frac{20,00,000}{80\%} = 25,00,000$

25.	Intrinsic value of B Limited is Rs.30. Intrinsic value of A Limited will be taken as the market price of A Limited in absence of information. Hence base values are 40:30 and exchange ratio will be 30:40 (or) 1:1.33																												
26.	Exchange ratio should be on the basis of EPS if the company wants to maintain EPS; Base values = 10:20; Exchange ratio = 20:10 (or) 2:1																												
27.	Going Private																												
28.	To raise funds through an initial public offering (IPO) and subsequently identify and acquire target companies.																												
29.	Gross cost of merger = 10 crores x 60 = Rs.600 crores Net cost of merger = 600 crores – 500 crores = Rs.100 Crores																												
30.	- Equivalent fully paid shares of B Limited = 20,00,000 + (10,00,000 x 0.50) = 25,00,000 - A Limited will be issuing 1,00,000 shares for 25,00,000 equivalent fully paid shares - No of equivalent fully paid shares held by Mr.A = 1,00,000 + (1,00,000 x 0.50) = 1,50,000 shares $\text{No of shares issued} = \frac{1,00,000}{25,00,000} \times 1,50,000 = 6,000 \text{ shares}$																												
31.	Gain for A Limited = Post-merger MPS - Pre-merger MPS = 150 - 100 = Rs.50 Gain for B Limited = Equivalent MPS - Pre-merger MPS = 300 - 200 = Rs.100																												
32.	Acquiring company is stronger company and they would like to pay a lower consideration in merger. Two exchange ratios under discussion is 0.5:1 (1:2) and 0.33:1 (1:3). Final exchange ratio will be closer to lower limit of 1:3 or 0.33:1.																												
33.	White Knight																												
34.	Horizontal merger																												
35.	<table><tr><th>Shareholders</th><th>Total Shares</th><th>% holding</th><th>Shares held by Mr.X</th></tr><tr><td>A Limited shareholders</td><td>60</td><td>10%</td><td>6 shares [60 x 10%]</td></tr><tr><td>B Limited shareholders</td><td>40</td><td>5%</td><td>2 shares [40 x 5%]</td></tr><tr><td>Total shares</td><td>100</td><td>8% [8/100]</td><td>8 shares</td></tr></table>					Shareholders	Total Shares	% holding	Shares held by Mr.X	A Limited shareholders	60	10%	6 shares [60 x 10%]	B Limited shareholders	40	5%	2 shares [40 x 5%]	Total shares	100	8% [8/100]	8 shares								
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36.	Spin-off																												
37.	Value of merged firm = 1000 lacs + 500 lacs + 500 lacs = 2,000 lacs Minimum exchange ratio: <table><tr><th>Particulars</th><th>Value</th><th>No of shares</th></tr><tr><td>Value of acquiring company</td><td>1,500 lacs</td><td>10,00,000</td></tr><tr><td>Value of target company</td><td>500 lacs</td><td>3,33,333 $\left(10,00,000 \times \frac{500}{1500}\right)$</td></tr><tr><td>Value of merged entity</td><td>2,000 lacs</td><td>13,33,333</td></tr></table> - Minimum exchange ratio is based on minimum consideration of Rs.500 lacs (Pre-merger value of target company) ER = 3,33,333:50,00,000 (or) 0.0667:1 Maximum Exchange ratio: <table><tr><th>Particulars</th><th>Value</th><th>No of shares</th></tr><tr><td>Value of acquiring company</td><td>1,000 lacs</td><td>10,00,000</td></tr><tr><td>Value of target company</td><td>1,000 lacs</td><td>10,00,000</td></tr><tr><td>Value of merged entity</td><td>2,000 lacs</td><td>20,00,000</td></tr></table> - Maximum exchange ratio is based on maximum consideration of Rs.1,000 lacs. - Maximum consideration = Post-merger value – pre-merger value = 2,000 lacs – 1,000 lacs = Rs.1,000 lacs ER = 10,00,000:50,00,000 (or) 0.20:1					Particulars	Value	No of shares	Value of acquiring company	1,500 lacs	10,00,000	Value of target company	500 lacs	3,33,333 $\left(10,00,000 \times \frac{500}{1500}\right)$	Value of merged entity	2,000 lacs	13,33,333	Particulars	Value	No of shares	Value of acquiring company	1,000 lacs	10,00,000	Value of target company	1,000 lacs	10,00,000	Value of merged entity	2,000 lacs	20,00,000
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38.	Post-merger value = 1000 lacs + 500 lacs + 500 lacs = 2,000 lacs Let us assume no of shares in both companies are 300. Exchange ratio agreed is 1:3 and hence we would have issued 100 shares for merger; No of shares post merger = 400																												

	Value of shares issued = $2,000 \text{ lacs} \times \left(\frac{100}{400}\right) = \text{Rs. } 500 \text{ lacs}$
39.	Consideration paid = Net cost of merger + pre-merger value = 300 lacs + 700 lacs = 1,000 lacs Value of merged entity = 1500 lacs + 700 lacs + 300 lacs = 2500 lacs; Let us assume that both company had 60 shares each before merger. % of company held by target company shareholders = $\frac{1,000 \text{ lacs}}{2,500 \text{ lacs}} = 40\%$ So, acquiring company shareholders hold 60 percent of company and they have 60 shares. Target company shareholders would have been given 40 shares for 40 percent holding; Exchange ratio = 40:60 (or) 2:3 (or) 0.67:1
40.	Leveraged buyout
41.	The company can maintain EPS if the post-tax interest cost on bank borrowing is equal to total earnings of target company; After-tax cost of debt = $15 \times 70\% = 10.50\%$ Maximum borrowing = $\frac{75 \text{ lacs}}{10.5\%} = \text{Rs. } 714.29 \text{ lacs}$
42.	Value of merged firm = 540 lacs + 90 lacs + 45 lacs = Rs.675 lacs Post – merger price = $\frac{675 \text{ lacs}}{30 \text{ lacs} + 6 \text{ lacs}} = \text{Rs. } 18.75 \text{ per share}$ Consideration paid = 6 lacs x 18.75 = Rs. 112.50 lacs
43.	Going public quickly and cost-effectively
44.	EPS
45.	Shareholders will not be at loss if pre-merger MPS is equal to post-merger MPS. Post-merger MPS will be maintained if the company's EPS is maintained. Company's EPS will be maintained if the exchange ratio is on the basis of EPS
46.	Pre-merger value of A Limited = 20 lacs x 10 = 200 lacs; Pre-merger value of B Limited = 40 lacs x 7.5 = 300 lacs; Hence combined firm should have minimum value of 500 lacs Earnings of combined firm = 20 lacs + 40 lacs + 2.5 lacs = 62.50 lacs PE Multiple to justify merger = $\frac{500 \text{ lacs}}{62.50 \text{ lacs}} = 8 \text{ Times}$
47.	Value of original shareholders refers to value of A Limited and B Limited shareholders in merged firm Value of A Limited shareholders = $20,00,000 \times \left(\frac{300 \text{ lacs}}{30 \text{ lacs}}\right) = 200 \text{ lacs}$ Value of B Limited shareholders = $10,00,000 \times \frac{300 \text{ lacs}}{30 \text{ lacs}} = 100 \text{ lacs}$
48.	Equity Buyback
49.	The company makes bonus issue of 2 shares for every 1 share. Hence Rs.150 share will become three shares of Rs.50. Under split one share of Rs.50 will be split into 20 shares and value of each share will be Rs.2.5
50.	Pac-man defense
51.	Earnings have already been reinvested and hence next year growth will be based on growth rate of individual companies Next year PAT = (100 lacs + 10%) + (50 lacs + 6%) + 10 lacs = 173 lacs
52.	Let us assume there are 100 shares in the company. Promoters currently hold 90 shares in company and minority shareholder hold 10 shares. Target holding of promoter is 75 percent and hence 90 shares would represent 75 percent holding. Overall shares post bonus = $\frac{90}{75\%} = 120$ We need to issue 20 shares as bonus and hence bonus ratio will be 20:10 (or) 2:1

Chapter 15 – Startup Finance

1. Which of the following best defines bootstrapping in the context of startups?
 - a. Securing venture capital funding to launch the business.
 - b. Utilizing personal savings and revenue to fund initial operations.
 - c. Collaborating with established corporations to share resources.
 - d. Initiating a crowdfunding campaign to raise capital.
2. Which funding method allows a startup to raise capital from a large number of individuals, typically through online platforms, in exchange for equity or rewards?
 - a. Family and Friends
 - b. Peer to peer lending
 - c. Crowdfunding
 - d. Microloans
3. What would be the risk perception of the seed money contributed by venture capital investors?
 - a. High
 - b. Medium
 - c. Low
 - d. Extreme
4. Which of the following is not true about Angel Investors?
 - a. Often, angel investors are among an entrepreneur's family and friends
 - b. Angel investors are focused on helping startups take their first steps, rather than the possible profit they may get from the business
 - c. Angel investors typically use their own money, unlike venture capitalists who use pooled money to invest
 - d. Angel investors can only be individuals
5. Which advantage of venture capital funding distinguishes it from traditional bank loans?
 - a. Lower interest rates and longer repayment terms.
 - b. Fixed repayment schedule with no equity dilution.
 - c. Minimal involvement and oversight from investors.
 - d. Access to mentorship, expertise, and industry connections.
6. Which of the following is not a characteristic of venture capital funding?
 - a. VC funding is usually for a long period
 - b. VC would be able to easily liquidate their holdings due to availability of many buyers for their stake
 - c. VC investments carry high risk
 - d. Majority of VC investments would be in the form of equity contribution
7. According to the Startup India scheme, what is the maximum age of an eligible startup to qualify for benefits?
 - a. 5 years
 - b. 7 years
 - c. 10 years
 - d. 15 years
8. Which funding approach involves a startup negotiating with its suppliers to delay payment for goods and services received?
 - a. Purchase order financing
 - b. Vendor Financing
 - c. Personal Financing

- d. Factoring Accounts Receivables
9. Which of the following is not true in the context of structure of venture capital fund?
- Domestic funds are established within the same country where investments are made, while offshore funds are established in foreign jurisdictions
 - Offshore funds (Unified structure) invest directly in Indian startups from a foreign entity, while the offshore structure involves investing in locally managed trust which in turn investments in Indian startups
 - Both domestic and offshore funds contribute to the growth and development of startups
10. Which type of entity is NOT eligible to be considered as a startup under the Startup India scheme?
- Private Limited company
 - Public Limited company
 - Registered partnership firm
 - Limited liability partnership
11. What is the primary distinction between venture capitalists (VCs) and angel investors?
- VCs invest exclusively in high-risk startups, while angel investors prefer established businesses.
 - Angel investors invest only in technology-based startups, while VCs fund a variety of industries.
 - Angel investors provide early-stage funding, often at the seed or startup phase, while VCs invest in later stages.
 - VCs are individual investors, while angel investors represent institutional funds
12. What is a potential drawback of venture capital funding for startups?
- Limited access to expertise and industry connections.
 - Minimal involvement in strategic decision-making by investors.
 - High level of control and autonomy retained by founders.
 - Equity dilution and loss of ownership stake for founders.
13. What is the maximum turnover limit for a startup to be eligible for benefits under the Startup India scheme?
- 10 crores
 - 100 crores
 - 25 crores
 - 50 crores
14. In which funding approach does a startup sell its outstanding invoices to a third party at a discount in exchange for immediate cash?
- Vendor financing
 - Purchase order financing
 - Factoring accounts receivables
 - Family and Friends
15. A Decacorn is a privately held start-up company which has achieved a valuation of _____
- Rs.100 crores
 - Rs.1,000 crores
 - USD 10 Million
 - USD 10 Billion
16. What is the primary purpose of the "Problem Statement" section in a startup pitch presentation?
- To highlight the founder's background and expertise.

- b. To showcase the startup's unique selling points.
 - c. To outline the market opportunity and potential growth.
 - d. To describe the pain points and challenges addressed by the startup's solution
17. Which of the following cannot be considered as a potential source of startup financing?
- a. Bank loans
 - b. Personal financing
 - c. Crowdfunding
 - d. Government grants
18. A Unicorn is a privately held start-up company which has achieved a valuation of _____
- a. Rs.100 crores
 - b. Rs.1,000 crores
 - c. USD 1 Million
 - d. USD 1 Billion
19. What is a key benefit of effective succession planning?
- a. Reducing the need for performance evaluations.
 - b. Creating a hierarchical leadership structure.
 - c. Enhancing employee engagement and retention.
 - d. Eliminating the need for cross-training.
20. What does the term "Burn Rate" refer to in the context of a startup pitch presentation?
- a. The rate at which a startup spends its available cash.
 - b. The speed at which a startup's revenue grows.
 - c. The time it takes for a startup to become profitable.
 - d. The valuation of a startup in its latest funding round.
21. In a startup pitch presentation, what does the term "TAM" stand for?
- a. Total Addressable Market
 - b. Target Audience Measurement
 - c. Total Available Margin
 - d. Time Allocation Management

Answer:

1.	Utilizing personal savings and revenue to fund initial operations
2.	Crowdfunding
3.	Extreme
4.	Angel investors can only be individuals Explanation: Though angel investors usually represent individuals, the entity that actually provides the fund may be a limited liability company, a business, a trust or an investment fund, among many other kinds of vehicles
5.	Access to mentorship, expertise and industry connections
6.	VC would be able to easily liquidate their holdings due to availability of many buyers for their stake
7.	10 years
8.	Vendor Financing
9.	Offshore funds (Unified structure) invest directly in Indian startups from a foreign entity, while the offshore structure involves investing in locally managed trust which in turn investments in Indian startups
10.	Public Limited Company
11.	Angel investors provide early-stage funding, often at the seed or startup phase, while VCs invest in later stages.
12.	Equity dilution and loss of ownership stake for founders

13.	100 crores
14.	Factoring accounts receivables
15.	USD 10 Billion
16.	To describe the pain points and challenges addressed by the startup's solution
17.	Government Grants
18.	USD 1 Billion
19.	Enhancing employee engagement and retention
20.	The rate at which a startup spends its available cash
21.	Total Addressable Market

He made students smile broader...

Success Galore in DJ' s wall

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Hello sir!
I took virtual classes of SFM from you and on your recommendation I purchased the SCMPE book. Your classes and your way of teaching is what every CA student needs. Thank you so so much for always being available to solve my doubts.

I practiced the classroom material and made notes of all the adjustments (something I carried forward for all the practical subjects). SFM was my most favourite subject, all thanks to you.
SCMPE- I was always sooo confused since I didn't know where to start or how much to practice...but your book was a blessing. It took me a lot of time to go through each chapter, but it was worth it. Definitely recommend it to all students.

Never met a teacher who is so selfless and dedicated to the success of students. Signed off

Good morning sir

My name is Priyanka Jain
I'm very happy to tell you that I have secured AIR 4 in CA final exam. Though I didn't attend your classes sir, but I followed your book.
You may not have seen me but you are one of my gurus sir. Without you it would not have been possible.
I bow down to your feet and seek your blessings sir.
Thank you so much. Always your student
Priyanka

Good morning sir!
I am Sreeraman. I attended your SFM Class, May 2019 batch. Happy to let you know that I cleared CA Final this November, with a score of 38.
I would like to thank you for the classes, workbooks, revision materials and revision videos on YouTube. They were very useful while preparing for the exams.
I used your SCMPE book also, to an extent.
Your materials (scmpe and sfm) capture a student's requirements very well (For example, summary of adjustments in your SCMPE book). I have always been inspired by your dedication and commitment.
Thanks for the time you had taken to guide me when I had doubts in the subject and for your other inputs.

I had watched all the revision videos more than two times sir.. Whenever I felt low and felt distracted, your voice in the video class, will make me brisk. I always felt your voice and video class are the best things I got in my life. I am really grateful to you sir.. You are a selfless person and guided me all through the way in this lockdown and entire 2020.



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