

OUTSCANNER

QUESTION BANK WITH VIDEO PODS

CA Final **AFM**
May 25 & onwards

CMA Final **SFM**
Jun 25 & onwards

with
MCQs

Adish Jain CA CFA



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Chartered Accountant (CA) &
Chartered Financial Analyst (CFA)

Ex-Morgan Staley & ICICI Securities with
2+ years work-ex in Equity Research

Teaches CA Final-AFM, CMA, CFA
and Financial Modelling

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**FAST AFM by
Adish Jain CA CFA**



Adish Jain CA CFA



+91 7045748955



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VIDEO-POD QUESTION BANK

$$\sigma_p^2 = (\sigma_A w_A)^2 + (\sigma_B w_B)^2 + 2\sigma_A w_A \sigma_B w_B \rho_{AB}$$

$$\sigma_p^2 = (\sigma_A w_A)^2 + (\sigma_B w_B)^2 + 2w_A w_B \rho_{AB}$$

In case of 3 securities in the portfolio:

$$\sigma_p^2 = (\sigma_A w_A)^2 + (\sigma_B w_B)^2 + (\sigma_C w_C)^2 + 2w_A w_B \rho_{AB} + 2w_A w_C \rho_{AC} + 2w_B w_C \rho_{BC}$$

Special Case of 2 securities, when r is equal to +1 and -1

Perfect Negative $r = -1$ $\rightarrow$ negative corr. $r = 0$ $\rightarrow$ positive corr. $r = +1$ $\rightarrow$ Perfect Positive

If we put $r = +1$ and -1 in the below formula of SD:

$$\sigma_p = \sqrt{(\sigma_A w_A)^2 + (\sigma_B w_B)^2 + 2\sigma_A w_A \sigma_B w_B \rho_{AB}}$$

For $r = -1$: $\sigma_p = \sigma_A w_A - \sigma_B w_B$

For $r = +1$: $\sigma_p = \sigma_A w_A + \sigma_B w_B$

$E(R_p) = E(R_A) \times w_A + E(R_B) \times w_B$

QUESTION 6:

RTP N 20

Mr. SG sold five 4-Month Nifty Futures on 1st February 2020 for ₹ 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.

Solution:

- Price of one future contract on 1st Feb, 2020

$$= \frac{900000}{5}$$

$$= ₹ 180000$$

- Calculation of Nifty Index Spot Price:

$$FP = SP \times [1 + (r - y) \times n] \times 75$$

$$180000 = SP \times [1 + (0.09 - 0.06) \times 4/12] \times 75$$

$$178218 = SP \times 75$$

$$2376.23 = SP$$

- Maximum contango/Backwardation

$$\text{spot} = 2376.23$$

$$\text{future} = 2400 (180000/75)$$

$$S < F$$

$$2376.23 < 2400 \therefore \text{market is in contango}$$

$$\text{Max. contango} = \text{Basis}$$

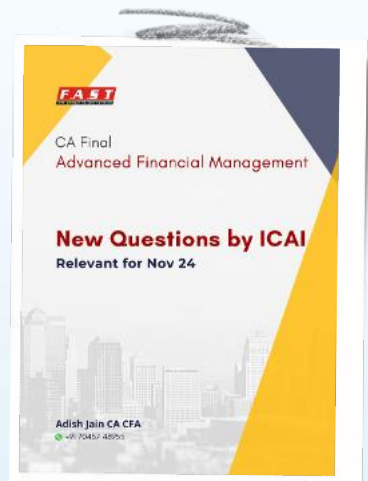
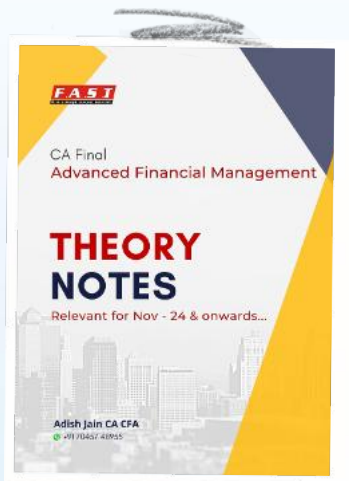
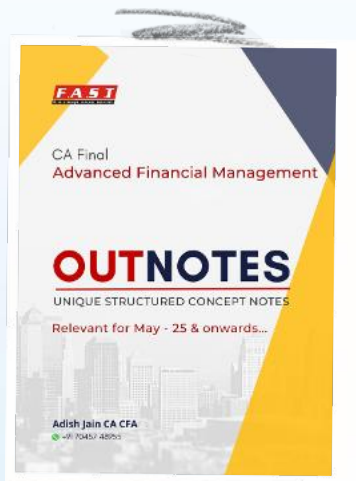
$$= S - F$$

Audio Solutions

UNIQUE STRUCTURED CONCEPT NOTES

NOTE:

This book has all the questions till November 24 exam. New questions of RTP and MTP are covered in this class



OutNotes vs. ICAI Chapters

No.	ICAI Chapter Name	OutNotes Chapter Name
1	Financial Policy and Corporate Strategy	Financial Policy and Corporate Strategy
2	Risk Management	Risk Management & Security Analysis
4	Security Analysis	
3	Advanced Capital Budgeting Decisions	Advanced Capital Budgeting Decisions
5	Security Valuation	Fixed Income Securities
	Preference Share Valuation	
	Bond Valuation	
	Money Market Securities	
	Equity Valuation	Equity & Business Valuation
13	Business Valuation	
6	Portfolio Management	Portfolio Management
7	Securitization	Securitization
8	Mutual Funds	Mutual Funds
9	Derivatives Analysis and Valuation	Derivatives & Interest Rate Risk Management
12	Interest Rate Risk Management	
10	Foreign Exchange Exposure and Risk Management	Foreign Exchange & International Financial Management
11	International Financial Management	
14	Mergers, Acquisitions and Corporate Restructuring	Mergers, Acquisitions and Corporate Restructuring
15	Startup Finance	Startup Finance

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Equity & Business Valuation



A. Dividend based Valuation Models



QUESTION 1:

N 10 | N 08

Amal Ltd. has been maintaining a growth rate of 12% in dividends. The company has paid dividend @ ₹3 per share. The rate of return on market portfolio is 15% and the risk-free rate of return in the market has been observed as 10%. The beta co-efficient of the company's share is 1.2.

You are required to calculate the expected rate of return on the company's shares as per CAPM model and the equilibrium price per share by dividend growth model.

Solution:

As per CAPM:

$$\begin{aligned} E_R &= R_f + \beta (R_m - R_f) \\ &= 10 + [1.2 (15 - 10)] \\ &= 16\% \text{ or } 0.16 \end{aligned}$$

Applying dividend growth mode for the calculation of equilibrium price:-

$$\begin{aligned} P_0 &= \frac{D_1}{K_e - g} \\ &= \frac{3(1.12)}{0.16 - 0.12} \\ &= ₹ 84 \end{aligned}$$

Therefore, equilibrium price per share will be ₹ 84.



QUESTION 2:

N 20 | N 11 | SM

A company has a book value per share of ₹ 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 the share today?

Solution:

$$\text{EPS} = 137.80 \times 15\% = 20.67$$

$$\text{DPS} = 20.67 \times (1 - 0.60) = 8.268$$

$$g = 0.15 \times 0.60 = 9\%$$

$$\begin{aligned} \text{Price of share } (P_0) &= \frac{D_1}{K_e - g} \\ &= \frac{8.268}{0.18 - 0.09} = 91.87 \end{aligned}$$



QUESTION 3:

SM | M 21 | M 05

A company's beta is 1.40. The market return is 14%. The risk free rate is 10% (i) What is the expected return based on CAPM (ii) If the risk premium on the market goes up by 2.5% points, what would be the revised expected return on this stock?

Solution:

$$\begin{aligned}
 \text{Expected Return} &= R_f + \beta (R_m + R_f) \\
 &= 10 + 1.40 (14 - 10) \\
 &= 15.6\% \\
 \text{Revised risk premium} &= (14\% - 10\%) + 2.5\% \\
 &= 6.5\% \\
 \text{Revised expected return} &= 10 + 1.40 (6.5) \\
 &= 19.1\%
 \end{aligned}$$



QUESTION 4:

N 21

Following are the details of X Ltd. and Y Ltd.:

Particulars	X Ltd.	Y Ltd.
Dividend per Share	₹ 4	₹ 4
Growth Rate	10%	10%
Beta	0.9	1.2
Current Market Price per Share	₹ 150	₹ 70

Other Information:

Risk Free Rate of Return 7%

Market Rate of Return 14%

- Calculate the price of shares of both the companies.
- Write the comment on the valuation on the basis of price calculated and current market price.
- As an investor what course of action should be followed?

Solution:

- a) Calculation of Prices of shares of both companies:

	X Ltd.	Y Ltd.
Beta	0.9	1.20
Cost of Equity using CAPM	$= 7\% + 0.9 [14\% - 7\%]$ $= 13.30\%$	$= 7\% + 1.20 [14\% - 7\%]$ $= 15.40\%$
Growth Rate	10%	10%
Price of Share	$= \frac{4.00}{0.133 - 0.10}$ $= ₹ 121.21$	$= \frac{4.00}{0.154 - 0.10}$ $= ₹ 74.07$

- b) and c) Comment on valuation and course of action:

Company	CMP	Value	Valuation	Action of the Investor
X Ltd.	₹ 150.00	₹ 121.21	Overvalued	Sell
Y Ltd.	₹ 70.00	₹ 74.07	Undervalued	Buy

**QUESTION 5:**

M 15

The following information is collected from the annual reports of J Ltd:

Profit before tax	₹ 2.50 crore
Tax rate	40 percent
Retention ratio	40 percent
Number of Outstanding shares	50,00,000
Equity capitalization rate → <i>ke</i>	12 percent
Rate of return on investment → <i>RoE</i>	15 percent

What should be the market price per share according to Gordon's model of dividend policy?

Solution:

PBT	2,50,00,000
Less: Tax @ 40%	(1,00,00,000)
EAES	1,50,00,000
÷ No. of shares	50,00,000
EPS	3

$$\text{Calculation of DPS} = 3 \times 0.60 = 1.80$$

$$\text{Calculation of growth} = 0.40 \times 0.15 = 6\%$$

$$\begin{aligned} \text{Price of share (P}_0\text{)} &= \frac{D_1}{K_e - g} \\ &= \frac{1.80}{0.12 - 0.06} = 30 \end{aligned}$$

**QUESTION 6:**

N 18 | N 13 | M 11 | M 05 | SM | RTP

Shares of Voyage Ltd. are being quoted at a price-earnings ratio of 8 times. The company retains ₹ 5 per share which is 50% of its Earning Per Share.

You are required to determine:

- the cost of equity to the company if the market expects a growth rate of 15% p.a.
- the indicative market price with the same cost of capital and if the anticipated growth rate is 16% p.a.
- the market price per share if the company's cost of capital is 20% p.a. and the anticipated growth rate is 18% p.a.

Solution:

1. Retained Earnings	₹ 5 per share
Retention ratio	50%
EPS	₹ 10 <i>5/50% = ₹ 10</i>
DPS	₹ 5
PF Ratio	8 times
Market Price	₹ 10 × 8 times = ₹ 80

$$\begin{aligned}\text{Computation of cost of equity} &= \frac{D_1}{P_0} + g \\ &= \frac{5}{80} + 0.15 \\ &= 21.25\%\end{aligned}$$

$$\begin{aligned}2. \quad \text{Market Price} &= \frac{D_1}{k_e - g} = \frac{5}{0.2125 - 0.16} \\ &= ₹ 95.24\end{aligned}$$

$$\begin{aligned}3. \quad \text{Market Price} &= \frac{D_1}{k_e - g} = \frac{5}{0.20 - 0.18} \\ &= ₹ 250\end{aligned}$$



QUESTION 7:

MTP N 23 | M 18 | N 14

The risk-free rate of return R_f is 9 percent. The expected rate of return on the market portfolio R_m is 13 percent. The expected rate of growth for the dividend of Platinum Ltd. is 7 percent. The last dividend paid on the equity stock of firm A was ₹ 2.00. The beta of Platinum Ltd. equity stock is 1.2.

a. What is the equilibrium price of the equity stock of Platinum Ltd.?

b. How would the equilibrium price change when:

- The inflation premium increases by 2 percent?
- The expected growth rate increases by 3 percent?
- The beta of Platinum Ltd. equity rises to 1.3?

Solution:

a. Calculation of cost of equity by using CAPM

$$\begin{aligned}&= R_f + \beta (R_m - R_f) \\ &= 9 + 1.2 (13 - 9) \\ &= 13.8\%\end{aligned}$$

Calculation of equilibrium price

$$\begin{aligned}&= \frac{D_1}{K_e - g} \\ &= \frac{2(1 + 0.07)}{0.138 - 0.07} \\ &= ₹ 31.47\end{aligned}$$

b. Revised price after the change:

$$\begin{aligned}R_f &= 11\% \\ R_m &= 15\% \\ \text{Growth} &= 10\% \\ \text{Beta} &= 1.3\end{aligned}$$

Calculation of K_e by using CAPM

$$\begin{aligned}&= R_f + \beta (R_m - R_f) \\ &= 11 + 1.3 (15 - 11) \\ &= 16.2\%\end{aligned}$$

Equilibrium price after the change:

$$= \frac{D_1}{K_e - g}$$

$$= \frac{2(1 + 0.1)}{0.162 - 0.10}$$

$$= 35.48$$



QUESTION 8:

M 13 | SM | RTP

X Limited just declared a dividend of ₹ 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 ₹ 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.

Calculate rupee amount up to two decimal points.

	Year - 1	Year - 2	Year - 3
FVIF @ 9%	1.090	1.188	1.295
FVIF @ 13%	1.130	1.277	1.443
PVIF @ 13%	0.885	0.783	0.693

Solution:

- a) Calculation of Dividends

Year	0	1	2	3	4
Growth		9%	9%	9%	9%
Dividend	14	15.26	16.63	18.13	19.76

The maximum amount Mr. B should pay for share

Year	CF's	PVAF@13%	PV
1	15.26	0.885	13.51
2	16.63	0.783	13.02
3	18.13 + 360 = 378.13	0.693	262.04
Max Amount			288.57

- b. Gordon's formula

If growth rate 9% is achieved for indefinite period, then maximum price of share should Mr. A willing be to pay is

$$= \frac{D_1}{K_e - g}$$

$$= \frac{15.26}{0.13 - 0.09}$$

$$= ₹ 381.5$$

c. Max price paid of the end of 3 year

$$P_3 = \frac{D_3 \times (1 + g)}{k_e - g}$$

$$= \frac{18.13 \times 1.09}{0.13 - 0.09}$$

$$= ₹ 494.04$$



QUESTION 9:

M 21

NM Ltd. (NML) is aspiring to enter the capital market in a three years' time. The Board wants to attain the target price of ₹ 70 for its shares at the end of three years. The present value of its shares is ₹ 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

Solution:

value of Share = PV of Dividend for 3 years + PV of Target price after 3 years

Let Base Dividend is D_0 , then

$$₹ 52.03 = [D_0 (1 + g) \times PVIF_{(15\%, 1)} + D_0 (1 + g)^2 \times PVIF_{(15\%, 2)} + D_0 (1 + g)^3 \times PVIF_{(15\%, 3)}] + 70.00 \times 0.6575$$

$$₹ 52.03 = [D_0 (1.15) \times 0.8696 + D_0 (1.15)^2 \times 0.7561 + D_0 (1.15)^3 \times 0.6575] + 70.00 \times 0.6575$$

$$D_0 = 2$$

Thus, Company should declare a dividend of ₹ 2 in base year.



QUESTION 10:

MTP M 15

SRK Ltd. 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:

₹	2013-14	2012-13	2011-12	2010-11	2009-10
EPS	14	13.6	13.1	12.7	12.2
DPS	8.2	8.1	7.9	7.8	7.7

In the opinion of MD of SRK Ltd., if current dividend policy is maintained annual growth in Earnings and Dividends will be no better than the annual growth in earnings over the past years.

Since the Board of SRK Ltd. 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 Ltd. 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

a. SRK Ltd. does not announce a change in its Dividend Policy.

b. SRK Ltd. does announce a change in its Dividend Policy by retaining 50% of its earnings.

Note: Growth Rate can be assumed to be remain stable.

Solution:

a) Calculation of cost of equity using CAPM

$$\begin{aligned} K_e &= R_f + \beta (R_m - R_f) \\ &= 6 + 1.5 (4) \\ &= 12\% \end{aligned}$$

$$\text{Average Growth Rate} \left(\frac{14.00}{12.20} \right)^{1/4} - 1 = 3.5\%$$

Calculation of MP by Gordon's formula

$$\begin{aligned} P_0 &= \frac{D_1}{K_e - g} \\ &= \frac{8.2 \times 1.035}{0.12 - 0.035} \\ &= 99.85 \end{aligned}$$

b) Dividend Payout Ratio: = 50%

$$RR = 1 - 0.5 = 50\%$$

$$ROE = 15\%$$

Calculation of growth rate

$$= RR \times ROE$$

$$= 0.50 \times 0.15$$

$$= 7.5\%$$

$$\begin{aligned} D_1 &= 14 \times 1.075 \times 50\% \\ &= 7.525\% \end{aligned}$$

$$\begin{aligned} P_0 &= \frac{D_1}{K_e - g} \\ &= \frac{7.525}{0.12 - 0.075} \\ &= 167.22 \end{aligned}$$



QUESTION 11:

M 12 | RTP N 18 *ism.*

In December, 2011 AB Co.'s share was sold for ₹ 146 per share. A long term earnings growth rate of 7.5% is anticipated. AB Co. is expected to pay dividend of ₹ 3.36 per share.

a. 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?

ROE

c. 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?

Solution:

Self note

We Will have to particularly remember that flow of this question (of removing and adding growth) is not applied to any other question

$$\begin{aligned}
 (a) \quad K_e &= \frac{D_1}{P_0} + g \\
 &= \frac{3.36}{146} + 0.075 \\
 &= 9.80\%
 \end{aligned}$$

$$\begin{aligned}
 (b) \quad \text{Revised growth} &= RR \times ROE \\
 &= 60\% \times 0.10 \\
 &= 6\%
 \end{aligned}$$

- Existing $D_1 = ₹ 3.36$

- Existing RR

$$\begin{aligned}
 g &= RR \times ROE \\
 7.5\% &= RR \times 0.10 \\
 RR &= 75\%
 \end{aligned}$$

- Existing Payout Ratio $= 1 - 0.75 = 25\%$

- Existing $EPS_1 = \frac{3.36}{25\%} = ₹ 13.44$

- Revised $EPS_1 = \frac{13.44}{1.075} \times 1.06 = 13.25$

- Revised $D_1 = 13.25 \times (1 - 0.60) = 5.3$

- $$\begin{aligned}
 K_e &= \frac{D_1}{P_0} + g \\
 &= \frac{5.3}{146} + 0.06 = 9.63\%
 \end{aligned}$$



QUESTION 12:

N 18

only on cell

A Company has an EPS of ₹ 2.50 for the last year and DPS of ₹ 1. The Earnings is 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.

Solution:

$$\begin{aligned}
 (a) \quad P_0 &= \frac{D_1}{K_e - g} \\
 &= \frac{1 \times 1.02}{0.14 - 0.02} \\
 &= 8.5
 \end{aligned}$$

$$\text{PE Ratio} = \frac{MP}{EPS} = \frac{8.5}{2.50} = 3.4 \text{ times}$$

- (b) PE Ratio (Current) = 7 times
 Price per share = ₹ 2.50 x 7 times
 = ₹ 17.50

We know that

$$P_0 = \frac{D_1}{K_e - g}$$

$$17.50 = \frac{₹ 1(1+g)}{0.14 - g}$$

$$g = 7.84\%$$

$$17.5 = \frac{1(1+g)}{0.14 - g}$$

$$2.45 - 17.5g = 1 + g$$



QUESTION 13:

N 22 | M 21 | M 19 | N 12 | N 09 | RTP 15m.

Following Financial data are available for PQR Ltd. for the year 2008:

	(₹ in lakh)
8% debentures	125
10% bonds (2007)	50
Equity shares (₹ 10 each) → capital.	100
Reserves and Surplus	300
Total Assets	600
Assets Turnovers ratio	1.1
Effective interest rate	8%
Effective tax rate	40%
Operating margin	10%
Dividend payout ratio	16.67%
Current market price of Share	₹ 14
Required rate of return of investors (assumed K_e)	15%

You are required to:

- Draw income statement for the year
- Calculate its sustainable growth rate of earnings
- 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?

Solution:

(a) Assets T/O Ratio = $\frac{\text{Sales}}{\text{Total Assets}}$

$$1.1 = \frac{T/O}{600}$$

$$\text{Sales} = 660$$

Since, operation margin is 10%

Therefore, Operating cost is 90%

Income statement

	(₹ Lakhs)
Sales	660

Less: Operating cost (660 × 90%)	(594)
EBIT	66
Less: Interest (125 + 50) × 8%	(14)
EBT	52
Less: Tax @ 40%	(20.8)
EAT	31.2
Less: Dividend @ 16.67%	(5.20)
Retained Earnings	26

(b) $ROE = \frac{EAT}{Eq. SHF} = \frac{31.2}{100+300} = 7.8\%$

Sustainable growth rate = $RR \times ROE$
 $= (1 - 0.1667)$
 $= 0.8333 \times 0.078$
 $= 6.5\%$

(c) Using Gordon's formula

$$D_1 = \frac{5.2 \text{ Lakhs}}{10 \text{ lakhs}} = ₹ 0.52$$

$$P_0 = \frac{D_1}{K_e - g} = \frac{0.52(1.065)}{0.15 - 0.065} = 6.51$$

Institute assumed D_0 .

(d) Current MP = 14, the share is overvalued. Hence investor should not invest in the company.

Self-note: Institute has assumed the given dividend as D_0 .



QUESTION 14:

N 20

AB Industries has Equity Capital of 12 Lakhs, total Debt of 8 Lakhs, and annual sales of 30 Lakhs. Two mutually exclusive proposals are under consideration for the next year. The details of the proposals are as under:

Particulars	Proposal 1	Proposal 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 Lakhs)	-	0.3
New Equity Raised (₹ In Lakhs)	-	1

You are required to calculate sustainable growth rate for both the proposals.

Solution:

Self-note: Solution given below is not as per suggested answers because the answer over there is logically incorrect. Remember that start point under Proposal 1 is Sales whereas the same under proposal 2 is Equity Capital.

Sustainable growth rate for proposal 1:

$$\text{Total Sales} = 30 \text{ Lakhs}$$

$$\text{Asset to sales Ratio} = \frac{\text{Asset}}{\text{Sales}}$$

$$0.65 = \frac{\text{Assets}}{30 \text{ Lakhs}}$$

$$\text{Assets} = 19.5 \text{ Lakhs}$$

$$\begin{aligned} \text{Net profit margin} &= 30 \text{ lakhs} \times 4\% \\ &= 1.2 \text{ lakhs} \end{aligned}$$

$$\text{Target Debt to Equity} = 2:3$$

$$\text{Total capital} = \text{Total assets} = 19.5 \text{ Lakhs}$$

$$\begin{aligned} \text{Equity portion in total capital} &= 19.5 \text{ Lakhs} \times \frac{3}{2+3} \\ &= 11.7 \text{ Lakhs} \end{aligned}$$

$$\begin{aligned} \text{Return on Equity (ROE)} &= \frac{\text{PAT or EAES}}{\text{ESHF}} \\ &= \frac{1.2}{11.7} = 10.26\% \end{aligned}$$

$$\begin{aligned} \text{Sustainable Growth Rate} &= \text{RR} \times \text{ROE} \\ &= 0.75 \times 10.26\% \\ &= 7.695\% \\ &\sim 7.70\% \end{aligned}$$

Sustainable growth rate for proposal 2:

$$\begin{aligned} \text{Total Equity} &= ₹ 12,00,000 + 1,00,000 \\ &= 13,00,000 \end{aligned}$$

$$\text{Debt equity Ratio} = \frac{\text{Debt}}{\text{Equity}}$$

$$4 = \frac{\text{Debt}}{13,00,000}$$

$$\text{Debt} = 52,00,000$$

$$\begin{aligned} \text{Total capital} &= 13,00,000 + 52,00,000 \\ &= 65,00,000 \end{aligned}$$

$$\text{Total Assets} = 65,00,000$$

$$\text{Assets to Sales} = \frac{\text{Asset}}{\text{sales}}$$

$$\begin{aligned}
 0.62 &= \frac{65,00,000}{\text{Sales}} \\
 \text{Sales} &= 104.84 \text{ lakhs} \\
 \text{Net profit} &= 104.84 \text{ lakhs} \times 5\% \\
 &= 5.242 \text{ lakhs} \\
 \text{Calculation of ROE} &= \frac{\text{PAT or EAES}}{\text{ESHF}} \\
 &= \frac{5.242 \text{ lakhs}}{13 \text{ lakhs}} \\
 &= 40.32\% \\
 \text{Payout Ratio} &= \frac{0.3}{5.242} \\
 &= 5.72\% \\
 \text{Retention Ratio} &= 100\% - 5.72\% \\
 &= 94.28\% \\
 \text{Sustainable growth rate} &= \text{RR} \times \text{ROE} \\
 &= 94.28\% \times 40.32\% \\
 &= 38.01\%
 \end{aligned}$$

Self-note: Solution to this question will not match with institute's solution as their solution has major conceptual mistakes.



QUESTION 15:

N 04 | 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 ₹ 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%.

Required:

Calculate what should be Mr. A's estimates of the price per share before and after the Budget announcement?

Solution:

$$\begin{aligned}
 \text{Post Tax } K_e &= \text{Pre-Tax } K_e \times (1-t) \\
 &= 10\% \times (1 - 0.3) \\
 &= 7\%
 \end{aligned}$$

$$\text{Value of a share based on expected dividend: } P_0 = \frac{D_0 (1 + g)}{k_e - g}$$

$$\text{Price estimate before budget announcement: } P_0 = \frac{2 \times (1 + 0.05)}{(0.10 - 0.05)} = \text{Rs } 42.00$$

Price estimate after budget announcement: $P_0 = \frac{1.80 \times (1 + 0.05)}{(0.07 - 0.05)} = \text{Rs } 94.50$

**QUESTION 16:**

MTP M 16

challenge-

A company had paid a dividend of ₹2.50 per share last year and its required rate of return for equity investors is 20%. What will be the market price of the share at the end of the year, if

- there is no growth in dividend?
- dividend grows at constant rate of 5% per annum in perpetuity?
- constant dividend for first five years and then grows at constant rate of 5% per annum in perpetuity?
- constant dividend for first five years and then, share is sold at the price of ₹ 20?

Solution:

(a) $P_0 = \frac{D_1}{K_e} = \frac{2.50}{0.20} = ₹ 12.50$

(b) $P_0 = \frac{D_1}{K_e - g}$
 $= \frac{2.50 \times 1.05}{0.20 - 0.05}$
 $= 17.5$

(c) Calculation of P_0 :

Year	CF'S	PVAF @ 20%	DCF
D_{1-5}	2.5	2.991	7.48
TV_5	$\frac{2.625}{0.20 - 0.05} = 17.5$	0.402	7.03
			14.51

(d) Calculation of P_0 :

Year	CF'S	PVAF @ 20%	DCF
D_{1-5}	2.5	2.991	7.48
TV_5	20	0.402	8.04
			15.52

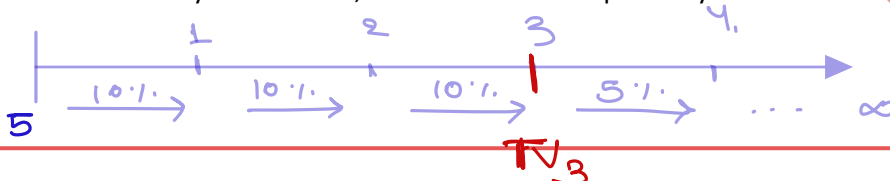
**QUESTION 17:**

M 19 | M 14

The shares of G Ltd. are currently being traded at ₹ 46. The company published its results for the year ended 31st March 2019 and declared a dividend of ₹ 5. The company made a return of 15% on its capital and expects that to be the norm in which it operates. G Ltd. Also expects the dividends to grow at 10% for the first three years and thereafter at 5%.

You are required to advise whether the share of the company is being traded at a premium or discount.

PVIF @ 15% for the next 3 years is 0.870, 0.756 and 0.658 respectively.



Solution:

$$D_1 = 5 (1.1) = 5.5$$

$$D_2 = 5.5 (1.1) = 6.05$$

$$D_3 = 6.05 (1.1) = 6.655$$

$$D_4 = 6.655 (1.05) = 6.988$$

$$K_e = 15\%$$

$$P_0 = \text{PV (Dividends)} + \text{PV (Terminal Value)}$$

$$= 5.5 (0.870) + 6.05 (0.756) + 6.655 (0.658) + \frac{6.655 \times (1.05)}{0.15 - 0.05} (0.658)$$

$$= 59.76$$

$$\frac{D_4}{K_e - g}$$

Hence, it is clear that shares are being traded at discount i.e., undervalued because intrinsic value of share is more than the market price.



QUESTION 18:

M 24 | M 16

XYZ Ltd. paid a dividend of ₹ 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.

Solution:

$$\text{Calculation of } \beta = \frac{\text{Covariance}_{(s,m)}}{\text{Variance}_{(m)}}$$

$$= \frac{30}{24} = 1.25 \rightarrow \text{use this number directly.}$$

$$\text{Calculation of } K_e = 11 + 1.25 (18 - 11)$$

$$= 19.75\%$$

Calculation of Price:

Year	CFs	PVAF @ 19.75%	DCF
1	2.8	0.835	2.34
2	3.92	0.69	2.73
3	5.49	0.582	3.2
4	7.68	0.486	3.73
5	10.76	0.406	4.37
5	$\frac{10.76 \times 1.15}{0.1975 - 0.15} = 260.42$	0.4061	105.76
			122.13



QUESTION 19:

M 23 | N 20 | M 19

An investor is considering to purchase the equity shares of LX Ltd., whose current market price (CMP) is ₹ 112. The company is proposing a dividend of 4 for the next year. LX is expected to grow @ 20 per cent per annum for the next four years. The growth will decline linearly to 16 per cent per annum after first four years. Thereafter, it will stabilise at 16 per cent per annum infinitely. The investor requires a return of 20 per cent per annum.

You are required

- To calculate the intrinsic value of the share of LX Ltd.
- Whether it is worth to purchase the share at this price.

Period	1	2	3	4	5	6	7
PVIF (20%, n)	0.833	0.694	0.579	0.482	0.402	0.335	0.279

Solution:

- a) Intrinsic value of shares:

Year	Growth	Dividend / TV	PVF @ 20%	DCF's
1	20%	4	0.833	3.332
2	20%	4.8	0.694	3.332
3	20%	5.76	0.579	3.332
4	20%	6.91	0.482	3.332
5	19%	8.23	0.402	3.308
6	18%	9.71	0.335	3.253
7	17%	11.36	0.279	3.169
7	-	$\frac{11.36 \times (1.16)}{0.20 - 0.16} = 329.44$	0.279	91.914
				114.973

Self-note: The question is silent on the time period during which the growth will fall from 20% to 16%. In the absence of specific information, hint can be taken from number of years for which PVIF are given and accordingly, fall in growth is assumed to be 1% every year.

- b) Since, MPS (₹ 112) < IV (₹ 114.97)
therefore, it is worth to purchase at this price.



QUESTION 20:

M 23

An investor is considering purchasing equity shares of Alpha Ltd., whose current Market price is ₹ 172.45. The company is proposing a dividend of ₹ 6 for the year ending 31st March, 2024. Alpha Ltd. is expected to grow @ 20 percent per annum for the next four years. Thereafter, the growth, over the next three years, will decline linearly by 100 basis points per annum. Thereafter, it will stabilize at a certain growth rate per annum infinitely. The required rate of return for the investor is 20%.

Dividend value is to be taken in 2 decimal points only.

You are required:

- To calculate the stable growth rate of Alpha Ltd. after the end of 7 years.
- To advise whether it is worth to purchase the share at this price if the investor has a stable target growth rate of 15% per annum.

Period	1	2	3	4	5	6	7
PVIF (20%, n)	0.8333	0.6944	0.5787	0.4823	0.4019	0.3349	0.2791

Solution:

- a) Stable growth rate after the end of 7 years.

PV of dividends from years 1 to 7:

Year	Growth	Dividend / TV	PVF @ 20%	DCF _s
1	20%	6	0.8333	5.00
2	20%	7.2	0.6944	5.00
3	20%	8.64	0.5787	5.00
4	20%	10.37	0.4823	5.00
5	19%	12.34	0.4019	4.96
6	18%	14.56	0.3349	4.88
7	17%	17.03	0.2791	4.76
				34.60

$$\text{PV of terminal value} = \frac{17.03 \times (1 + g)}{0.20 - g} \times 0.2791$$

$$\text{Now, } P_0 = \text{PV (Dividends)} + \text{PV (Terminal Value)}$$

$$172.45 = 34.6 + \frac{17.03 \times (1 + g)}{0.20 - g} \times 0.2791$$

$$g = 16\%$$

Thus, the stable growth rate after the end of the 7 years shall be 16%.

- b) Since above calculated growth rate ^(16%) is more than target growth rate ^(15%) it is worth to purchase the share.



QUESTION 21:

N 15 | RTP

X Ltd. is a Shoes manufacturing company. It is all equity financed and has a paid-up Capital of ₹ 10,00,000 (₹ 10 per share)

X Ltd. 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 and onwards.
- Further, 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

→ k_c
∴ all eq. financed.

Solution:

a) Expected Market Price per Share:

Year	EPS	CFs (D & TV)	PVAF	DCFs
2015	12	4.8	0.870	4.176
2016	15	6	0.756	4.536
2016		$\frac{15 \times 1.1 \times 50\%}{0.15 - 0.10} = 165$	0.756	124.74
				133.45

Expected MPS = ₹ 133.45

b) PE Ratio = $133.45 / 9.6 = 13.90$ times.**QUESTION 22:**

N 20 | PM

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%.

- What is the expected price of the stock at the end of 2008?
- What is the value of the stock, using the two – stage dividend discount model?

Solution:

Calculation of K_e :

Before 2008: $= 6.25 + 1.40 (5.5)$
 $= 13.95\%$

After 2008: $= 6.25 + 1.10 (5.5)$
 $= 12.3\%$

The dividends from ~~2003~~ onwards can be estimated as:

Year	Growth	EPS	DPS	PVAF @ 13.95%	DCFs
2004	15%	2.415	0.794	0.878	0.697
2005	15%	2.777	0.913	0.770	0.703
2006	15%	3.194	1.050	0.676	0.710
2007	15%	3.673	1.207	0.593	0.716
2008	15%	4.224	1.388	0.521	0.723
					3.549

a) Expected Share Price as on 2008 (P_{2008}) = $\frac{D_{2009}}{K_e - g}$

$$= \frac{4.224 \times (1.06) \times 65\%}{0.123 - 0.06}$$

$$€ = 46.19 \text{ po share}$$

b) Expected Share Price Today: $= 3.549 + 46.19 \times 0.521$

$$€ = 27.61 \text{ po share}$$



QUESTION 23:

N 19

only on
alci

The current EPS of M/s VEE Ltd. is ₹ 4. The company has shown an extraordinary growth of 40% in its earnings in the last few years. 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 years 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% and the PV factors are given below:

Years	1	2	3	4	5	6	7	8	9	10
PVF @ 17%	0.855	0.731	0.625	0.534	0.456	0.39	0.333	0.285	0.244	0.209

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 ₹ 125, suggest if it is advisable for the investor to invest in the company's stock or not.

Solution:

Year	Growth	EPS	Payout	DPS / TV	PVAF	DCF _s
1	40%	5.60	10%	0.56	0.855	0.48
2	40%	7.84	10%	0.78	0.731	0.57
3	40%	10.98	10%	1.10	0.625	0.69
4	40%	15.37	10%	1.54	0.534	0.82
5	40%	21.51	10%	2.15	0.456	0.98
6	34%	28.83	18%	5.19	0.390	2.02
7	28%	36.90	26%	9.59	0.333	3.19
8	22%	45.02	34%	15.31	0.285	4.36
9	16%	52.22	42%	21.93	0.244	5.35
10	10%	57.44	50%	28.72	0.209	6.00
10	-			$\frac{57.44 \times (1.1) \times 50\%}{0.17 - 0.1} = 451.31$	0.209	94.32
						118.78

Since the Intrinsic Value of Equity share is less than current market price, it is not advisable to invest in the same.

Self-note: Since, there is a change in the payout ratio, alternative 2 of TV calculation was ideally applied. But, since PVFs of 10 years are given, therefore, TV is to be calculated at year 10. Therefore alternative 1 is applied.



QUESTION 24:

RTP N 10

The Digital Electronic System Corporation (DESC) pays no cash dividends currently and is not expected to for the next five years. Its latest EPS was €10, all of which was reinvested in the company.

The firm's expected ROE for the next five years is expected to be 20% per year, and during this time it is also expected to continue to reinvest all of its earnings. It is expected that starting six years from now the DESC's ROE on new investments is expected to fall to 15%, and it is expected that the corporation shall start paying out 40% of its earnings in form of cash dividends, which it will continue to do forever after. DESC's market capitalization rate is 15% per year.

- Using DDM model, what is the value of DESC's share today?
- Now suppose that the current market price of share is equal to as computed in (a) above, then what do you expect to happen to its price over the next year? The year after?
- If you are expecting that DESC to pay out only 20% of earning starting in year 6 then, how your estimates will be affected?

Solution:

- (a) Growth (G_1): $RR_0 \times ROE_1$
 Year 0 to 5: $100\% \times 20\% = 20\%$
 Year 6: $100\% \times 15\% = 15\%$
 Year 7 and onwards: $60\% \times 15\% = 9\%$

Expected EPS for future years:

$$EPS_5 = 10 \times (1 + 0.20)^5 = \text{€ } 24.88$$

$$EPS_6 = 24.88 (1 + 0.15) = \text{€ } 28.61$$

$$D_6 = 28.61 \times 40\% = \text{€ } 11.44$$

$$\begin{aligned} \text{Hence, value of DESC's share now} &= \left[\frac{D_6}{k_e - g} \right] \times \frac{1}{(1 + K_e)^5} \\ &= \left[\frac{11.44}{15\% - 9\%} \right] \times \frac{1}{1.15^5} \\ &= \text{€ } 94.76 \end{aligned}$$

- The price should rise by 15% per year until year 6. Since there is no dividend, the entire return must be in capital gains.
- There will not be any change in the value because $ROE = K_e$.

Revised growth rate for year 7 & onwards = $(1 - 20\%) \times 15\% = 12\%$

$$D_6 = 28.61 \times 20\% = 5.72$$

$$D_7 = 28.61 \times (1.12) \times 20\% = \text{€ } 6.41$$

$$\begin{aligned} \text{Hence, value of DESC's share now} &= \left[\frac{D_6}{k_e - g} \right] \times \frac{1}{(1 + K_e)^5} \\ &= \left[\frac{5.72}{15\% - 12\%} \right] \times \frac{1}{1.15^5} \\ &= \text{€ } 94.80 \end{aligned}$$



QUESTION 25:

M 16 | RTP

Equity & Business Valuation

SAM Ltd. has just paid a dividend of ₹ 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 the 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 ₹ 2.50 per share and will grow @ 7% p.a.

An investor has 1,000 shares in SAM Ltd. and wants a receipt of at least ₹ 2,000 p.a. from this investment.

Required:

- EVALUATE whether the market value of the share is affected by the decision of the Board.
- RECOMMEND 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%.

Solution:

- (a) MV of share before declaring project

$$\begin{aligned}P_0 &= \frac{D_1}{K_e - g} \\&= \frac{2 \times 1.06}{0.08 - 0.06} = ₹ 106\end{aligned}$$

MV of share after declaring project

$$\begin{aligned}P_0 &= \frac{D_4}{K_e - g} \times \frac{1}{(1 + k_e)^3} \\&= \frac{2.5}{0.08 - 0.07} \times \frac{1}{(1 + 0.08)^3} \\&= 198.46\end{aligned}$$

MV of share will increase from ₹ 106 to ₹ 198.46 due to decision of the board

- (b) Number of shares investor must sell to maintain target receipt:

Year	Expected Market Price	No. of Shares to sell
1	$198.46 \times 1.08 = 214.34$	$2,000 / 214.34 = 10$ shares
2	$198.46 \times 1.08^2 = 231.48$	$2,000 / 231.48 = 9$ shares
3	$198.46 \times 1.08^3 = 250$	$2,000 / 250 = 8$ shares

Income to be received from sale of shares:

Year	No of shares sold	MP	Total Receipt
1	10	214.34	2143.40
2	9	231.48	2083.32
3	8	250	2000

Calculation of Improved dividend Income:

$$\begin{aligned}\text{No. of shares left} &= 1000 - (9 + 8 + 10) \\&= 973\end{aligned}$$

$$\begin{aligned}\text{Income to be received} &= 973 \times 2.5 \\&= 2432.5\end{aligned}$$



QUESTION 26:

N 17

only on calc

Rahim Enterprises is a manufacturer and exporter of woollen 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 ₹ 50 per share. The current issue price of this share is ₹ 125 ex-dividend. Annual earning is ₹ 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 ₹ 1,75,00,000 in one year's time and will produce annual cash inflows thereafter of ₹ 50,00,000. Analyse the effect of the new project on dividend payments and the share price.

Solution:

Impact on dividend:

Total earnings before the new project:

Total Earnings: $(25 \times 10,00,000)$ ₹ 2,50,00,000

Total earnings after the new project:

For 1st Year:

Existing Earnings	2,50,00,000
Less: Cost of new investment	<u>1,75,00,000</u>
Dividend Payment	75,00,000
No of Shares	<u>$\div 10,00,000$</u>
Dividend per share	7.5 per share

For 2nd year onwards:

Existing Earnings	2,50,00,000
Add: Cash from new project	<u>50,00,000</u>
Dividend Payment	3,00,00,000
No of Shares	<u>$\div 10,00,000$</u>
Dividend per share	30 per share

The dividend payment will change from existing ₹ 25 per share to ₹ 7.5 per share in first year and ₹ 30 in second years onwards.

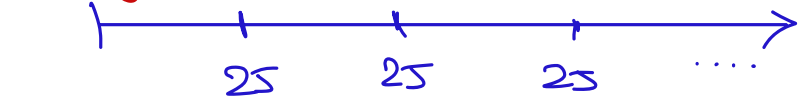
Impact on Share Price:

Before new Project: ₹ 125

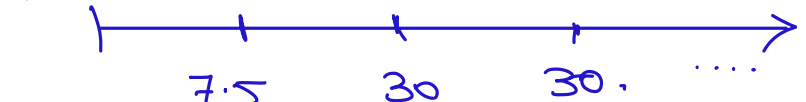
After new Project:

$$\begin{aligned}
 \text{Calculation of } K_e &= \frac{D_1}{P_0} + g \\
 &= \frac{25}{125} + 0 \\
 &= 20\% \\
 \text{Share price } (P_0) &= \frac{D_1}{(1 + K_e)} + \frac{D_2}{K_e} \times \frac{1}{(1 + K_e)} \\
 &= \frac{7.5}{1.20} + \frac{30}{0.20} \times \frac{1}{1.20} \\
 &= 131.25
 \end{aligned}$$

Existing.



Proposed



TV₁
(Alternative 2)

Same g of
0% forever

The share price will increase from of 125 to 131.25



QUESTION 27:

N 19

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 ₹ 50 crore for the industry. Division B and C captures 30% and 2% of their respective industry's sales, which are expected to be ₹ 20 crore and ₹ 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 ₹ 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 years 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: *no use.*

- 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? Ignore taxation. PV factors are given below:

Years	1	2	3	4	5
PVIF @ 18%	0.847	0.718	0.609	0.516	0.437

Solution:

- Calculation of profit of company:

Division		Net Profit
A	(₹ 50 crore x 10% x 5%)	0.25
B	(₹ 20 crore x 30% x 8%)	0.48
C	(₹ 8.5 crore x 2% x 10%)	0.017
Net Profit <i>of Y1.</i>		0.747 Cr.
÷	Number of shares	0.03 Cr.
EPS of year 1		24.9
×	PE Ratio	10
Market Price at year 1		249
×	PVIF (1 year, 18%)	0.847
PV of expected price		210.90

I would NOT like to purchase the share as the ~~expected~~ *current* market price of shares is ~~less~~ *more* than its ~~current~~ *intrinsic* price (₹ 210) *of ₹ 250.*

- If Earning is expected to grow @ 15%

Method 1: Logical Solution

Year	EPS	Div & TV	PVAF	
1	24.9	-	0.847	0
2	28.64	-	0.718	0

3	32.93	$32.93 \times 30\% = 9.88$	0.609	6.02
4	37.87	$37.87 \times 30\% = 11.36$	0.516	5.86
5	43.55	$43.55 \times 30\% = 13.07$	0.437	5.71
5	-	$\frac{43.55 \times 1.15 \times 30\%}{0.18 - 0.15} = 500.83$	0.437	218.86
				236.45

The maximum price I would be willing to pay for the share shall be ₹ 236.67

Method 2: Solution by ICAI

Year	EPS (₹)	Dividend (₹)	PVF@18%	PV (₹)
1	28.64	-	0.847	--
2	32.93	-	0.718	--
3	37.87	11.36	0.609	6.92
4	43.55	13.07	0.516	6.74
5	50.08	15.02	0.437	6.56
				20.22

S. Share Price after 5 years = $\frac{15.02 (1.15)}{0.18 - 0.15} = ₹ 575.77$

PV of the Market Price after 5 years = ₹ 575.77 × 0.437 = ₹ 251.61

Total PV of Inflows = ₹ 20.22 + ₹ 251.61 = ₹ 271.83

Thus, the maximum price I would be willing to pay for the share shall be ₹ 271.83.

Self-note: Ambiguity in 2nd part of the question is that years PE ratio is not used to calculate the terminal value, rather Gordons model is used. Since holding period is five years, therefore, TV is calculated at the end of fifth year.



QUESTION 28:

M 10 | RTP 15m.

Mr. A is thinking of buying shares at ₹ 500 each having face value of ₹ 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 ₹ 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.

Solution:

Year	CF's	PVAF@12%	
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	$900 \times 0.95 \times 1.2 = 1026$	0.452	463.75
Value of Share			563.68
Less: Cost of share (500 + 5%)			(525)
Gain			38.68

Since Mr. A is gaining he should buy the share

Let the maximum Price Mr. A should pay = X

Total cost with incidental expense = 1.05X

Since, Mr. A is getting maximum benefit of ₹ 563.68. It means that he can pay maximum of ₹ 563.68 including any incidental expense. Therefore,

$$1.05 X = 563.68$$

$$X = 536.84$$



QUESTION 29:

SM | RTP

Piyush Lonker and Associates presently pay a dividend of Re. 1.00 per share and has a share price of ₹ 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?

Solution:

- a) Firm's Expected or Required Return on Equity using a dividend discount model approach:

$$D_1 = D_0 (1 + g)$$

$$= 1 (1 + 0.12) \text{ or } ₹ 1.12$$

$$P_0 = ₹ 20$$

$$g = 12\% \text{ per annum}$$

$$K_e = \frac{D_1}{P_0} + g$$

$$= \frac{1.12}{20} + 12\%$$

$$= 17.6\%$$

$$P_0 = \frac{D_1}{K_e - g}$$

- (b) Firm's Expected or Required Return on Equity if dividends were expected to grow at a rate of 20% per annum for 5 years and 10% per year thereafter:

$$P_0 = \text{PV (Dividends)} + \text{PV (Terminal Value)}$$

$$20 = \frac{1.20}{(1 + k_e)^1} + \frac{1.44}{(1 + k_e)^2} + \frac{1.73}{(1 + k_e)^3} + \frac{2.07}{(1 + k_e)^4} + \frac{2.49}{(1 + k_e)^5} + \frac{2.49 (1.10)}{k_e - 0.10} \times \frac{1}{(1 + k_e)^5}$$

We will have to calculate the value of K_e using trial and error method and then use interpolation to find precise K_e :

If,	$K_e = 18\%$	----->	$P_0 = 20.23$
	$K_e = ?$	----->	$P_0 = 20$ (given P_0)
	$K_e = 19\%$	----->	$P_0 = 17.89$

Using interpolation,

$$\frac{K_e - 18}{19 - 18} = \frac{20 - 20.23}{17.89 - 20.23}$$

$$K_e = 18.10\%$$



QUESTION 30:

Perfect Solutions Ltd is growing at an extra ordinary growth rate of 20% for some years However, it is not expected to continue to future and it will fall linearly to ordinary growth rate of 6% in a period of 8 years It distributed dividend of ₹ 50 last year. Calculate the value of share using H model if opportunity cost is 12%.

Solution:

$$\begin{aligned} \text{Value of Share:} &= \frac{D_0(1 + g_n)}{K_e - g_n} + \frac{D_0(g_s - g_n) \times H}{K_e - g_n} \\ &= \frac{50(1+0.06)}{0.12-0.06} + \frac{50(0.20-0.06)4}{0.12-0.06} \\ &= ₹ 1,350 \end{aligned}$$



QUESTION 31:

only on calc

Alcatel is a telecommunications firm, paid dividends per share of ₹ 0.72 on earnings per share of ₹ 1.25 in 2019. The firm's earnings per share had grown at 12% over the prior 5 years but the growth rate is expected to decline linearly over the next 10 years to 5%, while the payout ratio remains unchanged. The beta for the stock is 0.8, the risk-free rate is 5.1% and the market risk premium is 4%. Determine the value of share based on H Model.

Solution:

$$\begin{aligned} \text{Calculation of cost of equity} &= R_f + \beta (R_m - R_f) \\ &= 5.1 + 0.80 (4) \\ &= 8.3\% \end{aligned}$$

$$\begin{aligned} \text{Value of Share:} &= \frac{D_0(1 + g_n)}{K_e - g_n} + \frac{D_0(g_s - g_n) \times H}{K_e - g_n} \\ &= \frac{0.72(1+0.05)}{0.083-0.05} + \frac{0.72(0.12-0.05) \times 5}{0.083-0.05} \\ &= ₹ 30.55 \end{aligned}$$

B. Cash Flow Based Valuation Models



QUESTION 32:

N 19

Mr. X, a financial analyst, intends to value the business of PQR Ltd. in terms of the future cash generation capacity. He has projected the following after tax cash flows:

Year:	1	2	3	4	5
Cash flows (₹ in lakh)	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 ₹ 10,260 lakhs 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 ₹ 3,620 lakh and cash / bank balance of ₹ 2,710 lakhs. Calculate the shareholder value per share if the number of outstanding shares is 151.50 lakh. *→ no use -*
- The firm has received a takeover bid from XYZ Ltd. of ₹ 225 per share. Is it a good offer?

[Given: PVIF at 20% for year 1 to year 5: 0.833, 0.694, 0.579, 0.482, 0.402]

Solution:

- (a) Calculation of value of firm

(₹ lakhs.)

FCFF / TV.

Year	CFs	PVF	DCFs
1	1760	0.833	1466.08
2	480	0.694	333.12
3	640	0.579	370.56
4	860	0.482	414.52
5	1170	0.402	470.34
5	$\frac{10260 \times 1.08}{0.20 - 0.08} = 92,340$	0.402	37120.68
			40175.3

- (b) Shareholder value per share:

Value of Firm	40175.3
Less: Value of debt	(3620)
Value of Equity	36555.3
÷ No. of share	151.50
Shareholder Value per share	241.29

- (c) Since, value of equity share is ₹ 241.29

Therefore, takeover bid of ₹ 225 per share is not a good offer.

Self-note: Cash & cash equivalent has nothing to do in the calculation of value of equity from the value of firm. It is of considered in the calculation of enterprise value and not here.

**QUESTION 33:**

MTP N 16

To be done after "portfolio mgmt"

Calculate the value of share from the following information:

Profit after Tax (PAT) of the company	€ 2900 million
Equity capital of company	€ 13,000 million
Par value of share	€ 40 each
Debt to Equity ratio of the company	1 : 3
Debt to Equity ratio of the proxy company	1 : 2
Beta of proxy company	0.20
Long run growth rate of the company	8%
Risk free interest rate	8.7%
Market returns	10.3%
Capital expenditure per share	€ 47
Depreciation per share	€ 39
Change in Working capital	€ 3.45 per share

Assume corporate tax rate to be 30% and Beta of Debt as zero.

Solution:**WN 1:** Calculation of K_e Step 1: Convert Equity Beta of proxy firm to its Asset Beta

$$\beta_A = \beta_E \times \left[\frac{E}{E + D(1 - t)} \right]$$

$$\beta_A = 0.2 \times \left[\frac{2}{2 + 1(1 - 0.3)} \right]$$

$$\beta_A = 0.148$$

It can be used as beta for proxy company

Step 2: Calculate Equity Beta of our company using Asset Beta of proxy company:

$$\beta_A = \beta_E \times \left[\frac{E}{E + D(1 - t)} \right]$$

$$0.148 = \beta_E \times \left[\frac{3}{3 + 1(1 - 0.3)} \right]$$

$$\beta_E = 0.183$$

Step 3: Calculate K_e using CAPM

$$\begin{aligned} K_e &= R_f + \beta (R_m - R_f) \\ &= 8.7 + 0.183 (10.3 - 8.7) \\ &= 8.99\% \end{aligned}$$

WN 2: Calculation of FCFE

Equity & Business Valuation

$$\text{No. of shares} = \frac{E(r) - R_f}{5} = 32.5 \text{ million}$$

$$\text{EPS} = \frac{E(r) - R_f}{\beta_p} = \text{€ } 8.923$$

Now, calculating FCFE:

EPS	8.923
+ Depreciation	39
– WC Investment	(3.45)
– Capital Expenditure	(47)
+ Borrowings	<u>2.8625</u> [¼ or 25% of (47 – 39 + 3.45)]
FCFE	<u>0.3356</u>

$$\begin{aligned} \text{Value of equity} &= \frac{\text{FCFE} \times (1 + g)}{k_e - g} \\ &= \frac{0.3356 \times (1.08)}{0.0899 - 0.08} \\ &= 36.61 \end{aligned}$$

Value of equity share is ₹ 36.61



QUESTION 34:

M 22 | M 16 | M 09 | RTP M 24

Mr. Amit is happy with the investment in a company as it is paying good dividend for the last few years. Last year it paid a dividend of ₹ 2 per share. The share is currently trading at ₹ 150 per share. He is of view that if he applies dividend discount model, the share is undervalued. As a financial expert examine his view that dividend discount model represents the fair value.

On the basis of the following information, calculate the value of share:

Profit after tax of the company	₹ 290 Cr.
Equity capital of company	₹ 1300 Cr.
Par value of share	₹ 40 each
Debt ratio of company (Debt/ Debt + Equity)	27%
Long run growth rate of the company	8%
Beta 0.1; risk free interest rate	8.7%
Market returns	10.3%
Capital expenditure per share	₹ 47
Depreciation per share	₹ 39
Change in Working capital	₹ 3.45 per share

hidden Adj: (prior of learning)

Note in notebook

Note: Round off figures (e.g. EPS etc.) upto 2 decimal points.

Solution:

$$\text{Number of Shares} = 1300/40 = 32.5 \text{ Cr.}$$

$$\text{EPS} = \frac{290 \text{ Cr}}{32.5 \text{ Cr}} = \text{€ } 8.92$$

Calculating FCFE:

	EPS	8.92	
+	Depreciation	39	
–	WC Investment	(3.45)	
–	Capital Expenditure	(47)	
+	Borrowings	<u>3.09</u>	[27% of (47 – 39 + 3.45)]
	FCFE	<u>0.56</u>	

Calculation of K_e :

$$\begin{aligned}
 &= R_f + \beta \times (R_m - R_f) \\
 &= 8.7 + 0.1 \times (10.3 - 8.7) \\
 &= 8.86\%
 \end{aligned}$$

$$\begin{aligned}
 \text{Value of share} &= \frac{\text{FCFE}(1-G)}{K_e - g} \\
 &= \frac{0.56 \times 1.08}{0.0886 - 0.08} \\
 &= \text{₹ } 70.33
 \end{aligned}$$

Calculation of value per share using dividend discount model:

$$\begin{aligned}
 P_0 &= \frac{D_0 \times (1+g)}{K_e - g} \\
 &= \frac{2 (1.08)}{0.0886 - 0.08} \\
 &= \text{₹ } 251.16
 \end{aligned}$$

From the above we can see that value per share on the basis of dividend discount model is more than the value per share on the basis of free cash flow to equity model.

dividend discount model assumes that the company follows a consistent dividend payout ratio which can be less than the actual cash available with the firm.

A stock's intrinsic value based on the dividend discount model may not represent the fair value for the shareholders because dividends are distributed in the form of cash from profits. In case the company is maintaining healthy cash in its balance sheet then it means that dividend pay-out is low which could result in undervaluation of the stock.

In the case of free cash flow to equity model a stock is valued on the cash flow available for distribution after all the reinvestment needs of capex and incremental working capital are met. Thus, using the free cash flow to equity model provides a better measure for valuations in comparison to the dividend discount model.

Thus, the view of Mr. Amit that dividend discount model represents the fair value is incorrect. The share is not under-valued rather it is overvalued if we take "free cash flow to equity model" into consideration.

**QUESTION 35:**

N 22 | M 14

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.

	For the year ended March 31, 2014
Revenues	₹ 7,500 Crores
Cost of Goods Sold (COGS)	₹ 3,000 Crores
Operating Expenses	₹ 2,250 Crores
Capital Expenditure	₹ 750 Crores
Depreciation (included in Operating Expenses)	₹ 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.

Solution:

Calculation of Working Capital

Year	Revenue	WC (25% of Revenue)	Increase in WC
0	7,500	1,875	
1	9,000	2,250	375
2	10,800	2,700	450
3	12,960	3,240	540
4	13,996.8	3,499.2	259.2

Calculation of EBIT

$$\begin{aligned} \text{EBIT}_0 &= 7,500 - 3,000 - 2,250 \\ &= ₹ 2,250 \end{aligned}$$

Calculation of Free Cash flows to firm

Year	1	2	3	4
EBIT	2,700	3240	3,888.00	4,199.04
Less: Tax @ 30%	-810	-972	-1,166.40	-1,259.71
EBIT (1 - t)	1,890	2268	7,721.40	2,939.33
Less: Δ in WC	-375	-450	-540.00	-259.20
Less: Capex - Depreciation	-172.5	-198.38	-228.13	-
FCFF	1,342.50	1,619.62	1,953.47	2,680.13

Calculation of PV of Cash Flows

Year	FCFF/TV	PVIF	DCF _s
1	1,342.50	0.870	1,167.98

2	1,619.62	0.756	1,224.43
3	1,953.47	0.658	1,285.38
3	$\frac{2680.13}{0.15 - 0.08} = 38287.57$	0.658	25,193.22
			28,871.01

Value of the Firm = ₹ 28,871.01 crores

**QUESTION 36:**

M 22 | M 10 | RTP

Following information is available in respect of XYZ 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	- ₹ 2,000 crores
EBIT	- ₹ 300 crores
Capital expenditure	- ₹ 280 crores
Depreciation	- ₹ 200 Crores

Information for high growth and stable growth period are as follows:

	High Growth	Stable Growth
Growth in Revenue & EBIT	20%	10%
Growth in capital expenditure and depreciation	20%	Capital expenditure are 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?

Solution:

Calculation of Change in working Capital

Year	Revenue	WC @ 25%	Increase in WC
0	2000	500	
1	2400	600	100
2	2880	720	120
3	3456	864	144
4	4147.2	1036.8	172.8
5	4561.92	1140.48	103.68

Wⁿ of NOPAT: 300 (1-30%)
= ₹ 210 (8)

Equity & Business Valuation

Calculating FCFF

Year	1	2	3	4	5
Revenue	2400	2880	3456	4147.2	4561.92
EBIT	360	432	518.4	622.08	684.29
Less: Tax @ 30%	(108)	(129.6)	(155.52)	(186.62)	(205.29)
EBIT (1 - t)	252	302.4	362.88	435.46	479
Add: Depreciation	240	288	345.6	414.72	—
Less: Capital Expenditure	(336)	(403.2)	(483.84)	(580.61)	—
Less: WC Investment	(100)	(120)	(144)	(172.8)	(103.68)
FCFF	56	67.2	80.64	96.77	375.32

Calculation of K_c

	High Growth	Stable Growth
K _e	= $10 + 1.15 \times (6) = 16.9\%$	= $9 + 1 \times (5) = 14\%$
K _d	= $13 \times (1 - 0.30) = 9.1\%$	= $12.86 \times (1 - 0.30) = 9\%$
K ₀	= $\frac{16.9 \times 1}{2} + \frac{9.1 \times 1}{2} = 13\%$	= $\frac{14 \times 3}{5} + \frac{9 \times 2}{5} = 12\%$

Calculation of Value of firm

Year	CF'S	PVAF@13%	DCF's
1	56	0.885	49.56
2	67.2	0.783	52.62
3	80.64	0.693	55.88
4	96.77	0.613	59.32
4.	$\frac{375.32}{0.12 - 0.10} = 18,766$	0.613	11503.56
			11,720.94

Value of Firm: 11720.94 (8)



QUESTION 37:

N 06 | RTP

sm.

only on calc

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 ₹10 each. The highest and the lowest market quotation during the last 6 months were ₹570 and ₹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 Ltd.'s Balance Sheet as at 31.3.2006 is summarised below:

	₹ Lakhs
Sources	
Share Capital	
20 lakhs equity shares of ₹10 each fully paid	200
10 lakhs equity shares of ₹10 each, ₹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	By way of	₹ lakhs
31.3.07	After tax earnings for equity	105
31.3.08	----- do -----	120
31.3.09	----- do -----	125
31.3.10	----- do -----	120
31.3.11	----- do -----	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.

Present value factors at 8% for years:

1-5: 0.93 0.86 0.79 0.74 0.68

You are required to:

- Calculate the total value of the business of XY Ltd.
- The number of shares to be issued by AB Ltd.; and
- The basis of allocation of the shares among the shareholders of XY Ltd.

Solution:

Price/share of AB Ltd. for determination of number of shares to be issue = $(₹ 570 + ₹ 430)/2 = ₹ 500$

Value of XY Ltd based on future cash flow $(105 \times 0.93) + (120 \times 0.86) + (125 \times 0.79) + (120 \times 0.74) + (300 \times 0.68)$	592.40 lakhs
Value of XY Ltd based on net assets	250.00 lakhs
Average value of XY Ltd $(592.40 + 250)/2$	421.20 lakhs
Price per Share of AB Ltd	500
No. of shares in AB Ltd to be issued $(421.2 \text{ Lakhs} \div 500)$	84240
Basis of allocation of shares	
Fully paid equivalent shares in XY Ltd. $(20 + 5)$ lakhs	2500000

Distribution to fully paid shareholders	84240x20/25	67392
Distribution to partly paid shareholders	84240- 67392 x 5/25	16848

**QUESTION 38:**

N 14 | RTP | M 18 | N 10 | SM

The valuation of Hansel Limited has been done by an investment analyst. Based on an expected free cash flow of ₹ 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 ₹ 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?

Solution:Calculation of K_0 :

$$\begin{aligned}\text{Value of firm} &= \frac{\text{FCFF}_1}{K_0 - g} \\ 1800 &= \frac{54}{K_0 - 0.09} \\ K_0 &= 12\%\end{aligned}$$

Back-Calculation of incorrect weights used by analyst

$$\begin{aligned}K_0 &= K_e \times W_e + K_d \times W_d \\ 12\% &= 0.20 \times W_e + 0.10 \times (1 - W_e) \\ W_e &= 0.2 \\ W_d &= 1 - W_e = 0.8\end{aligned}$$

Calculation of correct K_0 using correct weights:

$$\begin{aligned}\text{Correct } W_e &= 0.2 \times 3 = 0.60 \\ \text{Correct } W_d &= 0.8 \times 9/10 = 0.72 \\ \text{Correct } K_0 &= \frac{0.60 \times 0.20 + 0.72 \times 0.10}{1.32} = 14.55\%\end{aligned}$$

Correct value of firm:

$$\begin{aligned}&= \frac{54}{0.1455 - 0.09} \\ &= ₹ 972.97 \text{ lakhs}\end{aligned}$$

Correct value of Hansel = ₹ 972.97 lakhs

**QUESTION 39:**RTP *ISM*

BRS Inc deals in computer and IT hardwares and peripherals. The expected revenue for the next 8 years is as follows:

Year	Sales Revenue (\$ Million)
1	8
2	10
3	15
4	22
5	30
6	26
7	23
8	20

Summarized financial position as on 31st March 2012 was as follows:

Liabilities	Amount	Assets	Amount
Equity Stock	12	Fixed Assets (Net)	17
12% Bond	8	Current Assets	3
	20		20

Additional Information:

- a) Its variable expenses is 40% of sales revenue and fixed operating expenses (cash) are estimated to be as follows:

Period	Amount (\$ Million)
1 – 4 years	1.6
5 – 8 years	2

- b) An additional advertisement and sales promotion campaign shall be launched requiring expenditure as per following details:

Period	Amount (\$ Million)
1 years	0.50
2 – 3 years	1.50
4 – 6 years	3.00
7 – 8 years	1.00

- c) Fixed assets are subject to depreciation at 15% as per WDV method.
- d) The company has planned additional capital expenditures (in the beginning of each year) for the coming 8 years as follows:

Period	Amount (\$ 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%.

Equity & Business Valuation

- 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

Solution:

- (i) Value of Firm

Determination of Weighted Average Cost of Capital

	Cost (%)	Proportions	Weights	Weighted Cost
Equity Stock	16	12/20	0.60	9.60
12% Bonds	12% (1-0.30) = 8.40	8/20	0.40	3.36
				12.96 ay 13

Schedule of Fixed Assets & Depreciation

\$ Million

Year	Opening FA	Addition	Closing FA	Depreciation @ 15%
1	17.00	0.50	17.50	2.63
2	14.87	0.80	15.67	2.35
3	13.32	2.00	15.32	2.30
4	13.02	2.50	15.52	2.33
5	13.19	3.50	16.69	2.50
6	14.19	2.50	16.69	2.50
7	14.19	1.50	15.69	2.35
8	13.34	1.00	14.34	2.15

Determination of Investment

\$ Million

Year	Investment Required			Existing Investment in CA	Additional Investment required
	For Capital Expenditure	CA (20% of Revenue)	Total		
1	0.50	1.60	2.10	3.00	0.00
2	0.80	2.00	2.80	2.50*	0.30
3	2.00	3.00	5.00	2.00**	3.00
4	2.50	4.40	6.90	3.00	3.90
5	3.50	6.00	9.50	4.40	5.10
6	2.50	5.20	7.70	6.00	1.70
7	1.50	4.60	6.10	5.20	0.90
8	1.00	4.00	5.00	4.60	0.40

* Balance of CA in Year 1 (\$3 Million) – Capital Expenditure in Year 1 (\$0.50 Million)

** Similarly balance of CA in Year 2 (\$2.80) – Capital Expenditure in Year 2 (\$0.80 Million)

Determination of Present Value of Cash Inflows

\$ Million

Particulars	Years							
	1	2	3	4	5	6	7	8
Revenue (A)	8.00	10.00	15.00	22.00	30.00	26.00	23.00	20.00
Expenses								
Variable Costs	3.20	4.00	6.00	8.80	12.00	10.40	9.20	8.00
Fixed cash op. cost	1.60	1.60	1.60	1.60	2.00	2.00	2.00	2.00
Advertisement Cost	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
Total Expenses (B)	7.93	9.45	11.40	15.73	19.50	17.90	14.55	13.15
EBIT (C) = (A) - (B)	0.07	0.55	3.60	6.27	10.50	8.10	8.45	6.85
Less: Taxes @ 30%	0.02	0.16	1.08	1.88	3.15	2.43	2.53	2.06
NOPAT	0.05	0.39	2.52	4.39	7.35	5.67	5.92	4.79
Add: Depreciation	2.68	2.74	4.82	6.72	9.85	8.17	8.27	6.94
Less: Capital & CA Inv.	0	0.30	3.00	3.90	5.10	1.70	0.90	0.40
Free Cash Flow	2.68	2.44	1.82	2.82	4.75	6.47	7.37	6.54
PVF@13%	0.885	0.783	0.693	0.613	0.543	0.480	0.425	0.376
PV of CFs	2.371	1.911	1.261	1.729	2.579	3.106	3.132	2.46

Total Present Value of CFs of 8 years = \$ 18.549 million

$$\begin{aligned}
 \text{PV of Terminal value (TV}_8\text{) at 8}^{\text{th}} \text{ year:} &= \frac{\text{FCFF}_9}{k_0 - g} \times \text{PVIF}_{(13\%, 8)} \\
 &= \frac{\$6.54 (1.05)}{0.13 - 0.05} \times 0.376 \\
 &= \$32.2749 \text{ million}
 \end{aligned}$$

Value of Firm = Total PV of CFs of 8 years + PV of TV₈
= \$ 18.549 million + \$ 32.2749 million
= \$ 50.8239

(ii) Value of Equity

	\$ Million
Total Value of Firm	50.8239
Less: Value of Debt	8.0000
Value of Equity	42.8239



QUESTION 40:

MTP N 24

(Startup Valⁿ)

The ABC Startup has the following expected profits under different scenarios along respective probabilities

Year	Best Case		Base Case		Worst Case	
	Revenue	Expenses	Revenue	Expenses	Revenue	Expenses
1	₹ 100,00,000	₹ 80,00,000	₹ 100,00,000	₹ 90,00,000	₹ 100,00,000	₹ 95,00,000
2	₹ 120,00,000	₹ 92,40,000	₹ 110,00,000	₹ 95,70,000	₹ 102,00,000	₹ 98,94,000
3	₹ 144,00,000	₹ 108,00,000	₹ 121,00,000	₹ 102,85,000	₹ 104,04,000	₹ 101,95,920
Probability	30%		60%		10%	

You are required to suggest the value of ABC Startup using First Chicago Method assuming that:

- Applicable discounting rate is 20%.
- Startup is located in Tax-free Zone.
- The multiple for Terminal is 10. → *Relative Valⁿ*
- No depreciable assets are held by the ABC Startup.

→ no reference of this in outnotes

Note:

- Present Value Factor (PVF)

Year	1	2	3
PVF@20%	0.8333	0.6944	0.5787

- Round off the calculation to whole numbers.

Solution:

Valuation of Startup under different scenarios:

a) Best Case Scenario

	Year 1	Year 2	Year 3	
Revenue	₹ 1,00,00,000	₹ 1,20,00,000	₹ 1,44,00,000	
Expenses	₹ 80,00,000	₹ 92,40,000	₹ 1,08,00,000	
Cash Flow/ Earnings	₹ 20,00,000	₹ 27,60,000	₹ 36,00,000	
Terminal Value				₹ 3,60,00,000
PVF @ 20%	0.8333	0.6944	0.5787	0.5787
PV	₹ 16,66,600	₹ 19,16,544	₹ 20,83,320	₹ 2,08,33,200
Value of Startup				₹ 2,64,99,664

Year 3.

× 10 multiplier

b) Base Case Scenario

	Year 1	Year 2	Year 3	
Revenue	₹ 1,00,00,000	₹ 1,10,00,000	₹ 1,21,00,000	
Expenses	₹ 90,00,000	₹ 95,70,000	₹ 1,02,85,000	
Cash Flow/ Earnings	₹ 10,00,000	₹ 14,30,000	₹ 18,15,000	
Terminal Value				₹ 1,81,50,000
PVF @ 20%	0.8333	0.6944	0.5787	0.5787
PV	₹ 8,33,300	₹ 9,92,992	₹ 10,50,341	₹ 1,05,03,405
Value of Startup				₹ 1,33,80,038

Y2

× 10

c) Worst Case Scenario

	Year 1	Year 2	Year 3	
Revenue	₹ 1,00,00,000	₹ 1,02,00,000	₹ 1,04,04,000	
Expenses	₹ 95,00,000	₹ 98,94,000	₹ 1,01,95,920	
Cash Flow/ Earnings	₹ 5,00,000	₹ 3,06,000	₹ 2,08,080	
Terminal Value				₹ 20,80,800
PVF @ 20%	0.8333	0.6944	0.5787	0.5787
PV	₹ 4,16,650	₹ 2,12,486	₹ 1,20,416	₹ 12,04,159
Value of Startup				₹ 19,53,711

Value of ABC Startup as per First Chicago Method:

$$= 0.30 \times ₹ 2,64,99,664 + 0.60 \times ₹ 133,80,038 + 0.10 \times ₹ 19,53,711$$

$$= ₹ 1,61,73,293$$

C. NPV Based Questions of Valuation



QUESTION 41:

RTP M 19

The directors of Implant Inc. wishes to make an equity issue to finance a \$ 10 m (million) expansion scheme which has an expected 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 invest in IDRs which is currently yielding 10% per year.

The Present capital structure of Co. is as under. (\$ '000)

Ordinary Share (\$1 per share)	7,000
Share Premium	10,500
Free Reserves	25,500
	43,000
15% Term Bonds	6,000
11% Debenture (2012-2020)	8,000
	57,000

Means the market where stock price is affected rationally, and immediately as the information is out

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.

Solution:

Calculation of PV of savings in interest and redemption value

Interest	$60,00,000 \times 15\% \times 3.791$	34,11,900
Redeem value	$60,00,000 \times 0.621$	37,26,000
Total Outflow		71,37,900

Expected Share price of company:

Current value of the company	$(70,00,000 \times 2)$	1,40,00,000
Add: Funds Raised		1,50,00,000
Less: Floatation Cost		-6,00,000
Add: NPV of expansion scheme		22,00,000
Add: Net Saving due to early redemption of bonds		
PV of savings in Future Interest & RV	71,37,900	
Less: Redemption Outflow now	-60,00,000	
Less: Penalty Charges	-3,50,000	7,87,900
Revised value of Co.		3,13,87,900
÷ No. of Shares $(15 \div 0.5 + 7)$		3,70,00,000
Expected share price of the company		0.848

**QUESTION 42:**

N 20 | N 13

M/S. Roly Ltd. wants to acquire M/S. Poly Ltd. The following is the Balance Sheet of Poly Ltd. as on 31st March, 2020:

Liabilities	Amount	Assets	Amount
Equity Capital (₹ 10 per share)	10,00,000	Cash → H.O.A.	20,000
Retained Earnings	3,00,000	Debtors	50,000
12% Debentures	3,00,000	Inventories	2,00,000
Creditors and other liability	3,20,000	Plant & Machinery	16,50,000
	19,20,000		19,20,000

Shareholders of Poly Ltd. will get one share of Roly Ltd. at current market price of 20 for every two shares. External liabilities are expected to be settled at a discount of 20,000. Sundry debtors and Inventories are expected to realise 2,00,000.

Poly Ltd. will run as an independent unit. Cash Flow After Tax is expected to be ₹ 4,00,000 per annum for next 6 years Assume the disposal value of the plant after 6 years will be ₹ 1,50,000.

Poly Ltd. requires a return of 14%.

n	1	2	3	4	5	6
PVAF (14%, n)	0.877	0.769	0.675	0.592	0.519	0.456

Advise the Board of Directors on the financial feasibility of the Proposal.

Solution:**Calculation of Purchase Consideration**

Issue of Share 50000 x ₹ 20	10,00,000
Add: External Liabilities settled	3,00,000
Add: 12% Debentures settled	3,00,000
	16,00,000
Less: Debtors and Inventories realised	2,00,000
Less: Cash Balance realised	20,000
	13,80,000

PV of Future Cash Flows from Poly Ltd:

$$\begin{aligned}
 &= \text{Annual CF} \times \text{PVAF}_{(14\%, 6 \text{ years})} + \text{Disposal Value} \times \text{PVAF}_{(14\%, 6 \text{th year})} \\
 &= 4,00,000 \times 3.888 + 1,50,000 \times 0.456 \\
 &= 16,23,600
 \end{aligned}$$

$$\begin{aligned}
 \text{NPV of the proposal} &= \text{PV of future cash inflows} - \text{Purchase consideration} \\
 &= 16,23,600 - 13,80,000 \\
 &= 2,43,600
 \end{aligned}$$

Advise: The project is financially feasible

Self-note: Unlike other assets & liabilities, question will not specify about realisation of cash of target company. Keep in mind to deduct it while calculating purchase consideration. Also, question is silent about treatment of debentures, however, ICAI has added it while calculating purchase consideration.



QUESTION 43:

MTP M 16

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 ₹ 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 ₹ 20 crore.
- Synergy Gain of ₹ 2 crore per annum is expected to be accrued from the proposed acquisition.
- Nishana Ltd. has outstanding Debentures having a market value of ₹ 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.

Solution:

Calculation of Maximum Price:

Year	0	1	2	3	4	5
Operating cash flow		10	10	10	10	10
Gain on Sale of office premise	20					
Synergy Benefits		2	2	2	2	2
Disposal of Nishana Ltd.						50
Net cash flow	20	12	12	12	12	62
PVF @ 20%	1	0.833	0.694	0.579	0.482	0.402
Present value	20	9.996	8.328	6.948	5.784	24.924

Total value of firm	75.984
Less: MV of Debentures	-15.000
Total Value of Equity	60.984

Thus, the maximum price to be paid for acquisition of Nishana Ltd. ₹ 60.984 crore.



QUESTION 44:

M 12

only on calci

DEF Ltd has been regularly paying a dividend of ₹ 19,20,000 per annum for several years and it is expected that same dividend would continue at this level in near future. There are 12,00,000 equity shares of ₹ 10 each and the share is traded at par. → $MPS = FV$.

The company has an opportunity to invest ₹ 8,00,000 in one year's time as well as further ₹ 8,00,000 in two year's time in a project as it is estimated that the project will generate cash inflow of ₹ 3,60,000 per annum in three year's time which will continue for ever. This investment is possible if dividend is reduced for next two years.

Whether the company should accept the project? Also analyse the effect on the market price of the share, if the company decides to accept the project.

Solution:

$$\text{Dividend per share} = \frac{19,20,000}{12,00,000} = ₹ 1.6$$

$$\text{Calculation of } K_e = \frac{1.6}{10} = 16\%$$

Calculation of NPV of the Project:

Year	CFs	PVF @ 16%	DCFs
1	-8,00,000	0.862	-6,89,600
2	-8,00,000	0.743	-5,94,400
2	$\frac{3,60,000}{0.16} = 22,50,000$	0.743	16,71,750
			3,87,750

As NPV of the project is positive, the value of the firm will increase by ₹ 3,87,750.

The market price per share will increase from ₹ 10 to:

$$= 10 + \frac{3,87,750}{12,00,000}$$

$$= ₹ 10.32$$

***Solution by ICAI:**

Year	CFs	PVF @ 16%	DCFs
1	-8,00,000	0.862	-6,89,600
2	-8,00,000	0.743	-5,94,400
3	$\frac{3,60,000}{0.16} = 22,50,000$	0.641	14,42,250
			1,58,250

As NPV of the project is positive, the value of the firm will increase by ₹ 1,58,250. The market price per share will increase by 13 paise.

**QUESTION 45:**

MTP M 17

only on call

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 Next Year = ₹ 200 Crore

Book Value of Liabilities = ₹ 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 ₹ 950 Crore for the same to MS Stones.

The other data pertaining to the business are as follows:

Tax Rate 30%

Equity & Business Valuation

Growth Rate 4%
Applicable Discount Rate for Tile Business 12%

If market value of liabilities are ₹ 40 Crore more than book value, you are required to advise MD whether she should go for divestiture of the tile business or not.

Solution:

$$\begin{aligned}\text{PV of Cash Inflows:} &= \frac{200 \text{ crore } (1-0.30)}{0.12-0.04} \\ &= ₹ 1750 \text{ Crore}\end{aligned}$$

$$\begin{aligned}\text{Market Value of Liabilities} &= 780 \text{ Crore} + 40 \text{ Crore} \\ &= 820 \text{ Crore}\end{aligned}$$

$$\begin{aligned}\text{Net Equity Value} &= 1750 \text{ Crore} - 820 \text{ Crore} \\ &= 930 \text{ Crore}\end{aligned}$$

Since, the Tripati Tiles is offering ₹ 950 Crore, more than value of equity of ₹ 930 Crore, the company should go further with decision of divestiture of tile business.



QUESTION 46:

N 18 | M 16 | N 11 | M 07 | RTP | SM

ABC Co. is considering a new sales strategy that will be valid 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:

Income Statement	₹
Sales	20,000
Gross margin (20%)	4,000
Administration, Selling & distribution expense (10%)	2,000
PBT	2,000
Tax (30%)	600
PAT	1,400
Balance Sheet Information	
Fixed Assets	8,000
Current Assets	4,000
Equity	12,000

If it adopts the new strategy, sales will grow at the rate of 20% per year for three years From 4th year onward Cash Flow will be stabilized. The gross margin ratio, Assets turnover ratio, the Capital structure and the income tax rate will remain unchanged. *→ Even PAT*

Depreciation would be at 10% of net fixed assets at the beginning of the year.

The Company's target rate of return is 15%.

Determine the incremental value due to adoption of the strategy.

Solution:

Value of the company before new strategy

Self-note: Since, asset turnover ratio has to remain same, therefore, value of fixed assets has to be maintained. Capex to buy new assets will be same as the amount of depreciation on previous year's asset and hence they will offset each other.

PAT or FCFE = 1,400

Value of company Before strategy = $\frac{1,400}{0.15} = 9,333.33$

Value of company after the strategy

Value of Fixed Assets:

Years	Opening (a)	Depreciation (b)	Closing (c)	Capex (c + b – a)
1	8,000	800	8000 + 20% = 9,600	2,400
2	9,600	960	11,520	2,880
3	11,520	1,152	13,824	3,456
4	13,824.0	1,382.4	13,824.0	1,382.4

Calculation of increase in working capital:

Year	WC = CA - CL	Increase in WC
0	4,000	
1	4,800	800
2	5,760	960
3	6,912	1,152
4	6,912	0

Calculation of FCFE:

Year	1	2	3	4
PAT @ 7% of sales	1,680	2,016	2,419.2	2,419.2
Add: Dep	800	960	1,152.0	1,382.4
Less: Capex	-2,400	-2,880	-3,456.0	-1,382.4
Less: Increase in WC	-800	-960	-1,152.0	0.0
	-720	-864	-1,036.8	2,419.2

Calculation of value of company:

Years	CFS / TV	PVF @ 15%	DFCs
1	-720	0.87	-626.4
2	-864	0.756	-653.18
3	-1036.8	0.658	-682.21
3	$\frac{2419.2}{0.15} = 16128.0$	0.658	10612.22
			8,650.43

Incremental Value due to adoption of strategy = 8650.43 – 9,333.33
= - 682.90

Conclusion: The strategy is not financially viable.

D. Asset Based Valuation Models



QUESTION 47:

RTP N 11

Two Companies ABC Ltd and XYZ Ltd are in same industry. To increase its size, ABC Ltd made a takeover bid for XYZ Ltd.

Equity Beta of ABC and XYZ is 1.20 and 1.05 respectively. Risk Free Rate is 10% and Market Rate of Return is 16%. The growth rate of earnings after tax of ABC Ltd. in recent years has been 15% and XYZ's is 12%. Further both companies continuously followed Constant Dividend Policy. Mr. V, the CEO of ABC requires information about how much Premium above the current Market Price to offer for XYZ's shares. Two suggestions have forwarded by Merchant Bankers –

1. Price based on XYZ's Net worth as per Balance Sheet, after adjusting Current Value of Assets and estimated after tax profit for the next 5 years → *add to networth the profit of next 5 years.*
2. Price based on Dividend Valuation Model, using existing Growth Rate estimates.

Summarized Balance Sheet of Both Companies (₹ in Lakhs)

Liabilities	ABC Ltd	XYZ Ltd	Assets	ABC Ltd	XYZ Ltd
Equity Share Capital	2,000	1,000	Land & Building	5,600	1,500
General Reserves	4,000	3,000	Plant & Machinery	7,200	2,800
Share Premium	4,200	2,200	Long Term Loans	5,200	1,000
Current Liabilities -			Current Assets -		
Sundry Creditors	2,000	1,100	Accounts Receivable	3,400	2,400
Bank Overdraft	300	100	Stock	3,000	2,100
Tax Payable	1,200	400	Bank/Cash	200	400
Dividend Payable	500	400		-	-
Total	19,400	9,200	Total	19,400	9,200

Profit & Loss A/c (₹ in Lakhs)

Particulars	ABC Ltd	XYZ Ltd	Particulars	ABC Ltd	XYZ Ltd
To Net Interest	1,200	220	By Net Profit (EBIT)	7,000	2,550
To Taxation	2,030	820		-	-
To Distributable Profit (NP)	3,770	1,510		-	-
Total	7,000	2,550	Total (NP)	7,000	2,550
To Dividend	1,130	760	By Distributable Profit	3,770	1,510
To Balance c/d	2,640	750		-	-
Total	3,770	1,510	Total	3,770	1,510

Additional Information:

1. ABC Ltd.'s Land & Building have been recently revalued. XYZ Ltd's have not been revalued for 4 years, and during this period the average value of Land & Building have increased by 25% p.a. → *comp. effect.*
2. The Face Value of Share of ABC Ltd is ₹ 10 and of XYZ Ltd is ₹ 25 per share.
3. The current market Price of Shares of ABC Ltd is ₹ 310 and of XYZ Ltd's ₹ 470 per Share.

From the above data, you are required to calculate the Premium per Share above XYZ's Current Share Price by two suggested valuation methods. Discuss which of these two values should be used for bidding the XYZ's Shares clearly stating the assumptions made.

Solution:

Self-note: There is a mistake in the question as the balance sheet totals don't match. This is because of term loan, which is supposed to be a liability.

1) Net Asset Value Model:

Calculation of net worth:

Particulars	₹ Lakhs	
<u>Asset</u>		
Land & Building $[1500 \times (1.25)^4]$	3662.11	
Plant & Machinery	2800	
Account Receivable	2400	
Stock	2100	
Bank / Cash	400	11362.11
<u>Liabilities</u>		
Long term loan	-1,000	
Sundry Creditors	-1,100	
Bank Overdraft	-100	
Tax Payable	-400	
Dividend Payable	-400	-3,000
Net Asset Value		8362.11

Calculation of after-tax Profit for 5 years *growing @ 12%.*

Year	<i>CF's Profit</i>
1	1,691.20
2	1,894.14
3	2,121.44
4	2,376.01
5	2,661.13
	10,743.94

Value of the Equity of XYZ = Net worth + After Tax Profits
 = 8362.109 + 10743.935
 = 19106.04 lac

Value per share of XYZ: $= \frac{19106.04}{40}$
 = 477.65

Premium per share = 477.65 – 470 = ₹ 7.65
 Or

$$= \frac{7.65}{470} = 1.63\%$$

This is not a sound basis for valuation as it ignores the time value of money. The premium of 1.63% above the current market price is very small compared to those achieved in many real bids. **XX**

(2) Dividend Valuation Model:

Dividend Total 760

÷ No. of shares 40

Dividend 19 per shares

DPS: $\frac{760}{40} = ₹ 19 \text{ per share.}$

Ke using CAPM = $R_f + \beta_j (R_m - R_f)$

$$= 10\% + 1.05(16\% - 10\%)$$

$$= 16.3\%$$

$$P_0 = \frac{D_1}{K_e - g}$$

$$= \frac{19 \times 1.12}{0.163 - 0.12}$$

$$= 494.88$$

$$\text{Premium per share} = 494.88 - 470 = 24.88$$

Or

$$= \frac{24.88}{470} = 5.29\%$$

Discussion: Value of ₹ 494.88 arrived using dividend valuation model should be used for bidding because it is more logical method of arriving at the value of share.

Assumption:

- Valuation is based on a constant growth rate and unchanged dividend policy.
- It will be more rational to assess the value of XYZ Ltd. incorporating post merger synergies.



QUESTION 48:

N 20

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:

Particulars	in crores	
	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 & Building (Net)	720		190	
Plant & Machinery (Net)	900		350	
Furniture & Fixtures (Net)	30	1650	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 (C/E)		1955		890
Paid up Share Capital (₹ 10 per share)	250		125	
Reserves and Surplus	1,050	1,300	660	785
Borrowing		655		105
Capital Employed		1,955		890
Market Price 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?

Period	1	2	3	4	5
FVIF (30%, t)	1.3000	1.6900	2.1970	2.8560	3.7130
FVIF (15%, t)	1.1500	2.4725	3.9938	5.7424	7.7537

← annuity factor.

Solution:

1) Net Worth Method

Calculation of Net worth of SVL

	(In ₹ crores)	
<u>Assets</u>		
L&B [190 × 2.1970]	417.43	1357.43
P&M	350	
F&F	10	
CA	580	
<u>Liabilities</u>		
Creditors	130	

OD	10	
PFT	50	
PFD	50	
Borrowings	105	345
Net worth		1012.43

Calculation of Estimated Average PAT:

$$\begin{aligned}\text{Total profit on next 5 years} &= \text{Current PAT} \times \text{PVAF (15\%, 5 years)} \\ &= 250 \times 7.7537 \\ &= 1938.43\end{aligned}$$

$$\begin{aligned}\text{Average profit for 1 year} &= \frac{1938.43}{5} \\ &= 387.69\end{aligned}$$

$$\begin{aligned}\text{Total Value of the firm} &= 1012.43 + 387.69 \\ &= 1400.12\end{aligned}$$

$$\begin{aligned}\text{Value of firm per share} &= \frac{1400.12}{12.5} \\ &= 112.01\end{aligned}$$

$$\text{Premium per share} = 112.01 - 75 = 37.01$$

Or

$$= \frac{37.01}{75} = 49.33\%$$

2) Dividend Growth Formula

$$\text{Dividend per share} = \frac{125}{12.5} = ₹ 10$$

$$\text{Pre merger Growth} = 15\%$$

$$\begin{aligned}\text{Pre merger } K_e &= \frac{10 \times 1.15}{75} + 15\% \\ &= 30.33\%\end{aligned}$$

Growth of 15% is considered because MPS of ₹75 is based on 15% growth

$$\text{Expected growth after merger} = 18\%$$

$$\begin{aligned}\text{Value per share} &= \frac{10 \times 1.18}{0.3033 - 0.18} \\ &= 95.70\end{aligned}$$

$$\text{Premium per share} = 95.70 - 75 = 20.70$$

Or

$$= \frac{20.70}{75} = 27.60\%$$

c) ICL will put forward valuation based on growth rate method as it will lead to least cash outflow

E. Earnings Based Valuation Models



QUESTION 49:

M 08 | RTP

Given below is the Balance Sheet of S Ltd. as on 31.3.2008:

Liabilities	₹ (In lakh)	Assets	₹ (In lakh)
Share Capital (share of ₹ 10)	100	Land and building	40
Reserves and surplus	40	Plant and machinery	80
Long Term Debts	30	Investment	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 ₹ 64 lakhs includes ₹ 4 lakhs extraordinary income and ₹ 1 lakh income from investments of surplus funds; such surplus funds are unlikely to recur. *→ PBT (assumed)*
- In subsequent years, additional advertisement expenses of ₹ 5 lakhs are expected to be incurred each year.
- Market value of Land and Building Plant and Machinery have been ascertained at ₹ 96 lakhs and ₹ 100 lakhs respectively. This will entail additional depreciation of ₹ 6 lakhs each year.
- Effective Income-tax rate is 30%.
- The capitalization rate applicable to similar businesses is 15%. *→ kind of k.s.*

Solution:

Value of share using NAV method:

Land & Building	96,00,000
Plant & machinery	1,00,00,000
Investment	10,00,000
Stock	20,00,000
Debtors	15,00,000
Cash & Bank	5,00,000
Less: Long term Debt	-30,00,000
Net Assets	2,16,00,000
÷ No. of shares	10,00,000
Value Per Share	21.6

Value of share using Earning Capitalisation

Profit before tax	64,00,000
Less: Extra ordinary income	-4,00,000
Income from Investments	-1,00,000
Additional Expenditure	-5,00,000

Equity & Business Valuation

Depreciation	-6,00,000
Future Maintainable PBT	48,00,000
Less: Tax Rate @ 30%	-14,40,000
Future Maintainable PAT	33,60,000
÷ Capitalization rate	15%
Value of Business	2,24,00,000

Value of equity = 2,24,00,000 – 30,00,000
= 1,94,00,000

Value Per share = $\frac{1,94,00,000}{10,00,000} = 19.4$

Fair Value per Share = $\frac{21.6 + 19.4}{2}$
= 20.50 per share

Self-Note:

Assumptions made:

- Profit given is profit before tax
- The value arrived using earnings capitalisation method is value of business because capitalisation rate given is business (K_0) & not of only equity (K_e).

→ even if numerator is FMP which belongs only to equity.



QUESTION 50:

N 12 15m

H Ltd. agrees to buy over the business of B Ltd. effective 1st April, 2012. The summarized Balance Sheets of H Ltd. and B Ltd. as on 31st March 2012 are as follows:

Balance Sheet as at 31st March, 2012 (in Crores of Rupees)

Liabilities:	H. Ltd.	B. Ltd.
Paid up share Capital		
- Equity Shares of ₹ 100 each	350.00	
- Equity Shares of ₹ 10 each		6.50
Reserve & Surplus	950.00	25.00
Total	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 Ltd. proposes to buy out B Ltd. and the following information is provided to you as part of the scheme of buying:

- The weighted average post tax maintainable profits of H Ltd. and B Ltd. for the last 4 years are ₹ 300 crores and ₹ 10 crores respectively.
- Both the companies envisage a capitalization rate of 8%.
- H Ltd. has a contingent liability of ₹ 300 cores as on 31st March, 2012.

4. H Ltd. to issue shares of ₹ 100 each to the shareholders of B Ltd. 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 Assets basis and Earnings capitalization method respectively for both H Ltd. and B Ltd.)

You are required to arrive at the value of shares of both H Ltd. and B Ltd. under:

- Net Asset Value Method
- Earnings Capitalisation Method
- Exchange ratio of shares of H Ltd. to be issued to the shareholders of B Ltd. on a Fair value basis (taking into consideration the assumption mentioned in point 4 above.)

Solution:

- (a) Net Asset Value Method

Particulars	H Ltd.	B Ltd.
Net Fixed Assets	220	0.5
Net Current Assets	1020	29
Deferred Tax Assets	60	2
Less: Contingent liabilities	-300	0
Net Asset Value	1000	31.5
÷ Number of Shares	3.5	0.65
Per share value	285.714	48.462

- (b) Earning Capitalisation Method

	H Ltd.	B Ltd.
Future Maintainable Profit	300	10
÷ Capitalization rate	0.08	0.08
Value of Equity	3750	125
÷ Number of shares	3.5	0.65
Value per Share	1071.43	192.31

- (c) Fair Value Per Share

$$\begin{array}{rcl} \text{H Ltd.} & & \text{B Ltd.} \\ \frac{285.714 \times 1 + 1071.43 \times 3}{4} & & \frac{48.462 \times 1 + 192.31 \times 3}{4} \\ 875 & & 156.348 \end{array}$$

For every share of B Ltd., H Ltd should issue: $\left(\frac{156.348}{875} \right) = 0.1787$ shares



QUESTION 51:

M 19

"word extraordinary missing"

The closing price of LX Ltd. is ₹ 24 per share as on 31st March, 2019 on NSE Ltd. the Price Earnings Ratio Was 6. It was found that an amount of ₹ 24 Lakhs as income and an extra ordinary loss of ₹ 9 lakhs 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:

Equity & Business Valuation

(₹ in Lakhs)

Sales	150
Material Cost	40
Labour Cost	34
Fixed Cost	24

The company has 500,000 equity shares of ₹ 10 each and 100,000 9% Preference Shares of ₹ 100 each. The Price Earnings Ratio is 6 times. Post-tax cost of capital is 10 per cent per annum. Tax rate is 34 per cent.

You are required to determine:

- Existing Profit from old operations 
- The value of business.

Solution:

Self-note: Question has missed to specify that income of ₹ 24 lakhs was extra-ordinary. However, it is still assumed extraordinary from the flow of the question.

- Existing profit from old operations:

Particulars	Amount
Market Price	24
÷ PE Ratio	6
EPS	4
× Number of Shares	5,00,000
EAES	20,00,000
Add: Preference Dividend	9,00,000
PAT	29,00,000

- Value of Business

Existing PAT		29,00,000
÷ (1 - Tax rate)		66%
Existing PBT		43,93,939
Less: Extraordinary income		-24,00,000
Add: Extra ordinary loss		9,00,000
		28,93,939
Profit from new operation		
Sales	1,50,00,000	
Less: Material Cost	-40,00,000	
Labour Cost	-34,00,000	
Fixed Cost	-24,00,000	52,00,000
Pre-tax future maintainable profits		80,93,939
Less: Tax @34%		-27,51,939
Future Maintainable profit		53,42,000

$$\begin{aligned}
 \text{Value of business} &= \frac{53,42,000}{0.10} \\
 &= 5,34,20,000
 \end{aligned}$$

**QUESTION 52:**

M 21 | N 16 | N 12 | M 09 | RTP

XN Ltd. reported a profit of ₹ 100.32 lakhs after 34% tax for the financial Year 2015- 2016. An analysis of the accounts reveals that the income included extraordinary items of ₹ 14 lakhs and an extraordinary loss of ₹ 5 lakhs. The existing operations, except for the extraordinary items, are expected to continue in future. Further, a new product is launched and the expectations are as under:

	₹
Sales	70
Material costs	20
Labour costs	16
Fixed Costs	10

The company has 50,00,000 Equity Shares of ₹ 10 each and 80,000, 9% Preference Shares of ₹ 100 each with P/E Ratio being 6 times.

You are required to:

- compute the value of the business. Assume cost of capital to be 12% (after tax) and
- determine the market price per equity share.

Solution:

- Computation of value of business:

Existing PAT		1,00,32,000
÷ (1 - Tax rate)		66%
Existing PBT		1,52,00,000
Less: Extraordinary income		- 14,00,000
Add: Extra ordinary loss		5,00,000
		1,43,00,000
Profit from new operation		
Sales	70,00,000	
Less: Material Cost	-20,00,000	
Labour Cost	-16,00,000	
Fixed Cost	-10,00,000	24,00,000
Pre-tax future maintainable profits		1,67,00,000
Less: Tax @ 34%		-56,78,000
Future Maintainable profit		1,10,22,000
÷ Capitalization Rate		12%
Value of Business		9,18,50,000

- Market Price per equity share

Particulars	Amount
PAT	1,10,22,000
Less: Preference Dividend	7,20,000
EAES	1,03,02,000

Ambiguity:
Rather than considering reported PAT the Institute has considered future maintainable PAT

$$1 + 0.25 RR = 2.55375 RR - 0.2094075$$

÷ No of Shares	50,00,000
EPS	2.0604
× PE Ratio	6
Market price per share	12.3624



QUESTION 53:

SM | RTP | MTP N 19

Typical question (to be remembered.)

Capital Structure of Sun Ltd., as at 31.3.2003 was as under:

	₹ in lakhs
Equity share capital	80
8% Preference share capital	40
12% Debentures	64
Reserves	32

Sun Ltd., earns a profit of ₹ 32 lakhs annual 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.

1. Profit after tax covers fixed interest and fixed dividends at least 3 times.
2. Capital gearing ratio is 0.75.
3. 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%. → *div. rate*

Compute the value per equity share of the company assuming the risk premium as:

- a) 1% for every one time of difference for Interest and Fixed Dividend Coverage.
- b) 2% for every one time of difference for Capital Gearing Ratio.

Solution:

Income Statement:

EBIT	32,00,000
Less: Int @ 12%	(7,68,000)
PBT	24,32,000
Less: Tax @ 35%	(8,51,200)
PAT	15,80,800
Less: PD @ 8%	(3,20,000)
EAES	12,60,800
Less: Profit Dist. (Equity dividend)	(6,40,000)
Undistributed Profit	6,20,800

$$\begin{aligned} \text{Yield on share (FMP)} &= 6,40,000 \times 50\% + 6,20,800 \times 5\% \\ &= 3,51,040 \end{aligned}$$

$$\begin{aligned} \text{Interest \& fixed Dividend coverage Ratio} &= \frac{\text{PAT} + \text{Int on Debt}}{\text{Int on Debt} + \text{Pref Div}} \\ &= \frac{15,80,800 + 7,68,000}{7,68,000 + 3,20,000} \end{aligned}$$

$$= 2.16$$

$$\begin{aligned}\text{Capital gearing ratio} &= \frac{\text{Debt} + \text{Pref}}{\text{ESHF}} \\ &= \frac{64,00,000 + 40,00,000}{1,12,00,000} \\ &= 0.93\end{aligned}$$

Calculating capitalisation rate:

Normal Rate of Return	9.6%
Adjustment for:	
Add: Int & fixed Dividend coverage [(3 - 2.16) 1%]	0.84%
Add: Capital gearing Ratio [(0.93 - 0.75) 2%]	<u>0.36%</u>
Effective Capitalisation Rate	<u>10.8%</u>

Calculation of value per equity share

$$\begin{aligned}\text{Value of Equity} &= \frac{\text{Yield}}{\text{Capitalisation Rate}} \\ &= \frac{3,51,040}{0.108} \\ &= ₹ 32,50,370 \\ \text{Per share value} &= \frac{32,50,370}{80,000} = 40.63\end{aligned}$$

Note: FV per share is assumed as ₹ 100.



QUESTION 54:

M 11

only on calc

The following information is given for QB Ltd.

Earnings per share	₹ 12
Dividend per share	₹ 3
Cost of capital	18%
Internal Rate of Return on investment → ROI or ROE	22%
Retention Ratio	75%

Calculate the market price per share using

- Gordon's formula
- Walter's formula

Solution:

- Gordon's Formula:

$$P_0 = \frac{E(1-b)}{K_e - br}$$

Handwritten: $\frac{D_1}{K_e - g}$

$$= \frac{₹ 12 (1 - 0.75)}{0.18 - (0.75 \times 0.22)}$$

$$= ₹ 200$$

b. Walter Formula

$$P_0 = \frac{D + \frac{r}{K_e} (E - D)}{K_e}$$

$$= \frac{3 + \frac{0.22}{0.18} (12 - 3)}{0.18}$$

$$= ₹ 77.77$$



QUESTION 55:

N 20 | N 10 | M 06 | RTP

The following information relates to Maya Ltd:

Earnings of the company	₹ 10,00,000
Dividend payout ratio	60%
No. of Shares outstanding	2,00,000
Rate of return on investment	15%
Equity Capitalization rate	12%

- What would be the market value per share as per Walter's model?
- What is the optimum dividend payout ratio according to Walter's model and the market value of company's share at the payout ratio? *→ Even if they don't ask it, calculate it!*
- What inference could you draw?

Solution:

a) Market value per share as per Walter's model

$$\text{EPS} = \frac{10,00,000}{2,00,000} = 5$$

$$\text{DPS} = 5 \times 60\% = 3$$

$$P_0 = \frac{D + \frac{r}{K_e} (E - D)}{K_e}$$

$$= \frac{3 + \frac{0.15}{0.12} (5 - 3)}{0.12}$$

$$= 45.833$$

- b) ∴ return on investment (15%) > equity capitalisation rate (12%)
 ∴ Optimal dividend payout ratio = 0%

Value of equity at zero payout ratio

$$P_0 = \frac{0 + \frac{0.15}{0.12}(5 - 0)}{0.12}$$

$$= 52.0833$$

- c) When, return on investment (15%) > equity capitalisation rate (12%), as the payout ratio decreases, the value of share increases.

**QUESTION 56:**

M 17 | M 05

only on calci

You are requested to find out the approximate dividend payment ratio as to have the Share Price at ₹ 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) (K_e)	12%

Solution:

Calculation of EPS:

EAT	50,00,000
Less: Preference Dividend	<u>(8,00,000)</u>
EAES	42,00,000
÷ No. of shares	<u>5,00,000</u>
EPS	8.40

Calculating DPS (D) using Walter's Model:

$$P_0 = \frac{D + \frac{r}{K_e}(E - D)}{K_e}$$

$$56 = \frac{D_0 + \frac{0.15}{0.12}(8.4 - D)}{0.12}$$

$$D = 15.12$$

$$\text{Dividend payout Ratio} = \frac{15.12}{8.4} = 180\%$$

**QUESTION 57:**

M 07 | RTP

The following information is supplied to you:

	₹
Total Earnings	2,00,000
No. of equity shares (of ₹ 100 each)	20,000
Dividend paid	1,50,000
Price/Earnings ratio	12.5

- Ascertain whether the company is following an optimal dividend policy.
- Find out what should be the P/E ratio at which the dividend policy will have no effect on the value of the share.
- Will your decision change, if the P/E ratio is 8 instead of 12.5?

Solution:

a) $K_e = 1/\text{PE Ratio}$
 $= 1/12.5 = 8\%$

$$\begin{aligned} \text{ROE} &= \frac{\text{EAES}}{\text{ESHF}} \\ &= \frac{2,00,000}{20,000 \times 100} \\ &= 10\% \end{aligned}$$

∴ ROE (10%) > cost of equity (8%)

∴ Optimal payout ratio = 0 %

$$\begin{aligned} \text{Value at 0\% payout} &= \frac{0 + \frac{0.10}{0.08} (10 - 0)}{0.08} \\ &= 156.25 \end{aligned}$$

- b) For dividend policy to have no effect on the value of share, cost of equity = return on equity.
Hence, $k_e = r = 10\%$

$$\text{Therefore, PE Ratio} = \frac{1}{k_e} = \frac{1}{0.10} = 10 \text{ times}$$

- c) When PE is = 8
 $K_e = 1/8 = 12.5$

$$r = 10\%$$

When, $K_e > r$

Payout ratio = 100 %

$$\begin{aligned} \text{Value of share at 100\% payout} &= \frac{10 + \frac{0.10}{0.125} (10 - 10)}{0.125} \\ &= ₹ 80 \end{aligned}$$



QUESTION 58:

M 12

X Ltd. has an internal rate of return @ 20%. It has declared dividend @ 18% on its equity shares, having face value of ₹ 10 each. The payout ratio is 36% and Price Earnings 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.

Solution:

$$\begin{aligned}\text{Internal Rate of Return (r)} &= 20\% \\ \text{Dividend (D)} &= 10 \times 18\% = 1.80 \\ \text{Earnings Per share (E)} &= \frac{1.80}{0.36} = 5 \\ \text{Price of share (P)} &= 5 \times 7.25 = 36.25\end{aligned}$$

$$\begin{aligned}P_0 &= \frac{D + \frac{r}{K_e} (E - D)}{K_e} \\ 36.25 &= \frac{1.80 + \frac{0.20}{K_e} (5 - 1.80)}{K_e}\end{aligned}$$

$$36.25 K_e^2 = 1.80 K_e + 0.64$$

$$-36.25 K_e^2 + 1.80 K_e + 0.64 = 0$$

Solving above equation for K_e

$$\begin{aligned}K_e &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-1.80 \pm \sqrt{(1.80)^2 - 4 \times (-36.25) \times 0.64}}{2 \times (-36.25)} \\ &= 16\%\end{aligned}$$

Since, Internal rate of return (20%) > Cost of Equity (16%)

Therefore, 0% payout ratio will give limiting value of share

$$\begin{aligned}P_0 &= \frac{0 + \frac{0.20}{0.16} (5 - 0)}{0.16} \\ &= ₹ 39.06\end{aligned}$$

F. Relative Valuation



QUESTION 59:

N 21 MTP

only on calci

Snake Ltd. is taking over Lizard Ltd, both are listed companies. The PE Ratio of Lizard Ltd. has been low as 4 and high as 7 and is currently 5. Lizard Ltd.'s previous year EPS was ₹ 3.40 and current expected EPS this year to be ₹ 4.00.

Determine the different range of values of shares using P/E Model.

Solution:

The range of values using P/E Ratio and EPS either historic or projected are as follows.

EPS	Value (₹)	P/E Ratio	Value	Value of Shares
Historic	3.40	Lowest	4	13.60
Historic	3.40	Current	5	17.00
Historic	3.40	Highest	7	23.80
Expected	4.00	Lowest	4	16.00
Expected	4.00	Current	5	20.00
Expected	4.00	Highest	7	28.00



QUESTION 60:

J 21 | ~~SEP~~ M 24 | SM

MTP

On the basis of the following information:

Current dividend (D_0) ₹2.50

Discount rate (k) 10.50%

Growth rate (g) 2%

- Calculate the present value of stock of ABC Ltd.
- Is its stock overvalued if stock price is ₹35, ROE = 9% and EPS (E_0) = ₹2.25? Show detailed calculation using
 - PE Multiple Approach
 - Earning Growth Model (using discount rate of 10.5%)

Solution:

- a) Present Value of the stock of ABC Ltd.:

$$\begin{aligned}
 V_0 &= \frac{D_1}{K_e - g} \\
 &= \frac{2.50 \times 1.02}{0.105 - 0.02} \\
 &= ₹ 30
 \end{aligned}$$

- b) (i) Value of stock under the PE Multiple Approach

Particulars	
Actual Stock Price	₹ 35.00
Return on equity	9%
EPS	₹ 2.25
PE Multiple (1/Return on Equity) = 1/9%	11.11 times
Market Price per Share	₹ 25.00

Since, Actual Stock Price is higher, hence it is overvalued.

(ii) Value of the Stock under the Earnings Growth Model

Particulars	
Actual Stock Price	₹ 35.00
Return on equity	9%
EPS	₹ 2.25
Growth Rate	2%
Market Price per Share = $[EPS \times (1+g)] / (K_e - g)$	$= ₹ 2.25 \times 1.02 / (0.09 - 0.02)$

Since, Actual Stock Price is higher, hence it is overvalued



QUESTION 61:

N 19

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:

- Market to book value.
- Market to replacement cost.
- Market to sales
- Market to Net Income

The following data are available for your analysis: (Amount in ₹)

	SK Ltd.	AS Ltd.	XY Ltd.
Market Value	450	400	—
Book Value	400	300	250
Replacement Cost	600	550	500
Sales	550	450	500
Net Income	18	16	14

Solution:

Calculating average comparable ratios:

	SK Ltd.	AS Ltd.	Average
Market to BV	$450/400 = 1.125$	$400/300 = 1.333$	$[(1.125 + 1.333)/2] = 1.229$
Market to Replace Cost	$450/600 = 0.75$	$400/550 = 0.727$	0.739
Market to Sales	0.818	0.889	0.854
Market to Net Income	25	25	25

Calculating value of XY Ltd. using above ratios:

Particulars	Parameter Value	Ratio	Value of XY
Mkt to Book value	250	1.229	307.25
Mkt to Replacement Cost	500	0.739	369.5
Mkt to Sales	500	0.854	427
Mkt to Net Income	14	25	350
			1453.75

$$\begin{aligned}\text{Average value} &= \frac{1453.75}{4} \\ &= 363.4375\end{aligned}$$



QUESTION 62:

RTP N 18

only on calci

T Ltd. recently made a profit of ₹ 50 crore and paid out ₹ 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 ₹ 225 crore and number of shares is 10 crore. In case company is liquidated, building would fetch ₹ 100 crore more than book value and stock would realize ₹ 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 value of T Ltd. using:

- P/E Ratio
- Dividend Yield
- Valuation as per:
 - Dividend Growth Model
 - Book Value
 - Net Realizable Value

Solution:

(a) P/E Ratio = $9 \times ₹ 50 \text{ cr.} = 450 \text{ cr.}$

(b) Dividend yield = $\frac{40}{6\%} = 666.67 \text{ cr.}$

(c) (1) Dividend growth model = $\frac{D_1}{ke-g}$

$$= \frac{40 \text{ crore} \times 1.04}{0.12 - 0.04}$$

$$= ₹ 520 \text{ crore}$$

(2) Book value = ₹ 225 Cr. or $\frac{225}{10} = 22.5$

$$(3) \quad \text{NRV} = 225 + 100 - 25 = 300 \text{ cr.}$$

**QUESTION 63:**

N 21

Strong Ltd., (SL), an all equity financed, conglomerate is in need to borrow ₹ 2,000 crore to finance expansion of its core current operations. However, SL is susceptible to raise the amount from the market. The CFO has suggested for divesting one of the two non prime units to reduce the overall borrowings from the market. The following data, after internal due diligence, has been placed for consideration of the Board:

(₹ 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	12.5
Corporate Tax Rate (%)	30	30

You are required to advise the Board 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.

Solution:

- a) Price at which units can be Divested

(₹ Crore)		
Particulars	Unit I	Unit II
Reported Profit after Tax	147	140
÷ (1 - Tax Rate)	70%	70%
Reported profit before Tax	210	200
Less: Extra Ordinary Gains	16	8
Add: Extra Ordinary Losses	20	12
Add: Profit from New Product	56	12
Profit before Tax	270	216
Less: Tax @ 30%	81	64.80
Future Maintainable Profit after Tax	189	151.20
× PE Ratio	10	12.5
Price of Unit	1890	1890

- b) Unit I can be divested as it has lower PE Ratio.

Self-note: Above answer is as per ICAI. Logically, we should divest Unit II because even for lower earnings, it is being sold at a same value as Unit I. → This may be given as answer in exam.

- c) The amount of borrowing ₹ 2000 crore – ₹ 1890 crore = ₹ 110 crore

**QUESTION 64:**

SM Illustration

The balance sheet of H K Ltd. is as follows:

	₹ 000
Non-Current Assets	1000
Current Assets	
Trade Receivables	500
Cash and cash equivalents	500
	2000
Shareholders' funds	800
Long Term Debt	200
Current Liabilities and Provisions	1000
	2000

The shares are actively traded and the Current Market Price (CMP) is ₹12 per share. Shareholder funds represent 70,000 shares of ₹10 each and rest is retained earnings. Calculate the Enterprise Value of HK Ltd.

Solution:

$$\begin{aligned}
 \text{Calculation of enterprise value} &= \text{Equity} + \text{Debt} + \text{Preference} - \text{Cash \& Cash Equity} \\
 &= 8,40,000 + 2,00,000 + 0 - 5,00,000 \\
 &= 5,40,000
 \end{aligned}$$

mv of equity includes everying
RE are not to be separately added.

**QUESTION 65:**

SM Illustration

A Ltd. made a Gross Profit of ₹10,00,000 and incurred Indirect Expenses of ₹4,00,000. The number of issued Equity Shares is 1,00,000. The company has a Debt of ₹3,00,000 and Reserves & Surplus to the tune of ₹5,00,000. The market related details are as follows:

Risk Free Rate of Return	4.50%
Market Rate of Return	12%
β of the Company	0.9

Determine:

- Per Share Earning Value of the Company. → *Earning's Capitalized Value.*
- Equity Value of the company if applicable EBITDA multiple is 5.

→ assumed as CF CF, which is illogical

Solution:

- (a) Per Share Earning Value of the Company:

$$K_e = 4.5 + 0.9 (12 - 4.5) = 11.25\%$$

Per share earning value of company (EPS)

Gross profit	10,00,000
Less: Indirect expense	(4,00,000)
Net Profit EBITDA	6,00,000
÷ K_e	11.25%
Earnings Value of the company	53,33,333.33
÷ No. of shares	1,00,000

Earnings Value per share 53.33

(b) Equity Value of the company using EBITDA multiple

	(₹)
EBITDA <i>C's no other no. available</i>	600000
EBITDA Multiple	5
Capitalized Value <i>or E.V.</i>	3000000
Less: Debt	(300000)
Add: Surplus Funds	500000
Equity Value	3200000



QUESTION 66:

SM Illustration

To be solved after Portfolio mgmt.

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 unleveraged 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:

Year	1	2	3
Future Cash Flows	100	120	150

The pre-tax cost of debt will be 12%. Assume a tax regime of 30%.

What is the potential value to be placed on X Pvt Ltd?

Solution:

Value arrived using EBITDA multiple

EBITDA (Given)	90
Less: Extraordinary Gain	-10
Less: Promotion Cost	-20
Future Maintainable Profits	60
X EBITA multiple	5
Value of X Pvt. Ltd.	300

Value arrived using free Cash Flows:

$$\text{Unlevered Beta } (\beta_A) = \beta_E \times \frac{E}{E+D(1-t)} + \beta_D \times \frac{D(1-t)}{E+D(1-t)}$$

$$1.8 = \beta_E \times \frac{0.60}{0.60+0.40(1-0.30)} + 0$$

$$\beta_E = 2.64$$

$$\text{Calculating } K_e = R_f + \beta (R_m - R_f)$$

$$= 5 + 2.64 (11-5)$$

$$= 20.844$$

$$\text{Calculating } K_o = 0.2084 \times \frac{60}{100} + 0.12(1-0.30) \times \frac{40}{100}$$

$$= 15.864\%$$

Calculating Value:

Year	CFs	PVAF @ 15.864%	DCFs
1	100	0.863	86.3
2	120	0.745	89.4
3	150	0.643	96.45
			272.5

$$\text{Potential value using EBITA multiple} = 300$$

$$\text{Potential value using free cash flow} = 272.15$$

$$\text{Average can be considered} = \frac{300+272.15}{2}$$

$$= 286.075$$



QUESTION 67:

N 11 | 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 centres. Data for the for the firm's three segments are as follows:

Business Segment	Segment Sales	Segment Assets	Segment Income
Wholesale	€225,000	€600,000	€75,000
Retail	€720,000	€500,000	€150,000
General	€2,500,000	€4,000,000	€700,000

Industry data for "Pure-play" firms have been compiled and are summarized as follows:

Business Segment	Capitalization/Sales	Capitalization /Assets	Capitalization/ Income
Wholesale	0.85	0.7	9
Retail	1.2	0.7	8
General	0.8	0.7	4

Solution:

	Segment Sale	Segment Assets	Segment Income	Total
Wholesale	1,91,250	4,20,000	6,75,000	
Retail	8,64,000	3,50,000	12,00,000	
General	20,00,000	28,00,000	28,00,000	
	30,55,250	35,70,000	46,75,000	1,13,00,250

$$\text{Value of cranberry Ltd.} = \frac{1,13,00,250}{3} = 37,66,750$$

G. Other Important Topics



QUESTION 68:

N 19

Q 68 & 69, doesn't belong to any particular topic in outnotes. They are miscellaneous, ratio based questions.

Following information is available of M/s. TS Ltd.

	(₹ in 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 of ₹ 10 each	40 lakhs
EPS (₹)	7.5
Market price of share (₹)	75
P/E ratio	10 Times

TS Ltd. has an undistributed reserve of ₹ 8 crores. The company requires ₹ 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 issue at a price of ₹ 25 each.

Solution:

$$\text{Amount of Debt} = \frac{\text{Interest Amount}}{\text{Interest rate (\%)}} = \frac{1}{10\%} = 10 \text{ crores}$$

Equity share capital [40 × 10]	4 crores
Undistributed reserves	<u>8 crores</u>
Total Equity	<u>12 crores</u>

Total capital employed after fund raise = 12 + 10 + 3 = 25 Cr.

$$\begin{aligned} \text{Return on capital employed} &= \frac{\text{EBIT}}{\text{Debt+ESHF}} \\ &= \frac{5}{10 + 12} = 22.73\% \end{aligned}$$

Number of shares to be issued under option 2 = 3 Crores/25
= 0.12 Crores

Particulars		Option (i)	Option (ii)
Total Debt	(A)	10 + 3 = 13 Cr	10 Cr
Capital Employed	(B)	25	25
Debt to CE Ratio	(A/B)	52%	40%

Applicable PE Ratio	8 times	8 times
Cost of Additional debt	14%	

Calculating MP under both options:

Particulars	Option (i)	Option (ii)
EBIT [25 × 22.73%]	5.6825	5.6825
Int on Debt		
• Existing	- 1	-1
• Additional	3 × 14% = - 0.42	-
EBT	4.2625	4.6825
Less: tax @ 25%	-1.0656	-1.1706
EAT	3.1969	3.5119
÷ Number of shares	0.40	0.40 + 0.12 = 0.52
EPS	7.99	6.75
PE Ratio	8	8
MP Per Share	63.92	54

Advice: Option 1 – raising money through debt, should be preferred as it leads to higher share price.



QUESTION 69:

N 20 | MTP M 23 | SM

The Balance Sheet of M/s. Sundry Ltd. as on 31-03-2020 is follows:

Liabilities	₹ In lakhs	Assets	₹ In lakhs
Share Capital	300	Fixed Assets	600
Reserves	200	Inventory	500
Long Term Loan	400	Receivables	240
Short Term Loan	300	Cash	60
Payables & Provisions	200		
Total	1400	Total	1400

Sales for the year was 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.

Solution:

- Amount of External Fund Requirement

	In ₹
Capital invested in business (1400 – 200)	1200
Additional funds required 1200 × 20% (A)	240

This liability is an operating liability means as the sales will grow, along with assets, this liability will also grow.

Expected sales (₹ 600 + 20%)	720
Profit margin @ 4%	28.8
Dividend payout ratio @ 50%	14.4
Balance to be ploughed back (B)	14.4
Balance to be met from external source (A - B)	225.6

b) Amount to be raised from different sources:

1) Short term funds: Sales to short term loans and payables & provisions = 4:3

	in ₹ lakhs
Expected Sales	720
Expected ST loans and payables & provisions [720 x 3/4]	540
Less: Expected payables & provisions [200 + 20%]	(240)
Expected ST Loan	300
Less: Existing ST Loan	(300)
New ST loan to be raised	0

2) Long term funds: Ratio of fixed assets to long term loans = 1.5

	in ₹ lakhs
Expected fixed assets [600 + 20%]	720
Expected long term loan [720/1.5]	480
Less: Existing loan term loan	400
New LT loans to be raised	80

3) Equity:

	in ₹ lakhs
Amount to be raised from external sources	225.60
Less: Raised from short term	0
Less: Existing loan term loan	80
Amount to be raised through equity	145.60

After raising funds as per above table, the debt to equity ratio will not exceed 1.5 times.



QUESTION 70:

N 21

only on calc

Following is the information of M/s. DY Ltd. for the year ending 31/03/2021:

Sales	₹ 1000 Lakh
Operating Expenses Including Interest	₹ 620 Lakh
8% Debentures	₹ 250 Lakh
Equity Share Capital (Face value of ₹ 10 each)	₹ 250 Lakh
Reserves and Surplus	₹ 250 Lakh
Market Value of DY Ltd	₹ 900 Lakh

Equity & Business Valuation

Corporate Tax Rate	30%
Risk free Rate of Return	7%
Market Rate of Return	12%
Equity Beta	1.4

You are required to:

1. Calculate Weighted Average Cost of Capital of DY Ltd.
2. Calculate Economic Value Added
3. Calculate Market Value Added

Solution:

1. Weighted Average Cost of Capital of DY Ltd.

$$\begin{aligned}\text{Cost of Equity (K}_e\text{) as per CAPM} &= R_f + \beta \times (R_m - R_f) \\ &= 7\% + 1.4 \times (12\% - 7\%) \\ &= 14\%\end{aligned}$$

$$\text{Cost of Debt (K}_d\text{)} = 8\% (1 - 0.30) = 5.60\%$$

$$\begin{aligned}\text{WACC (ko)} &= 14\% \times \frac{500}{750} + 5.60\% \times \frac{250}{750} \\ &= 11.20\%\end{aligned}$$

2. Economic Value Added (EVA) of DY Ltd.

Calculation of NOPAT:

		₹ Lakhs
Sales		1000
Operating Expenses (excluding interest)		
Operating Expense (incl. interest)	620	
Less: Interest Expense	- 20	600
EBIT		400
Less: Tax @ 30%		120
Net Operating Profit after Tax (NOPAT)		280

Calculation of Capital Employed

	₹ Lakhs
Equity Share Capital	250
Reserves & Surplus	250
8% Debentures	250
Total Capital Employed	750

$$\begin{aligned}\text{EVA} &= \text{NOPAT} - (\text{WACC} \times \text{Total Capital}) \\ &= ₹ 280 \text{ Lakh} - 0.1120 \times ₹ 750 \text{ lakhs} \\ &= 196.00 \text{ lakhs}\end{aligned}$$

3. Determination of Market Value Added (MVA)

	₹ Lakhs
Market value of DY Ltd.	900
Capital employed [₹ 250 Lakh + ₹ 250 Lakh + ₹ 250 Lakh]	750
Market Value Added	150

**QUESTION 71:**

M 11 | M 14 | N 10 | RTP

Delta Ltd.'s current financial year's income statement reports its net income as ₹ 15,00,000. Delta's marginal tax rate is 40% and its interest expense for the year was ₹ 15,00,000. The company has ₹ 1,00,00,000 of invested capital, of which 60% is debt. In addition, Delta Ltd. tries to maintain a Weighted Average Cost of Capital (WACC) of 12.6%.

- Compute the operating income or EBIT earned by Delta Ltd. in the current year.
- What is Delta Ltd.'s Economic Value Added (EVA) for the current year?
- Delta Ltd. 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 does not pay any dividends, what would you expect to happen to the value of the company?

Solution:

- (a) Calculating operating income or EBIT

Net Income	15,00,000
÷ (1 – Tax Rate)	0.6
Profit before tax	25,00,000
+ Interest Paid	15,00,000
EBIT	40,00,000

- (b) EVA = NOPAT – Capital charge
 $= [40,00,000 (1 - 0.40)] - (1,00,00,000 \times 12.6\%)$
 $= 11,40,000$

- (c) Delta can pay dividends = $\frac{11,40,000}{2,50,000} = 4.56$

If Delta Ltd. does not pay a dividend, we would expect the value of the firm to increase because it will achieve higher growth, hence a higher level of EBIT. If EBIT is higher, then all else equal, the value of the firm will increase

**QUESTION 72:**

N 23 | M 10 | RTP | SM

The following information is given for 3 companies that are identical except for their capital structure:

	Orange	Grape	Apples
Total invested capital	1,00,000	1,00,000	1,00,000
Debt/assets ratio	0.8	0.5	0.2
Shares outstanding	6,100	8,300	10,000
Pre tax cost of debt	16%	13%	15%
Cost of equity	26%	22%	20%
Operating Income (EBIT)	25,000	25,000	25,000

The tax rate is uniform 35% in all cases.

- Compute the Weighted average cost of capital for each company.
- Compute the Economic Valued Added (EVA) for each company.

Equity & Business Valuation

- Based on the EVA, which company would be considered for best investment? Give reasons.
- If the industry PE ratio is 11x, estimate the price for the share of each company.
- Calculate the estimated market capitalisation for each of the Companies.

Solution:

- a) Working for calculation of WACC

	Orange	Grape	Apple
Total deb	80,000	50,000	20,000
Post tax Cost of debt	10.40%	8.45%	9.75%
Equity Fund	20,000	50,000	80,000

WACC

Orange: $(10.4 \times 0.8) + (26 \times 0.2) = 13.52\%$

Grape: $(8.45 \times 0.5) + (22 \times 0.5) = 15.225\%$

Apple: $(9.75 \times 0.2) + (20 \times 0.8) = 17.95\%$

- (b) Economic Value Added:

	Orange	Grape	Apple
WACC	13.52	15.225	17.95
EVA [EBIT (1-T) - (WACC x Invested Capital)]	2,730	1,025	-1,700

- (c) Orange 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

- (d) Estimated Price of each company shares

	Orange	Grape	Apple
EBIT (₹)	25,000	25,000	25,000
Less: Interest (₹)	12,800	6,500	3,000
Taxable Income (₹)	12,200	18,500	22,000
Less: Tax 35% (₹)	4,270	6,475	7,700
Net Income (₹)	7,930	12,025	14,300
÷ No. of Shares	6,100	8,300	10,000
EPS (₹)	1.30	1.45	1.43
Stock Price (EPS x PE Ratio) (₹)	14.30	15.95	15.73

Since the three entities have different capital structures they would be exposed to different degrees of financial risk. The PE ratio should therefore be adjusted for the risk factor.

- (e) Market Capitalisation

Estimated Stock Price (₹)	14.30	15.95	15.73
× No. of shares	6,100	8,300	10,000
Estimated Market Cap (₹)	87,230	1,32,385	1,57,300



QUESTION 73:

MTP N 20 | RTP

To be done after P.M.

STR Ltd.'s current financial year's income statement reported its net income after tax as ₹50 Crore. Following is the capital structure of STR Ltd. at the end of current financial year:

	₹
Debt (Coupon rate = 11%)	80 Crore
Equity (Share Capital + Reserves & Surplus)	250 Crore
Invested Capital	330 Crore

Following data is given to estimate cost of equity capital:

Asset Beta of TSR Ltd.	1.11
Risk –free Rate of Return	8.5%
Average market risk premium	9%

The applicable corporate income tax rate is 30%.

Estimate Economic Value Added (EVA) of RST Ltd. in ₹ lakh.

Solution:

Calculation of WACC

$$\beta_A = \beta_e \times \frac{E}{E + D(1 - t)}$$

$$1.11 = \beta_e \times \frac{250}{250 + 80(1 - 0.30)}$$

$$\beta_e = 1.359 \text{ times}$$

$$\begin{aligned} K_e &= R_f + \beta \times (R_m - R_f) \\ &= 8.5 + 1.359 (9) \\ &= 20.74\% \end{aligned}$$

$$\begin{aligned} WACC &= 20.74\% \times \frac{250}{330} + 11\% (1 - 0.3) \times \frac{80}{330} \\ &= 17.58\% \end{aligned}$$

Calculation of NOPAT

PAT	50 crores
÷ (1 – Tax rate)	70%
PBT	71.43
Add: Interest	8.8
EBIT	80.23
Less: Tax Rate @ 30%	24.07
NOPAT	56.16

$$\begin{aligned} \text{Calculation of EVA} &= \text{NOPAT} - \text{Capital Employed} \times \text{WACC} \\ &= 56.16 - 330 \times 17.58\% \\ &= -1.85 \text{ Cr.} \end{aligned}$$



QUESTION 74:

N 24

Economic Value Added (EVA) of ABC Ltd was ₹ 31,10,000.

Following is the capital structure of ABC Ltd. at the end of current financial year:

Equity (Share Capital + Reserves & Surplus) ₹ 170 lakhs

Equity & Business Valuation

Debt (Coupon Rate 10%)	₹ 80 lakhs
Invested Capital	₹ 250 lakhs
Following data is given to estimate the cost of equity capital:	
Beta of ABC Ltd.	0.9
Risk-free rate (i.e. current yield on Govt. Bonds)	8%
Average market risk premium	10%
Economic Value Added (EVA) of ABC Ltd was ₹ 31,10,000.	
The applicable corporate income tax rate is 30%.	
You are required to calculate the Profit After Tax of ABC Ltd.	

Solution:

Calc of WACC: $k_e = R_f + \beta (R_m - R_f)$
 $= 8\% + 0.9 (10\%) = 17\%$

Calc of k_d : Coupon rate $(1 - t) = 10\% (1 - 30\%) = 7\%$

Calc of WACC: $WACC = \frac{17\% \times 80}{250} + \frac{7\% \times 170}{250} = 13.8\%$

Calc of EBIT: $EVA = EBIT (1 - t) - \text{Cap. Emp}^d \times WACC$
 $31,10,000 = EBIT (1 - 0.3) - 25,00,000 \times 13.8\%$
 $EBIT = 93,71,428.57$

Calc of PAT: $EBIT = 93,71,428.57$
 $- \text{Dep} = 958b$
 $PBT = 93,00,000$
 $- \text{Tax} = 85,71,428.57$
 $PAT = 8,71,128.57$



QUESTION 75:

N 12 | N 04

With the help of the following information of Jatayu Limited compute the Economic Value Added:

Capital Structure	Equity capital ₹ 160 Lakhs
	Reserves and Surplus ₹ 140 lakhs
	10% Debentures ₹ 400 Lakhs
Cost of Equity	14%
Financial Leverage	1.5 times
Income Tax Rate	30%

Solution:

self note.

Calculation of EBIT

$$\text{Financial Leverage} = \frac{\text{EBIT}}{\text{EBIT-Int}}$$

$$1.5 = \frac{\text{EBIT}}{\text{EBIT}-40}$$

$$\text{EBIT} = 120$$

Calculation of Ko

$$= K_e \times W_e + K_d \times W_d$$

$$= 0.14 \times \frac{300}{700} + 0.10 \times (1 - 0.3) \times \frac{400}{700}$$

$$= 10\%$$

$$\begin{aligned} \text{EVA} &= [120 (1 - 0.30)] - (700 \times 10\%) \\ &= 14 \text{ Lakhs} \end{aligned}$$



QUESTION 76:

N 21

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 4 Crores as on 31st March 2021.

You are required to calculate:

- The amount of Capital Employed
- NOPAT, if WACC is 10%

Solution:

- $$\begin{aligned} \text{EVA} &= \text{NOPAT} - \text{WACC} \times \text{Capital Employed} \\ ₹ 4 \text{ Crore} &= (\text{WACC} + 0.025) \times \text{Capital Employed} - \text{WACC} \times \text{Capital Employed} \\ ₹ 4 \text{ Crore} &= \text{Capital Employed} \times 0.025 \\ \text{Capital Employed} &= ₹ 160 \text{ Crore} \end{aligned}$$
- $$\begin{aligned} \text{NOPAT if WACC is 10\%} \\ ₹ 4 \text{ Crore} &= \text{NOPAT} - 0.10 \times ₹ 160 \text{ crore} \\ \text{NOPAT} &= ₹ 20 \text{ crore} \end{aligned}$$



QUESTION 77:

M 18 | N 20 | M 18 | RTP

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 ₹ 100 crore, which is not recorded in the books. The Net Worth (NW) of Constant Engineering Ltd. is ₹ 200 Crore. Long term debt is ₹ 400 Crore. The product generates a revenue of ₹ 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.

Solution:

Capital Employed:

Equity & Business Valuation

	Amount (₹ Crore)
Net Worth	200
Long Term Debts	400
Patent Rights	100
Total	700

$$\text{WACC} = \frac{400}{700} \times 10\% + \frac{300}{700} \times 12\%$$

$$= 10.86\%$$

$$\text{EVA} = \text{NOPAT} - \text{Capital Charge}$$

$$= 84 \text{ crores} - 700 \text{ crores} \times 10.86\%$$

$$= 7.98 \text{ Cr.}$$

Self-note: 10% is R_f but considered as K_d also 12% is return on Bond Portfolio, but considered as K_e .



QUESTION 78:

M 19 | SM | RTP

Compute EVA of A Ltd. with the following information:

All figures in ₹ Lacs			
Profit and Loss Statement		Balance Sheet	
Revenue	1000	PPE	1000
Direct Costs	-390	Current Assets	300
Selling, General & Admin. Exp. (SGA)	-200		1300
EBIT	410	Equity	700
Interest	-10	Reserves	100
EBT	400	Non-Current Borrowings	100
Tax Expense	-120	Current Liabilities & Provisions	400
EAT	280		1300

Assume Bad Debts provision of ₹ 20 Lac is included in the SGA, and same amount is reduced from the trade receivables in current assets.

Also assume that the pre-tax Cost of Debt is 12%, Tax Rate is 30% and Cost of Equity (i.e. shareholder's expected return) is 8.45%.

Solution:

Calculation of NOPAT:

NOPAT	
EBIT	410
Less: Taxes @ 30%	-123
Add: Non-Cash Expenses	20
NOPAT	307

First deduct tax
then add back
non-cash.

Invested Capital / Capital Employed:

Equity		700
Reserves	100 + 20	120
Non-current borrowings		<u>100</u>
		<u>920</u>

Calculation of K_o :

$$K_o = 8.45 \times 800/900 + 12(1 - 0.30) \times 100/900$$

$$= 8.44\%$$

Self-note: Logically W_e should be $(820/920)$ and W_d $(100/920)$. However, they have not considered effect of 20 lacs in calculation of WACC.

$$\text{EVA} = \text{NOPAT} - \text{Invested Capital} \times \text{WACC}$$

$$= 307 - 920 \times 8.44\%$$

$$= 229.35 \text{ Lacs.}$$

**QUESTION 79:**

RTP M 15

only on calc

Similar to question 77, if the examiner gives additional data of market value of assets, then that should be considered while calculating capital employed

ABC Ltd. has divisions A, B & C. The division C has recently reported on annual operating profit of ₹ 20,20,00,000. This figure arrived at after charging ₹ 3 crores 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 ₹ 60 crore, but replacement cost of these assets is estimated at ₹84 crore.

You are required to compute EVA of the Division C.

Solution:

First necessary adjustment of the data as reported by historical accounting system shall be made as follows:

	₹
Operating Profit	20,20,00,000
Add: Cost of unutilized Advertisement Expenditures	2,00,00,000
	<u>22,20,00,000</u>

Invested Capital (as per replacement cost) = ₹ 84 crore.

$$\text{EVA} = \text{NOPAT} - \text{Capital Charge}$$

$$= 22,20,00,000 - (84,00,00,000 \text{ crore} \times 11\%)$$

$$= ₹ 12,96.00,000$$

Self-note: The advertisement expenditure of ₹ 2 crores will be added in NOPAT but not in capital employed because market value is given, therefore, everything is already included.

**QUESTION 80:**

RTP

The following data pertains to XYZ inc. Engaged in software consultancy business as on 31st December 2010
(\$Million)

Equity & Business Valuation

Income from consultancy	935.00
EBIT	180.00
Less: Interest on Loan	18.00
EBT	162.00
Tax @ 35%	56.70
	105.30

Balance Sheet

(\$ Million)

Liabilities	Amount	Assets	Amount
Equity Stock (10 million Share @ \$ 10 each)	100	Land and Building	200
Reserves & Surplus	325	Computers & Software	295
Loans	180	Current Assets:	
Current Liabilities	180	Debtors	150
		Bank	100
		Cash	40
	785		290
			785

With the above information and following assumption you are required to compute

(a) Economic Value Added

(b) Market value Added.

Assuming that:

a. WACC is 12%

b. The share of company currently quoted at \$ 50 each.

Solution:

- (i) EVA = NOPAT – capital charge
 = 117 – [605 × 12%]
 = \$ 44.4 million

Total Capital Employed (in Millions)

Equity 100

Reserve and Surplus 325

Loans 180

Capital Employed \$605

(ii) Market value added

Market Value of Capital Employed [10m × 50] + 180m \$ 680 million

Book Value of Capital Employed [425m + 180m] \$ 605 million

MVA \$ 75 million



QUESTION 81:

N 23 | N 18 | N 04 | SM | RTP

ABC Limited's shares are currently selling at ₹ 13 per share. There are 10,00,000 shares outstanding. The firm is planning to raise ₹ 20 lakhs to Finance a new project.

Required:

What is the ex-right price of shares and the value of a right, if

- The firm offers one right share for every two shares held.
- The firm offers one right share for every four shares held.
- How does the shareholders' wealth (holding 100 shares) change from (i) to (ii)? How does right issue increases shareholders' wealth?

Solution:

- (a) Number of Shares $= 10,00,000 \times \frac{1}{2}$
 $= 5,00,000$ shares
- Issue Price $= \frac{20,00,000}{5,00,000} = ₹ 4$
- Ex – right price $= \frac{P_0 \times n_0 + P_1 \times n_1}{n_0 + n_1}$
 $= \frac{13 \times 10,00,000 + 20,00,000}{15,00,000}$
 $= 10$
- Value of a Right $= \text{Ex-right price} - \text{issue price}$
 $= 10 - 4$
 $= 6$
- Value of Right per share $= \frac{10 - 4}{2}$
 $= 3$ per share
- (b) Ex-Right price $= \frac{13 \times 10,00,000 + 20,00,000}{12,50,000}$
 $= 12$
- Number of shares $= 10,00,000 \times \frac{1}{4}$
 $= 2,50,000$ shares
- Issue Price $= \frac{20,00,000}{2,50,000} = 8$
- Value of a right $= 12 - 8$
 $= 4$
- Value of right per share $= \frac{12 - 8}{4}$
 $= ₹ 1$
- c) Calculation of effect of right issue on wealth of Shareholder with 100 shares:
- Wealth of shareholder before right issue:
- | | | |
|-----------------|------------|------|
| Value of Shares | [100 × 13] | 1300 |
|-----------------|------------|------|

Wealth of shareholder when 1:2 right shares:

Value of shares	[150 × 10]	1500
Less: Cash paid	[50 × 4]	<u>(200)</u>
		<u>1300</u>

Wealth of shareholder when 1:4 right shares:

Value of shares	[125 × 12]	1500
Less: Cash paid	[25 × 8]	<u>(200)</u>
		<u>1300</u>

Thus, there will be no change in the wealth of shareholders from (i) and (ii).

Self-note: It is assumed that the right shares have been subscribed.



QUESTION 82:

M 03 | N 10 | RTP M 21 | RTP N 09

Pragya Limited has issued 75,000 equity shares of ₹ 10 each. The current market price per share is ₹ 24. The company has a plan to make a rights issue of one new equity share at a premium of 60% for every four shares 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.
- Suppose Mr. A, who is holding 100 shares in Pragya Ltd. is not interested in subscribing to the right issue, then advice what should he do.

Solution:

$$\begin{aligned}
 \text{(a) Post Right share price} &= \frac{P_0 \times n_0 + P_1 \times n_1}{n_0 + n_1} \\
 &= \frac{24 \times 75,000 + 16 \times 18,750}{93,750} \\
 &= 22.40
 \end{aligned}$$

$$\begin{aligned}
 \text{(b) Theoretical value of right alone} \\
 \text{Post Right Share Price} &22.4 \\
 \text{Less: Issue Price [10 + 60\%]} &\underline{(16)} \\
 &\underline{6.4} \text{ Per right}
 \end{aligned}$$

(c) Effect on the wealth of a shareholder if he sells the rights		
Pre-Rights wealth	[1,000 × 24]	<u>24,000</u>
Post-Right wealth		
Value of shares	[1,000 × 22.4]	22,400
Cash received $\left[\frac{1,000}{4} \times 6.4 \right]$	<u>1600</u>	<u>24,000</u>
Effect on wealth		<u>NIL</u>

There is no change in the wealth of the shareholder

- (d) Effect on the wealth of a shareholder if he ignores the rights

Pre-Rights wealth	$[1,000 \times 24]$	<u>24,000</u>
Post-Right wealth		
Value of shares	$[1,000 \times 22.4]$	<u>22,400</u>
Loss of wealth		<u>1,600</u>

- (e) If Mr. A is not interested in subscribing to the right issue, he can renounce his right eligibility @ ₹ 6.4 per right and can earn a gain of:

$$= 100 \times \frac{1}{4} \times 6.4 = ₹ 160$$



QUESTION 83:

M 21

Aggressive Ltd., is proposing to fund its expansion plan of ₹ 12 crore by making a rights issue. The current market price (CMP) is ₹ 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:

- The number of new equity shares to be offered for each rights held,
- Theoretical value of right and
- The total number of equity shares to be issued.

Solution:

- a) Number of new equity shares to be offered for each rights held

$$\begin{aligned} \text{Subscription Price} &= 40 \times 0.80 \\ &= ₹ 32 \text{ per share} \end{aligned}$$

$$\begin{aligned} \text{Ex Right Price to be restricted to} &= 40 \times 0.90 \\ &= ₹ 36 \end{aligned}$$

Let's assume pre-right number of shares to be 1 and Right's Ratio to be 'R'

$$\begin{aligned} ₹ 36 &= \frac{40 \times 1 + 32 \times R}{1 + R} \\ R &= 1 \end{aligned}$$

Thus, 1 equity share be offered for each share held.

- b) Theoretical Value of right = ₹ 36 – ₹ 32 = ₹ 4

- c) No. of equity share to be issued = $\frac{₹ 12 \text{ Crore}}{₹ 32} = 37,50,000$



QUESTION 84:

RTP N 10

only on calici

Equity & Business Valuation

Monopolo Ltd. has a paid-up ordinary share capital of ₹ 2,00,00,000 represented by 4,00,000 shares of ₹ 50 each. Earnings after tax in the most recent year were ₹ 75,00,000 of which ₹ 25,00,000 was distributed as dividend. The current price/earnings ratio of these shares, as normally reported in the financial press, is 8.

The company is planning a major investment that will cost ₹ 2,02,50,000 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.

1. You have been appointed as Financial Consultant of the Company and are required to calculate:
 - a. The Current Market Price of the Shares already in issue,
 - b. The price at which the Rights Issue will be made,
 - c. The number of new shares that will be issued,
 - d. The Price at which the Shares of the Entity should theoretically be quoted on completion of the Rights Issue (i.e., the 'Ex-Rights Price'), assuming no incidental costs and that the market accepts the Entity's forecast of incremental earnings.
2. It has been said that, provided the required amount of money is raised and that the market is made aware of the earnings 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.

Solution:

$$\begin{aligned} 1) \quad (a) \quad \text{EPS} &= \frac{\text{Earnings}}{\text{No. of shares}} \\ &= \frac{75,00,000}{4,00,000} \\ &= 18.75 \end{aligned}$$

$$\begin{aligned} \text{CMP} &= \text{PE Ratio} \times \text{EPS} \\ &= 8 \times 18.75 = 150 \end{aligned}$$

$$\begin{aligned} (b) \quad \text{Right Issue Price} &= 150 - 25\% \\ &= 112.5 \end{aligned}$$

$$\begin{aligned} (c) \quad \text{Number of shares to be issued} &= \frac{2,02,50,000}{112.5} \\ &= 1,80,000 \end{aligned}$$

$$(d) \quad k_e = \frac{1}{8} = 12.5\%$$

Calculation of PV of cash proceeds from investment

$$\begin{aligned} &= \frac{2,02,50,000 \times 15\%}{0.125} \\ &= 2,43,00,000 \end{aligned}$$

$$\begin{aligned} \text{Ex - Right Price} &= \frac{150 \times 400,000 + 2,43,00,000}{5,80,000} \\ &= 145.34 \end{aligned}$$

→ point of learning

2.	Pre-right Wealth	$[4,00,000 \times 150]$	6,00,00,000
	Post Right Wealth		
(1)	When right shares are subscribed:		
	Value of Share	$[580,000 \times 145.34]$	8,42,97,200
	Less: Cash paid	$[180,000 \times 112.50]$	<u>(2,02,50,000)</u>
	Net wealth		<u>6,40,47,200</u>
(2)	When rights are sold:		
	Value of Share	$[4,00,000 \times 145.34]$	5,81,36,000
	Add: Cash received	$[180,000 \times (145.34 - 112.50)]$	<u>59,11,200</u>
	Net wealth		<u>6,40,47,200</u>

Whether a shareholder decides so subscribe the shares or not, this wealth will not change.



QUESTION 85:

N 24 | M 21 | M 19 | N 10 | M 06 | RTP

Rahul Ltd. has surplus cash of ₹ 100 lakhs and wants to distribute 27% of it to the shareholder. The company decides to buy back shares. The Finance Manager of the company estimates that its share price after re-purchase is like 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 ₹ 3.

You are required to determine:

- The price at which the shares can be re-purchased, if the market capitalization of the company should ₹ 210 lakhs after buyback.
- The number of shares that can be re-purchased, and
- The impact of share-repurchase on the EPS, assuming that net income is the same.

Solution:

- (a) Let the Buy Back price be $= x$
- No. of share bought back $= \frac{\text{Buy Back Amount}}{\text{Buy Back Price}}$
- $$= \frac{100 \text{ lacs} \times 27\%}{x} = \frac{27 \text{ lacs}}{x}$$
- Post Buy back no. of shares $= \text{Pre buyback no. of shares} - \text{no. of shares bought back}$
- $$= 10 \text{ lacs} - \frac{27 \text{ lacs}}{x}$$
- Post Buy Back MP $= 1.1x$
- Market capitalization after buyback $= \text{MPS after buy back} \times \text{No. shares after buy back}$
- $$210 \text{ lacs} = 1.1x \times \left[10 \text{ lacs} - \frac{27 \text{ lacs}}{x} \right]$$
- $$x = 21.79$$
- (b) No. of shares to be repurchased $= \frac{27,00,000}{21.79} = 1,23,910$

$$(c) \quad \text{Post Buy Back EPS} = \frac{10,00,000 \times 3}{10,00,000 - 1,23,910} = 3.42$$

EPS will increase from ₹ 3 to ₹ 3.42 due to buy back



QUESTION 86:

N 18

Eager Ltd has Market Capitalization of ₹ 1,500 Crores and the Current market Price of its Share is ₹ 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%.

Solution:

$$\text{BB Price} = 1,500 + 10\% = 1,650$$

$$\text{Number of shares} = \frac{1500 \text{ Crore}}{1500} = 1 \text{ Cr.}$$

$$\text{Number of shares to be bought back} = 1 \text{ Cr.} \times 0.20 = 20 \text{ Lakh}$$

$$\text{Post buy-back no. of shares} = (1 \text{ Cr.} - 20 \text{ Lakhs}) = 80,00,000$$

$$\text{Amount required for Buyback of Shares} = ₹ 1,650 \times 20 \text{ Lakh} = ₹ 330 \text{ Crore}$$

$$\text{Amount of Loan @ 16\%} = ₹ 330 \text{ Crore}$$

$$\text{Interest on loan:} = 330 \text{ Crore} \times 16\% = ₹ 52.8 \text{ Cr.}$$

Particulars	(in ₹ crores)
Pre buyback PAT	200
÷ (1 - Tax Rate)	0.7
Pre buyback PBT/EBIT	285.71
Less: Post buy back Interest on loan	-52.8
Post buyback PBT	232.91
Less: Tax @ 30%	-69.87
Post buyback PAT	163.04 cr.
÷ Post Buy no. of share	0.8
Post buyback price	203.79



QUESTION 87:

M 21

SM Limited has a market capitalization of ₹ 3,000 crore and the current earnings per share (EPS) is ₹ 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 ₹ 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.

Solution:

Current Market Price of Share = ₹ 200 × 15 = ₹ 3,000

No. of Shares = $\frac{3,000 \text{ crore}}{3,000} = 1 \text{ crore}$

No. of Shares proposed for Buyback = 20% of 1 crore = 20 Lakh

Post Buy back per share (₹) = ₹ 3,057

Pre & Post buyback PE Ratio = 15 times

Post Buy back EPS = $\frac{3057}{15} = ₹ 203.80$

Post Buy back number of shares = 1 crore – 20 lakhs = 80 lakhs

Post buyback EAT = ₹ 203.80 × 80 Lakh = ₹ 16,304 Lakh

Post buyback EBT = $\frac{16,304}{(1 - 0.30)} = ₹ 23,291.429 \text{ Lakh}$

Pre buyback PAT = ₹ 200 × 1 crore = 20,000 Lakh

Pre buyback PBT = $\frac{20,000}{(1 - 0.30)} = ₹ 28,571.429 \text{ Lakh}$

Particulars	
Pre buyback PBT	₹ 28,571.429 Lakhs
Less: Post buyback PBT	₹ 23,291.429 Lakhs
Interest which can be paid for availing bank loan	₹ 5,280.00 Lakhs
÷ Interest Rate	8%
Loan Amount raised	₹ 66,000 Lakhs
Therefore, Amount paid for Buy back of Share	₹ 66,000 Lakhs
÷ No. of Shares Bought back	20 Lakhs
Share Buyback price per share	₹ 3,300
Less: Current Market Price per share (₹ 200 × 15)	₹ 3,000
Premium (in ₹)	₹ 300
Premium (in %) $\frac{300}{3000} \times 100$	10%



QUESTION 88:

M 23

only on cake

High Growth Ltd. (HGL) was having an excellent growth over a number of years. The Board of Directors is considering a proposal to reward its shareholders by buying back 20% shares at a premium. The premium is to be

Not only premium, but the entire amount of buyback is to be paid by availing the loan

Equity & Business Valuation

paid by raising a loan from the Bank. The interest on loan is to be serviced by internal accruals as supported by the financials of HGL. The company has a market capitalization of ₹ 15,000 crore and the current Earnings Per Share (EPS) is ₹ 600 with a Price Earnings Ratio (PER) of 25. The Board expects a post buy back Market Price per Share (MPS) of ₹ 10,000. The PER, post buy back, will remain the same. The loan can be availed at an interest rate of 16 % p.a.

Applicable corporate 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.
- Buy back premium per share.

Solution:

a)	Pre BB Price	= 600 × 25	= ₹ 15000
	Pre BB number of shares	= $\frac{15,000 \text{ Cr.}}{15,000}$	= 1 crore
	Pre BB PAT	= 600 × 1 Cr.	= 600 Crore

Number of shares to be bought back	= 1 Cr. × 20%	= 0.2 Crore
Post BB number of shares	= 1 Cr. – 0.2 Cr.	= 0.8 Crore
Post BB MPS	= 10,000	
Post BB EPS	= $\frac{\text{MPS}}{\text{PE}} = \frac{10,000}{25}$	= 400
Post BB PAT	= 400 × 0.8 Cr.	= 320 Cr.
Pre BB PAT	= 600 Cr.	
Pre BB PBT	= $\frac{600 \text{ Cr.}}{(1 - 0.3)}$	= 857.14 Cr.

Since, there is no interest Pre BB
Therefore, Pre BB PBT = Pre BB EBIT
& also, Pre BB EBIT = Post BB EBIT = 857.14 Cr.

Now, Post BB PAT	= 320 Crore
Post BB PBT	= $\frac{320 \text{ Cr.}}{(1 - 0.3)} = 457.14 \text{ Crore}$
Interest that can be paid post BB	= Post BB EBIT – Post BB PBT = 857.14 Cr. - 457.14 Cr. = 400 Cr.

b)	Loan amount will be	= $\frac{\text{Interest (₹)}}{\text{Interest (\%)}} = \frac{400 \text{ Cr.}}{0.16} = ₹ 2500 \text{ Crore.}$
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c)	Buy back price	= $\frac{\text{Total Loan}}{\text{Shares BB}} = \frac{2500 \text{ Cr.}}{0.2 \text{ Cr.}}$ = ₹ 12500 per share
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Ideally buyback price should be compared with pre-buyback MPS. However, in this question, since that price is lower than the buyback price. Therefore, it's being compared with post buyback MPS. **Equity & Business Valuation**

Premium per share

$$\begin{aligned}
 &= \text{BB price} - \text{Post BB MPS} \\
 &= ₹ 12,500 - ₹ 10,000 \\
 &= ₹ 2,500 \\
 &\text{Or} \\
 &= \frac{2500}{10,000} = 25\%
 \end{aligned}$$

Self-note: In the 'C' part of the question, the institute has calculated the buyback premium by deducting post BB MPS (rather than pre BB MPS) from the BB Price.



QUESTION 89:

N 13 | M 18

Intel Ltd., promoted by a Trans National Company, is listed on the stock exchange. The value of the floating stock is ₹ 45 crores. The Market Price per Share (MPS) is ₹ 150.

The capitalisation rate is 20 percent.

The promoters holding is to be restricted to 75 per cent as per the norms of listing requirement. The Board of Directors have decided to fall in line to restrict the Promoters' holding to 75 percent by issuing Bonus Shares to minority shareholders while maintaining the same Price Earnings Ratio (P/E).

You are required to calculate:

- Bonus Ratio;
- MPS after issue of Bonus Shares; and
- Free float Market capitalisation after issue of Bonus Shares

Solution:

Self-note: Since the information regarding the promoters' holding is missing in the question, above solution is based on assumption of promoter's holding as 80%.

a)	Free Float market capitalization	45,00,00,000
	÷ MPS per share	150
	Free float number of shares	30,00,000
	÷ Free float holding	20%
	Total number of shares	1,50,00,000
	× Promotor's holding	80%
	Promotor's number of shares	1,20,00,000

Even after bonus, promotor's no. of shares remains same as 120 lacs, but holding % to be taken as 80%

$$\text{Hence total shares after bonus} = \frac{120 \text{ lacs}}{75\%} = 160 \text{ lacs}$$

$$\text{Number of bonus shares to be issued to minority} = 160 \text{ lacs} - 150 \text{ lacs} = 10 \text{ lacs}$$

$$\begin{aligned}
 \text{Bonus Ratio} &= 10 \text{ lacs for } 30 \text{ lacs} \\
 &= 1:3
 \end{aligned}$$

b)	Pre-Bonus Market Cap	= 150 lacs shares × ₹ 150
		= 2,25,00,00,000

$$\text{Post Bonus Market Cap (same)} = 2,25,00,00,000$$

Equity & Business Valuation

Total no. of share after bonus = 1,60,00,00,000

Post Bonus MPS = $\frac{2,25,00,00,000}{1,60,00,00,000}$

= 140.625

(c) Free float M. Cap = $40,00,000 \times 140.625$
= 56,25,00,000

Mergers, Acquisition & Corporate Restructuring



A. Post-merger EPS and related calculations



QUESTION 1:

N 19 | M 12 | M 05 | M 03 | N 02 | RTP

XYZ Ltd., is considering merger with ABC Ltd. XYZ Ltd.'s shares are currently traded at ₹ 20. It has 2,50,000 shares outstanding and its earnings after taxes (EAT) amount to ₹ 5,00,000. ABC Ltd., has 1,25,000 shares outstanding; its current market price is ₹ 10 and its EAT are ₹ 1,25,000. The merger will be affected 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:

- What is the pre-merger earnings per share (EPS) and P/E ratios of both the companies?
- 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?
- Show the impact on earnings of the shareholders of two companies.

Solution:

- (i) Pre-merger EPS & PE Ratio:

	XYZ	ABC
Pre-merger EPS	$500,000/250,000 = 2$	$125,000/125,000 = 1$
PE Ratio	$20/2 = 10$	$10/1 = 10$

- (ii) $MPS = EPS \times PE \text{ Ratio}$

$$MPS = 6.4 \times 1 = ₹ 6.4$$

$$\begin{aligned} \text{Purchase Consideration (MV of ABC Ltd.)} &= 6.4 \times 1,25,000 \\ &= 8,00,000 \end{aligned}$$

$$\begin{aligned} \text{No. of shares to be issued} &= \frac{\text{Purchase Consideration}}{\text{Issue Price}} \\ &= \frac{8,00,000}{20} \\ &= 40,000 \end{aligned}$$

$$\begin{aligned} \text{Exchange Ratio} &= \frac{40,000}{1,25,000} \\ &= 0.32 \end{aligned}$$

$$\begin{aligned} \text{Post-merger EPS} &= \frac{5,00,000 + 1,25,000}{2,50,000 + 1,25,000 \times 0.32} \\ &= 2.16 \end{aligned}$$

- (iii) Impact on earnings of shareholders:

$$\text{Equivalent EPS of ABC Ltd} = 2.16 \times 0.32 = 0.6912$$

	XYZ	ABC
Post-merger EPS & Equivalent EPS	2.16	0.6912

Less: Pre-merger EPS	2	1
Gain/(loss) per share	0.16	-0.3088
× No. of shares	2,50,000	1,25,000
Total gain/(loss)	40,000	-40,000



QUESTION 2:

N 09

B Ltd. is 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 its 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 ₹ 15. B Ltd. has 5,00,000 shares in issue with a share price of ₹ 12.

Calculate the change in earnings per share of B Ltd. and C Ltd. if it acquires the whole of C Ltd. by issuing shares at its market price of ₹ 12. Assume the price of B Ltd. shares remains constant.

Solution:

	B Ltd.	C Ltd.
PE Ratio	17	10
No. of shares	5,00,000	1,00,000
MP/ Issue Price	12	15

$$\begin{aligned} \text{Purchase Consideration (MV of C Ltd.)} &= 15 \times 1,00,000 \\ &= 15,00,000 \end{aligned}$$

$$\begin{aligned} \text{No. of shares to be issued} &= \frac{\text{Purchase Consideration}}{\text{Issue Price}} \\ &= \frac{15,00,000}{12} \\ &= 1,25,000 \end{aligned}$$

$$\begin{aligned} \text{Exchange Ratio} &= \frac{1,25,000}{1,00,000} \\ &= 1.25 \end{aligned}$$

Pre-merger earnings of companies:

	B Ltd	C Ltd
MPS	12	15
× No. of shares ÷ PE	5,00,000 17	1,00,000 10
Market Capitalization EPS	60,00,000 0.7059	15,00,000 1.5
÷ PE ratio	17	10
	500.	100
Pre-merger PAT	3,52,941	1,50,000

$$\begin{aligned} \text{Post-merger EPS} &= \frac{3,52,950 + 1,50,000}{5,00,000 + 1,25,000} \\ &= 0.8047 \end{aligned}$$

Change in earnings per share of B Ltd. and A Ltd

Equivalent EPS: $1.25 \times 0.8047 = 1.0059$

	B Ltd	C Ltd
Post-merger EPS	0.8047	
Equivalent EPS		1.0059
Less: Pre-merger	0.7059	1.5
Gain/(loss) per share	0.0988	-0.4941

EPS of B will increase from ₹ 0.7059 to ₹ 0.8047 & EPS of C will decrease from ₹ 1.5 to ₹ 1.0059 (equivalent EPS).



QUESTION 3:

only on calc

The Directors of Aqua Limited are considering the acquisition of an Existing Company Bose Limited engaged in the line of business suited to them. The Financial Data at the time of acquisition being:

Company	Aqua Ltd.	Bose Ltd.
Earnings after tax (₹)	36,00,000	7,20,000
Earnings per share	5	2.4
No. of Equity Shares	7,20,000	3,00,000
PE Ratio	30	20

It is expected that the Net Profit after Tax of the two Companies would continue to be ₹ 43,20,000. Aqua Ltd would pay the amount in the form of Shares of Aqua Ltd. Explain the effect on EPS of the Merged Company if Aqua Ltd offers to pay 60 per share to the Shareholders of Bose Ltd.

Solution:

→ more more than mps. → stock deal.

$$\text{MV of Bose Ltd} = 60 \times 3,00,000 = 1,80,00,000$$

$$\text{MPS of Aqua Ltd} = 30 \times 5 = 150$$

$$\text{No. of Share to be issued} = \frac{1,80,00,000}{150} = 1,20,000$$

$$\text{Post-merger EPS} = \frac{36,00,000 + 7,20,000}{7,20,000 + 1,20,000} = 5.1428$$

Effect on EPS of the Merged Company (Aqua Ltd)

Post-merger EPS	5.1428
Less: Pre-merger	5.0000
Gain/(loss) per share	0.1428


QUESTION 4:

N 10 | N 08 | RTP

MK Ltd. considering acquiring NN Ltd. The following information is available:

Company	Earnings after tax (₹)	No. of Equity Shares	Market price Per Share (₹)
MK Ltd.	60,00,000	12,00,000	200.00
NN Ltd.	18,00,000	3,00,000	160.00

Exchange of equity shares for acquisition is based on current market values. There is no synergy advantage.

- Find the earning per share for company MK Ltd. after merger, and
- Find the exchange ratio so that shareholders of NN Ltd. would not be at a loss.

Solution:

$$(i) \quad \text{Swap Ratio} = \frac{\text{MPS of Target}}{\text{MPS of Acquiror}}$$

$$= \frac{160}{200} = 0.80$$

$$\text{Post-merger EPS} = \frac{60,00,000 + 18,00,000}{12,00,000 + 3,00,000 \times 0.80}$$

$$= ₹ 5.42$$

- Exchange Ratio so that shareholders are not at loss means the Breakeven Ratio:

$$\text{Pre-merger EPS of MK Ltd.} = ₹ 60,00,000 / 12,00,000 = ₹ 5.00$$

$$\text{Pre-merger EPS of NN Ltd.} = ₹ 18,00,000 / 3,00,000 = ₹ 6.00$$

∴ Exchange ratio should be 6:5

Justification:

$$\text{Post-merger EPS} = \frac{60,00,000 + 18,00,000}{12,00,000 + 3,00,000 \times 1.2}$$

$$= ₹ 5.00 \text{ per share}$$

$$\text{Equivalent EPS of NN Ltd} = 1.2 \times ₹ 5.00 = ₹ 6$$

$$\text{Pre-merger EPS of NN Ltd.} = ₹ 6$$

Hence, No loss of earnings


QUESTION 5:

N 17 | M 04 | RTP

M Co. Ltd. is studying the possible acquisition of N Co. Ltd., by way of merger. The following data are available in respect of the companies:

Particulars	N Co. Ltd	M Co. Ltd
Profit After Tax	₹ 24,00,000	₹ 80,00,000
Equity Shares outstanding (Nos.)	4,00,000	16,00,000
Market Price per share	₹ 160	₹ 200

- What is the present EPS of both the companies?
- If the merger goes through by exchange of equity, what is the new earning per share for M Co. Ltd.?
- N Co. Ltd. wants to be sure that the earnings available to its shareholders will not be diminished by the merger. What should be the exchange ratio in that case?
- What should be exchange ratio, if N Co. Ltd. wants to ensure the earnings to members are same as before the merger takes place?
- What should be the exchange ratio; if M Co. Ltd.'s pre-merger and post-merger EPS are to be the same?

Solution:

$$\begin{aligned} \text{a) EPS} &= \frac{\text{PAT}}{n} \\ \text{M Co Ltd.} &= \frac{80,00,000}{16,00,000} = 5 \\ \text{N Co Ltd.} &= \frac{24,00,000}{4,00,000} = 6 \end{aligned}$$

$$\begin{aligned} \text{b) Swap Ratio Based on MPS} &= \frac{160}{200} = 0.80 \\ \text{Post-merger EPS} &= \frac{80,00,000 + 24,00,000}{16,00,000 + 4,00,000 \times 0.80} \\ &= 5.4167 \end{aligned}$$

- c) Exchange ratio where earnings should not be diminished should be based on EPS

$$\begin{aligned} \text{Pre-merger EPS of M Co. Ltd.} &= \frac{\text{₹ } 80,00,000}{16,00,000} = \text{₹ } 5 \\ \text{Pre-merger EPS of N Co. Ltd.} &= \frac{\text{₹ } 24,00,000}{4,00,000} = \text{₹ } 6 \end{aligned}$$

Exchange ratio where earnings will be maintained = 6:5 or 1.2

Justification:

$$\begin{aligned} \text{Post-merger EPS} &= \frac{80,00,000 + 24,00,000}{16,00,000 + 4,00,000 \times 1.2} \\ &= \text{₹ } 5 \end{aligned}$$

$$\begin{aligned} \text{For M Ltd: Post-merger EPS} &= \text{₹ } 5 \\ \text{Pre-merger EPS} &= \text{₹ } 5 \end{aligned}$$

$$\begin{aligned} \text{For N Ltd: Post-merger Earnings} &= 4,00,000 \times 1.2 \times 5 = 24,00,000 \\ \text{Pre-merger earnings} &= 24,00,000 \end{aligned}$$

Hence, No loss of earnings

- Same as (c)
- Same as (c)



QUESTION 6:

M 23

Big Ltd. (BL), a listed company, is enjoying a price earnings ratio (PER) of 15 on an Earnings Per Share (EPS) of ₹ 5. The Total number of outstanding shares are 2,00,000.

BL is proposing to acquire Small Pvt. Ltd. (SPL) an unlisted company by issuing shares in the ratio 4:5 i.e., for 5 shares of SPL 4 shares of BL will be issued. The outstanding shares of SPL are 50,000. SPL will be listed before the actual merger to discover its value. The EPS of the merged entity will be ₹ 5.5.

No other information is available for SPL. You are required to calculate:

- Pre-merger EPS of SPL.
- Expected Market Price per Share of SPL at the time of listing, if it expects a PER of 10 and,
- Number of shares of BL to be issued to SPL if pre-merger EPS of BL is to be maintained.

Solution:

$$\begin{aligned} \text{a) Pre-merger earnings of BL} &= 5 \times 2,00,000 \\ &= 10,00,000 \end{aligned}$$

Calculating Pre-merger PAT of SPL using post-merger EPS:

$$\begin{aligned} \text{Post-merger EPS} &= \frac{\text{PAT}_{\text{BL}} + \text{PAT}_{\text{SPL}}}{n_{\text{BL}} + n_{\text{SPL}} \times \text{ER}} \\ 5.5 &= \frac{10,00,000 + \text{PAT}_{\text{SPL}}}{2,00,000 + 50,000 \times \frac{4}{5}} \end{aligned}$$

$$\text{PAT}_{\text{SPL}} = 3,20,000$$

$$\text{Premerger EPS of SPL} = \frac{3,20,000}{50,000} = ₹ 6.4 \text{ per share}$$

$$\text{b) Premerger MPS of SPL} = 6.4 \times 10 = ₹ 64$$

$$\text{c) Exchange ratio to maintain EPS} = \frac{\text{EPS of SPL}}{\text{EPS of BL}} = 6.4:5$$

$$\text{Number of shares to be issued to SPL} = 50,000 \times \frac{6.4}{5} = 64,000 \text{ shares}$$

Justification:

Self-note: While solving part (a) of the question, we have assumed that there is no synergy in earnings.

$$\begin{aligned} \text{Post merged EPS: } & \frac{12.160 + 3.2160}{2160 + 0.5 \times 64/5} \\ & = 5.5 \\ \text{Post merged EPS} &= \text{Pre-merged MPS} \\ &= 5.5 \end{aligned}$$



QUESTION 7:

Consider the same situation as in question 5 and also synergy in earnings of ₹ 16,00,000 per annum.

Particulars	N Co. Ltd	M Co. Ltd
Profit After Tax	₹ 24,00,000	₹ 80,00,000
Equity Shares outstanding (Nos.)	4,00,000	16,00,000
Market Price per share	₹ 160	₹ 200

- What will be the post-merger EPS?
- What is the maximum exchange ratio at which shareholders of M Co Ltd will not suffer loss?
- What is the minimum exchange ratio at which earnings of shareholders of N Co. Ltd will not decline?

Solution:

$$(i) \quad \text{Post-merger EPS} = \frac{24,00,000 + 80,00,000 + 16,00,000}{4,00,000 \times 0.80 + 16,00,000} = \frac{1,20,00,000}{19,20,000} = 6.25$$

(ii) For SHs of M Co. Ltd to not suffer loss, their:

$$\begin{aligned} \text{Post-merger EPS} &= \text{Pre-merger EPS} \\ \frac{24,00,000 + 80,00,000 + 16,00,000}{4,00,000 \times \text{ER} + 16,00,000} &= 5 \\ \text{ER} &= 2 \end{aligned}$$

(iii) For SHs of N Co. Ltd to not suffer loss, their:

$$\begin{aligned} \text{Post-merger Adjusted EPS} &= \text{Pre-merger EPS} \\ \text{Post MPS} \times \text{ER} &= \text{Pre-merger EPS} \\ \left[\frac{24,00,000 + 80,00,000 + 16,00,000}{4,00,000 \times \text{ER} + 16,00,000} \right] \times \text{ER} &= 6 \\ \text{ER} &= 1 \end{aligned}$$



QUESTION 8:

only on calc

The following information is provided related to the acquiring Earth Limited and the target Neptune Limited:

Particulars	Earth Ltd	Neptune Ltd
Profit After Tax	₹ 2000 Lakhs	₹ 400 Lakhs
Equity Shares outstanding (Nos.)	200 Lakhs	100 Lakhs
PE Ratio	10 times	5 times

Earth Ltd agrees to offer cash consideration of ₹ 25 per share. It will fund the acquisition by selling its investments which are presently earning a return of 12.5%. What will be the impact on the earnings of the shareholders of Earth Ltd. How much cash per share can Earth Ltd pay without loss of its earnings to its shareholder. Tax rate is 20%.

Solution:

$$\begin{aligned} \text{Pre-merger EPS of Earth Ltd} &= \frac{2000 \text{ lakh}}{200 \text{ lakh}} = ₹ 10 \\ \text{Purchase consideration} &= ₹ 25 \text{ per share} \times 1,00,00,000 \\ &= 25,00,00,000 \\ \text{Interest on purchase consideration} &= 25,00,00,000 \times 12.5\% \\ &= 3,12,50,000 \\ \text{Interest after tax} &= 3,12,50,000 \times (1 - 0.20) \\ &= 2,50,00,000 \\ \text{Post-merger EPS} &= \frac{20,00,00,000 + 4,00,00,000 - 2,50,00,000}{2,00,00,000} \end{aligned}$$

$$= ₹ 10.75$$

Change in earnings of shareholders of Earth Ltd.:

Post-merger EPS	10.75
Less: Pre-merger EPS	10
Gain/(loss) per share	0.75
☐ No. of shares	200 lakhs
Total gain/(loss)	150 lakhs

Maximum cash per share considering EPS:

$$\frac{20,00,00,000 + 4,00,00,000 - PC \times 12.5\% \times (1 - 20\%)}{2,00,00,000} = 10$$

$$PC = 4000 \text{ Lakh}$$

$$\begin{aligned} \text{Cash per share} &= \frac{4000 \text{ lakh}}{100 \text{ lakh}} \\ &= ₹ 40 \text{ per share} \end{aligned}$$



QUESTION 9:

M 16 | RTP

Stock deal.

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 ₹ 80.00 lakhs and P/E multiple is 10.5. He wants to buy another firm which has current income of ₹ 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 ₹ 42 and ₹ 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%.

cash deal.

Solution:

	Acquirer	Target
Net Profit (EAES)	₹ 80,00,000	₹ 15,75,000
P/E Multiple	10.5	10
Market Price	42	105
No. of Shares	20,00,000	1,50,000
EPS	₹ 4	₹ 10.50

Calculating Maximum Exchange Ratio:

$$\frac{80,00,000 + 15,75,000}{20,00,000 + 1,50,000 \times ER} = 4$$

$$ER = 2.625$$

Calculating Maximum Cash:

$$\frac{80,00,000 + 15,75,000 - \text{Cash per share} \times 50,000 \times 0.15 \times (1 - 0.3)}{20,00,000} = 4$$

$$\text{Cash per share} = 100$$

B. Post-merger MPS and related calculations

1. When question is silent about synergy



QUESTION 10:

N 22 | N 20 | M 18 | N 09 | N 07

A Ltd. wants to acquire T Ltd. and has offered a swap ratio of 1:2 (0.5 shares for every one share of T Ltd.) following information is provided:

Particulars	A Ltd	T Ltd
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
Price quoting per share on BSE before the merger announcement	₹ 30	₹ 14

1. You are required to determine:
 - a. The number of equity shares to be issued by A Ltd. for acquisition of T Ltd.
 - b. What is the EPS of A Ltd. after the acquisition?
 - c. Determine the equivalent earnings per share of T Ltd.
 - d. What is the expected market price per share of A Ltd. after the acquisition, assuming its PE multiple remains unchanged?
 - e. Determine the market value of the merged firm.
 - f. Ascertain the profits accruing to the shareholders of both the companies.
2. If you are the shareholder of T Ltd & holding 100 shares, will you be interested to sell your stake? Why?
3. After the announcement of merger, price of shares of A 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.

Solution:

- 1) (a) No. of equity shares = $1,80,000 \times 0.50 = 90,000$
- (b) Post-merger EPS = $\frac{18,00,000 + 3,60,000}{6,00,000 + 1,80,000 \times 0.50}$
= 3.130
- (c) Equivalent EPS = $3.13 \times 0.50 = 1.565$
- (d) Expected MPS after acquisition = 3.10×10
= ₹ 31.3
- (e) MV of Merged firm = $(18,00,000 + 3,60,000) \times 10$
= 2,16,00,000
- (f) Profit accruing to the shareholders:
Equivalent MPS = $31.3 \times 0.5 = 15.65$

Mergers, Acquisition & Corporate Restructuring

	A Ltd.	T Ltd.
Post-merger MPS or Equivalent MPS	31.30	15.65
Less: Pre-merger MPS	-30	-14
Gain / (Loss) per share	1.3	1.65
× No. of shares	6,00,000	1,80,000
Total gain / (loss)	7,80,000	2,97,000

2) Pre-merger value of 100 shares = $14 \times 100 = 1,400$

Equivalent value of 100 shares = $15.65 \times 100 = 1,565$

No, I am not agreed to sell the stake as there is increase in market value after the merger.

3) Calculating annual return after merger:

Equivalent EPS of S Ltd.	₹ 1.565
BSE Price after merger announcement	₹ 15.4
Return on Market Price per share	$\frac{1.565}{15.4} = 10.16\%$

As Mr. X is having another opportunity to earn 14% and expected return on S Ltd.'s share is 10.16%, it is advisable to offload the shares in market.



QUESTION 11:

M 22 | M 09 | N 04 | RTP M 09

only on call

Following information is provided relating to the acquiring company Mani Ltd. and the target company Ratnam Ltd.:

Particulars	Mani Ltd	Ratnam Ltd
Profit After Tax (₹ lakhs)	2,000	4,000
Equity Shares outstanding (Lakh Nos.)	200	1,000
PE Ratio	10 times	5 times

Required:

- What is the swap ratio based on current market prices?
- What is the EPS of Mani Ltd. after the acquisition?
- What is the expected market price per share of Mani Ltd. after the acquisition, assuming its P/E ratio is adversely affected by 10%?
- Determine the market value of the merged Co.
- Value of original shareholders → *new to learn*
- Calculate gain/loss for the shareholders of the two independent entities, due to the merger.
- What is the impact on the wealth of the shareholders?
- What is NPV of the merger to Mani Ltd?
- What is cost of the merger to Mani Ltd?

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Solution:

(a) Swap ratio based on MPS:

	Mani	Ratnam
EPS	$\frac{2000}{200} = ₹ 10$	$\frac{4000}{1000} = ₹ 4$
MPS	$₹ 10 \times 10 \text{ times} = ₹ 100$	$₹ 4 \times 5 \text{ times} = ₹ 20$

- Swap Ratio based on MPS $= \frac{20}{100} = 0.20$
- (b) Post-merger EPS $= \frac{2,000 + 4,000}{200 + 1,000 \times 0.2}$
 $= 15$
- (c) Expected MP after Acquisition $= \text{Post-merger EPS} \times \text{Post-merger PE}$
 $= 15 \times 9 = 135$
- (d) Market Value $= 135 \times 400$
 $= 54,000 \text{ lakhs}$
- (e) Value of original shareholders $= 135 \times 200$
 $= 27,000 \text{ lakhs}$
- (f) Gain-loss to the shareholders (in ₹ lakhs):
 Equivalent MPS $= 135 \times 0.2 = 27$

	Mani Ltd.	Ratnam Ltd.
Post-merger MPS or Equivalent MPS	135	27
Less: Pre-merger MPS	100	20
Gain / (Loss) per share	35	7
× No. of shares	200	1,000
Total gain / (loss)	7,000	7,000

- (g) Same as (f)
- (h) Same as (f)
- (i) Same as (f)



QUESTION 12:

N 19

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:

	ABC Ltd	XYZ Ltd
Earnings after tax (₹)	9,00,000	2,40,000
Number of equity shares	1,50,000	60,000
P/E ratio (no. of times)	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.

Solution:

a) Swap ratio based on current market price

Particulars	ABC Ltd.	XYZ Ltd.
EAT	₹ 9,00,000	₹ 2,40,000
No. of Equity Shares	1,50,000	60,000
EPS	₹ 6	₹ 4
PE Ratio	14	10
Market Price Per Share	₹ 84	₹ 40

$$\text{Swap Ratio} = \frac{40 \times (1 + 0.25)}{84} = 25:42 \text{ or } 0.60$$

b) No. of shares to be issued = $60,000 \times 0.60$
= 36,000

c) Post-merger EPS = $\frac{9,00,000 + 2,40,000}{1,50,000 + 36,000}$
= 6.13

Impact of merger on earnings:

Equivalent EPS of XYZ Ltd = $6.13 \times 0.6 = 3.68$

	ABC	XYZ
Post-merger EPS & Equivalent EPS	6.13	3.68
Less: Pre-merger EPS	6	4
Gain/(loss) per share	0.13	- 0.32

d) Post-merger MPS when PE Ratio remains same = $₹ 6.13 \times 14 \text{ times}$
= 85.82

e) Post-merger MPS when PE Ratio falls to 12 = $₹ 6.13 \times 12 \text{ times}$
= 73.56

Comments: With the change in PE Ratio from 14 to 12 merger, MPS of ABC Ltd will decline from 85.96 to 73.68.



QUESTION 13:

MTP M 21

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:

	C Ltd.	P Ltd.
Annual Earnings after Tax (Rs. lakh)	10000	5800
No. Shares Outstanding (lakh)	4000	1000
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.

A

T.

as this line become irrelevant.

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.

Solution:

$$\begin{aligned} \text{Post-merger PE} &= \frac{8 + 10}{2} = 9 \text{ times} \\ \text{Post-merger MPS} &= \frac{[(10,000 + 5,800) \times 1.08] \times 9}{4,000 + 1,000 \times \frac{3}{1}} \\ &= ₹ 21.94 \\ \text{Equivalent MPS} &= 21.94 \times \frac{3}{1} \\ &= ₹ 65.82 \\ \text{Pre-merger MPS} &= \frac{5,800}{1,000} \times 10 \\ &= ₹ 58 \end{aligned}$$

Gain to the SH of P Ltd.:

Equivalent MPS	65.82
Pre-merger MPS	<u>58</u>
Gain per share	<u>7.82</u>



QUESTION 14:

MTP M 20

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 Ltd	Y Ltd
Market Capitalization (Rs.)	75,00,000	90,00,000
Gross Profit Ratio	20%	20%
Inventory Turnover Ratio	5 times	4 times
Debtor Turnover Ratio	3 times	5 times
12% Debenture (Rs.)	10,00,000	-
10% Debenture (Rs.)	-	14,40,000
No. of Equity Shares	1,00,000	60,000
Operating Expenses	86%	78%
Corporate Tax Rate	30%	30%
Closing Stock (Rs.)	15,00,000	5,00,000
Debtors (Rs.)	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.

Solution:

Working Notes:

	X Ltd.	Y Ltd.
Calculating COGS:	$5 = \frac{\text{COGS}}{15,00,000}$	$4 = \frac{\text{COGS}}{500,000}$
Inventory T/O Ratio: $\left[\frac{\text{COGS}}{\text{Average Inventory}} \right]$	COGS = 75,00,000	COGS = 20,00,000
Gross Profit Ratio	20%	20%
Sales	$\frac{75,00,000}{80\%} = 93,75,000$	$\frac{20,00,000}{80\%} = 25,00,000$
Less: Operating Expenses	@ 86% = 80,62,500	@ 78% = 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 Rate @ 30%	357750	121800
EAT	8,34,750	2,84,200
÷ No. of Shares	1,00,000	60,000
EPS	8.35	4.74

$\text{MPS} = \frac{\text{Market Capitalization}}{\text{No of shares}}$	$\frac{75,00,000}{1,00,000} = ₹ 75$	$\frac{90,00,000}{60,000} = ₹ 150$
---	-------------------------------------	------------------------------------

a) Swap ratio based on EPS & MPS

	ER based on:	W	ER × W
EPS	$4.74/8.35 = 0.5677$	0.4	0.2271
MPS	$150/75 = 2$	0.6	1.2
			ER = 1.4271

(b) Post-merger EPS = $\frac{8,34,750 + 2,84,200}{1,00,000 + 60,000 \times 1.4271}$
= ₹ 6.03

(c) Pre-merger PE Ratio of X Ltd. = $\frac{75}{8.35} = 8.98$

Post-merger-MPS = 6.03×8.98
= ₹ 54.15

(d) Post-merger Gain/Loss in EPS

Equivalent EPS = $6.03 \times 1.4271 = 8.61$

	X Ltd.	Y Ltd.
Post-merger EPS	6.03	8.61

Pre-merger EPS	-8.35	-4.74
Gain/Loss	-2.32	3.87


QUESTION 15:

M 06 | RTP

only on calc

Reliable Industries Ltd. (RIL) is considering a takeover of Sunflower Industries Ltd. (SIL). The particulars of 2 companies are given below:

Particulars	Reliable Industries Ltd.	Sunflower Industries Ltd.
Earnings After Tax (EAT)	₹ 20,00,000	₹ 10,00,000
Equity Shares O/s	10,00,000	10,00,000
Earnings per share (EPS)	2	1
PE Ratio	10	5

Required:

- What is the market value of each Company before merger?
- 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?
- 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 than before the merger?

Solution:

- MV of each Company before merger:

	Reliable Industries	Sunflower Industries
Market Value	₹ 20,00,000 × 10 = ₹ 2,00,00,000	₹ 10,00,000 × 5 = ₹ 50,00,000

- Post-merger MV of RIL = $(20,00,000 + ₹ 10,00,000) \times 10$
= ₹ 3,00,00,000

$$\text{Post-merger MPS} = \frac{3,00,00,000}{10,00,000 + 10,00,000 \times 0.25} = 24$$

Gain/(loss) of shareholder in terms of MPS:

$$\text{Equivalent MPS:} = 24 \times 0.25 = 6$$

	Reliable	Sunflower
Post-merger MPS / Equivalent MPS	24	6
Less: Premerger MPS	$10 \times 2 = 20$	$1 \times 5 = 5$
Gain/(Loss) per share	4	1
× No. of shares	10,00,000	10,00,000
Total Gain/(Loss)	40,00,000	10,00,000

Shareholders will be better-off than before the merger situation.

$$(c) \quad \text{Post-merger EPS} = \frac{(20,00,000 + 10,00,000) + 20\%}{10,00,000 + 10,00,000 \times 0.25} = 2.88$$

$$\text{Post-merger MPS} = 2.88 \times 10 = 28.8$$

Gain/(loss) to shareholders in terms of MPS:

$$\text{Equivalent MPS:} = 28.8 \times 0.25 = 7.2$$

	Reliable	Sunflower
Post-merger MPS / Equivalent MPS	28.8	7.2
Less: Premerger MPS	20	5
Gain/(Loss) per share	8.8	2.2
× No. of shares	10,00,000	10,00,000
Total Gain/(Loss)	88,00,000	22,00,000

Shareholders will be better-off than before the merger situation.



QUESTION 16:

N 23 | M 11 | M 09 | N 20 | N 15 | M 05 | RTP

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.:

	Abhiman Ltd.	Abhishek Ltd.
Share Capital (₹)	200 Lakh	100 Lakh
Free Reserve and Surplus (₹)	800 Lakh	500 Lakh
Paid up Value per Share (₹)	100	10
Free float market Capitalisation (₹)	400 lakhs	128 lakhs
P/E Ratio (Times)	10	4

Trident Ltd. is interest 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	50%
Market Price	25%

- What is the swap ratio based on above weights?
- 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)
- Calculate:
 - Promoter's revised holding in the Abhiman Ltd.
 - Free float market capitalization.
 - Also calculate No. of shares, earning per Share (EPS) and Book Value (B.V.), if after acquisition of Abhishek Ltd., Abhiman Ltd. decided to:
 - Issue Bonus shares in the ratio of 1 : 2; and
 - Split the stock (share) as ₹ 5 each fully paid.

Solution:

Working Notes: Calculation of book value, EPS and Market Price:

Particulars	Abhiman	Abhishek
(a) Equity SHF	200+800 = 1,000 Lakh	(100+500) = 600 Lakhs
(b) No. of shares = $\frac{\text{Share Capital}}{\text{Paid up value}}$	200/100 = 2 Lakhs	100/10 = 10 Lakhs
(c) BVPS (a ÷ b)	500	60
(d) Promoter's Holding	50%	60%
(e) Free Float Market Cap	400 Lakhs	128 Lakhs
(f) Public Holding (1-d)	50%	40%
(g) Total Market Cap	800 Lakhs	320 Lakhs
(h) MPS (g ÷ b)	400	32
(i) PE Ratio	10	4
(j) EPS	40	8

a) Calculation of swap Ratio

Parameter	ER	Weight	ER × W
BVPS	60/500 = 0.12	25%	0.03
EPS	8/40 = 0.2	50%	0.1
MPS	32/400=0.08	25%	0.02
			0.15

(b) Post-merger BVPS = $\frac{800 + 200 + 100 + 500}{2 + 10 \times 0.15} = ₹ 457.14$

Post-merger Earning = $40 \times 2 + 10 \times 8 = 160$

Post-merger EPS = $\frac{160}{2 + 10 \times 0.15} = ₹ 45.71$

Post-merger MPS = $45.71 \times 10 = 457.1$

(c) (i) Promoter's Revised holding

No. of shares of Abhiman issued to promoters:

Abhiman 50% $2,00,000 \times 50\% = 1,00,000$

Abhishek 60% $10,00,000 \times 60\% \times 0.15 = 90,000$

1,90,000

Promoter's Holding in Abhiman = $\frac{1,90,000}{3,50,000} = 54.29\%$

(ii) Free float number of shares = $3,50,000 - 1,90,000 = 1,60,000$

Free Float Market Cap = $1,60,000 \times 457.1 = 73,136,000$

(iii) Pre-bonus no of shares = 3,50,000

Bonus shares issued = $3,50,000 \times \frac{1}{2} = 1,75,000$

Post Bonus no of shares = 5,25,000

$$\begin{aligned} \times \text{Split Ratio} &= 100/5 &= 20 \\ \text{No. of shares} & &= 1,05,00,000 \end{aligned}$$

$$\text{EPS} = \frac{1,60,00,000}{1,05,00,000} = 1.524$$

$$\text{BVPS} = \frac{16,00,00,000}{1,05,00,000} = 15.24$$



QUESTION 17:

M 18 | M 17 | M 15

During the audit of the Weak Bank (W), RBI has suggested that the Bank should either merge 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 (W)	Strong Bank (S)	Assigned Weights (%)
Gross NPA (%)	40	5	30
Capital Adequacy Ratio (CAR) (Total Capital/Risk Weight Asset)	5	16	28
Market price per Share (MPS)	12	96	32
Book value			10
Trading on Stock Exchange	Irregular	Frequent	

Balance Sheet (₹ in Lakhs)

Particulars	Weak Bank (W)	Strong Bank (S)
Paid up Share Capital (₹10 per share)	150	500
Reserves & Surplus	80 <i>-50 = 30</i>	5,500
Deposits	4,000	44,000
Other Liabilities	890	2,500
Total Liabilities	5,120	52,500
Cash in Hand & with RBI	400	2,500
Balance with Other Banks	-	2,000
Investments	1,100	19,000
Advances	3,500	27,000
Other Assets	70	2,000
Preliminary Expenses <i>(fictional)</i>	50 <i>0</i>	-
Total Assets	5,120	52,500

You are required to

- Calculate Swap ratio based on the above weights:

- b. As certain the number of Shares to be issued to Weak Bank;
 c. Prepare Balance Sheet after merger; and *→ new to learn.*
 d. Calculate CAR and Gross NPA of Strong Bank after merger. *→ new to learn.*

Solution:

- (a) Calculation of Book Value Per Share

Particulars	Weak Bank (W)	Strong Bank (S)
Share Capital (₹ Lakhs)	150	500
Reserves & Surplus (₹ Lakhs)	80	5,500
	230	6,000
Less: Preliminary Expenses (₹ Lakhs)	(50)	-
Net Worth or Book Value (₹ Lakhs)	180	6,000
÷ No. of Outstanding Shares (Lakhs)	15	50
Book Value Per Share (₹)	12	120

Calculation of Swap Ratio

	Strong	Weak	ER	Weight	ER × W
Gross NPA	5	40	0.125	0.30	0.0375
Capital Adequacy Ratio	16	5	0.3125	0.28	0.0875
MPS	96	12	0.125	0.32	0.04
BVPS	120	12	0.1	0.1	0.01
ER					0.175

For every share of Weak Bank, 0.1750 share of Strong Bank shall be issued

- (b) No. of shares to be issued to weak = $15 \times 0.175 = 2.625$ lakh shares
 (c) Balance Sheet after merger:

Liabilities	Amount	Assets	Amount
Paid up Share Capital	526.25	Cash in hand	2,900
Reserve & Surplus	5500.00	Balance	2,000
Capital Reserve	153.75	Investment	20,100
Deposits	48000.00	Advances	30,500
Other Liabilities	3390.00	Other Assets	2,070
	57570.00		57570.00

- (d) Calculation CAR & Gross NPA % of Bank 'S' after merger

$$\text{CAR/CRWAR} = \frac{\text{Total Capital}}{\text{Risky Weighted Assets}}$$

	Weak Bank	Strong Bank	Merged
	5%	16%	
Net Total Capital	₹ 180 lac	₹ 6000 lac	₹ 6180 lac
Risky Weighted Assets	₹ 3600 lac	₹ 37500 lac	₹ 41100 lac

$$\text{CAR} = \frac{6,180}{41,100} \times 100 = 15.04\%$$

$$\text{Gross NPA Ratio} = \frac{\text{Gross NPA}}{\text{Gross Advances}} \times 100$$

	Weak Bank	Strong Bank	Merged
Gross NPA Ratio (%)	0.40	0.05	
Gross Advances (₹)	₹ 3,500 lac	₹ 27,000 lacs	₹ 30,500 lacs
Gross NPA (₹)	₹ 1400 lac	₹ 1350 lac	₹ 2750 lac

$$\text{Gross NPA Ratio} = \frac{2,750}{30,500} \times 100 = 9.02\%$$


QUESTION 18:

N 20 | M 15 | N 08

BA Ltd. and DA Ltd. both the companies operate in the same industry. The financial statements of both the companies for the current financial year are as follows:

Balance Sheet	BA Ltd. (₹)	DA Ltd. (₹)
Current assets	14,00,000	10,00,000
Fixed Assets (Net)	10,00,000	5,00,000
Total (₹)	24,00,000	15,00,000
Equity capital (₹ 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 (₹)	24,00,000	15,00,000
Income Statement	BA Ltd. (₹)	DA Ltd. (₹)
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 (EAT)	2,10,000	99,000
Additional Information:		
No. of Equity Shares	1,00,000	80,000
Dividend payment ratio (D/P)	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:

- 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.
- Estimate future EPS growth rates for each company.

- Based on expected operating synergies BA Ltd. estimates that the intrinsic value of DA's equity share would be ₹ 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?
- 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.
- 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.

Solution:

- Decomposition of share price into EPS and P/E:

Particulars	BA Ltd.	DA Ltd.
Market Price	40	15
$EPS = \frac{EAES}{n}$	$\frac{2,10,000}{1,00,000} = 2.1$	$\frac{99,000}{80,000} = 1.2375$
$PE \text{ Ratio} = \frac{MPS}{EPS}$	$\frac{40}{2.1} = 19.047$	$\frac{15}{1.2375} = 12.12$
$BVPS = \frac{ESHF}{\text{No. of Shares}}$	$12,00,000/1,00,000 = 12$	$8,00,000/80,000 = 10$
$ROE = \frac{EPS}{BVPS}$	$\frac{2.1}{12} = 17.5\%$	$\frac{1.2375}{10} = 12.375\%$

- Future EPS growth rates

Growth Rate (RR × ROE)	10.5% (0.60 × 0.175)	4.95% (0.40 × 0.12375)
---------------------------	-------------------------	---------------------------

(c) Upper limit of ratio = $\frac{20}{40} = 0.50$

Lower limit of ratio = $\frac{15}{40} = 0.375$

Since ROE and growth rate of the acquirer are higher. Therefore, the negotiated terms will be close to the lower exchange ratio that is 0.375

(d) Post-merger EPS = $\frac{2,10,000 + 99,000}{1,00,000 + 80,000 \times 0.40}$
= 2.341

EPS accretion & dilution:

Equivalent EPS = $2.341 \times 0.4 = 0.9364$

Particulars	BA Ltd.	DA Ltd.
Post-merger EPS / Equivalent MPS	2.341	0.9364

Less: Pre-merger EPS	-2.1	-1.2375
Gain/(loss) per share	0.241	-0.3011

- (e) Post-merger MPS = Post-merger EPS $\times$ Post-merger PE Ratio
 $= 2.341 \times 19.047$
 $= 44.59$

MPS accretion & dilution:

Equivalent MPS = $44.59 \times 0.4 = 17.836$

Particulars	BA Ltd.	DA Ltd.
Post-merger MPS / Equivalent MPS	44.59	17.836
Less: Pre-merger MPS	40	15
Gain/(loss) per share	4.59	2.836



QUESTION 19:

N 18

C Ltd & D Ltd are contemplating a Merger deal in which C Ltd. will acquire D Ltd. The relevant information about the firms is:

	C Ltd	D Ltd
Total Earnings (E) (In Millions)	₹ 96	₹ 30
Number of Outstanding Shares (S) (In Millions)	20	14
Earnings Per Share (EPS) (₹)	4.8	2.143
Price Earnings Ratio (P/E)	8	7
Market Price Per Share (P) (₹)	38.4	15

- What is the Maximum Exchange Ratio acceptable to the Shareholders of C Ltd., if the P/E Ratio of the Combined Firm is 7?
- What is the Minimum Exchange Ratio acceptable to the Shareholders of D Ltd., if the P/E Ratio of the Combined is 9?

Solution:

- (a) Maximum exchange ratio acceptable to the shareholders of C Ltd:

Post-merger MPS = Pre-merger MPS of C Ltd.

$$\left[\frac{96 + 30}{20 + 14 \times ER} \right] \times 7 = 38.4$$

$$ER = 0.212$$

- (b) Minimum exchange ratio acceptable to the shareholders of D Ltd:

Equivalent MPS = Pre-merger MPS of D Ltd.

$$\left[\frac{(96 + 30) \times 9}{20 + 14 \times ER} \right] \times ER = 15$$

$$ER = 0.325$$


QUESTION 20:

N 21 | N 15 | RTP | SM

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:

Equity Shares outstanding (Nos.)	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.

Solution:

Swap Ratio = 0.70

	XYZ Ltd.	ABC Ltd.
Equity shares outstanding (Nos.)	10,00,000	4,00,000
EPS	₹ 40	₹ 28
Profit	₹ 4,00,00,000	₹ 1,12,00,000
PE Ratio	6.25	5.71
Market price per share	₹ 250	₹ 160

$$\begin{aligned} \text{a) Post-merger EPS} &= \frac{4,00,00,000 + 1,12,00,000}{10,00,000 + 4,00,000 \times 0.70} \\ &= ₹ 40 \end{aligned}$$

Gain/(loss) on shareholders in EPS:

$$\text{Equivalent EPS} = 40 \times 0.7 = 28$$

Particulars	XYZ Ltd.	ABC Ltd.
Post-merger EPS / Equivalent EPS	40	28
Less: Pre-merger EPS	40	28
Gain/(loss) per share	0	0

- If Share exchange ratio = 1:1

$$\begin{aligned} \text{Per merger EPS} &= \frac{4,00,00,000 + 1,12,00,000}{10,00,000 + 4,00,000 \times 1} \\ &= 36.57 \\ \text{Post-merger MPS} &= 36.57 \times 6.25 \\ &= 228.56 \end{aligned}$$

Gain from merger to the shareholders of ABC:

$$\text{Equivalent MPS} = 228.56 \times 1 = 228.56$$

	ABC Ltd
Equivalent MPS	228.56

Less: Premerger MPS	160
Gain/(Loss) per share	68.56
× No. of shares	4,00,000
Total Gain/(Loss)	2,74,24,000

c) Gain from merger to the shareholders of XYZ:

	XYZ Ltd
Post-merger MPS	228.56
Less: Premerger MPS	250
Gain/(Loss) per share	(21.44)
× No. of shares	10,00,000
Total Gain/(Loss)	2,14,40,000

d) maximum exchange ratio acceptable to shareholders of XYZ Ltd:

$$\frac{(4,00,00,000 + 1,12,00,000) \times 6.25}{10,00,000 + 4,00,000 \times ER} = 250$$

$$ER = 0.70$$

Thus, maximum acceptable ratio shall be 0.70 share of XYZ Ltd. for one share of ABC Ltd.



QUESTION 21:

RTP M 12

only on calc

AXE Ltd. is interested to acquire PB Ltd. AXE has 50,00,000 shares of ₹ 10 each, which are presently being quoted at ₹ 25 per share. On the other hand, PB has 20,00,000 shares of ₹ 10 each currently selling at ₹ 17. AXE and PB have EPS of ₹ 3.20 and ₹ 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.
- 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.
- The maximum ratio likely to acceptable to management of AXE.

Solution:

$$\text{a) Exchange Ratio based on EPS} = \frac{2.40}{3.20} = 0.75$$

$$\text{Earning of AXE Ltd.} = 3.20 \times 50,00,000 = ₹ 1,60,00,000$$

$$\text{Earning of PB Ltd.} = 2.40 \times 20,00,000 = ₹ 48,00,000$$

$$\text{Post-merger EPS} = \frac{1,60,00,000 + 48,00,000}{50,00,000 + 20,00,000 \times 0.75} = ₹ 3.20$$

Statement showing impact on EPS

	AXE Ltd.	PB Ltd.
Post-merger EPS / Equivalent EPS	3.20	2.40
Less: Pre-merger EPS	3.20	2.40

Thus, there is will be no change in EPS for shareholder of both companies

(b) Pre-merger PE of AXE Ltd. $= \frac{25}{3.2} = 7.8125$

Post-merger MPS $= \frac{(1,60,00,000 + 48,00,000) \times 7.8125}{50,00,000 + 20,00,000 \times 1} = 23.21$

Equivalent MPS = $23.21 \times 1 = 23.21$

Pre-merger MPS = 17

Thus PB Ltd. should accept the offer.

(c) Maximum share ratio acceptable to AXE Ltd.

Post-merger MPS = Pre-merger MPS

$$\frac{(1,60,00,000 + 48,00,000) \times 7.8125}{50,00,000 + 20,00,000 \times ER} = 25$$

ER = 0.75

Thus, the maximum exchange ratio acceptable to shareholders of AXE Ltd. is 0.75 shares for every share of PB Ltd.



QUESTION 22:

Self-added for class students

Consider the following information pertaining to two companies: (in ₹ '000)

	BT Ltd	W Ltd
Total Earnings	₹ 9000	₹ 1800
Number of Outstanding Shares	3000	1500
Price Earnings Ratio (times)	6	4

BT Ltd wished to takeover W Ltd. BT Ltd is confident that, by managing business of T Ltd more efficiently, they could achieve a permanent savings in administration and marketing cost to the tune of ₹ 50,000 annually. They are considering a cash offer of ₹ 5 per share.

- What would be cost of merger to BT Ltd.
- What will NPV of the merger of BT Ltd.

Solution:

$$\begin{aligned} \text{Post merge MPS: } & \frac{(9000,000 + 1800,000 + 30,000) \times 6}{3000000 - \left(\frac{1500,000}{4} \times 5 \right)} \\ & = 19.2 \end{aligned}$$

Pre-merge MPS of:

$$BT : \frac{9000000}{3000000} \times 6 = ₹ 18$$

$$W : \frac{1800000}{1500000} \times 4 = ₹ 4.8$$

$$(a) \text{ Cost of merger: } (5 - 4.8) \times 1500000 = ₹ 300,000$$

$$(b) \text{ NPV from merger: } (19.2 - 18) \times 3000000 = ₹ 36,00,000$$



QUESTION 23:

M 19

Given is the following information:

	Day Ltd.	Night Ltd.
Net Earnings	₹ 5 crores	₹ 3.50 crores
No. of Equity Shares	10,00,000	7,00,000

The shares of Day Ltd. and Night Ltd. trade at 20 and 15 times their respective P/E ratios.

Day Ltd. considers taking over Night Ltd. by paying ₹ 55 crores considering that the market price of Night Ltd. reflects its true value. It is considering both the following options:

- Takeover is funded entirely in cash.
- Takeover is funded entirely in stock.

You are required to calculate the cost of the takeover and advise Day Ltd. on the best alternative.

Solution:

Working Notes:

	Day Ltd	Night Ltd
Net Earnings	₹ 5 crores	₹ 3.5 crores
No. of Equity Shares	10,00,000	7,00,000
EPS	50	50
P/E	20 times	15 Times
MPS	₹ 1000	₹ 750
Market Value	1,00,00,00,000	52,50,00,000

- If takeover is funded by Cash:

Since Market Price of Night Ltd. reflects its full value, cost of takeover to Day Ltd is:

Particulars	Amount
Cash Paid to Night Ltd.	55 Cr.
Less: Premerger MV or night (3.50 × 15)	-52.5 Cr.
	2.50 Cr.

- Calculation of no. of shares to be issued = $\frac{55,00,00,000}{1,000} = 5,50,000$ shares

$$\text{Post-merger MV}^* = 1,00,00,00,000 + 52,50,00,000$$

$$= 1,52,50,00,000$$

$$\begin{aligned} \text{Share of Night Ltd in Post-merger MV} &= 1,52,50,00,000 \times \frac{5,50,000}{10,00,000 + 5,50,000} \\ &= 54,11,29,032 \end{aligned}$$

$$\begin{aligned} \text{Cost of Takeover} &= 54,11,29,032 - 52,50,00,000\# \\ &= 1,61,29,032 \end{aligned}$$

Best Alternative: Since true cost is lower in case of funding from stock, Day Ltd. would better off by funding the takeover by stock.

* Self-note: While calculating the post-merger MV under stock option, no synergy in value has been considered because in the suggested answers pre-merger MVs have been simply added. This is particularly in this question because we need to compare gain of target company in case of the stock deal with the gain of cash deal. Since no synergy is considered in case of cash deal, therefore it can not be considered even in stock deal. Remember this!

Self-note: While calculating the cost of takeover under stock option, suggested answer has deducted 55 Crores & not pre-merger MV of 52.5 Cr.

2. When question specifies post-merger MV or amount of synergy in value or way to calculate these.



QUESTION 24:

M 24 | N 21 | N 14

Elrond Limited plans to acquire Doom Limited. The relevant financial details of the two firms prior to the merger announcement are:

Particulars	Doom Ltd.	Elrond Ltd.
Market price per share	₹ 25	₹ 50
Number of outstanding shares	10 lakhs	20 lakhs

The merger is expected to generate gains, which have a present value of ₹ 200 lakhs. The exchange ratio agreed to is 0.5.

What is the true cost of the takeover & NPV of the merger from the point of view of Elrond Ltd?

Solution:

Shares to be issued to the shareholders of Doom = $10 \text{ lakhs} \times 0.5$
= 5 lakhs

Post-merger MV of Elrond = $₹ 50 \times 20 \text{ lakh} + ₹ 25 \times 10 \text{ lakh} + ₹ 200 \text{ lakh}$
= ₹ 1450 lakh

The cost of merger:

Particulars	Amount
Equivalent MV $\left[1450 \times \frac{5,00,000}{20,00,000 + 5,00,000} \right]$	290 Lakhs
Less: Premerger MV or night ($25 \times 10 \text{ lakhs}$)	250 Lakhs
	40 Lakhs



QUESTION 25:

M 22

M/s. Vasavi Ltd. is considering the takeover of M/s. SKPD Ltd. by the exchange of five new shares in M/s. Vasavi Ltd. for every eight shares in M/s. SKPD Ltd. The relevant financial details of the two companies prior to merger announcement are as follows:

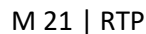
Particulars	Vasavi Ltd	SKPD Ltd
Profit Before Tax (₹ Crore)	18	20.8
No. of shares (Crore)	20	18
PE Ratio	11	8

Corporate tax rate 30%.

You are required to determine:

- Market value of both the companies
- Value of original share holders
- Price per share after merger

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	Long Ltd	Tall Ltd
Expected EPS	₹ 12	₹ 5
Expected DPS	₹ 10	₹ 3
No. of Shares	30,00,000	18,00,000
Current Market Price of Share	₹ 180	₹ 50

- Calculate the net cost of acquisition by Long Ltd., if ₹ 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.

→ synergy i.e. (Total gain)

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Cash paid for the shares of Tall Ltd.	(₹ 60 × 18,00,000)	₹ 10,80,00,000
Less: Pre-merger Value of Tall Ltd.	(₹ 50 × 18,00,000)	₹ 9,00,00,000
Net Cost of acquisition of Tall Ltd.	$10 \times 18 \text{ lac}$	₹ 1,80,00,000

(ii) Net Cost of acquisition in case of exchange of shares:

$$\text{Calculation of cost of Equity of Tall Ltd.} = \frac{D_1}{P_0} + g$$

$$= \frac{3}{50} + 0.06 = 12\%$$

$$\text{Growth rate after acquisition} = 8\%$$

$$\text{Value of Tall Ltd. after merger} = \frac{3}{0.12 - 0.08} = 75$$

$$\text{Post-merger MPS} = \frac{180 \times 30,00,000 + 75 \times 18,00,000}{36,00,000} = 67.50$$

$$= ₹ 187.50 \text{ per share}$$

Equivalent MPS

$$= 187.50 \times 1/3 = ₹ 62.5$$

Net cost of acquisition:

Particulars	Amount
Equivalent MPS of Tall Ltd	62.5
Less: Pre-merger MPS of Tall Ltd	50.0
Per share gain	12.5
× Pre-merger n	18,00,000
Total Gain	2,25,00,000

Share in 67.50 × 67.50 L.
 PM. MV: 1125 L.
 (-) Premerg mv: (50 × 18L)
 900
 g = 225 L

c) Calculation of gain from acquisition:

Post-merger MV of Long Ltd.	
(180 × 30,00,000 + ₹ 75 × 18,00,000)	₹ 67,50,00,000
Less: Pre-merger MV of:	
Long Ltd. (₹ 180 × 30,00,000)	₹ 54,00,00,000
Tall Ltd. (₹ 50 × 18,00,000)	₹ 9,00,00,000
Gain from Acquisition	₹ 4,50,00,000

Self-note: Part 'c' of the question ask for gain from acquisition. And total gain from acquisition means total combined gains of both the parties i.e., total synergy in value.



QUESTION 27:

N 12 | RTP

Yes Ltd. wants to acquire No Ltd. and the cash flows of Yes Ltd. and the merged entity are given below: (₹ in Lakhs)

Year	1	2	3	4	5
------	---	---	---	---	---

Yes Ltd.	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 Ltd. for each share of No Ltd.

PV factor at 15% for years 1 – 5 are 0.870, 0.756, 0.658, 0.572, 0.497 respectively.

You are required to:

- Compute the Value of Yes Ltd. before and after merger.
- Value of Acquisition and
- Gain to shareholders of Yes Ltd.

Interpretation is not clear as to what is examiner asking.

Point of learning: compulsory attractive 2 pg. 62.

Solution:

- Computation of value of Yes Ltd:

Before Merger Value of Yes Ltd.

Year	Cash Flows	PVAF @15%	Disc. CF
1	175	0.870	152.25
2	200	0.756	151.2
3	320	0.658	210.56
4	340	0.572	194.48
5	350	0.497	173.95
5	$\frac{350 \times 1.05}{0.15 - 0.05} = 3675$	0.497	1826.48
			2708.92

After Merger Value of Yes Ltd.

Year	Cash Flows	PVAF @15%	Disc. CF
1	400	0.870	348.00
2	450	0.756	340.20
3	525	0.658	345.45
4	590	0.572	337.48
5	620	0.497	308.14
5	$\frac{620 \times 1.06}{0.15 - 0.06} = 7302.22$	0.497	3,629.20
			5,308.47

- Value of Acquisition = Value After Merger – Value Before Merger
 = 5,308.47 lakhs – 2,708.92 lakhs
 = 2,599.55 lakhs
- Post-merger MV owned by SH of Yes Ltd. = $5,308.47 \times \frac{1}{1.5} = 3,538.983$
 Gain to shareholders of yes Ltd. = 3,538.98 lakhs – 2,708.92 lakhs

= 830.06 lakhs



QUESTION 28:

N 18 | M 10 | RTP

This is Earnings kr through wala question not value ke through

T Ltd. and E Ltd. 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: (₹ Lakhs)

Particulars	T Ltd	E Ltd
₹ 10 Equity shares outstanding	12 Lakhs	6 Lakhs
Debt:		
10% Debentures	580	--
12.5% Institutional Loan	--	240
Earnings before interest, depreciation and tax (EBIDAT)	400.86	115.71
Market Price/Share (₹)	220.00	110.00

T Ltd. plans to offer a price for E Ltd., business as a whole which will be 7 times EBIDAT reduced by outstanding debt, to be discharged by own shares at market price. *stock del. relative valm.*

E Ltd. is planning to seek one share in T Ltd. for every 2 shares in E Ltd. 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 Ltd.'s offer and E Ltd.'s plan;

- Net Consideration payable.
- No. of shares to be issued by T Ltd.
- EPS of T Ltd. after acquisition.
- Expected market price per share of T Ltd. after acquisition.
- State briefly the advantages to T Ltd. from the acquisition.

Calculations (except EPS) may be rounded off to 2 decimals in lakhs.

Solution:

Calculation as per T Ltd.'s Offer:

a)	EBITDA	115.71 Lakhs
	× EBITDA Multiple	7
	Value of Business	809.97 Lakhs
	Less: Debt	(240 Lakhs)
	Net consideration payable	569.97 Lakhs
b)	Net Consideration	569.97 Lakhs
	÷ MPS of T Ltd.	220
	No. of shares to be issued by T Ltd.	2.59 Lakhs

c) Pre-merger PAT

	T Ltd.	E Ltd.
EBITDA or EBIT	400.86	115.71
Less: Int @ 10%	-58.00	-30.00
EBT	342.86	85.71

This is PC to be paid to E & not post merged mv of E Ltd.
∴ Earnings ke rate

Less: Tax @ 30%	-102.86	-25.71
EAT	240.00	60.00

Post-merger EPS = $\frac{240 + 60}{12 + 2.59} = 20.56$

d) Pre-merger EPS = $\frac{240 \text{ lacs}}{12 \text{ Lacs}} = 20$

Pre-merger PE Ratio = $\frac{220}{20} = 11$

Post-merger MPS = $20.56 \times 11 = 226.16$

Calculation as per E Ltd.'s Offer:

- a) No. of shares to be issued = $6,00,000 \times 0.50$
= 3,00,000
- Consideration Payable = $3,00,000 \times 220$
= 6,60,00,000
- b) No. of shares to be issued = 3,00,000
- c) Post-merger EPS = $\frac{240 + 60}{12 + 3} = 20$
- d) Expected Post-merger MPS = $20 \times 11 = 220$
- e) Advantages of Acquisition to T Ltd:
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



QUESTION 29:

M 13

Longitude Limited is in the process of acquiring Latitude Limited on a share exchange basis Following relevant data are available:

		Longitude Limited	Latitude Limited
Profit after Tax (PAT)	₹ in Lakhs	120	80
Number of Shares	Lakhs	15	16
Earnings per Share (EPS)	₹	8	5
Price Earnings Ratio (P/E Ratio)		15	10
(Ignore Synergy) →	$S_E \neq S_V = 0$ ∴ value is not 0		

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
- EPS and
 - Market Value per Share

Mergers, Acquisition & Corporate Restructuring

Calculate Ratios up to four decimal points and amounts and number of shares up to two decimal points.

Solution:

i) Pre-merger Market Value per Share

	Longitude	Latitude
MPS = PE × EPS	15 × 8 = 120	10 × 5 = 50
Pre-merger MV = MPS × n	120 × 15 = 1800	50 × 16 = 800

ii) (a) Maximum Exchange Ratio without dilution of EPS:

Post-merger EPS = Pre-merger EPS

$$\frac{120 + 80}{15 + 16 \times ER} = 8$$

$$ER = 0.625$$

(b) Maximum Exchange Ratio without dilution of MPS:

Post-merger MPS = Pre-merger MPS

$$\frac{1800 + 800}{15 + 16 \times ER} = 120$$

$$ER = 0.417$$



QUESTION 30:

M 19 | RTP

only on calc

R Ltd. and S Ltd. operating in same industry are not experiencing any rapid growth but providing a steady stream of earnings. R Ltd.'s management is interested in acquisition of S. Ltd. due to its excess plant capacity. Share of S Ltd. is trading in market at ₹ 3.20 each. Other data relating to S Ltd. is as follows:

Balance Sheet of S Ltd. (₹)

Liabilities	Amount	Assets	Amount
Current Liabilities	15,980,000	Current Assets	24,875,000
Long Term Liabilities	12,800,000	Other Assets	9,400,000
Reserve & Surplus	27,995,000	Property Plants & Equipment	34,500,000
Share Capital (80 Lakhs shares of ₹ 1.5 each)	12,000,000		
Total	68,775,000	Total	68,775,000

Particulars	R Ltd.	S Ltd	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:

- Minimum price per share S Ltd. should accept from R Ltd.
- Maximum price per share R Ltd. shall be willing to offer to S Ltd.
- Floor Value of per share of S Ltd., whether it shall play any role in decision for its acquisition by R Ltd.

Solution:

If the examiner is not clear about the type of deal, then assume it to be the cash deal

- (a) Minimum Price per share S Ltd. Should accept R Ltd.

Book value per share of S Ltd.

Share capital	1,20,00,000
Reserve and Surplus	2,79,95,000
ESMF	3,99,95,000
÷ No. of shares	<u>80,00,000</u>

5

After Tax cash flows

$$\text{Total value of Business} = \frac{54,87,000}{0.1305} = 4,20,45,977$$

$$\text{Value per share} = \frac{4,20,45,977}{80,00,000} = 5.26$$

∴ Min. Price per share S Ltd. Should accept from R Ltd. Is ₹ 5 (current book value)

- (b) Maximum price per share, R Ltd. shall be willing to offer to S Ltd.

$$\text{Pre-merger MV of R Ltd.} = \frac{90,10,000}{0.1375} = 6,55,27,273$$

Calculating Maximum Price per share

$$\text{Post-merger MV} = \text{Pre-merger MV} \\ \frac{1,85,00,000}{0.125} - \text{Cash paid} = 6,55,27,273$$

$$\text{Total cash paid} = 8,24,72,727$$

$$\text{Max Cash per share} = \frac{8,24,72,727}{80,00,000} = 10.31$$

Point of learning

generally it is:

Post merger MPS = Pre merger MPS of A.

Since It is a cash deal and post-merger & pre-merger n are same. And since the data of n is missing. therefore, rather than per share basis, we compare the pre- and post-merger market value on totality basis

- (c) Floor value of per share of S Ltd shall be ₹ 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



QUESTION 31:

Companies X and Y are in the same business line generating Annual Cash Flows of ₹ 36 Lakhs and ₹ 18 Lakhs respectively. If the two Firms decides to merge together, a post – tax Cost Savings of ₹ 6 Lakhs every year is expected to occur. X Ltd. proposes to absorb & Ltd on paying a cash consideration of ₹ 150 Lakhs. The cost of Capital is 15%. What are the Merger Gains to be allocated to Shareholders?

Solution:

$$\text{Pre-merger MV of X Ltd} = \frac{36,00,000}{0.15} = 2,40,00,000$$

$$\text{Post-merger Cashflows} = 36,00,000 + 18,00,000 + 6,00,000 \\ = 60,00,000$$

$$\text{Post-merger MV} = \frac{60,00,000}{0.15} - 1,50,00,000$$

$$\begin{aligned}
 &= 2,50,00,000 \\
 \text{Gain to the shareholders} &= 2,50,00,000 - 2,40,00,000 \\
 &= 10,00,000
 \end{aligned}$$



QUESTION 32:

M 07 | RTP

AFC Ltd. wishes to acquire BCD Ltd. The shares issued by the two companies are 10,00,000 and 5,00,000 respectively:

- a. Calculate the increase in the total value of BCD Ltd. resulting from the acquisition on the basis of the following conditions:

Particulars	Value
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.	₹ 100
Current Market Price per Share of BCD Ltd.	₹ 20
Expected Dividend per Share of BCD Ltd	₹ 0.60

- b. 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.
- c. Calculate the gain to the shareholders of both the Companies, if AFC Ltd. pays ₹ 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 ₹ 8 and that of BCD is ₹ 2.50. It is assumed that AFC Ltd. invests its cash to earn 10%.

Solution:

- a) Calculation of K_e of BCD Ltd using pre-merger growth rate:

$$\begin{aligned}
 K_e &= \frac{D_1}{P_0} + g \\
 &= \frac{0.6}{20} + 7 = 10\%
 \end{aligned}$$

Post-merger value per share of BCD Ltd using post-merger growth rate:

$$MPS = \frac{0.60}{0.10 - 0.08}$$

$$MPS = 30$$

$$\begin{aligned}
 \text{Total post-merger value of BCD Ltd} &= 5,00,000 \times 30 \\
 &= 1,50,00,000
 \end{aligned}$$

$$\begin{aligned}
 \text{Pre-merger value of BCD Ltd.} &= 5,00,000 \times 20 \\
 &= 1,00,00,000
 \end{aligned}$$

$$\begin{aligned}
 \text{Increase in Value} &= 1,50,00,000 - 1,00,00,000 \\
 &= 50,00,000
 \end{aligned}$$

$$\begin{aligned} \text{b) Post-merger MPS} &= \frac{10,00,000 \times 100 + 1,50,00,000}{10,00,000 + 5,00,000 \times 0.25} \\ &= 102.22 \end{aligned}$$

Gain / (loss) to the shareholders:

$$\text{Equivalent MPS} = 102.22 \times 0.25 = 25.56$$

	AFC Ltd.	BCD Ltd.
Post-merger MPS / Equivalent MPS	102.22	25.56
Less: Pre-merger MPS	-100	-20
Gain/(loss) per share	2.22	5.56
× no. of shares	10,00,000	5,00,000
Total Gain/(Loss)	22,20,000	27,80,000

$$\text{c) Pre-merger PE Ratio of AFC Ltd.} = \frac{100}{8} = 12.50$$

$$\begin{aligned} \text{Post-merger MPS} &= \frac{8 \times 10,00,000 + 2.5 \times 5,00,000 - (22 \times 5,00,000 \times 10\%)}{10,00,000} \times 12.5 \\ &= 101.875 \end{aligned}$$

Gain/loss to shareholders:

	AFC Ltd.	BCD Ltd.
Post-merger MPS	101.875	
Cash Paid		22
Less: Pre-merger MPS	-100	-20
Gain/(loss) per share	1.875	2
× no. of shares	10,00,000	5,00,000
Total Gain/(Loss)	18,75,000	10,00,000



QUESTION 33:

M 24 | M 14

The equity shares of XYZ Ltd. are currently being traded at ₹ 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 ₹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 ₹4,00,000 p.a. Top management with their families are promoters of XYZ Ltd. Present value of these savings would add ₹ 30,00,000 in value to the acquisition.

Following additional information is available regarding PQR Ltd.:

Earnings per Share : ₹ 4
Total Number of Equity Shares Outstanding : 15,00,000
Market Price of Equity Share : ₹ 40

- 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?

cash deal.

point of learning

Solution:

- a) Maximum price per share at which PQR Ltd. can offer to pay for XYZ Ltd.'s share

Post-merger MPS = Pre-merger MPS of PQR Ltd.

$$\frac{MV_{PQR} + MV_{XYZ} + S_V - (\text{Cash per share} \times n_{XYZ})}{n_{PQR}} = \text{Pre-merger MPS}$$

$$\frac{10,00,000 \times 24 + 15,00,000 \times 40 + 80,00,000 + 30,00,000 - (\text{Cash per share} \times n_{XYZ})}{15,00,000} = 40$$

$$\text{Maximum price per share} = ₹ 35$$

Self-note: In the absence of information regarding stock vs cash deal, solve questions assuming cash deal as it makes solving such questions easy.

- b) Minimum price per share at which the management of XYZ Ltd.'s will be willing to offer their controlling interest

Pre-merger value promoters holding (40% of 10,00,000 × ₹ 24)	₹ 96,00,000
Add: PV of loss of remuneration to top management	₹ 30,00,000
÷ No. of Shares	₹ 1,26,00,000 4,00,000
Minimum Price	₹ 31.50



QUESTION 34:

RTP M 15

only on cash

Arun Ltd and Kumar Ltd operate in the same field, manufacturing newly born babies' clothes. Although Kumar Ltd also has interests in communication equipment, Arun Ltd is planning to take over Kumar Ltd and the Shareholders of Kumar Ltd do not regard it as a hostile bid.

The following information is available about the two Companies.

	Arun Ltd	Kumar Ltd
Current Earnings <i>→ E₀</i>	₹ 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 Investment <i>→ ROE</i>	15%	15%
Return required by Equity Shareholders	21%	24%

Dividends have just been paid and the Retained Earnings have already been re-invested in new projects. Arun Ltd plans to adopt a policy of retaining 35% of Earnings after Takeover and expects to achieve a 17% Return on New Investment.

Saving due to economies of scale are expected to be ₹ 85,00,000 p.a. Required Return to Equity Shareholders will fall to 20% due to portfolio effects. Requirements-

- Calculate the existing Share Prices of Arun Ltd and Kumar Ltd.
- Find the Value of Arun Ltd after the takeover.
- Advise Arun Ltd on the maximum amount it should pay for Kumar Ltd.

Solution:

- a) Existing Share Price:

Point of learning

It means that while calculating EI and DI, we will consider old growth rates of both the companies and not the new ones.

	Arun Ltd.	Kumar Ltd.
Current Earning ÷ No. of shares	6,50,00,000 50,00,000	2,40,00,000 15,00,000
EPS	13	16
× Dividend Payout Ratio	1 – 0.2 = 0.8	1 – 0.8 = 0.2
D0	10.4	3.2
Growth = $r \times ROE$	0.20 × 0.15 = 3%	0.80 × 0.15 = 12%
$P_0 = \frac{D_1}{K_e - g}$	$\frac{10.4 \times 1.03}{0.21 - 0.03} = 59.51$	$\frac{3.2 \times 1.12}{0.24 - 0.12} = 29.87$

b) Post-merger MV of Arun Ltd.:

E1 of Arun Ltd. [6,50,00,000 × 1.03]	6,69,50,000
E1 of Kumar Ltd. [2,40,00,000 × 1.12]	2,68,80,000
Synergy in Earnings (year 1.)	85,00,000
Post-merger earning after 1 year	10,23,30,000
× Payout ratio (revised)	65%
D1	6,65,14,500
Growth = 0.17 × 0.35	5.95%

$$\text{Post-merger Value} = \frac{6,65,14,500}{0.20 - 0.0595} = 47,34,12,811$$

(c) Maximum amount Arun Ltd. should pay for Kumar Ltd

$$\frac{MV_{\text{ARUN}} + MV_{\text{KUMAR}} + S_V - \text{Cash Paid}}{n_A} = \text{Pre-merger MPS}$$

$$\frac{47,34,12,811 - \text{Cash Paid}}{50,00,000} = 59.51$$

$$\text{Cash Paid} = 17,58,62,811$$

$$\text{Max Cash per share} = \frac{17,58,62,811}{15,00,000} = ₹ 117.24$$

C. Important Miscellaneous on M&A



QUESTION 35:

M 11 | RTP N 10

sm.

only on calci

Simple Ltd. and Dimple Ltd. are planning to merge. The total value of the companies are 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	Simple Ltd. ₹ lacs	Dimple Ltd. ₹ Lacs
High Growth	0.20	820	1050
Medium Growth	0.60	550	825
Slow Growth	0.20	410	590

The current debt of Dimple Ltd. is ₹ 65 lacs and Simple Ltd. is ₹ 460 lacs.

Calculate the expected value of debt and equity separately for the merged entity.

Also explain the reasons for any difference that exists from the expected values of debt and equity, if they do not change.

Solution:

Calculation of expected value of Debt & Equity of simple Ltd.

	Total	Debt	Equity
High Growth	820	460	360
Medium Growth	550	460	90
Slow Growth	410	410*	0*

Since the Company has limited liability the value of equity cannot be negative therefore the value of equity under slow growth will be taken as zero because of insolvency risk and the value of debt is taken at 410 lacs

Calculation of expected value of Debt & Equity of Dimple Ltd.

	Total	Debt	Equity
High Growth	1050	65	985
Medium Growth	825	65	760
Slow Growth	590	65	525

Expected Debt of the merged company:

merged

	Simple	Dimple	Total	Probability	Expected Debt
High Growth	460	65	525	0.2	105
Medium Growth	460	65	525	0.6	315
Slow Growth	410	65	475	0.2	95
					515

Expected Equity of the merged company:

1) → Segregate the D & E of individual co.

2) Then find merged Co's D & E.

3) then do exp. caln by x with prob.

merged

	Simple	Dimple	Total	Probability	Expected Equity
High Growth	360	985	1,345	0.2	269
Medium Growth	90	760	850	0.6	510
Slow Growth	0	525	525	0.2	105
					884

* Self-note: When the total value of company is less than debt, the amount payable to debt is limited to the total value and claim of equity becomes zero.

D. Demerger



QUESTION 36:

N 05 | RTP

The following information is relating to Fortune India Ltd. having two divisions, 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 Ltd. ₹	Fortune India Ltd. ₹
Outside Liabilities		
Secured Loans	400 Lakhs	3,000 lakhs
Unsecured Loans	2,400 lakhs	800 Lakhs
Current Liabilities & Provisions	1,300 lakhs	21,200 lakhs
Assets		
Fixed Assets	7,740 lakhs	20,400 lakhs
Investments	7,600 lakhs	12,300 lakhs
Current Assets	8,800 lakhs	30,200 lakhs
Loans & Advances	900 Lakhs	7,300 lakhs
Deferred tax/Misc. Expenses	60 Lakhs	(200) Lakhs

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 the purpose following points are to be considered:

1. Transfer of Liabilities & Assets at Book value.
2. Estimated Profit for the year 2009-10 is ₹ 11,400 Lakh for Fortune India Ltd. & ₹ 1,470 lakhs for Fortune Pharma Ltd.
3. Estimated Market Price of Fortune Pharma Ltd. is ₹ 24.50 per share.
4. Average P/E Ratio of FMCG sector is 42 & Pharma sector is 25, which is to be expected for both the companies.

Calculate:

1. The Ratio in which shares of Fortune Pharma are to be issued to the shareholders of Fortune India Ltd.
2. Expected Market price of Fortune India (FMCG) Ltd.
3. Book Value per share of both the Companies immediately after Demerger.

Solution:

1. Ratio in which shares of Fortune Pharma are to be issued

MPS		24.5
÷ PE		25
EPS	[A]	0.98
Profit	[B]	1,470
No. of shares to be issued of Fortune Pharma	[B ÷ A]	1500
÷ Existing shares of Fortune India		3000
Exchange Ratio		0.5:1

2.
$$EPS = \frac{EAS}{n}$$

$$= \frac{11,400}{3,000} = 3.8$$

$$\begin{aligned} \text{MPS} &= \text{EPS} \times \text{PE Ratio} \\ &= 3.8 \times 42 \\ &= 159.6 \end{aligned}$$

3. BV per share immediately after demerger

Particulars	(Before Demerger)	(b)	(a-b) (₹ Lakhs)
	Fortune India	Fortune Pharma	Fortune India (FMCG)
Assets	70,000	25,100	44,900
Outside liabilities	25,000	4,100	20,900
Shareholder's fund	45,000	21,000	24,000
÷ No. of shares		1500	3000
BVPS		14	8

Eq.

Ambiguity:

Ideally, miscellaneous expense should not be deducted from total assets while calculating ESHF FOR BVPS calculation,
it is actually deducted, while calculating ESHF using equity approach

E. Management Buyout & Leveraged Buyout



QUESTION 37:

RTP

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.

VenCap, a European venture capitalist firm has shown its interest to finance the proposed buy-out. Distress Ltd. is interested to sell the division for ₹ 180 crore and Mr. Smith is of opinion that an additional amount of ₹ 85 crores shall be required to make this division viable. The expected financing pattern shall be as follows:

Source	Mode	Amount (₹ Crore)
Management VenCap VC	Equity Shares of ₹ 10 each	60.00
	Equity Shares of ₹ 10 each	22.50
	9% Debentures with attached warrant of ₹ 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 @ ₹ 120 per share.

The loan is repayable in one go at the end of 8th year. The debentures are repayable in equal annual instalment 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 (₹ 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.

Solution:

$$\begin{aligned}
 \text{Amount of Equal Annual Instalment} &= \frac{\text{Amount of Debentures}}{\text{PVAF (9\% \& 6 years)}} \\
 &= \frac{22.50}{4.486} = ₹ 5.016 \text{ crores}
 \end{aligned}$$

Calculation of Interest:

Year	Opening	Interest @ 9%	Instalment	Closing
1	22.5	2.025	5.016	19.509

2	19.509	1.7558	5.016	16.249
3	16.249	1.4624	5.016	12.695
4	12.695	1.1436	5.016	8.8216

Income Statement:

Year	1	2	3	4
EBIT	48	57	68	82
Less: Interest on Debenture	2.025	1.756	1.462	1.143
Less: Interest on loan	12.8	12.8	12.8	12.8
PBT	33.175	42.444	53.738	68.057
Less: Tax @ 35%	11.611	14.855	18.808	23.82
EAT	21.564	27.589	34.93	44.237
Less: Dividend @ 12.5%	2.696	3.449	4.366	5.53
Retained profits	18.868	24.14	30.564	38.707
Total Retained Earning	112.279			

BV at year 0 = 60 + 22.5 = 82.500
 Addition in 4 years + 112.279
 BV at Year 4 = 194.779

Calculating growth rate in BV:

$$194.79 = 82.50 \times (1 + g)^4$$

$$G = 23.96\%$$

This growth rate is slightly higher than 20% as projected by Mr. Smith.

If the condition of VenCap for 18 shares is accepted the expected shareholding after 4 years shall be as follows:

No. of shares held by Management	$\left[\frac{60 \text{ Cr.}}{10}\right]$	6.00 crore
No. of shares held by VenCap at the starting stage	$\left[\frac{22.5 \text{ Cr.}}{10}\right]$	2.25 crore
No. of shares held by VenCap after 4 years	$\left[\frac{22.50}{100} \times 18\right]$	4.05 crore
Total holding of VenCap		6.30 crore

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.



QUESTION 38:

RTP M 15

TMC is a venture capital financier. It received a proposal for financing requiring an investment of ₹45 crore which returns ₹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.

Mergers, Acquisition & Corporate Restructuring

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.

Solution:

Probability of project success

$$= (1 - 0.28) \times (1 - 0.25) \times (1 - 0.22) \times (1 - 0.18) \times (1 - 0.18) \times (1 - 0.10) \\ = 0.255$$

Probability of project will fail = $1 - 0.255 = 0.745$

$$\text{Cost of equity using CAPM, } K_e = R_f + \beta (R_m - R_f) \\ = 6\% + 7 \times (8\% - 6\%) = 20\%$$

Net present value of the project:

Expected Cash Inflow: $(600 \text{ Cr.} \times 0.255 + 0 \times 0.745)$	153 Cr.
$\times \text{PVF (20\%, 6 years)}$	0.335
PV of Expected Inflows	51.255 Cr.
Less: PV of Initial Outflow	45 Cr.
NPV	6.255 Cr.

Since expected NPV of the project is positive it should be accepted.

F. Financial Restructuring | Reconstruction



QUESTION 39:

SM | M 17 | N 11 | RTP

The following is the Balance-sheet of XYZ Company Ltd as on March 31st, 2013. (₹ Lakhs)

Liabilities	Amount	Assets	Amount
6 lakh equity shares of ₹100/- each	600	Land & Building	200
2 lakh 14% Preference shares of ₹100/-	200	Plant & Machinery	300
13% Debentures	200	Furniture & Fixtures	50
Debenture Interest accrued and Payable	26	Inventory	150
Loan from Bank	74	Sundry debtors	70
Trade Creditors	300	Cash at Bank	130
		Preliminary Expenses	10
		Cost of Issue of debentures	5
		Profit & Loss A/c	485
	1400		1400

The XYZ Company did not perform well and has suffered sizable losses during the last few years. However, it is now felt that the company can be nursed back to health by proper financial restructuring and consequently the following scheme of reconstruction has been devised:

- Equity shares are to be reduced to ₹ 25/- per share, fully paid up;
- Preference shares are to be reduced (with coupon rate of 10%) to equal number of shares of ₹50 each, fully paid up.
- Debenture holders have agreed to forego interest accrued to them. Beside this, they have agreed to accept new debentures carrying a coupon rate of 9%.
- Trade creditors have agreed to forgo 25% of their existing claim; for the balance sum they have agreed to convert their claims into equity shares of ₹ 25/- each.
- In order to make payment for bank loan and augment the working capital, the company issues 6 lakh equity shares at ₹ 25/- each; the entire sum is required to be paid on application. The existing shareholders have agreed to subscribe to the new issue.
- While Land and Building is to be revalued at ₹ 250 lakh, Plant & Machinery is to be written down to ₹ 104 lakh. A provision amounting to ₹ 5 lakh is to be made for bad and doubtful debts.

You are required to show the impact of financial restructuring/re-construction. Also, prepare the new balance sheet assuming the scheme of re-construction is implemented in letter and spirit.

Solution:

Impact of Financial Reconstruction

- i) Benefits to XYZ Ltd.

	In ₹ Lakhs
Equity shares claimed reduced [6 lakhs × (100 - 25)]	450
Pref shares claim reduced [2 lakhs × (100 - 50)]	100
Debentures holder agree to forego	26
Trade creditors (300 × 25%)	75
Land and Building (250 - 200)	50
	701

ii) Utilization of benefits:

	In ₹ Lakhs
Plant and machinery	196
Provision for Bad & Doubtful	5
Preliminary expenses	10
Cost of issue of Debentures	5
Writing off P/L Account	485
	701

Balance sheet after reconstruction

Liabilities	Amount	Asset	Amount
21,00,000 Equity Shares of ₹ 25	525	Land & Building	250
2 lakhs 10% Preference shares of ₹ 50/-	100	Plant & Mach	104
9% Debentures	200	Furniture & Fix	50
		Inventory	150
		Sundry debtors (70 – 5)	65
		Cash at Bank (B/F)	206
	825		825

Calculation of Equity Shares:

Existing equity shares		6,00,000
Issued to creditors	$\left[\frac{300 \text{ Lakhs} \times (1 - 0.25)}{25} \right]$	9,00,000
New equity shares		6,00,000
Total Equity Shares		21,00,000

Fixed Income Securities



A. Capital Market Fixed Income Securities



QUESTION 1:

A 6 years bond of ₹1000 has an annual rate of interest of 14%. If the required rate of return is 16%, what is the value of bond? Assume the interest is paid

- a) Annually
- b) Half yearly.

Solution:

- a) Coupon = $1,000 \times 14\% = 140$
 IV = $140 \times \text{PVAF}_{(16\%, 6 \text{ years})} + 1,000 \times \text{PVF}_{(16\%, 6 \text{ years})}$
 = 924.52
- b) Coupon = $1,000 \times 14\% \times 6/12 = 70$
 IV = $70 \times \text{PVAF}_{(8\%, 12 \text{ periods})} + 1,000 \times \text{PVF}_{(8\%, 12 \text{ periods})}$
 = 924.64



QUESTION 2:

only on calci

A Company proposes to sell 10-year Debentures of ₹10,000 each. The Company would repay ₹1,000 at every year end and will pay interest annually at 15% on the outstanding amount. Find the PV of the Debentures, if the Capitalization Rate is 18%.

Solution:

Start of year. coupon.

Year	Principle	Interest @ 15%	Repayment	Total	PVAF @ 18%	CFs
1	10,000	1500	1,000	2,500	0.847	2117.50
2	9,000	1350	1,000	2,350	0.718	1687.30
3	8,000	1200	1,000	2,200	0.609	1339.80
4	7,000	1050	1,000	2,050	0.516	1057.80
5	6,000	900	1,000	1,900	0.437	830.30
6	5,000	750	1,000	1,750	0.370	647.50
7	4,000	600	1,000	1,600	0.314	502.40
8	3,000	450	1,000	1,450	0.266	385.70
9	2,000	300	1,000	1,300	0.225	292.50
10	1,000	150	1,000	1,150	0.191	219.65
						9080.45



QUESTION 3:

RTP N 09

only & calci (But do analyse)

Given a five-year, 8% coupon bond with a face value of Rs.1,000 and coupon payments made annually, determine its values given it is trading at the following yields: 8%, 6%, and 10%. Comment on the price and yield relation you observe. What are the percentage changes in value when the yield goes from 8% to 6% and when it goes from 8% to 10%?

Solution:

When YTM = 8%,

$$\begin{aligned}\text{Price} &= 80 \times \text{PVA}_{(8\%, 5y)} + 1,000 \times \text{PV}_{(8\%, 5y)} \\ &= 80 \times 3.993 + 1,000 \times 0.681 \\ &= 1,000.44\end{aligned}$$

When YTM = 6%

$$\begin{aligned}\text{Price} &= 80 \times \text{PVA}_{(6\%, 5y)} + 1,000 \times \text{PV}_{(6\%, 5y)} \\ &= 1,083.96\end{aligned}$$

When YTM = 10%

$$\begin{aligned}\text{Price} &= 80 \times \text{PVA}_{(10\%, 5y)} + 1,000 \times \text{PV}_{(10\%, 5y)} \\ &= 924.28\end{aligned}$$

Comment: As the yield increases the price decrease and as the yield decrease the price increases, inverse relationship between yield and price

Percentage change in value:

$$\text{Yield from 8\% to 6\%} = \frac{1083.96 - 1000}{1000} = 8.35\%$$

$$\text{Yield from 8\% to 10\%} = \frac{924.2 - 1000}{1000} = -7.62\%$$



QUESTION 4:

M 16 | RTP

M/s Agfa industries is planning to issue a debenture series on the following terms:

Face Value	₹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 per cent per annum. The company proposes to price the issue in such a manner that it can yield 16 per cent compounded rate of return to the investors. The Company also proposes to redeem the debentures at 5 per cent premium on maturity. Determine the issue price of the debentures.

Solution:

Calculation of Issue Price

Year	Coupon	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	0.41	4.1
7	10	0.354	3.54
8	10	0.305	3.05
9	14	0.263	3.68
10	14	0.227	3.18
10	105	0.227	23.84
Issue price of bond			71.34

**QUESTION 5:**

RTP | PM

John inherited the following securities on his uncle's death:

Types of Security	Nos.	Annual coupon %	Maturity Years	Yield %
Bond A (₹1,000)	10	9	3	12
Bond B (₹1,000)	10	10	5	12
Preference shares C (₹100)	100	11	*	13*
Preference shares D (₹100)	100	12	*	13*

*Likelihood of being called at a premium over par.

Compute the current value of his uncle's portfolio.

Solution:

Value of Bond A: $= 90 \times \text{PVAF}_{(12\%, 3 \text{ years})} + 1,000 \times \text{PVAF}_{(12\%, 3 \text{rd year})}$
 $= 216.16 + 711.78$
 $= 927.94$

Value of Bond B: $= 100 \times \text{PVAF}_{(@12\%, 5 \text{ years})} + 1,000 \times \text{PVAF}_{(@12\%, 5 \text{ years})}$
 $= 360.48 + 567.43$
 $= 927.91$

Preference Share C $= \frac{11}{0.13} = 84.62$

Preference Share D $= \frac{12}{0.13} = 92.31$

Value of Portfolio:

Security	Value	No.	Total
Bond A	927.94	10	9,279.4
B	927.91	10	9,279.1
Preference Share C	84.62	100	8,462.0
D	92.31	100	9,231.0
			36,251.5

→ no relevance.
 ∴ we are not using RV for valⁿ.



QUESTION 6:

N 09

An investor is considering the purchase of the following Bond:

Face value	₹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 ₹97.60, what would be his yield?

Solution:

$$\begin{aligned}
 \text{(a) IV} &= 11 \times \text{PVAF}_{(13\%, 3 \text{ years})} + 100 \times \text{PVAF}_{(13\%, 3 \text{ Year})} \\
 &= 25.97 + 69.31 \\
 &= 95.28
 \end{aligned}$$

$$\begin{aligned}
 \text{(b) Yield} &= \frac{\text{Coupon} + \frac{\text{RV} - \text{IP}}{n}}{\frac{\text{RV} + \text{IP}}{2}} \\
 &= \frac{11 + \frac{100 - 97.6}{3}}{\frac{100 + 97.6}{2}} \\
 &= 11.94\%
 \end{aligned}$$



QUESTION 7:

N 22 | N 19

Mr. X wants to invest 1,00,000 in the 7 years 8% bonds in the market (Face Value 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.

Solution:

- 1) a) Required yield rate = 9%

Year	CF	DF @ 9%	PV
1 – 5	8	3.889	31.11
5	100	0.650	65.00
Value of Bond			96.11

- b) Required yield rate = 7%

Year	CF	DF @ 7%	PV
1 – 5	8	4.100	32.80

5	100	0.713	71.30
Value of Bond			104.1

c) Required yield rate = 8.25%

Year	CF	DF @ 8.25%	PV
1 – 5	8	3.966	31.73
5	100	0.673	67.30
Value of Bond			99.03

d) Required yield rate = 7.75%

Year	CF	DF @ 7.75%	PV
1 – 5	8	4.019	32.15
5	100	0.689	68.90
Value of Bond			101.05

2) Logical Solution:

Purchase price bond = 100 + 1%
= ₹ 101

Effective yield when purchase price is 101 = 7.75%

Solution by ICAI:

Effective yield if transaction cost is 1% = $\frac{8}{101} = 0.0792$ or 7.92%

Yield: $8 + \frac{100 - 101}{5}$
 $\frac{101 + 100}{2}$
 = 7.76%

3) Time taken to recover 2% transaction cost

$= \frac{2\%}{8\%} \times 365$
 = 91.25 or 91 days.



QUESTION 8:

N 10

Calculation Market Price of:

- 10% Government of India security currently quoted at ₹110, but yield is expected to go up by 1%.
- A bond with 7.5% coupon interest, Face value ₹10,000 & term to maturity of 2 years, presently yielding 6%. Interest payable half yearly.
- Self-added for class students: A bond with 7.5% coupon interest, Face value ₹10,000 & term to maturity of 2 years, presently trading at ₹ 9,000. If interest payable half yearly, calculate the YTM of the bond using:

2. Precise Method
1. Approximate Method

Solution:

- a) *Self-Note: In the absence of information regarding maturity of bonds, it can be assumed as irredeemable. FV assumed as ₹ 100.*

Coupon = $100 \times 10\% = ₹ 10$

Calculation of existing yield = $\frac{10}{110} = 9.09\%$

$$\text{Revised yield} = 9.09\% + 1\% = 10.09\%$$

$$\text{Revised MP} = \frac{10}{10.09\%} = ₹ 99.11$$

$$\begin{aligned} \text{b) Value of bond} &= 375 \times \text{PVAF}_{(3\%, 4 \text{ periods})} + 10,000 \times \text{PVF}_{(3\%, 4 \text{th period})} \\ &= 10, \cancel{278.78} \end{aligned}$$

$$\text{c) } 273.88.$$



QUESTION 9:

04 | RTP M 09

only on
calc

There is a 9% 5-year bond issue in the market. The issue price is ₹90 and the redemption price ₹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?

Solution:

$$\text{After Tax Coupon} = 9 \times (1 - 0.30) = 6.3$$

$$\text{After Tax redemption Value} = 105 - (15 \times 0.10) = \text{Rs.} 103.50$$

$$\text{After Tax Capital gain} = \cancel{103.5 - 90 = \text{Rs.} 13.5} \quad (105 - 90) \times (1 - 10\%) = 13.5$$

$$\text{Post tax YTM} = \frac{\text{Coupon} + \frac{\text{RV} - \text{IP}}{n}}{\frac{\text{RV} + \text{IP}}{2}}$$

$$\begin{aligned}
 & 6.3 + \frac{103.5 - 90}{5} \\
 = & \frac{103.5 + 90}{2} \\
 = & 9.30\%
 \end{aligned}$$

point to remember



QUESTION 10:

RTP N 09

only on calc

Given a two-year, 8% annual coupon bond with a face value of Rs. 1,000 and with annual coupon payments that is fully taxable and selling at par, and an identical bond that is tax free, what would the yield and price on the tax-free bond have to be for an investor in a 35% tax bracket to be indifferent between the two bonds?

Solution:

For the investor to be indifferent, the tax-free bond's yield would have to be equal to the taxable bond's after-tax yield.

$$\text{YTM} = \frac{0.08(1 - 0.35) + \frac{1,000 - 1,000}{2}}{\frac{1,000 + 1,000}{2}}$$
$$= 5.2\%$$

Thus, the tax-free bond would have to yield 5.2% for the investor to be indifferent. Given a 5.2% discount rate, the price of the tax-free bond would be:

the tax-free bond would be:

$$P_0 = \frac{80}{1.052} + \frac{100 + 80}{1.052^2} = 80 \times PVAF_{(2y, 5.2\%)} + 1000 \times PVF_{(2y, 5.2\%)}$$

$$= 80 \times 1.854 + 1000 \times 0.904$$

$$= 1052.32$$

QUESTION 11:



QUESTION 11:

M 15

On 31st March 2013, the following information about Bonds is available:

Name of Security	Face Value ₹	Maturity Date	Coupon Rate	Coupon Date (s)
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 Mar & 30 th Sept

Calculate:

- a. If 10 years yield is 7.5% p.a. what price the Zero Coupon Bond would fetch on 31st March, 2013?
- ✗ b. What will be the annualized yield if the T-Bill is traded @ 98500?
- c. 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)?
- d. 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)?

Solution

- (i) Rate used for discounting shall be yield.

$$\text{Accordingly, ZCB shall fetch: } \frac{10,000}{(1 + 0.075)^{10}} = ₹4,852$$

- (ii) The day count basis is actual number days/365. Accordingly annualized yield shall be:

$$\begin{aligned} &= \frac{\text{FV} - \text{Price}}{\text{Price}} \times \frac{365}{\text{No. of days}} \times 100 \\ &= \frac{1,00,000 - 98,500}{98,500} \times \frac{365}{81} \times 100 \\ &= 6.86\% \end{aligned}$$

Note: Alternatively, it can also computed on 360 days a year.

- (iii) Price GOI 2023 would fetch
 $= 10.71 \times \text{PVAF}_{(8\%, 10)} + 100 \times \text{PVF}_{(8\%, 10)}$
 $= 10.71 \times 6.71 + 100 \times 0.4632$
 $= ₹ 118.18$

- (iv) Price GOI 2018 Bond would fetch:
 $= 5 \times \text{PVAF}_{(4\%, 10)} + 100 \times \text{PVF}_{(4\%, 10)}$
 $= 5 \times 8.11 + 100 \times 0.6756$
 $= 108.11$



QUESTION 12:

RTP N 20

Today being 1st January 2019, Ram is considering to purchase an outstanding Corporate Bond having a face value of ₹ 1,000 that was issued on 1st January 2017 which has 9.5% Annual Coupon and 11 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 ₹ 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:

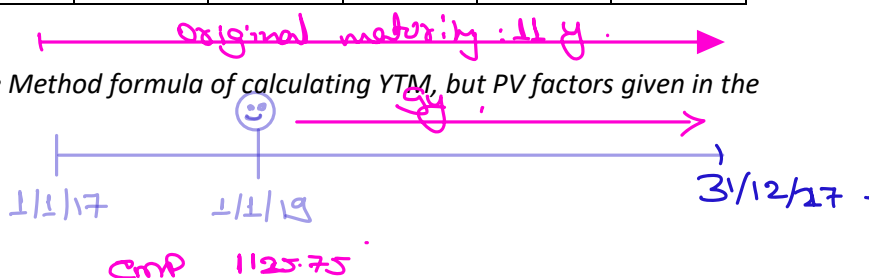
	1	2	3	4	5	6	7	8	9
6%	0.943	0.890	0.840	0.792	0.747	0.705	0.665	0.627	0.592
8%	0.926	0.857	0.794	0.735	0.681	0.630	0.583	0.540	0.500

Solution:

Self-Note: We could have applied the Approximate Method formula of calculating YTM, but PV factors given in the question is a hint for IRR method.

Given details:

$$\begin{aligned} \text{FV} &= ₹ 1000 \\ \text{Coupon} &= 0.095 \times 1000 = ₹ 95 \\ n &= 9 \text{ years} \\ P_0 &= 1,000 + 125.75 = ₹ 1125.75 \end{aligned}$$



To determine the prevailing rate of interest for the similar type of Bonds we shall compute the YTM of this Bond using IRR method as follows:

$$₹ 95 \times \text{PVIFA}_{(\text{YTM}\%, 9)} + ₹ 1000 \times \text{PVIF}_{(\text{YTM}\%, 9)} = ₹ 1125.75$$

Calculation of PV of CFs at 6% :

$$\begin{aligned}
 &= 95 \times \text{PVAF}_{(6\%, 9 \text{ years})} + 1000 \times \text{PVF}_{(6\%, 9\text{th year})} \\
 &= 95 \times 6.801 + 1,000 \times 0.592 \\
 &= 1,238.12
 \end{aligned}$$

Calculation of PV of CFs at 8%:

$$\begin{aligned}
 &= 95 \times \text{PVAF}_{(8\%, 9 \text{ years})} + 1000 \times \text{PVF}_{(8\%, 9\text{th year})} \\
 &= 95 \times 6.246 + 1,000 \times 0.500 \\
 &= 1,093.39
 \end{aligned}$$

Calculating precise yield using interpolation:

6%	—————	1,238.12
? = x		1,125.75
8%	—————	1,093.39

Calculating x:

$$\begin{aligned}
 \frac{x - 6}{8 - 6} &= \frac{1125.75 - 1238.12}{1093.39 - 1238.12} \\
 x &= 7.55\%
 \end{aligned}$$

Prevailing interest on the similar type of Bonds = 7.55%

The actual meaning of duration is not maturity. However, in the absence of maturity, we can consider given duration as maturity of 10 years.



QUESTION 13:

RTP N 19

A hypothetical company ABC Ltd. issued at 10% Debenture (Face Value of Rs. 1000) 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.

If yield on equivalent comparable bond is 11.80%, then calculate the spread of yield of the above bond from his comparable bond.

The relevant present value table is as follows:

Present Values	t ₁	t ₂	t ₃	t ₄	t ₅	t ₆	t ₇	t ₈	t ₉	t ₁₀
PVIF _{0.11, t}	0.901	0.812	0.731	0.659	0.593	0.535	0.482	0.434	0.391	0.352
PVIF _{0.13, t}	0.885	0.783	0.693	0.613	0.543	0.480	0.425	0.376	0.333	0.295

Solution:

we shall compute the YTM of this Bond using IRR method, using below equation:

$$= 100 \times \text{PVIFA}_{(\text{YTM}\%, 10)} + ₹ 1000 \times \text{PVIF}_{(\text{YTM}\%, 10)} = 850$$

Calculation of PV of CFs at 11% :

$$\begin{aligned}
 &= 100 \times \text{PVAF}_{(11\%, 10 \text{ years})} + 850 \times \text{PVF}_{(11\%, 10\text{th year})} \\
 &= 100 \times 5.890 + 1,000 \times 0.352 \\
 &= 941
 \end{aligned}$$

Calculation of PV of CFs at 13%:

$$\begin{aligned}
 &= 100 \times \text{PVAF}_{(13\%, 10 \text{ years})} + 850 \times \text{PVF}_{(13\%, 10\text{th year})} \\
 &= 100 \times 5.426 + 1,000 \times 0.295 \\
 &= 837.6
 \end{aligned}$$

Calculating precise yield using interpolation:

11%	_____	941
? = x	_____	850
13%	_____	837.6

Calculating x:

$$\frac{x - 11}{13 - 11} = \frac{850 - 941}{837.6 - 941}$$

$$x = 12.76\%$$

The spread from comparable bond = 12.76% - 11.80% = 0.96%



QUESTION 14:

M 09

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 ₹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?

Solution:

For a 5-year bond:

Since, CMP = FV

Therefore, YTM = Coupon Rate = 8%

Year	CFs	PVAFs @ 8%	DCFs	PVAFs @ 6%	DCFs	Change
1 – 5	80	3.993	319.44	4.212	336.96	17.52
5	1000	0.681	681	0.747	747	66
			1000		1083.96	83.52

If the yield of the bond falls the price will always increase. In case of 5-year bond, value increased from Rs. 1000 to Rs. 1083.96.

$$\text{\% of total change due to change in PV of Interest:} = \frac{17.52}{83.52} = 20.98\%$$

$$\text{\% of total change due to change in PV of Principal:} = \frac{66}{83.52} = 79.02\%$$

For a 20-year bond:

Year	CFs	PVAFs @ 8%	DCFs	PVAFs @ 6%	DCFs	Change
1 – 20	80	9.818	785.44	11.470	917.6	132.16
20	1000	0.215	215	0.312	312	97
			1000		1229.6	229.16

In case of 20 year bond also, value increased from Rs. 1000 to Rs. 1229.6.

$$\% \text{ of total change due to change in PV of Interest: } = \frac{132.16}{229.16} = 57.67\%$$

$$\% \text{ of total change due to change in PV of Principal: } = \frac{97}{229.16} = 42.33\%$$

**QUESTION 15:**

RTP M 11

S Ltd 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 ₹10,000 with yield to maturity of 8%. Assuming that:

- After 2 years from the date of issue, interest on comparable bonds is 10%, then what should be the price of each Bond?
- If after two additional years, the interest rate on comparable bond is 7%, then what should be the price of each Bond?
- What conclusions you can draw from the prices of Bonds, computed above?

Solution:(i) Series X

$$\begin{aligned} \text{Price} &= 800 \times \text{PVAF}_{(10\%, 8 \text{ years})} + 10,000 \times \text{PVAF}_{(10\%, 8 \text{ years})} \\ &= \text{Rs. } 800 \times 5.335 + \text{Rs. } 10,000 \times 0.467 \\ &= 8,938 \end{aligned}$$

Series Y

$$\begin{aligned} \text{Price} &= 1,000 \times \text{PVAF}_{(8 \text{ years } 10\%)} + 10,000 \times \text{PVAF}_{(8 \text{th year, } 10\%)} \\ &= \text{Rs. } 1,000 \times 5.335 + \text{Rs. } 10,000 \times 0.467 \\ &= 10,005 \end{aligned}$$

(ii) Series X

$$\begin{aligned} \text{Price} &= 800 \times \text{PVAF}_{(7\%, 6 \text{ years})} + 10,000 \times \text{PVAF}_{(7\%, 6 \text{ years})} \\ &= \text{Rs. } 800 \times 4.767 + \text{Rs. } 10,000 \times 0.666 \\ &= 10,474 \end{aligned}$$

Series Y

$$\begin{aligned} \text{Price} &= 700 \times \text{PVAF}_{(7\%, 6 \text{ years})} + 10,000 \times \text{PVAF}_{(7\%, 6 \text{ years})} \\ &= \text{Rs. } 700 \times 4.767 + \text{Rs. } 10,000 \times 0.666 \\ &= 9,997 \end{aligned}$$

- (iii) 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. (Vered.)

**QUESTION 16:**

N 11 | N 08 | RTP

Based on the credit rating of bonds, Mr. Z 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 to invest in AA rated, ₹1,000 face value bond currently selling at ₹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. (Assume the 364 day T-bill rate to be 9%).

You are required to calculate the intrinsic value of the bond for Mr. Z should be invest in the bond? Also calculate the current yield and the Yield to Maturity (YTM) of the bond.

Solution:

Discount Rate: AAA $9 + 3 = 12\%$

AA $12 + 2 = 14\%$

$$\begin{aligned}\text{Intrinsic Value} &= 150 \times \text{PVAF}_{(14\%, 5 \text{ years})} + 1,000 \times \text{PV}_{(14\%, 5 \text{ years})} \\ &= 514.96 + 519.37 \\ &= 1,034.33\end{aligned}$$

$$\begin{aligned}\text{Current Yield} &= \frac{\text{Coupon}}{\text{CMP}} \\ &= \frac{150}{1,025.86} = 14.62\%\end{aligned}$$

$$\begin{aligned}\text{YTM} &= \frac{150 + \frac{1,000 - 1,025.86}{5}}{\frac{1,000 + 1,025.86}{2}} = \frac{144.828}{1,012.96} \\ &= 14.30\%\end{aligned}$$

**QUESTION 17:**

N 07

MP Ltd issue a new series of bonds on January 1, 2010. The bonds were sold at par (₹1,000), having a coupon rate 10% p.a. and mature on 31st December, 2025. Coupon payments are made semi-annually on June 30th and December 31st each year. Assume that you purchased an outstanding MP Ltd. bond on 1st March, 2018 when the going interest rate was 12%.

Required:

- What was the YTM of MP Ltd. bonds as on January 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 basic value.

Solution:

- YTM of the bond on Jan 1, 2010:

$$\text{Periodic YTM} = \frac{1 + \frac{RV - IP}{n}}{\frac{RV + IP}{2}}$$

$$= \frac{50 + \frac{1,000 - 1,000}{32}}{\frac{1,000 + 1,000}{2}} = 5\% \text{ per 6m}$$

$$\text{Annualized YTM} = 5 \times 2 = 10\% \text{ p.a.}$$

(ii) Value of bond on 30th June 2018 (excluding coupon) = $50 \times \text{PVAF}_{(6\%, 15 \text{ period})} + 1000 \times \text{PVF}_{(6\%, 15 \text{ period})}$
 $= 50 \times 9.712 + 1000 \times 0.417$
 $= 902.6$

Value of bond on 30th June 2018 (including coupon) = $902.6 + 50$
 $= ₹ 952.6$

Dirty Price of bond on 1st March 2018 = $\frac{952.6}{1 + 0.06 \times \frac{4}{6}}$
 $= ₹ 915.96$

Coupon Accrued for 2M = $1,000 \times 10\% \times \frac{2}{12}$
 $= ₹ 16.67$

Amount to be paid to complete the transaction is = ₹ 915.96.

Amount paid for accrued interest = ₹ 16.67

Amount paid for bond's basic value (clean price) = ₹ 899.29



QUESTION 18:

MTP M 18

XYZ Ltd.'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.

Solution:

We shall compute Realized Yield to Maturity (r) as follows:

	0	1	2	3	4
Investment (Rs.)	900				
Annual Interest (Rs.)		150	150	150	150
Compound Factor @ 16%		1.56	1.35	1.16	1.00
Future Value of Intermediate cash Flows (Rs.)		234.00	202.50	174.00	150.00
Maturity Value (Rs.)					1000.00
	900.00	234.00	202.50	174.00	1150.00
Total of Future Benefits					1760.5

Accordingly, realised yield:

$$900(1+r)^4 = 1760.50$$

$$(1+r)^4 = 1.956$$

$$r = 18.30\%$$



QUESTION 19:

M 21 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%

Remember this concept from this question only. It is not covered anywhere in the outnotes

- 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.
 - 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.

Solution:

- For finding expected market price first we shall calculate Intrinsic Value of Bond as follows:

$$\begin{aligned} IV &= 90 \times PVF_{(12\%,1)} + 90 \times PVF_{(11.62\%,2)} + 90 \times PVF_{(11.33\%,3)} + 90 \times PVF_{(11.06\%,4)} + 90 \times PVF_{(10.80\%,5)} \\ &\quad + 1,000 \times PVF_{(10.80\%,5)} \\ &= 80.36 + 72.23 + 65.22 + 59.16 + 53.89 + 598.80 \\ &= ₹ 929.67 \end{aligned}$$

$$\begin{aligned} \text{Expected Price} &= \text{Intrinsic Value} \times \text{Beta Value} \\ &= 929.66 \times 1.10 \\ &= ₹ 1,022.63 \end{aligned}$$

- 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.~~



QUESTION 20:

N 08 | RTP

The following is the Yield structure of AAA rated debenture:

Period	Yield (%)
3 months	8.50
6 months	9.25
1 year	10.50

spot rates

2 years	11.25
3 years and above	12.00

- a. Based on the expectation theory calculate the implicit one-year forward rates in year 2 and year 3.
- b. 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.

Solution:

- (a) One year forward rate in year 2 (i.e., $FR_{(1 \times 2)}$):

$$(1 + 0.125)^2 = (1 + 0.1050)^1 \times (1 + r)^1$$

$$(1.125)^2 = (1.1050)^1 \times (1 + r)$$

$$r = 12.01\%$$

- One year forward rate in year 3 (i.e., $FR_{(2 \times 3)}$):

$$(1 + 0.12)^3 = (1 + 0.1125)^2 \times (1 + r)^1$$

$$(1.12)^3 = (1.1125)^2 \times (1 + r)$$

$$r = 13.52\%$$

- (b) Self-note: In the absence of information, given bond is assumed as ZCB. Since, we know that yields given in the question are spot rates and therefore, they can be used as the YTM of assumed ZCB. *Also because coupon rate is missing.*
- Calculating RV of the bonds:

$$\text{Existing CMP} = \frac{RV}{(1 + \text{Existing YTM})^n}$$

$$1,000 = \frac{RV}{(1 + 12\%)^5}$$

$$RV = 1,762.34$$

This is an awkward Case where redemption value of zero coupon bond is not equal to face value (that is rounded of number).

Calculating revised price using revised YTM:

$$\text{Revised CPM} = \frac{RV}{(1 + \text{Revised YTM})^n}$$

$$= \frac{1,762.34}{(1 + 12.5\%)^5}$$

$$= 977.97$$

$$\% \text{ change in price} = \frac{977.97 - 1,000}{1,000} = -2.20\%$$

**QUESTION 21:**

N 18 | N 13

Sonic Ltd. issued 8% 5-year bonds of ₹ 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 next year. This bond has a beta value of 1.02 and is more popular in the market due to less credit risk.

Calculate:

- Intrinsic Value of bond.
- Expected price of bond in the market.

Solution:

$$\begin{aligned}
 \text{(a) Intrinsic value of Bond} &= \frac{80}{(1.12)} + \frac{80}{(1.12)(1.1125)} + \frac{1080}{(1.12)(1.1125)(1.1075)} \\
 &= 918.27 \\
 \text{(b) Expected Price} &= 918.27 \times 1.02 \\
 &= 936.65
 \end{aligned}$$



QUESTION 22:

N 20

Following are the yields on Zero Coupon Bonds (ZCB) having a face value of ₹ 1,000:

Maturity (Years)	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

- Calculate the implied one year forward rates *→ tenure of rate.*
- Expected Yield to Maturity and prices of one year and two-year Zero-Coupon Bonds at the end of the first year.

Solution:

$$\begin{aligned}
 \text{(a) Calculation of 1 year forward rate after 1 year i.e., } FR_{(1 \times 2)} \\
 (1 + 0.11)^2 &= (1 + 0.10) \times (1 + r) \\
 r &= 12.01\%
 \end{aligned}$$

$$\begin{aligned}
 \text{Calculation of 1 year forward rate after 2 years i.e., } FR_{(2 \times 3)} \\
 (1 + 0.12)^3 &= (1 + 0.11)^2 \times (1 + r) \\
 r &= 14.03\%
 \end{aligned}$$

(b) Calculation of YTM of:

$$\begin{aligned}
 \text{1-year ZCB after 1 years} &= FR_{(1 \times 2)} \\
 &= 12.01\%
 \end{aligned}$$

$$\begin{aligned}
 \text{2-year ZCB after 1 years} &= FR_{(1 \times 3)} \\
 (1 + 0.12)^3 &= (1 + 0.11)^2 \times (1 + FR_{(1 \times 3)})^2 \\
 FR_{(1 \times 3)} &= 13.01\%
 \end{aligned}$$

Calculation of Price

$$\text{1-year ZCB} = \frac{1,000}{1 + 12.01\%} = 892.78$$

$$\text{2-year ZCB} = \frac{1,000}{(1.1301)^2} = 783.01$$

**QUESTION 23:**

M 10 | N 07 | RTP

From the following data for Government securities, calculate the forward rates:

Face value (₹)	Interest Rate	Maturity (Year)	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

Solution:

Calculation of forward Rates

$$\begin{aligned} \text{Spot Rate}_{(0 \times 1)}: \quad 91,000 &= \frac{1,00,000}{(1+r_1)^1} \\ 91,000 + 91,000 r_1 &= 1,00,000 \\ r_1 &= 9.89\% \end{aligned}$$

$$\begin{aligned} \text{Forward Rate}_{(1 \times 2)}: \quad 99,000 &= \frac{10,500}{(1.0989)} + \frac{1,10,500}{(1.0989)(1+r_2)} \\ 99,000 &= 9555.0 + \frac{1,10,500}{(1.0989)(1+r_2)} \\ r_2 &= 12.42\% \end{aligned}$$

$$\begin{aligned} \text{Forward Rate}_{(2 \times 3)}: \quad 99,500 &= \frac{11,000}{1.0989} + \frac{11,000}{(1.0989)(1.1242)} + \frac{1,11,000}{(1.0989)(1.1242)(1+r_3)} \\ 99,500 &= 10,010 + 8,904.12 + \frac{1,11,000}{(1.0989)(1.1242)(1+r_3)} \\ 11.50\% &= r_3 \end{aligned}$$

$$\begin{aligned} \text{Forward Rate}_{(3 \times 4)}: \quad 99,900 &= \frac{11,500}{1.0989} + \frac{11,500}{(1.0989)(1.1242)} + \frac{11,500}{(1.0989)(1.1242)(1.1150)} \\ &\quad + \frac{1,11,500}{(1.0989)(1.1242)(1.1150)(1+r_4)} \\ 99,900 &= 10,465.01 + 9,308.85 + 8,348.75 + \frac{1,11,500}{1.3775(1+r_4)} \\ r_4 &= 12.77\% \end{aligned}$$



QUESTION 24:

RTP | PM

only on calc

Pet feed plc has outstanding, a high yield bond with the following features:

Face Value €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%

- (i) If an investor expects that interest will be 8%, six years from now then how much he should pay for this bond now.
- (ii) 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 if the company extends the life of Bond for another 6 years.

Solution:

- (i) Six years from now, if the interest rate is expected to be 8%, then the company will not extend the bond. Hence total maturity of the bond is expected to be 6 years.

$$\begin{aligned}
 \text{Value of Bond (6 years)} &= 1,000 \times \overset{1-6y}{PVA_{(8\%, 6 \text{ years})}} + 10,000 \times PFA_{(8\%, 6 \text{ years})} \\
 &= 1,000 \times 4.623 + 10,000 \times 0.630 \\
 &= \text{£}10,923
 \end{aligned}$$

- (ii) At the end of 6th year, if the interest actually turns out to be 12%, then the company will extend the bond for further period of six years. Hence, total maturity becomes 12 years. Value of the bond at the end of 6th year:

$$\begin{aligned}
 \text{Value of Bond (6 years)} &= 1,000 \times \overset{7 \text{ to } 12y}{PVA_{(12\%, 6 \text{ years})}} + 10,000 \times PFA_{(12\%, 6 \text{ years})} \\
 &= 1,000 \times 4.111 + 10,000 \times 0.507 \\
 &= \text{£} 9,181
 \end{aligned}$$

$$\text{Potential loss} = 9,181 - 10,923 = \text{£}1,742$$



QUESTION 25:

N 21 | N 18 | RTP

Tangent Ltd. is considering calling ₹ 3 crores of 30 years, ₹ 1,000 bond issued 5 years ago with a coupon interest rate of 14 per cent. The bonds have a call price of ₹ 1,150 and had initially collected proceeds of ₹ 2.91 crores since a discount of ₹ 30 per bond was offered. The initial floating cost was ₹ 3,90,000. The Company intends to sell ₹ 3 crores of 12 per cent 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 ₹ 1,000. The estimated floatation cost is ₹ 4,25,000. The company is paying 40% tax and its after tax cost of

debt is 8 per cent. As the new bonds must first be sold and then their proceeds to be used to retire the old bonds, the company expects a two months period of overlapping interest during which interest must be paid on both the old and the new bonds. You are required to evaluate the bond retiring decision. [PVIFA 8%, 25 = 10.675]

Solution:

- (a) Net PV of futures cash flows if old bonds are not retired: (i.e., CFs from existing bonds)

PV of after-tax coupon $[3,00,00,000 \times 14\% (1 - 0.40) \times 10.675]$	(2,69,01,000)
PV of tax savings on after-tax floatation cost and discount on issue $[\frac{(3,90,000 + 9,00,000)}{30} \times 0.40 \times 10.675]$	1,83,610
PV of net cash outflow (A)	(2,67,17,390)

(b) Net PV of futures cash flows if old retired by issue of new bonds:

After-tax call premium $[30,000 \times (1,000 - 1,150) \times (1 - 0.40)]$	(27,00,000)
Floatation cost of new bonds	(4,25,000)
PV of tax benefit on floatation cost of new bonds $[\frac{4,25,000}{25} \times (40\%) \times 10.675]$	72,590
PV of after-tax coupon $[3,00,00,000 \times 12\% \times (1 - 0.4) \times 10.675]$	(2,30,58,000)
Post-tax over-lapping interest for 2m @ old coupon rate $[3,00,00,000 \times 14\% \times \frac{2}{12} \times (1 - 0.40)]$	(4,20,000)
Tax saving on unamortised floatation cost & discount of old bond $[(3,90,000 + 9,00,000) \times \frac{25}{30} \times 40\%]$	4,30,000
PV of net cash outflow (B)	(2,61,00,410)

(c) NPV of Bond refunding: = (A) – (B)
 $= 2,67,17,390 - 2,61,00,410$
 $= 6,16,980$



QUESTION 26:

N 21 | M 13 | M 09 | SM | RTP

ABC Ltd. has ₹ 300 million, 12 per cent bonds outstanding with six years remaining to maturity. Since interest rates are falling, ABC Ltd. is contemplating of refunding these bonds with a ₹ 300 million issue of 6 year bonds carrying a coupon rate of 10 per cent. Issue cost of the new bond will be ₹ 6 million and the call premium is 4 per cent. ₹ 9 million being the unamortized portion of issue cost of old bonds can be written off no sooner the old bonds are called off. Marginal tax rate of ABC Ltd. is 30 per cent. You are required to analyse the bond refunding decision.

Solution:

Self-Note: Cost of debt, which is used for discounting the CFs, is missing in the question. Now, best assumption of it will be to take the YTM of the bonds to be newly issued. Since, new bonds are issued at par, its YTM can be considered same as its Coupon Rate of 10%. Note that post tax cost of debt is used for discounting. $(10\% (1 - 0.30) = 7\%)$

(All calculations are in ₹ million)

(a) Net PV of futures cash flows if old bonds are not retired: (i.e., CFs from existing bonds)

PV of after-tax coupon [$300 \times 12\% (1 - 0.30) \times 4.767$]	(120.1284)
PV of tax savings on after-tax floatation cost and discount on issue $\left[\frac{9}{6} \times 30\% \times 4.767\right]$	2.1452
PV of net cash outflow (A)	(117.9832)

(b) Net PV of futures cash flows if old retired by issue of new bonds:

After-tax call premium [$300 \times 4\% \times (1 - 0.30)$]	(8.4)
Floatation cost of new bonds	(6)
PV of tax benefit on floatation cost of new bonds $\left[\frac{6}{6} \times (30\%) \times 4.767\right]$	1.4301
PV of after-tax coupon [$300 \times 10\% \times (1 - 0.3) \times 4.747$]	(100.107)
Tax saving on unamortised floatation cost & discount of old bond [$9 \times 30\%$]	2.7
PV of net cash outflow (B)	(110.3769)

(c) NPV of Bond refunding: = (A) – (B)

$$= 117.9832 - 110.3769$$

$$= 7.6063$$



QUESTION 27:

RTP M 14

Mr. A is planning for making investment in bonds of one of the two companies X Ltd. and Y Ltd. the detail of these bonds is as follows:

Company	Face Value	Coupon Rate	Maturity Period
X Ltd.	₹10,000	6%	5 years
Y Ltd.	₹10,000	4%	5 years

The current market price of X Ltd.'s bond is ₹10,796.80 and both bonds have same Yield to Maturity (YTM). Since Mr. A considers duration of bonds as the basis of decision making. You are required to calculate the duration of each bond and your decision.

Solution:

Calculation YTM by IRR method:

PVAF_{4%}

Year	CF's	PVF @ 5%	DCF @ 5%	PVF @ 4%	DCF @ 4%
1	600	0.952	571.2	0.962	577.2
2	600	0.907	544.2	0.925	555.0
3	600	0.864	518.4	0.889	533.4
4	600	0.823	493.8	0.855	513.0
5	10,600	0.784	8310.4	0.822	8,713.2
			10,438.0		10,891.8

PVAF_{5%}

Calculating precise YTM, using interpolation:

$$\frac{X - 4}{5 - 4} = \frac{10796.8 - 10891.8}{10438.0 - 10891.8}$$

$$X = 4.21\%$$

Calculating duration of Bond X:

%

Year	CF's	PVF @ 4.21%	DCF	Weight (w _%)	year × w
1	600	0.960	576.0	0.0534	0.05
2	600	0.921	552.6	0.0512	0.10
3	600	0.884	530.4	0.0491	0.15
4	600	0.848	508.8	0.0471	0.19
5	10,600	0.814	8628.4	0.7992	4.00
			10796.2	1.0000	4.49

Duration = 4.489 years

Calculating duration of Bond Y:

₹

Year	CF's	PVF @ 4.21%	DCF (w _₹)	Year × w
1	400	0.960	384.0	384.0
2	400	0.921	368.4	736.8
3	400	0.884	353.6	1,060.8
4	400	0.848	339.2	1,356.8
5	10,400	0.814	8465.6	42,328.0
			9910.8	45866.4

$$\text{Duration} = \frac{45,866.4}{9,910.8} = 4.628 \text{ years}$$

Decision: Since the duration of Bond of X Ltd. is lower, therefore, it is less risky and it should be preferred.



QUESTION 28:

J 21 | N 15 | RTP N 12

only on calc

The following data is available for a bond:

Fixed Income Securities

Face Value	₹1,000
Coupon Rate	11%
Years to Maturity	6
Redemption Value	₹1,000
Yield to Maturity	15%

(Round-off your answers to 3 decimals)

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

Solution:

Year	CF's	PVF @ 15%	DCF (w)	Year X w
1	110	0.870	95.70	95.70
2	110	0.756	83.16	166.32
3	110	0.658	72.38	217.14
4	110	0.572	62.92	251.68
5	110	0.497	54.67	273.35
6	1,110	0.432	479.52	2,877.12
			848.35	3881.31

(a) Price = 848.35

(b) Duration = $\frac{3,881.31}{848.35} = 4.58$ years

(c) Volatility = $\frac{4.58}{1 + 0.15} = 3.98\%$

(d) If yield increases by 100 bps,
The Market price of bond will come down by: $1\% \times 3.98 = 3.98\%$
Expected Market Price = $848.35 - 3.98\% = 814.59$

(e) If yield decreases by 75 bps,
The Market price of bond will go up by: $0.75\% \times 3.98 = 2.985\%$
Expected Market Price = $848.35 + 2.985\% = 873.67$



QUESTION 29:

M 23 | M 21

An investor has recently purchased substantial number of 7 year 6.75% ₹ 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 ₹ 897 per bond. Investors follow intrinsic value method for valuation of bonds.

- You are required to determine

- a. The Market Price, Duration and Volatility of the bond and
 - b. Required YTM of the new investor
2. What is relationship between the price of the bond and YTM?

Period (t)	1	2	3	4	5	6	7
PVIF (9%, t)	0.917	0.842	0.772	0.708	0.650	0.596	0.547

Solution:

- (1) (a) Market Price & Duration of Bond

Year	Cash flow	DCFs @ 9%		DCF (W%)	W% × Years
1	67.50	0.917	61.898	0.0677	0.0677
2	67.50	0.842	56.835	0.0622	0.1244
3	67.50	0.772	52.110	0.0570	0.1710
4	67.50	0.708	47.790	0.0523	0.2092
5	67.50	0.650	43.875	0.0480	0.2400
6	67.50	0.596	40.230	0.0440	0.2640
7	1117.50	0.547	611.273	0.6688	4.6816
			914.01		5.7579

Market Price of the bond is 914.01

Duration of the Bond is 5.758 years

Volatility of Bond = Duration/(1+YTM) = 5.758/(1+0.09) = 5.283

- (b) Required yield of new Investor

$$\text{Price} = 67.50 \text{ PVIAF}_{(r,7)} + 1050 \times \text{PVIF}_{(r,7)}$$

Now, let us discount the cash flow by 9%

$$\begin{aligned} \text{PV @ 9\%} &= 67.50 \text{ PVIAF}_{(9\%,7)} + 1050 \times \text{PVIF}_{(9\%,7)} \\ &= 67.50 \times 5.032 + 1050 \times 0.547 \\ &= 914.01 \end{aligned}$$

$$\text{NPV @ 9\%} = 914.01 - 897 = ₹ 17.01$$

Since, NPV of bond is positive, we need to increase discount rate say 12%

$$\begin{aligned} \text{PV @ 12\%} &= 67.50 \text{ PVIAF}_{(12\%,7)} + 1050 \times \text{PVIF}_{(12\%,7)} \\ &= 67.50 \times 4.564 + 1050 \times 0.452 \\ &= 782.67 \end{aligned}$$

$$\text{NPV @ 12\%} = 782.67 - 897 = - ₹ 114.33$$

Now we use interpolation formula

$$\text{Required yield of new Investor} = 9.39\%$$

- (2) Relationship between the price of the bond & YTM is opposite or inverse.



QUESTION 30:

N 08 | RTP

XL Ispat Ltd. has made an issue of 14 per cent non-convertible debentures on January 1, 2007. These debentures have a face value of Rs.100 and is currently traded in the market at a price of Rs.90.

Interest on these NCDs will be paid through post-dated cheques dated June 30 and December 31. Interest payments for the first 3 years will be paid in advance through post-dated cheques while for the last 2 years post-dated cheques 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 and the YTM of the bond.
- Calculate the duration of the NCD.
- Calculate the Modified Duration (*self-added for class students*)
- Assuming that intermediate coupon payments are, not available for reinvestment calculate the realised yield on the NCD.

Solution:

$$(i) \quad \text{Current yield} = \frac{\text{Annual Coupon}}{\text{CMP}}$$

$$= \frac{14}{90} = 15.56\% \text{ pa}$$

- (ii) YTM can be determined from the following equation

$$14 \times \text{PVIFA}_{(\text{Periodic YTM}, 10)} + 100 \times \text{PVIF}_{(\text{Periodic YTM}, 10)} = 90$$

Value of bond when ~~Annual YTM is 16%~~ Periodic YTM = 8%

$$= 7 \times \text{PVAF}_{(8\%, 10 \text{ periods})} + 100 \times \text{PVF}_{(8\%, 10\text{th period})}$$

$$= 46.97 + 46.32$$

$$= 93.27$$

Value of bond when ~~Annual YTM is 18%~~ Periodic YTM = 9%

$$= 7 \times \text{PVAF}_{(9\%, 10 \text{ period})} + 100 \times \text{PVF}_{(9\%, 10\text{th period})}$$

$$= 44.92 + 42.24$$

$$= 87.13$$

Precise periodic YTM using Interpolation:

8	— >	93.27
X	—	90
9	— >	87.13

Periodic Yield (X) = 8.53% per six months

Annual Yield = $8.53 \times 2 = 17.06\% \text{ pa}$

Duration of the bond:

Periods (n)	CF	PVAF @ 8.53%	DCF (W)	n × W
1	7	0.921	6.45	6.45
2	7	0.849	5.94	11.88
3	7	0.782	5.47	16.41
4	7	0.721	5.05	20.20

5	7	0.664	4.65	23.25
6	7	0.612	4.28	25.68
7	7	0.564	3.95	27.65
8	7	0.520	3.64	29.12
9	7	0.479	3.35	30.15
10	107	0.441	47.19	471.90
			89.97	662.69

$$\begin{aligned}\text{Duration} &= \frac{662.69}{89.97} \\ &= 7.366 \text{ semi-annual periods} \\ &= \frac{7.366}{2} = 3.683 \text{ years}\end{aligned}$$

$$\begin{aligned}\text{(iii) Modified Duration} &= \frac{\text{Annual Macaulays Duration}}{1 + \frac{\text{Annual YTM}}{2}} \\ &= \frac{3.683}{1 + \frac{0.1706}{2}} \\ &= 3.394\%\end{aligned}$$

$$\begin{aligned}\text{(iv) Total Cashflows after 5 years} &= 7 \times 10 + 100 \\ &= ₹ 170\end{aligned}$$

Realised yield p.a. = r

$$PV \times \left(1 + \frac{r}{k}\right)^{n \times k} = \text{FV of CFs}$$

$$90 \times \left(1 + \frac{r}{2}\right)^{5 \times 2} = 170$$

$$\frac{r}{2} = 6.57\%$$

$$r = 13.14\%$$

08

$$PV \times (1 + r)^n = FV.$$

r = rate per period.
 n : no. of periods.

$$90 \times (1 + r)^{10} = 170.$$

$$1 + r = (170/90)^{1/10}.$$

$$1 + r = (170/90)^{1/2 \times 1/5}.$$



QUESTION 31:

N 20

The following data are available for a bond:

Face Value	₹ 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 → Macaulays never tells you. The percentage change in price, therefore, we will have to use modified duration.
 - By Intrinsic Value Method.
 - Self-added for class students:* By Macaulay's Duration and Convexity Adjustment

Given:

	1	2	3	4	5
PVIF (10%, n)	0.909	0.826	0.751	0.683	0.621
PVIF (8%, n)	0.926	0.857	0.794	0.735	0.681

Solution:

Year	CF's	PVAF @ 10%	DLF	DCF × W
1	850	0.909	772.65	772.65
2	850	0.826	702.1	1,404.2
3	850	0.751	638.35	1,915.05
4	850	0.683	580.55	2,322.2
5	10,850	0.621	6,737.85	33,689.25
			9,431.5	40,103.35

- CMP of Bond = 9431.5
- Macaulay's duration = $\frac{40103.35}{9431.5} = 4.252$ years
- Volatility = $\frac{4.252}{1 + 0.10} = 3.865$
- Present yield = 10%

CMP of bond (V_0) = 9431.5

Let's assume the change in yield (Δy) = 0.02 or 2%

Price of bond if yield increases by 2%

$$\begin{aligned}
 (V_+) &= 850 \times \text{PVAF}_{(12\%, 5 \text{ years})} + 10,000 \times \text{PVAF}_{(12\%, 5 \text{th year})} \\
 &= 850 \times 3.605 + 10,000 \times 0.567 \\
 &= ₹ 8734.25
 \end{aligned}$$

Price of bond if yield decreases by 2%

$$\begin{aligned}
 (V_-) &= 850 \times \text{PVAF}_{(8\% 5 \text{ years})} + 10,000 \times \text{PVAF}_{(8\%, 5 \text{th years})} \\
 &= 850 \times 3.993 + 10000 \times 0.681 \\
 &= ₹ 10204.05
 \end{aligned}$$

$$\text{Convexity} = \frac{V_+ + V_- - 2V_0}{2V_0 \times (\Delta Y)^2}$$

$$= \frac{8734.25 + 10204.05 - 2 \times 9431.5}{2 \times 9431.5 \times (0.02)^2}$$

$$= 9.980$$

$$\text{Convexity Adjustment} = C \times (\Delta Y)^2 \times 100$$

$$= 9.98 \times (0.02)^2 \times 100 = 0.399\%$$

Self-note: Even if question doesn't ask to calculate convexity adjustment, calculate it.

(e) Expected market price, if there is a decrease in the YTM by 200 basis points

1 By Macaulay's Duration based estimate

$$\text{Decrease in YTM} = 200 \text{ bps i.e., } 2\%$$

$$\begin{aligned} \text{\% Increase in MP} &= 3.864 \times 2\% \\ &= 7.73\% \end{aligned}$$

$$\text{Expected MP} = 9,431.5 + 7.73\% = ₹ 10,160.55$$

Self-note: Even if examiner ask to calculate change in price using Macaulay's Duration, we know that it can be only if we use Modified Duration.

2. By Intrinsic Value method

$$\text{Bond Value at YTM of } 8\% = ₹ 10204.05$$

3. Macaulay's Duration and Convexity Adjustment:

$$\begin{aligned} \Delta \text{ in price} &= [-3.864 \times (-0.02) + 9.98 \times (-0.02)^2] \times 100 \\ &= +8.13\% \end{aligned}$$

$$\text{Expected price} = 9,431.5 + 8.13\% = 10,198.28$$



QUESTION 32:

N 15 | RTP

Mr. A will need ₹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	₹1,000	₹1,000
Coupon	7% payable annually	8% payable annually
Years to maturity	1	4
Current price	₹ 972.73	₹ 936.52
Current yield → <i>current YTM</i>	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 which quantity? Assume that there will not be any call risk or default risk.

Solution:

Bond X

Year	CF's	PVAF@10%	DCF (w)	
1	1070	0.909	972.63	972.63

must not. i.e. question of immunization.

Dualing

Fixed Income Securities

Duration = 1 year

Bond Y

Year	CF's	PVAF@10%	DCF (w)	
1	80	0.909	72.72	72.72
2	80	0.826	66.08	132.16
3	80	0.751	60.08	180.24
4	1,080	0.683	737.64	2,950.56
			936.52	3,335.68

$$\text{Duration} = \frac{3,335.68}{936.52} = 3.56 \text{ years}$$

We know that, weighted average duration = 2

$$1 \times w + 3.56 (1 - w) = 2$$

$$2 = w + 3.56 - 3.56w$$

$$w = 0.6094$$

$$1 - w = 0.3906$$

According the weights is Bond X = 60.94%

Bond Y = 39.06%

$$\text{Total Investments to be made} = 1,00,000 \times PVF_{(10\%, 2\text{nd year})} = 82,645$$

Investment in Bond X

$$\text{Amount:} = 82,645 \times 61\% = 50,413$$

$$\text{No. of Bonds} = \frac{50,413}{972.73} = 51.82 \text{ or } 52 \text{ bonds}$$

Investment in Bond Y

$$\text{Amount:} = 82,645 \times 39\% = 32,232$$

$$\text{No. of bonds} = \frac{32,232}{936.52} = 34.42 \text{ or } 34 \text{ bonds}$$



QUESTION 33:

N 18

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 ₹100 each and will be redeemed at par. Interest is payable annually *→ constant YTM*

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. Calculated the percentage amount to be invested in bonds B and C than need to be purchased to immunize the portfolio.

- c. After the Portfolio has been formulated, an interest Rate change occurs, increasing the yield to 11%. The new Duration of these Bonds are: A = 7.15 Years, B = 6.03 Years and C = 4.27 Years. Is the portfolio still immunized? Why or why not?
- d. Determine the new percentage of B & C that are needed to immunize the Portfolio, Bond A remaining at 45% of Portfolio.

Present Values at 9% for 1 to 10 Years are 0.917, 0.842, 0.772, 0.708, 0.650, 0.596, 0.547, 0.502, 0.460 & 0.4224 respectively.

Solution:

- (a) Duration of Bond A

n × DCF.

Year	CFs	PVF @ 9%	DCF (w)	x w	years × w x
1	10	0.917	9.17	0.0862	0.09
2	10	0.842	8.42	0.0792	0.16
3	10	0.772	7.72	0.0726	0.22
4	10	0.708	7.08	0.0666	0.27
5	10	0.650	6.50	0.0611	0.31
6	10	0.596	5.96	0.0560	0.34
7	10	0.547	5.47	0.0514	0.36
8	10	0.502	5.02	0.0472	0.38
9	10	0.460	4.60	0.0432	0.39
10	110	0.422	46.42	0.4364	4.36
			106.36	1.0000	6.86

Duration: 6.86 years

- Duration of Bond B

Year	CFs	PVF @ 9%	DCF (w)	w	years × w
1	11	0.917	10.09	0.0908	0.09
2	11	0.842	9.26	0.0834	0.17
3	11	0.772	8.49	0.0764	0.23
4	11	0.708	7.79	0.0701	0.28
5	11	0.650	7.15	0.0644	0.32
6	11	0.596	6.56	0.0591	0.36
7	11	0.547	6.02	0.0542	0.38
8	111	0.502	55.72	0.5016	4.01
			111.08	1.0000	5.84

Duration: 5.84 years

- Duration of Bond C

Year	CFs	PVF @ 9%	DCF (w)	w	years × w
1	9	0.917	8.25	0.0825	0.08
2	9	0.842	7.58	0.0758	0.15
3	9	0.772	6.95	0.0695	0.21
4	9	0.708	6.37	0.0637	0.26
5	109	0.650	70.85	0.7085	3.54
			100.00	1.0000	4.24

Duration: 4.24 years

(ii) $D_L = D_A$ $\rightarrow$ $w_A = 0.45$ $w_B = x$ $w_C = (1 - 0.45 - x)$ $\rightarrow$ point of leaving.

$$6 = 6.86 \times 0.45 + 5.84 \times x + 4.24 \times (1 - 0.45 - x)$$

$$x = 36.31\% \quad : \text{Weight of Bond B}$$

$$(1 - 0.45 - x) = 18.69\% \quad : \text{Weight of Bond C}$$

(iii) Duration = $7.15 \times 0.45 + 6.03 \times 0.3631 + 4.27 \times 0.1869$
 $= 6.21$ years

$\therefore$ Duration of portfolio $\neq$ duration of scheduled outflow

$\therefore$ portfolio is not immunised

(iv) $6 = 7.15 \times 0.45 + 6.03 \times x + 4.27 \times (1 - 0.45 - x)$
 $x = 24.66\% \quad : \text{Weight of Bond B}$
 $0.55 - x = 30.34\% \quad : \text{Weight of Bond C}$



QUESTION 34:

N 16 | RTP only on calc

A Ltd. has issued convertible bonds, which carries a coupon rate of 14%. Each bond is convertible into 20 equity shares of the company A Ltd. The prevailing interest rate for similar credit rating bond is 8%. The convertible bond has 5 years maturity. It is redeemable at par at ₹100. The relevant value table is as follows.

Present values	t_1	t_2	t_3	t_4	t_5
$PVIF_{0.14, t}$	0.877	0.769	0.675	0.592	0.519
$PVIF_{0.08, t}$	0.926	0.857	0.794	0.735	0.681

You are required to estimate:

(Calculation be made upto 3 decimal places)

- 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.

Solution:

(i) Current Market Price = $14 \times 3.993 + 100 \times 0.681$
 $= 124.00$

(ii) Minimum Market Price of Equity Shares at which Bondholder should exercise conversion option:
 Minimum MPS of Equity Shares = $\frac{124.002}{20} = 6.20$

(iii) Duration of the Bond

Year				
1	14	0.926	12.964	12.964
2	14	0.857	11.998	23.996
3	14	0.794	11.116	33.348
4	14	0.735	10.29	41.16
5	114	0.681	77.634	388.17

			124.002	499.638
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$$\text{Duration} = \frac{499.638}{124.002} = 4.03 \text{ years}$$

**QUESTION 35:**

RTP M 15

only on calc

Suppose Mr. A is offered a 10% Convertible Bond (par value ₹ 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 ₹ 33.50 and expected to grow by 7% each year. You are required to determine the floor price Mr. A shall be ready to pay for bond if his expected rate of return is 11%.

↳ minium price .

req. rate of return.

Solution:

Conversion Value of Bond @ 34.

$$= \text{CMP} (1 + g)^n \times \text{Conversion Ratio}$$

$$= ₹ 33.50 \times (1.07)^4 \times 25$$

$$= ₹ 33.50 \times 1.311 \times 25$$

$$= ₹ 1097.96$$

Value of Bond if Conversion is opted

$$= ₹ 100 \times \text{PVA}_{(11\%, 4)} + ₹ 1017.98 \text{ PV}_{(11\%, 4)}$$

$$= ₹ 100 \times 3.102 + ₹ 1097.96 \times 0.659$$

$$= ₹ 1033.76$$

Value of Bond if Redemption is opted

$$= ₹ 100 \times \text{PVA}_{(11\%, 4)} + ₹ 1050 \text{ PV}_{(11\%, 4)}$$

$$= ₹ 100 \times 3.102 + ₹ 1050 \times 0.659$$

$$= ₹ 1002.15$$

Since above value of Bond if conversion is opted, is based on the expectation of growth in market price which may or may not as per expectations. In such circumstances the redemption at premium still shall be guaranteed and bond may be purchased at its floor value of 1002.15

**QUESTION 36:**

M 18 | N 09

only on calc

Sabanam Ltd. has issued convertible debentures with coupon rate 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 ₹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) ₹ 5, (ii) ₹ 6 and (iii) ₹ 7.10

Cumulative PV factor for 8% for 5 years: 3.993 PV factor for 8% for year 5: 0.681

Solution:

If Debentures are not converted its value is as under:

Years	CFs	PVF @ 8 %	DCF (₹)
1 – 5	11	3.993	43.923
5	100	0.681	68.100
			112.023

Conversion Value of Bonds:

Market Price per share	No of shares	Total
₹ 5	16	₹ 80
₹ 6	16	₹ 96
₹ 7.10	16	₹ 113.60

Hence, unless the market price is ₹ 7.10 conversion should not be exercised.



QUESTION 37:

N 21

only on call

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 1 at any point of time but before maturity. Debentures will be redeemed at 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 behavior of the shares:

Period		Price Range (₹)		
From	To	Passive	Most Likely	Optimistic
01.04.2021	31.12.2022	4.0	4.5	5.0
01.01.2023	30.06.2025	4.5	6.5	7.0
01.07.2025	31.03.2026	3.5	5.0	5.5

BIL, as a matter of policy, rounds up the amount.

You are required to calculate *→ share*

- The break-even price at which the debentures can be converted
- The ideal period in which BIL shall convert and dispose of the shares

Given: PVIF(10%, 5) = 0.6209

PVIFA(10%, 5) = 3.7908

Solution:

- The Break-even price at which Debenture can be converted shall be equivalent to Present Value of stream of cash flows from holding debenture till maturity and it shall be computed as follows:

$$\begin{aligned}
 PV &= ₹ 15.28 \times PVIFA(10\%, 5) + ₹ 100 \times PVIF(10\%, 5) \\
 &= ₹ 15.28 \times 3.7908 + ₹ 100 \times 0.6209 \\
 &= ₹ 120
 \end{aligned}$$

$$\text{Thus, Break Even price} = \frac{₹ 120}{₹ 20} = 6/- \text{ per share}$$

- 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.



QUESTION 38:

M21 | M 18 | RTP | MTP M 22 V 2

The following data is related to 9% Fully Convertible (into Equity Shares) Debentures issued by JAC Ltd. at ₹1000.

Market Price of 9% Debenture	₹ 1000
Conversion Ratio	25
Straight Value of 9% Debenture	₹ 800
Market Price of Equity share on the date of Conversion	₹ 30
Expected Dividend Per Share	₹ 1

- Conversion Value of Debenture or Stock value of bond
- 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

Solution:

- Conversion Value of Debenture
 = Market Price of one Equity Share X Conversion Ratio
 = ₹ 30 × 25 = ₹ 750
- Market Conversion Price
 = $\frac{\text{Market Price of Convertible Debenture}}{\text{Conversion Ratio}}$
 = $\frac{1000}{25} = ₹ 40$
- Conversion Premium per share
 = Market Conversion Price – Market Price of Equity Share
 = ₹ 40 – ₹ 30 = ₹ 10
- Ratio of Conversion Premium
 = $\frac{\text{Conversion premium per share}}{\text{Market Price of Equity Share}}$
 = $\frac{10}{30} \times 100 = 33.33\%$
- Premium over Straight Value of Debenture
 = $\frac{\text{Premium over straight value (₹)}}{\text{Straight Value of Bond}}$
 = $\frac{1000 - 800}{800} = 25\%$
- Favorable income differential per share:
 = $\frac{\text{Coupon Interest from Debenture} - \text{Conversion Ratio} \times \text{Dividend Per Share}}{\text{Conversion Ratio}}$
 = $\frac{90 - 25 \times 1}{25} = ₹ 2.6$
- Premium pay back period

$$= \frac{\text{Conversion premium per share}}{\text{Favorable Income Differential Per Share}} \\ = \frac{10}{2.6} = 3.85 \text{ years}$$

**QUESTION 39:**

N 22 | M 14 | N 08 | RTP

GHI Ltd., AAA rated company has issue, fully convertible bonds on the following terms, a year ago:

Face value of bond	₹1000
Coupon (interest rate)	8.5%
Time of 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	₹45
Market price of convertible bond	₹1175

AAA rated company can issue vanilla bonds without conversion option at an interest rate of 9.5% $\rightarrow$ YTM.

Required: Calculate as of today:

- (i) Straight Value of bond. $\rightarrow$ simple bond with no features.
- (ii) Conversion Value of the bond.
- (iii) Conversion Premium per share.
- (iv) Percentage of downside/downturn risk.
- (v) Conversion Parity price and also interpret the results.

t	1	2	3
PVIF _{0.095, t}	0.9132	0.8340	0.7617

Solution:

- (i) Straight Value of Bond
- $$= ₹ 85 \times 0.9132 + ₹ 85 \times 0.8340 + ₹ 1085 \times 0.7617$$
- $$= ₹ 974.96$$
- (ii) Conversion Value
- $$= \text{Conversion Ratio} \times \text{Market Price of Equity Share}$$
- $$= ₹ 45 \times 25 = ₹ 1,125$$
- (iii) Conversion Premium
- $$= \text{Market Conversion Price} - \text{Market Price of Equity Share}$$

$$= \frac{₹ 1175}{25} - ₹ 45 = ₹ 2 \quad \underline{08} \quad 2/45 : 4.44\%$$

- (iv) Percentage of Downside Risk
- $$= \frac{₹ 1175 - ₹ 974.96}{₹ 974.96} \times 100 = 20.52\%$$

(v) Conversion Parity Price

$$= \frac{\text{Bond Price}}{\text{No. of Share on Conversion}}$$

$$= \frac{1175}{25} = 47$$

**QUESTION 40:**

MTP N 23

Following information is related to the Convertible Bond of A Ltd. which is currently priced at ₹ 1060 per Bond:

- (1) Conversion Parity Price - ₹ 53
- (2) Conversion Premium – 10.41667%
- (3) Percentage of Downside Risk with respect to Straight Value of Bond – 12.766%

Calculate:

- a. No. of shares on Conversion.
- b. Current Market Price Per Share of A Ltd.
- c. Straight Value of Bond

Solution:

- a. The No. of share on Conversion

$$\text{Conversion Parity Price} = \frac{\text{Bond Price}}{\text{No. of shares on Conversion}}$$

$$₹ 53 = \frac{1060}{\text{No. of shares on Conversion}}$$

$$\text{No. of shares on Conversion} = 20$$

- b. Market Price Per Share of A Ltd.

$$\text{Conversion Premium} = \frac{\text{Conversion Price of Share} - \text{CMP of share}}{\text{CMP of share}}$$

$$0.1041667 = \frac{53 - \text{CMP}}{\text{CMP}}$$

$$\text{CMP} = ₹ 48 \text{ per share}$$

- c. Straight Value of Bond

$$\text{Percentage of Downside Risk} = \frac{\text{Market Price of Bond} - \text{Straight Value of Bond}}{\text{Straight Value of Bond}}$$

$$0.12766 = \frac{1060 - \text{Straight Value of Bond}}{\text{Straight Value of Bond}}$$

Straight Value of Bond = ₹ 940 per Bond



QUESTION 41:

M 17 | N 09

only on calci

P Ltd. has current earnings of ₹ 6 per share with 10,00,000 shares outstanding. The company plans to issue 80,000, 8% convertible preference shares of ₹ 100 each at par. The preference shares are convertible into 2 equity shares for each preference share held. The equity share has a current market price of ₹ 42 per share. Calculate:

- 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 ₹ 20 Lakhs what will be the basic EPS, (A) before conversion and (B) on a fully diluted basis?

Solution:

- (i) Conversion value of preference share

= Conversion Ratio x Market Price

= $2 \times ₹ 42 = ₹ 84$

~~(Or ₹ 67,20,000)~~

- (ii) Conversion Premium

~~(₹ 100 / ₹ 84) - 1 = 19.05%~~

~~(Or ₹ 12,80,000 or ₹ 16 per share)~~

conversion parity price - mps.

100/2 = 42.

= ₹ 84.

8/42 = 19.05%.

- (iii) Effect of the issue on basic EPS

	₹
<u>Before Conversion</u>	
Total (after tax) earnings ₹ 6 × 10,00,000	60,00,000
Dividend on Preference shares	6,40,000
Earnings available to equity holders	53,60,000
No. of shares	10,00,000
EPS	5.36
<u>On Diluted Basis</u>	
Earnings	60,00,000
No of shares (10,00,000 + 1,60,000)	11,60,000
EPS	5.17

- (iv) EPS with increase in Profit

	₹
<u>Before Conversion</u>	
Earnings	80,00,000
Dividend on Pref. shares	6,40,000
Earning for equity shareholders	73,60,000

No. of shares	10,00,000
EPS	7.36
<u>On Diluted Basis</u>	
Earnings	80,00,000
No of shares	11,60,000
EPS	6.90

B. Money Market Fixed Income Securities



QUESTION 42:

Sm only on calci

RBI sold a 91-day T-bill of face value of ₹ 100 at a yield of 6%. What was the issue price?

Solution:

$$\begin{aligned}\text{Yield} &= \frac{\text{FV} - \text{IP}}{\text{IP}} \times \frac{365}{n} \times 100 \\ 6 &= \frac{100 - \text{IP}}{\text{IP}} \times \frac{365}{91} \times 100 \\ \text{₹} & \\ \text{IP} &= 98.53\end{aligned}$$



QUESTION 43:

M Ltd. has to make a payment on 30th January, 2010 of Rs. 80 lakhs. It has surplus cash today, i.e., 31st October, 2009; and has decided to invest sufficient cash in a bank's Certificate of Deposit scheme offering an yield of 8% p.a. on simple interest basis. What is the amount to be invested now?

Solution:

$$\begin{aligned}\text{Yield} &= \frac{\text{FV} - \text{IP}}{\text{IP}} \times \frac{365}{n} \times 100 \\ 8 &= \frac{80,00,000 - \text{IP}}{\text{IP}} \times \frac{365}{91} \times 100 \\ \text{IP} &= 78,43,558.65\end{aligned}$$



QUESTION 44:

only on calci

Z Co. Ltd. issued commercial paper worth ₹ 10 crores as per following details:

Date of issue	:	16th January, 2019
Date of maturity	:	17th April, 2019
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)

Solution:

$$\begin{aligned}\text{Yield} &= \frac{\text{FV} - \text{IP}}{\text{IP}} \times \frac{365}{n} \times 100 \\ 12.04\% &= \frac{10 - \text{IP}}{\text{IP}} \times 100 \times \frac{365}{91} \\ \text{IP} &= 9.70857\end{aligned}$$

**QUESTION 45:**

RTP N 11

only on calculation

Suppose Mr. X purchase Treasury Bill for Rs. 9,940 maturing in 91 days for ₹ 10,000. Then what would be annualized investment rate for Mr. X and annualized discount rate for the Govt. Investment.

Solution:

$$\text{Investment Rate} = \frac{10,000 - 9,940}{9,940} \times \frac{365}{91} \times 100 = 2.42\%$$

$$\text{Discount Rate} = \frac{10000 - 9940}{10000} \times \frac{360}{91} = 2.37\%$$

**QUESTION 46:**

MTP M 18

Two companies XYZ Ltd. and ABC Ltd., each issues Commercial Paper (CP) of ₹ 5 million each maturing in 91 days. While XYZ's CP has credit rating of A1 the ABC's CP has A3 from CRISIL. XYZ and ABC CPs are issued at 7.6% and 8.5% respectively.

You are required to determine the compensation for ABC's CP for greater credit risk. Assume number of days a year is 365.

Solution:

$$\text{Yield} = \frac{\text{FV} - \text{IP}}{\text{IP}} \times \frac{365}{n} \times 100$$

Issue Price of CP of XYZ Ltd. will be:

$$7.6 = \frac{5,000,000 - \text{IP}}{\text{IP}} \times \frac{365}{91} \times 100$$

$$\text{IP} = ₹ 49,07,022$$

Issue Price of CP of ABC Ltd. will be:

$$8.5 = \frac{5,000,000 - \text{IP}}{\text{IP}} \times \frac{365}{91} \times 100$$

$$\text{IP} = ₹ 48,96,239$$

Accordingly, compensation for higher Credit Risk shall be:

$$₹ 49,07,022 - ₹ 48,96,239 = ₹ 10,783$$

**QUESTION 47:**

M 18

A bond is held for a period of 45 days. The current discount yield is 6 per cent per annum. It is expected that current yield will increase by 200 basis points and current market price will come down by ₹ 2.50.

Calculate:

- Face value of the Bond and
- Bond Equivalent Yield

point of :
learning

When two variables are missing in a question, then there has to be two equations to be able to solve them

Solution:

$$(a) \quad \text{Discount Yield} = \frac{FV - \text{CMP}}{FV} \times \frac{360}{n} \times 100$$

Based on current discount yield:

$$6 = \frac{FV - \text{CMP}}{FV} \times \frac{360}{45} \times 100 \quad \text{----- (1)}$$

Based on revised discount yield:

$$8 = \frac{FV - (\text{CMP} - 2.5)}{FV} \times \frac{360}{45} \times 100 \quad \text{----- (2)}$$

Solving above two equations:

$$\text{Face Value} = ₹ 1000$$

Alternative by ICAI:

a	6% discount yield for 45 days	0.75%
b	8% discount yield for 45 days	1.00%
c	Change in discount yield (a) – (b)	0.25%
d	Change in Price	2.50
e	Face Value of Bond (d)/ (c)	1000

(b) Bond Equivalent Yield

Using above equation (1) and (2), calculating CMP in both the cases:

$$\text{CMP (at yield = 6\%)} = ₹ 992.5$$

$$\text{CMP (at yield = 8\%)} = 992.5 - 2.5 = 990$$

Bond Equivalent Yield:

When yield is 6%	$\frac{1000 - 992.50}{992.50} \times \frac{365}{45} \times 100 = 6.95\%$
When yield is 8%	$\frac{1000 - 990.00}{990.00} \times \frac{365}{45} \times 100 = 8.19\%$



QUESTION 48:

only on
calci

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	₹ 97,550
Face Value	₹ 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

Solution:

$$\begin{aligned}\text{Holding period Yield} &= \frac{\text{FV} - \text{IP}}{\text{IP}} \times 100 \\ &= \frac{1,00,000 - 97,550}{97,550} = 2.51\%\end{aligned}$$

$$\begin{aligned}\text{Effective Annualized} &= (1 + 0.02512)^{12/3} - 1 \\ &= 10.43\%\end{aligned}$$

Total Cost of Funds

Effective Annualized interest p.a.	10.433
Add: Brokerage $\left(0.15 \times \frac{12}{3}\right)$	0.60
Add: Rating Charges	0.50
Add: Stamp Duty $\left(0.175 \times \frac{12}{3}\right)$	0.70
Total	12.233

Ambiguity:

While calculating the total cost of funds, other cost like brokerage, etc are simply annualised

**QUESTION 49:**

N 12 | PM

A money market instrument with face value of ₹100 and discount yield of 6% will mature in 45 days. You are required to calculate:

- Current price of the instrument.
- Bond equivalent yield
- Effective annual return.

Solution:

$$\begin{aligned}\text{(a) Discount Yield} &= \frac{\text{FV} - \text{CMP}}{\text{FV}} \times \frac{360}{n} \times 100 \\ 6 &= \frac{100 - \text{CMP}}{100} \times \frac{360}{45} \times 100 \\ \text{IP} &= 99.25\end{aligned}$$

$$\begin{aligned}\text{(b) BEY} &= \frac{100 - 99.25}{99.25} \times \frac{365}{45} \times 100 \\ &= 6.129\% \text{ or } 6.13\%\end{aligned}$$

$$\begin{aligned}\text{(c) Holding period yield} &= \frac{\text{FV} - \text{IP}}{\text{IP}} \times 100 \\ &= \frac{100 - 99.25}{99.25} \times 100 = 0.756\%\end{aligned}$$

$$\begin{aligned}\text{Effective Annual return} &= [(1 + 0.00756)^{365/45} - 1] \times 100 \\ &= [1.06299 - 1] \times 100 \\ &= 6.299\% \text{ or } 6.3\%\end{aligned}$$



QUESTION 50:

AXY Ltd. is able to issue commercial paper of ₹ 50,00,000 every 4 months at a rate of 12.5%p.a. The cost of placement of commercial paper issue is ₹ 2,500 per issue. XYZ Ltd. is required to maintain line of credit ₹ 1,50,000 in bank balance. The applicable income tax rate for XYZ Ltd. is 30%. What is the cost of funds (after taxes) to XYZ Ltd. for commercial paper issue? The maturity of commercial paper is four months.

Solution:

Calculation of Issue price:

$$\begin{aligned} \text{Yield} &= \frac{\text{FV} - \text{CMP}}{\text{CMP}} \times \frac{365}{n} \times 100 \\ 12.5 &= \frac{50,00,000 - \text{IP}}{\text{IP}} \times 100 \times \frac{12}{4} \\ \text{IP} &= 48,00,000 \end{aligned}$$

Calculation of Total Post Tax cost (numerator):

Interest	$[(50,00,000 - 48,00,000) \times (1 - 0.30)]$	1,40,000
Cost of placement	$[2,500 \times (1 - 0.30)]$	1,750
Total post tax cost		<u>1,41,750</u>

Amount of Available for utilisation (denominator):

Issue Price	48,00,000
Less: line of credit	-1,50,000
Less: Issue	-2,500
	<u>46,47,500</u>

$$\text{Cost of fund} = \frac{1,41,750}{46,47,500} \times \frac{12}{4} \times 100 = 9.15\%$$



QUESTION 51:

Wonderland Limited has excess cash of ₹ 20 lakhs, which it wants to invest in short term marketable securities. Expenses relating to investment will be ₹ 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 breakeven its investment expenditure overtime value of money.

Solution:

(a)	Required Net pre-tax income	$20,00,000 \times 5\%$	= 1,00,000
	Expenses to be recovered		= + 50,000
	Gross income to be earned		= 1,50,000

Back calculating 'n' using yield formula:

$$\begin{aligned}\text{Yield (\%)} &= \frac{\text{Income to be earned}}{\text{Amount invested}} \times \frac{365}{n} \times 100 \\ 9 &= \frac{1,50,000}{20,00,000} \times \frac{12}{n} \times 100 \\ n &= 10 \text{ months}\end{aligned}$$

(b) To breakeven its investment expenditure:

Expenses to be recovered i.e., gross income to be earned = 50,000

$$\begin{aligned}9 &= \frac{50,000}{20,00,000} \times \frac{12}{n} \times 100 \\ n &= 3.33 \text{ months}\end{aligned}$$



QUESTION 52:

MTP N 17 | Old SM | MTP N 15

Bank A enter into a Repo for 14 days with Bank B in 10% Government of India Bonds 2028 @ 5.65% for ₹ 8 crore. Assuming that clean price (the price that does not have accrued interest) be ₹ 99.42 and initial Margin be 2% and days of accrued interest be 262 days. You are required to determine

- Dirty Price
- Start Proceed (First Leg)
- Repayment at maturity. (Second Leg)

Consider 360 days in a year

Solution:

Self-Note: Bond are traded in the market at clean price i.e., the price w/o accrued interest however when you buy a bond at its clean price, you will have to pay the amount of accrued interest also along with clean price. This total amount is called as dirty price.

$$\text{Dirty Price} = \text{Clean Price} + \text{Accrued Interest}$$

Accrued Interest = for the time period starting from last coupon payment date till the date for which dirty price is calculated.

$$\begin{aligned}\text{(a) Dirty Price} &= \text{clean price} + \text{Accrued Interest} \\ &= 99.42 + 100 \times 10\% \times \frac{262}{360} \\ &= 106.70\end{aligned}$$

$$\begin{aligned}\text{(b) Start Proceed} \\ \text{Total Dirty Price of securities} &= \frac{8,00,00,000}{100} \times 106.70 \\ &= 8,53,60,000 \\ \text{Amount of loan taken} &= 8,53,60,000 \times 98\% \\ &= 8,36,52,800\end{aligned}$$

(c)	Repayment at maturity	
	Amount of loan	8,36,52,800
	Add: Interest	$[83652800 \times 5.65\% \times 14/360]$
	Amount of repayment	<u>1,83,804</u>
		<u>8,38,36,604</u>



QUESTION 53:

MTP M 19

On 30th June 2015, PNB Bank proposes to borrow a sum of Rs. 400 crores from CB Bank via Repo @ 11.65% using 10.00% GOI Securities 2025 (face value Rs. 10,000) for a period of 14 days with a 3.00% haircut.

The current price of the securities is Rs. 9,872. The coupon dates are 30 April and 30 September. You are required to determine:

- Nominal Amount as well as No. of Securities to be delivered in the beginning of the Repo.
- The cash amount to be repaid at the end of the Repo.

Solution:

- (a) The GOI Security has semi-annual coupon of 30 April hence the accrual period is 1 May 2015 to 30 June 2015 i.e. 61 days. Therefore,

$$\text{Accrued Interest} = 10000 \times \frac{10}{100} \times \frac{61}{365} = ₹ 167.12$$

$$\text{Dirty Price} = \text{Rs. } 9,872 + \text{Rs. } 167.12 = \text{Rs. } 10,039.12$$

$$\text{Dirty Price Adjusted for 3\% haircut} = 10,039.12 - 3\% = ₹ 9737.95$$

$$\text{No. of securities required} = \frac{400 \text{ Cr}}{9737.95} = 4,10,764 \text{ (Approx)}$$

$$\text{Nominal Amount of Securities Required} = 4,10,764 \times 10,000 = ₹ 410.764 \text{ crore}$$

- (b) The original cash amount to be repaid at the end

$$= 400 \text{ crore} \times \left[1 + 0.1165 \times \frac{14}{365} \right] = ₹ 401.7874 \text{ crore}$$

Alternative Solution of part (a) by ICAI (having mistake):

It adjusted the haircut from the dirty price as follows and then did rest of the solution as follows:

$$\text{Dirty Price Adjusted for 3\% haircut} = \frac{10039.12}{1.03} = ₹ 9746.72$$

$$\text{Nominal Amount of Securities Required} = 400 \times \frac{10000}{9746.72} = ₹ 410.39447 \text{ crore}$$

$$\text{No. of securities required} = \frac{410.39447}{9746.72} = 4,21,059 \text{ (Approx)}$$

**QUESTION 54:**

M 21 | RTP

The Bank BK enters into a Repo for 9 days with Bank NE in 6% Government bonds 2022 for an amount of ₹ 2 crore. The other relevant details are as follows:

First Leg Payment (Start Proceed)	₹ 2,00,06,750
Second Leg Payment (Repayment Proceed)	₹ 2,00,31,759
Initial Margin	1.25%
Days of accrued interest	240

Assume 360 days in a year.

You are required to calculate:

- Repo Rate
- Dirty Price and
- Clean Price

Solution:

$$(i) \quad \text{Second Leg} = \text{Start Proceed} \times \left(1 + \text{Repo Rate} \times \frac{\text{No. of days}}{360} \right)$$

$$₹ 2,00,31,759 = ₹ 2,00,06,750 \times \left(1 + \text{Repo Rate} \times \frac{9}{360} \right)$$

$$1.00125 = \left(1 + \text{Repo Rate} \times \frac{9}{360} \right)$$

$$\text{Repo Rate} = 0.05 = 5\%$$

$$(ii) \quad \text{Total Number of Bonds} = \frac{2,00,00,000}{100} = 2,00,000$$

Note: FV per bond is assumed as ₹ 100

$$\text{Borrowing Amount} = \text{Total Dirty Price} \times (1 - \text{Repo Margin})$$

$$₹ 2,00,06,750 = \text{Total Dirty Price} \times (1 - 1.25\%)$$

$$\text{Total dirty Price} = 2,02,60,000$$

$$\text{Dirty Price per bond} = \frac{2,02,60,000}{2,00,000} = 101.3$$

$$(iii) \quad \text{Dirty Price} = \text{Clean Price} + \text{Interest Accrued}$$

$$101.30 = \text{Clean Price} + 100 \times \frac{240}{360} \times 6\%$$

$$\text{Clean Price} = ₹ 97.30$$

Portfolio Management



A. Modern Portfolio Theory | Capital Market Theory



QUESTION 1:

M 17 | N 09

A stock costing ₹ 150 pays no dividends. The possible prices that the stock might sell for at the end of the year with the respective probabilities are:

Prob.	Price
0.2	130
0.1	150
0.1	160
0.3	165
0.1	175
0.2	180

1. Calculate the expected return.
2. Calculate the Standard deviation of returns.

Solution:

$$E(R_A) = \frac{P_1 - P_0 + D}{P_0} \times 100$$

Prob. (P)	Price	(X)	(P × X)	$D_X = X - \bar{X}$	D_X^2	$P \times D_X^2$
0.2	130	-13.33	-2.67	-20	400	80
0.1	150	-	-	-6.67	44.49	4.45
0.1	160	6.67	0.67	-	-	-
0.3	165	10	3	3.33	11.09	3.33
0.1	175	16.67	1.67	10	100	10
0.2	180	20	4	13.33	177.69	35.54
			$\bar{X} = 6.67$			133.32

Expected Return: $E(R_A) = \sum (P \times X) = 6.67\%$

Variance (σ^2) $= \sum (P \times D_X^2) = 133.32\%$

Standard Deviation (σ) $= \sqrt{133.32} = 11.55\%$



QUESTION 2:

N 05 | RTP

Following information is available in respect of expected dividend, market price and market condition after one year.

Market condition	Probability	Market Price	Dividend per share
		₹	₹
Good	0.25	115	9
Normal	0.5	107	5
Bad	0.25	97	3

Portfolio Management

Ex deb. price : 106 - 6
of share = ₹100.

The existing market price of an equity share is Rs.106 (F.V. Rs.1), which is cum 10% bonus debenture of Rs.6 each, per share. M/s. X Finance Company Ltd. had offered the buy-back of debentures at face value.

Find out the expected return and variability of returns of the equity shares if buyback offer is accepted by the investor.

And also advise-Whether to accept buy back offer?

Solution:

Calculation of Returns

$$E(R_A) = \frac{P_1 - P_0 + D}{P_0} \times 100$$

$$\text{Good} = \frac{115 - 100 + 9}{100} \times 100 = 24\%$$

$$\text{Normal} = \frac{107 - 100 + 5}{100} \times 100 = 12\%$$

$$\text{Bad} = \frac{97 - 100 + 3}{100} \times 100 = 0\%$$

Prob. (P)	Return (x)	P × X	D _x = X - $\bar{X}$	D _x ²	P × D _x ²
0.25	24%	6	12	144	36
0.50	12%	6	0	0	0
0.25	0%	0	-12	144	36
		$\bar{X} = 12$			72

Expected Return: $E(R_A) = \sum (X \times P) = 12\%$

Variance (σ^2) = $\sum (P \times D_x^2) = 72\%$

Standard Deviation (σ) = $\sqrt{72} = 8.49\%$

Advise: The interest on the debenture is 10%p.a. whereas expected return on share is 12% since return on debenture looks good enough as compared to expected return on the shares considering the risk involved in both the securities.

Therefore, buy back should not be accepted.



QUESTION 3:

MTP N 20 | N 21 | M 08 | N 06 | RTP

Mr. A, a HNI invested on 1.4.2014 in certain equity shares as below:

Name of Co.	No. of shares	Cost (₹)
X Ltd.	1,00,000 (Rs.100 each) <i>F.V.</i>	2,00,00,000
Y Ltd.	50,000 (Rs.10 each)	1,50,00,000

In September 2014, 10% dividend was paid out by X Ltd. and in October 2014, 30% dividend paid out by Y Ltd. On 31.3.2015 market quotations showed a value of ₹ 220 and ₹ 290 per share for X Ltd. and Y Ltd. respectively.

On 1.4.2015, a technical analyst indicated as follows:

(a) that the probabilities of dividends from X Ltd. and Y Ltd. for the year ending 31.3.2016 are as below:

$\rightarrow \text{₹ } 16.5$
 $\rightarrow \text{₹ } 26.5$

Probability factor	Dividend from X Ltd (%)	Dividend from Y Ltd (%)
0.2	10	15
0.3	15	20
0.5	20	35

(b) that the probabilities of market quotations on 31.3.2016 are as below:

Probability factor	Price/share of X Ltd.	Price/share of Y Ltd.
0.2	220	290
0.5	250	310
0.3	280	330

You are required to:

- Analyse the average return from the portfolio for the year ended 31.3.2015;
- Analyse the expected average return from the portfolio for the year 2015-16; and
- Advise Mr. A, of the comparative risk in the two investments.

Solution:

- a. Average return from the portfolio for the year ended 31.3.2015

	X Ltd	Y Ltd
Cost per share (P_0)	$= \frac{2,00,00,000}{1,00,000} = 200$	$= \frac{1,50,00,000}{50,000} = 300$
Price on 31.3.2015 (P_1)	220	290
Dividend (D)	$= 100 \times 10\% = 10$	$= 10 \times 30\% = 3$
Average Return $= \frac{P_1 - P_0 + D}{P_0}$	$= \frac{220 - 200 + 10}{200} \times 100 = 15\%$	$= \frac{290 - 300 + 3}{300} \times 100 = -2.33\%$
Weight in the portfolio (W)	$= \frac{2,00,00,000}{3,50,00,000} = 57.14\%$	$= \frac{1,50,00,000}{3,50,00,000} = 42.86\%$
Return on portfolio	$= 15\% \times 57.14\% + (-2.33\%) \times 42.86\% = 7.57\%$	

- b. expected average return from the portfolio for the year 2015-16. This will be calculated using the concept of joint probability:

For Share of X Ltd.:

Path	Div. (D)	$P_1 - P_0$	Yield = $P_1 - P_0 + D$	Joint Prob. (P)	Yield $\times$ P
1	10	$220 - 220 = 0$	10	$0.20 \times 0.20 = 0.04$	0.40
2	10	$250 - 220 = 30$	40	$0.20 \times 0.50 = 0.10$	4.00
3	10	$280 - 220 = 60$	70	$0.20 \times 0.30 = 0.06$	4.20
4	15	$220 - 220 = 0$	15	$0.30 \times 0.20 = 0.06$	0.90
5	15	$250 - 220 = 30$	45	$0.30 \times 0.50 = 0.15$	6.75
6	15	$280 - 220 = 60$	75	$0.30 \times 0.30 = 0.09$	6.75
7	20	$220 - 220 = 0$	20	$0.50 \times 0.20 = 0.10$	2.00
8	20	$250 - 220 = 30$	50	$0.50 \times 0.50 = 0.25$	12.50

Portfolio Management

9	20	$280 - 220 = 60$	80	$0.50 \times 0.30 = 0.15$	12.00
					49.50

Expected Return: $\frac{49.5}{220} = 22.5\%$

For Share of Y Ltd.:

Path	Div. (D)	$P_1 - P_0$	Yield = $P_1 - P_0 + D$	Joint Prob. (P)	Yield $\times$ P
1	1.50	$290 - 290 = 0$	1.5	0.04	0.06
2	1.50	$310 - 290 = 20$	21.5	0.10	2.15
3	1.50	$330 - 290 = 40$	41.5	0.06	2.49
4	2.00	$290 - 290 = 0$	2.0	0.06	0.12
5	2.00	$310 - 290 = 20$	22.0	0.15	3.30
6	2.00	$330 - 290 = 40$	42.0	0.09	3.78
7	3.50	$290 - 290 = 0$	3.5	0.10	0.35
8	3.50	$310 - 290 = 20$	23.5	0.25	5.88
9	3.50	$330 - 290 = 40$	43.5	0.15	6.52
					24.65

Expected Return: $\frac{24.65}{290} = 8.5\%$

For Portfolio of X Ltd & Y Ltd:

	X Ltd	Y Ltd
Value of portfolio as on 31.3.15	$1,00,000 \times 220 = 220$ Lakhs	$50,000 \times 290 = 145$ Lakhs
Weight in the portfolio (W)	$= \frac{220 \text{ Lakhs}}{365 \text{ Lakhs}} = 60.27\%$	$= \frac{145 \text{ lakhs}}{365 \text{ Lakhs}} = 39.73\%$
Return on portfolio	$= 22.5\% \times 60.27\% + 8.5\% \times 39.73\% = 16.94\%$	

- b. To analyse the risk, we need to calculate the Standard Deviation of each investment as follows:

For Share of X Ltd.:

Prob. (P)	Yield (X) (₹)	$D_x = X - \bar{X}$	D_x^2	$P \times D_x^2$
0.04	10	-39.50	1,560.25	62.41
0.10	40	-9.50	90.25	9.03
0.06	70	20.50	420.25	25.22
0.06	15	-34.50	1,190.25	71.42
0.15	45	-4.50	20.25	3.04
0.09	75	25.50	650.25	58.52
0.10	20	-29.50	870.25	87.03
0.25	50	0.50	0.25	0.06
0.15	80	30.50	930.25	139.54
	$\bar{X} = 49.5$			₹ 456.25

Variance (σ^2) $= \sum (P \times D_x^2) = ₹ 456.25$

Standard Deviation (σ) in ₹ = $\sqrt{456.25} = ₹ 21.36$

Standard Deviation (σ) in % = $\frac{21.36}{220} = 9.71\%$

For Share of Y Ltd.:

Prob. (P)	Yield (Y) (₹)	$D_Y = Y - \bar{Y}$	D_Y^2	$P \times d_Y^2$
0.04	1.5	-23.15	535.92	21.44
0.10	21.5	-3.15	9.92	0.99
0.06	41.5	16.85	283.92	17.04
0.06	2.0	-22.65	513.02	30.78
0.15	22.0	-2.65	7.02	1.05
0.09	42.0	17.35	301.02	27.09
0.10	3.5	-21.15	447.32	44.73
0.25	23.5	-1.15	1.32	0.33
0.15	43.5	18.85	355.32	53.30
	$\bar{Y} = 24.65$			₹ 196.75

Variance (σ^2) = $\sum (P \times D_x^2) = ₹ 196.75$

Standard Deviation (σ) in ₹ = $\sqrt{196.75} = ₹ 14.03$

Standard Deviation (σ) in % = $\frac{14.03}{290} = 4.84\%$



QUESTION 4:

M 22 | N 17 | M 07 *only on calu*

The return of security 'L' and security 'K' for the past five years are given below:

Year	Security L- Return (%)	Security K- Return (%)
2012	10	11
2013	4	-6
2014	5	13
2015	11	8
2016	15	14

Calculate the Covariance, the Correlation coefficient, risk and return of above portfolio.

Solution:

Possible returns of Security L = X

Self-note: In the absence of information, weight of security L & K are assumed as 50% each.

Year	Security L (X)	d_x	d_x^2	Security K (Y)	d_y	d_y^2	$d_x \times d_y$
2012	10	1	1	11	3	9	3
2013	4	-5	25	-6	-14	196	70
2014	5	-4	16	13	5	25	(20)
2015	11	2	4	8	0	0	0
2016	15	6	36	14	6	36	36
	45		82	40		266	89

Assumption:

Portfolio Management

$$\bar{x} = \frac{45}{5} = 9$$

$$S.D_x = \sqrt{\frac{82}{5}} = 4.05$$

$$\bar{y} = \frac{40}{5} = 8$$

$$S.D_y = \sqrt{\frac{266}{5}} = 7.29$$

$$Cov_{(x,y)} = \frac{\sum (dx \times dy)}{n} = \frac{89}{5} = 17.8$$

$$r_{(x,y)} = \frac{COV}{\sigma_x \sigma_y} = \frac{17.8}{4.05 \times 7.29} = 0.603$$

$$\text{Return of portfolio} = 9 \times 0.50 + 8 \times 0.50 = 8.5\%$$

$$\begin{aligned} \text{S.D of Portfolio} &= \sqrt{(4.05 \times 0.5)^2 + (7.29 \times 0.5)^2 + 2 \times 4.05 \times 7.29 \times 0.5 \times 0.5 \times 0.603} \\ &= \sqrt{26.29} = 5.13\% \end{aligned}$$



QUESTION 5:

N 20

Ramesh has identified stocks of two companies A and B having good investment potential:

Following data is available for these stocks:

Year	Market Price per share in Rs.	
	A	B
2013	19.6	8.7
2014	18.75	12.8
2015	33.42	16.2
2016	42.64	18.25
2017	43.25	15.6
2018	44.6	13.25
2019	34.75	18.6

You are required to calculate:

- The Risk and Return by investing in Stock A and B
- The Risk and Return by investing in a portfolio of these Stocks if he invests in Stock A and B in proportion of 6:4.
- Self-added for class students:* What if he invests into 2 shares of A Ltd and 3 shares of B Ltd
- The better opportunity for investment

Solution:

Calculation of Possible Returns

2014	$\frac{18.75 - 18.6}{19.6} \times 100 = -4.34\%$	$\frac{12.8 - 8.7}{8.7} \times 100 = 47.13\%$
2015	$\frac{33.42 - 18.75}{18.75} \times 100 = 78.24\%$	$\frac{16.2 - 12.8}{12.8} \times 100 = 26.56\%$

2016	$\frac{42.64 - 33.42}{33.42} \times 100 = 27.59\%$	$\frac{18.25 - 16.2}{16.2} \times 100 = 12.65\%$
2017	$\frac{43.25 - 42.64}{42.64} \times 100 = 1.43\%$	$\frac{15.6 - 18.25}{18.25} \times 100 = (14.52\%)$
2018	$\frac{44.6 - 43.25}{43.25} \times 100 = 3.12\%$	$\frac{13.25 - 15.6}{15.6} \times 100 = (15.06\%)$
2019	$\frac{34.75 - 44.6}{44.6} \times 100 = -22.09\%$	$\frac{18.6 - 13.25}{13.25} \times 100 = 40.38\%$

Years (n)	Security A: X	d_x	d_x^2	Security B: Y	d_y	d_y^2	$dx \times dy$
2014	-4.34	-18.33	335.99	47.13	30.94	957.28	-567.13
2015	78.24	64.25	4128.06	26.56	10.37	107.54	666.27
2016	27.59	13.60	184.96	12.65	-3.54	12.53	-48.14
2017	1.43	-12.56	157.75	-14.52	-30.71	943.1	385.72
2018	3.12	-10.87	118.16	-15.06	-31.25	976.56	339.69
2019	-22.09	-36.08	1301.77	40.38	24.19	585.16	-872.78
	83.95		6226.69	97.14		3582.17	-96.37

(a) Risk and Returns of investing in Stock A & B

$$\bar{X} = \frac{83.95}{6} = 13.99$$

$$\bar{Y} = \frac{97.14}{6} = 16.19$$

$$SD_x = \sqrt{\frac{6,226.69}{6}} = 32.21$$

$$SD_y = \sqrt{\frac{3,582.17}{6}} = 24.43$$

(b) Return of portfolio = $13.99 \times 60\% + 16.19 \times 40\% = 14.87\%$

$$\text{Covariance of A \& B} = \frac{-96.37}{6} = -16.06$$

$$\begin{aligned} \text{Risk of Portfolio} &= \sqrt{(32.21 \times 0.6)^2 + (24.43 \times 0.4)^2 + 2 \times 0.6 \times 0.4 \times (-16.06)} \\ &= \sqrt{461.28} = 21.48 \end{aligned}$$

(c)

$$\begin{array}{l|l} \text{MV}_A : 34.75 \times 2 = 69.5 & \text{w}_A : \frac{69.5}{69.5 + 55.8} = 55.47\% \\ \text{MV}_B : 18.6 \times 3 = 55.8 & \\ \hline & \text{w}_B = \frac{55.8}{69.5 + 55.8} = 44.53\% \end{array}$$

- (d) On the basis of Return 'B' is preferable and on the basis of Risk 'Portfolio Investment' is preferable over the individual stocks.



QUESTION 6:

Forecast of returns for securities A and B are laid out below:

Probability	Security A	Security B
10%	15	10
20%	20	20
40%	25	25
10%	30	30
20%	35	35

Compute:

- Expected return from the portfolio, if it is formed with 70% investment in A and remainder in B.
- Covariance of AB
- Correlation Coefficient of AB
- Risk of the portfolio

Solution:

P	X	P × X	d _x	P × d _x ²	Y	P × Y	d _y	P × d _y ²	P × D _x × D _y
0.1	15	1.5	-10.5	11.03	10	1.00	-15.0	22.5	15.75
0.2	20	4.0	-5.5	6.05	20	4.00	-5.0	5.0	5.50
0.4	25	10.0	-0.5	0.10	25	10.00	0.0	0.0	0.00
0.1	30	3.0	4.5	2.03	30	3.00	5.0	2.5	2.25
0.2	35	7.0	9.5	18.05	35	7.00	10.0	20.0	19.00
		25.50		37.26		25.00		50.00	42.50

- a) Expected Return on portfolio

$$\bar{X} = 25.5\%$$

$$\bar{Y} = 25\%$$

$$\text{Expected return from the portfolio} = 25.5\% \times 0.7 + 25\% \times 0.3 = 25.35\%$$

- b) Covariance of AB = $\sum (P \times D_x \times D_y) = 42.5\%$

- c) SD of Security A (σ) = $\sqrt{\sum (P \times D_x^2)} = \sqrt{37.26} = 6.10\%$

$$\text{SD of Security B } (\sigma) = \sqrt{\sum (P \times D_y^2)} = \sqrt{50} = 7.07\%$$

$$\text{Correlation Coefficient of AB} = \frac{\text{Cov}(x,y)}{\sigma_x \times \sigma_y} = \frac{42.5}{6.10 \times 7.07} = 0.99$$

$$\text{Risk of the portfolio} = \sqrt{\frac{(6.10 \times 0.7)^2 + (7.07 \times 0.3)^2 + 2 \times 6.10 \times 7.07 \times 0.7 \times 0.3 \times 0.99}{2}} = \sqrt{40.58} = 6.37\%$$

**QUESTION 7:**

N 20 | N 08

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 are as follows:

Security	Risk (σ)	Expected Return (ER)
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?

Solution:

(i) Return = $12 \times 100\% = 12\%$

Risk = $10\% \times 100\% = 10\%$

(ii) Return = $12 \times 0.50 + 20 \times 0.50 = 16\%$

$$\begin{aligned} \text{Risk} &= \sqrt{(10 \times 0.50)^2 + (18 \times 0.50)^2 + 2 \times 10 \times 0.50 \times 18 \times 0.50 \times 0.15} \\ &= \sqrt{119.5} = 10.93 \end{aligned}$$

(iii) Return = $12 \times 0.75 + 20 \times 0.25 = 14\%$

$$\begin{aligned} \text{Risk} &= \sqrt{10^2 \times (0.75)^2 + (18 \times 0.25)^2 + 2 \times 10 \times 0.75 \times 18 \times 0.25 \times 0.15} \\ &= \sqrt{86.625} = 9.31\% \end{aligned}$$

(iv) Return = $20\% \times 1 = 20\%$

Risk = $18\% \times 1 = 18\%$

	(i)	(ii)	(iii)	(iv)
Return	12%	16%	14%	20%
Risk	10%	10.93%	9.31%	18%

In terms of return we see that portfolio (iv) is the best, in terms of risk we see that portfolio (iii) is the best.

**QUESTION 8:**

M 18 | N 10 | N 08 | RTP

Consider the following information on two stocks, A and B:

Year	2016	2017
Return on A (%)	10	16
Return on B (%)	12	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 of return from each of the two stocks.
- The covariance of returns from the two stocks.
- Correlation coefficient between the returns of the two stocks.
- The risk of a portfolio containing A and B in the proportion of 40% and 60%.

Solution:

A – (X)	B – (Y)	d_x	d_y	d_x^2	d_y^2	$D_x \times d_y$
10	12	-3	-3	9	9	9
16	18	3	3	9	9	9
26	30			18	18	18

- (i) Expected Return on portfolio

$$\bar{x} = \frac{26}{2} = 13\%$$

$$\bar{y} = \frac{30}{2} = 15\%$$

$$\text{Expected return from the portfolio} = 13 \times 0.40 + 15 \times 0.60 = 14.2\%$$

- (ii) Standard deviation of the stock

$$SD_x = \sqrt{\frac{18}{2}} = 3\%$$

$$SD_y = \sqrt{\frac{18}{2}} = 3\%$$

- (iii) Covariance $= \frac{\sum (dx \times dy)}{n} = \frac{18}{2} = 9$

- (iv) Correlation Coefficient $= \frac{Cov_{(x,y)}}{\sigma_x \times \sigma_y} = \frac{9}{3 \times 3} = 1$

- (v) SD of the portfolio $= \sqrt{(3 \times 0.4)^2 + (3 \times 0.6)^2 + 2 \times 3 \times 0.4 \times 3 \times 0.6 \times 1}$
 $= \sqrt{9} = 3\%$



QUESTION 9:

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 the expected rates of return, standard deviations, and correlation coefficients (all estimates are for aggregate stock market of developed countries and stock market of Economy A).

	Developed Country Stocks	Stocks of Economy A
Expected rate of return (annualized percentage)	10	15
Risk [Annualized Standard Deviation (%)]	16	30
Correlation Coefficient (ρ)	0.30	

Assuming the risk-free interest rate to be 3%, you are required to determine:

- What percentage of your portfolio should you allocate to stocks of Economy A if you want to increase the expected rate of return on your portfolio by 0.5%?
- What will be the standard deviation of your portfolio assuming that stocks of Economy A are included in the portfolio as calculated above?
- Also show how well the Fund will be compensated for the risk undertaken due to inclusion of stocks of Economy A in the portfolio?

To be done after the topic

"PF performance evaluation"

Solution:

- (i) let the weight of developed stock = W_D

$$E(R_P) = E(R_D) \times W_D + E(R_A) \times W_A$$

$$10.5\% = 10 \times W_D + 15 \times (1 - W_D)$$

$$10.5 = 10 W_D + 15 - 15 W_D$$

$$-4.5 = -5 W_D$$

$$0.9 = W_D \quad : \text{Developed Country}$$

$$0.1 = 1 - W_D \quad : \text{Economy A}$$

(ii) S.D. = $\sqrt{(16 \times 0.90)^2 + (30 \times 0.1)^2 + 2 \times 16 \times 0.10 \times 30 \times 0.90 \times 0.30}$
 $= 15.57$

(iii) share Ratio = $\frac{R_P - R_f}{\sigma_P}$

Before inclusion of stock of Economy A = $\frac{10 - 3}{16} = 0.438$ *75*

After inclusion of stock of Economy A = $\frac{10.5 - 3}{15.57} = 0.48$ *27*

Due to inclusion of stock of economy A, sharp e ratio of funds will increase from 0.438 to 0.482



QUESTION 10:

only on calc

$w_x: 50\%$ $w_y: 50\%$

An Investor holds two Equity Shares x and y in equal proportion with the following risk and return characteristics:

$E(R_A)$	26%
$E(R_B)$	20%
σ_A	28%
σ_B	23%

The Returns of these Securities have a positive correlation of 0.8. You are required to calculate the Portfolio Return and Risk.

Further, suppose that the investor wants to reduce the Portfolio Risk (σ_p) to 15%, how much should the correlation coefficient be to bring the portfolio risk to the desired level?

Solution:

$$\begin{aligned} \text{Portfolio Return} &= 26 \times 0.50 + 20 \times 0.50 \\ &= 23\% \end{aligned}$$

$$\begin{aligned} \text{Risk} &= \sqrt{(28 \times 0.50)^2 + (23 \times 0.50)^2 + 2 \times 23 \times 0.50 \times 23 \times 0.50 \times 0.80} \\ &= \sqrt{585.85} = 24.20\% \end{aligned}$$

If the investor wants to reduce the portfolio risk to 15%, then correlation coefficient should be:

$$\begin{aligned} 15 &= \sqrt{(28 \times 0.50)^2 + (23 \times 0.50)^2 + 2 \times 28 \times 0.50 \times 23 \times 0.50 \times \text{corr}} \\ 15 &= \sqrt{196 + 132.25 + 322 \times \text{corr}} \\ 225 &= 328.25 + 322 \times \text{corr} \\ \text{Correlation coefficient} &= -0.32 \end{aligned}$$



QUESTION 11:

From the following information, ascertain risk of the portfolio:

Security	Standard Deviation	Proportion
P	5%	0.3
Q	12%	0.6
R	6%	0.1

Correlation Co-efficient: PQ = 0.50, PR = -0.40, QR = 0.75

Solution:

write formula

$$\begin{aligned} \text{Risk of the portfolio} &= \sqrt{(5 \times 0.3)^2 + (12 \times 0.6)^2 + (6 \times 0.1)^2} \\ &\quad + 2 \times 5 \times 0.3 \times 12 \times 0.6 \times 0.5 \\ &\quad + 2 \times 5 \times 0.3 \times 6 \times 0.1 \times (-0.4) \\ &\quad + 2 \times 12 \times 0.6 \times 6 \times 0.1 \times 0.75 \\ &= \sqrt{71.01} = 8.43\% \end{aligned}$$



QUESTION 12:

only on calc

An investor has formed a portfolio with three securities- A, B and C. Proportion of investment in these securities is 30-30-40. From the following information, compute portfolio return and risk:

Security	Expected return	Variance	Co-variance
A	15	38.20	AB – 6.87
B	8	6.39	BC – 7.20
C	11	8.45	AC – 4.00

Solution:

Portfolio Return = $15 \times 0.30 + 8 \times 0.30 + 11 \times 0.40 = 11.3\%$

$$\begin{aligned} \text{Portfolio Risk} &= \sqrt{(6.18 \times 0.30)^2 + (2.53 \times 0.30)^2 + (2.91 \times 0.40)^2 +} \\ &\quad 2 \times 0.30 \times 0.30 \times 6.87 + \\ &\quad 2 \times 0.30 \times 0.40 \times 7.20 + \\ &\quad 2 \times 0.40 \times 0.30 \times 4 \\ &= \sqrt{9.29} = 3.05\% \end{aligned}$$



QUESTION 13:

Jill has invested in a portfolio with following details:

Security	Expected return	Standard Deviation	Proportion
Infoedge	12%	10%	70%
Gilt Edged Securities	4%	0%	30%

Calculate the risk and return of the portfolio.

How would position change if Jill has ₹ 1,00,000 to invest and she borrows ₹ 50,000 @ 8% and invest the entire available amount in the shares of Infoedge.

Solution:

Return of Portfolio = $12 \times 0.70 + 4 \times 0.30 = 9.6\%$

$$\begin{aligned} \text{Risk of portfolio} &= \sqrt{(10 \times 0.70)^2 + (0 \times 0.30)^2 + 2 \times 10 \times 0.70 \times 0 \times 0.30} \\ &= \sqrt{49} = 7\% \end{aligned}$$

After the changes proportion:

Infoedge	1,50,000	150%
Borrowing	- 50,000	- 50%
Total	1,00,000	100%

Return of portfolio = $12 \times 1.5 + 8 \times - 0.5 = 14\%$

Portfolio Management

$$\begin{aligned}\text{Risk of portfolio} &= \sqrt{(10 \times 1.5)^2 + (0 \times -0.5)^2 + 2 \times 10 \times 1.5 \times 0 \times -0.5} \\ &= \sqrt{225} = 15\%\end{aligned}$$



QUESTION 14:

M 24 | N 10 | RTP

An investor has decided to invest Rs.1,00,000 in the shares of two companies, namely, ABC and XYZ. The projections of returns from the shares of the two companies along with their probabilities are as follows:

Probability	ABC (%)	XYZ (%)
0.2	12	16
0.25	14	10
0.25	-7	28
0.3	28	-2

You are required to:

- 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.

Solution:

P	X	P × X	d _x	P × d _x ²	Y	P × Y	d _y	P × d _y ²	P × D _x × D _y
20%	12	2.40	-0.55	0.06	16	3.20	3.90	3.04	-0.43
25%	14	3.50	1.45	0.53	10	2.50	-2.10	1.10	-0.76
25%	-7	-1.75	-19.55	95.55	28	7.00	15.90	63.20	-77.71
30%	28	8.40	15.45	71.61	-2	-0.60	-14.10	59.64	-65.35
		12.55		167.75		12.10		126.98	-144.25

- (a) Expected Return of ABC and XYZ:
- ABC = 12.55
- XYZ = 12.10

Risk of ABC and XYZ:

ABC = $\sqrt{167.74} = 12.95$

XYZ = $\sqrt{126.99} = 11.27$

- (b) Return of the portfolio = $12.55 \times 0.50 + 12.1 \times 0.50 = 12.325\%$

Correlation = $\frac{\text{Cov}_{(x,y)}}{\sigma_x \times \sigma_y} = \frac{-144.25}{12.95 \times 11.27} = -0.988$

S.D._P = $\sqrt{(12.95 \times 0.50)^2 + (11.27 \times 0.50)^2 + 2 \times 12.95 \times 0.50 \times 11.27 \times 0.50 \times -0.988}$

= 1.26

Expected return of portfolio is between the E(R_{ABC}) and E(R_{XYZ}) but the risk of the portfolio is lower than SD_{ABC} & SD_{XYZ}

- (c) Minimum Risk portfolio

$W_A = \frac{\text{Var}_B - \text{Cov}_{AB}}{\text{Var}_A + \text{Var}_B - 2 \times \text{Cov}_{AB}}$

$$= \frac{126.99 - (-144.25)}{167.74 + 126.99 - 2 \times -144.25}$$

$$= 0.4651 \text{ or } 46.51\%$$

$$W_B = 1 - 0.4651$$

$$= 0.5349 \text{ or } 53.49\%$$

**QUESTION 15:**

M 23 | M 09

No particular concept in the out notes for this question

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:

	W _A	W _B	W _C
Portfolio X	0.3	0.4	0.3
Portfolio Y	0.2	0.5	0.3

It is supposed that there are no restrictions on short sales.

- What would be the weight for each stock for a portfolio constructed by investing ₹5,000 in portfolio X and ₹3,000 in portfolio Y?
- Suppose the investor invests ₹4,000 out of ₹8,000 in security A. How he will allocate the balance between security B and C to ensure that his portfolio is on minimum variance set?

Solution:

- (a) Weight for each stock in a portfolio

	W _A	W _B	W _C	Total
Portfolio X	1,500 (5,000 × 0.30)	2,000 (5,000 × 0.40)	1,500 (5,000 × 0.30)	5,000
Portfolio Y	600 (3,000 × 0.20)	1,500 (3,000 × 0.50)	900 (3,000 × 0.30)	3,000
	2,100	3,500	2,400	8,000
Stock weights	0.2625	0.4375	0.30	

- (b) ₹4,000 is already invested in security A and Rest of ₹4,000 will be invested in security B & C in the ratio of 43.75:30.

$$\text{Amount invested in B} = 4,000 \times \frac{43.75}{43.75 + 30} = ₹2,373$$

$$\text{Amount invested in C} = 4,000 \times \frac{30}{43.75 + 30} = ₹1,627$$

**QUESTION 16:**

N 02 | M 04 | RTP

concept of efficient frontier.

Following is the data regarding six securities:

	A	B	C	D	E	F
Return (%)	8	8	12	4	9	8
Risk (Standard deviation)	4	5	12	4	5	6

- (i) Assuming three will have to be selected, state which ones will be picked.
- (ii) Assuming perfect correlation, show whether it is preferable to invest 75% in A and 25% in C or to invest 100% in E.

Solution:

- (i) B has more risk and same return as A
∴ B will not be selected
D has same risk and lower return than A
∴ D will not be selected
F has same return higher risk than A
∴ F will not be selected
Securities selected: A, C and E
- (ii) 75% in A and 25% in C
Return = $8 \times 0.75 + 12 \times 0.25 = 9$
Risk = $4 \times 0.75 + 12 \times 0.25 = 6$
Return of above portfolio is same as E but risk is lower in E therefore investing in E is preferable

B. Sharpe Index Model & CAPM



QUESTION 17:

M 22 | M 17 | N 04 | SM | RTP

The following information is available with respect of Jay Kay Ltd.

Year	Jay Kay Ltd.		Market		Return on govt. bonds
	Average share price	Dividend per Share	Average Index	Dividend Yield	
2012	242	20	1812	4%	6
2013	279	25	1950	5%	5
2014	305	30	2258	6%	4
2015	322	35	2220	7%	5

Compute Beta Value of the company as at the end of 2015. ~~What is your observation?~~

Solution:

$$\frac{P_1 - P_0}{P_0} \rightarrow \text{Capital gain yield} \quad \frac{D_1}{P_0} \rightarrow \text{Dividend yield}$$

Possible returns of market (x)

$$2013 : \frac{1950 - 1812}{1812} = 7.62\% + 5\% = 12.62\%$$

$$2014 : \frac{2,258 - 1,950}{1,950} = 15.79\% + 6\% = 21.79\%$$

$$2015 : \frac{2,220 - 2,258}{2,258} = -1.68\% + 7\% = 5.32\%$$

Possible Return of Jay Kay Ltd. (Y)

$$2013 : \frac{25 + 279 - 242}{242} = 25.62\%$$

$$2014 : \frac{30 + 305 - 279}{279} = 20.07\%$$

$$2015 : \frac{35 + 322 - 305}{305} = 17.05\%$$

Computation of beta:

Year	Market (x)	Jay Kay (y)	xy = x × y	x ²
2013	12.62	25.62	323.32	159.26
2014	21.79	20.07	437.33	474.8
2015	5.32	17.05	90.71	28.3
	39.73	62.74	851.36	662.36

$$\bar{x} = \frac{39.73}{3} = 13.24 \quad \bar{y} = \frac{62.74}{3} = 20.91$$

$$\begin{aligned} \text{Beta of the share} &= \frac{\sum xy - n \times \bar{x} \times \bar{y}}{\sum x^2 - n \times \bar{x}^2} \\ &= \frac{851.36 - 3 \times 13.24 \times 20.91}{662.36 - 3 \times 13.24^2} = 0.153 \end{aligned}$$



QUESTION 18:

N 18 | M 06 | RTP

The distribution of return of security 'F' and the market portfolio 'P' is given below:

Probability	Return (%)	
	Security F	Portfolio 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 for the security.

Solution:

Let the Possible return of Market Portfolio P and Security F be X & Y respectively.

Prob. (P)	Portfolio P: (X)	P × X	D _x	P × D _x ²	Security F: (Y)	P × Y	D _y	P × D _x × D _y
0.3	-10	-3.0	-24.0	172.8	30	9	13	-93.6
0.4	20	8.0	6.0	14.4	20	8	3	7.2
0.3	30	9.0	16.0	76.8	0	0	-17	-81.6
		14.0		264.0		17		-168.0

$$\text{Cov}_{(x,y)} = -168.0$$

$$\text{Variance}_{(x)} = 264$$

$$\text{Beta} = \frac{\text{Cov}_{(x,y)}}{\text{Var}_{(x)}} = \frac{-168.0}{264.0} = -0.636$$



QUESTION 19:

only on calcd

Following are the returns of share S and Market (M) for last 6 years:

Years	1	2	3	4	5	6
Return on S (%)	18	9	20	-10	5	12
Return on market portfolio (%)	15	7	16	12	4	-6

- Calculate Covariance & Correlation Co-efficient of returns
- Determine beta coefficient of S
- What is S's total risk?

iv. How much is unsystematic risk?

Solution:

Year	Market (X)	d_x	dx^2	Security S (Y)	d_y	D_y^2	$d_x \otimes d_y$
1	15	7	49	18	9	81	63
2	7	-1	1	9	0	0	0
3	16	8	64	20	11	121	88
4	12	4	16	-10	-19	361	-76
5	4	-4	16	5	-4	16	16
6	-6	-14	196	12	3	9	-42
	48		342	54		588	49

$$(i) \quad \bar{x} = \frac{48}{6} = 8 \quad \bar{y} = \frac{54}{6} = 9$$

$$\sigma_x^2 = \frac{342}{6} = 57 \quad \sigma_y^2 = \frac{588}{6} = 98$$

$$\sigma_x = \sqrt{57} = 7.55 \quad \sigma_y = \sqrt{98} = 9.90$$

$$\text{Covariance} = \frac{49}{6} = 8.17$$

$$\text{Correlation} = \frac{\text{Cov}_{(x,y)}}{\sigma_x \times \sigma_y}$$

$$= \frac{8.17}{7.55 \times 9.90} = 0.109$$

$$(ii) \quad \text{Beta of the security} = r_{(s,m)} \times \frac{\sigma_s}{\sigma_m}$$

$$= 0.109 \times \frac{9.9}{7.55} = 0.143 \quad \text{Himed -}$$

$$(iii) \quad \text{Total Variance (} \sigma_A^2 \text{)} = 98 \quad \text{✓.}^2$$

$$\text{S.D. (} \sigma_x \text{)} = 9.9 \quad \text{✓.}$$

$$(iv) \quad \text{Unsystematic Risk}$$

$$\text{Systematic Variance} = \beta_A^2 \times \sigma_m^2$$

$$= (0.143)^2 \times 57$$

$$= 1.17 \quad \text{✓.}^2$$

$$\text{Unsystematic Variance} = \text{Total Variance} - \text{System Variance}$$

$$= 98 - 1.17 = 96.83 \quad \text{✓.}^2$$

$$\text{Unsystematic S.D.} = \sqrt{96.83} = 9.84 \quad \text{✓.}$$



QUESTION 20:

N 22 | M 21 | M 08 | RTP

M/s. Siri Ltd has a surplus amount of ₹ 3 Crores to invest and has shortlisted the following equity shares.

Company	Beta
S	1.6
K	1.0
P	-0.3
D	2.0
C	0.6

Required:

1. If m/s. Siri Ltd. invests an equal amount in all securities, what is the beta of the portfolio?
2. 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?
3. 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? *→ R_f is missing.*
4. 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:
 - a) Bull phase: Expected market returns = 10%
 - b) Bear phase: Expected market returns = -5%

Solution:

Self-note: R_f is missing in the question. Therefore, solution has been done ignoring R_f .

- (i) Beta of the portfolio = $1.6 \times 20\% + 1 \times 20\% + -0.3 \times 20\% + 2 \times 20\% + 0.6 \times 20\%$
= 0.98
- (ii) Beta of the portfolio = $1.6 \times 15\% + 1 \times 30\% + -0.3 \times 15\% + 2 \times 30\% + 0.6 \times 10\%$
= 1.155
- (iii) Case (i) = $0.98 \times 12\%$ = 11.76%
Case (ii) = $1.155 \times 12\%$ = 13.86%
- (iv) Right mix of securities & expected return:
 - a) Bull phase:

Securities to invest in:	Weights	Beta
S Ltd	20%	1.6
K Ltd	20%	1
D Ltd	60%	2

$$\begin{aligned} \text{Beta of the portfolio} &= 1.6 \times 20\% + 1 \times 20\% + 2 \times 60\% \\ &= 1.72 \text{ times} \end{aligned}$$

$$\text{Expected return} = 1.72 \times 10\% = 17.2\%$$

b) Bear phase:

Securities to invest in:	Weights	Beta
K Ltd	20%	1
P Ltd	60%	- 0.3
C Ltd	20%	0.6

$$\begin{aligned}\text{Beta of the portfolio} &= 1 \times 20\% + (-0.3) \times 60\% + 0.6 \times 20\% \\ &= 0.14 \text{ times}\end{aligned}$$

$$\text{Expected return} = 0.14 \times -5\% = -0.7\%$$

**QUESTION 21:**

MTP M 23

On the basis of given information, Mr. XLY want to create a portfolio equally as risky as the market and is having ₹ 20,00,000 to invest.

Assets	Investment	Beta
Stock A	₹ 4,00,000	0.70
Stock B	₹ 5,00,000	1.10
Stock C	?	1.60
Debentures	?	0

$$\text{i.e. } \beta_p = \beta_m = 1.$$

How do you recommend and interpret the risk scenario and investment in all the securities?

Solution:

$$W_A = 4,00,000 \div 20,00,000 = 0.20$$

$$W_B = 5,00,000 \div 20,00,000 = 0.25$$

Since, portfolio should be as risky as that of the market.

Therefore, Beta of the portfolio = 1

Hence,

$$W_A (0.7) + W_B (1.1) + W_C (1.6) + W_D (0) = 1$$

$$0.2 \times 0.7 + 0.25 \times 1.1 + 1.6W_C + W_D \times 0 = 1$$

$$0.14 + 0.275 + 1.6W_C + 0 = 1$$

$$W_C = 0.3656$$

$$\begin{aligned}\text{Amount of investment in C} &= 20,00,000 \times 0.3656 \\ &= 7,31,200\end{aligned}$$

$$\begin{aligned}W_D &= 1 - W_A - W_B - W_C \\ &= 1 - 0.2 - 0.25 - 0.3656 \\ &= 0.1844\end{aligned}$$

$$\begin{aligned}\text{Amount of investment in D} &= 20,00,000 \times 0.1844 \\ &= 3,68,800\end{aligned}$$



QUESTION 22:

M 19

Following are the details of a portfolio consisting of 3 shares:

Shares	Portfolio Weight	Beta	Expected Return (%)	Total Variance
X Ltd.	0.3	0.50	15	0.020
Y Ltd.	0.5	0.60	16	0.010
Z Ltd.	0.2	1.20	20	0.120

Standard Deviation of Market Portfolio Return = 12%

You are required to calculate the following:

- The Portfolio Beta.
- Residual Variance of each of the three shares.
- Portfolio Variance using Sharpe Index Model.

Solution:

(i) Portfolio Beta = $0.30 \times 0.50 + 0.50 \times 0.60 + 0.20 \times 1.20 = 0.69$

(ii) Total Variance X: $\sigma_x^2 = 0.020$

Y: $\sigma_y^2 = 0.010$

Z: $\sigma_z^2 = 0.120$

Systematic Variance = $\beta^2 \times \sigma_m^2$

X Ltd. = $(0.50)^2 \times (.12)^2 = 0.003600$

Y Ltd. = $(0.60)^2 \times (.12)^2 = 0.005184$

Z Ltd. = $(1.20)^2 \times (.12)^2 = 0.020736$

Unsystematic Variance = Total Variance – Systematic Variance

X Ltd. = $0.020 - 0.003600 = 0.016400$

Y Ltd. = $0.010 - 0.005184 = 0.004816$

Z Ltd. = $0.120 - 0.020736 = 0.099264$

- (iii) Portfolio Variance using Sharpe Index Model

$$\begin{aligned} \text{Unsystematic variance} &= \sigma_{EA}^2 \times w_A^2 + \sigma_{EB}^2 \times w_B^2 + \sigma_{EC}^2 \times w_C^2 \\ &= 0.016400 \times (0.30)^2 + 0.004816 \times (0.50)^2 + 0.099264 \times (0.20)^2 \\ &= 0.006651 \end{aligned}$$

Systematic Variance = $(0.12)^2 \times (0.69)^2 = 0.006856$

Total Variance = $0.006856 + 0.006651$
 $= 0.013507$



QUESTION 23:

N 19

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:

- The standard deviation of expected returns of A and B.
- 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 expected return, standard deviation of expected return of the portfolio?

Solution:

- Standard deviation of expected returns of A and B

Particulars	A	B
Systematic Var ($\sigma_m^2 \times \beta_A^2$)	$(25)^2 \times (0.8)^2 = 400$	$(25)^2 \times (1.2)^2 = 900$
Unsystematic Var. (σ_{EA}^2)	$(35)^2 = 1225$	$(45)^2 = 2025$
Total Variance	1,625	2,925
Standard Deviation	$\sqrt{1,625} = 40.31$	$\sqrt{2,925} = 54.08$

- Expected Return of portfolio = $E(R_A) \times W_A + E(R_B) \times W_B + E(R_{TB}) \times W_{TB}$
 $= 14 \times 0.25 + 18 \times 0.40 + 6 \times 0.35$
 $= 12.8\%$

Calculation of Standard Deviation:

$$\text{Beta of the portfolio } (\beta_p) = 0.8 \times 0.25 + 1.2 \times 0.40 + 0 \times 0.35$$

$$= 0.68$$

$$\text{Systematic variance of PF} = \sigma_m^2 \times \beta_p^2$$

$$= (25)^2 \times (0.68)^2$$

$$= 289$$

$$\text{Unsystematic Variance of PF} = \sigma_{EA}^2 \times W_A^2 + \sigma_{EB}^2 \times W_B^2 + \sigma_{ERF}^2 \times W_{ERF}^2$$

$$= (35)^2 \times (0.25)^2 + (45)^2 \times (0.40)^2 + 0$$

$$= 400.56$$

$$\text{Total variance of the PF} = 400.56 + 289$$

$$= 689.56$$

$$\text{Total S.D. of the PF} = \sqrt{689.56} = 26.26$$



QUESTION 24:

N 21 MTP | N.20 | M 15 | RTP

Following are the details of a portfolio consisting of three shares:

Share	Portfolio Weight	Beta	Expected Return (%)	Total variance
D	0.2	0.4	14	0.015
E	0.5	0.5	15	0.025
F	0.3	1.1	21	0.100

Standard Deviation of Market Portfolio Returns = 10%

You are given the following additional data:

Covariance (D, E) = 0.030

Covariance (D, F) = 0.020

Covariance (E, F) = 0.040

Calculate the Portfolio variance considering:

a. Correlation between each pair of securities.

Or

~~Portfolio variance~~ using of modern portfolio theory given by Markowitz

b. Co-movement between securities due to change in the market index.

Or

~~Portfolio variance~~ on the basis of Sharpe Index Model

Solution:

$$\begin{aligned}
 \text{(a) Portfolio Variance} &= (\sigma_D W_D)^2 + (\sigma_E W_E)^2 + (\sigma_F W_F)^2 + 2 \times W_D \times W_E \times \text{Cov}_{DE} \\
 &\quad + 2 \times W_E \times W_F \times \text{Cov}_{EF} + 2 \times W_F \times W_D \times \text{Cov}_{FD} \\
 &= 0.015 \times (0.2)^2 + 0.025 \times (0.5)^2 + 0.10 \times (0.3)^2 + 2 \times 0.2 \times 0.5 \times 0.03 \\
 &\quad + 2 \times 0.5 \times 0.3 \times 0.04 + 2 \times 0.3 \times 0.2 \times 0.02 \\
 &= 0.03625
 \end{aligned}$$

$$\text{(b) Systematic Variance of security} = \sigma_m^2 \times \beta_s^2$$

$$A = (10)^2 \times (0.40)^2 = 0.0016$$

$$B = (10)^2 \times (0.50)^2 = 0.0025$$

$$C = (10)^2 \times (1.1)^2 = 0.0121$$

Unsystematic Variance of the security = Total Variance - Systematic Variance

$$A = 0.015 - 0.0016 = 0.0134$$

$$B = 0.025 - 0.0025 = 0.0225$$

$$C = 0.10 - 0.0121 = 0.0879$$

$$\text{Portfolio Beta} = 0.20 \times 0.40 + 0.50 \times 0.50 + 0.30 \times 1.10$$

$$= 0.66$$

$$\text{Systematic Risk of PF} = \beta_p^2 \times \sigma_m^2$$

$$= (0.66)^2 \times (0.10)^2 = 0.004356$$

$$\text{Unsystematic Risk of PF} = \sigma_{EA}^2 \times w_A^2 + \sigma_{EB}^2 \times w_B^2 + \sigma_{EC}^2 \times w_C^2$$

Total Variance of PF

$$\begin{aligned}
 &= 0.0134 \times (0.20)^2 + 0.0225 \times (0.50)^2 + 0.0879 \times (0.30)^2 \\
 &= 0.014072 \\
 &= \text{Systematic Variance} + \text{Unsystematic Variance} \\
 &= 0.004356 + 0.014072 \\
 &= 0.018428
 \end{aligned}$$

**QUESTION 25:**

SM | RTP

only on excel

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 among these stocks?

	X	Y	SENSEX
Average Return	0.15	0.25	0.06
Variance of return	6.30	5.86	2.25
β	0.71	0.685	
Correlation Co-efficient	0.424 <i>(x,m)</i>		
Co-efficient of determination (r^2)	0.18 <i>(x,m)</i>		

Solution:

	X	Y
Total Variance (σ_A^2) [A]	6.30%	5.86%
Systematic Variance ($\sigma_m^2 \times \beta_A^2$) [B]	$2.25 \times (0.71)^2 = 1.13\%$	$2.25 \times (0.685)^2 = 1.06\%$
Systematic SD ($\sqrt{\text{Sys. var.}}$)	$\sqrt{1.13} = 1.06\%$	$\sqrt{1.06} = 1.03\%$
Unsystematic Variance [A - B]	5.17	4.80
Unsystematic S.D. ($\sqrt{\text{Unsys. var.}}$)	$\sqrt{5.17} = 2.27$	$\sqrt{4.80} = 2.19$

Portfolio Risk

$$\begin{aligned}
 \text{Beta of Portfolio} &= 0.71 \times 0.50 + 0.685 \times 0.50 \\
 &= 0.698
 \end{aligned}$$

$$\begin{aligned}
 \text{Systematic Variance } PF &= \beta_p^2 \times \sigma_m^2 \\
 &= (0.698)^2 \times 2.25 \\
 &= 1.096
 \end{aligned}$$

$$\begin{aligned}
 \text{Unsystematic Variance} &= \overset{5.17}{\cancel{(2.27)^2}} \times (0.50)^2 + \overset{4.8}{\cancel{(2.19)^2}} \times (0.50)^2 \\
 &= 2.493\%
 \end{aligned}$$

$$\begin{aligned}
 \text{Total Variance} &= \text{Systematic Variance} + \text{Unsystematic Variance} \\
 &= 2.492 + 1.096 = 3.588
 \end{aligned}$$

$$\text{Total S.D.} = \sqrt{3.588} = 1.89$$



QUESTION 26:

M 12 | RTP

A has portfolio having following features:

Security	β	Random Error (σ_e)	Weight
L	1.6	7	0.25
M	1.15	11	0.30
N	1.4	3	0.25
K	1.0	9	0.20

You are required to find out the risk of the portfolio if the standard deviation of the market index is 18%.

Solution:

Portfolio Beta = $1.6 \times 0.25 + 1.15 \times 0.30 + 1.4 \times 0.25 + 1.0 \times 0.20 = 1.295$ *find*

Systematic Variance *PF* = $\beta_P^2 \times \sigma_m^2$
 $= (1.295)^2 \times (18)^2$
 $= 543.36$ *1.2*

Unsystematic Variance *PF* = $\sigma_{EL}^2 \times W_L^2 + \sigma_{EM}^2 \times W_M^2 + \sigma_{EN}^2 \times W_N^2 + \sigma_{EK}^2 \times W_K^2$
 $= (7 \times 0.25)^2 + (11 \times 0.30)^2 + (3 \times 0.25)^2 + (9 \times 0.20)^2$
 $= 17.76$ *1.2*

Total Variance = $543.36 + 17.76$
 $= 561.12$

Total S.D. = $\sqrt{561.12}$
 $= 23.69\%$



QUESTION 27:

N 09 | RTP

A study by a Mutual fund has revealed the following data in respect of three securities:

Security	σ (%)	Correlation with Index, P_m
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 are the covariances among the various stocks? *covariance as per Sharpe's Index model.*
- 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 (iv)?

Solution:

$$\begin{aligned}
 \text{(i)} \quad \beta_s &= r_{(s,m)} \times \frac{\sigma_s}{\sigma_m} \\
 \beta_A &= 0.60 \times \frac{0.20}{0.15} = 0.8 \\
 \beta_B &= 0.95 \times \frac{0.18}{0.15} = 1.14 \\
 \beta_C &= 0.75 \times \frac{0.12}{0.15} = 0.6
 \end{aligned}$$

$$\begin{aligned}
 \text{(ii)} \quad r_{(A,B)} &= r_{(A,m)} \times r_{(B,m)} \\
 r_{(A,B)} &= \frac{\text{Cov}_{(A,B)}}{\sigma_A \times \sigma_B}
 \end{aligned}$$

$$\text{Hence, } r_{(A,m)} \times r_{(B,m)} = \frac{\text{Cov}_{(A,B)}}{\sigma_A \times \sigma_B}$$

$$\begin{aligned}
 \text{For Cov}_{(A,B)}: \quad 0.60 \times 0.95 &= \frac{\text{Cov}_{(A,B)}}{20 \times 18} \\
 \text{Cov}_{AB} &= 205.2
 \end{aligned}$$

$$\begin{aligned}
 \text{For Cov}_{(B,C)}: \quad 0.95 \times 0.75 &= \frac{\text{Cov}_{(B,C)}}{18 \times 12} \\
 \text{Cov}_{BC} &= 153.9
 \end{aligned}$$

$$\begin{aligned}
 \text{For Cov}_{(A,C)}: \quad 0.60 \times 0.75 &= \frac{\text{Cov}_{(A,C)}}{20 \times 12} \\
 \text{Cov}_{AC} &= 108
 \end{aligned}$$

(iii) Risk of the portfolio:

$$\begin{aligned}
 \text{Variance} &= (\sigma_A W_A)^2 + (\sigma_B W_B)^2 + (\sigma_C W_C)^2 + 2 \times W_A \times W_B \times \text{Cov}_{AB} \\
 &\quad + 2 \times W_B \times W_C \times \text{Cov}_{BC} + 2 \times W_C \times W_A \times \text{Cov}_{CA} \\
 &= (20 \times (1/3))^2 + (18 \times (1/3))^2 + (12 \times (1/3))^2 \\
 &\quad + 2 \times (1/3) \times (1/3) \times 205.2 \\
 &\quad + 2 \times (1/3) \times (1/3) \times 153.9 \\
 &\quad + 2 \times (1/3) \times (1/3) \times 108 \\
 &= 200.24
 \end{aligned}$$

$$\text{S.D.} = \sqrt{200.24} = 14.15$$

$$\text{(iv) Beta of the portfolio} = \frac{0.80 + 1.14 + 0.6}{3} = 0.847$$

$$\text{(v) Total Variance} = 200.24$$

$$\begin{aligned}
 \text{Systematic Variance} &= \beta_p^2 \times \sigma_m^2 \\
 &= (0.847)^2 \times (15)^2 \\
 &= 161.42
 \end{aligned}$$

Portfolio Management

$$\text{Systematic S.D.} = \sqrt{161.42} = 12.705$$

$$\text{Unsystematic Variance} = \text{Total Variance} - \text{System Variance}$$

$$= 200.24 - 161.42$$

$$= 38.82$$

$$\text{Unsystematic S.D.} = 6.23$$



QUESTION 28:

N 16 | M 09 | SM | RTP

The rates of return on the security of Company X and market portfolio for 10 periods are given below:

Period	Return of Security 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?

Solution:

- (a) Beta of Security X

Period	Market (X)	Security X (Y)	XY	X ²
1	22	20	440	484
2	20	22	440	400
3	18	25	450	324
4	16	21	336	256
5	20	18	360	400
6	8	-5	-40	64
7	-6	17	-102	36
8	5	19	95	25
9	6	-7	-42	36
10	11	20	220	121
	120	150	2,157	2,146

$$\bar{X} = \frac{120}{10} = 12$$

$$\bar{Y} = \frac{150}{10} = 15$$

$$\begin{aligned}\text{Beta of the security} &= \frac{\sum xy - n\bar{x}\bar{y}}{\sum x^2 - n\bar{x}^2} = \frac{2,157 - 10 \times 12 \times 15}{2,146 - 10 \times (12)^2} \\ &= \frac{357}{706} = 0.506\end{aligned}$$

(ii) Characteristic line =

$$R_A = \alpha + \beta_A \times R_m$$

$$\bar{y} = \alpha + \beta_A \times \bar{x}$$

$$15 = 0.506 \times 12 + \alpha$$

$$8.928 = \alpha$$

Equation of Characteristics Line for Security X: $R_A = 0.506 \times R_m + 8.928$



QUESTION 29:

RTP M 10

Consider the following information relating to Stock A and the market for the last five years:

Year	Stock A (%)	Return on Market (%)
2005	29	-10
2006	31	24
2007	10	11
2008	6	-8
2009	-7	3

- (a) Determine the regression equation for the return from the stock and the market and calculate the alpha (α) and beta (β) *CL eqn*
- (b) The total variance of the return from the stock A and the components of variance that are explained by the market index and not explained by the market index.

Solution: *→ sys → unsys.*

(a) Calculation of Alpha & Beta

Year	Market (x)	dx	dx ²	Stock A (y)	dy	dx ²	dx dy
2005	-10	-14	196	29	15.2	231.04	(212.8)
2006	24	20	400	31	17.2	295.84	344
2007	11	7	49	10	(3.8)	14.44	(26.6)
2008	-8	-12	14	6	(7.8)	60.84	93.6
2009	3	-1	1	-7	(20.8)	432.64	20.8
	$\Sigma(x) = 20$		790	$\Sigma(y) = 69$		1034.8	219

$$\bar{x} = \frac{20}{5} = 4$$

$$\bar{y} = \frac{69}{5} = 13.8$$

$$\text{Var}_x = \frac{790}{5} = 158$$

$$\text{Var}_y = \frac{1034.8}{5} = 206.96$$

$$\text{S.D.}_x = \sqrt{158} = 12.57$$

$$\text{S.D.}_y = \sqrt{206.98} = 14.39$$

$$\text{Cov}_{(x,y)} = \frac{219}{5} = 43.8$$

$$r_{(x,y)} = \frac{\text{Cov}_{(x,y)}}{\sigma_x \times \sigma_y} = \frac{43.8}{12.57 \times 14.39} = 0.242$$

$$\beta = r_{(s,m)} \times \frac{\sigma_s}{\sigma_m} = 0.242 \times \frac{14.39}{12.57} = 0.277$$

Calculation of Alpha:

$$R_A = \beta \times R_m + \alpha$$

$$\bar{Y} = \alpha + \beta_A \times \bar{X}$$

$$13.8 = \alpha + 0.277 \times 4$$

$$12.692 = \alpha$$

Equation of regression for return from stock & market: $R_A = 12.692 + 0.277 R_m$

- (b) Total variance = 206.96
 Coefficient of determination (r^2) = $(0.242)^2$
 $= 0.0586$
 Variance Explained by market = $\sigma_A^2 \times r^2$
 $= 206.96 \times 0.0586 = 12.13 \%$
 Unsystematic variance = $\sigma_A^2 \times (1 - r^2)$
 Not explained by market = $206.96 \times (1 - 0.0586)$
 $= 194.83 \%$



QUESTION 30:

N 09 | RTP

An investor holds two stocks A and B. An analyst prepared ex-ante probability distribution for the possible economic scenarios and the conditional returns for two stocks and the market index as shown below:

Economic scenario	Probability	Conditional Returns %		
		A	B	Market
Growth	0.4	25	20	18
Stagnation	0.3	10	15	13
Recession	0.3	-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. CAPM assumptions are holding true.

Solution:

- Expected Return on A = $25 \times 0.40 + 10 \times 0.30 + (-5) \times 0.30 = 11.5\%$
 Expected Return on B = $20 \times 0.40 + 15 \times 0.30 + (-3) \times 0.30 = 10.1\%$

Expected Return on Market Index = $18 \times 0.40 + 13 \times 0.30 + (-3) \times 0.30 = 10.2\%$

Calculating Required rate of return (R_j) as per CAPM for Security A

Prob.	Market (x)	$P \cdot X$	D_x	$P \cdot d_x^2$	Security A (y)	$P \cdot Y$	D_y	$Pd \cdot dy$
0.4	18	7.2	7.8	24.336	25	10	13.5	42.12
0.3	13	3.9	2.8	2.352	10	3	-1.5	-1.26
0.3	-3	-0.9	-13.2	52.272	-5	-1.5	-16.5	65.34
		10.2		78.96		11.5		106.2

$$\text{Beta} = \frac{\text{Cov}(x,y)}{\text{Var}(x)}$$

$$= \frac{106.2}{78.96} = 1.345$$

$$R(j) \text{ on stock A} = 11 + 1.345 \times (10.2 - 11)$$

$$= 9.924\%$$

Calculating Required rate of return as per CAPM for Security B

Economic Scenario	Prob	M(x)	B(y)	$P_y y$	dg	$Pdxdy$
Growth	0.40	18	20	8	9.9	30.888
Stag	0.30	13	15	4.5	4.9	4.116
Recession	0.30	-3	-8	(2.4)	(18.1)	71.676
				$\bar{y} = 10.1$		106.68

$$\text{Beta} = \frac{\text{Cov}(x,y)}{\text{Var}(x)}$$

$$= \frac{106.68}{78.96} = 1.351$$

$$R(j) \text{ on stock B} = 11 + 1.351 \times (10.2 - 11)$$

$$= 9.92\%$$

Conclusion:

Stock A: $E(r) (11.5\%) > R(j) (9.924\%)$
Make fresh investments.

Stock B: $E(r) (11.1\%) > R(j) (9.92\%)$
Make fresh investments



QUESTION 31:

N 24 | SM

Following is the data regarding Three Securities.

Stock	Expected Return (%)	Std. deviation	Correlation with the Market return
A	19%	2.50	0.840

Portfolio Management

B	13.50%	2.00	0.540
C	11.00%	0.80	0.975
Market risk	-	1.20	-
Market rate of return	14.00%	-	-
Risk free rate	9.00%	-	-

- (i) Advise which of the above stocks are over, under or correctly valued in the market?
(ii) What will be strategy you would like to recommend?

Solution:

Stock	$\beta = r_{(s,m)} \times \frac{\sigma_s}{\sigma_m}$	$R(j) = R_f + \beta (R_m - R_f)$	E(R)	Valuation	Strategy
A	$0.840 \times \frac{2.5}{1.2} = 1.75 \text{ times}$	$9 + 1.75 (14 - 9) = 17.75\%$	19%	Under Value	Buy
B	$0.540 \times \frac{2.0}{1.2} = 0.9 \text{ times}$	$9 + 0.9 (14 - 9) = 13.5\%$	13.50%	Correctly Valued	Hold
C	$0.975 \times \frac{0.8}{1.2} = 0.65 \text{ times}$	$9 + 0.65 (14 - 9) = 12.25\%$	11.00%	Over Valued	Sell



QUESTION 32:

SM

only on

Pearl Ltd. expects that considering the current market prices, the equity shareholders should get a return of at least 15.50% while the current return on the market is 12%. RBI has closed the latest auction for ₹ 2500 crores of 182 day bills for the lowest bid of 4.3% although there were bidders at a higher rate of 4.6% also for lots of less than ₹ 10 crores. What is Pearl Ltd's Beta?

Solution:

$$E(R) = 15.50\%$$

$$\text{Average } R_f = \left(\frac{4.3 + 4.6}{2} \right) = 4.45\%$$

$$15.5\% = 4.45 + \beta \times (12 - 4.45)$$

$$11.05 = 7.55 \beta$$

$$1.464 = \beta$$



QUESTION 33:

M 16 | M 03

Abinash is holding 5,000 shares of Future Group Limited. Presently the rate of dividend being paid by the company is ₹ 5 per share and the share is being sold at ₹ 50 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	12.5%	10%
Market risk premium	6%	4.8%
Beta value	1.5	1.25
Expected growth rate	5%	8%

In view of the above factors whether Abinash should buy, hold or sell the shares? Narrate the reason for the decision to be taken.

Solution:

Particulars	Existing	Revised
Calculation of K_e $= R_f + \beta (R_m - R_f)$	21.5% [12.5 + 1.5(6)]	16% [10 + 1.25 (4.8)]
Intrinsic value $= \frac{D_0(1+g)}{K_e - g}$	$\frac{5(1+0.05)}{0.215 - 0.05}$ 31.82	$\frac{50(1+0.08)}{0.16 - 0.08}$ 67.5

Based on existing factors, fair value of the share is ₹ 31.82. Share is overvalued since actual price (₹ 50) > fair price (₹ 31.82). Hence, we will sell the share.

However, based revised factors, fair value of the share is ₹ 67.5, share is undervalued, since actual price (₹ 50) < fair price (₹ 67.5). Hence, we will buy the share



QUESTION 34:

M 24 | N 14

An investor is holding 5,000 shares of X Ltd. Current year dividend rate is ₹ 3/ share. Market price of the share is ₹ 40 each. The investor is concerned about several factors which are likely to change during the next financial year as indicated below:

	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.

Solution:

	Current Year	Next Year
CAPM (K_e) = $R_f + \beta(R_m - R_f)$	18.5% [12 + 1.3 × (5)]	15.6% [10 + 1.4 × (4)]

Portfolio Management

$IV = \frac{D_1}{K_e - g}$	$\frac{3 \times (1.09)}{0.185 - 0.09} = 34.42$	$\frac{2.5 \times (1.07)}{0.156 - 0.07} = 31.10$
Advice:	Since MPS (₹ 40) > IV (₹ 34.42) ∴ company should sell since overvalued	Since MPS (₹ 40) > IV (₹ 31.10) ∴ company should sell since overvalued



QUESTION 35:

RTP M 22

only on calc

Mr. A is having 1 lakh shares of K Ltd. The beta of the company is 1.40.

Mr. B a financial advisor has suggested having the following portfolio:

Security	Beta	% Holding
L	1.20	10
M	0.75	10
N	0.40	30
O	1.40	50
		100

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 is giving a negative return of 2.5%.
- If the probability of market giving negative return is more, please advise Mr. A whether to continue the holdings of M/s. K Ltd. or to buy the portfolio as per the suggestion of Mr. B. If so, why?

Solution:

- As per CAPM, $R_j = R_f + \beta (R_m - R_f)$

In the present scenario:

For present investment (K Ltd):

$$R_j = 8 + 1.4 (12 - 8) = 13.6$$

For suggested portfolio:

$$\text{Beta: } = 1.2 \times 0.1 + 0.75 \times 0.1 + 0.4 \times 0.3 + 1.4 \times 0.5 = 1.015$$

$$R_j = 8 + 1.015 (12 - 8) = 12.06$$

- If market goes up by 2.5%:

$$\text{Present Investment: } R_j = 8 + 1.4 (14.5 - 8) = 17.1$$

$$\text{Suggested Portfolio: } R_j = 8 + 1.015 (14.5 - 8) = 14.60$$

- If market goes down by 2.5%:

$$\text{Present Investment: } R_j = 8 + 1.4 (9.5 - 8) = 10.1$$

$$\text{Suggested Portfolio: } R_j = 8 + 1.015 (9.5 - 8) = 9.52$$

(c) If market is giving a negative return of 2.5%:

$$\text{Present Investment: } R_j = 8 + 1.4 (-2.5 - 8) = -6.7$$

$$\text{Suggested Portfolio: } R_j = 8 + 1.015 (-2.5 - 8) = -2.66$$

(ii) If the probability of market giving negative return is more, it is advisable to Mr. A to buy the portfolio suggested by Mr. B because Beta of the portfolio is less than of K Ltd.



QUESTION 36:

N 21 | RTP N 15

only on calc

Two companies A Ltd. and B Ltd. paid a Dividend of Rs. 3.50 per share. Both are anticipating that Dividend shall grow @ 8%. The Beta of A Ltd. and B Ltd are 0.95 and 1.42 respectively. The Yield on GOI Bond is 7% and it is expected that Stock Market Index shall increase at an annual rate of 13%. You are required to determine-

- Value of Share of both companies.
- Why there is a difference in the value of shares of the two companies.
- If current Market Price of Share of A Ltd. and B Ltd. are Rs. 74 and Rs. 55 respectively, write down your comment on the basis on valuation.
- As an Investor what course of action should be followed?

Solution:

(a) Value of share of both the companies:

Particulars	A Ltd	B Ltd
Calculation of K_e	12.7%	15.52%
$R_f + \beta (R_m - R_f)$	$[7 + 0.95 (13 - 7)]$	$[7 + 1.42 (13 - 7)]$
Intrinsic value		
$\frac{D_0 (1 + g)}{K_e - g}$	$\frac{3.5 (1.08)}{0.127 - 0.8} = 80.43$	$\frac{3.5 (1.08)}{0.1552 - 0.8} = 50.27$

- The valuation of share of B Ltd. is higher because if systematic risk is higher though both have same growth rate.
- The price of share of A Ltd. is ₹74, the share is undervalued and price of share of B Ltd. is ₹55, it is overvalued
- Since share A is undervalued and it should be bought. Since share B Ltd overvalued and should not be bought.



QUESTION 37:

SM | RTP

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. a beta of 1.24. The correlation coefficient 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 investing in A Ltd.?
- If you invest 30% in B Ltd. and 70% in A Ltd., what is your expected rate of return and portfolio Standard deviation?
- What is the market portfolios expected rate of return and how much is the risk-free rate?

Whenever a particular thing (asked in the question) is not directly calculable because of data given in question, then think of reverse calculation. For example, think where are R_f and R_m are being used and accordingly using CAPM back calculate them.

When two variables are missing in a equation, then there has to be two equations to solve it

Portfolio Management

(iv) What is the beta of Portfolio if A Ltd.'s weight is 70% and B Ltd.'s weight is 30%?

Solution:

(i) Yes, investing in B Ltd is better than investing in A Ltd. as B Ltd. Has more return and less risk as compared to A Ltd. However, investing in both will yield diversification advantage.

(ii) $E(R_p) = 22 \times 0.70 + 24 \times 0.30 = 22.6\%$

$$S.D = \sqrt{(0.40 \times 0.70)^2 (0.38 \times 0.30)^2 + 2 \times 0.40 \times 0.70 \times 0.38 \times 0.30 \times 0.72}$$

$$= 0.3706 \text{ or } 37.06\%$$

(iii) $22\% = R_f + 0.86 (R_m - R_f) \quad \text{--- (1)}$

$24\% = R_f + 1.24 (R_m - R_f) \quad \text{--- (2)}$

$\text{---} \quad \text{---} \quad \text{---}$

$-2 = 0.86 (R_m - R_f) - 1.24 (R_m - R_f)$

$-2 = -0.38 (R_m - R_f)$

$+ 5.26 = R_m - R_f$

Putting the value of $(R_m - R_f)$ in equation 1 above.

$22 = R_f + 0.86 (5.26)$

$17.48\% = R_f$

$22.74\% = R_m$

(iv) $\beta_p = 0.86 \times 0.70 + 1.24 \times 0.30$

$= 0.974$



QUESTION 38:

N 12 | RTP

only on call

Mr. FedUp wants to invest an amount of ₹ 520 lakhs and had approached his Portfolio Manager. The Portfolio Manager had advised Mr. FedUp to invest in the following manner:

Security	Moderate	Better	Good	Very Good	Best
Amount (in Lakhs)	60	80	100	120	160
Beta	0.50	1.00	0.80	1.20	1.50

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 Securities are at 8% and the NIFTY is yielding 10%.
- Advisability of replacing Security 'Better' with NIFTY.

Solution:

(i)

Security	(APM = $R_f + \beta(R_m - R_f)$)	Beta
Moderate	9% $8 + 0.50 (10 - 8)$	$9 \times 60/520$
Better	10% $8 + 1 (10 - 8)$	$10 \times 80/520$
Good	9.6% $8 + 0.80 (10 - 8)$	$9.6 \times 100/520$
Very G	10.4%	$10.4 \times 120/520$

	$8 + 1.20 (10 - 8)$	
Best	11%	$11 \times 160/520$
	$8 + 1.50 (10 - 8)$	
		10.208%

- (ii) When security 'Better' is replaced with nifty, the answer would be the same because the beta of market is 1 and beta of better is also 1.

**QUESTION 39:**

N 16 | RTP

Investor's Weekly, a news magazine on the happenings at Dalal Street, publishes the following data in its July edition for Security A:

Equilibrium Return → Return as per CAPM.

Market Return

6% Treasury Bills are traded at

Covariance of the security with Market Portfolio

Coefficient of Correlation

Determine Market Risk (σ of Market Portfolio) and Security Risk.

12%

12%

₹120

196%

0.80

Point of
lossing.

Solution:

$$R_f = \frac{100 \times 6\%}{120} = 5\%$$

Using CAPM, calculating beta:

$$R(j) = R_f + \beta (R_m - R_f)$$

$$12 = 5 + \beta (12 - 5)$$

$$12 - 5 = 7 \beta$$

$$1 = \beta$$

Using beta, calculating Variance_(m):

$$\beta = \frac{\text{covariance}}{\text{var}_m}$$

$$1 = \frac{196\%}{\text{var}_m}$$

$$\text{Var}_{(m)} = 196$$

$$\sigma_m = 14\%$$

Using beta & σ_m , calculating σ_s :

$$1 = 0.80 \times \frac{\sigma_s}{14}$$

$$\sigma_s = 17.5\%$$



QUESTION 40:

RTP M 12 | SM

Assuming that shares of ABC Ltd. and XYZ Ltd. 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	1.2	19.80%
XYZ	0.9	17.10%

You are required to derive Security Market Line.

Solution:

Equation of expected return using CAPM:

$$\text{ABC: } 19.80\% = R_f + 1.2 (R_m - R_f) \quad \text{--- (1)}$$

$$\text{XYZ: } 17.10\% = R_f + 0.9 (R_m - R_f) \quad \text{--- (2)}$$

Deducting equation (1) from (2)

$$19.80 = R_f + 1.2 (R_m - R_f)$$

$$17.10 = R_f + 0.9 (R_m - R_f)$$

$$\text{---} \quad \text{---} \quad \text{---}$$

$$2.70 = 0.30 (R_m - R_f)$$

$$9 = R_m - R_f$$

Putting the value of $(R_m - R_f)$ in equation 1

$$19.80 = R_f + 1.2 \times 9$$

$$9\% = R_f$$

$$18\% = R_m$$

Hence, Equation of SML:

$$E(R_s) = 9 + \beta_s (18 - 9)$$

$$E(R_s) = 9 + 9 \times \beta_s$$



QUESTION 41:

N 23 | M 07 | RTP

Expected returns on two stocks for particular market returns are given in the following table:

Scenario	Market Return	Aggressive Stock	Defensive Stock
Bearish Case	7%	4%	9%
Bullish Case	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%.

- c. The Security Market Line (SML), if the risk free rate is 7.5% and market return is equally likely to be 7% or 25%.
- d. The Alphas of the two stocks. *as per Sharpe Index model.*

Solution:

- (i) Using equation of characteristic line:

For Aggressive Stock:

$$E(R_A) = \beta_A R_m + \alpha$$

$$4\% = 7 \times \beta_A + \alpha \quad \text{---- (1)}$$

$$40 = 25 \times \beta_A + \alpha \quad \text{---- (2)}$$

Deducting equation (i) from (ii)

$$4 = 7 \beta_A + \alpha$$

$$40 = 25 \beta_A + \alpha$$

$$\underline{\quad - \quad - \quad - \quad}.$$

$$-36 = -18 \beta_A$$

$$\beta_A = 2 \text{ Times}$$

For Defensive Stock:

$$E(R_D) = \beta_D \times R_m + \alpha$$

$$9\% = 7 \times \beta_D + \alpha$$

$$18\% = 25 \times \beta_D + \alpha$$

$$\underline{\quad - \quad - \quad - \quad}.$$

$$-9 = -18 \beta_D$$

$$0.5 = \beta_D$$

- (ii) Expected return of Aggressive = $4 \times 0.50 + 40 \times 0.50$
 $= 22\%$
- Expected return of Defensive = $9 \times 0.50 + 18 \times 0.50$
 $= 13.5\%$

- (iii) Expected $R_m = \frac{7 + 25}{2} = 16\%$

Equation of SML:

$$E(R_S) = R_f + \beta_S \times (R_m - R_f)$$

$$E(R_S) = 7.5 + \beta_S \times (16 - 7.5)$$

$$E(R_S) = 7.5 + \beta \times 8.5$$

- (iv) Calculating Alpha using characteristic line equation:

Considering the case where $R_m = 7\%$

Aggressive

$$4 = 7\beta_A + \alpha$$

$$4 = 7 \times 2 + \alpha$$

$$\alpha = -10$$

Defensive

$$9 = 7\beta_A + \alpha$$

$$9 = 7 \times 0.50 + \alpha$$

$$\alpha = 5.5$$



QUESTION 42:

RTP N 09

only on calc

The following data are available to you as a portfolio manager

Security	Expected Return	Beta	Standard Deviation
O	0.32	1.70	0.50
P	0.30	1.40	0.35
Q	0.25	1.10	0.40
R	0.22	0.95	0.24
S	0.20	1.05	0.28
T	0.14	0.70	0.18
Composite Index	0.12	1.00	0.20
T-bills	0.08	0.00	0.00

- In terms of a security market line (SML), which of the securities listed above are undervalued? Why?
- Assume that a portfolio is constructed using equal portions of the six stocks listed above.
 - Why is the expected return of such a portfolio?
 - What would the expected return if this portfolio was increased by 40% through borrowed funds with the cost of borrowing at 12%?

Solution:

- (a) Security valuation status:

Security	$R(j) = R_f + x (R_m - R_f)$	$E(r)$	Valuation
O	$= 8 + 1.70 (12-8) = 14.80\%$	32%	Undervalued
P	$= 8 + 1.40 (12-8) = 13.60\%$	30%	Undervalued
Q	$= 8 + 1.10 (12-8) = 12.40\%$	25%	Undervalued
R	$= 8 + 0.95 (12-8) = 11.80\%$	22%	Undervalued
S	$= 8 + 1.05 (12-8) = 12.20\%$	20%	Undervalued
T	$= 8 + 0.70(12-8) = 10.80\%$	14%	Undervalued

Since expected return for all the securities is higher than required rate of return.

∴ securities are undervalued

- (b) (i) Expected return on the portfolio with equal weights:

$$E(R) = 32 \times \frac{1}{6} + 30 \times \frac{1}{6} + 25 \times \frac{1}{6} + 22 \times \frac{1}{6} + 20 \times \frac{1}{6} + 14 \times \frac{1}{6}$$

$$= 23.83\%$$

- (ii) Expected return on the portfolio with borrowings

$$W_{PF} = 1.4$$

$$W_{BR} = -0.4$$

$$E(R) = 1.4 \times 23.83\% + (-0.4) \times 12\%$$

$$= 28.56\%$$



QUESTION 43:

M 11 | RTP

Mr. Tempest has the following portfolio of four shares:

Name	Beta	Investment ₹ Lacs
Oxy Rin Ltd.	0.45	0.8
Boxed Ltd.	0.35	1.5
Square Ltd.	1.15	2.25
Ellipse Ltd.	1.85	4.5

The risk-free rate of return is 7% and the market rate of return is 14%. Required.

- Determine the portfolio return.
- Calculate the portfolio Beta.

Solution:

$$(ii) \quad \text{Portfolio Beta} = \frac{0.45 \times 0.8 + 0.35 \times 1.5 + 1.15 \times 2.25 + 1.85 \times 4.5}{0.8 + 1.5 + 2.25 + 4.5}$$

$$= 1.304 \text{ times}$$

$$(i) \quad \text{As per CAPM, } R(j) = R_f + \beta (R_m - R_f)$$

$$= 7 + 1.304 (14 - 7)$$

$$= 16.13\%$$



QUESTION 44:

N 19 | N 13 | M 08 | M 03 | SM

Mr. X holds the following portfolio:

Securities	Cost (₹)	Dividend (₹)	Market Price (₹)	Beta
Equity Shares:				
A Ltd.	16,000	1,600	16,400	0.9
B Ltd.	20,000	1,600	21,000	0.8
C Ltd.	32,000	1,600	44,000	0.6
PSU Bonds	68,000	6,800	64,600	0.4

The risk-free rate of return is 12%.

Calculate the following:

- Expected rate of return in each, using the Capital Asset Pricing Model (CAPM).
- The average return on his portfolio. (Calculate up to two decimal points)

Solution:

- Expected rate of return on his portfolio

Calculating R_m :

Sec	Cost (P_0)	D	MP(P_1)
A Ltd.	16,000	1,600	16,400
B Ltd.	20,000	1,600	21,000
C Ltd.	32,000	1,600	44,000
PSU Bonds	68,000	6,800	64,600
	1,36,000	11,600	1,46,000

Typical & Ambiguous

044,4546

No logic
Accept the flow

Ambiguity 2: Rather than wted org, suggested has taken simple Avg.

Portfolio Management

$$R_m = \frac{D_1 + P_1 - P_0}{P_0} \times 100$$

$$= \frac{11,600 + 1,46,000 - 1,36,000}{1,36,000} \times 100 = 15.88\%$$

Expected return on individual security = $R_f + \beta (R_m - R_f)$

A Ltd.	$12 + 0.90 (15.88 - 12)$	15.49%
B Ltd.	$12 + 0.80 (15.88 - 12)$	15.10%
C Ltd.	$12 + 0.60 (15.88 - 12)$	14.33%
PSU Bonds	$12 + 0.40 (15.88 - 12)$	13.55%

(ii) Average $\beta_P = \frac{0.9 + 0.8 + 0.6 + 0.4}{4} = 0.675$

Average $R_P = 12 + 0.675 (15.88 - 12)$
 $= 14.62\%$



QUESTION 45:

M 15

Upar Wale question mein RF Diya Tha and RP Pucha Tha. Is question me Vise versa Hai.

Your client is holding the following securities:

Securities	Cost (₹)	Dividends/Interest (₹)	Market price (₹)	Beta
Gold Ltd.	10000	1,725	9,800	0.6
Silver Ltd.	15,000	1,000	16,200	0.8
Bronze Ltd.	14000	700	20,000	0.6
GOI Bonds	36000	3,600	34,500	0.01

Average return of the portfolio is 15.7%, calculate:

- Expected rate of return in each, using the Capital Asset Pricing Model (CAPM).
- Risk free rate of return.

Solution:

(ii) Rate of return from market:

Security	Cost (P_0)	Dividend (D)	MPS (P_1)
Gold Ltd.	10,000	1,725	9,800
Silver Ltd.	15,000	1,000	16,200
Bronze Ltd.	14,000	700	20,000
GOI Bonds	36,000	3,600	34,500
	75,000	7,025	80,500

$$R_m = \frac{7,025 + 80,500 - 75,000}{75,000} = 16.7\%$$

$$\text{Average Beta} = \frac{0.6 + 0.8 + 0.6 + 0.01}{4} = 0.503$$

Calculating R_f using Equation of CAPM:

$$E(R) = R_f + \beta (R_m - R_f)$$

$$15.7 = R_f + 0.503 (16.7 - R_f)$$

$$15.7 = R_f + 8.4 - 0.503 R_f$$

$$R_f = 14.69\%$$

(i) Expected rate of return in each security using CAPM:

	$R_f + \beta (R_m - R_f)$	
Gold Ltd	$14.69 + 0.6 (16.7 - 14.69)$	15.896%
Silver Ltd	$14.69 + 0.80 (16.7 - 14.69)$	16.298%
Bronze	$14.69 + 0.60 (16.7 - 14.69)$	15.896%
GOI	$14.69 + 0.01 (16.7 - 14.69)$	14.7101%



QUESTION 46:

M 18

(Sindia to 44)

As an investment manager, you are given following information:

Particulars	Initial Price (₹)	Dividend (₹)	Market Price of the dividends (₹)	Beta (Risk Factor)
A. Equity Shares				
Manufacturing Ltd	30	2	55	0.8
Pharma Ltd	40	2	65	0.7
Auto Ltd	50	2	140	0.5
B. Govt of India Bonds	1005	140	1010	0.99

By Assuming risk free return as 16%, compute:

- Expected rate of return on the portfolio (aggregate) of investor
- Expected rate of return of portfolio in each above stated share/bond using Capital Asset Pricing Model (CAPM); and
- Average Rate of Return *2 kiska? : PF ko.*

Solution:

(i) Expected rate of return on the portfolio *(aggragate)*

Particulars	Initial Price (P_0)	Dividend (D)	Market Price (P_1)
A. Equity shares	30		
Manufacturing	30	2	55
Pharma	40	2	65
Auto	50	2	140
B. Govt of India	1,005	140	1,010
	1,125	146	1,270

$$E(R_p) = \frac{146 + 1,270 - 1,125}{1,125} = 25.87\%$$

→ (isi ko next part mei

R_m assume kar liya.)

Portfolio Management

(ii) Expected rate of return of portfolio in each above stated share/bond

Particulars	$R(j) = R_f + \beta (R_m - R_f)$	
Manufacturing	$= 16 + 0.80 (25.87 - 16)$	23.90%
Pharma	$= 16 + 0.70 (25.87 - 16)$	22.91%
Auto	$= 16 + 0.50 (25.87 - 16)$	20.93%
Govt of India	$= 16 + 0.99 (25.87 - 16)$	25.77%

(iii) Average $\beta_p = \frac{0.8 + 0.7 + 0.5 + 0.99}{4} = 0.748$

Average $R_p = 16 + 0.748 (25.87 - 16)$
 $= 23.38\%$



QUESTION 47:

This question is another variation of previous three questions.

MTP M 24

Here given portfolio is not assumed as market.

Your client is holding the following securities:

Particulars of Securities	Cost	Dividends/ Interest	Market price at the end of holding period	Beta
	₹	₹	₹	
Equity Shares:				
G Ltd.	20,000	1,450	19,600	0.6
S Ltd.	30,000	1,000	30,400	0.8
B Ltd.	28,000	1,400	32,000	0.6
GOI Bonds	72,000	5,060	71,980	0.01

Evaluate:

- Risk free rate of return.
- Expected rate of return of each security (except GOI Bond), using the Capital Asset Pricing Model (CAPM).

Note:

- Use weighted average Beta in calculations.
- Round off calculations upto 3 decimal points.

Solution:

Particulars of Securities	Cost ₹	Market Price	Capital gain	Dividend/ Interest
G Ltd.	20,000	19,600	₹400	1,450
S Ltd.	30,000	30,400	400	1,000
B Ltd.	28,000	32,000	4,000	1,400
GOI Bonds	72,000	71,980	₹20	5,060
Total	1,50,000	1,53,980	3,980	8,910

- a) Risk free return [Return on Govt. Security (GOI Bond)]

$$= \frac{5,060 + (72,000 - 71,980)}{72,000} = 7\%$$

- b) Weighted Average of Beta

$$= 0.6 \times 19,600/1,53,980 + 0.8 \times 30,400/1,53,980 + 0.60 \times 32,000/1,53,980 + 0.01 \times 71,980/1,53,980$$

$$= 0.364$$

↓
 Ambiguity = opening
 weights could
 have been considered!

Average Return on Portfolio = $(8,910 + 3,980) / 1,50,000 \times 100\% = 8.593\%$

Calculating Market Return:

$$8.593\% = 7\% + (R_m - 7\%) \times 0.364$$

$$R_m = 11.376\%$$

Expected Rate of Return for each security is

$$\text{Rate of Return} = R_f + \beta (R_m - R_f)$$

$$\text{G Ltd.} = 7 + 0.6 (11.376 - 7) = 9.626\%$$

$$\text{S Ltd.} = 7 + 0.8 (11.376 - 7) = 10.501\%$$

$$\text{B Ltd.} = 7 + 0.6 (11.376 - 7) = 9.626\%$$



QUESTION 48:

N 21 MTP

Suppose one of your HNI clients is holding the following portfolio as per his risk appetite:

Particulars	Securities
Equity Shares:	
G Ltd	1000
S Ltd	1000
B Ltd	500
PSU Bonds	20,000

The other data related to each of these securities is as follows:

Cost (₹)	Dividend / Interest (₹)	Market Price (₹)	Beta
10,000	1,725	9,800	0.6
15,000	1,000	16,200	0.8
28,000	1400	28,300	0.6
1,800	180	1,725	0.1

Your client is interested in investing some more funds in Bonds issued by GOI.

- Estimate the minimum rate of return that your client would expect from these Bonds keeping in view his risk appetite and assuming Market Return as 15.70%.
- Analyse whether this portfolio has out-performed the market or not assuming Risk Free Rate of Return as 7%.

Solution:

- Minimum rate of return that client would expect from the Bonds (Risk Free Rate):

Security	Cost	Market Price	Dividend/ Interest	Total Income (P1 - P0 + D)	No. of Securities	Total Income	Total Cost
	(a)	(b)	(c)	(d) = b - a + c	(e)	(f) = d × e	(g) = a × e
G Ltd.	10,000	9,800	1,725	1,525	1,000	15,25,000	1,00,00,000
S Ltd.	15,000	16,200	1,000	2,200	1,000	22,00,000	1,50,00,000
B Ltd.	28,000	28,300	1,400	1,700	500	8,50,000	1,40,00,000
PSU Bonds	1,800	1,725	180	105	20,000	21,00,000	3,60,00,000
Total						66,75,000	7,50,00,000

$$E(R_p) = \frac{66,75,000}{7,50,00,000} \times 100 = 8.9\%$$

Portfolio Management

Average Beta of the portfolio:

Security	Total Cost	Beta	Beta × Cost
G Ltd.	1,00,00,000	0.6	60,00,000
S Ltd.	1,50,00,000	0.8	1,20,00,000
B Ltd.	1,40,00,000	0.6	84,00,000
PSU Bonds	3,60,00,000	0.1	36,00,000
Total	7,50,00,000		3,00,00,000

$$\beta_p = \frac{3,00,00,000}{7,50,00,000} = 0.4 \text{ times}$$

Calculating R_f using CAPM:

$$8.90\% = R_f + 0.40 [12.7\% - R_f]$$

$$8.90\% = R_f + 5.08 - 0.40 R_f$$

$$R_f = 6.37\%$$

(b) The expected return on the Portfolio using CAPM:

$$E(R_p) = 7 + 0.40 [12.7 - 7] \\ = 9.28\%$$

Since the actual return is 8.90% which is quite lower than expected return considering the systematic risk borne by the investor and hence portfolio has not outperformed the market



QUESTION 49:

N 07 | RTP

only on calci

XYZ Ltd. has substantial cash flow and until the surplus funds are utilised 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	Market price per share ₹	Expected dividend yield
i	60,000	1.16	4.29	19.50%
ii	80,000	2.28	2.92	24.00%
iii	1,00,000	0.9	2.17	17.50%
iv	1,25,000	1.5	3.14	26.00%

The current market return is 19% and the risk-free rate is 11%. Required to:

- Calculate the risk of XYZ's short-term investment portfolio relative to that of the market;
- Whether XYZ should change the composition of its portfolio.

Solution:

(i) Risk of XYZ's portfolio relative to the market:

Investment	MV	Dividend yield	Dividend	Weight (W)	Beta	W B
I	2,57,400	19.5%	50,193	0.234	1.16	0.271
II	2,33,600	24.0%	56,064	0.212	2.28	0.484
III	2,17,000	17.5%	37,975	0.197	0.9	0.177
IV	3,92,500	26.0%	1,02,050	0.357	1.5	0.535
	11,00,500		2,46,282			1.467

$$\beta_p = \frac{\sum (MV \times \beta)}{\sum (MV)} = 1.468 \text{ times.}$$

↓
How much risk it actually has.

kindest

Expected Return = $\frac{2,46,282}{11,00,500} = 22.38\%$

Implicit Beta calculated using CAPM:

$$E(R) = R_f + \beta (R_m - R_f)$$

$$22.38 = 11 + \beta (19 - 11)$$

$$\beta = 1.423$$

Based on return YPE has given
how much max β (risk) can PF
ftip.pmuchmox

Market β implicit is 1.42 while the portfolio β is 1.46. Thus, the portfolio is marginally risky compared to the market.

(ii) The composition of its portfolio

Investment	R(j) as per CAPM	E(R)	Valuation
I	$11 + 1.16 (19-11) = 20.28\%$	19.50%	Over
II	$11 + 2.28 (19-11) = 29.24\%$	24%	Over
III	$11 + 0.9 (19-11) = 18.20\%$	17.50%	Over
IV	$11 + 1.5 (19-11) = 23.00\%$	26%	Under

In case of investment I, II, III expected dividend yield is less than required rate of return, their proportion in the portfolio should be reduced.

In case of investment (iv) expected dividend yield is more than required rate of return $\therefore$ its proportion should be increased



QUESTION 50:

N 19

Out of the syllabus
Not expected again

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 (σ)	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.

Solution:

Portfolio Management

Calculating Average return from portfolio & market:

Month	Market	Security
January	0.82	-0.52
February	0.04	2.2
March	2.8	2.17
April	1.72	4.17
May	0.27	2.04
June	0.39	3
July	1.95	1.99
August	0.64	4
September	1.53	-1.38
October	2.7	2.67
November	2.52	3.99
December	2.09	1.86
	17.47	26.19

Average monthly portfolio A return (R_p) = 2.18

Average monthly market return (R_m) = 1.46

Portfolio Risk (σ_p) = 1.62

Market Risk (σ_m) = 0.95

Since portfolio A is fully diversified, then will have only systematic risk (just like market portfolio). And, using the variance of above two portfolios, we can calculate the beta that portfolio A should have based on its systematic risk relative to market:

$$\sigma_p^2 = \beta_p^2 \times \sigma_m^2$$

$$\beta_p = \frac{\sigma_p}{\sigma_m} = \frac{1.62}{0.95} = 1.705$$

Calculating the expected return (R_p^1) based on above beta using CAPM:

$$\text{Monthly risk free rate: } \frac{12\%}{12} = 1\%$$

$$R_p^1 = R_f + \beta (R_m - R_f)$$

$$= 1 + 1.705 (1.46 - 1)$$

$$= 1.78 \text{ per month}$$

(a) Return due to the net selectivity

$$= R_p - R_p^1$$

$$= 2.18\% - 1.78\%$$

$$= 0.40\% \text{ per month}$$

(b) The returns due to higher risk assumed by the portfolio manager

$$= R_p^1 - R_m$$

$$= 1.78\% - 1.46\%$$

$$= 0.32\%$$



QUESTION 51:

M 10 15m

Ramesh wants to invest in stock market. He has got the following information about individual securities:

Security	Expected Return	Beta	σ_{ei}^2
A	15	1.5	40
B	12	2	20
C	10	2.5	30
D	9	1	10
E	8	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?

Solution:

Security	E(R)	Beta	σ_{EA}^2	$\frac{R_p - R_f}{\beta}$	Rank
A	15	1.5	40	5.33	I
B	12	2	20	2.5	III
C	10	2.5	30	1.2	V
D	9	1	10	2	IV
E	8	1.2	20	0.833	VI
F	14	1.5	30	4.67	II

I	II	III	IV	V	VI
Sec	$\frac{(E(R) - R_f) \times \beta}{\sigma_{ei}^2}$	$\frac{\sum (E(R) - R_f) \times \beta}{\sigma_{ei}^2}$	$\frac{\beta^2}{\sigma_{ei}^2}$	$\frac{\sum \beta^2}{\sigma_{ei}^2}$	C_i
A	0.30	0.30	0.056	0.056	1.92
F	0.35	0.65	0.075	0.131	2.81
B	0.50	1.15	0.20	0.331	2.67
D	0.20	1.35	0.10	0.431	2.54
C	0.25	1.6	0.208	0.639	2.17
F	0.06	1.66	0.072	0.711	2.05

$$C_i = \frac{\sigma_m^2 \times \frac{[E(r) - R(f)]\beta}{\sigma_{ei}^2}}{\frac{\sum \beta^2}{\sigma_{ei}^2} \times \sigma_m^2 + 1}$$

Cut off points = $C^* = 2.81$

Accounting securities A & F will be selected

Calculating weight of Sec A & F in optimum portfolio

$$Z_p : \frac{\beta}{\sigma_{ei}^2} \left[\frac{E(R) - R_f}{\beta} - C^* \right]$$

Portfolio Management

$$Z_A : \frac{1.5}{40} (5.33 - 2.81) = 0.0945$$

$$Z_F : \frac{1.5}{30} (4.67 - 2.81) = 0.0930$$

$$W_A = \frac{0.0945}{0.0945 + 0.0930} = 50.4\%$$

$$W_F = \frac{0.0930}{0.0945 + 0.0930} = 49.6\%$$

C. Other Important Topics



QUESTION 52:

SM

only on calc

With the help of following data determine the return on the security X.

Factor	Risk Premium associated with the Factor	β_i
Market	4%	1.3
Growth Rate of GDP	1%	0.3
Inflation	-4%	0.2

Risk Free Rate of Return is 8%.

Solution:

$$\begin{aligned}
 \text{Expected return} &= R_f + \beta_1 \times RFP_1 + \beta_2 \times RFP_2 + \beta_3 \times RFP_3 \\
 &= 8\% + 1.3 \times 4\% + 0.3 \times 1\% + 0.2 \times (-4\%) \\
 &= 12.7\%
 \end{aligned}$$



QUESTION 53:

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. Further, 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 (Book Price)	Factor III (Inflation)
Small cap growth	25%	0.8	1.39	1.35
Small cap value	10%	0.9	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%	-3.50%	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 Capital Asset Pricing Model (CAPM), determine the expected return on the market index.
- 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.

Solution:

- Arbitrage pricing theory =

Portfolio Management

$$E(r) = R_f + \beta_1 \times RFP_1 + \beta_2 \times RFP_2 + \beta_3 \times RFP_3 \dots\dots\dots$$

$$\text{Small cap growth} = 4.5 + 0.8 (6.85\%) + 1.39 (-3.5\%) + 1.35 (0.65\%) = 5.99\%$$

$$\text{Small cap value} = 4.5 + 0.9 (6.85\%) + 0.75 (-3.5\%) + 1.25 (0.65\%) = 8.85\%$$

$$\text{Large cap growth} = 4.5 + 1.165 (6.85\%) + 2.75 (-3.5\%) + 8.65 (0.65\%) = 8.48\%$$

$$\text{Large cap Value} = 4.5 + 0.85 (6.85\%) + 2.05 (-3.5\%) + 6.75 (0.65\%) = 7.54\%$$

Expected return on market index:

$$= 5.99 \times 0.25 + 8.85 \times 0.10 + 8.48 \times 0.50 + 7.54 \times 0.15$$

$$= 7.75\%$$

$$\begin{aligned} \text{(ii) Beta of portfolio} &= 0.80 \times 0.25 + 0.9 \times 0.10 + 1.165 \times 0.50 + 0.85 \times 0.15 \\ &= 1 \end{aligned}$$

$$\begin{aligned} \text{CAPM } E(R) &= 4.5 + 1 (6.85) \\ &= 11.35\% \end{aligned}$$

(iii) Let us assume that Mr. Nirmal will invest X% in small cap value stock

$$0.90x + 1.165 (1 - x) = 1$$

$$0.90x + 1.165 - 1.165x = 1$$

$$-0.265x = -0.165$$

$$x = 0.6226 \quad \text{Small cap value}$$

$$1 - x = 0.3774 \quad \text{Large cap growth}$$



QUESTION 54:

N 18 | M 09

Mr. X owns a portfolio with the following characteristics:

	Security A	Security B	Risk Free security
Factor 1 sensitivity (λ_1)	0.8	1.5	0
Factor 2 sensitivity (λ_2)	0.6	1.2	0
Expected Return	15%	20%	10%

It is assumed that security returns are generated by a two-factor model.

- If Mr. X has ₹1,00,000 to invest and sells short ₹50,000 of security B and purchases ₹1,50,000 of security A. What is the sensitivity of Mr. X's portfolio to the two factors?
- If Mr. X borrows ₹1,00,000 at the risk-free rate and invests the amount he borrows along with the original amount of ₹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?
- What is the expected return premium of factor 2?

Solution:

Risk.

(i) Sensitivity of Mr. X's portfolio to the two factors

Security	Amount	Weight	Factor 1		Factor 2	
			Beta	B × W	Beta	B × W
A	1,50,000	1.5	0.8	1.2	0.6	0.9
B	-50,000	-0.5	1.5	-0.75	1.2	-0.6
	1,00,000			0.45		0.3

- (ii) Sensitivity of the portfolio to the two factors:

Investment in security A & B

$$A = 2,00,000 \times \frac{1,50,000}{1,00,000} = 300,000$$

$$B = 2,00,000 \times \frac{50,000}{1,00,000} = 1,00,000$$

Security	Amount	Weight	Factor 1		Factor 2	
			Beta	B × W	Beta	B × W
A	3,00,000	3	0.8	2.4	0.6	1.8
B	(1,00,000)	-1	1.5	-1.5	1.2	-1.2
Borrowing	(1,00,000)	-1	0	0	0	0
	1,00,000	1		0.9		0.6

- (iii) Expected return as per factor model:

$$\text{Sec A: } 15 = 10 + 0.80 \times \text{FRP}_1 + 0.60 \times \text{FRP}_2$$

Multiplying the above equation with 2:

$$\text{Sec A: } 30 = 20 + 1.60 \times \text{FRP}_1 + 1.20 \times \text{FRP}_2 \quad \text{----- (i)}$$

$$\text{Sec B: } 20 = 10 + 1.50 \times \text{FRP}_1 + 1.20 \times \text{FRP}_2 \quad \text{----- (ii)}$$

$$\begin{array}{r} \text{---} \quad \text{---} \quad \text{---} \\ \hline \end{array}$$

$$10 = 10 + 0.1 \text{ FRP}_1 + 0$$

$$\text{FRP}_1 = 0\%$$

$$\text{FRP}_2 = 8.33\%$$

**QUESTION 55:**

N 23 | M 11 | RTP

kind of mugup? we don't know what this is.
% assumed FRPs.

An investor has categorized all the available stock in the market into the following types and the estimated weights of the categories of stocks in the market index are given below. Further, the sensitivity of returns of these categories of stocks to two factors Inflation and Stock Market are also given below:

Category	Weight in Market Index	Factor 1 (Inflation)			Factor 2 (Stock Market)		
		Beta 1	Expected Value (%)	Actual Value (%)	Beta 2	Expected Value (%)	Actual Value (%)
Small Cap	20%	1.2	6.7	6.7	0.8	10	10.5
Medium Cap	30%	1.75	4.5	6	0.9	7	8
Large Cap	15%	1.3	6.75	8	1.165	9	10
Flexi Cap	35%	1.7	7	6.5	0.85	8.85	9.75

Risk Free Rate of Interest is 7.50%.

Round off to 2 decimals.

You are required to calculate:

- Expected return on the market index for both the factors.
- Expected return on the market index under Arbitrage Pricing Theory (Existing Scenario)
- Expected return on the market index under Arbitrage Pricing Theory, if the composition of the Portfolio is changed to 25% equally in all four categories.
- Which alternative (Existing or Changed) will be more profitable?

Portfolio Management

Solution:

- a. $E(R)$ on market index for Factor 1 $= 6.7 \times 0.2 + 4.5 \times 0.3 + 6.75 \times 0.15 + 7 \times 0.35$
 $= 6.15\%$
 $E(R)$ on market index for Factor 2 $= 10 \times 0.2 + 7 \times 0.3 + 9 \times 0.15 + 8.85 \times 0.35$
 $= 8.55\%$
- b. $E(R_m)$ using arbitrage pricing theory:
 $E(R) = R_f + \beta_1 \times RFP_1 + \beta_2 \times RFP_2 + \beta_3 \times RFP_3$
 Small Cap: $= 7.5 + 1.2 (6.7 - 6.7) + 0.8 (10.5 - 10) = 7.9\%$
 Medium Cap $= 7.5 + 1.75 (6 - 4.5) + 0.9 (8 - 7) = 11.03\%$
 Large Cap $= 7.5 + 1.3 (8 - 6.75) + 1.165 (10 - 9) = 10.29\%$
 Flexi Cap $= 7.5 + 1.7 (6.5 - 7) + 0.85 (9.75 - 8.85) = 7.42\%$
 $E(R)$ on market index $= 7.9 \times 0.2 + 11.03 \times 0.3 + 10.29 \times 0.15 + 7.42 \times 0.35$
 $= 9.03\%$
- c. $E(R)$ on market index at equal weight:
 $= 7.9 \times 0.25 + 11.03 \times 0.25 + 10.29 \times 0.25 + 7.42 \times 0.25$
 $= 9.16\%$
- d. Changed alternative (investing 25% equally in all four categories,) is more profitable than existing composition since it has higher rate of expected return.

(Actual - Exp. Value)
 has no logic.



QUESTION 56:

M 17 | M 16 | RTP

Five portfolios experienced the following results during a 7- year period:

Portfolio	Average Annual Return (R_p) (%)	Standard Deviation (σ_p)	Correlation with the market returns (r)
A	19.0	2.5	0.840
B	15.0	2.0	0.540
C	15.0	0.8	0.975
D	17.5	2.0	0.750
E	17.1	1.8	0.600
Market Risk (σ_m)		1.2	
Market rate of Return (R_m)	14.0		
Risk-free Rate (R_f)	9.0		

Rank the portfolios using:

- Sharpe's method
- Treynor's method
- Jensen's Alpha

Solution:

Calculation of Beta and $R(j)$ as per CAPM:

$$\text{Beta} = r_{(s,m)} \times \frac{\sigma_s}{\sigma_m}$$

$$R(j) = R_f + \beta (R_m - R_f)$$

Security	Beta	R(j)
A	$A = 0.840 \times \frac{2.5}{1.2} = 1.75$	$A = 9 + 1.75 (14 - 9) = 17.75\%$
B	$B = 0.540 \times \frac{2}{1.2} = 0.9$	$B = 9 + 0.9 (14 - 9) = 13.5\%$
C	$C = 0.975 \times \frac{0.80}{1.2} = 0.65$	$C = 9 + 0.65 (14 - 9) = 12.25\%$
D	$D = 0.750 \times \frac{2}{1.2} = 1.25$	$D = 9 + 1.25 (14 - 9) = 15.25\%$
E	$E = 0.6 \times \frac{1.8}{1.2} = 0.9$	$E = 9 + 0.90 (14 - 9) = 13.5\%$

$$\text{Sharpe ratio} = \frac{E(r) - R_f}{\sigma_p}$$

$$\text{Treynor Ratio} = \frac{E(r) - R_f}{\beta_p}$$

$$\text{Jensen's Alpha} = E(r) - R(j)$$

Portfolio	Sharpe Ratio	Treynor	Jensen Alpha
A	$\frac{19-9}{2.50} = 4$ IV	$\frac{19-9}{1.75} = 5.7143$ (V)	$19 - 17.75 = 1.25$ V
B	$\frac{15-9}{2} = 3$ V	$\frac{15-9}{0.9} = 6.6667$ (IV)	$15 - 13.5 = 1.5$ IV
C	$\frac{15-9}{0.80} = 7.5$ I	$\frac{15-9}{0.65} = 9.2308$ (II)	$15 - 12.25 = 2.75$ II
D	$\frac{17.5-9}{2} = 4.25$ III	$\frac{17.5-9}{1.25} = 6.8$ (II)	$17.5 - 15.25 = 2.25$ III
E	$\frac{17.1-9}{1.8} = 4.5$ II	$\frac{17.1-9}{0.90} = 9$ (I)	$17.1 - 13.5 = 3.6$ I


QUESTION 57:

N 22 | RTP N 10

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Following is the information related to three Mutual Fund:

Year	MF A	MF B	MF C
2020	10%	5%	14%
2021	8%	10%	10%
2022	12%	8%	18%

Portfolio Management

Correlation between Market and Mutual Fund:

	MF A	MF B	MF C
Correlation with market	0.45	0.25	0.65

Variance of the market is 9% & rate of return of government bond is 7%

You are required to rank the mutual fund using:

- Reward-to-variability ratio
- Reward-to-volatility ratio

Solution:

Calculation of Expected return, standard deviation & Beta

MF A:

Year	X	$X - \bar{X}$	$(X - \bar{X})^2$
2020	10	0	0
2021	8	-2	4
2022	12	2	4
	30		8

$$E(R_A) = \frac{30}{3} = 10\%$$

$$\sigma_A = \sqrt{8/3} = 1.63\%$$

$$\beta_A = 0.45 \times \frac{1.63}{3} = 0.245$$

MF B:

Year	X	$X - \bar{X}$	$(X - \bar{X})^2$
2020	5	-2.67	7.13
2021	10	2.33	5.43
2022	8	0.33	0.11
	23		12.67

$$E(R_B) = \frac{23}{3} = 7.67\%$$

$$\sigma_B = \sqrt{12.67/3} = 2.06\%$$

$$\beta_B = 0.25 \times \frac{2.06}{3} = 0.172$$

MF C:

Year	X	$X - \bar{X}$	$(X - \bar{X})^2$
2020	14	0	0
2021	10	-4	16
2022	18	4	16
	42		32

$$E(R_c) = \frac{42}{3} = 14\%$$

$$\sigma_c = \sqrt{32/3} = 3.27\%$$

$$\beta_c = 0.65 \times \frac{3.27}{3} = 0.709$$

	Reward-to-variability (Sharpe ratio)	Rank	Reward-to- volatility (Treynor ratio)	Rank
Formula	$\frac{E(r) - R_f}{\sigma_p}$		$\frac{E(r) - R_f}{\beta_p}$	
MF A	$\frac{10 - 7}{1.63} = 1.84$	2	$\frac{10 - 7}{0.245} = 12.24$	1
MF B	$\frac{7.67 - 7}{2.06} = 0.33$	3	$\frac{7.67 - 7}{0.172} = 3.90$	3
MF C	$\frac{14 - 7}{3.27} = 2.14$	1	$\frac{14 - 7}{0.709} = 9.87$	2


QUESTION 58:

N 20

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
Coefficient of Determination	0.3025	0.6561	0.9604	

The yield on 182 days Treasury Bill is 9 percent per annum

You are required to:

- Rank the funds as per Sharpe's measure.
- Rank the funds as per Treynor's measure.
- Compare the performance with the market.

Solution:

$$(a) \quad \text{Sharpe's Ratio} = \frac{E(R) - R_f}{\sigma_p}$$

$$\text{Growth} = \frac{7 - 9}{9.6}$$

$$\text{Balanced} = \frac{6 - 9}{7.4}$$

$$= -0.208$$

$$= -0.405$$

Ranking

I

II

% negative
 % Bigger than -0.625

Portfolio Management

$$\text{Regular} = \frac{5-9}{6.4} = -0.625 \quad \text{III}$$

(b) Calculation of correlation

$$\text{Growth} = \sqrt{0.3025} = 0.55$$

$$\text{Balanced} = \sqrt{0.6561} = 0.81$$

$$\text{Regular} = \sqrt{0.9604} = 0.98$$

$$\text{Calculation of Beta} = \text{correlation}_{(s,m)} \times \frac{\sigma_s}{\sigma_m}$$

$$\text{Growth} = 0.55 \times \frac{9.6}{7.6} = 0.695$$

$$\text{Balance} = 0.81 \times \frac{7.4}{7.6} = 0.789$$

$$\text{Regular} = 0.98 \times \frac{6.4}{7.6} = 0.825$$

$$\text{Treynor's Ratio} = \frac{E(R) - R_f}{\beta_p}$$

Ranking

$$\text{Growth} = \frac{7-9}{0.695} = -2.878 \quad \text{I}$$

$$\text{Balanced} = \frac{6-9}{0.789} = -3.802 \quad \text{II}$$

$$\text{Regular} = \frac{5-9}{0.825} = -4.849 \quad \text{III}$$

(c) Share Ratio of market = $\frac{9-9}{7.6} = 0$

$$\text{Treynor ratio of market} = \frac{9-9}{1} = 0$$

Since, Sharpe and Treynor Ratios of all the funds is less than that of market, therefore funds have performed weaker than market



QUESTION 59:

N 24

A Portfolio Manager (PM) has three mutual funds in his portfolio. Following are the details of these three mutual funds:

Particulars	Growth fund	Balanced fund	Regular fund	Market
Average Return (%)	7.5	6.3	5.4	
Variance				50.41
Sharpe Ratio	-0.15	-0.36	-0.48	
Treynor's Ratio	-2	-3	-4.80	

The yield on 182 days Treasury bill is 9 per cent per annum.

so it is not in decimal like 0.02 or 0.08.
so it is in %

You are required to calculate

- (i) Variance of the Funds
- (ii) Coefficient of Determination of the Funds

Solution:

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

QUESTION 60:

M 23

Mr. Potential has made investments in two mutual funds. The following information is available:

Mutual Fund	Smart	Growth
Jenson Alpha	1.10%	1.50%
Treynor's Ratio	0.0714	0.0775
Actual Return	8.5%	9.1%
Risk Premium	4%	

You are required to calculate:

- Beta (β) for both the funds
- Risk free Rate
- Security Market Line

Point of learning: Traylor is in decimal to get number.

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Adish Jain CA CFA

Portfolio Management

Solution:

Working Notes:

	Smart	Growth
a. Jensen Alpha	1.1%	1.5%
b. Actual Return	8.5%	9.1%
c. CAPM Expected Return [b – a]	7.4%	7.6%
d. Market Risk Premium	4%	4%
e. Equation of CAPM [i]	$7.4 = R_f + \beta_S \times 4$	$7.6 = R_f + \beta_G \times 4$
f. Treynor Ratio = $\frac{R_i - R_f}{\beta_i}$ [ii]	$7.14 = \frac{8.5 - R_f}{\beta_S}$	$7.75 = \frac{9.1 - R_f}{\beta_G}$

a) Solving Equation [i] & [ii] above, β_i :

Value of R_f as per eq. [ii]	$R_f = 8.5 - 7.14 \times \beta_S$	$R_f = 9.1 - 7.75 \times \beta_G$
Putting above value in eq. [i]	$7.4 = R_f + \beta_S \times 4$ $7.4 = (8.5 - 7.14 \times \beta_S) + \beta_S \times 4$ $\beta_S = 0.35$	$7.6 = R_f + \beta_G \times 4$ $7.6 = (9.1 - 7.75 \times \beta_G) + \beta_G \times 4$ $\beta_G = 0.40$

b) Putting above value of β_i in eq. [i], R_f :

As per eq. [i]	$7.4 = R_f + \beta_S \times 4$ $7.4 = R_f + 0.35 \times 4$ $R_f = 6\%$	$7.6 = R_f + \beta_G \times 4$ $7.6 = R_f + 0.40 \times 4$ $R_f = 6\%$
----------------	--	--

c) Market Risk Premium = $R_f - R_m$

$$4\% = 6\% - R_m$$

$$R_m = 10\%$$

Equation of Security market Line:

$$E(R_i) = R_f + \beta_i \times (R_f - R_m)$$

$$E(R_i) = 6 + 4\beta_i$$

Self-note: Risk premium given in the question is common for both the securities, therefore it has to assumed as market risk premium & not security risk premium.



QUESTION 61:

N 16

Mr. Abhishek is interested in investing ₹2,00,000 for which he is considering following three alternatives:

- (i) Invest ₹2,00,000 in Mutual Fund X (MFX)
- (ii) Invest ₹2,00,000 in Mutual Fund Y (MFY)
- (iii) Invest ₹1,20,000 in Mutual Fund X (MFX) and ₹80,000 in Mutual Fund Y (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%.

Covariance of returns of MFX, MFY and market portfolio Mix are as follow:

	MF X	MF Y	MIX
--	------	------	-----

MF X	4.8	4.3	3.37
MF Y	4.3	4.25	2.8
MIX	3.37	2.8	3.1

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 kiska? : Sabke... MFX MFY & PF.
- Sharpe ratio, Treynor ratio and Alpha of MFX, MFY and Portfolio Mix

Solution:

- (i) Variance of Return

$$MF_x = 4.80$$

$$MF_y = 4.25$$

$$MIX = 3.10$$

- (ii) Portfolio Return, beta, portfolio variance and portfolio standard deviation

$$\begin{aligned} \text{Portfolio return} &= 15 \times \frac{1,20,000}{2,00,000} + 14 \times \frac{80,000}{2,00,000} \\ &= 14.6\% \end{aligned}$$

$$\text{Portfolio Beta} = \frac{\text{Cov}(x,y)}{\text{Var}(x)}$$

$$MF_x = \frac{3.37}{3.1} = 1.087$$

$$MF_y = \frac{2.8}{3.1} = 0.903$$

$$\begin{aligned} \text{PF MIX} &= 1.087 \times \frac{120}{200} + 0.903 \times \frac{80}{200} \\ &= 1.013 \end{aligned}$$

$$\text{Portfolio Variance} = 4.8 \times (0.60)^2 + 4.25 \times (0.40)^2 + 2 \times 0.60 \times 0.40 \times 4.3 = 4.472$$

$$\text{Portfolio S.D} = \sqrt{4.472} = 2.115$$

- (iii) Expected Return = $R_f + \beta (R_m - R_f)$

$$MF_x = 10 + 1.087 (12 - 10) = 12.17\%$$

$$MF_y = 10 + 0.903 (12 - 10) = 11.81\%$$

$$\text{PF MIX} = 10 + 1.013 (12 - 10) = 12.03\%$$

Systematic Risk

$$\text{Systematic Variance} = \sigma_m^2 \times \beta_s^2$$

$$MF_x = 3.1 \times (1.087)^2 = 3.663$$

$$MF_y = 3.1 \times (0.903)^2 = 2.528$$

$$\text{PF MIX} = 3.1 \times (1.013)^2 = 3.181$$

Systematic Standard Deviation

$$MF_x = \sqrt{3.663} = 1.914$$

$$MF_y = \sqrt{2.529} = 1.590$$

$$PF\ MIX = \sqrt{3.181} = 1.784$$

Systematic Risk

Unsystematic Variance = Total – Systematic Variance

$$MF_X = 4.8 - 3.663 = 1.137$$

$$MF_Y = 4.25 - 2.529 = 1.722$$

$$PF\ MIX = 4.472 - 3.181 = 1.291$$

Unsystematic Standard deviation

$$MF_X = \sqrt{1.137} = 1.066$$

$$MF_Y = \sqrt{1.721} = 1.312$$

$$PF\ MIX = \sqrt{1.291} = 1.136$$

$$(iv) \quad \text{Sharpe Ratio} = \frac{E(r) - R_f}{\sigma_p}$$

$$MF_X = 15 - 10 / 2.19 = 2.281$$

$$MF_Y = 14 - 10 / 2.0616 = 1.940$$

$$PF\ MIX = 14.6 - 10 / 2.115 = 2.175$$

$$\text{Treynor Ratio} = \frac{E(r) - R_f}{\beta}$$

$$MF_X = \frac{15 - 10}{1.087} = 4.60$$

$$MF_Y = \frac{14 - 10}{0.9032} = 4.43$$

$$PF\ MIX = \frac{14.6 - 10}{1.013} = 4.54$$

$$\text{Jenson Alpha} = E(R) - R(j)$$

$$MF_X = 15 - 12.17 = 2.83\%$$

$$MF_Y = 14 - 11.81 = 2.19\%$$

$$PF\ MIX = 14.6 - 12.03 = 2.57\%$$



QUESTION 62:

N 22 | RTP M 10

Ms. Sunidhi is working with an MNC at Mumbai. She is well versant with the portfolio management techniques and wants to test one of the techniques on an equity fund she has constructed and compare the gains and losses from the technique with those from a passive buy and hold strategy. The fund consists of equities only and the ending NAVs of the fund he constructed for the last 10 months are given below:

Month	NAV (₹/unit)	Month	NAV (₹/unit)
Dec 2008	40	May 2009	37
Jan 2009	25	Jun 2009	42
Feb 2009	36	Jul 2009	43
Mar 2009	32	Aug 2009	50
Apr 2009	38	Sep 2009	52

Assume

1. Sunidhi had invested a notional amount of ₹2 lakhs equally in the equity fund and a conservative portfolio (of bonds) in the beginning of December 2008 and the total portfolio was being rebalanced each time the NAV of the fund increased or decreased by 15% compared to the NAV of previous month.
2. There is no income earned from the conservative portfolio during the period.
3. There is no taxation or entry/exit load.

You are required to determine:

- a. The value of the portfolio for each level of NAV following the Constant Ratio Plan.
- b. Whether there are any errors in the technique developed by Sunidhi? If so, explain briefly.

Solution:

- a) Value of portfolio for each level of NAV using constant Ratio Plan

Month	NAV	Equity	Bond	Total	Rebalance Buy/(sell)	No. of Units
Dec	40	1,00,000	1,00,000	2,00,000	-	2,500
Jan	25	62,500	1,00,000	1,62,500		2,500
Rebalancing		81,250	81,250	1,62,500	750	3,250
Feb	36	1,17,000	81,250	1,98,250	-	3,250
Rebalancing		99,125	99,125	1,98,250	(496.53)	2,753.47
Mar	32	88,111.04	99,125	1,87,236.04	-	2,753.47
April	38	1,04,631.86	99,125	2,03,756.86	-	2,753.47
Rebalancing		1,01,878.43	1,01,878.43	2,03,756.86	(72.46)	2,681.01
May	37	99,197.37	1,01,878.43	2,01,075.8		2,681.01
June	42	1,12,602.42	1,01,878.43	2,14,480.85		2,681.01
July	43	1,15,283.43	1,01,878.43	2,17,161.86		2,681.01
Aug	50	13,4050.5	1,01,878.43	2,35,928.93		2,681.01
Rebalancing		1,17,964.464	1,17,964.465	2,35,928.93	(321.72)	2,359.29
Sept	52	1,22,683.08	1,17,964.465	2,40,647.545		2,359.29

Gain/loss under constant ratio plan:

Value of portfolio in sept 2009	2,40,647.55
Less: Initial amount	<u>(2,00,000.00)</u>
Gain from portfolio	<u>40,647.55</u>

Gain/loss under buy and hold strategy

Value of portfolio at sept 2009	
- Value of equity (52 × 2500)	1,30,000
- Value of Bonds	<u>1,00,000</u>
Total	2,30,000
Initial Amount	<u>(2,00,000)</u>
Gain	<u>30,000</u>

Gain under constant ratio plan is higher than gain under buy and had strategy

Portfolio Management

- b) ~~Though~~ the value of portfolio as per technique is ~~less~~ ^{more} than Buy & Hold Strategy, ~~but~~ there is no error as if market has been ~~bullish~~ ^{bullish} then the value of ~~much lesser~~ ^{much higher} under Buy & Hold Strategy.

PF will be much higher in CRP.



QUESTION 63:

MTP M 18 V1

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Ms. Kiran had a surplus fund of ₹ 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 her research advised her to purchase following shares:

Company	Number of Shares	Price per Share
O Ltd.	100	400
H Ltd.	1000	40
A Ltd.	320	125
R Ltd.	400	100
T Ltd.	200	200

On April 1, 2016, the prices of these stocks were as follows:

Company	Price per Share
O Ltd.	300
H Ltd.	60
A Ltd.	120
R Ltd.	150
T Ltd.	125

You are required to exhibit how Kiran can rebalance her portfolio on 1.4.2016 so that her exposure to individual stock is maintained at original level in terms of rupee value.

Solution:

Company	Price	No. of Shares	N.V.	New no. of shares	Buy/(Sell) Shares
O Ltd.	300	100	30,000	142.26	42.27
H Ltd.	60	1000	60,000	711.33	(288.67)
A Ltd.	120	320	38,400	355.67	35.67
R Ltd.	150	400	60,000	285.43	(115.47)
T Ltd.	125	200	25,000	341.44	141.44
			2,13,400		



QUESTION 64:

MTP N 23 | M 12 | RTP

Indira has a fund of ₹ 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. She has 3 close friends who have advised following different strategies:

- Buy and Hold strategy
- Constant Ratio

5326 .



c. CPPI

Suppose she immediately starts with investment in Bonds (non-fluctuating) and Equity and decides to rebalance her portfolio after each 10 days and to invest in Nifty as equity component changes in tandem with that of Nifty. Further, Bond has no Beta.

As on date (i.e. beginning of month) Nifty is 5326 and minimum Nifty within a month can be most be 4793.40. If she chooses CPPI she will use "2" as the multiplier. If she chooses Constant Ratio plan she will maintain the ratio of 60:40 in Equity and Bonds respectively. Further, portfolio will be rebalanced each time Nifty is changed by 5% as compared to the previous Nifty.

You are required to evaluate Portfolio Position of Indira under each of the Strategies suggested by her friends and highlight the course of action to be taken if in the coming month after a gap of 10 days Nifty happened:

- (1) 10 days later-being the 1st day of rebalancing if NIFTY falls to 5122.96.
- (2) 10 days further from the above date if the NIFTY touches 5539.04.

Solution:a. Under buy & hold strategy

$$\text{Max fall in NIFTY} = \frac{5,326 - 4,793.4}{5,326} = 10\%$$

$$\text{Floor value} = 3,00,000 - 10\% = 2,70,000$$

Under this strategy investor invests an amount equal to floor value in Bonds i.e., 2,70,000 and the remaining ₹ 30,000 in equity.

Value of investment after 20 days:

Equity	$30,000 \times \frac{5539.04}{5326}$	31,200
Bonds		2,70,000
Total		3,01,200

b. Under CPPI

Immediately to start with:

$$\begin{aligned} \text{Value of equity} &= (\text{Portfolio Value} - \text{Floor Value}) \times \text{multiplier} \\ &= (3,00,000 - 270,000) \times 2 = 60,000 \end{aligned}$$

$$\begin{aligned} \text{Value of debt} &= \text{Total value of portfolio} - \text{value of equity} \\ &= 3,00,000 - 60,000 = 2,40,000 \end{aligned}$$

After 10 days:

$$\text{Change in Nifty} = \frac{5122.96 - 5326}{5326} = -3.81\%$$

Since change in nifty is less than 5%, portfolio will not be rebalanced.

After further 10 days:

$$\text{Change in Nifty} = \frac{5539.04 - 5122.96}{5122.96} = 8.12\%$$

Since change in nifty is more than 5%, portfolio will be rebalanced.

Portfolio Management

Value of portfolio on this date before rebalancing:

$$\begin{aligned}\text{Equity} &= 60,000 \times \frac{5539.04}{5236} &&= 62,400 \\ \text{Value of debt} &&&= 2,40,000 \\ \text{Total Value of portfolio} &&&= 3,02,400\end{aligned}$$

Ideal values as per policy

$$\begin{aligned}\text{Equity} &= (3,02,400 - 2,70,000) \times 2 &&= 64,800 \\ \text{Debt} &= 3,02,400 - 64,800 &&= 2,37,600\end{aligned}$$

Indira should sell the risk-free security of Rs. 2,400 and invest the amount in equity.

c. Constant Ratio Plan

The ratio to be maintained is given as 60:40. Thus, Indira will invest ₹ 1,80,000 in equity and ₹ 120,000 in bonds.

After 10 days:

Since change in nifty is less than 5%, portfolio will not be rebalanced.

After further 10 days:

Since change in nifty is more than 5%, portfolio will be rebalanced.

Value of portfolio on this date before rebalancing:

$$\begin{aligned}\text{Equity} &= 1,80,000 \times \frac{5539.04}{5326} &&= 1,87,200 \\ \text{Value of debt} &&&= 1,20,000 \\ \text{Total Value of portfolio} &&&= 3,07,200\end{aligned}$$

Ideal values as per policy

$$\begin{aligned}\text{Equity} &= 3,07,200 \times 60\% &&= 1,84,320 \\ \text{Debt} &= 3,07,200 - 1,84,320 &&= 1,22,880\end{aligned}$$

Indira should sell the equity of Rs. 2,880 and invest the amount in bonds.



QUESTION 65:

RTP

The total market value of the equity share of O.R.E. Company is ₹ 60,00,000 and the total value of the debt is ₹ 40,00,000. The treasurer estimate that the beta of the stock is currently 1.5 and that the expected risk premium on the market is 10 per cent. The treasury bill rate is 8 per cent.

Required:

- What is the beta of the Company's existing portfolio of assets?
- Estimate the Company's Cost of capital and the discount rate for an expansion of the company's present business.

Solution:

$$\begin{aligned}\text{(i)} \quad \beta_A &= \frac{60,00,000}{1,00,00,000} \times 1.50 + \frac{40,00,000}{1,00,00,000} \times 0 \\ &= 0.9 \text{ times}\end{aligned}$$

$$\begin{aligned}
 \text{(ii)} \quad K_e &= R_f + \beta (R_m - R_f) \\
 &= 8 + 0.90 (10) \\
 &= 17\%
 \end{aligned}$$

**QUESTION 66:**

M 19

Equity of KGF Ltd. (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 (β_p) of 1.45, balance value is applied on Spares and Consumables Division, which has an Asset Beta (β_{sc}) of 1.20 KGFL Debt beta (β_D) is 0.24.

You are required to calculate:

- (i) Equity Beta (β_E),
- (ii) Ascertain Equity Beta (β_E), if KGF Ltd. 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 (β_{D1}) is 0.35 and any further funds raised by way of Debt will have a Beta (β_{D2}) of 0.40.
- (iii) Whether the new Equity Beta (β_E) justifies increase in its value on account of leverage?

Solution:

- (i) Equity Beta

$$\begin{aligned}
 \beta_A &= \text{Weighted Average Beta of Division} \\
 &= 1.20 \times 0.26 + 1.45 \times 0.74 = 1.385
 \end{aligned}$$

$$\beta_F = \beta_e \times \frac{E}{E+D} + \beta_d \times \frac{D}{E+D}$$

$$1.385 = \beta_e \times \frac{410}{580} + 0.24 \times \frac{170}{580}$$

$$1.385 = 0.7069 \beta_e + 0.0703$$

$$\beta_e = 1.86$$

- (ii) Calculation of New Debt amount raised

Let the amount raised through debt and amount for which equity is bought back = x

$$\frac{170 + x}{410 - x} = 1.90$$

$$X = 210$$

New Debt taken = 210

Old debt = 170

Equity after repurchase = 410 – 210 = 200

New equity beta after changed capital structure:

$$\beta_F = \beta_e \times \frac{200}{580} + 0.35 \times \frac{170}{580} + 0.40 \times \frac{210}{580}$$

$$1.385 = 0.3448 \beta_e + 0.1026 + 0.1448$$

$$\beta_e = 3.3 \text{ times}$$

- (iii) With the increase of leverage the equity Beta increases from 1.86 to 3.3 as financial risk faced by ESHF increase



QUESTION 67:

RTP N 17

ABC Ltd. 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:

	S.D.	Correlation of Coefficient
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 not 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 Ltd.
- Cost of Equity of ABC Ltd.
- Assuming that ABC Ltd. wants to raise debt of an amount equal to half of its Market Value then determine equity beta, if yield of debt is 5%.

↳ hint for β_D .

↳ E & D: 50% each

typical...

Solution:

(i) Calculation of Beta = $\text{corr} \times \frac{\sigma_s}{\sigma_m}$

$$\text{Car AC} = 0.60 \times \frac{0.30}{0.20} = 0.9 \text{ times}$$

$$\text{Window AC} = 0.70 \times \frac{0.35}{0.20} = 1.225 \text{ times}$$

$$\begin{aligned} \text{Beta of comparable firm} &= r_{(s,m)} \times \frac{\sigma_s}{\sigma_m} \\ &= 0.85 \times \frac{0.50}{0.20} = 2.125 \text{ times} \end{aligned}$$

Calculation of Beta of Split A/C

$$2.125 = 0.50 \times 1.225 + 0.50 \times \beta_{\text{split}}$$

$$2.125 = 0.6125 + 0.50 \beta_{\text{split}}$$

$$\beta_{\text{split}} = 3.025 \text{ times}$$

Calculation of Beta of ABC

$$\begin{aligned} \beta_f &= 0.90 \times 60\% + 1.225 \times 25\% + 3.025 \times 15\% \\ &= 1.30 \text{ times} \end{aligned}$$

$$\begin{aligned}
 \text{(ii) CAPM} &= R_f + \beta (R_m - R_f) \\
 &= 4 + 1.30 (10 - 4) \\
 &= 11.80\%
 \end{aligned}$$

$$\begin{aligned}
 \text{(iii) Using CAPM, } R_d &= R_f + \beta_d (R_m - R_f) \\
 5 &= 4 + \beta_d (10 - 4) \\
 \beta_d &= 0.167
 \end{aligned}$$

$$\beta_f = 0.50 \times \beta_e + 0.50 \times 0.167$$

$$1.30 = 0.50 \beta_e + 0.167 \times 0.50$$

$$2.433 = \beta_e$$



QUESTION 68:

RTP N 08

A Ltd., pays no taxes and is entirely financed by equity shares. The company's equity has a Beta of 0.6 and is expected to earn 20%. The company has now decided to buy back half of the equity shares by borrowing an equal amount. If the debt yield a risk free return of 10%. Calculate.

- The beta of the equity shares after the buy back.
- The required return and risk premium on the equity shares before the buy back.
- The required return and risk premium on the equity shares after the buyback.
- The required return on debt.

Solution:

$$\begin{aligned}
 \text{a) } \beta_A &= \beta_E \times W_E + \beta_D \times W_D \\
 0.6 &= \beta_E \times 50\% + 0 \times 50\% \\
 \beta_E &= 1.2
 \end{aligned}$$

- b) Required return & Equity risk premium before buyback

$$R_j = 20\%$$

$$R_j = R_f + \text{Equity Risk Premium}$$

$$20 = 10 + \text{Equity Risk Premium}$$

$$\text{Equity Risk Premium} = 10\%$$

- c) Calculating R_m :

$$\text{Equity Risk Premium before buyback} = \beta_{(\text{before buyback})} \times (R_m - R_f)$$

$$10\% = 0.6 (R_m - 10\%)$$

$$R_m = 26.67\%$$

$$\begin{aligned}
 \text{Required return \& Equity risk premium after buyback} &= \beta_{(\text{after buyback})} \times (R_m - R_f) \\
 &= 1.2 (26.67 - 10) \\
 &= 20\%
 \end{aligned}$$

- d) Required return on debt = 10%

Mutual Fund



**QUESTION 1:**

N 14

only on calci

Cinderella Mutual Fund has the following assets in Scheme Rudolf at the close of business on 31st March, 2014.

Company	No. of Shares	Market Price (₹)
Nairobi	25,000	20
Dakar	35,000	300
Senegal	29,000	380
Cairo	40,000	500

The total number of units of Scheme Rudolf are 10 lacs. The Scheme Rudolf has accrued expenses of ₹ 2,50,000 and other liabilities of ₹ 2,00,000. Calculate the NAV per unit of the Scheme Rudolf.

Solution:

Shares	No. of shares	Price (₹)	Amount (₹)
Nairobi Ltd.	25,000	20.00	5,00,000
Dakar Ltd.	35,000	300.00	1,05,00,000
Senegal Ltd.	29,000	380.00	1,10,20,000
Cairo Ltd.	40,000	500.00	2,00,00,000
Total Amount			4,20,20,000
Less: Accrued Expenses			2,50,000
Other Liabilities			2,00,000
Total Value			4,15,70,000
÷ No. of Units			10,00,000
NAV per Unit			41.57

**QUESTION 2:**

M 16 | M 14 | M 10 | RTP | SM

Calculate the NAV of a regular income scheme on per unit basis of Red Bull mutual fund from the following information:

Particulars	Rs. In Crores
Listed shares at cost (ex-dividend)	30.00
Cash in hand	0.75
Bonds & Debentures at cost (ex-interest)	2.30
Of these, bonds not listed & not quoted	1.00
Other fixed interest securities at cost	2.50
Dividend accrued → <i>(dividend receivable)</i>	0.80
Amount payable on shares	8.32
Expenditure accrued → <i>0.5 exp.</i>	1.00
Value of listed bonds & debentures at NAV date	10.00

Number of units (₹10 face value)

30 lakhs

Current realizable value of fixed income securities of face value of ₹ 100 is

106.50

→ Extra. Info: No use.

Mutual Funds

The listed shares were purchased when index was
and the Present index is

7100
9000

Unlisted bonds and debentures are at cost. Other fixed interest securities are also at cost.

Solution:

Particulars	₹ crores
Equity Shares $\left[\frac{30}{7,100} \times 9,000 \right]$	38.028
Cash in hand	0.75
Bonds and debentures not listed	1.00
Bonds and debentures listed	10.00
Dividends accrued	0.80
Fixed interest securities	2.50
Less: Amount payable on shares	(8.32)
Expenditure accrued	(1.00)
Net Assets	43.758
Number of units	0.3
Net Assets Value per unit	₹ 145.86

Self-note: 'Current Realisable Value of Fixed Income' given in the question is of no use in the solution.



QUESTION 3:

N 20 | M 18 | M 12

SG Mutual Fund Co. has the following assets under it on the close of business as on:

Company	No. of Shares	1 st February 2012 Market price per share (Rs.)	2 nd February 2012 Market price per share (Rs.)
Q Ltd	2,000	200.00	205.00
R Ltd	30,000	312.40	360.00
S Ltd	40,000	180.60	191.55
T Ltd	60,000	505.10	503.90

Total No. of Units 6,00,000

a. Calculate Net Assets Value (NAV) of the Fund as on 1st February.

b. Following information is given:

Assuming one Mr. Zubin, an investor, submits a cheque of Rs. 30,00,000 to the Mutual Fund and the Fund manager of this company purchases 8,000 shares of R. Ltd; and the balance amount is held in Bank. In such a case, what would be the position of the Fund?

c. Find new NAV of the Fund as on 2nd February 2012.

Solution:

(i) Net Assets Value (NAV) of the Fund as on 1st February:

Company	No. of Shares	MPS on 1 st Feb	MV
Q Ltd.	2,000	200.0	4,00,000

On 1st
Feb...

R Ltd.	30,000	312.4	93,72,000
S Ltd.	40,000	180.6	72,24,000
T Ltd.	60,000	505.1	3,03,06,000
			4,73,02,000

$$\text{NAV per unit} = \frac{4,73,02,000}{6,00,000} = 78.8367 \text{ i.e., } 78.84$$

- (ii) Closing Cash Balance = $30,00,000 - 8,000 \times 312.40$
 $= 5,00,800$

$$\text{No. of units to be issued} = \frac{30,00,000}{78.8367} = 38,053.34$$

$$\text{Total Units} = 6,00,000 + 38,053.34 = 6,38,053.34$$

The revised position of fund shall be as follows:

Company	No. of Shares	MPS on 1 st Feb	MV
Q Ltd.	2,000	200.0	4,00,000
R Ltd.	38,000	312.4	1,18,71,200
S Ltd.	40,000	180.6	72,24,000
T Ltd.	60,000	505.1	3,03,06,000
Cash			5,00,800
			5,03,02,000

$$\text{NAV per unit} = \frac{5,03,02,000}{6,38,053.34} = 78.8367 \text{ i.e., } 78.84$$

- (iii) On 2nd Feb, the NAV of fund will be as follows:

Company	No. of Shares	MPS on 2 nd Feb	MV
Q Ltd.	2,000	205.00	4,10,000
R Ltd.	38,000	360.00	1,36,80,000
S Ltd.	40,000	191.55	76,62,000
T Ltd.	60,000	503.90	3,02,34,000
Cash			5,00,800
			5,24,86,800

$$\text{NAV per unit} = \frac{\text{₹ } 5,24,86,800}{6,38,053} = \text{₹ } 82.26 \text{ per unit}$$



QUESTION 4:

N21 | M 15 | RTP

There are two Mutual Funds viz D Mutual Fund Ltd. and K Mutual Fund Ltd. Each having close ended equity schemes.

NAV as on 31-12-2014 of equity schemes of D Mutual Fund Ltd. is Rs. 70.71 (consisting 99% equity and remaining cash balance) and that of K Mutual Fund Ltd. is 62.50 (consisting 96% equity and balance in cash)

Following is the other information:

Mutual Funds

We will have to assume that the beta calculated using below data is the beta of only equity component of the NAVs and not entire NAVs

Particular	Equity Schemes	
	D Mutual Fund Ltd.	K Mutual Fund Ltd.
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% 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.

Solution:

	D Mutual Fund	K Mutual Fund
NAV as on 31/12/2014	70.71	62.50
Less: Equity	70.0029	60
Cash	0.7071	2.50

Calculating 'E(R) - R_f' using Sharpe Ratio:

Sharpe Ratio		
$\frac{E(r) - R_f}{\sigma_p}$	$2 = \frac{E(r) - R_f}{11.25}$	$3.3 = \frac{E(r) - R_f}{5}$
	$22.5 = E(r) - R_f$	$16.5 = E(r) - R_f$

Calculating β_p using Treynor Ratio:

Treynor Ratio		
$\frac{E(r) - R_f}{\beta_p}$	$15 = \frac{22.50}{\beta_p}$	$15 = \frac{16.5}{\beta_p}$
	$\beta_p = 1.5$	$\beta_p = 1.1$
If market goes down by:	5%	5%
Beta	1.50	1.10
Equity will go down by:	7.50%	5.50%

Cash balance at the end of the month:

	DMF	KMF
Opening Cash in Hand	0.7071	2.50
Less: Annual Average Cost (3/12)	(0.25)	(0.25)
Closing Cash Balance	0.4571	2.25

NAV at the end of the month:

Value of equity	$70.0029 \times (1 - 0.075) = 64.7527$	$60 \times (1 - 0.055) = 56.07$
Add: Cash	0.4571	2.25
	65.2098	58.95

**QUESTION 5:**

M 18

NAV

The unit price of Equity Linked Savings Scheme (ELSS) of a mutual fund is Rs. 10/-. The public offer price (POP) of the units is Rs. 10.204 and the redemption price is Rs. 9.80.

Calculate: A) Front-end Load B) Back end Load

Solution:

(a) Front-end load

$$\text{Offer Price} = \text{NAV} (1 + \text{Entry load})$$

$$10.204 = 10 (1 + \text{Entry load}\%)$$

$$1.0204 - 1 = \text{Entry load}$$

$$\text{Entry load} = 2.04\%$$

(b) Back-end load

$$\text{Redemption price} = \text{NAV} (1 - \text{Exit load})$$

$$9.80 = 10 (1 - \text{Exit load})$$

$$1 - 0.98 = \text{Exit load}$$

$$\text{Exit load} = 2\%$$

**QUESTION 6:**

M 10 | M 09 | M 03

only on calc

A mutual fund that had a net asset value of Rs. 16 at the beginning of a month, made income and capital gain distribution of Rs. 0.04 and Rs. 0.03 respectively per unit during the month, and then ended the month with a net asset value of Rs. 16.08. Calculate monthly and annual rate of return.

Solution:

$$\begin{aligned} \text{Monthly return} &= \frac{\text{NAV}_1 - \text{NAV}_0 + D + CG}{\text{NAV}_0} \\ &= \frac{0.04 + 0.03 + 16.08 - 16}{16} \times 100 \\ &= 0.9375\% \end{aligned}$$

$$\text{Annual Return} = 0.9375 \times 12 = 11.25\% \text{ p.a.}$$

**QUESTION 7:**

N 18 | M 13 | RTP

On 1-4-2012 ABC Mutual Fund issue 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 off 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% was in arrears. In April 2012 the fund earned dividends amounting to Rs. 2 lakhs and it distributed 80% of the realized earnings. On 30-4-2012 the market value of the portfolio was Rs. 198 lakhs.

Mr. Akash, an investor, subscribed to 100 units on 1-4-2012 and disposed off the same at closing NAV on 30-4-2012. What was his annual rate of earnings?

$$(2L \text{ div} + 3L \text{ CG}) \times 80\% = 4 \text{ lac.}$$

Solution:

Calculation of Cash Balance on 30/4/2012

Opening Balance	(20 x 10)	200
Less: Initial Expense		-12
Less: Invested		-185
Add: Proceeds from sale of securities		63
Less: Securities Purchased		-56
Less: Fund management expense	(9 – 10%)	-7.2
Add: Dividend received		2
Less: Dividend distributed	(3 + 2) x 80%	-4
Closing Cash		0.8

Calculation of closing NAV₁:

MV of the portfolio	198
Add: Cash Balance	0.8
Less: Fund Management Expense Payable	(0.8)
Closing NAV <i>Total NAV</i>	198
÷ Number of Units	20
NAV per unit <i>(₹)</i>	₹ 9.9 <i>p.u.</i>

$$\text{Calculation of Dividend \& capital gains} = \frac{4,00,000}{20,00,000}$$

$$= 0.20 \text{ per unit}$$

$$\text{Annual Rate of earnings} = \frac{\text{NAV}_1 - \text{NAV}_0 + D + CG}{\text{NAV}_0} \times 12 \times 100$$

$$= \frac{0.20 + 9.9 - 10}{10} \times 100 \times \frac{12}{1}$$

$$= 12\%$$

could have been day-wise calc.



QUESTION 8:

M 22 | N 09 | RTP

A mutual fund made an issue of New Fund Offer (NFO) on 01/01/2021 of 10.00 Lakh Units of ₹ 10 each. No entry load was charged. It made the following investments:

Particulars	(₹)
25,000 Equity Shares of XYZ Ltd., ₹ 100 each @ 320	80,00,000
5% Government Securities	4,00,000
10% NCDs Unlisted	5,00,000
8% Listed Debentures	10,00,000

despite the effect of bonus, share price on post-bonus basis, opp'd by 15%.

During the year, dividends of ₹ 8.00 lakhs were received on equity shares. Interest on all types of debt securities were received. 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.

1st event

2nd event

- Find out the NAV per unit as on 31st December given that the operating expenses paid during the year amounting to ₹ 3,00,000.
- Find out the NAV, if the MF had distributed a dividend of ₹ 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?

Solution:

- (a) Calculating cash balance on 31st Dec:

	In ₹
Issue proceeds	1,00,00,000
Investments in securities	(99,00,000)
Dividend Received	8,00,000
Interest on 5% Govt. Securities	20,000
Interest on 10% NCDs	50,000
Interest on 8% Listed Debentures	80,000
Interim Dividend (25,000 ÷ 100 ÷ 10%)	2,50,000
Less: Operating expenses paid	(3,00,000)
Cash Balance on 31 st Dec	10,00,000

Calculation of NAV

Cash Balance	10,00,000
Equity shares (27,500 ÷ 368)	1,01,20,000
5% Govt. Securities	4,00,000
10% NCDs	5,00,000
8% Listed Debentures (20% premium)	12,00,000
Total NAV	1,32,20,000
No. of Units	10,00,000
NAV per Unit	₹ 13.32

- (b) Calculation of NAV, if dividend of ₹ 0.50 is paid:

$$\begin{aligned}
 &= \frac{\text{Net Assets}}{\text{Number of units}} \\
 &= \frac{1,32,20,000 - 5,00,000}{10,00,000} = 12.72
 \end{aligned}$$

- (c) Annualized Return

$$\begin{aligned}
 &= \frac{\text{NAV}_1 - \text{NAV}_0 + D + CG}{\text{NAV}_0} \\
 &= \frac{13.22 - 10}{10} = 32.2\%
 \end{aligned}$$

$$\text{Or } = \frac{(12.72 - 10) + 0.5}{10} = 32.2\%$$



QUESTION 9:

M 19

The following particulars relating to Vishnu Fund Scheme:

Particulars	Value Rs. in Crores
1. Investments in Shares (at cost)	
a. Pharmaceutical Companies	79
b. Construction Industries	31
c. Service Sector Companies	56
d. IT Companies	34
e. Real Estate Companies	10
2. Investments in Bonds (Fixed Income)	
a. Listed Bonds (8000, 14% Bonds of Rs. 15,000 each)	12
b. Unlisted Bonds	7
3. No. of Units outstanding (crores)	4.2
4. Expenses Payable	3.5
5. Cash and Cash equivalents	1.5
6. Market expectations on listed bonds → RRR or YTM of Bond.	8.842%

Particulars relating to each sector are as follows:

Sector	Index on Purchase date	Index on Valuation
Pharmaceutical companies	260	465
Construction Industries	210	450
Service Sector Companies	275	480
IT Companies	240	495
Real Estate Companies	255	410

The fund has incurred the following expenses:

Consultancy and Management fees	Rs. 480 Lakhs
Office Expenses	Rs. 150 Lakhs
Advertisement Expenses	Rs. 38 Lakhs

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 Expenses ratio.

Note: Calculate figure in ₹ Crore up-to 3 decimal points.

Solution:

- Calculation of NAV

Crore ₹

1	Value of Shares		
a.	Pharmaceutical Companies	$\frac{79}{260} \times 465$	141.2885
b.	Construction Companies	$\frac{31}{210} \times 450$	66.4286
c.	Service Sector Companies	$\frac{56}{275} \times 480$	97.7455
d.	IT Companies	$\frac{34}{240} \times 495$	70.1250
e.	Real Estate Companies	$\frac{10}{255} \times 410$	16.0784
2.	Investment in Bonds		
a.	Listed Bonds	$\frac{12 \text{ Cr.} \times 14\%}{0.08842}$	19.00
b.	Unlisted Bonds		7.000
3.	Cash and Cash Equivalents		1.500
4.	Less: Expense Payable		(3.500)
	NAV of the Fund		415.665

(ii) NAV of the Fund Per Unit

$$= \frac{415.665 \text{ crore}}{4.20 \text{ crore}} = 98.9679 \text{ i.e., ₹ 98.97}$$

(iii) *Self Note:* To calculate return we need to have NAV_0 (that is NAV 2 years back), we have the price details of shares and bonds of 2 years back but details of cash and expense payable is missing. Hence assumed it to be zero.

$$\text{Calculation of } NAV_0 = \frac{229 \text{ crore}}{4.20 \text{ crore}} = 54.5238 \text{ i.e., ₹ 54.52}$$

$$\begin{aligned} \text{Net Return} &= \frac{D + NAV_1 - NAV_0}{NAV_0} \times 100 \times \frac{12}{24} \\ &= \frac{2 \times 3 + 98.9678 - 54.5238}{54.5238} \times 100 \times \frac{12}{24} \\ &= 46.26\% \end{aligned}$$

$$(iv) \text{ Average Total NAV} = \frac{415.665 + 229}{2} = 322.3325$$

$$\text{Expense ratio:} = \frac{\text{Annual Expenses}}{\text{Average NAV}}$$

$$= \frac{4.80 + 1.50 + 0.38}{322.3325} \times 100$$

$$= 1.04\% \text{ p.a.}$$



QUESTION 10:

N 17 | N 11 | M 11 | M 06 | RTP M 12

SBI mutual fund has a NPV of Rs. 8.50 at the beginning of the year. At the end of the year NAV increases to Rs. 9.10. Meanwhile fund distributes Rs. 0.90 as dividend and Rs. 0.75 as capital gains.

- What is the fund's return during the year?
- Had these distributions been re-invested at an average NAV of Rs. 8.75 assuming 200 units were purchased originally. What is the return?
- Which option is preferable?

Solution:

(i) Funds return = $\frac{0.90 + 0.75 + 9.10 - 8.50}{8.50} = 26.47\%$ *write formula.*

- (ii) If all dividends and capital gain are reinvested into additional units at ₹ 8.75 per unit the position would be.

Total amount ~~reinvested~~ *of div* = $(0.90 + 0.75) \times 200 = ₹ 330$

Additional units ~~allotted~~ *reinvested* = $\frac{₹ 330}{8.75} = 37.71 \text{ Units}$

Closing number of units = $200 + 37.71 = 237.71$

Return = $\frac{(NAV_1 \times n_1) - (NAV_0 \times n_0)}{(NAV_0 \times n_0)}$

$$= \frac{237.71 \times 9.10 - 200 \times 8.50}{200 \times 8.50}$$

$$= 27.24\%$$

- (iii) Second option is preferable as the return is higher in this case



QUESTION 11:

M 24 | N 12

only on calc

The following information is extracted from Steady Mutual Fund's Scheme:

- Asset value at the beginning of the month - Rs. 65.78
- Annualised return - 15 %
- Distributions made in the nature of Income - Rs. 0.50 and Rs. 0.32 & Capital gain (per unit respectively).

You are required to:

- Calculate the month end net asset value of the mutual fund scheme (limit your answers to two decimals).
- Provide a brief comment on the month end NAV.

Solution:

- (i) Annual Return = $\frac{NAV_1 - NAV_0 + D + CG}{NAV_0}$
- $$15 = \frac{0.50 + 0.32 + NAV_1 - 65.78}{65.78} \times 100 \times \frac{12}{1}$$
- $$NAV_1 = 65.78$$
- (ii) Closing NAV is the same as opening NAV i.e., ₹ 65.78

**QUESTION 12:**

M 21 | N 16 | M 15 | M 13 | N 09 | N 04 | RTP

Even if question number 12 to 16 has dividend payout plan, institute has calculated the return on totality basis.

Mr. K has invested in three Mutual fund schemes as per details below:

Particulars	MF A	MF B	MF C
Date of investment	01.12.2018	01.01.2019	01.03.2019
Amount of investment	Rs. 5,00,000	Rs. 10,00,000	Rs. 5,00,000
Net Asset Value (NAV) at entry date	Rs. 10.50	Rs. 10	Rs. 10
Dividend received upto 31-03-2019	Rs. 9,500	Rs. 15,000	5,000
NAV as at 31-03-2019	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. K upto 31-03-2019, taking the year consisting of 365 days.

Provide a brief comment on the course of action he should take for future period.

(Calculation should be upto three decimal places)

Solution:

Calculation of effective yield on per annum basis in respect of three mutual fund schemes to Mr. K up to 31-03-2019:

Particulars	MF A	MF B	MF C
(a) Investments	Rs. 5,00,000	Rs. 10,00,000	Rs. 5,00,000
(b) Opening NAV	Rs. 10.50	Rs. 10	Rs. 10
(c) No. of units (a/b)	47,619.048	1,00,000	50,000
(d) Unit NAV on 31-3-2019	Rs. 10.40	Rs. 10.10	Rs. 9.80
(e) Total NAV on 31-3-2019 (c x d)	₹4,95,238.099	₹ 10,10,000	₹ 4,90,000
(f) Increase / Decrease of NAV (e - a)	(₹ 4,761.901)	₹ 10,000	(₹ 10,000)
(g) Dividend Received	₹ 9,500	₹ 15,000	₹ 5,000
(h) Total yield (f + g)	₹ 4,738.099	₹ 25,000	(₹ 5,000)
(i) Number of Days	121	90	31
(j) Effective yield p.a. (h/a x 365/i x 100)	2.859%	10.139%	(-) 11.774%

Comments: Since the Effective Yield in Scheme C is negative and that of Scheme A is much lower than Scheme B, it is advised that Mr. K should redeem the investments in Scheme A and Scheme C and the proceeds should be invested in Scheme B in the next period.

Self-note: Even if these type of questions have Dividend Payout Plans, these are to be solved on Totality Basis (& not on per unit basis).



QUESTION 13:

M 24 | N 23

only on calc

Mr. K has invested in three Mutual fund schemes as per details below:

Particulars	MF A	MF B	MF C
Date of investment	01.06.2022	01.07.2022	01.08.2022
Net Asset Value (NAV) at entry date	₹ 11	₹ 10.5	₹ 12
Dividend received upto 31-03-2023	₹ 12,500	₹ 17,000	₹ 4,000
NAV as at 31-03-2023	₹ 11.25	₹ 11.48	₹ 10.80
Increase/(Decrease) in NAV (₹)	₹ 22,727.27	₹ 93,333.33	(₹ 50,000)
Effective Yield per annum	4.2296%	14.6978%	-13.8190%

Ignore Entry/Exit load expenditure.

Assume 365 days in a year. Round off the investment to nearest ₹100.

You are required to calculate:

- The amount of investment made initially by Mr. S in these schemes.
- Number of units invested in the three schemes by Mr. S.

Advise also whether he can continue to hold this investment or can he redeem now.

Solution: *Solution below is not same as lengthy solⁿ of institute.*

Amount of investment & number of units invested *But this is also logical & should fetch marks.*

Particulars	MF A	MF B	MF C
(a) Opening NAV (₹)	₹ 11	₹ 10.5	₹ 12
(b) Closing NAV (₹)	₹ 11.25	₹ 11.48	₹ 10.80
(c) Increase in NAV per unit (₹) [b – a]	₹ 0.25	₹ 0.98	(₹ 1.20)
(d) Total Inc./ (Dec.) in NAV (₹)	22,727.27	93,333.33	(50,000)
(e) No. of units invested [d/c]	90,909.08	95,238.09	41,666.67
(f) Amount of Investment [a x e]	10,00,000	10,00,000	5,00,000

Advice: Since there is no entry and exit load, he can sell the MF B and MF C and continue to hold investment in MF A.



QUESTION 14:

M 18

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 (Rs.)	2,00,000	4,00,000	2,00,000
Net Assets Value (NAV) at the time of purchase (Rs.)	10.30	10.10	10
Dividend Received up to 31.03.2018 (Rs.)	6,000	0	5,000
NAV as on 31.03.2018 (Rs.)	10.25	10	10.20
Effective Yield per annum as on 31.03.018 (percent)	9.66	-11.66	24.15

Assume 1 year = 365 days

Mr. Y has misplaced the documents of his investment. Help him in finding the date of his original investment after ascertaining the following:

- Number of units in each scheme;
- Total NAV;
- Total Yield; and *→ total yield of all MF combined.*
- Number of days investment held. *→ n*
- Date of Invest.*

Solution:

	MFx	MFy	MFz
(i) Number of units	= 2,00,000/10.30 = 19,417.48	= 4,00,000/10.10 = 39,603.96	= 2,00,000/10 = 20,000

(ii) Total NAV	= 19,417.48 × 10.25 = 1,99,029.17	= 39,603.96 × 10 = 3,96,039.6	= 20,000 × 10.20 = 2,04,000
	= 7,99,068.77 i.e., ₹ 8,00,000		

(iii) Total Yield = $\frac{NAV_1 - NAV_0 + D + CG}{NAV_0}$

NAV ₁	199,029.17	396,039.6	204,000
(-) NAV ₀	200,000	400,000	200,000
+ Dividend	6,000	0	5,000
Total	5029.17	(3960.4)	9,000
	10,068.77		

Total Yield = $\frac{10,068.77}{8,00,000} \times 100 = 1.2586\%$

(iv) No. of Days Investment Held

Let No. of days be	X	Y	Z
Initial Investment (₹)	2,00,000	4,00,000	2,00,000
Yield (₹)	5,029.17	-3,960.40	9,000.00
Yield (%)	2.5146	-0.9901	4.5
Period of Holding (Days)	$\frac{2.5146}{9.66} \times 365$ = 95 Days	$\frac{-0.9901}{-11.66} \times 365$ = 31 Days	$\frac{4.5}{24.15} \times 365$ = 68 Days

(v) Date of Investment

	26.12.17	28.02.18	22.01.18
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QUESTION 15:

M 22

Mr. D has invested in the three mutual funds (MF) as per the following details:

Particulars	MF A	MF B	MF C
Amount of Investment (Rs.)	2,00,000	5,00,000	4,00,000
Net Assets Value (NAV) at the time of purchase (Rs.)	10.00	25.00	20.00
Dividend yield up to 31.03.2022 <i>(Assumed periodic)</i>	3%	5%	4%
NAV as on 31.03.2022 (Rs.)	10.50	22.80	20.80
Annualized Yield per annum as on 31.03.2022	9.733%	-11.185%	15%

Assume 1 year = 365 days

Mr. Y has misplaced the documents of his investment.

You are required to help Mr. Y to find out following:

- Number of units allotted in each scheme;
- Value of Investment as on 31.03.2022;
- Holding period of his investments on days on 31.03.2022
- Dates of original investments.
- Total returns on investments.
- Assuming the past performance of all three scheme will continue for next one year, what action should investor take? What will be the expected return for the next one year after the above action?
- Will your answer in point (f) change if the mutual fund charges exit load of 5% if the investment is redeemed within one year? If so, advice the investor what and when the action to be taken to optimise the returns.

Solution:

- a) Number of units of each scheme:

A	$\frac{2,00,000}{10} = 20,000$
B	$\frac{5,00,000}{25} = 20,000$
C	$\frac{4,00,000}{20} = 20,000$

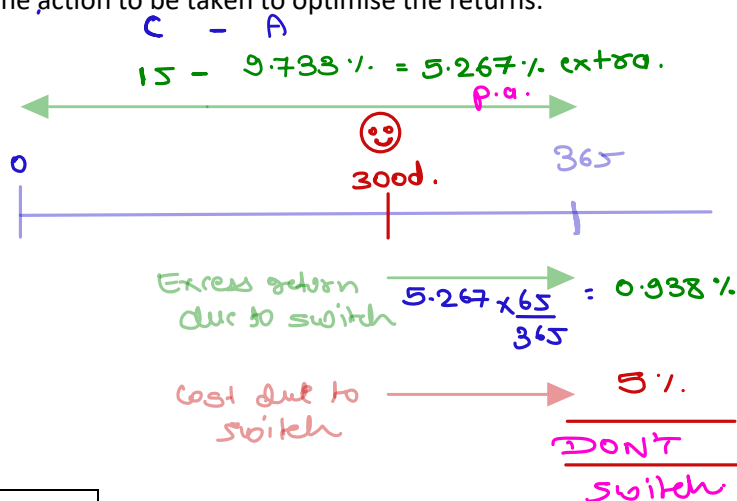
- b) Value of Investment on 31.03.2022

A	$20,000 \times 10.5 = 2,10,000$
B	$20,000 \times 22.8 = 4,56,000$
C	$20,000 \times 20.8 = 4,16,000$

- c) Holding periods of investments (n):

$$\text{MF A: } 0.09733 = \left[\left(\frac{10.5 - 10}{10} \right) + 0.03 \right] \times \frac{365}{n}$$

$$n = 300 \text{ days}$$



$$\text{MF B: } -0.11185 = \left[\left(\frac{22.8 - 25}{25} \right) + 0.05 \right] \times \frac{365}{n}$$

$$n = 124 \text{ days}$$

$$\text{MF C: } 0.15 = \left[\left(\frac{20.8 - 20}{20} \right) + 0.04 \right] \times \frac{365}{n}$$

$$n = 195 \text{ days}$$

d) Original Date of Investment:

A 04.06.2021

B 27.11.2021

C 17.09.2021

e) Total Yield:

MF	Dividend (₹)	CG (₹)	Total Yield (₹)
A	$2,00,000 \times 3\% = 6,000$	$2,10,000 - 2,00,000 = 10,000$	16,000
B	$5,00,000 \times 5\% = 25,000$	$4,56,000 - 5,00,000 = -44,000$	-19,000
C	$4,00,000 \times 4\% = 16,000$	$4,16,000 - 4,00,000 = 16,000$	32,000
			29,000

$$\text{Total Yield (\%)} = \frac{\text{Total Yield (₹)}}{\text{Total Investment}}$$

$$= \frac{29,000}{11,00,000} \times 100 = 2.64\%$$

f) If part of all three schemes will continue for next one year, the investor should redeem the units of MFs 'A' and 'B' and invest the proceeds in MF 'C'. The expected return next will be 15%.

g) if MF charges exit load of 5%:

	MF A	MF B
Holding period	300 days	124 days
Days left to complete the year	65 days	241 days
Additional return in MF C for days left	$\frac{15 - 9.733}{365} \times 65 = 0.94\%$	$\frac{15 - (-11.185\%)}{365} \times 65 = 17.29\%$
Additional cost of Exit Load	5%	5%
Decision	Redeem after 65 days	Redeem now

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 'B' now and units of MF 'A' after 65 days.



QUESTION 16:

N 24 | N 13 | RTP N 17 | N 15 | N 06

On 01-07-2010, Mr. X invested Rs. 50,000/- at initial offer in Mutual Funds at a face value of Rs. 10 each per unit. On 31-03-2011, a dividend was paid @ 10% and annualized yield was 120%. On 31-03-2012, 20% dividend and

→ Refer similar nature earlier question of N24 exam.

Mutual Funds

capital gain of Rs. 0.60 per unit was given. On 31-03-2013, Mr. X redeemed all his 6271.98 units when his annualized yield was 71.50% over the period of holding. Calculate NAV as on 31-03-2011, 31-03-2012 and 31-03-2013.

For calculations consider a year of 12 months.

Solution:

Self-note: This is a reinvestment plan since number of units are changing from 5,000 to 6271.98 units. This question has been solved using two methods:

Methods 1: Formula of Return from Mutual Fund

As on 31/3/11

$$\text{No. of units on 1/7/2010} = \frac{50,000}{10} = 5,000$$

$$\text{Total dividend reinvested} = 5000 \times 10 \times 10\% = 5000$$

$$\text{Total no. of units on 31/3/2011} = 5000 + \frac{5000}{\text{NAV}_1}$$

$$\begin{aligned} \text{Annualized Return} &= \frac{(\text{NAV}_1 \times n_1) - (\text{NAV}_0 \times n_0)}{(\text{NAV}_0 \times n_0)} \times 100 \times \frac{12}{9} \\ 120 &= \frac{[\text{NAV}_1 \times (5000 + \frac{5000}{\text{NAV}_1})] - 50,000}{50,000} \times 100 \times \frac{12}{9} \\ \text{NAV}_1 &= 18 \end{aligned}$$

$$\text{No. of units} = 5,000/18 + 5,000 = 5,277.78$$

As on 31/3/12

Since, there is no dividend or capital gain during the year 2012-2013, therefore closing number of units on 31/03/2012 will be same as 31/03/2013 i.e., 6,271.93

$$\begin{aligned} \text{Total Div \& CG in 2011-12} &= 5277.78 \times (2 + 0.6) \\ &= 13,722.23 \end{aligned}$$

Total no. of units on 31/3/2012 = Units of 31/3/2011 + units allotted for reinvestment

$$6,271.98 = 5,277.78 + \frac{13,722.23}{\text{NAV}_2}$$

$$\text{NAV}_2 = 13.80$$

As on 31/3/13

Calculation of NAV₃ on 31/3/2013

$$\begin{aligned} \text{Annual Return} &= \frac{(\text{NAV}_3 \times n_3) - (\text{NAV}_0 \times n_0)}{(\text{NAV}_0 \times n_0)} \times 100 \times \frac{12}{33} \\ 71.5 &= \frac{(\text{NAV}_3 \times 6271.98) - 50,000}{50,000} \times 100 \times \frac{12}{33} \\ \text{NAV}_3 &= 23.65 \end{aligned}$$

Methods 2: Common sense approach followed by ICAI

Self-note: Suggested answer missed to consider CG of ₹ 0.6 per unit in the year 2011-12 in its solution.

Yield for 9 months ($120\% \times 9/12$) = 90%
 Market value of Investments as on 31.03.2011 = ₹ 50,000/- + (₹ 50,000 × 90%)
 = ₹ 95,000/
 Therefore, NAV as on 31.03.2011 = (₹ 95,000 - ₹ 5,000)/5,000 = ₹ 18.00

Since dividend was reinvested by Mr. X, additional units acquired = $\frac{₹ 5,000}{₹ 18} = 277.78$ unit

Therefore, units as on 31.03.2011 = 5,000 + 277.78 = 5,277.78

Alternatively, units as on 31.03.2011 = (₹ 95,000/₹ 18) = 5,277.78

Dividend as on 31.03.2012 = 5,277.78 × ₹ 10 × 0.2 = ₹ 10,555.56

Let X be the NAV on 31.03.2012, then number of new units reinvested will be = ₹ 10,555.56/X.

Accordingly, 6,271.98 units shall consist of reinvested units and 5277.78 (as on 31.03.2011).

Thus, by way of equation it can be shown as follows:

$$6271.98 = \frac{5277.78 \times (2 + 0.6)}{X} + 5277.78$$

It was missed in suggested answer

Therefore, NAV as on 31.03.2012 = X = ₹ 13.80

NAV as on 31.03.2013 = ₹ 50,000 (1 + 0.715 × 33/12)/6,271.98 = ₹ 23.65



QUESTION 17:

N 19 | M 19 | N 08 | RTP

Sun Moon Mutual Fund (Approved Mutual Fund) sponsored open-ended equity-oriented scheme “Chanakya Opportunity Fund”. There were three plans viz. ‘A’ – Dividend Reinvestment 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 & choose ‘B’, ‘C’ & ‘A’ Plan respectively.

The History of the Fund as follows:

Date	Dividend %	Bonus Ratio	Net Asset Value per Unit (F.V. 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

Charu Anand Bacchan

On 31st July all three investors redeemed all the 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 per cent only on sale/redemption of units.
- Ignore Education Cess.

Solution:

Mutual Funds

Plan A: Mrs. Charu

Dates	Dividend per unit	Total Dividend	NAV	Unit reinvested	Total number of units
01-04-1999					10,000
28-07-2003	2	20,000	30.7	651.47	10,651.47
31-03-2004	7	74,560.29	58.42	1276.28	11,927.75
31-10-2007	4	47,711.00	42.18	1131.13	13,058.88
15-03-2008	2.5	32,647.20	46.45	702.85	13,761.73
24-03-2009	4	55,046.92	48.1	1144.43	14,906.16

Total sale proceeds: $14,906.16 \times 53.75$	8,01,206.10
Less: STT @ 0.2%	(1,602.41)
	7,99,603.69
Less: STCG @ 10%: $(53.75 - 48.10) \times 1144.43 \times 10\%$	(646.59)
	7,98,957.10

$$\begin{aligned} \text{Annual Return} &= \frac{(\text{NAV}_1 \times n_1) - (\text{NAV}_0 \times n_0)}{(\text{NAV}_0 \times n_0)} \times 100 \times \frac{12}{124} \\ &= \frac{7,98,957.09 - 1,00,000}{1,00,000} \times 100 \times \frac{12}{124} \\ &= 67.64\% \end{aligned}$$

Plan B: Mr Anand

Date	Bonus Ratio	Units Issued	Total
1/4/1999	0	10,000	10,000
31/3/04	5:4	12,500	22,500
31/3/08	1:3	7,500	30,000
24/3/09	1:4	7,500	37,500

Total sale proceeds: $37,500 \times 22.98$	8,61,750
Less: STT @ 0.2%	(1,723.5)
	8,60,026.5
Less: STCG @ 10%: $(22.98 - 19.95) \times 7500 \times 10\%$	(2,272.5)
	8,57,754

$$\begin{aligned} \text{Annualized Return} &= \frac{8,57,754 - 1,00,000}{1,00,000} \times 100 \times \frac{12}{124} \\ &= 73.33\% \end{aligned}$$

Plan C: Mr. Bacchan

Total sale proceeds: $10,000 \times 82.07$	8,20,700
Less: STT @ 0.2%	(1,641.4)
	8,19,058.6

$$\begin{aligned}\text{Annualized Return} &= \frac{8,19,058.6 - 1,00,000}{1,00,000} \times 100 \times \frac{12}{124} \\ &= 69.59\%\end{aligned}$$

**QUESTION 18:**

MTP M 24

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 ₹ 10. On 1-4-2018 Mr. K invested ₹ 2,00,000 each in Plan-D and Plan-B when the NAV was ₹ 38.20 and ₹ 35.60 respectively. Both the plans matured on 31-3-2023.

Particulars of dividend and bonus declared over the period are as follows:

Date	Dividend %	Bonus Ratio	Net Asset Value (₹)	
			Plan D	Plan B
30-09-2018	10	---	39.10	35.60
30-06-2019	---	1:5	41.15	36.25
31-03-2020	15	---	44.20	33.10
15-09-2021	13	---	45.05	37.25
30-10-2021	---	1:8	42.70	38.30
27-03-2022	16	---	44.80	39.10
11-04-2022	---	1:10	40.25	38.90
31-03-2023	---	---	40.40	39.70

Evaluate the Effective Yield Per Annum in respect of the above two plans.

Note:

- Use following PV Factors:
PVIF (2%,5) = 0.9057, PVIF (4%,5) = 0.8219, PVIF (8%,5) = 0.6806, PVIF (13%,5) = 0.5428
- Round off calculations upto 2 decimal points.

∴ factors given
∴ IRR method also.

Solution:**Plan – D**

$$\text{Unit acquired} = \frac{2,00,000}{38.20} = 5235.60$$

Date	Units held	Dividend		Re- investment Rate	New Units	Total Units
		%	Amount			
01.04.2018						5235.60
30.09.2018	5235.60	10	5235.60	39.10	133.90	5369.50
31.03.2020	5369.50	15	8054.25	44.20	182.22	5551.72
15.09.2021	5551.72	13	7217.24	45.05	160.20	5711.92
27.03.2022	5711.92	16	9139.07	44.80	204.00	5915.92
31.03.2023	Maturity Value	(₹ 40.40 X 5915.92)				₹ 2,39,003.17

$$\begin{aligned}\therefore \text{Approximate Effective Yield} &= \frac{2,39,003.17 - 2,00,000}{2,00,000} \times \frac{1}{5} \times 100 \\ &= 3.90\%\end{aligned}$$

Mutual Funds

Now more accurate effective yield can be computed by using the IRR method as follows:

At Rate of: PV of Maturity Value is:

2% → 2,16,465.17

? = 3.64% ← 2,00,000.00

4% → 1,96,436.71

$$\frac{x - 2}{4 - 2} = \frac{21 - 216465.17}{196436.71 - 216465.17}$$

Accurate Effective Yield = 3.64%

Plan – B

Date	Particulars	Calculation Working	No. of Units	NAV (₹)
24 01.04.2018	Investment	₹ 2,00,000/35.60 =	5617.98	35.60
30.06.2019	Bonus	5617.98/5 =	<u>1123.60</u>	36.25
			6741.58	
30.10.2021	"	6741.58/8 =	<u>842.70</u>	38.30
			7584.28	
11.04.2022	"	7584.28/10 =	<u>758.43</u>	38.90
			8342.71	
31.03.2023	Maturity Value	8342.71 x ₹ 39.70 =		3,31,205.59

$$\therefore \text{Approximate Effective Yield} = \frac{1,31,205.59}{2,00,000} \times \frac{1}{5} \times 100$$

$$= 13.12\%$$

Now more accurate effective yield can be computed by using the IRR method as follows:

At Rate of: PV of Maturity Value is:

8% → 2,25,418.52

? = 10.78% ← 2,00,000.00

13% → 1,79,778.39

Accurate Effective Yield = 10.78%



QUESTION 19:

M 21

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 ₹ 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.

Solution:

Method 1: Using formula of Return from Mutual Funds

Let the number of units on 01/04/2016 (n_0) be X

Date	Bonus Ratio	Units Allotted	Total Units
01-04-2016	-	X	X
30-09-2017	1 : 5	$X \times \frac{1}{5} = 0.2 X$	1.2 X
30-09-2019	1 : 4	$1.2 X \times \frac{1}{4} = 0.3 X$	1.5 X

$$\text{Annual Return} = \frac{(\text{NAV}_1 \times n_1) - (\text{NAV}_0 \times n_0)}{(\text{NAV}_0 \times n_0)} \times 100 \times \frac{12}{60}$$

$$17.5 = \frac{(100 \times n_1) - 16,00,000}{16,00,000} \times 100 \times \frac{12}{60}$$

$$n_1 = 30,000$$

$$\text{Number of units on 01/04/2016 } (n_0) = \frac{30,000}{1.5} = 20,000 \text{ units}$$

$$\text{Opening NAV} = \frac{16,00,000}{20,000} = ₹ 80 \text{ per unit}$$

Method 2: Using common sense followed by ICAI

(a) Amount invested by Mr. Optimistic as on 01/04/2016	₹ 16,00,000
(b) Gain during 5 years ($16,00,000 \times 17.5\% \times 5$ years)	₹ 14,00,000
(c) Value of investment as on 31/03/2021 (a + b)	₹ 30,00,000
(d) NAV as on 31/03/2021	₹ 100 per Unit
(e) Total number of units as on 31/03/2021 (c / d)	30000 Units
Total units before second bonus = $30,000 \times 4/5$	24000 Units
Total units before first bonus = $24,000 \times 5/6$	20000 Units
NAV as on 01/04/2016 = $16,00,000 / 20000$	₹ 80 per Unit

**QUESTION 20:**

N 21

M/S Enterprise, an Asset management Company (AMC) on 1.04.2016 has floated a scheme "Dividend Plan". Mr. X, an investor, has invested in the scheme. Dividend is given in the form of units. The details (except the issue price) are as follows:

Date	Dividend (%)	NAV
1.04.2016		?
31.03.2018	20	48
31.03.2019	25	50
31.03.2020	30	45
31.03.2021	-	49
Initial Investment (₹)	₹ 18,40,000	
Average Profit (₹) over 5 years	₹ 54,576	

↳ absolute.

Mutual Funds

You are required to calculate the issue price of the scheme as on 01.04.2016 to ascertain the capital appreciation. Assume face value of units as ₹ 10/-

Solution:

Particulars	₹
(a) Amount invested by Mr. X	18,40,000
(b) Gains during 5 years [₹ 54,576 × 5]	2,72,880
(c) Value of investment as on 31/3/21 (a + b)	21,12,880
(d) NAV as on 31.03.21	₹ 49 per unit
(e) Total Number of units as on 31.03.21 (c)	₹ 43,120 units

Let us assume the no. of units on 31.03.2020 before dividends be N_3 , then:

$$N_3 + \frac{N_3 \times 10 \times 30\%}{45} = 43,120$$

$$N_3 = 40,425$$

Let us assume the no. of units on 31.03.2019 before dividends be N_2 , then:

$$N_2 + \frac{N_2 \times 10 \times 25\%}{50} = 40,425$$

$$N_2 = 38,500$$

Let us assume the no. of units on 31.03.2018 before dividends be N_1 , then:

$$N_1 + \frac{N_1 \times 10 \times 20\%}{48} = 38,500$$

$$N_1 = 36,960$$

Hence, no. of units on 01.04.2016 = 36,960

$$\text{NAV as on 01.04.16} = \frac{18,40,000}{36,960} = ₹ 49.78$$

Thus, issue price of unit is ₹ 49.78



QUESTION 21:

M 23 | N 20

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 (₹)	27,748.6	
Average Yield (%)		6.4

You are required to calculate issue price of both the schemes as on 01.04.2015

Solution:

Self-note: FV of the MF units is missing. Looking at NAV numbers, assumption of FV of ₹ 10 looks to be the most logical. Dividend plan is assumed as dividend reinvestment plan. *[make it a rule for all such types of quesⁿ, if it is silent]*

Average Annual Gain over a period of 5 years	27,748.6
Total Gain over a period 5 years (27,748.6 × 5)	1,38,743
Initial Investment	9,20,000
Total value of Investment on 31/03/2020	10,58,743
NAV as on 31/03/2020	49
No. of units on 31/03/2020	21,607

Let us as assume the no. of units on 31.03.2019 before dividends be N_3 , then:

$$N_3 + \frac{N_3 \times 10 \times 15\%}{45} = 21,607$$

$$N_3 = 20,910$$

Let us as assume the no. of units on 31.03.2018 before dividends be N_2 , then:

$$N_2 + \frac{N_2 \times 10 \times 10\%}{50} = 20,910$$

$$N_2 = 20,500$$

Let us as assume the no. of units on 31.03.2017 before dividends be N_1 , then:

$$N_1 + \frac{N_1 \times 10 \times 12\%}{48} = 20,500$$

$$N_1 = 20,000$$

Hence, no. of units on 01.04.2015 = 20,000

$$\text{NAV as on 01.04.15} = \frac{9,20,000}{20,000} = ₹ 46$$

Thus, issue price of unit is ₹ 46

Bonus Plan

Let the opening no. of units be x

Dates	No. of Bonus units issued	
1/4/15	X	X
31/12/16	0.25x	1.25x
31/12/18	0.25x	1.5x

$$\begin{aligned}\text{Annual Return} &= \frac{(\text{NAV}_1 \times n_1) - (\text{NAV}_0 \times n_0)}{(\text{NAV}_0 \times n_0)} \times 100 \times \frac{12}{60} \\ 6.4 &= \frac{44 \times 1.5x - 10,00,000}{10,00,000} \times 100 \times \frac{12}{60} \\ X &= 20,000 \\ \text{Issue Price} &= \frac{10,00,000}{20,000} = 50\end{aligned}$$



QUESTION 22:

N 19 | M 09 | RTP

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.

1. How much should the mutual fund earn to provide Mr. Alex a return of 15 percent per annum?
2. 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?

Solution:

(i) Return to be earned by Mutual Fund

$$\begin{aligned}&= \frac{\text{Return}}{1 - \text{Initial exp}\%} + \text{Recurring exp}\% \\&= \frac{0.15}{1 - 0.06} + 0.02 \\&= 17.96\%\end{aligned}$$

(ii) Total Income, if Mr. Alex manages his portfolio:

Annual Professional Income	= 40,00,000
From equity (50,00,000 × 15%)	= 7,50,000
Total Income	= 47,50,000

Total Income if amount invested in multi cap fund:

Annual Professional Income (40,00,000 + 10%)	44,00,000
From equity (50,00,000 × 13%)	<u>6,50,000</u>
	50,50,000

*Self note: Ambiguity:
It should be: 40L
30%*

Since total income of Mr. Alex increases by investing into multi-cap fund, therefore can invest the portfolio in multi-cap funds

$$\begin{aligned}\text{Net financial Benefit} &= 50,50,000 - 47,50,000 \\&= 3,00,000\end{aligned}$$

**QUESTION 23:**

M 21 | N 18

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 ₹ 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 ₹ 0.04. The NAV has appreciated by 25% during the year.

Assume the face value of the unit as ₹ 10.00.

You are required to calculate:

- Opening NAV,
- Number of the units purchased,
- Original amount of the investment.

Solution:

- (i) Let N be the opening NAV, then

$$N (1 + 0.25) = ₹ 24.95$$

$$N = ₹ 19.96$$

i.e., beginning NAV = ₹ 19.96

- (ii) Let X be the number of units purchased

Then ending units = 20,800

Accordingly,

$$20,800 = X + \frac{0.998X}{24.95}$$

$$20,800 = \frac{24.05X + 0.998X}{24.95}$$

$$X = 20,000$$

Thus, number of units to be purchased = 20,000

- (iii) Original amount of investment:

Initial NAV	₹ 19.96
Entry Load	₹ 0.04
	₹ 20.00
Number of funds purchased	₹ 20,000
Amount of investment	₹ 4,00,000

**QUESTION 24:**

N 15 | J 21 | RTP

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 lakh 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 distributed.

In respect of April-June quarter, the following additional information are available:

Mutual Funds

	Rs. in lakh
Portfolio value appreciation	425.47
Income of April	22.950
Income of May	34.425
Income of June	45.450

You are required to calculate

- Income available for distribution;
- Issue price at the end of April;
- repurchase price at the end of May; and
- net asset value (NAV) as on 30th June.

Solution:

- (i) Income Available for Dist.

	Total Income		Units		Per Unit
Income of April	22.950	→	300	→	0.0765
Issue: Amount collected as Div. Equal.	0.459	←	6	←	0.0765
Add:	23.409		306		0.0765
Balance Income of May	34.425	→	306	→	0.1125
	57.834		306		0.189
Redem: Amount paid as Dividend Equal ⁿ	(0.567)	←	(3)	←	0.189
	57.267		303		0.189
Add: Income of June	45.450		303		0.15
Income available for distribution	102.717		303		0.339
Income distributed @ 70%	(71.9019)		303		(0.2373)
	30.8151				0.1017

- (ii) Issue price at end of April

Opening NAV	18.75
Add: Entry load @ 2%	<u>0.375</u>
	19.125
Dividend equalisation	<u>0.0765</u>
Issue price	19.2015

- (iii) Repurchase price for may

Opening NAV	18.75
Less: Exit load @ 2%	<u>(0.375)</u>
	18.375
Add: Dividend equalisation	<u>0.189</u>
Repurchase price	18.564

- (iv) NAV as on 30th June

Opening Balance	(300 × 18.75)	5625
Add: Portfolio App		425.47
Income for April		22.950

	Income from May	34.425
	Income from June	45.450
Add:	Unit Issued (6 × 19.2015)	115.209
Less:	Unit Redeemed (3 × 18.564)	(55.692)
Less:	70% Income Distributed	<u>(71.9019)</u>
	Total NAV	6,140.9101
÷	No. of units	<u>303</u>
	Per Unit	20.2670

**QUESTION 25:**

RTP

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ANP Plan, a hedge fund currently has assets of ₹ 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 ₹ 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%

Abhi tak portfolio Ne Jo Bhi maximum value achieve ki Hai, uska beyond Jo Bhi gross return every year Milega Uske Upar 2% Dena Hai

Solution:

		Amount in ₹ Cr		
		29%	4.5%	-1.8%
Closing Assets		25.8	20.9	19.64
		(20+29%)	(20+4.5%)	(20 - 1.8%)
Less:	Max Value	(21)	(21)	(21)
		4.8	0	0
		2%	—	—
×	Incentive fee (%)	0.096		
Add: Fund charges @ 0.1% of 20 Cr.		0.02	0.02	0.02
		0.116	0.02	0.02

**QUESTION 26:**

→ positive PF -

From the below data of returns of Index Fund and Sensex, calculate annualized tracking error.

Month	MF monthly Return (%)	Sensex monthly Return (%)
Feb	3.00	6.67
Mar	16.50	14.58
Apr	8.33	13.64
May	16.92	12.00
Jun	11.84	14.29
Jul	5.88	9.38

Solution:

Month	MF Return (%)	Sensex Return (%)	d	(d - $\bar{d}$) ²
Feb	3.00	6.67	-3.67	5.403
Mar	16.50	14.58	1.92	10.663
Apr	8.33	13.64	-5.30	15.68
May	16.92	12.00	4.92	39.203
Jun	11.84	14.29	-2.44	1.21
Jul	5.88	9.38	-3.49	4.62
Total			-8.06	76.876

$$\bar{d} = \frac{\sum d}{n} = \frac{-8.06}{6} = -1.34\%$$

$$\text{Monthly Tracking Error} = \sqrt{\frac{\sum (d - \bar{d})^2}{n - 1}} = \sqrt{\frac{76.876}{5}} = 3.92\%$$

$$\text{Annualized Tracking Error} = 3.92 \times \sqrt{12} = 13.58\% \rightarrow \text{understand this after the concept of Risk: return.}$$

Derivatives & Interest Rate Risk Management



A. Basics of Derivatives

B. Forward and Futures Contract



QUESTION 1:

RTP N 12

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 Compounded Continuously Risk-Free Rate of Interest (CCRRI) is 12% p.a. You are required to find out:

- Fair Value of the contract if no arbitrage opportunity exists.
- Value of cost of carry

[Given $e^{-0.01} = 0.9905$, $e^{-0.02} = 0.9802$, $e^{-0.03} = 0.97045$ and $e^{0.03} = 1.03045$]

(Ref pg no :- 14 of outnotes)

Solution:

Logical Solution:

- Calculation of fair value of contract, if no Arbitrage opportunity exists

$$\begin{aligned}
 FP &= (S_0 - PV(I)) \times e^{rt} \\
 &= (1000 - 24.49) \times e^{0.12 \times 90/360} \\
 &= 975.51 \times 1.03045 \\
 &= 1005.21
 \end{aligned}$$

Calculation of Income

Dividend	Day	PV (I)
7.50	30	$7.50/e^{0.12 \times 30/360} = 7.43$
8.50	60	$8.50/e^{0.12 \times 60/360} = 8.33$
9	90	$9/e^{0.12 \times 90/360} = 8.73$
		<u>24.49</u>

- Value of cost of carry = Forward – Spot
 $= 1005.21 - 1000$
 $= 5.21$

Solution by ICAI:

- Fair Value of Future Contract = ₹ 1000 $e^{0.12 \times 90/360}$ – Dividend Proceeds
 $= ₹ 1000 \times 1.03045 - ₹ 24.49$
 $= ₹ 1005.96$
- Since Value of Future Contract = Spot Price + Cost to Carry
 $₹ 1005.96 = ₹ 1000 + \text{Cost to Carry}$
 Cost to Carry = ₹ 5.96



QUESTION 2:

M 12 | RTP M 12

On 31-8-2011, the value of stock index was ₹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	3%
November	4%
December	3%

Assuming that interest is continuously compounded daily, find out the future price of contract deliverable on 31-12-2011. Given: $e^{0.01583} = 1.01593$

Solution:

The date given is as on 31/8/2011 therefore the relevant months are September, October, November and December

$$\begin{aligned}
 FP &= S_0 \times e^{(r-y) \times t} \\
 &= 2200 \times e^{(0.08 - 0.0325) \times 4/12} \\
 &= 2200 \times 1.01593 = 2235.05
 \end{aligned}$$

Calculation of average dividend yield

$$\text{Dividend yield} = \frac{3+3+4+3}{4} = 3.25\%$$



QUESTION 3:

RTP N 09 | RTP M 11

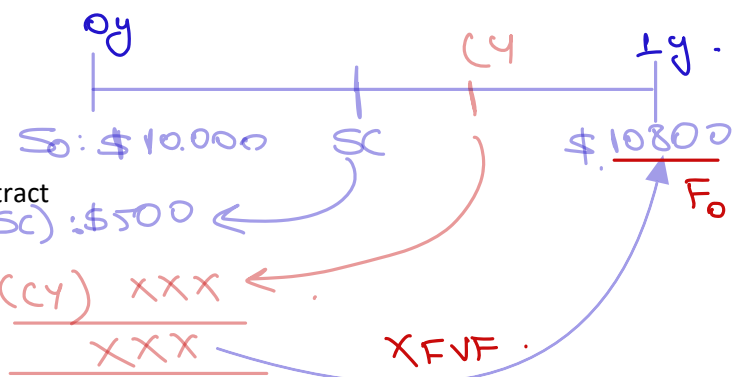
The following information about copper scrap is given:

Spot Price	: \$ 10,000
Future Price	: \$ 10,800 for a one-year contract
Interest rate	: 12%
PV (storage cost)	: \$ 500 per year

What is the PV (convenience yield) of copper scrap?

Solution:

The formula to be used is the when the question is silent



$$\begin{aligned} \text{FP} &= (S_0 + \text{PV}(S) - \text{PV}(\text{CY})) \times (1 + r \times n) \\ 10800 &= (10000 + 500 - \text{PV}(\text{CY})) \times (1 + 0.12 \times \frac{12}{12}) \\ 10800 &= (10500 - \text{PV}(\text{CY})) \times 1.12 \\ \text{PV}(\text{CY}) &= 857.14 \end{aligned}$$

Conclusion: PV of convenience yield is \$857.14



QUESTION 4:

N 11 | N 08 | RTP

The 6-months forward price of a security is ₹ 208.18. The borrowing rate is 8% per annum payable with monthly rests. What should be the spot price?

Solution:

$$\begin{aligned} \text{FP} &= S_0 \times \left(1 + \frac{r}{k}\right)^{nk} \\ 208.18 &= S_0 \times \left(1 + \frac{0.08}{12}\right)^{\frac{6}{12} \times 12} \\ 208.18 &= S_0 \times 1.0407 \\ 200.04 &= S_0 \\ S_0 &= 200.04 \end{aligned}$$



QUESTION 5:

N 19

If the examiner is silent about the timing of the income, then assume it to be happening on expiry date

A future contract is available on R Ltd that pays an annual dividend of ₹4 and whose stock is currently priced at 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%. *U/A* *I.* *S₀*

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)

Solution:

- Price of one future contract:

$$\begin{aligned} &= ([S_0 \times (1 + r \times n)] - I) \times \text{Contract size} \\ &= ([125 \times (1 + .08 \times 12/12)] - 4) \times 1000 \\ &= 1,31,000 \end{aligned}$$
- New Share price:

$$= 125 - 6\% = 117.5$$

New price of one future contract

$$\begin{aligned} &= [117.5 \times (1 + .08 \times 12/12) - 4] \times 1000 \\ &= 1,22,900 \end{aligned}$$

(iii) Loss on long position $= 1,22,900 - 1,31,000$
 $= 8,100$



QUESTION 6:

RTP N 20

Mr. SG sold five 4-Month Nifty Futures on 1st February 2020 for ₹ 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 Index 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.

Solution:

- a. Price of one future contract on 1st Feb, 2020

$$= \frac{900000}{5}$$

$$= ₹ 180000$$

- b. Calculation of Nifty Index Spot Price:

$$FP = SP \times [1 + (r - y) \times n] \times 75$$

$$1,80,000 = SP \times [1 + (0.09 - 0.06) \times 4/12] \times 75$$

$$2,376.24 = SP$$

- c. Maximum contango/Backwardation

$$\text{spot} = 2376.24$$

$$\text{future} = 2400 (180000/75)$$

$$S (2376.24) < F (2400)$$

∴ market is in contango

$$\text{Max. contango} = \text{Basis}$$

$$= S - F$$

$$= 2376.24 - 2400 = - 23.76$$

- d. Pay-off of the transaction

In Feb: Sell - Inflow	9,00,000	
In May: Buy - Outflow	<u>-7,87,500</u>	(5 × 2100 × 75)
Gain	<u>1,12,500</u>	

Note: Remember 75 multiplies in second part of the question

What position in forward should portfolio manager take to hedge against potential price increase?

Long position.
(as it is a short)



QUESTION 7:

RTP M 15

1m25 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 $e^{0.005942} = 1.005960$, $e^{0.001849} = 1.001851$.

Solution:

$$\begin{aligned} \text{(a)} \quad FP &= S_0 \times e^{(r-y) \times t} \\ &= 2290 \times e^{(0.0416 - 0.0175) \times 90/365} \\ &= 2290 \times 1.005960 \\ &= 2303.65 \end{aligned}$$

Justified forward price is ₹2303.65

(b) Logical Solution:

Self-note: Value of e^{rt} given in the question are incorrect.

$$FFP = S_0 \times e^{(r-y) \times t}$$

$$\begin{aligned} \text{Index forward price after 28}^{\text{th}} \text{ days} &= 2450 \times e^{(0.0416 - 0.0175) \times 62/365} \\ &= 2450 \times e^{0.004094} \\ &= 2450 \times 1.00410 \\ &= 2460.05 \end{aligned}$$

Calculation of $e^{0.00409}$

$$\begin{aligned} E^x &= 1 + \frac{x^1}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} \\ &= 1 + \frac{0.00409}{1} + \frac{0.00409^2}{2 \times 1} + \frac{0.00409^3}{3 \times 2 \times 1} \\ &= 1.00410 \end{aligned}$$

$$\begin{aligned} \text{Gain on long position} &= 2460.05 - 2303.65 \\ &= 156.39 \end{aligned}$$

Solution by ICAI:

$$\begin{aligned} \text{Gain/loss on Long Position after 28 days} &= S_t - F_{0,t}(S_0) \\ &= 2450 - 2290 \times e^{28/365(0.0416 - 0.0175)} \\ &= 2450 - 2290 \times e^{0.001849} \\ &= 2450 - 2290 \times 1.001851 \\ &= 155.76 \end{aligned}$$

(order here one is able to remember)
[validate with given est value]

- (c) Gain on long position at 90th day = 2470 – 2303.65
= ₹166.35



QUESTION 8:

N 09 | M 04 | MTP N 14 | RTP

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The following data relate to Anand Ltd.'s share price:

Current price per share ₹ 1,800

6 months future's price/share ₹ 1,950

Assuming it is possible to borrow money in the market for transactions in securities at 12% per annum, you are required:

- to calculate the theoretical minimum price of a 6-months forward purchase; and
- to explain arbitrage opportunity.

Solution:

$$\begin{aligned}\text{Calculation of FFP} &= S_0 \times (1 + r \times n) \\ &= 1800 \times (1 + 0.12 \times 6/12) \\ &= 1908\end{aligned}$$

Calculation of arbitrage profit:

Since AFP (₹ 1950) > FFP (₹ 1908)

∴ Futures are overvalued.

∴ Cash and Carry arbitrage will be followed

Contract entered.

Expire.

Particulars	Today		At the end of 6m	
	Action	Amount	Action	Amount
Future	Sell @ 1950.	–	Settle (Delivery)	1950
Spot	Buy	(1800)	—	—
Borrowing	Borrow	1800	Repay	(1908) *
Profit		0		42

$$* 1800 \times (1 + 0.12 \times 6/12) = 1908$$



QUESTION 9:

M 09 | RTP

The share of X Ltd. is currently selling for ₹ 300. Risk free interest rate is 0.8% per month. A three months futures contract is selling for ₹ 312. Develop an arbitrage strategy and show what your risk-less profit will be 3 months hence assuming that X Ltd. will not pay any dividend in the next three months.

What will be the strategy if actual futures price is ₹ 290 today.

$$0.8 \times 12 = 9.6 \text{ p.a. compounded monthly.}$$

Solution:

$$S_0 = ₹300$$

Calculation of Fair Future Price:

$$\begin{aligned}\text{FFP} &= S_0 \times (1 + r)^n \\ &= 300 \times (1 + 0.008)^3 \\ &= 307.26\end{aligned}$$

$$\left(1 + \frac{0.096}{12}\right)^{3/12 \times 12}$$

If Actual Future Price (AFP) is ₹312:

Since AFP (₹312) > FFP (307.26)

∴ Futures are overvalued.

∴ Cash and Carry arbitrage will be followed

Particulars	Today		At the end of 3m	
	Action	Amount	Action	Amount
Future	Sell	–	Settle	312
Spot	Buy	(300)		
Borrowing	Borrow	300	Repay	(307.26) *
Profit		0		4.74

$$* 300 \times (1 + 0.008)^3 = 307.26$$

If Actual Future Price (AFP) is ₹290:

AFP (₹290) < FFP (₹307.26)

∴ Futures are undervalued

∴ Reverse cash and carry arbitrage will be followed

Particulars	Today		At the end of 3m	
	Action	Amount	Action	Amount
Future	Buy	–	Settle	(290)
Spot	Sell	300		
Investment	Invest	(300)	Redeem	307.26
Profit		0		17.26



QUESTION 10:

N 19

The NSE-50 Index futures are traded with rupee value being ₹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. $\rightarrow$ AFP.

- 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 (a) 1260 (b) 1175.

Assume 365 days in a year for your calculations. $\rightarrow S_T$

Solution:

i)
$$FP = S_0 \times [1 + (r - y) \times n]$$

$$= 119500 \times [1 + (0.095 - 0.03) \times 91/365]$$

$$= 1,21,436.55$$

Since AFP (₹ 1225 × 100) > FFP (₹ 121437)

Therefore, Futures are overpriced.

- ii) Since futures is overpriced

∴ we will conduct cash and carry arbitrage by Selling futures, buying spot and borrowing on 15th sept and settling these positions on 15th Dec.

iii) Calculation of Gain loss

Particulars	On 15 th Sept		On 15 th Dec		
	Action	Amount	Action	126000	117500
Future	Sell	–	Settle	- 3500.00	5000.00
Spot	Buy (long)	- 119500	Sell	1,26,000.00	1,17,500.00
Borrow	Borrow	119500	Repay	1,22,330.35*	1,22,330.35*
Dividend			Received	893.79 [#]	893.79 [#]
Profit		0		1063.44	1063.44

$$* S_0 \times 1 + r \times n = 119500 \times [1 + 0.095 \times 91/365] = 122330.35$$

$$^{\#} 119500 \times 3\% \times 91 / 365 = 893.79$$



QUESTION 11:

J 21

Mr. A is holding 1000 shares of face value of ₹ 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,
- On 29-02-2020 M/s. ABC Ltd., declared dividend of 25%,
- Closing price of M/S. ABC Ltd.'s share quoted in Stock Exchange on various dates are as follows:

Date	Share Price	
	Scenario — 1 Bullish	Scenario — 2 Bearish
01-01-2020	1000	1000
31-01-2020	1020	980
29-02-2020	1040	960
31-03-2020	1050	940

You are required to find out:

- Earnings of Mr. A through Stock Lending Scheme in both the scenarios.
- Total Earnings of Mr. A during 01-01-2020 to 31-03-2020 in both the scenarios.
- What is the Profit or loss to M/S. XYZ by shorting the shares using through Stock Lending Scheme in both the scenarios?

Solution:

- Earnings of Mr. A through Stock Lending Scheme:

Remember: Div. payment is not to be considered.

Particulars	Scenario A		Scenario B	
	Price	Lending fees	Price	Lending fees
31/1/2020	1020	$(1020 \times 1000 \times 1\%) = 10200$	980	9800
29/2/2020	1040	10400	960	9600
31/3/2020	1050	10500	940	9400
		31100		28800

(b) Total Earnings of Mr. A during 01-01-2020 to 31-03-2020:

Particulars	Scenario 1	Scenario 2
Dividend Received	$(₹100 \times 1000 \text{ shares} \times 25\%) = 25000$	25000
Lending Charges	31100	28800
Total Earnings	56100	53800

(c) Profit or loss to M/S. XYZ

	Scenario 1	Scenario 2
P/(L) on short sales	$(1000 - 1050) \times 1000 = (50000)$	$(1000 - 940) \times 1000 = 60000$
Lending charges	(31100)	(28800)
Bank Guarantee	(20000)*	(20000)
	(1,01,100)	11,800

* $₹1000 \times 1000 \text{ shares} \times 8\% \times 3/12$

Self-note: Suggested answers did not include dividends paid by XYZ in part 'c' of the solution.

Assumption: M/s XYZ Ltd. has borrowed all the 1000 shares from Mr. A



QUESTION 12:

N 08 | RTP

Calculate the price of 3 months PQR futures, if PQR (FV ₹ 10) quotes ₹ 220 on NSE and the three months future price quotes at ₹ 230 and the one month borrowing rate is given as 15 percent and the expected annual dividend is 25 percent per annum payable before expiry. Also examine arbitrage opportunities. What if 3 months PQR Futures quotes at ₹210 today.

Solution:

Calculation of Fair Future Price

$$FFP = S_0 \times (1+r)^n - I$$

$$FFP = 220 \times \left(1 + \frac{0.15}{12}\right)^3 - 2.50$$

$$FFP = 225.85$$

When AFP (₹230) > FFP (225.85), we will follow cash and carry arbitrage

Particulars	Today		At the end of 3M	
	Action	Amount	Action	Amount
Futures	Sell	—	Settle	230
Spot	Buy	220	-	-
Borrowings	Borrow	(220)	Repay	(228.35)*

Dividend		Received	2.5
Profit	0		4.15

$$* 220 \times \left[1 + \left(\frac{0.15}{12} \right) \right]^3$$

If 3M FP quotes at ₹210 then, AFP (₹210) < FFP (₹225.85) we will follow reverse cash and carry arbitrage

Particulars	Today		At the end of 3M	
	Action	Amount	Action	Amount
Futures	Buy	–	Settle	(210)
Spot	Sell	220		
Investments	Invest	(220)	Redeem	228.35*
Dividends			Pay	(2.5)
Profit		0		15.85



QUESTION 13:

RTP N 13

Suppose current price of an index is ₹ 13,800 and yield on index is 4.8% (p.a.). A 6- month future contract on index is trading at ₹ 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 ₹ 10,200 and ₹ 15,600 and 50% of stock included in index shall pay dividend in next 6 months.

Also calculate implied risk-free rate

Solution:

The fair price of the index future contract can be calculated as follows:

$$\begin{aligned} \text{FP} &= 13,800 \times [1 + (0.12 \times 6/12)] - (13,800 \times 4.8\% \times 50\%) \\ &= ₹ 14,296.80 \end{aligned}$$

Since presently 6-month index future is trading at ₹ 14,340, hence it is overpriced.

Therefore, Mr. X should follow cash and carry arbitrage:

- 1) He should take long position in a portfolio replicating index.
- 2) He should take short position in index futures.

He can earn an abnormal return as follows:

Step 1: Take position as per point 1 & 2 above today:

Total amount invested: 13,800

Step 2: Square off above portfolio after 6m and inflow will be:

	If price turns out to be:	
	10,200	15,600
Profit on sale of long spot index	10,200	15,600
Profit on short futures position	4,140.0	- 1,260.0

Dividend Received #	331.2	331.2
Total Profit	14,671.2	14,671.2

$(13,800 \times 4.8\% \times 50\%) = 331.2$

Step 3: Implied risk-free rate = $\frac{\text{Profit on investment}}{\text{Amount of Investment}} \times \frac{12}{6} \times 100$

$$= \frac{14,671.2 - 13,800}{13,800} \times \frac{12}{6} \times 100$$

$$= 12.63\%$$

Since the above implied risk-free rate (12.63%) is more than given risk free rate (12%), Mr. A has earned an abnormal return



QUESTION 14:

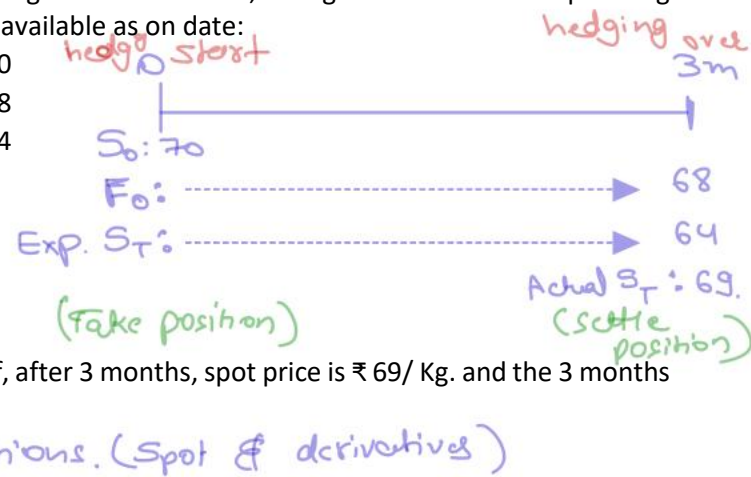
M 23 | RTP N 20 | M 19

Mr. V is a commodity trader and specialized himself in trading of rice. He has 24,000 Kg. of rice which he is planning to sell after 3 months from now. The following details are available as on date:

Spot price	1 Kg.	70
3 month's future is trading at	1 Kg.	68
Expected Lower price after 3 months	1 Kg.	64
Contract size	500 Kg/contract	

You are required to advise to Mr. V:

- Interpret the position of trader in the cash market.
- How to mitigate the risk of fall in price.
- How to use the futures market.
- What will be the effective realized price for his sales if, after 3 months, spot price is ₹ 69/ Kg. and the 3 months future contract price is:
 - ₹ 72/Kg
 - ₹ 67/Kg



Solution:

- Rice trader is having long position in cash market
- The risk of fall in price can be mitigated by hedging this position by taking a position in derivatives market.
- Since, Mr. V has a long position in the cash market, therefore he should take a short position in future market to mitigate the risk. *Chogic of him is Golden rule*
- No. of contracts to short = $\frac{24,000 \text{ kgs}}{500 \text{ kgs}} = 48 \text{ contracts}$

Calculation of effective price realized:

Particulars	If price = ₹ 72/Kg	If price = ₹ 67/Kg
Sale proceeds from spot market	₹ 16,56,000 (69 × 24,000)	₹ 16,56,000 (69 × 24,000)
Gain/Loss or short future's position	(₹ 96,000) ((68 - 72) × 48 × 500)	₹ 24,000 ((67 - 68) × 48 × 500)
Total realization / inflow quantity	15,60,000	16,80,000

÷ Quantity	24,000	24,000
Effective realized price per kg	₹ 65/kg	₹ 70/kg



QUESTION 15:

M 21 | M 17 | N 13 | RTP

A trader is having in its portfolio shares worth ₹85 lakhs at current price and cash ₹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 ₹100 lakhs Nifty futures.

Solution:

$$(i) \quad \text{Current portfolio Beta} = \frac{\beta_x \times MV_x + \beta_y \times MV_y}{\text{Total Value of Portfolio}}$$

$$= \frac{85 \text{ lakhs} \times 1.6 + 15 \times 0}{100}$$

$$= 1.36 \text{ times}$$

- Calculation of portfolio Beta after 3m

Value of index after 3m:

$$\beta_p = \frac{\Delta \text{ in portfolio return}}{\Delta \text{ in market return (index)}}$$

$$1.6 = \frac{-3.2}{\Delta \text{ in market return (index)}}$$

Δ in market return (index)

Value of Nifty Futures after 3 months

Loss on long nifty futures

= - 2% i.e., market fell by 2%

= 100 - 2% = 98

= 100 - 98 = 2 lacs i.e., mark to market

Portfolio value after 3m:

	Value	
Share	85 - 3.2%	= 82.28
Cash	15 - 2	= 13.00
		= 95.28

$$\% \text{ Change in portfolio value} = \frac{100 - 95.28}{100} = 4.72\%$$

$$\text{Portfolio Beta after 3m} = 4.72\% / 2\% = 2.36 \text{ times}$$

Self-note: Ambiguity in this suggested answer is that the beta actually calculated in part b of this question is not the beta after three months (which is what is being asked). It is rather today's beta only.

Point of learning:

When question gives you information regarding change in market or share price and ask you to calculate beta, then apply change / change formula of beta calculation.

Not used avg formula of β_p .



QUESTION 16:

N 11 | M 19 | RTP

A Portfolio Manager (PM) has the following four stocks in his portfolio:

Security	No. of Shares	Market Price per share (₹)	Beta
VSL	10,000	50	0.9
CSL	5,000	20	1
SML	8,000	25	1.5
APL	2,000	200	1.2

Compute the following:

- Portfolio beta.
- If the PM seeks to reduce the beta to 0.8, how much risk free investment should he bring in?
- If the PM seeks to increase the beta to 1.2, how much risk free investment should he bring in?

result of option 2.

Solution:

- (a) Computation of portfolio beta

Security	Market Value	Weight	β	$\beta \times W$
VSL	5,00,000	0.417	0.9	0.3753
CSL	1,00,000	0.083	1	0.083
SML	2,00,000	0.167	1.5	0.2505
APL	4,00,000	0.333	1.2	0.3996
	12,00,000			$\beta = 1.108$

- (b) $\beta_{RA} \times W_{RA} + \beta_{RFA} \times W_{RFA} = \beta_T$

$$1.108 \times W_{RA} + 0 \times W_{RFA} = 0.8$$

$$W_{RA} = 0.722 \sim 72.20\%$$

$$W_{RFA} = 27.80\%$$

$\therefore W_{RA}$ i.e., 72.20% is equal to ₹ 12,00,000

$$\therefore W_{RF} \text{ i.e., } 27.80\% = \frac{1200000}{0.7220} \times 0.2780 = 4,62,050$$

PM should long risk-free security of ₹4,62,050

- (c) $\beta_{RA} \times W_{RA} + \beta_{RFA} \times W_{RFA} = \beta_T$

$$1.108 \times W_{RA} + 0 \times W_{RFA} = 1.20$$

$$W_{RA} = 1.0830$$

$$W_{RFA} = -0.083$$

$$\therefore 1.0830 \text{ -----} > 1200000$$

$$\therefore -0.083 \text{ -----} > 91966.76$$

PM should short risk-free security of ₹91966.76



QUESTION 17:

RTP N 14

Mr. A has a portfolio of ₹ 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

Solution:

- (a) Change in composition through risk free security

- (i) Decrease beta to 0.85

$$\beta_{RA} \times W_{RA} + \beta_{RFA} \times W_{RFA} = \beta_T$$

$$1.15 \times W_{RA} + 0 \times W_{RF} = 0.85$$

$$W_{RA} = 0.7391$$

$$W_{RF} = 0.2609$$

If, Total PF 100% -----> 5 Cr.

Then, W_{RA} i.e., 73.91% -----> 5 Cr. $\times$ 0.7391 = ₹3.6955 cr.

And, W_{RF} i.e., 26.09% -----> 5 Cr. $\times$ 0.2609 = ₹1.3045 cr.

Hence, to reduce Beta of portfolio to 0.85 Mr. A should sell risky Assets (X Ltd. & Y Ltd.) of ₹1.3045 Cr. & buy Risk free securities for ₹1.3045 cr.

- (ii) Increase beta to 1.45

$$\beta_{RA} \times W_{RA} + \beta_{RFA} \times W_{RFA} = \beta_T$$

$$1.15 \times W_{RA} + 0 = 1.45$$

$$W_{RA} = 1.2609$$

$$W_{RFA} = - 0.2609$$

If, Total PF 100% -----> 5 Cr.

Then, W_{RA} i.e., 126.09% -----> 5 Cr. $\times$ 1.2609 = ₹6.3045 cr.

And, W_{RF} i.e., - 26.09% -----> 5 Cr. $\times$ - 0.2609 = - ₹1.3045 cr.

Hence, to increase Beta to 1.45, Mr. A should continue to held portfolio equity shares of ₹5 cr. and short sell risk free securities of ₹1.3045 Cr. and invest the sale proceeds in the equity shares of X and Y. Hence total investment in the equity portfolio would become ₹6.3045 cr.

- (b) Index Futures

- (i) Decrease beta to 0.85

$$\begin{aligned} \text{No. of Index Futures Contracts} &= V_p \times \frac{\beta_T - \beta_p}{F \times m} \\ &= \frac{5 \text{ Cr.} \times (0.85 - 1.15)}{21000 \times 150} \\ &= - 4.76 \\ &\sim 5 \text{ contracts short} \end{aligned}$$

To reduce the beta to 0.85, Mr A should short 5 contracts

- (ii) Increase beta to 1.45

$$\begin{aligned}\text{No. of Index Future Contracts} &= V_p \times \frac{\beta_T - \beta_p}{F \times m} \\ &= 50000000 \times \frac{1.45 - 1.15}{21000 \times 150} \\ &= + 4.76 \\ &\sim 5 \text{ contracts long}\end{aligned}$$

To increase beta to 1.45, Mr. A should long 5 contracts.



QUESTION 18:

RTP M 09

only on call

You have the following five stocks in your portfolio:

Security	No. of shares	Price/share	Beta
A	10,000	50	1.2
B	5,000	20	2
C	8,000	25	0.7
D	1,000	100	1
E	500	200	1.3

- Compute portfolio beta
- How much additional investment is required in Risk free investment to have beta to 0.8?
- How much additional investment is required in Security B to increase beta to 1.4? *(point of learning)*
- ~~XX~~ If the Nifty future is 2700 points and future have a contract multiplier of 50, how many future contracts to be hedged to obtain the position as in (iii) above?

Solution:

(i) Portfolio Beta:

Security	MV	W	Beta	B x W
A	5,00,000	0.5	1.2	0.60
B	1,00,000	0.1	2	0.20
C	2,00,000	0.2	0.7	0.14
D	1,00,000	0.1	1	0.10
E	1,00,000	0.1	1.3	0.13
	10,00,000			1.17

(ii) Risk free investment to have beta to 0.8

$$\beta_{RA} \times W_{RA} + \beta_{RFA} \times W_{RFA} = \beta_T$$

$$1.17 \times W_{RA} + 0 \times W_{RFA} = 0.80$$

$$W_{RA} = 68.38\%$$

$$\text{If, } W_{RA} \text{ i.e., } 68.38\% \text{ -----> } 10,00,000$$

$$\text{Then, } W_{RFA} \text{ i.e., } 31.62\% \text{ -----> } 4,62,416$$

Additional Investment in risk free Security is ₹4,62,416 long

(iii) Additional Security B to increase beta to 1.4

$$1.17 \times W_{EP} + 2 \times W_{AB} = 1.40$$

W_{EP} = Weight of Existing Portfolio

$$1.17 \times W_{EP} + 2 \times (1 - W_{EP}) = 1.40$$

W_{AB} = Weight of Additional Security B

$$W_{EP} = 72.29\%$$

If, W_{EP} i.e., 72.29% -----> 10,00,000

Then, W_B i.e., 27.71% -----> 3,83,330

Additional Investment in Security B is ₹3,83,330 long

(iv) Logical Solution:

No. of futures contract to be hedged

$$\begin{aligned} &= V_p \times \frac{\beta_T - \beta_p}{F \times M} \\ &= 10,00,000 \times \frac{1.40 - 1.17}{2700 \times 50} \\ &= 1.70 \\ &\sim 2 \text{ contracts long} \end{aligned}$$

To obtain the position as in (iii) above, 2 futures contracts should be hedged

Solution by ICAI:

Rupee Value of one Future contract

= Index Value x multiplier

$$= 2700 \times 50 = 135000$$

No of Future Contracts = $(\beta_{RA} \times \text{additional investment}) / \text{Rupee Value of Future contract}$

$$= 1.17 \times 383,334 / 135000$$

$$= 3 \text{ (rounded)}$$



QUESTION 19:

N 21 | RTP M 17

On 1st July 2021 Mr. P has made the following investment:

Name of Company	No. of Equity Share	Beta Value	Purchase Price per Equity Share
ML Ltd	1000	1.25	₹ 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%
 - 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.

Solution:

1. To hedge his market exposure Mr. P should take short position in the Nifty Futures.

$$\begin{aligned}\text{No. of Contract of Nifty Future} &= V_p \times \frac{\beta_T - \beta_p}{F \times M} \\ &= 700 \times 1000 \times \frac{(0 - 1.25)}{17500 \times 50} \\ &= 1 \text{ contract short}\end{aligned}$$

2. Profit or loss of Mr. P during the expiry of September 2021 Futures:

- a. If Nifty rises by 10%

Then security rise by: $10\% \times 1.25 = 12.5\%$

	₹
Loss on Nifty Futures ($17,500 \times 50 \times 1 \times 10\%$)	(87,500)
Gain on Stock of ML Ltd. ($₹ 7,00,000 \times 12.5\%$)	87,500
Net Gain/ (Loss)	0

- b. If ML Ltd. falls by 5%

Then market fall by: $5\% / 1.25 = 4\%$

	₹
Gain on Nifty Futures ($17,500 \times 50 \times 1 \times 4\%$)	35,000
Loss on Stock of ML Ltd. ($5\% \times ₹ 7,00,000$)	(35,000)
Net Gain/ (Loss)	0

3. 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.



QUESTION 20:

M 11 | RTP

only on calc

A Mutual Fund is holding the following assets in ₹Crores:

Investments in diversified equity shares 90.00

Cash and Bank Balances 10.00

The Beta of the equity share 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.

Solution:

Calculation of no. of future contracts to short

$$\begin{aligned}&= V_p \times \frac{\beta_T - \beta_p}{F \times M} \\ &= 90,00,00,000 \times \frac{0 - 1.1}{4300 \times 50} \\ &= -4604.6 \\ &\sim 4605 \text{ short contracts}\end{aligned}$$

$$\frac{10000 \times (0 - 0.99)}{4300 \times 50}$$

Justification of the answer

Loss on equity shares: $[90 \text{ cr.} \times (-10\% \times 1.1)] =$

Gain on index futures: $[4,605 \times 50 \text{ units} \times (-10\% \times 4,300)]$

- (9.9 Cr) **loss**

+ 9.9 Cr. **gain**
0.00



QUESTION 21:

J 21 | N 21 | N 13 | M 05 | RTP

Ram buys 10,000 shares of X Ltd. at a price of ₹22 per share whose beta value is 1.5 and sells 5,000 shares of A Ltd. at a price of ₹40 per share having a beta value of 2. He obtains a complete hedge by Nifty futures at ₹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 overall profit/loss to Ram?

Is it possible stock as well as nifty to rise or fall at the same percentage? Please state the reason.

Solution:

MV of X – Long	2,20,000
MV of A – Short	-2,00,000
Value of portfolio	20,000

$$\begin{aligned} \text{Beta of the portfolio} &= \frac{1.5 \times 2,20,000 + 2 \times (-2,00,000)}{2,20,000 - 2,00,000} \\ &= -3.5 \end{aligned}$$

$$\begin{aligned} \text{No. of contracts to hedge:} &= V_p \times \frac{\beta_T - \beta_P}{F \times M} \\ &= \frac{20,000 \times [0 - (-3.5)]}{1,000} \\ &= +70 \\ &= 70 \text{ contracts long} \end{aligned}$$

Calculation of Gain or loss:

Particulars	Position	Value	%Δ	Gain/(loss)
X	Long	2,20,000	-2%	(4,400)
A	Short	2,00,000	+3%	(6,000)
Future	Long	70,000	-1.5%	(1,050)
				(11,450)

It is possible for stock as well as nifty to raise or fall at the same percentage. When beta of the stock is equal to 1, it moves same as market.



QUESTION 22:

N 24

Mohan buys 10,000 shares of X Ltd. @ ₹ 25 per share whose beta value is 1.5 and sells 5,000 shares of A Ltd. @ ₹ 40 per share having a beta value of 2. He obtains a complete hedge by buying 25 Nifty Futures. He closes out his position at the closing price of the next day when the share of X Ltd. has fallen by 4% and Nifty Futures has dropped by 2.50%. In the process he suffered a loss of ₹ 16,625.

You are required to determine:

- The value of the Nifty future
- Initial cash outlay
- Cash inflow at the close out
- Percentage Gain/ loss to Shares of A Ltd. at the time of closure

Solution:

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QUESTION 23:

RTP M 15

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

Derivatives & Interest Rate Risk Management

client purchased 1,00,000 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 long 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 \$1,14,500 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 long to obtain a complete hedge and beta value of X Inc.

You are required to find these values.

Solution:

Calculation of loss on Index Futures Position:

Particulars	Position	Value	%Δ	Gain/(loss)
Total Loss				(1,14,500)
Loss on X	Long	(1 Lac × 22) = 22,00,000	-2%	(44,000)
Loss on A	Short	(0.5 Lac × 40) = (20,00,000)	+3%	(60,000)
Loss on Index Futures				(10,500)

Value of Index Futures long position: = 10,500 / 1.5% = 7,00,000

Value of the portfolio to be hedged: = 22,00,000 (Long) – 20,00,000 (Short)
= 2,00,000

Calculation of β_P using hedging formula:

$$\begin{aligned} \text{Value of Index Futures Position} &= V_P \times (\beta_T - \beta_P) \\ 7,00,000 &= 2,00,000 \times (0 - \beta_P) \\ -3.5 &= \beta_P \end{aligned}$$

Calculation of β_X using formula of Weighted Average Beta of the portfolio:

$$\begin{aligned} -3.5 &= \frac{2200000 \times \beta_X + (-2000000 \times 2)}{200000} \\ \beta_X &= 1.50 \end{aligned}$$



QUESTION 24:

M21 | N 20 | N 07 | RTP

BSE

Value of portfolio

Risk free interest rate

Dividend yield on Index

Beta of portfolio

5000 So
₹10,10,000
9% p.a. ✓
6% p.a. ✓
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.

Solution:

(i) Price of Index future = $S_0 \times [1 + (r - y) \times n]$

$$= 5,000 \times \left[1 + (0.09 - 0.06) \frac{4}{12} \right]$$

$$= 5,050$$

Price of future contract = 5050×50 multiplier = 2,52,500

(ii) No. of contracts to short = $V_p \times \frac{\beta_T - \beta_P}{F \times M}$

$$= 10,10,000 \times \frac{0 - 1.50}{5050 \times 50}$$

$$= -6 \text{ i.e., 6 contracts short}$$

Price of index futures of the end of 3m = $4500 \times \left[1 + (0.09 - 0.06) \times \frac{1}{12} \right] = 4511.25$

Gain on short futures position = $6 \text{ contract} \times 50 \text{ times} \times (5050 - 4511.25)$

$$= ₹ 1,61,625$$



QUESTION 25:

N 21

only on dice

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.

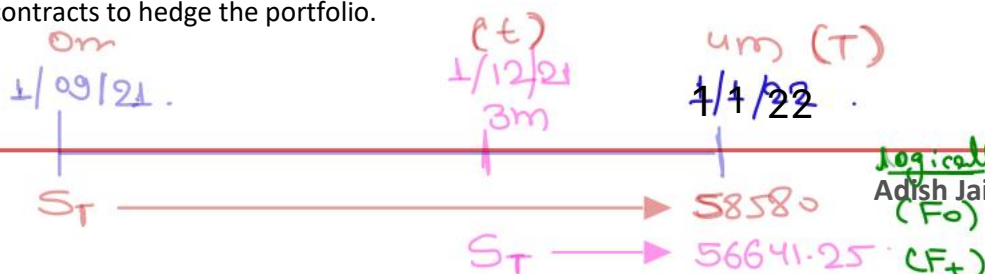
The following information is available:

Value of the portfolio	1,16,00,000
BSE Sensex on 1st January 2022	58,580 (S_T)
(Anticipated on 1st September 2021)	F_0
BSE Sensex on 1st January 2022	56641.25 (S_T)
(Anticipated on 1st December 2021)	$F(t)$
Dividend Yield of Index	6% p.a.
181 days' treasury bill offer a rate of interest	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 1 December 2021
- The number of contracts to hedge the portfolio.

Solution:



Ambiguity:

To calculate S_0 and S_t using CoC model, examiner should give us F_0 and F_t . But examiner has actually given S_t and S_T , which is of no use. In the absence of information we will assume S_t of 58580 as F_0 (since it is anticipated on 1 September.) and S_T of 56641.25 as F_t (Since it is anticipated on 1 December.)

Derivatives & Interest Rate Risk Management

- a. Present value of the Sensex as on 1st September 2021:

$$\begin{aligned} \text{FFP} &= S_0 \times [1 + (r-y) \times n] \\ 58,580 &= S \times [1 + (0.09 - 0.06) \times 4/12] \\ S &= 58,000 \end{aligned}$$

- b. Turned out value of the Sensex as on 1 December 2021:

$$\begin{aligned} 56,641.25 &= S_1 \times [1 + (0.09 - 0.06) \times 1/12] \\ S &= 56,500 \end{aligned}$$

- c. Number of contracts to hedge the portfolio:

$$\begin{aligned} &= V_p \times \frac{\beta_T - \beta_p}{F \times M} \\ &= \frac{1,16,00,000 \times (0 - 1.5)}{58,580 \times 50} = -5.95 \\ &\sim 6 \text{ contracts short} \end{aligned}$$

Self-note: The ambiguity in this question is that this is actually S_T but is used as F_0 .



QUESTION 26:

N 22 | N 16 | M 21 RTP

The Following data relate to A Ltd.'s Portfolio:

Shares	No. of shares (lakh)	Price per share	Beta
X Ltd	6	₹1000	1.5
Y Ltd	8	₹1500	1.3
Z Ltd	4	₹500	1.7

The CEO is of opinion 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 0.95. Treasury Manager has suggested 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, currently trading at 8250 and each Nifty points multiplier is ₹ 210.

You are required to:

- Interpret the opinion of CEO, whether it is correct or not.
- Calculate the existing systematic risk of the portfolio,
- Advise the value of risk-free securities to be acquired,
- Advise the number of shares of each company to be disposed off,
- Advise the position to be taken in Nifty Futures and determine the number of Nifty contracts to be bought/sold; and
- Calculate the new systematic risk of portfolio if the company has taken position in Nifty Futures and there is 2% rise in Nifty

Or

Calculate The value of portfolio beta for 2% rise in Nifty

Note: Make calculations in ₹ lakh and upto 2 decimal points.

Solution:

- (a) Yes, the apprehension of CEO is correct as the β of current portfolio is more than market as the beta (Systematic Risk) of market portfolio is:

(in Lakhs)

Shares	No. of shares	Market Price	Market Value	W	β	$W \times \beta$
X Ltd.	6.00	1,000.00	6,000.00	0.30	1.50	0.45
Y Ltd.	8.00	1,500.00	12,000.00	0.60	1.30	0.78
Z Ltd.	4.00	500.00	2,000.00	0.10	1.70	0.17
			20,000.00	1.00		1.40

(b) Since the Beta of existing portfolio is 1.40, the systematic risk of the current portfolio is 1.40.

(c) Required Beta 0.95

Let the proportion of risk-free securities for target beta $0.95 = W_{RF}$

$$0.95 = 0 \times W_{RF} + 1.40 \times W_{RA}$$

$$W_{RA} = 0.6786 \text{ i.e., } 67.86\%$$

$$W_{RF} = 1 - 0.6786 = 0.3214 \text{ i.e. } 32.14\%$$

Shares to be disposed-off to reduce beta = 20000 lakhs $\times$ 32.14% = ₹6,428 lakh and Risk Free securities to be acquired for the same amount.

(d) Number of shares of each company to be disposed off

Shares	Weight	Amount of disposal	Market Price	No. of Shares (Lakh)
X Ltd.	0.30	1928.4	1000.00	1.9284
Y Ltd.	0.60	3856.8	1500.00	2.5712
Z Ltd.	0.10	642.8	500.00	1.2856
		6428.0		

(e) Number of Nifty Contract to be sold:
$$= V_p \times \frac{\beta_T - \beta_P}{F \times M}$$

$$= \frac{20,000 \text{ lakh} \times (0.95 - 1.40)}{8,250 \times 210}$$

= - 519 contracts

(f) If there is 2% rises in Nifty there will be 2.80% ($2\% \times 1.40$) rise for portfolio of shares

	₹Lakh
Current Value of Portfolio of Shares [A]	20,000
Value of Portfolio after rise $(20,000 + 2.8\%)$	20,560
Loss on short futures $(8,250 \times ₹210 \times 519 \times 2\%)$	- 179.83
Net value of the portfolio after rise of Nifty [B]	20,380.17
% Change in value of portfolio $(20,380.17 - 20,000) / 20,000$	1.90%
% Rise in the value of Nifty	2%
New Systematic Risk (Beta) $(1.9\% / 2\%)$	0.95 times



QUESTION 27:

N 24 | M 13 | RTP

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On January 1, 2013 an investor has a portfolio of 5 shares as given below:

Security	Price	No. of Shares	Beta
A	349.3	5,000	1.15
B	480.5	7,000	0.4
C	593.52	8,000	0.9
D	734.7	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 investor needs to sell to get a full hedge until February for his portfolio if the current value of NIFTY is 5900 and NIFTY futures have a minimum trade 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 desires to reduce the beta of his portfolios to 0.6.
- What will be the new beta if 4 Future contracts are sold to the investors?

No. of days in a year be treated as 365.

Given: $\ln(1.105) = 0.0998$, $e^{0.015858} = 1.01598$ and $e^{0.01668} = 1.01682$

Solution:

48 21 use

- Beta of the portfolio

Security	Market Value	Weights	Beta	B × W
A	17,46,500	0.0926	1.15	0.106
B	33,63,500	0.1784	0.40	0.071
C	47,48,160	0.2578	0.90	0.227
D	73,47,000	0.3897	0.95	0.370
E	16,49,700	0.0875	0.85	0.074
	1,88,54,860			0.849

- Theoretical value of Nifty futures for February 2013

$$\begin{aligned}
 FP &= S_0 \times e^{rt} \\
 &= 5900 \times e^{0.105 \times 58/365} \\
 &= 5900 \times e^{0.01668} \\
 &= 5900 \times 1.01682 \\
 &= 5999.24
 \end{aligned}$$

- Number of contracts to sell for full hedge:

$$\text{No. of contracts:} = V_p \times \frac{\beta_T - \beta_P}{F \times M}$$

$$= 18,854,860 \times \frac{0 - 0.849}{5999.24 \times 200}$$

$$= -13.34 \text{ contracts}$$

$$\sim 13 \text{ contracts short}$$

(d) Number of contracts if portfolio beta is to be reduced to 0.6

$$= 18,854,860 \times \frac{0.60 - 0.849}{5999.12 \times 200}$$

$$= 3.91 \text{ contracts}$$

$$\sim 4 \text{ contracts short}$$

(e)



QUESTION 28:

N 23 | N 15

On April 1, 2015, an investor has a portfolio consisting of eight securities as shown below:

Security	Market Price	No. of Shares	Value
A	29.4	400	0.59
B	318.7	800	1.32
C	660.2	150	0.87
D	5.2	300	0.35
E	281.9	400	1.16
F	275.4	750	1.24
G	514.6	300	1.05
H	170.5	900	0.76

The cost of capital for the investor is 20% p.a. continuously compounded. The investor fears a fall in the prices of the shares in the near future. Accordingly, he approaches you for the advice to protect the interest of his portfolio. You can make use of the following information:

- The current NIFTY value is 8500.
- NIFTY futures can be traded in units of 25 only.
- Futures for May are currently quoted at 8700 and Futures for June are being quoted at 8850.

You are required to calculate:

- the beta of his portfolio.
- the theoretical value of the futures contract for contracts expiring in May and June.

3. the number of NIFTY contracts that he would have to sell if he desires to hedge until June in each of the following cases:
- His total portfolio
 - 50% of his portfolio
 - 120% of his portfolio

Given ($e^{0.03} = 1.03045$, $e^{0.04} = 1.04081$, $e^{0.05} = 1.05127$)

Solution:

- (i) Beta of the portfolio:

Security	MV	Weights	Beta	$\beta \times W$
A	11,760	0.0118	0.59	0.007
B	2,54,960	0.2564	1.32	0.338
C	99,030	0.0996	0.87	0.087
D	1,560	0.0016	0.35	0.001
E	1,12,760	0.1134	1.16	0.132
F	2,06,550	0.2077	1.24	0.258
G	1,54,380	0.1552	1.05	0.163
H	1,53,450	0.1543	0.76	0.117
Total	9,94,450			1.103

Portfolio Beta: 1.103

- ii) Theoretical value of May's futures contract

$$\begin{aligned}
 &= S_0 \times e^{rt} \\
 &= 8,500 \times e^{0.20 \times 2/12} \\
 &= 8,500 \times e^{0.0333} \\
 &= 8,500 \times 1.033868 \\
 &= 8788
 \end{aligned}$$

Calculation of $e^{0.0333}$ using interpolation:

$$\begin{array}{rcl}
 e^{0.03} & \text{---} & 1.03045 \\
 e^{0.0333} & \text{---} & ? \\
 e^{0.04} & \text{---} & 1.04081
 \end{array}$$

$$\begin{aligned}
 \frac{0.0333 - 0.03}{0.04 - 0.03} &= \frac{x - 1.03045}{1.04081 - 1.03045} \\
 x &= 1.0338688
 \end{aligned}$$

Theoretical value of June's futures contract

$$\begin{aligned}
 &= S_0 \times e^t \\
 &= 8,500 \times e^{0.20 \times 3/12} \\
 &= 8,500 \times e^{0.05} \\
 &= 8,500 \times 1.05127 = \\
 &= 8935.795
 \end{aligned}$$

(iii) No. of NIFTY Contracts required to sell to hedge:

(a) Total Portfolio

$$= V_p \times \frac{\beta_T - \beta_P}{F \times M}$$

$$= 9,94,450 \times 100\% \times \frac{0-1.103}{8850 \times 25}$$

$$= -4.95 \text{ i.e., 5 contracts short}$$

(b) 50% of the Portfolio

$$= 9,94,450 \times 50\% \times \frac{0-1.103}{8850 \times 25}$$

$$= -2.47 \text{ i.e., 3 contracts short}$$

(c) 120% of the Portfolio

$$= 9,94,450 \times 120\% \times \frac{0-1.103}{8850 \times 25}$$

$$= -5.94 \text{ i.e., 6 contracts short}$$



QUESTION 29:

N 10 | RTP

Sensex futures are traded at a multiple of 50. Consider the following quotations of Sensex futures in the 10 trading days during February, 2009:

Day	High	Low	Closing
04/02/2009	3306.4	3290.0	3296.5
05/02/2009	3298.0	3262.5	3294.4
06/02/2009	3256.2	3227.0	3230.4
07/02/2009	3233.0	3201.5	3212.3
10/02/2009	3281.5	3256.0	3267.5
11/02/2009	3283.5	3260.0	3263.8
12/02/2009	3315.0	3286.3	3292.0
14/02/2009	3315.0	3257.1	3309.3
17/02/2009	3278.0	3249.5	3257.8
18/02/2009	3118.0	3091.4	3102.6

Abhishek bought one Sensex futures contract on February, 04. The average daily absolute change in the value of contract is ₹10,000 and standard deviation of these changes is ₹2,000. The maintenance margin is 75% of initial margin.

You are required to determine the daily balances in the margin account and payment on margin calls, if any.

Solution:

$$\text{Initial margin} = \mu + 3\sigma$$

$$= 10,000 + 3 \times 2,000 = 16,000$$

$$\text{Maintenance margin} = 75\% \times 16,000 = 12,000$$

Calculation of daily margin balance & margin calls:

Day	Settlement Price	Mark to Market Gain/(loss)	Margin Call	Closing Balance
4/2/2009	3296.5	-	-	1,6000
5/2/2009	3294.4	(105)	-	15,895
6/2/2009	3230.4	(3200)	-	12,695
7/2/2009	3212.3	(905)	4210	16,000
10/2/2009	3267.5	2760	-	18,760
11/2/2009	3263.8	(185)	-	18,575
12/2/2009	3292.0	1410	-	19,985
14/2/2009	3309.3	865	-	20,850
17/2/2009	3257.8	(2575)	-	18,275
18/2/2009	3120.6	(7760)	5485	16,000



QUESTION 30:

N 21 | N 20

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% of contract value and the maintenance margin is 6%. The index closed at the following levels on next five days:

Day	Settlement Price (₹)
1	9380
2	9520
3	9100
4	8960
5	9140

→ Ideally the Q. should given index futures price.

You are required to calculate:

- 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
- Net profit/loss on each of the contracts

Solution:

- Calculation of mark to market cash flows and daily closing balances:

$$\begin{aligned} \text{Value of future contract} &= ₹9,170 \times 50 \text{ Nifty futures} \\ &= ₹4,58,500 \end{aligned}$$

$$\text{Initial Margin: } 4,58,500 \times 8\% = ₹36,680$$

$$\text{Maintenance margin: } 6\% \times 4,58,500 = ₹27,510$$

- An investor who has taken a long position at 9170

Day	Settlement price	Mark to market gain/(loss)	Margin call	Closing margin balance
0	9,170	-	-	36,680

1	9,380	10,500	–	47,180
2	9,520	7,000	–	54,180
3	9,100	-21,000	–	33,180
4	8,960	-7,000	10,500	36,680
5	9,140	9,000	–	45,680

- An investor has taken a short position at 9190

Day	Settlement price	Mark to market gain/(loss)	Margin call	Closing margin balance
0	9,170	–	–	36,680
1	9,380	-10,500	10,500	36,680
2	9,520	-7,000	–	29,680
3	9,100	21,000	–	50,680
4	8,960	7,000	–	57,680
5	9,140	-9,000	–	48,680

2. Net profit/loss on each of the contracts:

$$\begin{aligned} \text{On long Position} &= (9,140 - 9,170) \times 50 \\ &= 1,500 \text{ Loss} \end{aligned}$$

$$\begin{aligned} \text{On Short Position} &= (9,170 - 9,140) \times 50 \\ &= 1,500 \text{ Profit} \end{aligned}$$



QUESTION 31:

MTP N 20 | M 12 | RTP

1 tonne = 1000 kg.

A company is long on 10 MT of copper @ ₹ 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.

Required:

- Calculate the Optimal Hedge Ratio for perfect hedging in Future Market.
- Advise the position to be taken in Future Market for perfect hedging.
- Determine the number and the amount of the copper futures to achieve a perfect hedge.

Solution:

$$\begin{aligned} \text{(a) Standard Deviation of Spot Price } (\sigma_s) &= \sqrt{\text{Variance}} \\ &= \sqrt{16} = 4 \end{aligned}$$

$$\text{Standard Deviation of Futures Price } (\sigma_f) = \sqrt{36} = 6$$

$$\begin{aligned} \text{Optimal Hedge Ratio} &= \text{Correlation}_{(S,F)} \times \frac{\sigma_s}{\sigma_f} \\ &= 0.75 \times \frac{4}{6} \\ &= 0.50 \end{aligned}$$

- (b) Since, company has long position in spot market
 $\therefore$ they should take short position in future's market

- (c) Amount of copper (V_p) = $534 \times 1000 \times 10 = ₹53,40,000$ *long.*

$$\begin{aligned} \text{Amount of copper futures} &= V_p \times (HR_T - HR_P) \\ &= 53,40,000 \times (-0.5) \\ &= -26,70,000 \text{ short} \end{aligned}$$

$$\begin{aligned} \text{No. of contracts} &= \frac{-26,70,000}{534 \times 1000} = -5 \\ &= 5 \text{ contracts short} \end{aligned}$$

Self-note: To calculate the number of contracts, ideally the 'amount of copper futures' should be divided by copper futures price. In the absence of information, spot price is used.

$$\begin{aligned} &+ V_p \times (\beta_T - \beta_P) \\ &= (-) \text{ve.} \end{aligned}$$

C. Options



QUESTION 32:

M 24 | M 18 | M 16 | M 10 | M 06 | RTP

Fresh Bakery Ltd.'s share price has suddenly started moving both upward and downward on a rumour that the company is going to have a collaboration agreement with a multinational company in bakery business. If the rumour turns to be true, then the stock price will go up but if the rumour turns to be false, then the market price of the share will crash. To protect from this an investor has purchased the following call and put option:

- (i) One 3 months call with a striking price of ₹ 52 for ₹ 2 premium per share.
- (ii) One 3 months put with a striking price of ₹ 50 for ₹ 1 premium per share.

Assuming a lot size of 50 shares, determine the followings:

1. The investor's position, if the collaboration agreement pushes the share price to ₹ 53 in 3 months.
2. The investor's ending position, if the collaboration agreement fails and the price crashes to ₹ 46 in 3 month's time.

Solution:

- (1) If share price becomes ₹53, call will be exercised and put will lapse

$$\begin{aligned} \text{(loss)/profit on call} &= [(53 - 52) - 2] \times 50 \\ &= -50 \end{aligned}$$

$$\begin{aligned} \text{(loss)/profit on put} &= -1 \times 50 \\ &= -50 \end{aligned}$$

$$\text{Total Loss} = ₹100$$

- (2) If share price becomes ₹46, call will lapse and put will exercise

$$\begin{aligned} \text{(loss)/profit on call} &= -2 \times 50 \\ &= -100 \end{aligned}$$

$$\begin{aligned} \text{(loss)/profit on put} &= [(50 - 46) - 1] \times 50 \\ &= 150 \end{aligned}$$

$$\text{Total Profit} = ₹50$$



QUESTION 33:

N 20 | M 19 | N 11 | N 09 | N 08 | RTP

Mr. X established the following spread on the Delta Corporation's stock :

- (i) Purchased one 3-month call option with a premium of ₹ 30 and an exercise price of ₹ 550.
- (ii) Purchased one 3-month put option with a premium of ₹ 5 and an exercise price of ₹ 450.

Delta Corporation's stock is currently selling at ₹ 500. Determine profit or loss, if the price of Delta Corporation's:

- (i) remains at ₹500 after 3 months.
- (ii) falls at ₹350 after 3 months.
- (iii) rises to ₹600.

Assume the size of option is 100 shares of Delta Corporation

Solution:

- i) Call option (lapse) - 30

	Put option (lapse)	<u>- 5</u>	
		- 35	
		<u>× 100 shares</u>	
	Total Loss	<u>-3500</u>	
ii)	Call option (lapse)	- 30	
	Put option (exercise)	<u>95</u>	[(450 - 350) - 5]
		65	
		<u>× 100 shares</u>	
	Total Profit	<u>6500</u>	
iii)	Call option (exercise)	20	[(600 - 550) - 20]
	Put option (lapse)	<u>- 5</u>	
		15	
		<u>× 100 shares</u>	
	Total Profit	<u>1500</u>	



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QUESTION 34:

RTP N 18

This is a typical question based on the concept of hedging. Has no particular concept in out notes.

Ram holding shares of Reliance Industries Ltd. which is currently selling at ₹ 1000. 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

Note: For general or basic question of hedging using options, Think of only LONG position, the decision to be taken will be buy call or Put.

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.

Solution:

Since ram is holding a long position in spot market, therefore to hedge it, he should Buy a put option.

Since, he cannot afford to lose more than 5% of the value, he will take put option with exercise price

$$= 1000 - 5\% = ₹950$$

Payoff of Mr. Ram after 1 month:

Particulars	If $S_T = 900$	If $S_T = 1050$
1 share <u>(spot)</u>	900	1050

using Golden Rule

1 put option (X = 950)	50	—
Net Cashflow	950	1050
Less: Premium	- 8	- 8
Net Proceed	942	1,042

Comment: In both the cases it can be observed that total inflow to Ram is not less than ₹942 as Put Option will compensate for loss below spot price of ₹ 950. However, to buy this put option Mr. Ram will have to pay premium of ₹8.



QUESTION 35:

N 18 | M 09 | RTP

The equity share of VCC Ltd. is quoted at ₹210. A 3-month call option is available at a premium of ₹6 per share and a 3-month put option is available at a premium of ₹5 per share. Ascertain the net payoffs to the option holder of a call option and a put option.

a) the strike price in both cases in ₹220; and

b) the share price on the exercise day is ₹200,210,220,230,240.

Also indicate the price range at which the call and the put options may be gainfully exercised.

Solution:

Payoffs to option holder of a Call option:

Share price (S_T)	Exercise Price	Premium	Net-pay off
200	220	6	-6
210	220	6	-6
220	220	6	-6
230	220	6	4
240	220	6	14
			0

Payoffs to option holder of a Put option:

Exercise Price	Share price	Premium	Net-pay off
220	200	5	15
220	210	5	5
220	220	5	-5
220	230	5	-5
220	240	5	-5
			0

Price Range

Call option can be gainfully exercise for price higher than:

$$220 + 6 = ₹226$$

Put option can be gain fully exercised for price lower than:

$$220 - 5 = ₹215$$



QUESTION 36:

MTP M 16

A call option has been entered into by Arnav for delivery of share of X Ltd. at Rs. 460. The expected future prices at the time of expiry of contract are as follows:

Price (Rs.)	Prob.
470	0.20
450	0.25
480	0.35
490	0.05
500	0.15

Determine the premium at which Arnav will break even.

Solution:

Price	Pay off ($S_1 - E$)	Prob.	
470	10	0.20	2
450	0	0.25	0
480	20	0.35	7
490	30	0.05	1.5
500	40	0.15	6
			$V_c = 16.5$



QUESTION 37:

M 22 | N 18 | N 12 | N 10

No particular concept in our notes. It is based on common sense that the maximum amount of premium one would pay will be equal to the maximum amount of payoff one would receive.

You as an investor had purchased a 4-month call option on the equity shares of X Ltd. of ₹10, of which the current market price is ₹132 and the exercise price ₹150. You expect the price to range between ₹120 to ₹190. The expected share price of X Ltd. and related probability is given below:

Expected Price (₹)	120	140	160	180	190
Probability	.05	.20	.50	.10	.15

Compute the following:

- Expected Share price at the end of 4 months.
- Value of Call Option at the end of 4 months, if the exercise price prevails. $\rightarrow S_T = E$
- In case the option is held to its maturity, what will be the expected value of the call option?
- Find out the price of share quoted at the stock exchange to get the value of the call option as computed in (c) above?

Solution:

- Expected share price at the end of 4M

Expected price	Prob	
120	0.05	6
140	0.20	28
160	0.50	80

180	0.10	18
190	0.15	28.5
		160.5

- b. Value of call option at the end of 4M, if exercise price prevails, since the exercise price prevails that is ₹150, therefore the value of call option will be $150 - 150 = 0$

- c. Exercise price = ₹150
Expected value of call option:

Expected Price	Pay off	Prob	Pay off × Prob
120	0	0.05	0
140	0	0.20	0
160	10	0.50	5
180	30	0.10	3
190	40	0.15	6
			14

- d. To get the value of option as 14 on maturity, the share price should be: $150 + 14 = 164$



QUESTION 38:

N 23 | M 11 | RTP

The following information is available pertaining to shares of Omni Limited:

Current Market Price	S_0	₹ 420
Strike Price	E	₹ 450
Maximum Price in 3m time	S_u	₹ 525
Minimum Price in in 3m time	S_d	₹ 378
Continuously Compounded Rate of Return (p.a.) (%)	r	8%
e^{rt} value of n		1.0202

- a. Calculate the 3 months call option by using Binomial Method and Risk Neutral Method. Are the calculated values under both the models are same?
- b. What will be the value as per binomial model if given option is a put option? *only on calc*
- c. State also clearly the basis of Valuation of options under these models.

Solution:

- a. Value of option using Binomial Model:

Binomial Tree:

At month 0	At month 3	Call payoff	Put Payoff
$S_0 = 420$	$S_u = 525$	75	0
Exercise price = <u>450</u>	$S_d = 378$	0	72

$$\text{Delta of Call} = \frac{75 - 0}{525 - 378} = 0.5102$$

Risk-less hedged portfolio will be: 0.5102 share of Omni Ltd Long & 1 Call option short

Let the value of Call option be X

Particulars	Today		At the end of 3m		
	Action	Amount	Action	525	378
0.5102 shares	Buy	214.28	Sell	267.86	192.86
1 call option (E = 430)	Sell	(X)	Settle	(75)	(0)
Total OF		214.28 - X	Total IF	192.86	192.86

Value of investment today = PF of Future CFs

$$214.28 - X = \frac{192.86}{e^{rt}}$$

$$214.28 - X = \frac{192.86}{1.0202}$$

$$X = 25.24$$

Value of call option (X) = ₹ 25.24

Value of option using Risk Neutral Model:

Binomial Tree:

At month 0		At month 3	Call payoff	Put Payoff
$S_0 = 420$	$p = 0.3434$	$S_u = 525$	75	0
Exercise price = 450	$(1-p) = 0.6566$	$S_d = 378$	0	72

Calculation of $R = e^{rt} = e^{0.08 \times 3/12} = e^{0.02} = 1.0202$

$$420 = \frac{p \times 525 + (1 - p) \times 378}{1.0202}$$

$$P = 34.34\%$$

$$1 - P = 1 - 34.34\% = 65.66\%$$

$$V_c = \frac{75 \times 0.3434 + 0 \times 0.6566}{1.0202} = ₹ 25.25$$

Value of call option (X) = ₹ 25.25

Conclusion: Value of option under both the model is same.

b. $\text{Delta of Put} = \frac{0 - 72}{525 - 378} = 0.4898$

Risk-less hedged portfolio will be: 0.4898 share of Omni Ltd Long & 1 Put option Long

Let the value of Put option be X

Particulars	Today		At the end of 3m		
	Action	Amount	Action	525	378
0.4898 shares	Buy	205.72	Sell	257.14	185.14
1 put option	Buy	X	Settle	0	72
	Total OF	205.72 + X	Total IF	257.14	257.14

Value of investment today = PF of Future CFs

$$205.72 + X = \frac{257.14}{e^{rt}}$$

$$205.72 + X = \frac{257.14}{1.0202}$$

$$X = 46.33$$

Value of put option is ₹ 46.33

c. Basis of valuation of Options:

- Binomial model uses an approach called "Risk less Hedge Approach" to find the price of the option, by creating a portfolio which will have same value at expiration irrespective of any price. Hedge means to create an equal and opposite position for protecting the value of portfolio.
- In Risk Neutral Model, valuation of options is based on arbitrage and is therefore independent of risk preferences; one should be able to value options assuming any set of risk preferences and get the same answer.



QUESTION 39:

M 12 | RTP

Handwritten note: how only on call

Sumana wanted to buy shares of EIL which has a range of ₹411 to ₹592 a month later. The present price per share is ₹421. Her broker informs her that the price of this share can soar up to ₹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 ₹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 ₹592 so that buying of a one-month CALL of EIL at the execution price of ₹522 is justified. Advise her. Take the risk free interest to be 3.60% and $e^{0.036} = 1.037$.

Solution:

Binomial Tree:

At month 0	At month 3
$S_0 = 421$	$S_u = 592$
	$S_d = 411$

Calculation of probability (p) of share price attaining ₹ 592:

$$R = e^{rt} = e^{0.036} = 1.037$$

$$u = \frac{592}{421} = 1.4062$$

Handwritten note: Ambiguity.

$$d = \frac{411}{421} = 0.9762$$

$$p = \frac{R-d}{u-d} = \frac{1.037 - 0.9762}{1.4062 - 0.9762} = 0.1414 \text{ or } 14.14\%$$

Self-note: Ambiguity in this question is that the given interest rate of 3.6% is assumed as per month and not p.a.



QUESTION 40:

N 17

A call option on gold with exercise price ₹ 26,000 per ten gram and three months to expire is being traded at a premium of ₹ 1,010 per ten grams. It is expected that in three months time the spot price might change to ₹ 27,300 or 24,700 per ten grams. 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.

Solution:

Binomial Tree:

At month 0		At month 3	Call payoff
$S_0 = 26,000$	$p = 0.80$	$S_u = 27,300$	1300
$E = 26,000$	$(1-p) = 0.20$	$S_d = 24,700$	0

Calculation of probabilities (p) of S_u & S_d :

$$R = 1 + (r \times n)$$

$$R = 1 + 0.12 \times \frac{3}{12} = 1.03$$

$$u = \frac{27,300}{26,000} = 1.05$$

$$d = \frac{24,700}{26,000} = 0.95$$

$$p = \frac{R-d}{u-d} = \frac{1.03-0.95}{1.05-0.95} = 0.8 \text{ or } 80\%$$

$$(1-p) = 1 - 0.8 = 0.2 \text{ or } 20\%$$

$$\text{Value of call option} = \frac{1,300 \times 0.80 + 0 \times 0.20}{1.03} = 1,010$$

Since fair premium = actual premium that is ₹1,010 therefore event premium of option is justified

When examiner give the probability of price moving up and down. We don't use that probability, rather we calculate the probability implied or hidden in S_0 .

Derivatives & Interest Rate Risk Management



QUESTION 41:

N 19 | N 15 | RTP

Mr. Dayal is interested in purchasing equity shares of ABC Ltd. which are currently selling at ₹600 each. He expects that price of share may go upto ₹780 or may go down to ₹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 ₹630. S_0 S_u S_d S_0

- What combination of share and option should Mr. Dayal select if he wants a perfect hedge?
- Explain how Mr. Dayal will be able to maintain identical position regardless of the share price (not a part of original question).
- 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?

Solution:

When examiner ask you to 1st calculate Delta & show Hedged portfolio and then ask the value of option, then follow alternative method (table se reverse calculation wala) of calculating value of option.

- Binomial Tree:

At month 0	At month 3	Call payoff
$S_0 = 600$	$S_u = 780$	150
$E = 630$	$S_d = 480$	0

Calculation of delta of call option:

$$\Delta_c = \frac{\Delta \text{ in pay off}}{\Delta \text{ in price}}$$

$$= \frac{150 - 0}{780 - 480} = 0.50 \text{ times}$$

If he wants a perfect hedge, then Mr. Dayal should buy 0.50 shares and sell 1 call option.

- Position today is long 0.50 shares and short 1 call option. Position after three months:

Particulars	At the end of 3m		
	Action	780	480
0.50 shares	Sell	390	240
1 call option	Settle	(150)	(0)
		240	240

- Let the value of call option be X

Value of 0.5 share = $600 \times 0.5 = ₹ 300$

Value of investment today = PF of Future CFs

$$300 - X = \frac{240}{1 + 0.1 \times \frac{3}{12}}$$

$$X = ₹ 65.85$$

Value of call option today = ₹ 65.85

- Expected value of option after 3m = $150 \times 0.60 + 0 \times 0.40 = 90$

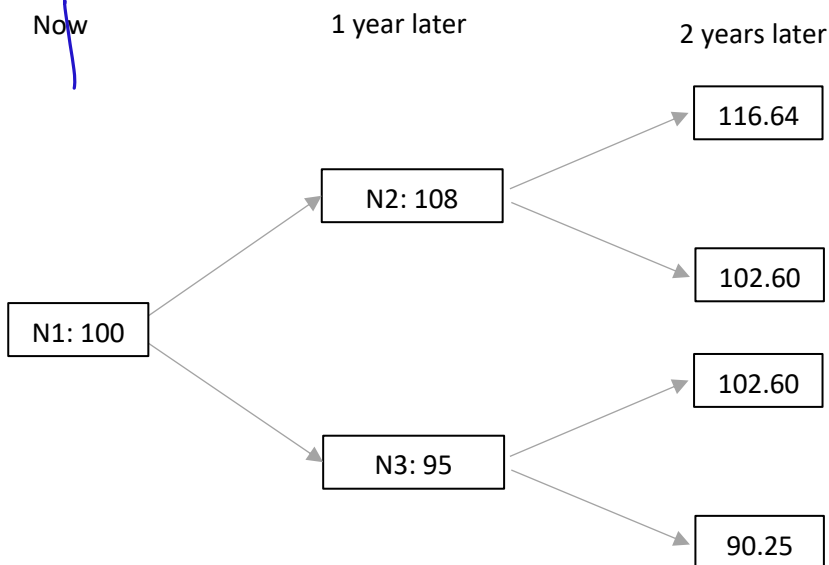
$$\begin{aligned}\text{Expected rate of return} &= \frac{90 - 65.85}{65.85} \times 100 \\ &= 36.67\%\end{aligned}$$



QUESTION 42:

N 20

A two year tree for a share of stock in ABC Ltd.,



Consider a two years American call option on the stock of ABC Ltd., with a strike price of ₹ 98. The current price of the stock is 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 node i.e., N1, N2 and N3
(Round off upto 2 decimal points).

Solution:

- Probability
Binomial Tree

At year 0	At year 1	At year 2
$S_0 = 100$ $E = 98$	$S_u = 108$	$S_{uu} = 116.64 \mid C_{uu} = 18.64$
		$S_{ud} = 102.60 \mid C_{ud} = 4.60$
	$S_d = 95$	$S_{du} = 102.60 \mid C_{du} = 4.60$
		$S_{dd} = 90.25 \mid C_{dd} = 0.00$

Calculation of probabilities (p) of S_u & S_d :

$$R = e^{rt} = e^{0.05 \times 12/12} = e^{0.05} = 1.05127$$

$$u = \frac{108}{100} = 1.08$$

$$d = \frac{95}{100} = 0.95$$

$$p = \frac{R-d}{u-d} = \frac{1.05127-0.95}{1.08-0.95} = \frac{0.10127}{0.13} = 0.7790$$

$$1-p = 0.2210$$

Expected Pay offs: = Max [Intrinsic Value, Discounted Value]

$$\text{At } N_2 = \text{Max} [(108 - 98), (\frac{18.64 \times 0.7790 + 4.60 \times 0.2210}{1.05127})] = 14.78$$

$$\text{At } N_3 = \text{Max} [(0), (\frac{4.60 \times 0.7790 + 0 \times 0.2210}{1.05127})] = 3.41$$

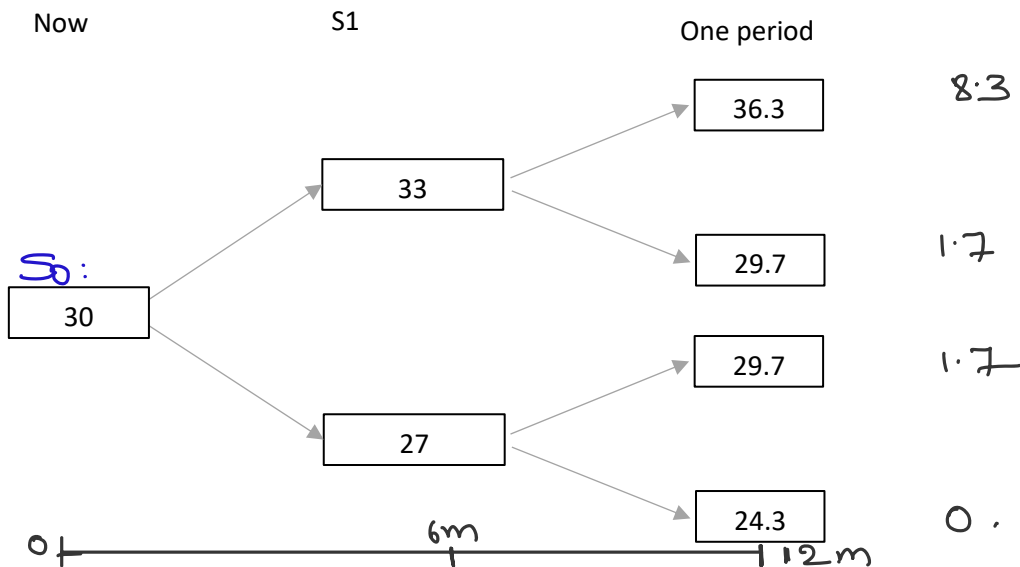
$$\text{At } N_1 = \text{Max} [(100 - 98), (\frac{14.78 \times 0.7790 + 3.41 \times 0.2210}{1.05127})] = 11.67$$



QUESTION 43:

RTP N 09 | SM

Following is a two sub-periods tree of 6-months each for the share of CAB Ltd.:



Using the binomial model, calculate the current fair value of a regular call option on CAB Stock with the following characteristics: $X = ₹ 28$, Risk Free Rate = 5 percent p.a. You should also indicate the composition of the implied riskless hedge portfolio at the valuation date.

Solution:

Calculation of probabilities (p) of S_u & S_d :

$$R = 1 + r \times n$$

$$= 1 + 0.05 \times \frac{6}{12} = 1.025$$

$$u = \frac{33}{30} = 1.1$$

$$d = \frac{27}{30} = 0.90$$

$$p = \frac{R-d}{u-d} = \frac{1.025 - 0.90}{1.1 - 0.90} = 0.625$$

Payoffs at different nodes:

$$C_{uu} = 8.30$$

$$C_{ud} = 1.70$$

$$C_{du} = 1.70$$

$$C_{dd} = 0$$

Value of call option

$$\text{At } S_u = \frac{8.3 \times 0.625 + 1.7 \times 0.375}{1.025} = 5.68$$

$$\text{At } S_d = \frac{1.7 \times 0.625 + 0 \times 0.375}{1.025} = 1.04$$

$$\text{At } S_0 = \frac{5.68 \times 0.625 + 1.04 \times 0.375}{1.025} = 3.84$$

Current FV of regular call = 3.84

Riskless Hedge Portfolio

At month 0	At month 6	Pay off
$S_0 = 30$	$S_u = 33$	$C_u = 5$
$X = 28$	$S_d = 27$	$C_d = 0$

$$\Delta_c = \frac{5 - 0}{33 - 27} = 5/6 \text{ or } 0.833 \text{ shares}$$

For riskless hedge portfolio, we will buy 0.833 shares of CAB Ltd for selling every 1 Call option.



QUESTION 44:

M 09 | RTP

Consider a two year at the money American call option with a strike price of Rs. 50 on a stock. 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 binominal 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.

Solution:

Binomial Tree

At year 0	At year 1	At year 2
$S_0 = 50$ $E = 50$	$S_u = 60$	$S_{uu} = 72 \mid C_{uu} = 22$
		$S_{ud} = 48 \mid C_{ud} = 0$
	$S_d = 40$	$S_{du} = 48 \mid C_{du} = 0$
		$S_{dd} = 32 \mid C_{dd} = 0$

Calculation of probabilities (p) of S_u & S_d :

$$R = 1 + 0.06 \times \frac{12}{12} = 1.06$$

$$U = \frac{60}{50} = 1.02$$

$$d = \frac{40}{50} = 0.80$$

$$p = \frac{R - d}{U - d} = \frac{1.06 - 0.80}{1.02 - 0.80} = 0.65$$

$$1 - P = 0.35$$

Calculation of payoffs at different nodes = Max [Intrinsic Value, Discounted Value]

$$\text{At } S_u = \text{Max} [(60 - 50), (\frac{22 \times 0.65 + 0 \times 0.35}{1.06})] = 13.49$$

$$\text{At } S_d = \text{Max} [(0), (\frac{0 \times 0.65 + 0 \times 0.35}{1.06})] = 0$$

$$\text{At } S_0 = \text{Max} [(50 - 50), (\frac{13.49 \times 0.65 + 0 \times 0.35}{1.06})] = 8.27$$

Value of option: ₹ 8.27



QUESTION 45:

RTP M 11

The following table provides the prices of options on equity shares of X Ltd. The risk free interest is 9%. You as a financial planner are required to spot any mispricing in the quotations of option premium and stock price? Suppose, if you find any such mispricing then how you can take advantage of this pricing position.

Shares	Maturity	Exercise Price (₹)	Share Price (₹)	Call Price (₹)	Put Price (₹)
X Ltd	6 months	100	160	56	4

Solution:

According to Put Call Parity Theorem:

$$V_C + PV(X) = V_P + \text{Spot}$$

Calculating PV(X) i.e., fair value of risk-free security (having FV equal to strike price) using this theorem:

$$56 + PV(X) = 4 + 160$$

$$PV(X) = 108$$

Actual price of RF security (PV of exercise price) = $\frac{100}{1.045} = 95.67$

Strategy: Sell Share, Sell Put & Buy call option and invest the proceeds into a RF security

Particulars	Today		At the end of 6m		
	Action	Amount	Action	P = 170	P = 80
Call	Buy	(56)	Settle	70	0
Put	Sell	4	Settle	0	(20)
Share	Sell	160	Buy	(170)	(80)
Investment	Invest	(108)	Redeem	112.97*	112.97*
Profit		0		12.97	12.97

* $108 \times e^{0.045} = 108 \times 1.046$



QUESTION 46:

SM

- Q1A
- The shares of TIC Ltd. are currently priced at ₹ 415 and call option exercisable in three months' time has an exercise rate of ₹ 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 ₹ 25?
 - Calculate value of aforesaid call option based on Block Scholes valuation model if the current price is considered as ₹ 380.
 - What would be the worth of put option if current price is considered ₹ 380.
 - If TIC Ltd. share price at present is taken as ₹ 408 and a dividend of ₹ 10 is expected to be paid in the two months time, then, calculate value of the call option.

Given:

Log Natural		Cumulative area till $-\infty$	
1.0375	0.03681	0.5033	0.6928
0.9500	-0.05129	0.3933	0.6529
0.9952	-0.00480	-0.2976	0.3830
e^x		-0.4076	0.3418
0.0125	1.012578	0.1250	0.5498
0.0083	1.008368	0.0150	0.5060

Solution:

- Value of call option, if spot price is ₹ 415

Calculation of $N(d_1)$:

$$d_1 = \frac{\ln\left(\frac{S_0}{E}\right) + \left(r + \frac{\sigma^2}{2}\right)t}{\sigma\sqrt{t}}$$

$$\begin{aligned}
 &= \frac{\ln\left(\frac{415}{400}\right) + \left(0.05 + \frac{(0.22)^2}{2}\right)^{3/12}}{0.22\sqrt{3/12}} \\
 &= \frac{0.03681 + 0.01855}{0.11} = 0.5033
 \end{aligned}$$

$N(d_1)$: Area of 0.5033 = 0.6928

Calculation of $N(d_2)$:

$$\begin{aligned}
 d_2 &= d_1 - \sigma\sqrt{t} \\
 &= 0.5033 - 0.22\sqrt{3/12} = 0.3933
 \end{aligned}$$

$N(d_2)$: Area of 0.3933 = 0.6529

$$\begin{aligned}
 \text{Value of call option} &= S_0 \times N(d_1) - \frac{E}{e^{rt}} \times N(d_2) \\
 &= 415 \times 0.6928 - \frac{400}{e^{0.05 \times 3/12}} \times 0.6529 \\
 &= 287.512 - \frac{400}{e^{0.0125}} \times 0.6529 \\
 &= 287.512 - \frac{400}{1.012578} \times 0.6529 \\
 &= 29.60
 \end{aligned}$$

The fair price of call option is 29.60. If the option is ₹25 then it is worth buying the option as it is undervalued.

b. Value of call option, if spot price is ₹ 380

Calculation of $N(d_1)$:

$$\begin{aligned}
 d_1 &= \frac{\ln\left(\frac{380}{400}\right) + \left(0.05 + \frac{(0.22)^2}{2}\right)^{3/12}}{0.22\sqrt{3/12}} \\
 &= \frac{\ln(0.95) + 0.01855}{0.11} \\
 &= \frac{-0.05129 + 0.01855}{0.11} = -0.2976
 \end{aligned}$$

$N(d_1)$: Area of -0.2976 = 0.3830

Calculation of $N(d_2)$:

$$\begin{aligned}
 d_2 &= d_1 - \sigma\sqrt{t} \\
 &= -0.2976 - 0.22\sqrt{3/12} = -0.4076
 \end{aligned}$$

$N(d_2)$: Area of -0.4076 = 0.3418

$$\text{Value of call option:} = 380 \times 0.3830 - \frac{400}{e^{0.05 \times 3/12}} \times 0.3418$$

$$= 145.54 - 135.022$$

$$= 10.518 \sim 10.52$$

(c) If the given option is a put option:

Using call parity theorem: $V_s + V_p = V_c + \frac{E}{e^H}$

$$380 + V_p = 10.518 + \frac{400}{e^{0.05 \times 3/12}}$$

$$380 + V_p = 405.549$$

$$V_p = 25.55$$

(d) Calculation of Value of call option

Calculation of Ex-dividend spot price (S_0^*)

$$\text{PV of Dividend} = \frac{10}{e^{0.05 \times 2/12}}$$

$$= \frac{10}{1.008368} = 9.92$$

$$S_0^* = 408 - 9.92 = 398.08$$

Calculation of $N(d_1)$:

$$d_1 = \frac{\ln\left(\frac{398.08}{400}\right) + \left(\frac{0.05 + (0.22)^2}{2}\right)^{3/12}}{0.22\sqrt{3/12}}$$

$$= \frac{\ln(0.9952) + 0.01855}{0.11}$$

$$= \frac{-0.00480 + 0.01855}{0.11} = 0.125$$

$$N(d_1) : \text{Area of } 0.125 = 0.5418$$

Calculation of $N(d_2)$:

$$d_2 = d_1 - \sigma\sqrt{t}$$

$$0.125 - 0.22\sqrt{3/12} = 0.015$$

$$N(d_2) : \text{Area of } 0.015 = 0.5060$$

$$\text{Value of call option} = 398.08 \times 0.5498 - \frac{400}{e^{0.05 \times 3/12}} \times 0.5060$$

$$= 218.864 - 199.886$$

$$= 18.978$$



QUESTION 47:

RTP N 09 | N 06 | N 08 | RTP M 10

From the following data for certain stock, find the value of a call option:

Price of stock now	₹80
Exercise price	₹75
Standard deviation of continuously compounded annual return	0.4
Maturity period	6 months
Annual interest rate	12%

Given: Number of S.D. from Mean, (z)

0.25
0.3
0.55
0.6

Area of the left or right (one tail)

0.4013
0.3821
0.2912
0.2743

Given: $e^{0.12 \times 0.5} = 1.062$ | $\ln(1.0667) = 0.0646$

Solution:

Calculation of $N(d_1)$:

$$\begin{aligned}
 \text{Calculation of } D_1 &= \frac{\ln\left(\frac{S_0}{E}\right) + \left(r + \frac{\sigma^2}{2}\right)t}{\sigma\sqrt{t}} \\
 &= \frac{\ln\left(\frac{80}{75}\right) + \left(0.12 + \frac{(0.4)^2}{2}\right)6/12}{0.4\sqrt{6/12}} \\
 &= \frac{\ln(1.0667) + 0.1}{0.2828} \\
 &= \frac{0.0646 + 0.1}{0.2828} \\
 &= 0.5820
 \end{aligned}$$

Calculation of tail area for d_1 :

0.55	————>	0.2912
0.60	————>	0.2743
0.5820	————>	??

Using Interpolation:

$$\begin{aligned}
 \frac{0.5820 - 0.55}{0.60 - 0.55} &= \frac{x - 0.2912}{0.2743 - 0.2912} \\
 x &= 0.2803
 \end{aligned}$$

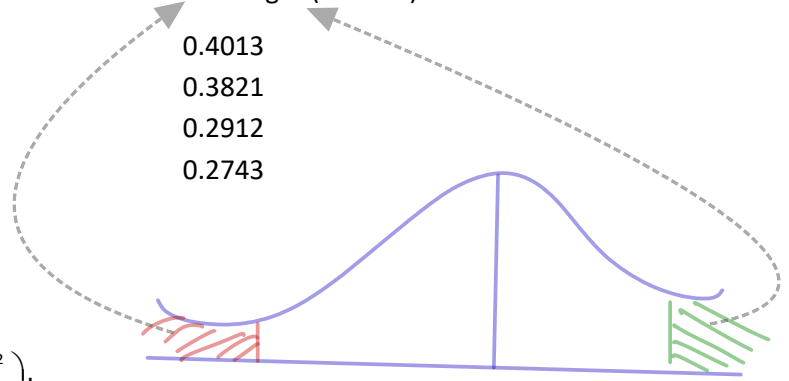
Calculation of $N(d_1)$:

$$N(d_1) = 1 - 0.2803 = 0.7197$$

Calculation of $N(d_2)$:

$$\begin{aligned}
 \text{Calculation of } D_2 &= D_1 - \sigma\sqrt{t} \\
 &= 0.5820 - 0.40 \times \sqrt{6/12} = 0.2992
 \end{aligned}$$

Calculation of tail area for D_2



$$0.25 \longrightarrow 0.4013$$

$$0.30 \longrightarrow 0.3821$$

$$0.2992 \longrightarrow ??$$

Using Interpolation:

$$\frac{0.2992 - 0.25}{0.30 - 0.25} = \frac{x - 0.4013}{0.3821 - 0.4013}$$

$$X = 0.3824$$

Calculation of $N(d_2)$:

$$1 - 0.3824 = 0.6176$$

$$\begin{aligned} \text{Value of call Option} &= S_0 \times N(d_1) - \frac{E}{e^{rt}} \times N(d_2) \\ &= 80 \times 0.7197 - \frac{75}{e^{0.12 \times 6/12}} \times 0.6176 \\ &= 57.576 - \frac{75}{1.062} \times 0.6176 \\ &= 13.96 \end{aligned}$$

D. FORWARD RATE AGREEMENT (FRA)



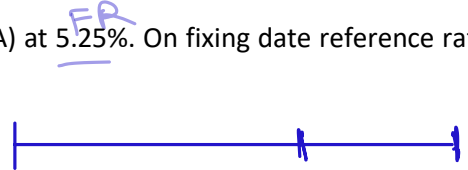
QUESTION 48:

RTP

only on calc

TM Fincorp has *long* bought a 6 x 9 ₹100 crore Forward Rate Agreement (FRA) at 5.25%. On fixing date reference rate *NP* i.e., MIBOR turns out be as follows:

Period	Rate (%)
3 months	5.5
6 months	5.7
9 months	5.85



You are required to determine:

- Profit/Loss to TM Fincorp. in terms of basis points.
 - The settlement amount.
- (Assume 360 days in a year)

Solution:

- a) Profit to TM Fincorp = $(0.055 - 0.0525) \times 100$
 = 25 Basis points (bps)
- b) Settlement Amount = $\frac{NP \times (RR - FR) \times 3/12}{1 + RR \times 3/12}$
 = $\frac{100 \times (0.055 - 0.0525) \times 3/12}{1 + 0.055 \times 3/12} \times 100 \text{ Cr.}$
 = 6,16,523



QUESTION 49:

MTP M 14 V 2

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. *RR* *NP* *FR*

- Indicate whether the treasurer should take a long or short position to hedge interest rate risk.
- Using the appropriate terminology identify the type of FRA used here.
- Calculate the gain or loss to the company as a consequence of entering the FRA.

Solution:

- To hedge the interest rate risk, treasure should take a short position in FRA
- Appropriate terminology = FRA 90 × 180 or FRA 3 × 6
- Gain or loss on FRA = $\frac{15,000,000 \times (0.015 - 0.0125) \times 90/360}{1 + 0.0125 \times 90/360}$
 = \$ 9345.79



QUESTION 50:

N 19 | M 13 | RTP

M/s. Parker & Co. is contemplating to borrow an amount of ₹60 crores for a period of 3 months in the coming 6 month's time from now. The current rate of interest is 9% p.a., but it may go up in 6 month's 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 9.30% p.a.

What will be final settlement amount, if the actual rate of interest after 6 months happens to be (i) 9.60% p.a. and (ii) 8.80% p.a.?

Solution:

Parker & Co. will take a long position in FRA to hedge itself. Gain or loss if:

- i) RR turns out to be 9.6%
- $$\frac{NP \times (RR - PR) \times n}{1 + RR \times n}$$
- $$60 \text{ Cr.} \times \frac{(0.096 - 0.093) \times 3/12}{1 + 0.096 \times 3/12}$$
- $$= 439453.125 \text{ Cr. Gain}$$
- (ii) RR turns out to be 8.8%
- $$60 \text{ Cr.} \times \frac{(0.088 - 0.093) \times 3/12}{1 + 0.088 \times 3/12}$$
- $$= -733855.1859 \text{ Cr. Loss}$$



QUESTION 51:

M 10 | 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%

- (a) Forward Rate Agreement (FRA) for Yen is ~~what?~~ *what?* *→ period of 6 months* *→ expiry date*
- a.b What should be 3 months FRA rate at 3 months forward?
- b.c The 6 & 12 months LIBORS are 5% & 6.5% respectively. A bank is quoting 6/12 USD FRA at 6.50 – 6.75%. Is any arbitrage opportunity available? Calculate profit in such case.

Solution: (a) The forward rate agreement on JPY is nil *→ Ambiguous!* *Actual FR will be some number.*

- (i) Calculation of Fair FR 3 × 6

$$\left(1 + S_6 \times \frac{6}{12}\right) = \left(1 + S_3 \times \frac{3}{12}\right) \left(1 + \text{Fair FR} \times \frac{3}{12}\right)$$

$$\left(1 + 0.05 \times \frac{6}{12}\right) = \left(1 + 0.045 \times \frac{3}{12}\right) \left(1 + \text{Fair FR} \times \frac{3}{12}\right)$$

$$1.025 = (1.01125) \left(1 + \text{Fair FR} \times \frac{3}{12} \right)$$

$$5.44\% = \text{Fair FR}$$

(ii) Calculation of Fair FR 6×12

$$\left(1 + S_{12} \times \frac{12}{12} \right) = \left(1 + S_6 \times \frac{6}{12} \right) \times \left(1 + \text{Fair FR} \times \frac{6}{12} \right)$$

$$\left(1 + 0.065 \times \frac{12}{12} \right) = \left(1 + 0.05 \times \frac{6}{12} \right) \left(1 + \text{Fair FR} \times \frac{6}{12} \right)$$

$$1.065 = 1.025 \left(1 + \text{Fair FR} \times \frac{6}{12} \right)$$

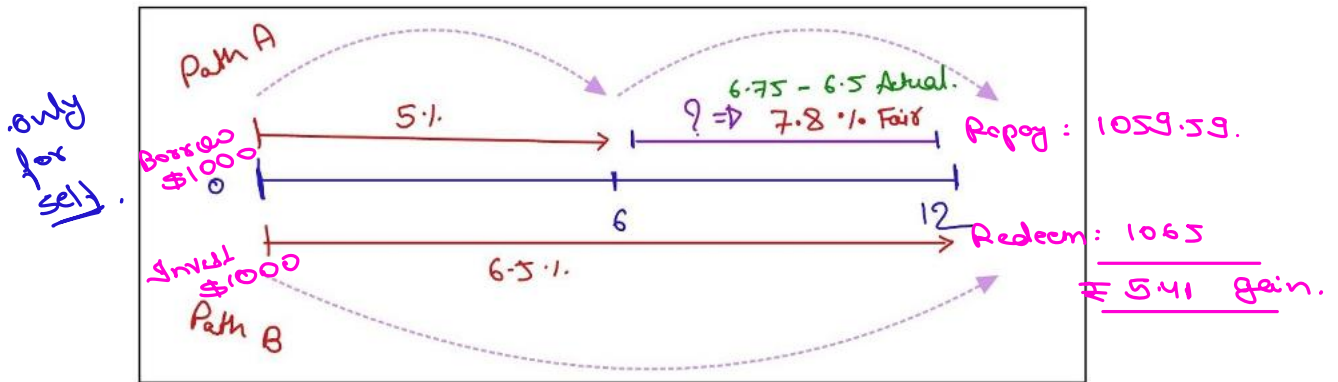
$$\text{Fair FR} = 7.80\%$$

Arbitrage:

Since, Actual FR [6.50% - 6.75%] < Fair FR (7.80%)

Therefore, Its undervalued

Hence, Arbitrage process will be: Borrow in Path-A and Invest in Path-B



Step 1: Borrow \$ 1,000 @ 5% for 6 months & Buy 6×12 FRA @ 6.75%. Therefore, outflow at the end of 12M:

$$\$ 1000 \times \left(1 + 0.05 \times \frac{6}{12} \right) \times \left(1 + 0.0675 \times \frac{6}{12} \right) = 1059.59$$

Step 2: Invest \$ 1000 @ 6.5% for 1 year. Therefore, Inflow at the end of 1 year:

$$\$ 1000 \times \left(1 + 0.065 \times \frac{12}{12} \right) = \$ 1065$$

Step 3: Arbitrage profit = inflow – outflow

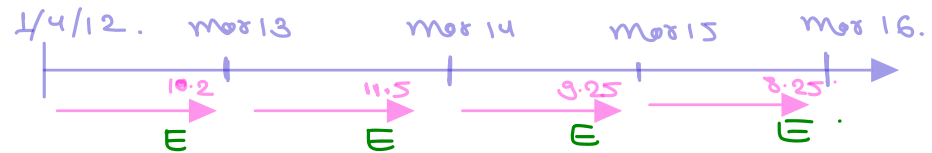
$$= 1065 - 1059.59 = \$ 5.41$$

E. INTEREST RATE OPTIONS: CAP, FLOOR & COLLAR



QUESTION 52:

M 24 | N 17



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.

- 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 8.50% p.a.
- 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 respective interest due dates.

Solution:

- The Textile manufacturer (borrower) can hedge the interest rate risk by buying a CAP option will following specification:

- Exercise Rate = 8.5%
- National principle = ₹40,00,000
- Cap option start date = 1/4/2012
- Cap option end date = 31/3/2016
- Int. Pay off settlement date = 31st March every year
- Ref. Rate = Rate applicable to loan
- Premium = 0.75% to be paid on 1st Oct, 2021

Whenever the interest rate will rise above 8.5%, cap option will be exercise and pay off from the option will compensate the rising interest cost.

- Settlement Amount [pay off = Notional Principle $\times$ (RR- E) $\times$ n]

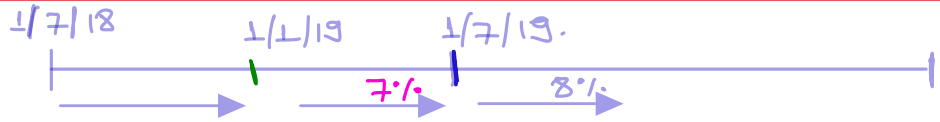
Date	Calculation	Settlement Amount
31/3/2013	$40,00,000 \times (10.2 - 8.50) \times 12/12$	68,000
31/3/2014	$40,00,000 \times (0.115 - 0.085) \times 12/12$	1,20,000
31/3/2015	$40,00,000 \times (0.0925 - 0.085) \times 12/12$	30,000
31/3/2016	Option not exercised	0

The textile manufacturer will have to pay premium @ 0.75% of ₹ 30,000 (i.e., $40,00,000 \times 0.75\%$) on Oct. 1, 2012



QUESTION 53:

M 22 | RTP



MPD Ltd. issues a ₹ 50 million Floating Rate Loan on July 1, 2018 with resetting of coupon rate every 6 Months equal to LIBOR + 50 bps.

MPD is interested in an Interest rate Collar Strategy of selling a Floor and buying a cap. MPD buys the 3 years cap and sell 3 years Floor as per the following details on July 1, 2018:

Principal Amount	₹ 50 million
Strike Rate	5% for Floor & 8% for Cap
Reference Rate	6 months LIBOR
Premium	NIL, since premium paid for cap = premium received for Floor

The Reset dates & Interest rates p.a., on that dates are:

Reset Date	LIBOR (%)
31/12/2018	7.00
30/06/2019	8.00
31/12/2019	8.50
30/06/2020	4.75
31/12/2020	4.25
30/06/2021	5.25

Solved word could have been settlement date.

Using the above data, you are required to determine:

- Effective Interest paid out at each six reset dates, (Round off to the nearest rupee)
- Average overall effective rate of interest p.a. (round off to 2 decimals)

Solution:

Self-note: Solution of this question has been updated by ICAI in May-22 suggested to make it logical.

- Effective interest paid out at each reset date

Reset Date	Date of Payment	No. of days	Libor	Interest (L + 0.5%)	Payoff (Recd.)/Paid		Effective Interest
					Cap	Floor	
31-12-2018	30-06-2019	181	7	18,59,589			18,59,589
30-06-2019	31-12-2019	184	8	21,42,466			21,42,466
31-12-2019	30-06-2020	182	8.5	22,37,705	- 1,24,317		21,13,388
30-06-2020	31-12-2020	184	4.75	13,19,672		62,842	13,82,514
31-12-2020	30-06-2021	181	4.25	11,77,740		1,85,959	13,63,699
30-06-2021	31-12-2021	184	5.25	14,49,315			14,49,315
		1096					1,03,10,971

- Average overall effective rate of interest p.a.

$$= \frac{1,03,10,971}{500,00,000} \times \frac{365}{1096} \times 100$$

$$= 6.87\% \text{ p.a.}$$



QUESTION 54:

RTP

Two companies ABC Ltd. and XYZ Ltd. approach the DEF Bank for FRA (Forward Rate Agreement). They want to borrow a sum of ₹100crores after 2 years for a period of 1 year. Bank has calculated Yield Curve of both companies as follows:

Year	XYZ Ltd.	ABC Ltd.*
1	3.86	4.12
2	4.2	5.48
3	4.48	5.78

*The difference in yield curve is due to the lower credit rating of ABC Ltd. compared to XYZ Ltd.

- 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 Ltd. if interest rate in 2 years turns out to be
 - 4.50%
 - 5.50%

Solution:

(i) Rate of interest under FRA 2 × 3

For XYZ Ltd.: $(1 + 0.0448)^3 = (1 + 0.042)^2 (1 + \text{fair FR})^1$
 $1.1405 = (1.085) (1 + \text{Fair FR})^1$
 Fair FR = 5.04%

Bank will quote 5.04% for a 2V3 FRA.

For ABC Ltd.: $(1 + 0.0578)^3 = (1 + 0.0548)^2 (1 + \text{Fair FR})^1$
 $1.01445 = (1.009133) (1 + \text{Fair FR})^1$
 Fair FR = 6.38%

Bank will quote 6.38% for a 2V3 FRA.

(ii)

		4.50%	5.50%
Spot Interest paid	₹ 100 crores X 4.50%	₹ 4.50 crores	₹ 5.50 crores
Premium Paid	₹ 100 crores X 5.04%		₹ 0.10 crores
Cap payoff received	₹ 100 crores X 0.1%	₹ 0.10 crores	₹ 0.10 crores
		-	- 0.46 crores
		4.60 crores	5.14 crores



QUESTION 55:

M 13 | RTP

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 lump sum 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:

Premium

No. info. xx

P/O

xx

P/O

xx

P/O

xx

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.

Solution:

Lump Sum premium $= 1,50,00,00,000 \times 0.1\% = 150,000$

Calculation of equated 6 monthly premiums:

$$\begin{aligned}
 1,50,000 &= \text{Equated 6 monthly premiums} \times \text{PVAF (3.5\%, 4 periods)} \\
 1,50,000 &= \text{Equated 6M premium} \times 3.6731 \\
 40837 &= \text{Equated 6M premium}
 \end{aligned}$$

Calculation of amount of interest rate risk hedged:

Reset Period	LIBOR	Pay off received	Premium paid	Net Payoff
1	9%	75000 $1,50,00,000 \times (9-8\%) \times 6/12$	40,837	34,163
2	9.5%	1,12,500 $1,50,00,000 \times (9.5-8) \times 6/12$	40,837	71,663
3	10.00%	1,50,000 $1,50,00,000 \times (10-8) \times 6/12$	40,837	1,09,163

F. INTEREST RATE FUTURES



QUESTION 56:

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 deposit 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 3 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.

Solution:

- To hedge the position, the borrower will take a long position in 3 × 9 FRA @ 5.94%

FRA shall be useful as:

If Interest Rate turns out to be	4.5%	6.5%
Int. On Borrowings	(11,25,000) (50,000,000 × 4.5% × 6/12)	(16,25,000) (50,000,000 × 6.5% × 6/12)
Gain/(Loss) on FRA	(360,000) [50,000,000 × (4.5 – 5.94%) × 6/12]	140,000 (50,000,000 × (6.5% – 5.94%) × 6/12)
Net Interest Cost	(14,85,000)	(14,85,000)

$$\text{Net Interest Cost (\%)} = \frac{14,85,000}{50,000,000} \times \frac{12}{6} \times 100 = 5.94\%$$

- 3 months future contract shall be useful as:

$$\begin{aligned} \text{No. of Contracts} &= \frac{\text{Amount of Borrowing}}{\text{Contract Size}} \times \frac{\text{Duration of Loan}}{3 \text{ months}} \\ &= \frac{€ 50,000,000}{€ 50,000} \times \frac{6}{3} = 2000 \text{ Contracts to borrow} \end{aligned}$$

If Interest Rate turns out to be	4.5%	6.5%
Interest paid on Borrowings	(11,25,000) (50,000,000 × 4.5% × 6/12)	(16,25,000) (50,000,000 × 6.5% × 6/12)
Gain/(Loss) on Futures	(337,500) [2,000 × 50,000 × (4.5 – 5.85) % × 3/12]	162,500 [2,000 × 50,000 × (6.5 – 5.85) % × 3/12]
Net Interest	(14,62,500)	(14,62,500)

$$\text{Net Interest Cost (\%)} = \frac{(14,62,500)}{5,00,00,000} \times \frac{12}{6} \times 100 = 5.85\%$$



QUESTION 57:

M 21 RTP

Espaces plc 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 £25 million for the entire period of slack season in about 3 months.

The banker of the firm has given the following quotations for Forward Rate Agreement (FRA):

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.

You are required to:

- Advise the position to be taken in Future Market by the firm to hedge its interest rate risk and demonstrate how 3 months Future contract shall be useful for the firm, if later interest rate turns out to be (i) 4.5% and (ii) 6.5%
- Evaluate whether the interest cost to Espace plc shall be less had it adopted the route of FRA instead of Future Contract.

Note: Ignore the time value of money in settlement amount for future contract.



QUESTION 58:

N 24

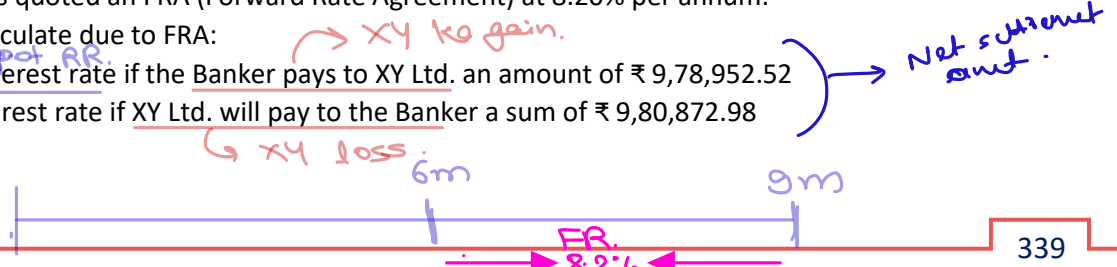
XY Ltd. is planning to expand its operations in view of growing demand for its products. For this purpose, it is considering to borrow an amount of ₹ 100 crores for a period of 3 months in the coming 6 months' time from now. The current rate of interest is 8% per annum but due to inflation it may go 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 8.20% per annum.

You are required to calculate due to FRA:

- Take actual interest rate if the Banker pays to XY Ltd. an amount of ₹ 9,78,952.52
- The actual interest rate if XY Ltd. will pay to the Banker a sum of ₹ 9,80,872.98

Solution:





QUESTION 59:

N 23 | M 21 MTP

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 Bonds	Conversion Factor
7.96 GOI 2023	1037.4	1.037
6.55 GOI 2025	926.4	0.906
6.80 GOI 2029	877.5	0.9195
6.85 GOI 2026	972.3	0.9643
8.44 GOI 2027	1146.3	1.1734
8.85 GOI 2028	1201.7	1.2428

Calculate the Invoice price in each of the case & recommend the Security that should be delivered by the XYZ Bank if Future Settlement Price is 1000.

Solution:

The XYZ Bank shall choose those CTD (Cheapest-to-Deliver) Bonds from the basket of deliverable Bonds which gives maximum profit computed as follows:

Profit = Future Settlement Price $\times$ Conversion Factor - Quoted Spot Price of Deliverable Bond Accordingly, the profit of each bond shall be computed as follows:

Security (1)	Future Settlement Price (2)	Conversion Factor (3)	Invoice Price (4) = 2 $\times$ 3	Quoted Price of Bonds (5)	Profit (4) – (5)
7.96 GOI 2023	1,000	1.0370	1037.00	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	1173.40	1146.30	27.10
8.85 GOI 2028	1,000	1.2428	1242.80	1201.70	41.10

Since maximum profit to the Bank is in case of 6.80 GOI 2029, same should be opted for.

G. SWAPS



QUESTION 60:

RTP N 11

only on calc

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.

Solution:

When PLR is 4%:

$$\text{Interest Received} = 2,50,00,000 \times 6.5\% \times \frac{1}{12} = 1,35,416.67$$

$$\text{Interest Paid} = 2,50,00,000 \times 5.5\% \times \frac{1}{12} = 1,14,583.33$$

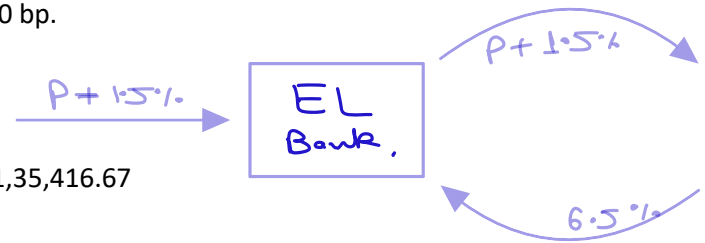
$$\text{Net Interest Received} = 1,35,416.67 - 1,14,583.33 = 20,833.34$$

When PLR increases by 200bps i.e., become 6%:

$$\text{Interest Received (Same as above)} = 1,35,416.67$$

$$\text{Interest Paid} = 2,50,00,000 \times 7.5\% \times \frac{1}{12} = 1,56,250$$

$$\text{Net Interest Paid} = 1,35,416.67 - 1,56,250 = (20,833.33)$$



QUESTION 61:

RTP M 11

The following details are related to borrowing requirements of two companies, ABC Ltd & DEF Ltd:

Company	Requirement	Fixed	Floating
ABC	Fixed Rupee Rate	<i>D</i> 4.5%	PLR + 2.0% <i>A</i>
DEF	Floating Rupee Rate	<i>A</i> 5.0%	PLR + 3.0% <i>D</i>

P + 7.0%
P + 7.5%

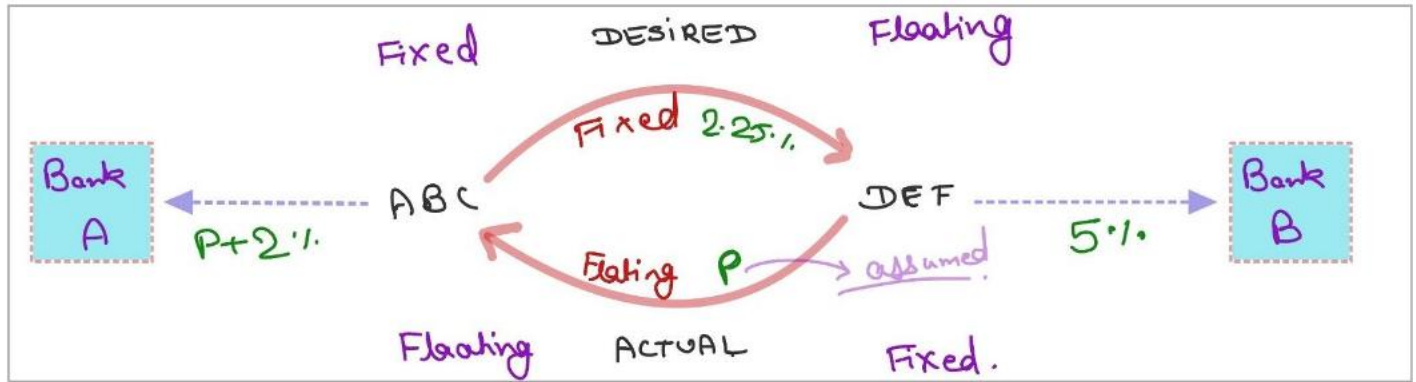
Both Companies are in need of Rs. 2,50,00,000 for a period of 5 years. The interest rates on the floating rate loans are reset annually.

You are required to exhibit how these two companies can reduce their borrowing cost by adopting swap assuming that gains resulting from swap shall be share equally among them.

Solution:

a. Exhibition of swap diagram.

Swap Diagram:



Calculation of Saving in total interest cost

Total Interest cost under Desired position (PLR + 3% + 4.5%)	PLR + 7.5%
(-) Total Int. Cost under Actual (PLR + 2% + 5%)	(PLR + 7%)
Net savings in int.	0.5%
Distributed as (1:1)	
ABC Ltd. (50%)	0.25%
DEF Ltd (50%)	0.25%

Calculation of fixed leg under the swap by assuming floating leg as flat 'PLR'

From view point of ABC Ltd.

Desired – (Actual + Swap) = Savings

$$4.5\% - (\text{PLR} + 2\% - \text{PLR} + F) = 0.25$$

$$4.5 - \text{PLR} - 2\% + \text{PLR} - F = 0.25$$

$$F = 2.25\%$$

Swap Arrangement will be as follows:

ABC Ltd. Wants to borrow at fixed rate of 4.5% and DEF Ltd. At floating rate of PLR + 3%. However, to save the interest cost we will make ABC Borrow at a floating rate of PLR + 2% and DEF at a fixed rate of 5% and make them enter into fixed v/s floating swap as follows:

- ABC will pay fixed rate of 2.25% and received PLR
- DEF will pay PLR and received 2.25%

Accordingly, effective interest cost =

$$\begin{aligned} \text{ABC Ltd:} &= \text{PLR} + 2\% + 2.25\% - \text{PLR} \\ &= 4.25\% \end{aligned}$$

$$\begin{aligned} \text{DEF Ltd:} &= 5\% + \text{PLR} - 2.25 \\ &= \text{PLR} + 2.75\% \end{aligned}$$



QUESTION 62:

N 20 | M 19

IB an Indian firm has its subsidiary in Japan and Zaki a Japanese firm has its subsidiary in India and face the following interest rates:

Derivatives & Interest Rate Risk Management

Company	IB	Zaki
INR Floating Rate	BPLR + 0.5%	BPLR + 2.5%
JPY Fixed Rate	2%	2.25%

Zaki wishes to borrow Rupee Loan at a floating rate and IB wishes to borrow JPY at a fixed rate. The amount of loan required by both the firms is same at the current exchange rate. A financial institution may arrange a swap and requires 25 basis points as its commission. Gain, if any, is to be shared by the firms equally.

You are required to find out:

- Whether a swap can be arranged which may be beneficial to both the firms?
- What rate of interest will the firms end up paying?

Solution:

- Though Company IB has an advantage in both the markets but it has comparative more advantage in the INR floating-rate market. Company Zaki has a comparative advantage in the JPY fixed interest rate market. IB wishes to borrow at fixed rate of 2% Zaki wishes to borrow at a floating rate of Int. BPLR + 2.5% However, to arrange a swap we will make IB Borrow at a floating rate of BPLR + 0.5% and Zaki at a fixed rate of 2.25%.

Total Interest Cost under Desired:	BPLR + 2.5 + 2 =	BPLR + 4.5%
Total Interest Cost under Actual:	BPLR + 0.5 + 2.25 =	BPLR + 2.75
Gross savings		1.75%
Commission		(0.25)
Net Savings		<u>1.50</u>

Since, there is a net savings of 1.5%

Therefore, a beneficial swap can be arranged

- | | |
|--------------------------------------|------|
| Total saving in interest | 1.50 |
| Distributed in the ratio 1:1 between | |
| IB | 0.75 |
| Zaki | 0.75 |

Calculating effective interest cost

Particulars	IB	Zaki
Int. Cost under desired position	2%	BPLR + 2.5%
(-) saving due to swap	(0.75)	(0.75)
Effective Interest under swap	1.25	BPLR + 1.75%



QUESTION 63:

M 23

IF an Indian firm has its subsidiary in Singapore and SF a Singapore firm has its subsidiary in India and face the following interest rates:

Company	IF	SF
INR Floating Rate	BPLR + 0.5%	BPLR + 1.5%
SGD (fixed rate)	3%	3.50%

Ignore currency & solved as fixed vs floating swap.

Handwritten notes:
 For INR Floating Rate: A → B + 4.5%
 For SGD (fixed rate): D → B + 4%

SF wishes to borrow Rupee loan at a floating rate and IF wishes to borrow SGD at a fixed rate. The amount of loan required by both the companies is same at the current exchange rate. A Bank arranges a swap and requires 50 basis points as its commission, which is to be shared equally, IF requires a minimum gain of 20 basis points and SF requires a minimum gain of 10 basis points for structuring the deal. The Bank is very keen to structure the deal, even if, it has to forego a part of its commission.

You are required to find out

- Whether there are any advantages available to IF and SF?
- Whether a swap can be arranged which may be beneficial to both the firms?
- What rate of interest will they end up paying? Show detailed working

Solution:

Net interest cost be.

- Though firm IF has an advantage in both the markets but it has comparative more advantage in the INR floating-rate market. Firm SF has a comparative advantage in the SGD fixed interest rate market.
- Firm IF wants to borrow in the SGD fixed interest rate market and firm SF wants to borrow in the INR floating-rate market. This gives rise to the swap opportunity and we make the borrow other way round.

Total interest cost under desired:	BPLR + 1.5 + 3 =	BPLR + 4.5%
Total interest cost under actual:	BPLR + 0.5 + 3.5 =	<u>BPLR + 4%</u>
Gross savings		0.5%
Commission		<u>(0.2)%*</u>
Net Savings		<u>0.3%</u>

Since, there is a net savings of 0.3%, therefore, a swap beneficial to both the firms can be arranged.

$$\begin{aligned}
 * \text{ Maximum commission} &= \text{Gross savings} - \text{minimum gain of IF \& SF} \\
 &= 0.5\% - 0.2\% - 0.1\% \\
 &= 0.2\%
 \end{aligned}$$

- Calculating effective interest cost

Particulars	IF	SF
Interest Cost under desired position	3%	BPLR + 1.5%
(-) saving due to swap	(0.2)	(0.1)
Effective Interest under swap	2.8%	BPLR + 1.4%

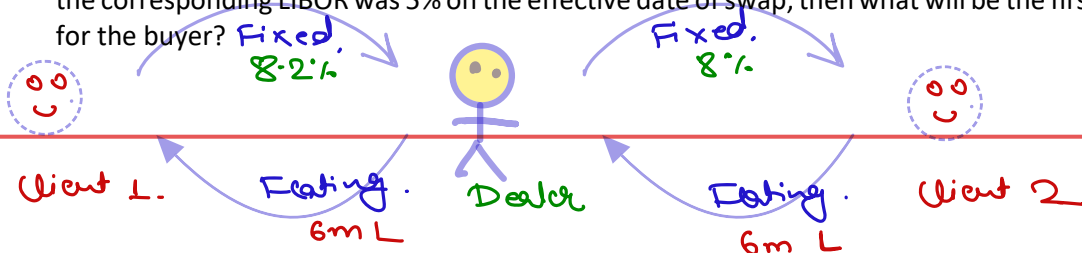


QUESTION 64:

N 23 | M 21 | N 18 | N 10 | N 08 | RTP

Suppose a dealer bank quotes for a generic swap "AIC 8%/8.20% vs. 6M LIBOR Flat". Notional principal amount of swap is ₹ 1 Million, and the same is for a period of three years, reset after every six months. In this context, answer the following questions:

- Interpret the dealer bank quote.
- If a firm is buying a swap, what is the nature of cash flows?
- If a firm is selling a swap, what is the nature of cash flows?
- Calculate semi-annual fixed payment for the buyer of swap at the end of every six months.
- If the six-month period from the effective date of swap to the settlement date comprises of 181 days and that the corresponding LIBOR was 5% on the effective date of swap, then what will be the first floating rate payment for the buyer?



- f. If the settlement is on "Net Basis", how much the buyer of swap has to pay or receive at the end of first six months?

[Assume 30/360 days basis]

Solution:

- a) Interpretation of dealer bank quote:
- AIC in the dealer bank quote refers to 'All in cost' i.e. cost of swap all inclusive.
 - First part of the quote i.e. '8%/8.20%' refers to the fixed leg part and the second part of the quote i.e., '6m LIBOR Flat' refers to the floating leg part.
 - The difference in the fixed rates i.e. 20 bps refers to the margin charged by the Bank on the fixed leg of transactions.
 - The term 'flat' on the floating leg quote, indicates that the Bank does not charge any commission on the floating leg. Therefore, bank charges 20 bps for transacting swap as a whole.
- b) A buyer of swap pays 'Fixed' cash flows and receives 'Floating'. ~~As per the quote~~, the buyer would pay 8.2% ~~(higher of 8%, 8.2%)~~ to the Bank and would receive '6M LIBOR' against it.
- c) A seller of swap pays 'floating' cash flows and receives 'fixed'. As per the quote, the seller would pay '6M LIBOR' to the bank and would receive 8% ~~(lower of 8%, 8.2%)~~ against it.
- d) Semi-annual Payment every six-month for buyer of Swap:
- $$= 10,00,000 \times 8.20\% \times \frac{180}{360}$$
- $$= ₹ 41,000$$
- e) Floating Rate Payment ~~to be received.~~
- $$= 10,00,000 \times 0.05 \times \frac{181}{360}$$
- $$= ₹ 25,138$$
- f) Net Settlement buyer will pay:
- $$= 41,000 - 25,138 = ₹ 15,862$$



QUESTION 65:

M 10 older

ABC Bank is seeking fixed rate funding. It is able to finance at a cost of six months LIBOR + 1/4% for ₹200 million for 5 years. The bank is able to swap into a fixed rate at 7.5% versus six month LIBOR treating six months as exactly half a year.

- a. What will be the "all in cost" funds to ABC Bank?
- b. Another possibility being considered is the issue of a hybrid instrument which pays 7.5% for first three years and LIBOR – 0.25% for remaining two years.

Given a three-year swap rate of 8%, suggest the method by which the bank should achieve fixed rate funding.

Solution:

- a) Calculation of 'all in cost' funds to ABC Bank:

Cost finance (Int on borrowing)	L + 0.25%
Int paid under swap	7.5%
(-) Int Received under swap	(L)
All in cost (%)	7.75%

$$\begin{aligned} \text{All in cost (₹)} &= ₹200 \text{ million} \times 7.75\% \times \frac{6}{12} \\ &= ₹7.75 \text{ million} \end{aligned}$$

b) Calculation of Cost of funds under hybrid instrument:

Two swaps are given:

5 year: 7.5% v/s LIBOR

3 year: 8.0% v/s LIBOR

Years	1 - 3	4 - 5
Interest paid on Hybrid Instrument	7.5%	L - 0.25%
Interest under 5 year swap:		
Received floating	(L)	(L)
Paid fixed	7.5	7.5
Interest under 3 year swap:	+15 - L	7.25%
Received fixed	(8)	-
Paid floating	L	-
	7%	7.25%

Conclusion: The bank should achieve fixed rate funding by issuing hybrid instrument as the interest cost is lower.



QUESTION 66:

N 24 | N 10 | M 18 | N 17 | RTP

Typical Question

fixed v/s floating.

Derivative Bank entered into a plain vanilla swap through on OIS (Overnight Index Swap) on a principal of ₹10 crores and agreed to receive MIBOR overnight floating rate for a fixed payment on the principal. The swap was entered into on Monday, 2nd August, 2010 and was to commence on 3rd 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%

If Derivative Bank received ₹317 net on settlement, calculate Fixed rate and interest under both legs.

Notes: Sunday is Holiday.

Work in rounded rupees and avoid decimal working.

Consider 365 days in a year.

Solution:

Day	Int. Rate	Interest	Closing
Monday	-	-	10,00,00,000
Tuesday	7.15%	21,233	10,00,21,233
Wednesday	8.15%	22,334	10,00,43,567
Thursday	8.12%	22,256	10,00,65,823
Friday	7.95%	21,795	10,00,87,618
Sat + Sun (2 days)	7.98%	43,764	10,01,31,382

Derivatives & Interest Rate Risk Management

Monday	8.15%	22,358	10,01,53,740
		1,53,740	

Interest under floating leg (₹): 1,53,740

- Net settlement (317)

Interest under fixed leg (₹): 1,53,423

$$\begin{aligned} \text{Interest under fixed leg (\%):} &= \frac{153423}{10,00,00,000} \times \frac{365}{7} \times 100 \\ &= 7.9999 \sim 8\% \end{aligned}$$



QUESTION 67:

RTP N 10

TMC Corporation entered into €3.5 million notional principal interest rate swap agreement. As per the agreement TMC is to pay a fixed rate and to receive a floating rate of LIBOR.

The Payment will be made at the interval of 90 days for one year and it will be based on the adjustment factor 90/360. The term structure of LIBOR on the date of agreement is as follows:

Days	Rate (%)
90	7.00
180	7.25
270	7.45
360	7.55

You are required to calculate Fixed Rate on the swap and first net payment on the Swap.

Solution:

Calculation of PVF

Days	Rate (%)	Periodic rates	PVFs
90	7.00	$\frac{7.0 \times 90}{360} = 1.75\%$	$\frac{1}{1.0175} = 0.9828$
180	7.25	$\frac{7.25 \times 180}{360} = 3.50\%$	$\frac{1}{1.0350} = 0.9662$
270	7.45	$\frac{7.45 \times 270}{360} = 5.59\%$	$\frac{1}{1.0559} = 0.9471$
360	7.55	$\frac{7.55 \times 360}{360} = 7.55\%$	$\frac{1}{1.0755} = 0.9298$
		Total	3.8258

$$\begin{aligned} \text{Swap Fixed Rate} &= \frac{1 - PVF_n}{\sum PVFs} \times \frac{360}{n} \times 100 \\ &= \frac{1 - 0.9298}{3.8258} \times \frac{360}{90} \times 100 = 7.34\% \end{aligned}$$



QUESTION 68:

M 11 | RTP

Although examiner did not specify that the actual borrowings were opposite to desire, but it is understood because swap is entered only when borrowing opposite to desires made

A Inc. and B Inc. intend to borrow \$200,000 and ¥200,000 in ¥ respectively for a time horizon of one year. The prevalent interest rates are as follows:

Company	¥ Loan	\$ Loan
A Inc	5% A	9% D.
B Inc	8% D	10% A

→ 17%
→ 15%

The prevalent exchange rate is \$1 = ¥120.

They entered in a currency swap under which it is agreed that B Inc will pay A Inc @ 1% over the ¥ 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, quantify the opportunity gain or loss component of the ultimate outcome, resulting from the designed currency swap.

Solution:

Net Interest cost

	A	B
Int on Borrowing	5%	10%
Int Paid under swap	9%	6%
Int Received under swap	(6%)	(9%)
Effective Int cost	8%	7%

Gain/Loss due to swap	A	B
Cost under desired position	9%	8%
(-) Net Interest cost	(8%)	(7%)
	1%	1%

Currency	\$	Yen
Loan Amount	\$ 2,00,000	¥ 2,40,00,000 (2,00,000 × 120)
Gain	\$ 2,000 (\$ 2,00,000 × 1%)	¥ 2,40,000 (¥ 2,40,00,000 × 1%)



QUESTION 69:

RTP M 18

TMC Holding Ltd. has a portfolio of shares of diversified companies valued at ₹400 crore enters into a swap arrangement with None Bank on the terms that it will get 1.15% quarterly on notional principal of ₹400 crore in exchange of return on portfolio which is exactly tracking the Sensex which is presently 21600.

Calculate the net payment to be received/ paid at the end of each quarter if Sensex turns out to be 21,860, 21,780, 22,080 and 21,960.

Solution:

Calculation of Sensex returns:

Quarters		
1	$\frac{21,860 - 21,600}{21,600}$	1.204%
2	$\frac{21,780 - 21,860}{21,860}$	-0.365%
3	$\frac{22,080 - 21,780}{21,780}$	1.377%
4	$\frac{21,960 - 22,080}{22,080}$	- 0.543%

Net amount to be (paid)/received (in crores):

Quarters	Payment of Sensex	Received of Int	Net Amount
1	(4.816) $400 \times 1.204\%$	4.60 $(400 \times 1.15\%)$	(0.216)
2	1.46 $[400 \times (-0.365\%)]$	4.60 $(400 \times 1.15\%)$	6.06
3	(5.508)	4.60	(0.908)
4	2.172	4.60	6.772

Foreign Exchange & International Financial Management



A. Basics of Forex



QUESTION 1:

Based on the following quotations, answer the given questions.

$\$/\text{₹} = 0.02295/0.02350$ $\$/\text{€} = 1.510/1.515$ $\text{¥}/\text{£} = 135/139$

HC: \$ FC Pay. An American importer has payable € 40000. How much is the liability in \$? FC transact?	Forex mkt. Buy € 40k. pay \$	40.000×1.515 $= \\$ 60.600$
HC: £ FC Rec A UK exporter has to receive ¥ 500,000. Amount receivable in his home currency is?	Sell ¥ 5k. Rec £	$500.000 \div 139$ $£ 3597$
HC: ₹ FC: Pay. An Indian investor wants to invest \$7000 in US. How much ₹ does he need to pay?	Buy \$ 7000 Pay ₹	$7000 \div 0.02295$ $= ₹ 305011$
HC: € Rec FC A European company is borrowing \$100,000 from US. How much Euro will he get?	Sell \$ 1k Rec €	$1.00.000 \div 1.515$ $€ 66,007$
HC: ¥ A Japanese person had taken a loan of £ 5000. How much will be the amount in Yen at the time of repayment (rate 10%)?	Buy £ 5k Pay ¥	5500×139 $= ¥ 764.500$



QUESTION 2:

From the following quotes, calculate cross rate:

Rates	Implied Cross Rate
$\text{₹}/\$ 65$ $\$/\text{€} 1.2$	$\text{₹}/\text{€} = 65 \times 1.2 =$
$\$/\text{£} 1.5$ $\$/\text{¥} 0.0095$	$\text{¥}/\text{£} = \frac{1.5}{0.0095} =$
$\text{₹}/\$ 60.45/60.55$ $\$/\text{£} 1.45/1.55$	$\text{₹}/\text{£} = \frac{60.45 \times 1.45}{60.55 \times 1.55} =$

$$\text{₹}/\text{¥} = \frac{1}{\frac{60.45 \times 1.45}{60.55 \times 1.55}} = \frac{1}{\frac{87.6525}{93.8525}} = \frac{93.8525}{87.6525}$$

$$\text{€}/\text{₹} = \frac{0.0135}{1.64} - \frac{0.0138}{1.58}$$

€/₹ 0.0135/0.0138 ₹/₹ 1.58/1.64	$\text{₹}/\text{€} = \frac{1.58}{0.0138} - \frac{1.64}{0.0135}$
€/₹ 0.0135/45 \$/₹ 0.014/5	$\text{\$/€} = \frac{0.014}{0.0145} - \frac{0.015}{0.0135}$
₹/€ 80.55/85 ₹/\$ 60.05/10	$\text{\$/€} = \frac{80.55}{60.10} - \frac{80.85}{60.05}$

$$\text{€}/\text{\$} = 0.7427 - 0.7461$$

B. Cross Rates



QUESTION 3:

N 14 | N 20 | M 14 | M 13 | RTP

Edelweiss Bank Ltd. sold Hong Kong dollar 2 crores value spot to its customer at ₹ 8.025 and covered itself in the London market on the same day, when the exchange rates were

US\$ 1 = HK\$ 7.5880- 7.5920

Local interbank market rates for US \$ were

Spot US \$ 1 – ₹ 60.70-61.00

Calculate the cover rate and ascertain the profit or loss on the transaction. Ignore brokerage.

Solution:

Calculation of implied ₹ / HKD is the cross currency

$$\text{Ask } \frac{\text{₹}}{\text{HK\$}} = \frac{61.00}{7.5880} = 8.0390$$

$$\text{Bid } \frac{\text{₹}}{\text{HK\$}} = \frac{60.70}{7.5920} = 7.9952$$

$$\text{₹ / HK\$} = 7.9952 - 8.0390$$

∴ the bank had sold Hong Kong Dollars

∴ to cover the position, they will now buy Hong Kong dollars

Accordingly cover rate would be ₹ / HK\$ Ask Rate i.e., ₹ / HK\$ = 8.0390

$$\begin{aligned} \text{Gain/(Loss) on the transaction} &= (8.025 - 8.0390) \times 2 \text{ Cr.} \\ &= - ₹ 2,80,000 \end{aligned}$$



QUESTION 4:

M 09 | RTP N 14 | SM

Your forex dealer had entered into a cross-currency deal and had sold US \$ 10,00,000 against EURO at US \$ 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 US \$ 1 INR 31.4300/4500

1 month margin 25/20

2 months margin 45/35

Spot US \$ 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?

Solution:

Forex Dealer had sold US Dollars, to square off the position he will now buy US Dollars

Sold 1.4400

Buy 1.4450

Foreign Exchange & International Financial Management

Since quantity of 5000 is in terms of euro, therefore calculation of Cross rate of rupee per euro make sense (not euro per rupee)

Loss per \$	(0.005)
	<u>\$ 1,000,000</u>
Total loss	€ (5000)

Since there is a loss of € 5000, we will have to buy this euro from the market to pay it to our broker.

$$\text{Implied ₹/€ Ask Rate} = \frac{\frac{₹/\$}{\text{€}/\$}}{\frac{\text{€}/\$}{1.44}} = \frac{31.45}{1.44} = ₹/€ 21.8403$$

$$\text{Loss in ₹} = € 5000 \times ₹ 21.8403 = ₹ 109201.38$$

Since loss calculation in rupee terms is possible, therefore we will assume rupees as our home currency and do that calculation



QUESTION 5:

M 14 | N 11 | M 05 | RTP | SM

On January 28, 2013 an importer customer requested a Bank to remit Singapore Dollar (SGD) 25,00,000 under an irrevocable Letter of Credit (LC). However, due to some factors, the Bank could affect the remittances only on February 4, 2013. The interbank market rates were as follows:

	January 28, 2013	February 4, 2013
US\$ 1	₹ 45.85/45.90	₹ 45.91/45.97
GBP£ 1	US\$ 1.7840/1.7850	US\$ 1.7765/1.7775
GBP£ 1	SGD 3.1575/3.1590	SGD 3.1380/3.1390

The Bank wishes to retain an exchange margin of 0.125%

Required: How much does the customer stand to gain or lose due to the delay?

Solution:

To buy SGD 25,00,000 against ₹, we need to calculate implied ₹ / SGD Ask using cross currency

	January 28, 2013	Feb 4, 2013
₹/SGD Interbank Rate	$\frac{45.90 \times 1.7850}{3.1575}$ 25.9482	$\frac{45.97 \times 1.7775}{3.1380}$ 26.0394
+ Margin @ 0.125%	0.0324	0.0325
₹/SGD Merchant Rate	25.9806	26.0719

$$\begin{aligned} \text{Loss due to delay} &= (₹ 26.0719 - ₹ 25.9806) \times 25,00,000 \\ &= 2,28,250 \end{aligned}$$



QUESTION 6:

N 13 | RTP | SM

You, a foreign exchange dealer of your bank, are informed that your bank has sold a T.T. on Copenhagen for Danish Kroner 10,00,000 at the rate of Danish Kroner 1 = ₹ 6.5150. You are required to cover the transaction either in London or New York market. The rates on that date are as under:

Mumbai-London	₹ 74.3000	₹ 74.3200
Mumbai-New York	₹ 49.2500	₹ 49.2625

London-Copenhagen	DKK 11.4200	DKK 11.4350
New York-Copenhagen	DKK 07.5670	DKK 07.5840

In which market will you cover the transaction, London or New York, and what will be the exchange profit or loss on the transaction? Ignore brokerages.

Solution:

Bank has sold a T.T therefore to cover the transaction we will have to buy DKK 10,00,000 @ ₹/DKK.

$$\begin{aligned} \text{Using cross currency, } ₹/\text{DKK} &= \frac{₹/\text{£}}{\text{DKK}/\text{£}} \\ \text{In London Market: } ₹/\text{DKK} &= \frac{74.32}{11.42} = 6.5079 \\ \text{New York Market: } ₹/\text{DKK} &= \frac{49.2625}{7.5670} = 6.5102 \end{aligned}$$

Calculation of gain loss if you cover in:

London Market:

Sold at	6.5150
Buy at	(6.5079)
	₹ 0.0071
	<u>×10,00,000</u>
Profit	₹ 7100

New York Market:

Sold	6.5150
Buy	(6.5102)
	₹ 0.0048
	<u>×10,00,000</u>
Profit	₹ 4800

Conclusion: will cover the transaction in London market since there is more profit and the rate is less for buying



QUESTION 7:

N 20 | RTP M 17 | N 08 | RTP

USD 10,000 is lying idle in your Bank Account. You are able to get the following quotes from the dealers:

Dealer	Quote
A	EUR/USD 1.1539
B	EUR/GBP 0.9094
C	GBP/USD 1.2752

Is there an opportunity of gain from these quotes?

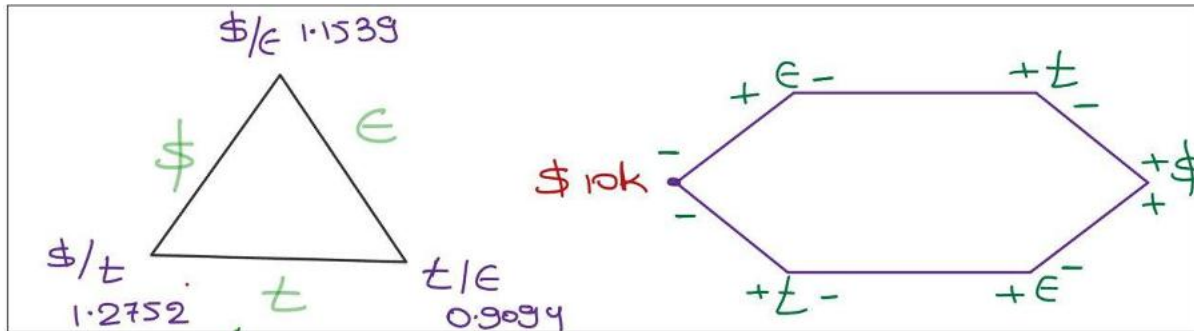
Solution:

A	\$ / €	1.1539
B	GBP/€	0.9094

Foreign Exchange & International Financial Management

C \$/GBP 1.2752

Self-note: Create the triangular arbitrage diagram for easy solving.



Calculating fair \$/€

$$\frac{\$}{\text{GBP}} \times \frac{\text{GBP}}{\text{€}}$$

$$0.9094 \times 1.2752 = 1.1597$$

∴ Actual \$/€ (1.1539) < implied \$/€

We will buy € and pay Dollars

Process of Arbitrage

- (1) Sell \$ 10000 @ \$/€ 1.1539 and receive €:

$$= \frac{10000}{1.1539} = \text{€ } 8666.26$$
 - (2) Sell € 8666.26 @ £/€ 0.9094 and receive £

$$= 8666.26 \times 0.9094 = \text{£ } 7881.10$$
 - (3) Sell £ 7881.10 @ \$/£ 1.2752 and receive \$

$$= 7881.10 \times 1.2752 = \$ 10050$$
- Arbitrage profit = \$ 10050 - \$ 10000
 = \$ 50



QUESTION 8:

RTP N 14

only on calci

Followings 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

100.73 / 102.08.

The arbitrageur has USD 1,00,00,000. Assuming that bank wishes to retain an exchange margin of 0.125%, explain whether there is any arbitrage gain possible from the quoted spot exchange rates.

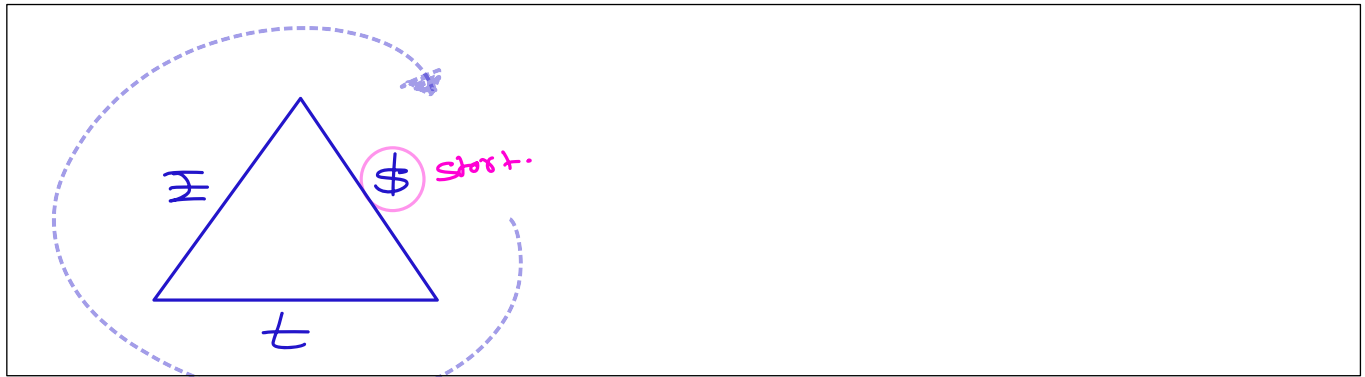
Solution:

Point of learning:

Self-note: Create the triangular arbitrage diagram for easy solving. In case of two-way quotes arbitrage is possible only when both actual bid and ask rates are higher or lower than the fair rates

Actual Fair possible
 → ₹/\$ 50 - 52 53 - 55

₹/\$ 50 - 54 53 - 55 Not possible



Calculation of fair ₹/\$ = $\frac{₹/£}{\$/£}$

$\frac{102.5}{1.72}$	-	$\frac{103}{1.70}$
= ₹ 59.59	-	₹ 60.59

∴ ₹/\$ Actual (59.25 – 59.35) < Fair ₹/\$ (59.59 – 60.59)

∴ we will buy \$ pay ₹

Arbitrage:

- (1) Sell \$ 1,00,00,000 and receive £:

\$/£:	1.72
+ margin @ 0.125%	<u>0.0022</u>
	£1.7222

£ to be received: 58,06,526.54
- (2) Sell £ 58,06,526.54 and receive ₹

₹/£	102.50
(-) Margin 0.125%	<u>0.1281</u>
	₹ 102.3719

₹ to be received: 59,44,25,154.30
- (3) Sell ₹ 59,44,25,154.30 and receive \$:

₹/\$	59.35
+ margin @ 0.125%	<u>+ 0.0742</u>
	\$ 59.4242

\$ to be received: 1,00,03,082.15
- (4) Arbitrage Gain: 1,00,03,082.15 – 1,00,00,000 = 3,082.15

C. Forward Contract



QUESTION 9:

Spot Rate	₹/€ 75.455/750
Swap Points	Forwards Rates
30/40	75.485 - 75.790
130/125	75.325 - 75.625
1010/1005	74.445 - 74.745
1.20/1.35	76.655 - 77.100

0.310.2 Elisa

75.455 08 75.750
75.485 - 75.790
75.325 - 75.625
74.445 - 74.745
76.655 - 77.100
75.852 - 75.718



QUESTION 10:

M 18 | RTP | SM

Pg 186 of outnotes

An importer 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/₹	821 US\$	USD/SGD	56 \$/05 \$
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

Solution:

Inter-bank ₹/US\$ ask spot rate	49.38
Oct swap points	0.13
Inter-bank ₹/\$ forward rate	49.51

Now,

Inter-bank SG\$/US\$ spot Bid Rate	1.7058
2m swap points	0.0096
Inter-bank SG\$/US\$ forward	1.7154

Using cross currency:

₹/SG\$ Interbank ask Forward Rate $\left[\frac{49.51}{1.7154} \right]$	28.8621
---	---------

Add: Margin	0.0500
₹/SG\$ Merchant Ask Forward Rate	28.9121

∴ this is given.
∴ we will assume given rates to be interbank.

7 → What We ultimately need :
₹/SG\$ 2m forward merchant Ask.



QUESTION 11:

N 22 | M 09 | RTP | SM

The following 2-way quotes appear in the foreign exchange market:

	Spot	2-months spread
US \$	₹ 46.00/₹ 46.25	₹ 1.00/₹ 1.25

Required:

- Calculate 2 months forward rates
- How many US dollars should a firm sell to get ₹ 25 lakhs after 2 months?
- How many Rupees is the firm required to pay to obtain US \$ 2,00,000 in the spot market?
- Assume the firm has US \$ 69,000 in current account earning no interest. ROI on Rupee investment is 10% p.a. Should the firm encash the US \$ now or 2 months later?

Solution:

- Bid: $46.00 + 1.00 = 47.00$
 Ask: $46.25 + 1.25 = 47.75$

b. $\frac{25,00,000}{47} = \$ 53191.49$

c. $US\$ 200,000 \times ₹ 46.25 = ₹ 9,250,000$

d.	Spot	2m Fwd
	\$ 69,000 × ₹ 46	\$ 69,000 × ₹ 47
	₹ 31,74,000	₹ 32,43,000
Add: Int @ 10% for 2m	<u>52900</u>	<u>0</u>
	<u>32,26,900</u>	<u>₹ 32,43,000</u>

The firm should encash the US\$ 2 months later as the amount that we will receive 2 months later will be more.



QUESTION 12:

N 16 | RTP | SM

(easy, typical commonsense based q.)

On April 3, 2016, a Bank quotes the following:

Spot exchange Rate US \$1	₹ 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. Assume 1 swap point = 0.0001.

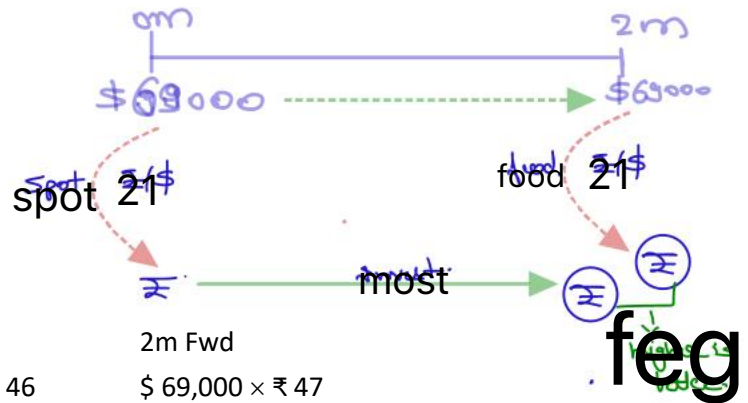
You are required to:

- 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 US\$ on INR, on an average rate.

Solution:

- Calculation of swap points for 2 Months and 15 days

It's not Bid Ask Spread!
It is food margin



Ambiguity:
X Not Bid Ask avg.
✓ spot fwd avg.

Foreign Exchange & International Financial Management

2 m	70	90
2.5 m	? = 115	? = 138
3 m	160	186

Bid:

Ask:

$$\frac{2.5-2}{3-2} = \frac{x-70}{160-70}$$

$$\frac{2.5-2}{3-2} = \frac{x-90}{186-90}$$

$$x = 115$$

$$x = 138$$

Swap point are: 115 – 138

- b. Spot exchange rate on 5/4/2016 ₹ 66.2525 ₹ 67.5945
 Swap point of 2.5 months 115 138
 Forward exchange rate on 20th June 2016 66.264 67.6083
- c. Calculation of forward premium / discount on base currency

$$= \frac{F-S}{S} \times \frac{12}{n} \times 100$$

Premium: Bid: $\frac{66.264 - 66.2525}{66.2583} \times \frac{12}{2.5} \times 100 = 0.0833\%$
 Ask: $\frac{67.6083 - 67.5945}{67.6014} \times \frac{12}{2.5} \times 100 = 0.0980\%$



QUESTION 13:

MTP M 23 | M 09

You have following quotes from Bank X and Bank Y:

		Bank X	Bank Y
SPOT	CHF/\$	USD/CHF 1.0750/55	USD/CHF 1.0753/60
3 months		5/10	
6 months		8/16	
SPOT	\$/£	GBP/USD 1.1945/60	GBP/USD 1.1940/50
3 months		25/20	
6 months		37/26	

Calculate:

- N.B.** a. How much minimum CHF amount you have to pay for 1 Million GBP spot? *Buying.*
 b. Considering the quotes from Bank X only, for GBP/CHF what are the Implied Swap points for both Bid and Offer Spot rates over 5 months? *CHF/£.*

Solution:

- a) Converting Swift codes to symbolic rates:

	Bank X	Bank Y
CHF/\$	1.0750/55	1.0753/60
\$/£	1.1945/60	1.1940/50

To calculate CHF/£, we will do cross currency by multiplying CHF/\$ and \$/£

Since, quotation of CHF/\$ is cheaper from bank A and quotation of \$/£ is cheaper from bank B, we will use them. Therefore:

$$\text{CHF/£} = 1.1950 \times 1.0755 = 1.2852$$

$$\begin{aligned} \text{CHF amount to be paid for 1m GBP Spot} &= 1,000,000 \times 1.2852 \\ &= \text{CHF } 1,285,200 \end{aligned}$$

b) Calculation of Implied swap points for Bank X

Please note that we can never do cross currency calculation for swap points. We can only do it for forward rate.

	Bid	Ask
<u>Spot CHF/£:</u>	$= 1.0750 \times 1.1945$ $= 1.2841$	$= 1.0755 \times 1.1960$ $= 1.2863$
<u>5 m forward CHF/£:</u>		
• Calculating 5m swap points CHF/\$ using interpolation:		
	$= 5 + [(8-5) \times 2/3]$ $= 7$	$= 10 + [(16-10) \times 2/3]$ $= 14$
5m CHF/\$ forward rate:		
CHF/\$	1.0750 <u>+ 0.0007</u> 1.0757	1.0755 <u>+ 0.0014</u> 1.0769
• Calculating 5m swap points \$/£ using interpolation:		
	$25 + [(37-25) \times 2/3]$ $= 33$	$= 20 + [(26-20) \times 2/3]$ $= 24$
5m \$/£ forward rate:		
\$/£	1.1945 <u>- 0.0033</u> 1.1912	1.1960 <u>- 0.0024</u> 1.1936
• 5m CHF/£ forward rate using cross currency		
	$= 1.1912 \times 1.0757$ $= 1.2814$	$= 1.1936 \times 1.0769$ $= 1.2854$
• CHF/£ 5m Implied Swap points:		
	Bid	Ask
CHF/£ 5m fwd	1.2814	1.2854
CHF/£ spot	<u>1.2841</u>	<u>1.2863</u>
Discount:	<u>0.0027</u>	<u>0.0009</u>

Therefore 5-month swap points are at discount of 27/9.



QUESTION 14:

RTP N 20

eaten

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.

- 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?
- 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.

Solution:

Spot: \$/£ 1.35

3m Fwd: \$/£ 1.30

★ Expected spot: \$/£ 1.32 *also food convergence is here!*

- The course of action will be to buy in the forward market. Expected Profit/(Loss) will be:

Expected Forward after 3m:	Sell	\$1.32
3m Forward today:	Buy	(\$1.30)
	Profit	\$0.02
		<u>1,000,000</u>
	Profit	<u>\$ 20,000</u>

b.	Actual Forward after 3m	Sell	\$1.26
	3m Forward today:	Buy	(\$1.30)
		Loss	(\$0.04)
			<u>£1,000,000</u>
		Loss	<u>(\$ 40,000)</u>

Self-note: In case of speculation, (only question in forex), think of net settlement of forward contract.



QUESTION 15:

M 03 | RTP | SM

In March, 2009, the Multinational Industries make the following assessment of dollar rates per British pound to prevail as on 1.9.2009:

\$/Pound	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 1.9.2009? If, as of March, 2009, the 6-month forward rate is \$ 1.80, should the firm sell forward its pound receivables due in September, 2009.

Solution:

Calculation of expected spot Rate

\$/£	Prob	
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
		\$/£ 1.81

Expected spot rate for 1/9/2009 is \$1.81

6M forward is \$1.80

No, the firm should not sell forward its pound receivables as if the firm sells forwards in forward market it will get \$1.80 for each pound sold. Whereas if the firm sells in the expected spot, it will get \$1.81 for each pound



QUESTION 16:

N 18 | N 04 | RTP | SM

Digital Exporters are holding an Export bill in United States Dollar (USD) 5,00,000 due after 60 days. They are worried about the falling USD value, which is currently at ₹ 75.60 per USD. The concerned Export Consignment has been priced on an Exchange rate of ₹ 75.50 per USD. The Firm's Bankers have quoted a 60-day forward rate of ₹ 75.20. Calculate:

- Rate of discount quoted by the Bank, assuming 365 days in a year.
- The probable loss of operating profit if the forward sale is agreed to.

Solution:

$$S_0 = ₹ 75.60$$

$$F = ₹ 75.20$$

- Rate of discount on USD

$$= \frac{F - S}{S} \times 100 \times \frac{365}{60}$$

$$= \frac{75.20 - 75.60}{75.60} \times 100 \times \frac{365}{60}$$

$$= - 3.22\% \text{ p.a. i.e., discount}$$
- Probable loss of operating profit = $(75.20 - 75.50) \times 5,00,000$

$$= ₹ - 1,50,000$$



QUESTION 17:

N 21 | N 16 | M 08 | RTP | SM

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 US\$ 60,000 on December 31, 2016. The present exchange rate is 1 US \$ = ₹ 65. It can purchase forward 1 \$ at ₹ 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.

Foreign Exchange & International Financial Management

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:

- ₹ 68 per US \$.
- ₹ 62 per US \$.
- ₹ 70 per US \$.
- ₹ 65 per US \$.

Solution:

Outflow	[\$ 60,000 × ₹ 64]	3,840,000
Premium	[₹ 3,840,000 × 2%]	76,800
Opportunity cost on interest:	$\left(76800 \times 12\% \times \frac{6}{12} \right)$	<u>4608</u>
Total outflow based on forward rate	[A]	<u>₹ 3,921,408</u>

Total outflow based on spot rate of 31st Dec:

i)	₹ 68/\$		
	Outflow for \$ 60,000 based on spot after 6m	[B]	₹ 4,080,000
	Gain	[B – A]	₹ 1,58,592
ii)	₹ 62/US\$		
	Outflow for \$ 60,000 based on spot after 6m	[C]	₹ 3,720,000
	Loss	[C – A]	₹ (201408)
iii)	70/\$		
	Outflow for \$ 60,000 based on spot after 6m	[D]	₹ 4,200,000
	Gain	[D – A]	₹ 2,78,592
iv)	₹ 65/\$		
	Outflow for \$ 60,000 based on spot after 6m	[E]	₹ 3,900,000
	Loss	[E – A]	₹ 21,408

Self-note: It is due to the premium on forward given in this question, we will calculate the gain or loss on totality basis rather than per unit basis.



QUESTION 18:

N 20

ZX Ltd. has made purchases worth USD 80,000 on 1st May 2020 for which it has to make a payment on 1st November 2020. The present exchange rate is INR/USD 75. The company can purchase forward dollars at INR/USD 74. The company will have to make an upfront premium @ 1 per cent of the forward amount purchased. The cost of funds to ZX Ltd. is 10 per cent per annum. *1st May.*

The company can hedge its position with the following expected rate of USD in foreign exchange market on 1st May 2020 :

Exchange Rate	Probability
INR/USD 77	0.15
INR/USD 71	0.25
INR/USD 79	0.2
INR/USD 74	0.4

You are required to advise the company for a suitable cover for risk.

Solution:

Outflow if forward cover is taken

Buy \$ 80,000 @ \$ 74	₹ 5,920,000	
Add: Premium @ 1%	₹ 59,200	
Add: Interest @ 10%	<u>2960</u>	$\left(\frac{59,200 \times 10\% \times 6}{12} \right)$
Total outflow in ₹ on 1 st Nov, 2020	5982160	

Outflow if forward cover not taken

$$\text{Calculation of expected spot} = 77 \times 0.15 + 71 \times 0.25 + 79 \times 0.20 + 74 \times 0.40$$

$$= 74.70$$

Buy \$ 80,000 @ ₹ 74.70 ₹ 5,976,000

Advise: ∴ Outflow is lower in case of no hedging

∴ is not advised to take forward cover



QUESTION 19:

J 21

only on calc
To be done after IRPT.

XYZ has taken a six-month loan from its foreign collaborator for USD 2 millions. Interest is payable on maturity @ LIBOR plus 1%. The following information is available:

You are required to:

Spot Rate	INR/USD 68.5275
6 months Forward rate	INR/USD 68.4575
6 months LIBOR for USD	2%
6 months LIBOR for INR	6%

- Calculate Rupee requirements if forward cover is taken.
- Advise the company on the forward cover.
- What will be your opinion if spot rate of INR/USD is 68.4275?

Solution:

(i) Repayment of loan in USD: $= 2 \text{ million} \times \left[1 + \left(0.03 \times \frac{6}{12} \right) \right]$

$$= \$ 2.03 \text{ million}$$

Outflow in ₹ at forward rate $= 2.03 \times 68.4515$

$$= ₹ 138.97 \text{ million}$$

- (ii) Calculation of fair forward cover fair 6M forward rate ₹/\$

$$= ₹ 68.5275 \times \left(\frac{1 + 0.06 \times 6/12}{1 + 0.02 \times 6/12} \right)$$

$$= ₹ 69.8845$$

$$\text{Outflow in ₹ at fair forward rate} = 2.03 \times 69.8845$$

$$= ₹ 141.87 \text{ million}$$

∴ Actual 6M forward ₹/\$ rate is undervalued

∴ outflow based on actual rate (₹ 138.97) < outflow based on fair rate (₹ 141.87M)

∴ forward cover is advisable

(iii) Spot Rate change to ₹ 68.4275

Calculation of Fair 6M forward cover rate ₹/\$

$$= ₹ 68.4275 \times \left(\frac{1 + 0.06 \times 6/12}{1 + 0.02 \times 6/12} \right)$$

$$= ₹ 69.7825$$

$$\text{Outflow in ₹ at fair forward rate} = 2.03 \times 69.7825$$

$$= ₹ 141.66 \text{ million}$$

∴ Actual forward ₹/\$ Rate is undervalued

∴ outflow based on actual rate (₹ 138.97 mn) < outflow on fair rate (₹ 141.66 mn)

∴ forward cover is advisable



QUESTION 20:

M 14 | RTP | SM

JKL Ltd., an Indian company has an export exposure of JPY 10,000,000 receivable August 31, 2014. Japanese Yen (JPY) is not directly quoted against Indian Rupee.

The current spot rates are:

INR/US \$	=	₹ 62.22
JPY/US\$	=	JPY 102.34

$$₹/¥ : 0.6080$$

It is estimated that Japanese Yen will depreciate to 124 level and Indian Rupee to depreciate against US \$ to ₹

65. Forward rates for August 2014 are

INR/US \$	=	₹ 66.50
JPY/US\$	=	JPY 110.35

$$E(S_T) = 0.5242$$

$$₹/¥ : 0.6026$$

Required:

- Calculate the expected loss, if the hedging is not done.
- How the position will change, if the firm takes forward cover?
- If the spot rates on August 31, 2014 are:

INR/US \$	=	₹ 66.25
JPY/US\$	=	JPY 110.85

$$S_T, ₹/¥ 0.5977$$

Is the decision to take forward cover justified?

Solution:

Calculating ₹/¥ using cross currency

- Current spot $= \frac{62.22}{102.34} = ₹/¥ 0.6080$
- Expected spot rate of 31st Aug $= \frac{65}{124} = ₹/¥ 0.5242$
- Forward rate $= \frac{66.50}{110.35} = ₹/¥ 0.6026$

- Actual Spot rate on 31st Aug $= \frac{66.25}{110.85} = ₹/¥ 0.5977$

i) Expected Loss if hedging not done (current spot v/s expected spot rate)

$$= (0.5242 - 0.6080) \times ₹ 10,000,000$$

$$= (₹ 8,38,000)$$

ii) Loss if forward cover is taken (Current spot V/s forward)

$$= (0.6026 - 0.6080) \times ₹ 10,000,000$$

$$= (₹ 54,000)$$

Conclusion: With the help of forward cover the amount of loss will reduce from (₹ 8,38,000) to (₹ 54,000)

iii) Loss based on actual spot of Aug 31 (Current spot vs actual spot of 31st Aug)

$$= (0.5977 - 0.6080) \times ₹ 10,000,000$$

$$= (₹ 1,03,000)$$

∴ Loss under forward cover is less than Loss based on actual Spot of 31st Aug

∴ Forward cover is still justified.



QUESTION 21:

N 21 | N 03 | RTP M 11 | SM

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 ₹ 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.

Solution:

Current Spot (¥/₹)	¥ 108 = ₹ 30	
	$1 ₹ = \frac{¥108}{30} = ¥/₹ 3.6$	
Expected spot	$= 3.6 - 10\% = ¥/₹ 3.24$	
Rupee outflow based on today's spot	$= \frac{10,800,000}{3.6}$	₹ 30,00,000.00
Rupee outflow based on expected spot	$= \frac{10,800,000}{3.24}$	<u>3,33,333.33</u>
Expected loss		<u>₹ (3,33,333.33)</u>
Expected outflow based on today's spot		₹ 30,00,000.00
Outflow based on forward Rate	$= \frac{10,800,000}{3.3}$	<u>32,72,727.27</u>
Loss due to forward		<u>₹ (2,72,727.27)</u>

With the help of forward cover, the amount of loss has been reduced by 3,33,333.33 to 2,72,727.27



QUESTION 22:

M 21 MTP

(new preferred.)
only on calc

HC ₹

Buy FC

FC outflow.

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 Non-Deliverable Forward (NDF) Market for hedging the same risk. *Andia.*

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

Analyse 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 ₹ / SKW Rate and final payment (to be computed in ₹ Lakh) to be rounded off upto 4 decimal points.

Solution:

- Do Nothing

We shall compute the cross rates in Spot Market on both days and shall compare the amount payable in INR on these two days.

On 1st February 2020

Rupee - Dollar ask rate	= ₹ 75.50
Dollar - SKW bid rate	= SKW 1190.00
Using cross currency,	
Rupee - SKW ask rate	= ₹ 75.50 / 1190.00
	= ₹ 0.0634/SKW
Amount payable to Importer	= 1190m × ₹ 0.0634 = ₹ 754.4600Lakh

On 1st March 2020

Rupee - Dollar ask rate	= ₹ 75.75
Dollar - SKW bid rate	= SKW 1188.00
Using cross currency,	
Rupee - SKW ask rate	= ₹ 75.75 / 1188.00
	= ₹ 0.0638/SKW
Amount payable to Importer	= 1190m × ₹ 0.0638 = ₹ 759.2200 Lakh

Thus, Exchange Rate Loss = (₹ 759.2200 Lakh – ₹ 754.4600 Lakh) ₹ 4.7600 Lakh

(ii) Hedging in NDF

Since company needs SKW after one month it will take long position in SKW at quoted rate of SKW 1190/USD and after one-month it will reverse its position at fixing rate of SKW 1187/USD. The profit/ loss position will be as follows:

Buy SKW 1190m and pay USD (1190m/ 1190)	(USD 1,000,000)
Sell SKW 1190m and receive USD at Fixing Rate (1190m/ 1185)	USD 1,004,219
Profit	USD 4,219

Final Position

Amount Payable in Spot Market (as computed earlier)	₹ 759.2200 Lakh
Less: Profit form NDF Market USD 4219 × 75.50	₹ 3.1853 Lakh
	₹ 756.0347 Lakh

Thus, Exchange Rate Loss = (₹ 756.0347 Lakh – ₹ 754.4600 Lakh) ₹ 1.5747 Lakh

Decision: Since Exchange Loss is less in case of NDF same can be opted for.



QUESTION 23:

J 21

Typical Question only on calci
 Questigagow

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 (FEFC). The rates for ₹ /USD and USD/EUR in inter-bank market are quoted as follows:

	₹ / 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.

Solution:

(i)	₹/\$	\$/€
Spot bid rate	67.8000	1.0775
Add: Swap point (2m)	0.21	0.004
2M forward Bid 1/B Rate	68.01	1.0815
Calculating implied ₹ /€ Bid rate using cross currency		
₹ /€	68.01 × 1.0815	73.5528
Margin @ 0.1%	(0.0736)	
	₹ 73.4792	

Foreign Exchange & International Financial Management

ii) Cash inflow to the company=

$$= 5,00,000 \times 50\% \times 73.4792$$

$$= ₹ 18,369,800$$

iii) Interest amount to be paid to bank =

$$\text{Number of days for interest} = 60 + 20 \text{ days}$$

$$\text{Interest} = ₹ 18,369,800 \times 8\% \times \frac{80}{365} = ₹ 3,22,100.60$$



QUESTION 24:

N 19 | N 07 | RTP | SM

Following information relates to AKC Ltd. which manufactures some parts of an electronics device which are exported to USA, Japan and Europe on 90 days credit terms.

Cost and Sales information:

	Japan	USA	Europe
Variable cost per unit	₹ 225	₹ 395	₹ 510
Export sale price per unit	Yen 650	US\$10.23	Euro 11.99
Receipts from sale due in 90 Days	Yen 78,00,000	US\$1,02,300	Euro 95,920

Foreign exchange rate information:

	Yen/₹	US\$/₹	Euro/₹
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

Advice AKC Ltd. by calculating average contribution to sales ratio whether it should hedge its foreign currency risk or not.

Solution:

Calculation of Average contribution to sales Ratio

When Hedged:

	Japan	USA	Europe
No. of units	12,000	10,000	8000
Sales	(7,800,000/650) ₹ 3,213,844.25	(1,02,300/10.23) ₹ 4,736,111.11	(95,920/11.99) ₹ 5,388,764.04
VC	(2,700,000)	(3,950,000)	(4,080,000)
Contribution	5,13,844.25	7,86,111.11	1,308,764.04

$$\text{Total Contribution} = 26,08,719.4$$

$$\text{Total Sales} = 1,33,38,719.4$$

$$\text{Average contribution to sales ratio} = \frac{26,08,719.4}{1,33,38,719.4} \times 100 = 19.56\%$$

When not hedged:

	Japan	USA	Europe
No. of units	12,000	10,000	8,000
Sales	31,72,021.15	47,44,897.96	53,58,659.22
VC	-27,00,000	-39,50,000	-40,80,000
Contribution	4,72,021.15	7,94,897.96	12,78,659.22

Total Contribution = 25,45,578.33

Total Sales = 1,32,75,578.33

Average contribution to sales ratio = $\frac{25,45,578.33}{1,32,75,578.33} \times 100 = 19.17\%$

Conclusion: The AKC Ltd should hedge the foreign currency risk as average contribution to sales ratio is higher in that case

D. Exchange Rate Theories



QUESTION 25:

N 19 | N 12 N 17 | M 04 | SM

6% p.a. compounded quarterly.

The US dollar is selling in India at ₹ 72.50. If the interest rate for a 3 months borrowing in India is 6% per annum and the corresponding rate in USA is 2.75%.

- Do you expect that US dollar will be at a premium or at discount in the Indian Forex Market?
- What will be the expected 3-months forward rate for US dollar in India?
- What will be the rate of forward premium or discount?

Solution:

↳ on \$

- Since the rate of interest in US is lower than the rate of interest in India, therefore USD will be at forward premium.

- Calculation of fair forward Rate

$$= ₹ 72.50 \times \left(\frac{1 + 0.06 \times 3/12}{1 + 0.0275 \times 3/12} \right)$$

$$= ₹ 73.0850$$

- Rate of premium = $\frac{F - S}{S} \times 100 \times \frac{12}{3}$
- $$= \frac{73.09 - 72.50}{72.50} \times 100 \times \frac{12}{3}$$
- $$= + 3.26\%$$



QUESTION 26:

PM

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 dollar. 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? (Use interest-rate parity assumption).

Solution:

- To hedge the foreign exchange risk, the shoe company will sell DM 50,000 at 90-day forward at DM/\$ 1.70. At the end of 90 days, forward contract will be settled and DM 50,000 will be sold @ DM/\$ 1.70

$$\text{Inflow from this transaction} = \frac{50,000}{1.7} = \$ 29,411.76$$

- Spot DM/\$ = 1.71
Forward DM/\$ = 1.70

- ∴ forward rate is lower than spot rate of Dollar
- ∴ Dollar is at forward discount
- ∴ DM is at forward premium

$$\begin{aligned}
 \text{(iii) Implied differential in interest rate} &= \frac{S - F}{F} \times 100 \times \frac{365}{90} \\
 &= \frac{1.71 - 1.70}{1.70} \times 100 \times \frac{365}{90} = 2.39\%
 \end{aligned}$$



QUESTION 27:
MTP N 23 | SM

only a formula: $F = S \times \frac{FVF_P}{FVF_L}$, $P/CD = \frac{S - F}{S}$ SEE

The following table shows interest rates for the United States Dollar and French Franc. The spot exchange rate is 7.05 Franc per Dollar. Complete the missing entries:

	3m	6m	1y
Dollar interest rate (annually compounded)	11.50%	12.25%	?
Franc interest rate (annually compounded)	19.50%	?	20%
Forward Franc per Dollar	?	?	7.52
Forward discount per Franc (percent per year)	?	6.30%	?

Solution:

Self-note: Since the interest rate given in the question is annually compounded, logically the questions is supposed to be solved using the Discrete compounding. Institute however has solved it using simple interest based formula.

a. For 3 months:

$$\begin{aligned}
 \text{3m Forward Franc per Dollar} &= 7.05 \times \frac{(1 + 0.195 \times \frac{3}{12})}{(1 + 0.115 \times \frac{3}{12})} \\
 &= 7.19 \text{ Franc/USD}
 \end{aligned}$$

$$\begin{aligned}
 \text{Annualised Forward discount per Franc} &= \frac{7.05 - 7.19}{7.19} \times \frac{12}{3} \times 100 \\
 &= - 7.79\%
 \end{aligned}$$

b. For 6 months:

$$\begin{aligned}
 \text{Annualised Forward discount per Franc} &= \frac{S - F}{F} \times \frac{12}{6} \times 100 \\
 - 6.3\% &= \frac{7.05 - F}{F} \times \frac{12}{6} \times 100
 \end{aligned}$$

$$\text{6m Forward Franc per Dollar} = 7.28 \text{ Franc/USD}$$

$$\text{6m Forward Franc per Dollar} = 7.05 \times \frac{(1 + r \times \frac{6}{12})}{(1 + 0.1225 \times \frac{6}{12})}$$

But since per. rate of interest is given for 6 months, interest rate assumed quarterly & semiannually compounded. Also refer note in previous question.

$$7.28 = 7.05 \times \frac{(1 + r \times \frac{6}{12})}{(1 + 0.1225 \times \frac{6}{12})}$$

$$\text{Frank Interest Rate} = 19.17\%$$

c. For 1 year:

$$1\text{y Forward Franc per Dollar} = 7.05 \times \frac{(1 + 0.2 \times \frac{12}{12})}{(1 + r \times \frac{12}{12})}$$

$$7.52 = 7.05 \times \frac{(1 + 0.2 \times \frac{12}{12})}{(1 + r \times \frac{12}{12})}$$

$$\text{Dollar Interest Rate} = 12.5\%$$



QUESTION 28:

M 16 | SM

(IRPT + hedging)

ABC Ltd. of UK has exported goods worth Can \$ 5,00,000 receivable in 6 months. The exporter wants to hedge the receipt in the forward market. The following information is available:

Spot Exchange Rate	Can \$ 2.5/£	S_0
Interest Rate in UK	12%	
Interest Rate in Canada	15%	

The forward rates truly reflect the interest rates differential. Find out the gain/loss to UK exporter if Can \$ spot rates (i) declines 2%, (ii) gains 4% or (iii) remains unchanged over next 6 months.

Solution:

$$\begin{aligned} \text{Fwd Can\$/£} &= \frac{S(1 + r_p n)}{(1 + r_b n)} \\ &= 2.50 \frac{(1 + 0.15 \times 6/12)}{(1 + 0.12 \times 6/12)} \\ &= \text{CA\$ } 2.5354/\text{£} \end{aligned}$$

$$\begin{aligned} \text{Pound receipt of forward rate} &= \frac{\text{CA\$}500,000}{\text{CA\$}2.5354} \\ &= \text{£ } 197207.54 \\ &\sim \text{£ } 197208 \end{aligned}$$

(i) If CA\$ declines by 2%

Expected spot rate = 2.5 + 2% = CA\$ 2.55/£

$$\text{Inflow based on spot rate after 6M} = \frac{\text{CA\$}5,00,000}{\text{CA\$}2.55} = \text{£ } 1,96,078$$

$$\text{Gain to UK exporter} = 1,97,208 - 1,96,078 = \text{£ } 1,130$$

(ii) Gain by 4%

Expected spot rate = $2.5 - 4\% = \text{CA\$ } 2.4/\text{£}$

Inflow based on spot rate after 6M $= \frac{\text{CA\$ } 5,00,000}{\text{CA\$ } 2.40} = \text{£ } 2,08,333$

Loss to UK exporter $= 1,97,208 - \text{£ } 2,08,333 = - \text{£ } 11,125$

(iii) Remains unchanged

Expected spot rate = $\text{CA\$ } 2.5/\text{£}$

Inflow based on spot rate after 6M $= \frac{\text{CA\$ } 5,00,000}{\text{CA\$ } 2.50} = \text{£ } 2,00,000$

Less to UK exporter $= 1,97,208 - \text{£ } 2,00,000 = - \text{£ } 2,792$



QUESTION 29:

M 18 | M 16 | N 10 | M 06 | MTP N 19 | SM

Given the following information:

Exchange rates: 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.

- Assuming that there is no transaction cost determine does the Interest Rate Parity holds in above quotations.
- If yes, then explain the steps that would be required to make an arbitrage profit if Mercy is authorized to work with CAD 1,000 for the same purpose. Also determine the profit that would be made in CAD.

Solution:

a) Calculation of fair forward Rate

$$\begin{aligned} \text{Fair CA\$ / DM 3m Fwd} &= 0.665 \times \left(\frac{1 + 0.09 \times 3/12}{1 + 0.07 \times 3/12} \right) \\ &= \text{CA\$ } 0.668 \end{aligned}$$

Since, Actual Forward Rate (CA\$ 0.670/DM) $\neq$ Fair forward Rate (CA\$ 0.668/DM)

Therefore, Interest Rate Parity does not hold good.

b) Actual Forward Rate (CA\$ 0.670/DM) $>$ Fair forward Rate (CA\$ 0.668/DM)

$\therefore$ DM is overvalued & we will borrow in CA\$

Arbitrage process

1) Borrow CA\$ 1,000 for 9% @ 3 monters

$$\begin{aligned} \text{Outflow at end of 3M} &= \text{CA\$ } 1,000 \left(\frac{1 + 0.09 \times 3}{12} \right) \\ &= \text{CA\$ } 1,022.5 \end{aligned}$$

2) Sell CA\$ 1,000 @ CA\$ 0.665 and receive DM

$$= \frac{1000}{0.665} = \text{DM } 1503.76$$

3) Invest DM 1,503.76 @ 7% for 3M

$$= 1,503.760 \left(1 + 0.07 \times \frac{3}{12} \right)$$

$$= 1,530.08$$

4) Sell DM 1,530.08 @ CA\$ 0.670 and receive CA\$

$$= \text{DM } 1,530.08 \times \text{CA\$ } 0.670$$

$$= \text{CA\$ } 1025.15$$

5) Profit CA\$ 1025.15 – CA\$ 1022.5

$$\text{Profit} = \text{CA\$ } 2.65$$



QUESTION 30:

N 18

Spot rate 1 US\$ = ₹ 68.50

USD premium on a six month forward is 3%. The annualized interest in US 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.

Solution:

Calculation of actual forward:

$$3 = \frac{F - S}{S} \times 100$$

$$3 = \frac{F - 68.50}{68.50} \times 100$$

$$F = ₹/\$ 70.56$$

Calculation of fair forward:

$$= 68.50 \times \left(\frac{1 + 0.9 \times 6/12}{1 + 0.04 \times 6/12} \right)$$

$$= ₹/\$ 70.1789$$

Since, Actual Forward Rate (₹/\$ 70.56) > Fair Forward Rate (₹/\$ 70.1789)

Therefore, \$ is overvalued against ₹ and we will follow below arbitrage process

(i) Borrow ₹ equivalent to USD 3 million i.e.

$$= \$ 3 \text{ Million} \times ₹ 68.50 = ₹ 205.5 \text{ million}$$

$$\therefore \text{Outflow at 6m} = ₹ 205.5 \text{ million} \left[1 + 0.09 \times \frac{6}{12} \right]$$

$$= ₹ 214.78 \text{ million}$$

(ii) Sell ₹ 205.5 million @ ₹ 68.50 and receive \$

$$= \frac{205.5}{68.50} = \$ 3 \text{ Million}$$

(iii) Invest \$ 3 Million @ 4% for 6M

actual \$ fwd rate

Learning :

If the question specifies the forward premium discount, then don't consider it to be an annualised (it is rather periodic). However, if we have to calculate it, then we always calculate annualised

$$\begin{aligned}\text{Inflow at 6m} &= \$ 3 \text{ million} \times \left(1 + 0.04 \times \frac{6}{12}\right) \\ &= \$ 3.06 \text{ million}\end{aligned}$$

$$\begin{aligned}\text{(iv) Sell } \$ 3.06 \text{ million @ forward rate ₹ 70.56 \text{ and receive ₹:} \\ &= \$ 3.06 \times ₹ 70.56 \\ &= ₹ 215.9136 \text{ million}\end{aligned}$$

$$\begin{aligned}\text{(v) Arbitrage profit} &= 215.9136 - 214.75 \\ &= 1.1636\end{aligned}$$



QUESTION 31:

N 06 | MTP M 16 | SM

Spot rate 1 US \$	₹ 48.0123
180 days Forward rate for 1 US \$	₹ 48.8190
Annualised interest rate for 6 months	Rupee = 12%
Annualised interest rate for 6 months	US \$ = 8%

Is there any arbitrage possibility? If yes how an arbitrageur can take advantage of the situation, if he is willing to borrow ₹ 40,00,000 or US \$83,312.

Further should arbitrageur go for Covered Interest Rate Arbitrage if he has forecasted the spot rates 180 days hence as below:

Future rate for 1 US \$	Probability
₹ 48.7600	25%
₹ 48.8000	60%
₹ 48.8200	15%

Solution:

Calculation of fair 180 forward ₹/\$

$$\begin{aligned}&= ₹ 48.0123 \times \left(\frac{1 + 0.12 \times 6/12}{1 + 0.08 \times 6/12}\right) \\ &= ₹ 48.9356\end{aligned}$$

Actual (\$48.8190) < \$48.9356 (Fair)

Therefore, ₹/\$ forward is undervalued therefore we will borrow in Dollars

Calculation of gain under Covered Interest Arbitrage:

Step 1) Borrow \$83,312 @ 8% for 6M

$$\begin{aligned}\text{Outflow at end of 6M} &= \$83,312 \left(1 + 0.08 \times \frac{6}{12}\right) \\ &= \$ 86,644.48\end{aligned}$$

Step 2) Sell \$83,312 @ ₹ 48.0123 and receive

$$\$83,312 \times ₹ 48.0123 ₹ 4,000,000$$

Step 3) Invest ₹ 4,000,000 @ 12% for 6M

$$\begin{aligned}\text{Inflow outer 6M} &= ₹ 4,000,000 \left(1 + 0.12 \times \frac{6}{12} \right) \\ &= ₹ 4,240,000\end{aligned}$$

Step 4) Sell ₹ 4,240,000 @ ₹/\$ 48.8190 & receive \$

$$\begin{aligned}&= \frac{₹ 4,240,000}{₹ 48.8190} \\ &= \$ 86,851.43\end{aligned}$$

$$\begin{aligned}\text{Step 5) Arbitrage profit} &= \$ 86,851.43 - \$ 86,644.48 \\ &= \$ 206.95\end{aligned}$$

Calculation of gain under Uncovered Interest Arbitrage:

If ₹ 4,240,000 is converted @ at expected spot rate:

$$\begin{aligned}&= 48.7600 \times 0.25 + 48.8000 \times 0.60 + 48.8200 \times 0.15 \\ &= ₹ 48.793\end{aligned}$$

Step 4) Sell ₹ 4,240,000 @ ₹/\$ 48.793 & receive \$

$$\frac{₹ 4,240,000}{₹ 48.793} = \$ 86,897.71$$

$$\begin{aligned}\text{Step 5) Arbitrage profit} &= \$ 86,897.71 - \$ 86,644.48 \\ &= 253.23\end{aligned}$$

Conclusion: $\therefore$ Profit under covered interest arbitrage (\$ 206.95) < Profit under uncovered arbitrage (\$ 253.23),
 $\therefore$ arbitrage should not go for covered interest arbitrage



QUESTION 32:

RTP M 12

only on

The risk free rate of interest rate in USA is 8% p.a. and in UK is 5% p.a. The spot exchange rate between US \$ and UK £ is 1\$ = £ 0.75.

Assuming that interest is compounded on daily basis then at which forward rate of 2 year there will be no opportunity for arbitrage.

Further, show how an investor could make risk-less profit, if two year forward price is 1 \$ = 0.85 £.

Given $e^{-0.06} = 0.9413$ & $e^{-0.16} = 0.852$, $e^{0.16} = 1.1735$, $e^{-0.1} = 0.9051$

Solution:

Calculation of fair forward rate

$$\begin{aligned}&= £ 0.75 \times \frac{e^{0.05 \times 2}}{e^{0.08 \times 2}} = £ 0.75 \times \frac{e^{0.10}}{e^{0.16}} = £ 0.75 \times e^{(0.1 - 0.16)} \\ &= £ 0.75 \times 0.9413 = £/\$ 0.7060\end{aligned}$$

Actual (£ 0.85/\$) > fair forward (£ 0.71/\$)

Since, Dollars is overvalued

Therefore, we will borrow in pounds

Arbitrage Process:

- 1) Borrow £ 1000 @ 5% p.a. for 2 years. Outflow after 2 years:

$$= £ 1,000 \times e^{0.05 \times 2} \rightarrow e^{0.1} \rightarrow \frac{1}{e^{0.1}}$$

$$= \frac{£ 1000}{0.9051} = £ 1104.85$$

- 2) Sell £ 1000 @ £ 0.75/\$ & receive \$:

$$= \frac{£ 1000}{0.75} = \$ 1,333.33$$

- 3) Invest \$ 1,333.33 @ 8% p.a. for 2 years Inflow after 2 years:

$$= 1,333.33 \times e^{0.16}$$

$$= 1,333.33 \times 1.1735$$

$$= \$ 1564.66$$

- 4) Sell \$ 1564.66 @ 0.85 £/\$ and receive £:

$$= 1564.66 \times 0.85$$

$$= £ 1329.96$$

- 5) Arbitrage Profit:

$$= £ 1329.96 - £ 1104.85$$

$$= £ 225.11$$



QUESTION 33:

RTP M 16

only on calcu

Following are the rates quoted at Mumbai for British Pound (£):

Spot	52.60/70	Interest Rates	India	London
3 m forward	20/70	3 months	8%	5%
6 m forward	50/75	6 months	10%	8%

Verify whether there is any scope for covered interest arbitrage, if you can borrow in rupees.

Solution:

3M forward

- 1) Borrow ₹ 1,000 @ 8% for 3M

$$= ₹ 1,000 (1 + 0.08 \times 3/12) = ₹ 1,020$$

- 2) Sell ₹ 1,000 @ ₹ 52.60

$$= \frac{₹ 1,000}{₹ 52.70} = £ 18.98$$

- 3) Invest £ 18.98 @ 5% for 3M

$$= £ 18.98 \left(1 + 0.05 \times \frac{3}{12} \right) = £ 19.22$$

- 4) Sell £ 19.22 @ ₹ 52.80 and receive
 $£ 19.63 \times ₹ 52.80 = ₹ 1014.816$
- 5) Loss = 1020 – 1014.82 = 5.18

6M Forward

- 1) Borrow ₹ 1,000 @ 10% for 6M
 $₹ 1,000 \left(1 + 0.10 \times \frac{6}{12} \right) = ₹ 1,050$
- 2) Sell ₹ 1,050 @ 52.70 and receive £
 $\frac{₹ 1,050}{₹ 52.70} = 18.98$
- 3) Invest £ 18.98 @ 8% for 6M
 $£ 18.98 \left(1 + 0.08 \times \frac{6}{12} \right) = £ 19.74$
- 4) Sell £ 19.74 @ ₹ 53.10 and receive ₹
 $₹ 19.74 \times ₹ 53.10 = 1048.194$
- 5) Loss = ₹ 1,050 - 1,048.194 = 1.81



QUESTION 34:

N 19

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:

	Exchange Rates
Spot	₹/\$ 72.65/73
3-m forward	₹/\$ 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.

- (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.?

Solution:

- (i) Option (1) Forward Cover:
 $₹ \text{ received} = ₹ 72.95 \times \$ 50,000$
 $= ₹ 3,647,500$

Option (2) Money market hedge

Step 1) Borrow PV of \$ 50,000 @ 6% for 3M

$$\frac{\$50,000}{1 + 0.06 \times \frac{3}{12}} = \$49,261.084$$

Step 2) Sell \$ 49,261.084 @ 72.65 and receive

$$\$49,261.084 \times ₹72.65 = ₹3,578,817$$

Step 3) Invest ₹ 3,578,817 @ 9% for 3M

$$₹3,578,817 [1 + 0.09 \times 3/12]$$

$$₹3,659,340$$

Conclusion: ∴ inflow under MMH is higher
∴ it is better

(iii) Foreign exchange exposure of H Ltd = \$ 50,000

$$\begin{aligned} \text{Risk of H Ltd} &= \$50,000 \times (73 - 72.95) \\ &= ₹2500 \end{aligned}$$



QUESTION 35:

RTP | N 09 | N 08 | SM

Columbus Surgicals Inc. is based in US, has recently imported surgical raw materials from the UK and has been invoiced for £ 480,000, payable in 3 months. It has also exported surgical goods to India and France.

The Indian customer has been invoiced for £ 138,000, payable in 3 months, and the French customer has been invoiced for € 590,000, payable in 4 months. *FC*

Current spot and forward rates are as follows:

£ / US\$

Spot: 0.9830 – 0.9850

3 months forward: 0.9520 – 0.9545

US\$ / €

Spot: 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 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.

Solution:

Hedging as an Exporter:

Alternative 1: Money Market Hedging:

1) Borrow PV of foreign currency

$$= \frac{5,90,000}{1 + 0.16 \times \frac{4}{12}}$$

$$= €5,60,127$$

2) Sell € 5,60,127 and receive \$

$$= € 5,60,127 \times 1.8890$$

$$= \$ 1,058,080$$

3) Invest \$ 1,058,080 @ 11.5% for 4m. Inflow after 4m:

$$= \$ 1,058,080 \times \left[1 + 0.115 \times \frac{4}{12} \right]$$

$$= \$ 1,098,640$$

Alternative 2: Forward Market Hedging

$$\text{Dollar receipts using fwd rates} = € 5,90,000 \times \$ 1.9510 = \$ 1,151,090$$

Suggestion: Take forward market as the amount received is more in forward market i.e. (\$ 1,151,090) than MMH (\$ 1,098,639)

Hedging as an Importer:

$$\text{Net Payables} = £ 4,80,000 - £ 1,38,000 = £ 3,42,000$$

Alternative 1: Money Market Hedging:

Step 1) Invest in PV of £ 342000 @ 10% for 3M foreign currency

$$= \frac{£ 3,42,000}{1 + 0.10 \times 3/12}$$

$$= £ 3,33,659$$

Step 2) Buy £ 3,33,659 @ £/\$ 0.9830

$$= \frac{333,659}{0.9830}$$

$$= \$ 3,39,429$$

Step 3) Borrow \$ 3,39,429 @ 13% for 3m. Outflow after 3m:

$$= \$ 3,39,429 \times (1 + 0.13 \times 3/12)$$

$$= \$ 3,50,460$$

Alternative 2: Forward Market Hedging

$$\text{Dollar receipts using fwd rates} = \frac{£ 3,42,000}{£ 0.9520} = \$ 3,59,244$$

Suggestion: We will choose MMH since lower the outflows, the better it is end therefore we will suggest MMH



QUESTION 36:

M 10 | N 17 | N 08 | RTP | SM

only on calc

The rate of inflation in India is 8% per annum and in the U.S.A. it is 4%. The current spot rate for USD in India is ₹ 46. What will be the expected rate after 1 year and after 4 years applying the Purchasing Power Parity Theory?

Solution:

$$\text{Expected spot for 1 year} = ₹ 46 \frac{(1.08)}{(1.04)} = ₹ 47.77$$

$$\text{Expected spot rate for 4 years} = ₹ 46 \frac{(1.08)^4}{(1.04)^4} = ₹ 53.47$$

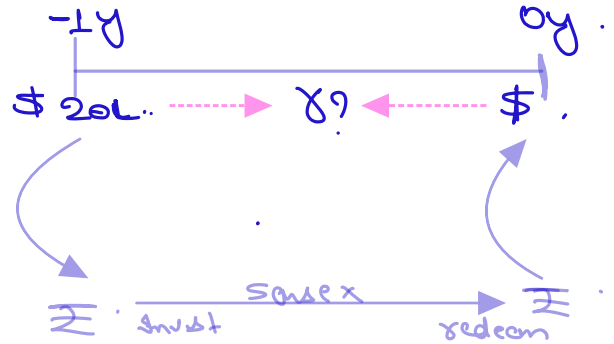


QUESTION 37:

J 21

A US investor chose to invest in Sensex for a period of one year. The relevant information is given below.

Size of investment (\$)	20,00,000
Spot rate 1 year ago (₹/\$)	42.50/60
Spot rate now (₹/\$)	43.85/90
Sensex 1 year ago	3,256
Sensex now	3,765
Inflation in US	5%
Inflation in India	9%



- 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?

Solution:

Self-note: Below Solution is a logical solution of this question and does not match with Suggested Answer since that solution has ambiguities.

- a) Amount of investment in USD = \$ 20,00,000

Sell \$ 20,00,000 @ ₹/\$ 42.50 and receive ₹:
 $= \$ 20,00,000 \times ₹ 42.50 = ₹ 8,50,00,000$

Invest ₹ 8,50,00,000 in Sensex value of this investment after one year:
 $= \frac{8,50,00,000}{3256} \times 3765 = ₹ 98,287,776$

Sell ₹ 98,287,776 @ ₹/\$ 43.90 and receive \$:
 $= \$ 2,238,902$

Nominal rate of return = $\frac{22,38,902 - 20,00,000}{20,00,000} = 11.95\%$

- b) Real depreciation/appreciation of Rupee

Particulars	Bid	Ask
$E(S_T)$ based on purchasing power parity	$\left[42.50 \times \frac{1.09}{1.05} \right] = 44.1190$	$\left[42.60 \times \frac{1.09}{1.05} \right] = 44.2229$
Real Dep/ App in ₹	$\frac{43.85 - 44.1190}{42.50} = -0.633\%$	$\frac{43.90 - 44.2229}{42.60} = -0.751\%$

- c) If purchasing power parity holds good exchange rate should be ₹/\$ 44.1190 – 44.2229 calculated in past (b) above

d) Nominal return to Indian investor = $\frac{3,765 - 3,256}{3,256} \times 100 = 15.63\%$

Calculating real return:

$$(1 + r_{\text{real}}) (1 + r_{\text{inflation}}) = (1 + r_{\text{nominal}})$$

$$(1 + r_{\text{real}}) (1 + 0.09) = (1 + 0.1563)$$

$$r_{\text{real}} = 6.08\%$$

E. Fate of Forward Contract



QUESTION 38:

N 04

only on call

On 15th January 2015 you as banker booked a forward contract for US\$ 250000 for your import customer deliverable on 15th March 2015 at ₹ 65.3450. On due date, customer request you to cancel the contract. On this date quotation for US\$ in the inter-bank market is as follows:

Spot	₹ 65.2900/2975 per US\$
Spot/ April	3000/ 3100
Spot/ May	6000/ 6100

Assuming that the flat charges for the cancellation is ₹100 and exchange margin is 0.10%, then determine the cancellation charges payable by the customer.

Solution:

Cancellation rate:

₹/\$ Spot interbank bid rate	65.2900
Less Margin @ 0%	<u>(0.06529)</u>
	65.2247
Rounded off to	65.2250

Cancellation charges:

Customer Buys at	(₹ 65.3450)
Customer sell at	<u>₹ 65.2250</u>
Loss per \$	0.12
	<u>× \$ 2,50,000</u>
Customer pays to bank	30,000
Flat cancellation charges	<u>100</u>
	₹ 30,100



QUESTION 39:

N 15 | SM

means customer sell = Exporter.

A bank enters into a forward purchase TT covering an export bill for Swiss Francs 1,00,000 at ₹ 32.4000 due 25th April and covered itself for same delivery in the local interbank market at ₹ 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 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

Sw Fr/\$

and in the interbank market US dollars were quoted as under:

Spot	USD 1 = ₹ 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.

Solution:

Calculation of cancellation rate

₹/\$ April spot (Ask)	₹ 49.4455	
Add: swap points	<u>₹ 0.4200</u>	
	<u>₹ 49.8655</u>	
And, SWF / \$ April fwd (Bid)	1.5150	
Using Cross currency, 1M forward ₹/SWF	$= \frac{₹ 49.8655}{SWF 1.5150}$	₹ 32.9145
Add: Margin @ 0.1%		<u>0.0329</u>
		32.9474
Rounded off to		₹/SWF 32.9475

Calculation of cancellation charges

Customer Sell @	₹ 32.4000
Cancellation rate / customer Buy @	<u>(₹ 32.9475)</u>
Loss per SWF	(₹ 0.5475)
	<u>× 1,00,000</u>
Customer will pay to bank	₹ 54,750



QUESTION 40:

SM

Suppose you as a banker entered into a forward purchase contract for US\$ 50,000 on 5th March with an export customer for 3 months at the rate of ₹ 59.6000. On the same day you also covered yourself in the market at ₹ 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 US\$ in the market is as follows:

Spot	₹ 59.1300/1400 per US\$
Spot/ 5th June	₹ 59.2300/2425 per US\$
Spot/ 5th July	₹ 59.6300/6425 per US\$

Assuming a margin 0.10% on buying and selling, determine the extension charges payable by the customer and the new rate quoted to the customer.

Solution:

Calculation of cancellation rate

Customer Buys at	₹ 59.2425
Add: Margin @ 0.1%	<u>₹ 0.0592</u>
	59.3017

Rounded off to	59.3025
Calculation of extension charges	
Customer sell at	₹ 59.6000
Customer Buys at	<u>(₹ 59.3025)</u>
	0.2975
Rounded off to	<u>× 50,000</u>
Bank pay to customer	14,875
Calculation of new contract to be entered	
Customer sell at	59.6300
Less: Margin @ 0.1%	<u>(0.05963)</u>
	59.5703
Rounded if	59.5700



QUESTION 41:

M 17 | N 10 | RTP M 15 | SM

An importer requested his bank to extend for Forward contract of US \$ 25,000 which is due for maturity on 31-10-2015 for a further period of six month. The other details are as under:

Contract rate US \$ 1 = ₹ 61.00

The US \$ quoted on 31-10-2015

Spot: ₹ 60.3200/60.6300

Six-month premium: 0.86 %/0.98%

Margin money for buying and selling rate are 0.086% and 0.15% respectively

Compute:

- (1) Cost to importer in respect to extension of forward contract.
- (2) New Forward contract rate.

In the absence of information, we are assuming that extension request has been made on the due date

Bank perspective.

Solution:

- (i) The cost to the importer in respect of the extension

Calculation of cancellation Rate

Spot Bid Rate (₹/\$)	60.3200
Less: Margin @ 0.086%	<u>- 0.0519</u>
	60.2681
Rounded off	60.2675

Calculation of extension charges

Customer buy US\$ at	₹ 61.0000
Customer sell US\$ at	<u>₹ 60.2675</u>
Loss per \$	₹ 0.7325
	<u>× \$20,000</u>
Customer pay to banks	₹ 14,650

- (ii) ₹/\$ spot Ask Rate 60.6300
- Add: Premium (0.98%) + 0.5942

3M Forward	61.2242
Add: Margin @ 0.15%	<u>0.0918</u>
	61.3160
Rounded off	61.3150



QUESTION 42:

N 18

On 19th January, Bank A entered into forward contract with a customer for a forward sale of US \$ 7,000, delivery 20th March at ₹ 46.67. On the same day, it covered its position by buying forward from the market due 19th March, at the rate of ₹ 46.655. On 19th February, the customer approaches the bank and requests for early delivery of US\$.

Rates prevailing in the interbank markets on that date are as under:

Spot (₹/\$)	46.5725/5800
March	46.3550/3650

Interest on outflow of funds is 16% and on inflow of funds is 12%. Flat charges for early delivery are ₹ 100.

What is the amount that would be recovered from the customer on the transaction?

Note: Calculation should be made on months basis than on days basis.

Solution:

- Swap difference (Importer)

Bank Buy \$ spot	(₹ 46.5800)
Bank Sell 1M Forward	<u>₹ 46.3550</u>
Loss per \$	(₹ 0.225)
	<u>× \$ 7,000</u>
Customer will pay to Bank	(₹ 1575)

- Interest on outlay of funds

Bank Buys at spot	₹ 46.5800
Bank sells at contracted	<u>(₹ 46.67)</u>
Inflow / Gain rate per \$	₹ 0.09
	<u>× \$7000</u>
Total inflow	₹ 630

Customer will receive interest from bank:

$$= 630 \times 12\% \times 1/12 = ₹ 6.3$$

- Total net amount to be recovered from customer

Sold US\$ 7000 @ ₹ 46.67	₹ 326,690
Early delivery charges	
• Swap charges / Diff.	₹ 1575
• Int on outlay of funds	(₹ 6.30)
• Flat charges	<u>₹ 100</u>
	3,28,358.7

mean buy for customer: importer would case.

→ - Sale of \$7000 @ 46.67.
- Swap diff.
- Int of IF/OF.

**QUESTION 43:**

M 21 | M 19

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?

Solution:

- If Bank agrees to take early delivery-

Working Notes-

(1) Swap Difference

(a) Bank Sells at Spot Rate on 30 th November 2020	₹ 75.22
(b) Bank Buys at Forward Rate of 31 st December 2020 (75.27 + 0.15)	₹ 75.42
Swap loss per US\$ (a – b)	– ₹ 0.20
Swap loss for US\$ 1,00,000 (1,00,000 × -0.20)	₹ 20,000

(2) Interest on Outlay Funds

(a) On 30 th November Bank sells at	₹ 75.22
(b) It buys from customer at	₹ 75.40
Outlay of Funds per US\$ (b – a)	₹ 0.18
Interest on Outlay fund for US\$ 1,00,000 for 31 days (US\$100000 × 00.18 × 31/365 × 18%)	₹ 275.18

(3) Charges for early delivery

Swap loss	₹ 20,000.00
Interest on Outlay fund for US\$ 1,00,000 for 31 days	₹ 275.18
Total charges of early delivery	₹ 20,275.18

(4) Net Inflow to Mr. Guru

Amount received on sale (₹ 75.40 × 1,00,000)	₹ 75,40,000
Less: Charges for early delivery payable to bank	₹ 20,275.18
Net Inflow to Mr. Guru	₹ 75,19,724.82

- If Mr. Guru deploys these funds in US\$, then inflow will be -

Receipt of US\$ on 30 th November 2020	US\$ 1,00,000
Add: Interest for 31 Days $\left(1,00,000 \times 3\% \times \frac{31^*}{365}\right)$	US\$ 254.79
US\$ available on 31 st December 2020 for sale	US\$ 1,00,254.79
Sale of US\$ 1,00,000 to bank as per agreed rate (₹ 75.40)	₹ 75,40,000.00
Sale of US\$ 254.79 @ ₹ 75.32 i.e. Forward Rate	₹ 19,190.78
Amount of Inflow	₹ 75,59,190.78

Advice: Since Cash Inflow will be higher in deployment of funds option the same should be chosen.



QUESTION 44:

N 21 MTP | M 18 | N 20 | M 15

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 @ ₹ 73.8775. The Bank has covered its position in the market @ ₹ 73.7575. (2) (1)

The exchange rates for USD \$ in the interbank market on 4th, 7th and 14th April 2021 were:

	4th April	7th April	14th April
Spot USD 1 =	73.2775/73.2975	73.1575/73.1975	73.1375/73.1775
Spot/March	73.3975/73.4275	73.2775/73.3275	73.2575/73.3075
April	73.5275/73.5675	73.4075/73.4650	73.3875/73.4475
May	73.7775/73.8250	73.6575/73.7275	73.6375/73.7050
June	74.0700/74.1325	73.9575/74.0675	73.9500/74.0525

The contract which expired in March cannot trade in the market in the month of April

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 June 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.

Solution:

- (i) Cancellation Rate:

The forward sale contract shall be cancelled at Spot TT Purchase for \$ prevailing on the date of cancellation as follows:

\$/ ₹ Market Buying Rate	₹ 73.1575
Less: Exchange Margin @ 0.10%	₹ 0.0732
	₹ 73.0843

Rounded off to ₹ 73.0850

(ii) Amount payable on \$ 1,00,000

Customer buys \$ @ ₹/\$	₹ 73.8775
Customer sells \$ @ ₹/\$	₹ 73.0850
Loss per \$	0.7925
	× \$1,00,000
Amount payable by customer to bank	₹ 79,250

(iii) Swap Loss

On 4th April, the bank does a swap sale of \$ at market buying rate of ₹ 73.4275 and forward purchase for April at market selling rate of ₹ 73.2775.

Bank buys at fwd rate	₹ 73.4275
Bank sells at spot rate	₹ 73.2775
Amount payable by customer	₹ 0.1500

Swap Loss for \$ 1,00,000 in ₹ = ₹ 15,000

(iv) Interest on Outlay of Funds

On 4th April, the bank receives delivery under cover contract at ₹ 73.7575 and sell spot at ₹ 73.2775.

Bank buys at	₹ 73.7575
Bank sells at	₹ 73.2775
Net outflow to bank	₹ 0.4800

Outlay for \$ 1,00,000 in ₹ 48,000

Interest on ₹ 48,000 @ 12% for 3 days

₹ 47

(v) New Contract Rate

The contract will be extended at current rate

\$/ ₹ Market forward selling Rate for June	₹ 74.0525
Add: Exchange Margin @ 0.10%	₹ 0.0741
	₹ 74.1266

Rounded off to

₹ 74.1275

(vi) Total Cost

Cancellation Charges	₹ 79,250.00
Swap Loss	₹ 15,000.00
Interest	₹ 47.00
	₹ 94,297.00



QUESTION 45:

N 23 | N 16

On 10th July, an importer entered into a forward contract with bank for US \$ 50,000 due on 10th September at an exchange rate of ₹ 66.8400. The bank covered its position in the interbank market at ₹ 66.6800.

How the bank would react if the customer requests on 12th 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 US\$ in the interbank market were as below:

	10 th September	12 th September
Spot	US\$1 = ₹ 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% p.a.

You are required to show the calculations to:

1. Cancel the Contract
2. Execute the Contract, and
3. Extend the Contract as above.

Solution:

Working notes

a) Swap diff.

On 10th September

Sell \$ spot @	₹ 66.1500
Buy September forward	(66.3200)
	(₹ 0.17)
	<u>× 50,000</u>
Receiver for customer	(8,500)

b) Cancellation charges

On 12th September

Cancellation Rate

Customer sell \$@	65.9600
(-) Margin @ 0.1%	(0.06596)
	65.8940
Rounded off to	65.8950

Cancellation charges

customer sell @	65.8950
(Contracted rate) customer Buys@	(66.8400)
Customer to bank (47250) x 50000	(0.9450)

c) Interest on outlay from funds

Bank sell spot @	66.1500
Bank Buys @ original inter Bank Forward Rate	<u>(66.6800)</u>
Outflow per \$	(₹ 0.53)
	<u>× \$ 50,000</u>
	<u>(₹ 26,500)</u>
Customer will pay interest to bank	$= (\text{₹ } 26500) \times \frac{2}{365} \times 12\%$
	$= 17.42$

d) Total amount payable by customer to bank:

Swap charges	8,500
Cancellation charges	47,250
Interest on outlay of funds	<u>17.42</u>
	<u>55,767.42</u>

1. Cancel the Contract: Bank need not do anything, but customer will have to pay ₹ 55,767.42 and the contract is already cancelled.

2. Execute the Contract: Existing contract is cancelled. Customer will have to pay ₹ 55,767.42 and he can buy \$50,000 at spot rate on 12th September.

Spot Rate Ask ₹/\$	65.9900
Add: Margin @ 0.1	<u>0.6599</u>
	66.6499
Rounded off to:	66.6500
× Amount	<u>\$ 50,000</u>
₹ to be paid	<u>33,32,500</u>

3. Extend the Contract: Existing contract is cancelled. Customer will have to pay ₹ 55,767.42 and book a new forward contract for 10th November:

Nov Fwd Rate Ask ₹/\$	66.4900
Add: Margin @ 0.1	<u>0.6649</u>
	67.1549
Rounded off to:	67.1550

F. Foreign Currency Exposures



QUESTION 46:

N 09 | RTP N 10 | SM | MTP N 21

M/s Omega Electronics Ltd. exports air conditioners to Germany by importing all the components from Singapore. The company is exporting 2,400 units at a price of Euro 500 per unit. The cost of imported components is S\$ 800 per unit. The fixed cost and other variables cost per unit are ₹ 1,000 and ₹ 1,500 respectively. The cash flows in Foreign currencies are due in six months.

The current exchange rates are as follows:

₹ /Euro 51.50/55

₹ /S\$ 27.20/25

After six months the exchange rates turn out as follows:

₹ /Euro 52.00/05

₹ /S\$ 27.70/75

- (1) You are required to calculate loss/gain due to transaction exposure.
- (2) Based on the following additional information calculate the loss/gain due to transaction and operating exposure if the contracted price of air conditioners is ₹ 25,000:
 - a. the current exchange rate changes to

₹ /Euro	51.75/80
₹ /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.

↓
deviate
from suggested.

Solution:

- (1) Transaction exposure on Euro Receivable

$$\begin{aligned} \text{Gain on Euro exposure} &= (\text{₹ } 52 - \text{₹ } 51.50) 500 \times 2,400 \\ &= \text{₹ } 6,00,000 \end{aligned}$$

$$\begin{aligned} \text{Loss on S\$ exposure} &= (27.25 - 27.75) \times 800 \times 2,400 \\ &= \text{₹ } -9,60,000 \end{aligned}$$

$$\begin{aligned} \text{Net Loss due to transaction exposure} &= -9,60,000 + 6,00,000 \\ &= \text{₹ } -3,60,000 \end{aligned}$$

- (2) Transaction exposure Gain/(loss) on S\\$ = $(27.15 - 27.75) \times 800 \times 2,400 = \text{₹ } 11,52,000$

Total Gain/(loss) on existing current rates

$$\begin{aligned} &= 2400 (25,000 - 1,500 - 800 \times 27.75) - (2,400 \times 1,000) \\ &= \text{₹ } 720,000 \end{aligned}$$

$$\text{Price of AC in Euro based on existing current rates} = \frac{25,000}{51.70} = \text{€ } 485.44$$

$$\text{Price of AC in Euro based on revised current rates} = \frac{25,000}{51.75} = \text{€ } 483.09$$

$$\% \text{ Change in price} = \frac{485.44 - 483.09}{485.44} = -0.48\%$$

$$\% \text{ Increase in quantity} = -0.48\% \times -1.5 = +0.72\%$$

$$\text{Revised quantity sold} = 2,400 + 0.72\% = 2,417.28 \sim 2417 \text{ units}$$

$$\begin{aligned} \text{Total profit based on new quantity} &= \\ &= 2,417 (25,000 - 800 \times 27.75 - 1500) - 24,00,000 \\ &= ₹ 7,42,100 \end{aligned}$$

$$\begin{aligned} \text{Profit due to operating exposure} &= 7,42,100 - 7,20,000 \\ &= ₹ 22,100 \end{aligned}$$



QUESTION 47:

M 21

XP Pharma Ltd., has acquired an export order for ₹ 10 million for formulations to a European company. The Company has also planned to import bulk drugs worth ₹ 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.

	Spot Rate	Annualized Premium
₹/\$	67.10 / 67.20	\$ - 7%
₹/Euro	63.15 / 63.20	Euro - 6%
₹/Pound	88.65 / 88.75	Pound - 5%

Advice XP Pharma Ltd. about invoicing in which currency. Calculation should be upto three decimal places

Solution: Invoicing will be done using Spot rate

Realisation of invoiced amt will happen @ fwd rate.

- (i) Proceeds of Exports in INR = ₹ 10 Million
Position of Inflow under three currencies will be as follows:

Currency	Invoice at Spot Rate	Expected Rate after 3-months	Conversion in INR after 3-months
\$	₹ 100,00,000 / ₹ 67.10 = \$ 149031.297	₹ 67.10 (1 + 0.07/4) = ₹ 68.274	₹ 68.27 × \$ 149031.297 = ₹ 1,01,74,336.962.771
€	₹ 100,00,000 / ₹ 63.15 = € 1,58,353.127	₹ 63.15 (1 + 0.06/4) = ₹ 64.10	₹ 64.10 × € 1,58,353.127 = ₹ 1,01,50,435
£	₹ 100,00,000 / ₹ 88.65 = £ 1,12,803.158	₹ 88.65 (1 + 0.05/4) = ₹ 89.76	₹ 89.76 × £ 1,12,803.158 = ₹ 1,01,25,211

- (ii) Payment of Import in INR = ₹ 5 Million

Position of outflow under three currencies will be as follows:

Currency	Invoice at Spot Rate	Expected Rate after 6-months	Conversion in INR after 6-months
\$	₹ 50,00,000 / ₹ 67.20 = \$ 74404.762	₹ 67.20 (1 + 0.07/2) = ₹ 69.55	₹ 69.55 × \$ 74404.762 = ₹ 51,74,851

€	₹ 50,00,000/ ₹ 63.20 = € 79,113.924	₹ 63.20 (1 + 0.06/2) = ₹ 65.10	₹ 65.10 × € 79,113.924 = ₹ 51,50,316
£	₹ 50,00,000/ ₹ 88.75 = £ 56,338.028	₹ 88.75 (1 + 0.05/2) = ₹ 90.9069	₹ 90.97 × £ 56,338.028 = ₹ 51,25,014.069

Advice: Since cash inflow is highest (1,01,74,367) in case of \$ hence invoicing for Export should be in \$. However, cash outflow is least (51,25,070) in case of £ the invoicing for import should be in £.



QUESTION 48:

N 14 | N 12 | SM

only on calc

Gibraltar Limited has imported 5000 bottles of shampoo at landed cost in Mumbai, of US \$ 20 each. The company has the choice for paying for the goods immediately or in 3 months' time. It has a clean overdraft limited where 14% p.a. rate of interest is charged.

Calculate which of the following method would be cheaper to Gibraltar Limited.

- Pay in 3 months' time with interest @ 10% and cover risk forward for 3 months.
- Settle now at a current spot rate and pay interest of the over-draft for 3 months.

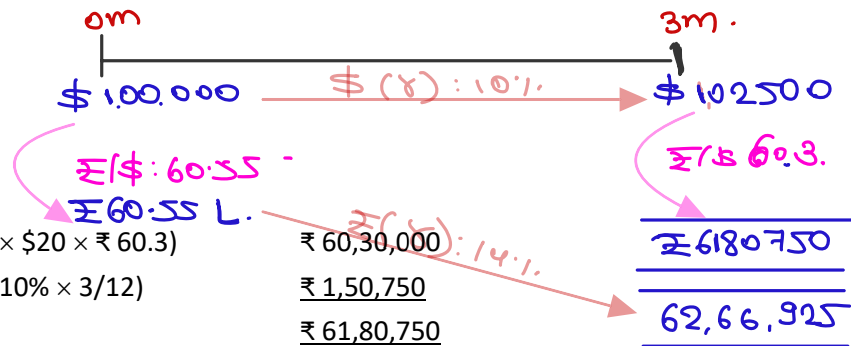
The rates are as follows:

Mumbai ₹/\$ spot : 60.25-60.55
3 months swap : 35/25

Solution:

Calculation of which of the below would be cheaper

- | | | | |
|------|-----------------------|----------------------------|-------------|
| (i) | Outflow in ₹ | (5,000 × \$20 × ₹ 60.3) | ₹ 60,30,000 |
| | Interest @ 10% for 3M | (₹ 60,30,000 × 10% × 3/12) | ₹ 1,50,750 |
| | Total outflow in ₹ | | ₹ 61,80,750 |
| (ii) | Outflow in ₹ | (5000 × \$20 × ₹ 60.55) | ₹ 60,55,000 |
| | Interest @ 14% for 3M | (₹ 60,55,000 × 14% × 3/12) | ₹ 2,11,925 |
| | | | ₹ 62,66,925 |



The outflow in case of (ii) option is more than the outflow in case of (i) ∴ the cheaper method would be to go through the first option



QUESTION 49:

M 15 | N 12 | N 11 | RTP | SM

DEF Ltd. has imported goods to the extent of US\$ 1 crore. The payment terms are 60 days interest-free credit. For additional credit of 30 days, interest at the rate of 7.75% p.a. will be charged.

The banker of DEF Ltd. has offered a 30 days loan at the rate of 9.5% p.a. Their quote for the foreign exchange is as follows:

Spot rate INR/US : 62.5
 60 days forward rate INR/US\$: 63.15
 90 days forward rate INR/US\$: 63.45

Which one of the following options would be better?

- Pay the supplier on 60th day and avail bank loan for 30 days.

b. Avail the supplier's offer of 90 days credit.

Solution:

(i) Pay the supplier on 60th day and avail bank loan for 30 days.

Particulars	Amount
Outflow in ₹ on the 40 th Day	₹ 63,15,00,000 (₹ 1,00,00,000 × ₹ 63.15)
Bank loan for 30 days @ 9.5%	₹ 49,30,890 (₹ 63,15,00,000 × 9.5% × 30/365)
Total outflow in ₹	₹ 63,64,30,890

(ii) Avail the supplier's offer of 90 days credit.

Particulars	Amount
Outflow at the 60 th Day	\$ 1,00,00,000
Additional 30 days credit @ 7.75%	64,583.33 (₹ 1,00,00,000 × 7.75% × 30/365)
Outflow at the 90 th Day	\$ 1,00,64,583.33
90 day fwd rate	63.45
Total outflow in ₹	₹ 63,85,97,812

Conclusion: Option (i) would be better as it is having less outflow



QUESTION 50:

MTP N 20 | RTP

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 ₹ 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 are as follows:

Spot Rate INR/ US\$ (buying)	₹ 66.98
60 days Forward Rate INR/ US\$ (buying)	₹ 67.16
90 days Forward Rate INR/ US\$ (buying)	₹ 68.03

Advise which one of the following options would be better for XYZ Ltd.

- Pay immediately after utilizing cash available and for balance amount take 90 days loan from bank.
- Pay the supplier on 60th day and avail bank's loan (after utilizing cash) for 30 days.
- 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 ₹ in Crore.

Solution:

Option (a) Pay immediately

Particulars	Amount
Amount payable in US\$ at 60d	\$ 80,000,000
Less: Discount @1%	(\$ 0.08M)
Amount payable in \$ today	\$ 7.92M
Spot Rate	₹ 66.98
Amount payable in ₹ today	₹ 530.482 mn ~ ₹ 53.0482 Cr.
Less: Available cash balance	₹ (0.25 Cr.)
Rupees to be borrowed today	₹ 52.7982 Cr.
Add: Interest @ 9% for 90 days	₹ 1.1880 cr.
Total outflow at the end of 3m	₹ 53.9862 Cr.

Option b) Pay after 60 days

	Amount
Amount payable in US\$	\$ 8 million
× 60 days forward (₹/\$)	₹ 67.16
	₹ 537.28 Mn ~ 53.728 Cr
Less: Cash balance available	
0.25 cr	
Add Int for 60d <u>0.0017</u>	
@ 4% <u>0.2517 cr.</u>	(0.2517 Cr)
Rupee to be borrowed after 60 days	53.4763 Cr
Add: Int for 30 days @ 9%	0.4011
	₹ 53.8774 Cr

Option c) Pay after 90 day

Amount payable in US\$ in 60 days	\$ 8 Mn
Add: Interest @ 8% for 30 days	0.0533
$\left[\$8\text{million} \times 8\% \times \frac{30}{360} \right]$	
Amount payable in US\$ in 90 days	8.0533 Mn
Exchange Rate 90 day forward	68.03
Amount payable in ₹ in 90 days	₹ 54.7866
Less cash available	
0.25 Cr.	
Less: [Int @ 4% for 90 days) <u>0.0025 Cr.</u>	(₹ 0.2525)
Cash outflow at the 90 th days	₹ 54.5341

Conclusion: Option 2 is advised



QUESTION 51:

M 12 | RTP

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 ₹ 48.90.

The market rates for Rupee and Dollar are as under:

Spot	₹ 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?

Solution:

- a) Net cash inflow in rupees under option A:

Particulars	Amount
Cover the payable in forward market	\$7,00,000
Amount payable in \$ (\$ payable after 3M)	
3M forward rate	
48.70	
+ 0.45	₹ 49.15
Rupees payable after 3M	(A) 34,405,000
Dollar receivable after 2M	\$4,50,000
× 2M forward Rate – Contracted Rate	48.90
Rupee Receivable	₹ 22,005,000
Add: Int for 1M @12%	2,20,050
Rupee Receivable after 3M	(B) 2,225,050
Net Rupees payable after 3M (A – B)	(12,179,950)

- b) Net cash inflow in rupees under option A:

Dollar payable after 3n		\$7,00,000
Dollar Receivable after 3m		(\$4,50,000)
Dollar payable after 3m		\$2,50,000
× Forward Rate 3m	-	₹ 49.15
Rupee Payable after 3m (A)		₹ 1,22,87,500
Cancellation Rate: Ask (48.70 + 0.30)	₹ 49.00	
Cancellation charges (loss):		
(48.90 – 49) 450000		₹ 45,000
Total ₹ payable after 3m (A + B)		1,23,32,500

Recommendation: Option (a) is recommended since it has lower outflows

Self-note: Logically, interest of cancellation charges (₹ 45,000) should also be considered for 3m. However, it's not considered in suggested answer.



QUESTION 52:

RTP N 10

owe : has to pay to.

Trueview plc, a group of companies controlled from the United Kingdom includes subsidiaries in India, Malaysia and the United States. As per the CFO's forecast that, at the end of the June 2010 the position of inter-company indebtedness will be as follows:

- The Indian subsidiary will be owed ₹ 1,44,38,100 by the Malaysian subsidiary and will to owe the US subsidiary US\$ 1,06,007.
- The Malaysian subsidiary will be owed MYR 14,43,800 by the US subsidiary and will owe it US\$ 80,000.

Suppose you are head of central treasury department of the group and you are required to net off inter-company balances as far as possible and to issue instructions for settlement of the net balances.

For this purpose, the relevant exchange rates may be assumed in terms of £ 1 are US\$ 1.415; MYR 10.215; ₹ 68.10. What are the net payments to be made in respect of the above balances?

Solution:

All amounts are in pounds.

	India	Malaysia	United State
Malaysia pays to India	212013	(212013)	
India to US sub	(74917)		74917
US pay to Malaysia		141341	(141341)
Malaysia to US		(56537)	56537
	137096	(127209)	(9887)



QUESTION 53:

SM

only on

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?

Solution:

Forward Bid	£ 1 = \$ 2.816
Futures price	£ 1 = \$ 2.806
Buy £ 62,500 @ \$ 1.2806	\$ (80,037.5)
Sell £ 62,500 @ \$ 1.2816	<u>\$ 80,100</u>
Profit	\$ 62.5



QUESTION 54:

RTP M 11 | SM

ABC Technologic is expecting to receive a sum of US\$ 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 \$1000. As

on date spot and futures \$ contract are quoting at ₹ 44.00 & ₹ 45.00 respectively. Suppose after 3 months the company closes out its position futures are quoting at ₹ 44.50 and spot rate is also quoting at ₹ 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.

Solution:

Today Number of contract = $\$4,00,000 / \$100 = 400$ contract short on \$ @ ₹/\$ us
After 3m Gain to the company on future position = $(₹ 45 - ₹ 44.50) \times \$ 400 \times 100$
 $= ₹ 2,00,000$ IF

Amount received from spot market $= \$ 4,00,000 \times 44.5$
 $= ₹ 1,78,00,000$ IF

Effective price realization = $\frac{1,78,00,000 + 2,00,000}{4,00,000} = ₹ 45$ per US\$



QUESTION 55:

M 23 | M 19 | N 17 | N 16 | M 15 | RTP | SM

EFD Ltd. is an export business house. The company prepares invoice in customers' currency. Its debtors of US\$. 10,00,000 is due on April 1, 2015.

Market information as at January 1, 2015 is:

Exchange rates US\$/INR <u>\$/₹</u>		Currency Futures US\$/INR	
Spot	0.016667	Contract size: ₹ 24,816,975	
1-month forward	0.016529	1-month	0.016519
3-months forward	0.016129	3-month	0.016118
Initial Margin		Interest rates in India	
1-Month	₹ 17,500	6.50%	
3-Months	₹ 22,500	7%	

On April 1, 2015 the spot rate US\$/INR is 0.016136 and currency future rate is 0.016134. Which of the following methods would be most advantageous to EFD Ltd?

- 1) Using forward contract
- 2) Using currency futures
- 3) Not hedging the currency risk

Solution:

- (1) Using forward contract

$$\begin{aligned} \text{Rupee inflow after 3M} &= \$ 1,00,00,000 \\ &\quad \$ 0.016129 \\ &= ₹ 62,00,01,240 \end{aligned}$$

- (2) Currency futures

On 1st Jan:

$$\text{No. of contracts} = \frac{\$1,00,00,000 / 0.016118}{2,48,16,975}$$

$$= 25$$

$$= \text{i.e., 25 contracts long of ₹ @ ₹/\$ 0.016118}$$

On 1st April 2015

- Gain/(loss) on futures:

$$\begin{aligned} \text{Gain in \$:} &= (\$0.016134 - 0.016118) \times 25 \text{ contracts} \times 24,86,975 \\ &= \$ 9,926.79 \end{aligned}$$

$$\text{Gain in ₹:} = \$ 9926.79 / \$ 0.016136 = ₹ 615195 \text{ (Inflow)}$$

- Settlement of foreign currency payable or receivable

$$\begin{aligned} \text{Sell US\$ 10,000,000 @ ₹/\$ 0.016136} &= \frac{\$1,00,00,000}{\$0.016136} \\ &= ₹ 61,97,32,276 \text{ (inflow)} \end{aligned}$$

$$\begin{aligned} \text{Int. On margin} &= ₹ 22,500 \times 25 \text{ contracts} \times 7\% \times \frac{3}{12} \\ &= ₹ 9,843.75 \text{ (outflow)} \end{aligned}$$

$$\text{Net Inflow} = 6,15,195 + 61,97,32,276 - 9843.75 = ₹ 62,03,37,627$$

3) No Hedging

$$\text{Inflow under no hedging:} = \frac{\$1,00,00,000}{\$0.16136} = ₹ 61,97,32,276$$

Conclusion: Futures, Higher the better



QUESTION 56:

N 06 | RTP

only on

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	
Spot	US \$/₹ 0.02140	Contract size	₹ 4,72,000
1 Month Forward	0.02136	June	0.02126
3 Months Forward	0.02127	September	0.02118
	Initial Margin	Interest Rates in India	
June	₹ 10,000	7.50%	
September	₹ 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.

- 1) Using forward contract
- 2) Using currency futures
- 3) Not hedging currency risks.

It may be assumed that variation in margin would be settled on the maturity of the futures contract.

Solution:

1. Forward contract: $= \frac{\$100,000}{\$0.02127} = ₹ 47,01,457$
2. Currency features

No. of contracts $\left[\frac{1,00,000 / 0.02118}{472000} \right] = 10$ contracts long

On 1st Sept, 2009

 - 1) Gain/(loss) on future $(\$ 0.02134 - \$ 0.02118) \times ₹ 4,72,000 \times 10$ contracts
 $= \$ 755.2$ (Inflow)
 Sell \$ 755.2 @ \$ 0.02133 $= ₹ 35,406$
 - 2) Int. on margin $= ₹ 15,000 \times 8\% \times 3/12 \times 10 = ₹ 3,000$ (outflow)
 - 3) Sell US\$ 1,00,000 @ \$0.02133 $= \$1,00,000 / \0.02133
 $= ₹ 4688233$

Net inflow: $₹ 46,88,233 + ₹ 35,406 - 3,000 = ₹ 47,20,639$

Conclusion: Since, in case of option (ii) the inflow is the highest that is why this option to be chosen



QUESTION 57:

N 11 | M 21 RTP | SM

Zaz plc, a UK Company is in the process of negotiating an order amounting €2.8 million with a large German retailer on 6 month's credit. If successful, this will be first time for Zaz has exported goods into the highly competitive German Market. The Zaz is considering following 3 alternatives for managing the transaction risk before the order is finalized.

- a) Mr. Peter the Marketing head has suggested that in order to remove transaction risk completely Zaz should invoice the German firm in Sterling using the current €/£ average spot rate to calculate the invoice amount.
- b) Mr. Wilson, CE is doubtful about Mr. Peter's proposal and suggested an alternative of in-voicing the German firm in € and using a forward exchange contract to hedge the transaction risk.
- c) Ms. Karen, CFO is agreed with the proposal of Mr. Wilson to invoice the German first in €, but she is of opinion that Zaz should use sufficient 6 month sterling future contracts (to the nearest whole number) to hedge the transaction risk.

Following data is available:

Spot Rate	€ 1.1960 - €1.1970/£
6 month forward points	0.60 – 0.55 Euro Cents.
6 month future contract is currently trading at	€ 1.1943/£
6 month future contract size is	£62,500
After 6 month Spot rate and future rate	€ 1.1873/£

You are required to

- a. Calculate (to the nearest £) the £ receipt for Zaz plc, under each of 3 above proposals.
- b. In your opinion which alternative you consider to be most appropriate.
- c. Interpret the proposal of Mr. Peter from non-financial point of view.

Solution:

Proposal I Invoice in home currency

$$\begin{aligned} \text{Average Rate} &= \frac{1.1960 + 1.1970}{2} = \text{€ } 1.1965/\text{£} \\ \text{Pounds receivable after 6M} &= \frac{\text{€ } 2.8 \text{ million}}{\text{€ } 1.1965} = \text{£ } 2,340,159 \quad \text{IF} \end{aligned}$$

Proposal II

Forward contract

Ask rate will be applicable € 1.1970

+ swap points (0.0055)

€ 1.1915/£

Pounds receivable after 6M = $\frac{\text{€ } 28,00,000}{\text{€ } 1.1915} = \text{£ } 23,49,979 \quad \text{IF}$

Proposal III

Currency futures, NS. Karen

Today:

$$\begin{aligned} \text{No. of contract to long} &= \left[\frac{28,00,000 / 1.1943}{62500} \right] \\ &= 37.51 \\ &= 38 \text{ contracts long of £ futures @ € / £ 1.1943} \end{aligned}$$

After 6m:

- 1) loss futures: $= (1.1873 - 1.1943) \times 38 \times 62,500$
 $= \text{€ } 16,625$
 Loss in terms of £ $= \frac{(16,625)}{1.1873} = \text{£ } 14,002 \text{ (outflow)}$
- 2) Spot market: Sell € 2.8 million @ € 1.1873
 Amount received in £ $= \frac{28,00,000}{1.1873} = \text{£ } 23,58,292 \text{ (Inflow)}$
 Net inflow after 6m $= \text{£ } 23,44,290 \text{ (Inflow)}$

Opinion: Since Mr. Wilson's proposal that is forward hedge gives the highest inflow it is most appropriate

From non-financial perspective, in case of proposal (i) there must be a doubt as to whether this would be acceptable to German firm as it is described as a competitive market and Telereal Trillium is moving into it first time.



QUESTION 58:

M 19 | N 15 | M 07 | SM

XYZ Ltd. a US firm will need £ 3,00,000 in 180 days. In this connection, the following information is available:

Spot rate 1 £ = \$ 2.00

180 days forward rate of £ as of today = \$1.96

Interest rates are as follows:

	U.K.	US
180 days deposit rate	4.50%	5%
180 days borrowing rate	5%	5.50%

Handwritten note:
 Ambiguity:
 Rates are not assumed
 pos. Rates assumed
 periodic.

A call option on £ that expires in 180 days has an exercise price of \$ 1.97 and a premium of \$ 0.04.

XYZ Ltd. has forecasted the spot rates 180 days hence as below:

Future rate	Probability
\$1.91	25%
\$1.95	60%
\$2.05	15%

Which of the following strategies would be most preferable to XYZ Ltd.?

1. A forward contract;
2. A money market hedge;
3. An option contract;
4. No hedging.

Show calculations in each case

Solution:

1. \$ outflow after 180 days under Forward contract

$= £ 3,00,000 \times \$ 1.96$
 $= \$ 5,88,000$

2. Money Market Hedge

Invest PV of £ 3,00,000 @ 4.5% for 180 days

$$= \frac{£300,000}{1 + 0.045} = £ 2,87,081$$

Buy at spot rate @ \$2.00

$$= £ 2,87,081 \times \$2 = \$ 5,74,163$$

Borrow \$ 5,74,163 @ 5.50% for 180 days

$$= \$ 5,74,163 (1 + 0.055)$$

Outflow at the end of 180th day = \$ 6,05,742

3. Option contract

Today:

To hedge the £ payable exposure, we will buy call option on £ 3,00,000 @ E = \$/£ 1.97

After 180 days:

Probability	Expected spot	Option exercised	Effective Rate	C × d
0.25	\$1.91	No	1.91	\$0.4775
0.60	\$1.95	No	1.95	\$1.7
0.15	\$2.05	Yes	1.97	\$0.2955
				\$1.943/£

$$\times £ 3,00,000$$

\$ Outflow under the option

$$\$ 5,82,900$$

Calculation of premium £ 300000 × 0.04

$$\$ 12,000$$

Total \$ outflow after 180 days

$$\$ 5,94,900$$

4. No Hedging = £ 3,00,000 × \$ 1.955

= \$ 5,86,500

Conclusion: \$ Outflow after 180 days under different alternatives

1. Forward contract \$ 5,88,000
2. Money Market \$ 6,05,742
3. Option Contract \$ 5,94,900
4. No Hedging \$ 5,86,500

Outflow under no hedging is least, this strategy is preferable

Note: Interest on option premium has been ignored. Answer may differ if considered in calculation.



QUESTION 59:

N 13 | SM

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 Finance 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\$ 705000 option on a 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	0.88	1.75
0.94	1.02	NA	NA	NA
0.95	0.65	1.64	1.92	2.34

According to the suggestion of finance 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 use forward rate as the best estimate of spot. Transaction costs are ignored.

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.

Solution:

Forward Cover

	1M	3M
Contract	CA\$ 10,10,000	CA\$ 705,000
Rates	× US\$ 0.9301	× US\$ 9356
Outflow at the end of 1M & 3M US\$	9,39,401	US \$ 6,59,598

Option Contract

1M	3M
----	----

No. of contracts	20.2 contract	14.1 contracts
	$\left(\frac{\text{CA\$10,10,000}}{\text{CA\$50,000}} \right)$	$\left(\frac{\text{CA\$7,05,000}}{\text{CA\$50,000}} \right)$
	~ 20 contracts long of call	~ 14 contracts long of call
	<u>1M</u>	<u>3M</u>
Total exposure	Can\$ 10,10,000	Can\$ 7,05,000
Less: Hedged exposure	(Can\$ 10,00,000)	(Can\$7,00,000)
	<u>(\$50,000 × 20 contracts)</u>	<u>(\$ 50,000 × 14 contracts)</u>
Unhedged exposure	<u>Can \$ 10,000</u>	<u>Can\$5,000</u>

Settlement:

US\$ outflow (Hedged amount)	(US\$ 9,40,000) <i>OF</i> [Can\$ 10,00,000 × 0.94]	(US\$ 6,65,000) [Can\$ 7,00,000 × 0.95]
US\$ Outflow (Unhedged Amount)	(US\$ 9301) <i>OF</i> <i>GM</i> [\$ 10,000 × 0.9301]	(US\$ 4678) [\$ 5000 × 0.9356]
Premium (Outflow)	(US\$ 10200) <i>OF</i> (20 contracts × \$ 50000 × 0.0102)	(US\$ 11480) (14 contracts × 50,000 × 0.0164)
Total Outflow	US\$ 9,59,501	US\$ 6,81,158

Recommendation: Forward hedging is preferable.

Note: Interest on option premium has been ignored. Answer may differ if considered in calculation.



QUESTION 60:

M 10 | RTP M 10 | SM

A Ltd. of U.K. has imported some chemical worth of USD 3,64,897 from one of the U.S. supplier. The amount is payable in six months time. The relevant spot and forward rates are:

Spot rate	USD 1.5617-1.5673	<i>1 t</i>
6 months' forward rate	USD 1.5455 -1.5609	<i>1 t</i>

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?

Solution:

a) Forward cover = $\frac{\text{USD } 3,64,897}{\text{USD } 1.5455} = \text{£ } 2,36,103$

b) Money Market Cover

Invest PV @ 4.5% for 6 months. \$ to be invested today:

$$= \frac{\text{USD } 3,64,897}{1 + 0.045 \times 6/12} = \text{USD } 3,56,867$$

Buy \$ 3,56,867 @ Spot rate of USD 1.5617 & pay £

$$= \frac{\text{USD } 3,56,867}{\text{USD } 1.5617} = \text{£ } 2,28,512$$

Borrow £ 2,28,512 @ 7% for 6 months. Outflow after 6m:

$$= \text{£ } 2,28,512 (1 + 0.07 \times 6/12) \\ = \text{£ } 236,510$$

b) Currency Options

Today:

$$\text{No. of contracts} = \frac{364897 / 1.7}{12500} = 17.17 \text{ contracts}$$

~ 17 put contracts long

$$\text{Hedged exposure} = 17 \text{ contracts} \times \text{GBP } 12500 \times \text{USD } 1.70 \\ = \text{USD } 3,61,250$$

$$\text{Unhedged exposure} = \text{USD } 3,64,897 - \text{USD } 3,61,250 \\ = \text{USD } 3,647$$

After 6 months:

$$\text{Hedged exposure: Outflow in £} = \left(\frac{\text{USD } 3,61,250}{\text{USD } 1.70} \right) = (\text{£ } 2,12,500)$$

$$\text{Underhedged exposure: Outflow in £} = \left(\frac{\text{USD } 3,647}{\text{USD } 1.5455} \right) = (\text{£ } 2,360)$$

$$\text{Premium: outflow in £} = \left(\frac{\text{USD } 0.096 \times 12,500 \times 17 \text{ contracts}}{\text{£ } 1.5617} \right) = \text{£ } 13,063 \\ \text{£ } 2,27,923$$

Recommendation: Out of the above 3, the lowest outflow is in case of option. Therefore, we will choose the (c) option.

Note: Interest on option premium has been ignored. Answer may differ if considered in calculation.



QUESTION 61:

N 15 | SM

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.

Solution:

Alternative I : Forward market cover

$$\frac{¥500,000}{¥1.9726} = ₹ 2,53,473$$

Alternative II: Currency Option

Particulars		Amount
Hedged exposure (Outflow): (entire ₹ 500,000 is hedged)	¥500,000	₹ 2,35,294
	¥2.125	
Premium	$2,35,294 \times 0.098$	₹ 11,815
	1.9516	
		₹ 2,47,109

Conclusion: ∴ In case of options, the outflow is lower ∴ We will choose that option

Note: Interest on option premium has been ignored. Answer may differ if considered in calculation.



QUESTION 62:

N 23

A Japanese company imports hi-tech printer cartridges from US worth \$ 1 million. The chief financial officer of the company wishes to know the best strategy for protection against uncertainty, for the payment that has to be made at the end of 3 months. Financial team of the company has collected the following options for evaluation:

Table 1: Exchange rates quoted in Forex Market:

¥/\$ Quotation	Bid Price	Ask Price
Spot rates	146.03	146.63
3m Forward	144.03	145.00
6m Forward	146.35	146.70

Table 2: Option Market rates for European option with 3 months expiry:

	Strike Price (X) ¥/\$	Premium (%) for Call & Put Options
Call & Put	145.20	1.6766% (Call) & 1.7414% (Put)
Call & Put	146.00	1.3505% (Call) & 2.1006% (Put)

The expected spot price at expiry is ¥/\$: 144.90/145.05

Suggest the best strategy for CFO of the Japanese Company to protect against uncertainty, with respect to the following alternatives:

a. Forward Hedge

- b. Buy 3 months call, X=145.20
- c. Sell 3 months put, X = 145.20
- d. Buy call & sell put both having X = 146.00

Solution:

- a) Forward Hedge

Amount payable after 3 months \$ 1,000,000

3-month applicable buying rate ¥ 145/\$

Amount payable in Yen ¥ 145 m

- b) Buy 3-month call option today @ X = ¥ 145.20/\$ for \$ 1m

On expiry, if expected spot price after 3 month is ¥ 145.05, then company would not exercise its option.

Accordingly, the cost of import will be

Buying Yen in spot Market after 3 months	¥ 145.05 m
Add: Premium Paid (\$ 1 m x 1.6766% x ¥ 145.20)	¥ 2.43 m
	¥ 147.48 m

- c) Selling 3 month Put at X = ¥ 145.20/\$ for \$ 1m

On expiry, if expected spot price after 3 month ¥ 144.90, then Put Option buyer will exercise his /her option.

Accordingly, the import Bill will be:

Buying Yen in under option after 3 months	¥ 145.20 m
Less: Premium Received (\$ 1 m x 1.7414% x ¥ 145.20)	- ¥ 2.53 m
	¥ 142.67 m

- d) Buying Call and selling Put at X = ¥ 146

Net Premium receipt

If expected spot Rate expiry happens to be ¥ 144.90/145.05, then call option will be lapsed and Put option by buyer will be exercised.

Accordingly, the import bill will be:

Buying US\$ under Put Option	¥ 146.00 m
Add: Premium paid on call option = ¥ 146.00 x 1.3505%	¥ 1.9717 m
Less: Premium Receipt on Put option = ¥ 146.00 x 2.1006%	(¥ 3.0669 m)
	¥ 144.9048 m

Decision: Since expected outflow is least in case of selling Put option, the same strategy is recommended.



QUESTION 63:

RTP N 18

theory & [mcq]

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.

Solution:

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.

G. Important Residual Topics



QUESTION 64:

N 24 | N 18 | RTP | SM

You as a dealer in foreign exchange have the following position in Swiss Francs on 31st October, 2009:

Particulars	Swiss Francs
Balance in the Nostro A/c 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 A/c and keep as overbought position on Swiss Francs 10,000?

Solution:

Nostro A/C – Cash Position

	Debit	Credit
Opening balance Credit		1,00,000
Remitted by TT	75,000	
Credit balance C/d	25,000	
	1,00,000	1,00,000
To credit balance b/d		25,000
Buy spot		5,000
To Bal c/d (Cr. Bal)	30,000	

Exchange Position

	Bought	Sold
Opening Position	50,000	
Purchased 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	
	1,60,000	1,65,000
Bal c/d (over sold)	5,000	
	1,65,000	1,65,000

Bank buy in spot SWF 5,000 to make the balance of Nostro account to SWF 30,000. But, this would make the exchange position as Nil.

Since bank has to maintain position over-bought by SWF 10,000, ∴ Bank will by SWF 10,000 in forward market

To balance b/d	5,000
Buy spot	5,000
Buy forward	10,000
Balance c/d (over bought)	<u>10,000</u>
	<u>15,000</u> <u>15,000</u>



QUESTION 65:

MTP M 14

only on calc

You as a forex dealer have dealing position in your account in London:

Particulars	£
Opening Balance (Oversold)	187,500
Purchase of cheques not credited to the account	164,000
Outstanding Forward Contracts:	
Sales	4,096,500
Purchases	3,651,500
DD issued not yet presented for payment	610,040
Bill purchased in hand not due for	1,442,820

What must you do to square up your position?

Solution:

Exchange Position

	Purchase (£)	Sales (£)
Balance (Oversold)		1,87,500
Cheques purchased	1,64,000	
Forward Sales		40,96,500
Forward Purchases	36,51,500	
DD issued		6,10,040
Bill purchased	14,42,820	
	52,58,320	48,94,040
Balance Overbought		3,64,280

Since dealer has overbought position of £364,280, it will sell this amount (nearest amount £364,000 because it will have to buy in interbank market where the deals are available in rounding off).



QUESTION 66:

RTP | SM

only on calc

ABN-Amro Bank, Amsterdam, wants to purchase ₹ 15 million against US\$ for funding their Nostro account with Canara Bank, New Delhi. Assuming the inter-bank, rates of US\$ is ₹ 51.3625/3700, what would be the rate Canara Bank would quote to ABN-Amro Bank? Further, if the deal is struck, what would be the equivalent US\$ amount.

Solution:

ABN wants to purchase ₹ 15 million against US\$ Quote given = ₹/\$ that means we will have to sell dollar therefore relevant rate is bid rate

$$= \frac{1,50,00,000}{51.3625} = 2,92,041.86$$



QUESTION 67:

SM

only on wle

XYZ Bank, Amsterdam, wants to purchase ₹ 25 million against £ for funding their Nostro account and they have credited LORO account with Bank of London, London.

Calculate the amount of £'s credited. Ongoing inter-bank rates are per \$=₹ 61.3625/3700 & per £= \$ 1.5260/70.

Solution:

$$\begin{aligned} ₹/£ &= ₹/\$ \times \$/£ \\ &= 61.3625 \times 1.5260 \quad - \quad 61.3700 \times 1.5270 \\ &= ₹ 93.6392 \quad - \quad 93.7120 \end{aligned}$$

$$\text{Amount of £ to be credited} = \frac{25,000,000}{93.6392} = £ 2,66,982.20$$



QUESTION 68:

SM

نہی نہ

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	₹ 48.5275
6 months forward	₹ 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.

Solution:

$$\begin{aligned} \text{a. Interest amount: } & \text{USD } 20,00,000 \times 3/100 \times 6/12 = \text{USD } 30,000 \\ \text{Commitment in \$} &= 20,00,000 + 30,000 = \$ 20,30,000 \\ \times 6\text{m ₹/\$ fwd rate} & \quad \times 48.4575 \\ \text{Commitment in ₹} &= 9,83,68,725 \end{aligned}$$

- It is seen from the forward rates that the market expectation is that the dollar will depreciate. If the firm's own expectation is that the dollar will depreciate more than what the bank has quoted, it may be worthwhile not to cover forward and keep the exposure open.

If the firm has no specific view regarding future dollar price movements, it would be better to cover the exposure.



QUESTION 69:

M 21 | M 12

only on calc

MC 5

FC \$

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 differ if Mr. Mammen invests in the bond just before the interest payable.

Solution: typical:

- (i) If USD is flat

$$\begin{aligned} \text{Return in \$} &= \frac{(\text{Price at end} - \text{Price at beginning}) + \text{Interest}}{\text{Price at beginning}} \\ &= \frac{(103 - 100) + 3}{100} = 0.06 \text{ say } 6\% \end{aligned}$$

return in ₹: ∵ USD is flat
∴ return in ₹ = 6%

- (ii) If USD appreciates by 3%, return in ₹:

$$(1 + 0.06) \times (1 + 0.03) - 1 = 1.06 \times 1.03 - 1 = 0.0918 \text{ i.e., } 9.18\%$$

- (iii) If USD depreciates by 3%, return in ₹:

$$(1 + 0.06) \times (1 - 0.03) - 1 = 1.06 \times 0.97 - 1 = 0.0282 \text{ i.e., } 2.82\%$$

- (iv) If Indian Rupee is appreciated by 5%, return in ₹:

$$(1 + 0.06) \times (1 - 0.05) - 1 = 1.06 \times 0.95 - 1 = 0.007 \text{ i.e., } 0.7\%.$$

- (v) No, our answer will not differ even if Mr. Mammen invests in bond just before the interest is payable.



QUESTION 70:

M 23 | N 20 | N 18

MC 5

ICL an Indian MNC is executing a plant in Sri Lanka. It has raised ₹ 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:

Market	Japan	US
Nature of Investment	Index Fund (JPY)	Treasury Bill (USD)
Dividend (in billions)	25	
Income from stock lending (in billions)	11.9276	
Discount on initial investment at the end	2%	
Interest		5% pa
Exchange Rate (1st April, 2020)	JPY/INR 1.58	USD/INR 0.014
Exchange Rate (30th September, 2020)	JPY/INR 1.57	USD/INR 0.013

\$/₹

You, as an Investment Manager, is required to suggest the best course of option. What would be your decision from a risk perspective? You may ignore taxation.

Solution:

Option I: Investment in Japan

Investible today	₹ 200 billion
Exchange Rate spot rate today	¥/₹ 1.58
Amount Invested today	¥ 316 billion

	<u>In Billion</u>
Dividend	¥ 25
Income from stock lending	¥ 11.9276
Value of investment after 6M 316×0.98	<u>¥ 309.68</u>
¥ Inflow after 6M	¥ 346.6076
Convent forward Rate	<u>¥/₹ 1.57</u>
Total ₹ inflow after 6M	<u>₹ 220.7692</u>

Option II: Investment in US

	<u>In Billion</u>
₹ Outflow today	₹ 200
Exchange Rate	<u>\$/₹ 0.014</u>
\$ Outflow	\$ 2.8
Int. @ 5% for 6M	<u>\$ 0.07</u>
\$ Inflow after 6M	\$ 2.87
Forward Rate	<u>\$/₹ 0.013</u>
Total ₹ Inflows	₹ 220.7692

Suggestion: Both Japan and US given same return. However, USD is more stable, and Treasury Bills are risk free, so investment in Treasury Bills (USD) is suggested.



QUESTION 71:

N 19

A German subsidiary of an US based MNC has to mobilize 100000 Euro's working capital for the next 12 months. If has the following options:

Loan from German Bank	:	@ 5% p.a.
Loan from US Parent Bank	:	@ 4% p.a.
Loan from Swiss Bank	:	@ 3% p.a.

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.

Solution:

Loan from German Bank

Effective Int. Cost	5% + 0.25%	5.25%
---------------------	------------	-------

Loan from us Parent Bank

Net Int. To US Bank	4%	
Withholding tax	8%	
Gross Int. to US Bank	$4\% / (1 - 0.08)$	4.35%
Add: Premium (12M) on US\$	$(5-4) / 1.04$	0.96%
Effective Int cost		5.31%

Loan from Swiss Bank

Net Int to cost	3%	
Withholding tax	8%	
Cross Int to bank	$3\% / (1 - 0.08)$	3.26%
Add Premium (12M) on US\$	$(5-3) / 1.03$	1.94%
		5.20%



QUESTION 72:

M 19

only on loan *Typical & easy.*

K Ltd. currently operates from 4 different buildings and wants to consolidate its operations into one building which is expected to cost ₹ 90 crores. The Board of K Ltd. has 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:

- Calculate the overall cost both in percentage and rupee terms on an annual basis.
- What is the cost of hedging in rupee terms? *means it doesn't hedge.*
- 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.

Solution:

- Overall cost both in percentage and rupee terms
Overall cost in % terms

Particulars	Amount
Upfront fee = 1.2% $\left[\frac{1.2}{3.4} \right]$	0.35%
Add: Interest cost (2.50 + 1.05)	3.55%

after considering Savings of hedging cost.

Add cost of Hedging	4%
	7.9%

Overall cost in ₹ terms

$$\text{GBP } 1,00,00,000 \times 7.9\% \times 90 = ₹ 7,11,00,000$$

(ii) Cost of Hedging in Rupee terms

$$\text{Annual Cost} \quad 1,00,00,000 \times 90 \times 4\% \quad 3,60,00,000$$

(iii) Gain/(Loss) on loan amount

Particulars	INR Depreciate	INR Appreciate
Expected Spot Rate	₹/₹ 99 (90 × 1.1)	₹/₹ 81 (90 × 0.9)
Gain/(Loss) on loan amount	IF OF (90 - 99) × 10M = - 9,00,00,000	IF OF (90 - 81) × 10M = + 9,00,00,000
Saving of Hedging cost	3,60,00,000	3,60,00,000
Net Gain/(Loss)	- 5,40,00,000	+12,60,00,000



QUESTION 73:

M 22 | N 08 | RTP 1 Sm

Handwritten note: Savings in hedging cost of five year should be considered here logically

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 = ₹ 75

180 days forward rate US \$ 1 = ₹ 77

Commission charges for letter of credit at 2% per 12 months.

a. Justify why the offer from the foreign branch should be accepted?

b. Based on the present market condition company is not interested to take the risk of currency fluctuations and wanted to hedge with an additional expense of ₹ 30,000, if so, what is your advice to the company?

Assume 360 days in the year.

Solution:

a) Alternative I: To finance the purchase by availing loan at 19% p.a.

Cost of Equipment in \$	\$ 15,000
× Exchange Rate	₹/\$ 75
Amount to be borrowed = Cost of Equipment in ₹	₹ 11,25,000
Repayment of borrowing after 2 quarters in ₹:	$= 11,25,000 \times \left[1 + \frac{0.19}{4}\right]^2$ ₹ = 12,34,413

Alternative II: To accept the offer from foreign branch

Cost of Equipment		\$ 15,000
Add: Interest of loan	$\$ 15,000 \times 2\% \times \frac{180}{360}$	\$ 150
= Outflow after 6m in \$		\$ 15,150
× Exchange Rate		₹/\$ 77
= Outflow after 6m in ₹ [A]		₹ 11,66,550
Commission charges (₹)	$\$ 15,000 \times 2\% \times \frac{180}{360} \times 75$	₹ 11,250
Outflow with interest for 2 quarters [B]	$₹ 11,250 \times \left[1 + \frac{0.19}{4}\right]^2$	₹ 12,344
Total outflow after 6m in ₹ [A + B]		₹ 11,78,894

suggested
ne yaha
comp. karna
Bhul gaya.

Advise: Option 2 is cheaper by (₹ 12,34,413 – ₹ 11,78,869) lakh or ₹ 55,544. Hence, the offer may be accepted.

- (b) If company is not interested to take the risk of currency fluctuations and wanted to hedge with an additional expense of ₹ 30,000 then it can do so because even taking forward position is resulting in increased cash outflow by the same amount.

$$11250 \times \left(1 + 0.19 \times \frac{180}{360}\right)$$



QUESTION 74:

N 18

MC 3

An Indian Company obtains the following Quotes (₹/\$)

Spot	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 \$ or ₹. Interest Rates are:

3- Months Interest Rate=	₹ : 12%	\$: 6%
6 - Months Interest Rate =	₹ : 11.50%	\$: 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 - (a) Rupee Borrowing, (b) Dollar Borrowing.

Note: For the purpose of calculation, you can take the units of Dollar and Rupee as 100 each.

Solution:

- Borrow in Dollars

Particulars	Amount
Dollars to be Borrowed	\$ 100
Add: Int for 5.5% for 6M	\$ 2.75
	$[\$ 100 \times 5.5 \times 6/12]$
Dollars payable after 6M	\$ 102.75
Exchange Rate (6M-F)	\$ 36.40
Rupee outflow after 6M	₹ 3740.1

- Borrow in Rupees

Particulars	Amount
Dollars needed today	\$ 100
Exchange Rate (Spot)	₹ 36.10
Total Borrowing in ₹	<u>₹ 3610</u>
Add: Interest for 11.50% for 6M	<u>₹ 207.58</u>
Rupee outflow after 6M	₹ 3817.58

Advise: The co. Should borrow in Dollars because it leads to lower outflow of Rupee after 6M

Calculation of Rate at which company will be indifferent:

$$= (1 + S_6 \times \frac{6}{12}) = (1 + S_6 \times \frac{3}{12}) \times (1 + FR_{3 \times 6} \times \frac{3}{12})$$

(a) Rupee Borrowing

$$(1 + 0.115 \times \frac{6}{12}) = (1 + 0.12 \times \frac{3}{12}) \times (1 + FR_{3 \times 6} \times \frac{3}{12})$$

$$FR_{3 \times 6} = 10.68\%$$

(b) Dollar Borrowing

$$(1 + 0.055 \times \frac{6}{12}) = (1 + 0.06 \times \frac{3}{12}) \times (1 + FR_{3 \times 6} \times \frac{3}{12})$$

$$FR_{3 \times 6} = 4.93\%$$



QUESTION 75:

N 20

Interest rates for 3 months in USA and Canada are as follows:

Currency	Borrow	Invest
US \$	4%	2.50%
Canadian \$	4.50%	3.50%
Can \$/US \$ spot	1.235 - 1.240	
3 months forward	1.255 - 1.260	

Advice, the currency in which borrowing and lending for 3 months needs to be done for the US company. Take 3 months = 90/360 days.

Solution:

Assumption: Principal amount of US\$ 1,000

BORROWING:

Option 1: Borrowing in US\$

$$\text{Outflow after 3m in US\$} = 1000 * \left(1 + 0.04 \times \frac{3}{12} \right) = \$ 1010$$

Option 2: Borrowing in Can\$

1) Can\$ to be borrowed: equivalent to \$ 1,000

$$= \$ 1000 \times \text{CA\$ } 1.240 = \text{CA\$ } 1240$$

- 2) Can\$ to be repaid after 90 days:

$$= 1240 \times \left(1 + 0.045 \times \frac{90}{360} \right) = \text{CA\$ } 1253.95$$

- 4) US\$ outflow for buying Can\$ 1253.95:

$$= \frac{\text{CA\$ } 1253.95}{\text{CA\$ } 1.255} = \text{US\$ } 999.16$$

Advice: Since US\$ outflow is least in Can \$, the borrowings should be made in Can \$.

INVESTMENT:

Option 1: Investing in US\$

$$\text{Inflow after 3m in US\$} = \text{US\$ } 1,000 \left(1 + 0.025 \times \frac{3}{12} \right) = \text{US\$ } 1006.25$$

Option 2: Investing in Can\$

- 1) Convert US\$ 1000 at spot rate and receive CA\$

$$= \text{US\$ } 1000 \times \text{CA\$ } 1.235 = \text{CA\$ } 1235$$

- 2) Invest CA\$ 1235 @ 3.5% for 3m & inflow after 3m:

$$= \text{CA\$ } 1235 \left(1 + 0.035 \times \frac{3}{12} \right) = \text{CA\$ } 1245.81$$

- 3) Convert CA\$ 1245.81 at 3m Forward Can\$/US\$ 1.260:

$$= \frac{\text{CA\$ } 1245.81}{1.260} = \text{US\$ } 988.74$$

Advice: Since inflow is more in US\$, amount should invest in US \$.



QUESTION 76:

M 19 | N 13 | RTP

Your bank's London office has surplus funds to the 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 centres 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 months	80/85	
	London on Frankfurt	

Foreign Exchange & International Financial Management

Spot	1.8260/90	€ / £ .
1 month	60/55	
2 month	95/90	
3 month	145/140	

At which centre, will be investment be made & what will be the net gain (to the nearest pound) to the bank on the invested funds?

Solution:

Alternative I: Invest in London

Particulars	Amount
\$ to be invested	\$ 5,00,000
÷ Exchange Rate	\$ 1.5390
£ to be invested today	£ 3,24,886
Add: Interest for 3m @ 5%	£ 4,061
Total £ Inflow after 3m [A]	£ 3,28,947
\$ amount invested	\$ 500,000
Add: Cost of funds @ 4% for 3m	\$ 5,000
	\$ 5,05,000
÷ Exchange Rate	\$ 1.543
[B]	£ 3,27,285
Net Gain [A - B]	£ 1,662

Alternative II: Invest in New York

Net Gain in \$ = \$ 5,00,000 × (8% - 4%) × 3/12	\$ 5,000
Exchange Rate (Ask Rate)	\$ 1.5475
	£ 3,231

Alternative III: Invest in Frankfurt

\$ to be invested today	\$ 5,00,000
× Exchange Rate [€/\$: $\frac{1.8260}{1.5390}$]	€ 1.1865
€ to be invested today	€ 5,93,250
Add: Interest 3% for 3m	€ 4,449
€ inflow after 3m	€ 5,97,699
÷ Exchange Rate (€/£ ask)	€ 1.815
£ inflow after 3m	£ 3,29,311
Net gain	= £ 3,29,311 - 3,27,285 = £ 2026

Conclusion: Investment should be made in New York centre in terms of dollar and net gain will be £ 3231



QUESTION 77:

MTP M 19

With the relaxation of investment norms in India in international market upto \$ 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 ₹ 1.58 crore on 1.1.20x1 in Standard & Poor Index. On 1.1.20x2 Mr. X sold his investment. The other relevant data is given below:

	1.1.20x1	1.1.20x2
Index of Stock Market in India	7395	?
Standard & Poor 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 1.1.20x2 at which Mr. X would be indifferent between investment in Standard & Poor Index and Indian Stock Market.

Solution:

(a) Return for US investor: $\frac{2028 - 1919}{2,028} = - 5.37\%$

(b)	Amount in ₹	1.58cr.
	Exchange Rate	₹ 62.25
	Amount invested in \$	\$ 2,53,815
	Index on 01.01.2001	2,028
	No. of index purchase	125.16
	Index on 01.01.2001	1,919
	Amount redeemed in	\$2,40,182.04
	Rate	67.25
	Proceeds in ₹	₹ 1,61,52,242.19

$$\text{Rate} = \frac{1,61,52,242.19 - 1,58,00,000}{1,58,00,000} \times 100 = 2.23\%$$

(c)	Initial Investment	1,58,00,000
	÷ Purchase price	7395
	No. of Indian Index	2136.58

$$\frac{2,136.58 \times X - 1,58,00,000}{1,58,00,000} = 2.23\%$$

$$X = 7,560$$



QUESTION 78:

M 07 | 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:

U.S. \$12.5 million

U.K. £ 6 million

Following exchange rate information is obtained:

	\$/₹	£/₹
Spot	0.0215	0.0149
30 days forward	0.0217	0.015

Annual borrowing/deposit rates (Simple) are available.

₹	6.4%/6.2%
\$	1.6%/1.5%
£	3.9%/3.7%

The Indian operation is forecasting a cash deficit of ₹ 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 in ₹ for each company under each of the following scenarios ignoring transaction costs and taxes:
 - Each company invests/finances its own cash balances/deficits in local currency independently. *decentralized.*
 - Cash balances are pooled immediately in India and the net balances are invested/borrowed for the 30 days period. *centralized.*
- Which method do you think is preferable from the parent company's point of view?

Solution:

- (a) Cash balance at the end of 30 days period if each company invests/finances its own cash balances/deficits:

Particulars	Rupees	US	UK
Surplus funds / Deficit	(500M)	\$12.5M	£ 6 million
Interest	(2.67M) [-500M × 6.4% × 30/360]	\$ 0.015625M [\$12.5 × 1.5% × 30/360]	£ 0.0185 M [£ 6M × 3.7% × 30/360]
Amount after 30 days	(502.67M)	\$ 12.515625	£ 6.0185M
Exchange Rate		\$ 0.0217	£ 0.015
	(502.67M)	₹ 576.5757	₹ 401.233
		₹ 475.32M	

- (b) Cash balance at the end of 30 days period if balances/deficits are pooled immediately:

Particulars	Rupees	US	UK
	(500)	\$ 12.5M	£ 6M
Exchange		\$ 0.0215	£ 0.0149
Equivalent Amount	(₹ 500)	₹ 581.396	₹ 402.684
		484.08	

Add: Int. @ 6.2% for 30 days	2.5
	486.58



QUESTION 79:

RTP N 20

Suppose you are a treasurer of XYZ plc in the UK. XYZ have two overseas subsidiaries, one is based in Amsterdam and another in Switzerland. The surplus position of funds in hand is as follows which it does not need for the next three months but will be needed at the end of that period (91 days).

Holding Company	£ 150,000
Swiss Subsidiary	CHF 1,996,154
Dutch Subsidiary	€ 1,450,000

Given the rates below:

Spot Rate (€)	£0.6858- 0.6869	£/€
91 day Pts	0.0037 0.0040	
Spot Rate (£)	CHF 2.3295- 2.3326	CHF/£
91 day Pts	0.0242 0.0228	

Interest rates for the Deposits

Amount of Currency	91-day Interest Rate % pa		
	£	€	CHF
0 – 100,000	1	¼	0
100,001 – 500,000	2	1 ½	¼
500,001 – 1,000,000	4	2	½
Over 1,000,000	5.375	3	1

You have been approached by your banker wherein the above-mentioned surplus was lying, requesting you to swap the surplus lying with other two subsidiaries and place them in deposit with them.

Determine the minimum interest rate per annum (upto 3 decimal points) that should be offered by the bank to your organization so that your organization is ready to undertake such swap arrangement.

Note: Consider 360 days a year.

Solution:

Particulars	Holding	Swiss	Dutch
Surplus Funds	£ 1,50,000	CHF 1996154	€ 14,50,000
Interest	£ 758.33 (2% × 91/360 × 1,50,000)	5046 (1% × 91/360)	€ 10,996
Amount after 91 days	£ 1,50,758.33	CHF 2001200	€ 14,60,996
Exchange Rate		2.3098	£ 0.6895
Equipment Amount in pounds	£ 1,50,758	£ 8,66,395	£ 10,07,356
Total Amount in pound if surplus invested individually	£ 1,50,758 + £ 8,66,395 + £ 10,07,356 = £ 2024,509.		

Particulars	Holding	Swiss	Dutch
Amount	£ 1,50,000	CHF 1996154	€ 14,50,000
Exchange Rate	—	CHF 2.3326	£ 0.6858
Equivalent Amount	£ 1,50,000	£ 85,57,604 85,764	£ 9,94,410
Surplus investible today	£ 20,00,174		

$$\text{Min. Int Rate} = \frac{(20,24,509 - 20,00,174)}{20,00,174} \times \frac{360}{91} \times 100 = 4.813\%$$



QUESTION 80:

N 21 | N 20 | N 06 | RTP

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%. → **MC**

- You are required to find out the investment worth of the project by
 - Home Currency Approach
 - Foreign Currency Approach
- What will be the impact if there is a withholding tax of 10% applicable on the project in case of
 - Home Currency Approach
 - Foreign Currency Approach

Given:

t	1	2	3	4	5
PVIF (8%, t)	0.92593	0.85734	0.79383	0.73503	0.68058
PVIF (7%, t)	0.93457	0.87344	0.81630	0.76290	0.71299

Solution:

Working Notes:

Year	₹/LKR
1	$0.37 \times \frac{1.06}{1.0502} = 0.373$
2	$0.373 \times \frac{1.06}{1.0502} = 0.376$
3	$0.376 \times \frac{1.06}{1.0502} = 0.380$
4	$0.380 \times \frac{1.06}{1.0502} = 0.384$

5	$0.384 \times \frac{1.06}{1.0502} = 0.388$
---	--

1. a) Home Currency Approach

Years	CF (LKR Bn.)	₹/LKR	CF (₹ Bn.)	PVF @ 8%	DCF (₹ Bn.)
1	5	0.373	1.865	0.92593	1.727
2	6	0.376	2.256	0.85734	1.934
3	7	0.380	2.66	0.79383	2.112
4	8	0.384	3.072	0.73503	2.258
5	9	0.388	3.492	0.68058	2.377
PV of Inflows					10.408
Less: Outflows	25	0.370			-9.250
					1.158

b) Foreign Currency Approach

$$(1 + 0.06) (1 + \text{Risk Premium}) = 1.08$$

$$1 + \text{Risk Premium} = 1.08/1.06 = 1.01887$$

$$\text{Therefore, Risk adjusted LKR Rate} = 1.01887 \times 1.0502 - 1 = 0.07 \text{ or } 7\%$$

Calculation of NPV

Years	CF (LKR)	PVF @ 7%	DCF
1	5	0.93457	4.673
2	6	0.87344	5.241
3	7	0.81630	5.714
4	8	0.76290	6.103
5	9	0.71299	6.417
PV of Inflows			28.148
Less: Outflow			-25.000
NPV (LKR)			3.148
× ₹/LKR			0.370
NPV (₹)			1.165

Decision: NPV is positive in the approach so, project will worth investment.

2. If there is a withholding tax of 10%:

a) Home Currency Approach

PV of Inflows (₹ Bn.)	10.408
Less: Tax @ 10%	1.041
After tax inflows (₹ Bn.)	9.367
Less: PV of Outflows (₹ Bn.)	-9.250
NPV (₹ Bn.)	0.117

b) Foreign Currency Approach

PV of Inflows (LKR Bn.)	28.148
Less: Tax @ 10%	2.815
After tax inflows (LKR Bn.)	25.333
Less: PV of Outflows (LKR Bn.)	25.000
NPV (LKR Bn.)	0.333
	0.37
NPV ₹ Bn	1.1232

Decision: NPV is positive in the approach so, project will worth investment.



QUESTION 81:

M 17 | N 07 | RTP

A USA based company is planning to set up a software development unit in India. Software developed 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 subject to corporate tax of 30 per cent and a withholding tax of 10 per cent 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 estimates are as follows:

Rent for fully furnished unit with necessary hardware in India ₹ 15,00,000

Man power cost (80 software professional will work for 10 hours/day ₹ 400 per man hour

Administrative and other costs ₹ 12,00,000

Advise the US Company on the financial viability of the project. The rupee-dollar rate is ₹ 48/\$.

Note: Assume 365 days a year.

Solution:

Calculating total cost incurred in India

Revenue	\$ 10 million × ₹ 48	₹ 48,00,00,000
Less costs		
Rent		(₹ 15,00,000)
Manpower	₹ 400 × 80 × 10 × 365	(₹ 11,68,00,000)
Admin Cost		(₹ 12,00,000)
Profit before tax		₹ 36,05,00,000
Less: Corporate tax @ 30%		(10,81,50,000)
Profit after tax		₹ 2,52,35,00,000
Less: withholding tax @ 10%		(₹ 2,52,35,000)
Profit		₹ 22,71,15,000

Total cost in ₹ = Revenue – Profit

$$= ₹ 48,00,00,000 - 22,71,15,000 = ₹ 25,28,85,000$$

$$\text{Cost in \$} = \frac{25,28,85,000}{48} = \$ 52,68,437.5$$

$$\text{NPV from the project} = \$ 1,20,00,000 - \$ 52,68,438 = \$ 67,31,562$$

Advise: Since positive NPV Therefore, project is viable



QUESTION 82:

N 22 | M 22 | N 21 | N 15 | RTP

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 ₹ Currency Cash Flows in nominal terms for this proposal is given below:

Years	Net Cash Flows (in lakhs)			
	0	1	2	3
In US \$	(25)	5	7	8
In ₹	0	60	80	90
If not imported cost of leather to be purchased in India (in ₹)	400	450	500	600

Other information:

- DD Ltd. evaluates all investments by using discount rate of 9% p.a.
- All US customers are invoiced in US \$. US \$ Cash flows converted into ₹ at the forward rate and discounted at Indian Rate.
- Inflation in USA and India are expected to be 9% and 8% respectively.
- The current exchange rate 1 US \$ = ₹ 74

You are required to Calculate Net Present Value and recommend the decision.

Present value factor @ 9% are as under:

Year 1	Year 2	Year 3
0.917	0.842	0.772

Note: Calculation to be made up to 2 decimal points.

Solution:

Expected exchange Rates:

Year	₹/\$
1	$74.00 \times 1.08/1.09 = 73.32$
2	$73.32 \times 1.08/1.09 = 72.65$
3	$72.65 \times 1.08/1.09 = 71.98$

NPV of the proposal if leather is imported from US

	0	1	2	3
Cash Flow is US\$ (Lakh)	(25)	5	7	8
Expected Forward Rates ₹ / US\$	74.00	73.32	72.65	71.98
US Cash Flows in ₹ Lakh	(1,850.00)	366.60	508.55	575.84
Cost of leather if not imported (₹)	(400.00)	(450.00)	(500.00)	(600.00)
India Cash Flows in ₹ Lakh	----	60.00	80.00	90.00
Total Cash Flow ₹ Lakh	(2,250.00)	(23.40)	88.55	65.84
PVF @ 9%	1.000	0.917	0.842	0.772
PV in ₹ Lakh	(2,250.00)	(21.46)	74.56	50.83
NPV				(2146.07)

Logically since dollar cost of importing the leather is already considered in cost, therefore, the same cost should not be considered again for purchase in India in rupees.

Decision: Proposal should not be accepted as NPV is negative.



QUESTION 83:

M 13 | RTP

only on calc

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:

	Year – 0	Year – 1	Year – 2	Year - 3
Cash flows in Indian ₹ (000)	-50,000	-1,500	-2,000	-2,500
Cash flows in African Rands (000)	-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 ₹ 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.
- Ignore taxation.

Solution:

Calculation of forward Rate

Year

0	6	
1	AR 7.6364	$[6 \times 1.40/1.10]$
2	AR 9.7190	$[7.6364 \times 1.40/1.10]$
3	AR 12.3696	$[9.7190 \times 1.40/1.10]$

Cash flows (India)

	0	1	2	3
Real	- 50,000	-1,500	-2,000	-2,500
Nominal	-50,000	-1,650	-2,420	-3,327.5
		$[1,500 \times 1.1]$	$[2,000 \times (1.1)^2]$	$[2,500 \times (1.1)^3]$

Cash Flow (Africa)

	0	1	2	3
Real CF (AR)	-200000	50,000	7,00,000	90000
Nominal CF (AR)	-200000	70,000	1,37,200	246960
		$(50,000 \times 1.4)$	$(70,000 \times (1.4)^2)$	$(90,000 \times (1.4)^3)$
AR/₹ Fwd rates	6	7.6364	9.719	12.3696
Nominal CF (₹)	-33,333	9,167	14,117	19,965

Calculation of NPV

African CF (₹)	-33,333	9,167	14,117	19,965
Indian CF (₹)	-50,000	-1,650	-2,420	-3,327.50
Total CFs	-83,333	7,517	11,697	16,638
PVF @ 20%	1	0.833	0.694	0.579
PV	-83,333	6,262	8,118	9,633
NPV of 3 years	-59,320			
PV of terminal value	$[\frac{16,638}{0.20} \times 0.57] 48,167$			
Total NPV of Project	-11,153			



QUESTION 84:

N 24

PQR Ltd. is considering a project in US, which involve an initial investment of ₹ 124.50 Crore. The project will have useful life of 5 years. Current spot exchange rate is INR/USD is 83. The risk free rate in US is 4.186 % and the same in India is 6.9768%. Cash inflows in USD from the project are as follows

Year	1	2	3	4	5
Cash inflow	30,00,000	40,00,000	50,00,000	60,00,000	70,00,000

PQR Ltd. is expecting net surplus of 1858.08 lakh to be received after closure of the project. There is no salvage value. PQR Ltd. want to take a forward cover to protect itself from exchange rate fluctuations.

n	1	2	3	4	5
PVIF(6.976%, n)	0.935	0.874	0.817	0.764	0.714
PVIF(4.186%,n)	0.959	0.921	0.884	0.849	0.815
PVIF(12%, n)	0.893	0.797	0.712	0.636	0.567
PVIF(15%, n)	0.870	0.756	0.658	0.572	0.497

You are required to recommend the INR/USD rate for the forward cover?

Solution:

Ans: This is assumed as NPV

One idea To calculate forward rate is IRPT. However, since examiner has given NPV and another data, therefore it should be used to back calculate the forward rate.

Calc of PV of ₹ Cash CF					
	\$ CF	Forward Rate (F)	₹ CF	PVIF	DCF
0	-	-	(12450)	1	(12450)
1	30	F	30F	0.893	
2	40	F	40F	0.797	
3	50	F	50F	.	
4	60	F	60F	.	
5	70	F	70F	.	

Same forward rate has been assumed for every year

Adish Jain CA CFA

-12450 + 172.12F.

$$NPV = PV(CI) - PV(CO)$$

$$1858.08 = 172.125 - 12450$$

$$T = ₹ \$ 83.1285$$

Recommended rupee per dollar forward rate is 83.1285

Applicable

discount rate is

missing in the

question,

therefore, based

on data of PVF,

we have

considered 12%



QUESTION 85:

N 24

15m

MC\$

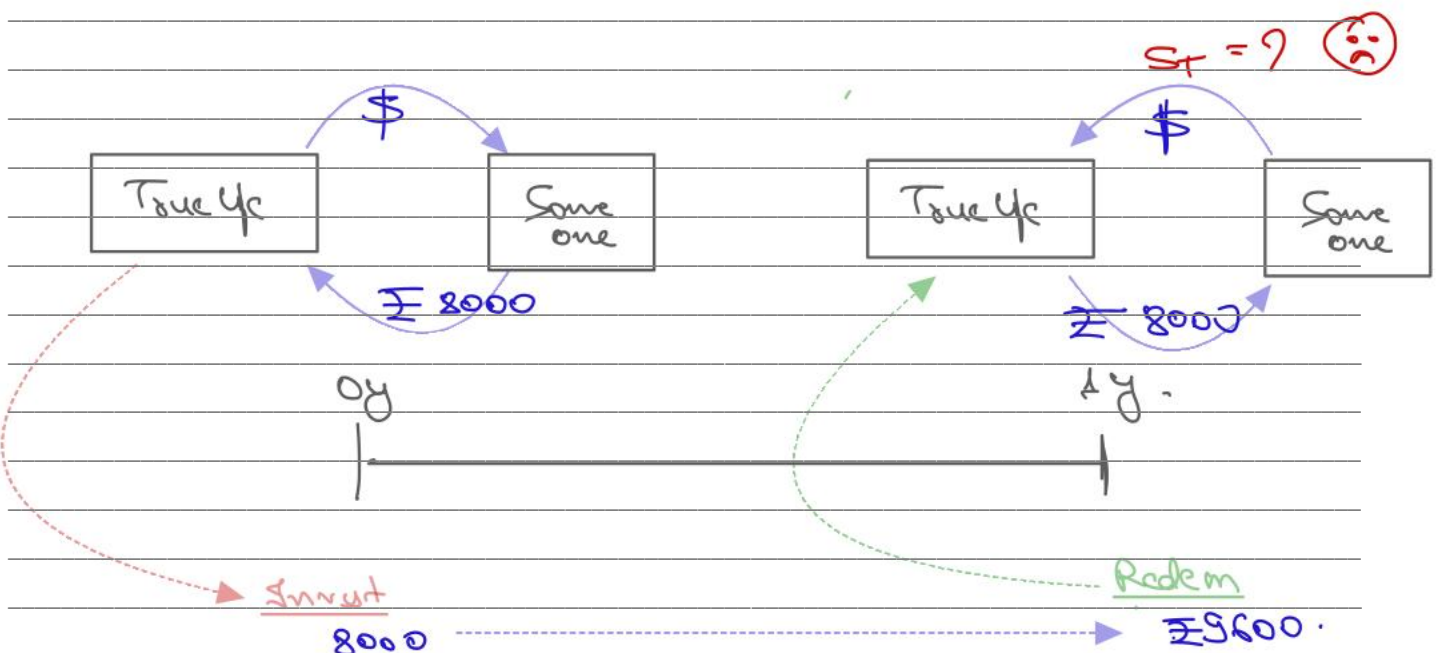
relate this to currency swap in derivatives

True Life Inc., a US based company, has won a contract to implement a project in India. The project will require an initial investment of ₹ 8000 million. The whole project along with the equipment will be sold to the Indian Government for ₹ 9600 million 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.

- Construct a swap that will help the True Life Inc. to reduce the exchange rate risk.
- Assume that the Indian Government offers a swap at spot rate which is INR/USD 80 in one year. The spot rate after one year is expected to be INR/USD 84. Further, you may also assume that the True Life Inc. can also take a USD loan at 6% per annum.

ADVISE whether the company should opt for this option or just do nothing.

Solution:





QUESTION 86:

N 21 MTP

Perfect Inc., a U.S. based Pharmaceutical Company has received an offer from Aidscore 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 ₹ 200 crores for machinery and factory. The scrap value of machinery and factory is estimated at the end of five (5) year to be ₹ 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 ₹ 50 crores shall be required and thereafter ₹ 5 crores each year.

As per GOI directions, it is estimated that the price per bottle will be ₹ 7.50 and production will be 24 crores bottles per year. The price in addition to inflation of respective years shall be increased by ₹ 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/ remittance received.

The Spot rate of \$ is ₹ 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 realised 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).

Solution:

Working Notes:

(i) Estimated Exchange Rates (Using PPP Theory)

Year	0	1	2	3	4	5	6
Exchange rate	57	57.54	57.82	57.82	57.54	56.99	56.18

(ii) Share in sales

Year	1	2	3	4	5
Annual Units in crores	24	24	24	24	24
Price per bottle (₹)	7.50	8.50	9.50	10.50	11.50
Price fluctuating Inflation Rate	6.00%	5.50%	5.00%	4.50%	4.00%
Inflated Price (₹)	7.95	8.97	9.98	10.97	11.96
Inflated Sales Revenue (₹ Crore)	190.80	215.28	239.52	263.28	287.04
Sales share @55%	104.94	118.40	131.74	144.80	157.87

(iii) Royalty Payment

Year	1	2	3	4	5
Annual Units in crores	24	24	24	24	24
Royalty in \$	0.01	0.01	0.01	0.01	0.01
Total Royalty (\$ Crore)	0.24	0.24	0.24	0.24	0.24
Exchange Rate	57.54	57.82	57.82	57.54	56.99
Total Royalty (₹ Crore)	13.81	13.88	13.88	13.81	13.68

(iv) Tax Liability

Year	1	2	3	4	5
Sales Share	104.94	118.40	131.74	144.80	157.87
Total Royalty	13.81	13.88	13.88	13.81	13.68
Total Income	118.75	132.28	145.61	158.61	171.55
Less: Expenses					
Production Cost (Sales share x 40%)	41.98	47.36	52.69	57.92	63.15
Depreciation (195 x 20%)	39.00	39.00	39.00	39.00	39.00
PBT	37.77	45.92	53.92	61.69	69.40
Tax on Profit @30%	11.33	13.78	16.18	18.51	20.82
Net Profit	26.44	32.14	37.74	43.18	48.58

(v) Free Cash Flow

Year	0	1	2	3	4	5	6
Sales Share	0.00	104.94	118.40	131.74	144.80	157.87	0.00
Total Royalty	0.00	13.81	13.88	13.88	13.81	13.68	0.00
Production Cost	0.00	-41.98	-47.36	-52.69	-57.92	-63.15	0.00
Initial Outlay	-200.00	0.00	0.00	0.00	0.00	0.00	0.00
Working Capital	-50.00	-5.00	-5.00	-5.00	-5.00	70.00	0.00
Scrap Value	0.00	0.00	0.00	0.00	0.00	5.00	0.00
Tax on Profit	0.00	0.00	-11.33	-13.78	-16.18	-18.51	-20.82
Free Cash Flow	-250.00	71.77	68.59	74.15	79.51	164.89	-20.82

(vi) Remittance of Cash Flows

Year	0	1	2	3	4	5	6
Free Cash Flow	-250.00	71.77	68.59	74.15	79.51	164.89	-20.82
50% of Current Year Cash Flow	0.00	35.89	34.29	37.07	39.76	82.45	0.00
Previous year remaining cash flow	0.00	0.00	35.88	34.30	37.08	39.75	82.44
Total Remittance	-250.00	35.88	70.17	71.37	76.84	122.20	61.62

(vii) NPV of Project under Appraisal

Year	0	1	2	3	4	5	6	7
Total Remit (₹ Crore)	-250.00	35.88	70.17	71.37	76.84	122.20	61.62	-
Exchange Rate	57.00	57.54	57.82	57.82	57.54	56.99	56.18	-
Remittance (\$ Mn)	-43.86	6.24	12.14	12.34	13.35	21.44	10.97	-
US Tax @35% (\$ Mn)	0.00	0.00	2.18	4.25	4.32	4.67	7.50	3.84
Indian Tax (\$ Mn)	0.00	0.00	1.96	2.38	2.82	3.25	3.71	-
Net Tax (\$ Mn)	0.00	0.00	0.22	1.87	1.51	1.42	3.79	3.84
Net Cash Flow (\$ Mn)	-43.86	6.24	11.92	10.47	11.84	20.02	7.18	-3.84
PVF @ 15%	1.000	0.870	0.756	0.658	0.572	0.497	0.432	0.376
Present Value (\$ Mn)	-43.86	5.43	9.01	6.89	6.77	9.95	3.10	-1.44
Net Present Value (\$ Mn)								= -4.15

Decision: Since NPV of the project is negative, Perfect inc. should not invest in the project.



QUESTION 87:

N 20

Typical & Ambiguous.

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	-	0.4
10	0.3	0.4
15	0.15 Additional reduction	0.2

Don't have any clarity of what is HC and what is FC therefore, based on the flow of question that is in USD, we continue to perform all the calculation in USD

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 out:

- 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.

Solution:

(a)

IN USD million			
Decline	0%	10%	15%
Selling price	10	10	10
Less: cost	(6)	(5.7)	(5.55)
Profit per unit	4	4.3	4.45
X No. of units	10,00,000	10,00,000	10,00,000

Total Profit	40,00,000	43,00,000	44,50,000
Less: Dep	(10,00,000)	(9,00,000)	(8,50,000)
EBT	30,00,000	34,00,000	36,00,000
Less: Tax @ 30%	(9,00,000)	(10,20,000)	(10,80,000)
PAT	21,00,000	23,80,000	25,20,000
Add: Dep	10,00,000	9,00,000	8,50,000
CFAT	USD 31,00,000	USD 32,80,000	USD 33,70,000

(b) Expected value = $31,00,000 \times 0.4 + 32,80,000 \times 0.4 + 33,70,000 \times 0.2$
 $= \text{USD } 32,26,000$

(c) Initial Investment = USD 25 Million

$$\text{PV of Inflows} = \frac{\text{FCF}_1}{k_e - g}$$

$$= \frac{\text{USD } 32,26,000 \times (1.03)}{0.11 - 0.03} = \text{USD } 4,15,34,750$$

NPV of the project: $4,15,34,750 - 2,50,00,000 = 1,65,34,750$



QUESTION 88:

N 21

A US company wants to setup a manufacturing plant in India which requires an initial outlay of ₹ 8 Million. It is expected to have a useful life of 5 years with a salvage of ₹ 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 ₹ 1 Million.

Since the cost of production lower in India, the variable cost of production would be 30 per unit. Additional fixed cost per annum is estimated at ₹ 0.5 Million. The company is projecting its annual sales to 80000 units at the price of 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 ₹ 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.

PVF @8% for the five years are as under:

Year	1	2	3	4	5
PVIF	0.926	0.857	0.749	0.735	0.681

Solution:

a. Initial Investment in US\$

Particulars	Amount
Initial Outlay	₹ 80,00,000
Additional Working Capital	₹ 10,00,000
Total	₹ 90,00,000
Exchange Rate	₹ 72/US\$
Initial Investment in US\$	US\$ 1,25,000

b. Expected Exchange Rates

Years	Rate
1	$72.00 \times 1.09/1.08 = 72.67$
2	$72.67 \times 1.09/1.08 = 73.34$
3	$73.34 \times 1.09/1.08 = 74.02$
4	$74.02 \times 1.09/1.08 = 74.41$
5	$74.41 \times 1.09/1.08 = 75.40$

c. Annual Cash Inflows in ₹

Particulars	Amount (₹)
Sales (80000 X ₹ 100)	80,00,000
Less: Variable Cost (80000 x ₹ 30)	24,00,000
Additional Fixed Cost	5,00,000
Depreciation (₹ 80,00,000 - ₹ 20,00,000)/5	12,00,000
PBT	39,00,000
Less: Tax @ 34%	13,26,000
PAT	25,74,000
Add: Depreciation	12,00,000
CFAT	37,74,000

d. Annual Cash Inflows in \$

Year	CF (₹)	₹/\$ rate	CF (\$)
1	37,74,000	72.67	51,933.40
2	37,74,000	73.34	51,458.96
3	37,74,000	74.02	50,986.22
4	37,74,000	74.71	50,513.33
5	37,74,000	75.40	50,053.05

e. Release of Working Capital in US\$ at the end (₹ 10,00,000/ ₹ 75.40) = US\$ 13,262.60

Salvage Value of Project in US\$ (₹ 20,00,000/ ₹ 75.40) = US\$ 26,525.20

NPV of the Project

Year	Nature of CF	CF (\$)	PVFs @ 8%	DCF (\$)
0	Initial Outlay	(1,25,000.00)	1.000	(1,25,000.00)
1	Annual CF	51,933.40	0.926	48,090.33
2	Annual CF	51,458.96	0.857	44,100.33
3	Annual CF	50,986.22	0.794	40,483.06
4	Annual CF	50,513.33	0.735	37,127.30
5	Annual CF	50,053.05	0.681	34,086.13
5	Working capital	13,262.60	0.681	9,031.83
5	Salvage Value	26,525.20	0.681	18,063.66
NPV				1,05,982.64

Since the NPV of the project is positive, it is feasible.



QUESTION 89:

M 21 | N 19 | M 14 | RTP

[Replacement decision of Capital Budgeting]

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:

1. Variable operating cost will be US \$ 20 per unit of production;
2. 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; *→ irrelevant.*
3. Production capacity of the proposed project in India will be 5 million units;
4. Expected useful life of the proposed plant is five years with no salvage value;
5. Existing working capital investment for production & sale of two million units through exports was US \$ 15 million;
6. 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;
7. Applicable Corporate Income Tax rate is 35%, and
8. 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.

Present Value Interest Factors (PVIF) @ 12% for five years are as below:

Year	1	2	3	4	5
PVIF	0.8929	0.7972	0.7118	0.6355	0.5674

Solution:

A) Incremental Initial Outflow:

	in million
Initial cost of new project	US\$ 500
Working capital in new project	US\$ 50
WC release existing project	<u>(US\$ 15)</u>
	<u>US\$ 535</u>

B) Incremental Intermediate Cashflows

Cashflow from new project:

Decline		\$ Million
Sales	(5 million × \$80)	400
Less : Variable cost	(5 million × \$20)	(100)
Fixed cost		(30)
Depreciation	(₹ 500/ 5 years)	<u>(100)</u>
EBIT		170
Less: Taxes @ 35%		<u>(59.5)</u>

EAT		110.5
Add: Dep		<u>100</u>
CFAT		210.5

Cashflow from existing project:

By export		\$ Million
Sales	$(1.5M \times \$80)$	120
Less: Variable cost	$(1.5 \times \$40)$	<u>(60)</u>
Contribution / EBT		60
Less: Taxes @ 35%		<u>(21)</u>
CFAT		39

Incremental Intermediate Cashflows:

	\$ Million
CFs from New Project	210.50
Less: CFs from Existing Project	- 39.00
	171.50

C) Incremental Terminal Cashflows:

	\$ Million
WC realisation from New Project	50
Less: WC realisation from Existing Project	- 15
	35

D) Calculation of NPV using Incremental Approach (\$ mn)

Year		CFs	PVAF / PVF	DCF
0	Initial Outflow	- 535	1	- 535.0000
1 – 5	Intermediate Cash Inflow	171.50	3.6048	618.2232
5	Terminal Cash Inflow	35	0.5674	19.8590
	Incremental NPV			108.0822

Since NPV is positive, proposal should be accepted



QUESTION 90:

MTP N 23

VK Ltd. is an Indian company which is planning to set up a manufacturing plant through its subsidiary in the small country Farland, (where hitherto it was exporting) in view of growing demand for its product and competition from other MNCs. The currency of Farland is the Farroh (Fr.).

An initial investment of Fr. 80 million in plant and machinery would be required. In addition to that the initial investment in working capital of Fr. 6 million would be also required which shall be financed through a loan from a local bank of Farland, at interest rate of 10% p.a. The working capital shall also be subject to inflation. At the end

of 5 years, the subsidiary would be taken over by the Govt. of Farland for a price of Fr. 2 million. The part of the proceeds would be used to pay off the bank loan.

It is expected that subsidiary shall produce Net Cash Flows from Operations of Fr. 30 million per year at current price level over the five-year period, before allowing for Farland inflation of 8% per year. Depreciation on Plant and Machinery shall be charged at 20% per year on straight line basis. As a result of setting up the subsidiary, VK Ltd. expects to lose after-tax export income from Farland of INR 8,00,000 per year in current price terms, before allowing for India inflation of 3%. Profits in Farland are taxed at a rate of 20% after allowing deduction for interest and depreciation. All after-tax cash profits are remitted to the India at the end of each year. Indian tax @ 30% is charged on profit earned, but due to tax treaty between Farland and the India the tax paid in Farland is allowed to be set off against any India Tax liability. Taxation is paid in the year in which the liability arises. VK Ltd. requires foreign investments to be discounted at 12%. The current exchange rate is Fr.2.5/INR and the Farroh is expected to depreciate against INR by 5% per year.

Advise should VK Ltd. undertake the investment in Farland or not.

Note: 1. Present Figures in thousands multiple.

2. Round off all calculations.

3. PVF @12%

Year	1	2	3	4	5
PVF	0.893	0.797	0.712	0.636	0.567

Solution:

Calculation of the project cash flows for VK Ltd.'s subsidiary in Farland (Fr.'000)

Year	-	1	2	3	4	5
Cash flows from operations		32,400	34,992	37,791	40,815	44,080
Depreciation		-16,000	-16,000	-16,000	-16,000	-16,000
Interest		-600	-600	-600	-600	-600
Profit before Tax		15,800	18,392	21,191	24,215	27,480
Farland Tax		-3,160	-3,678	-4,238	-4,843	-5,496
Profit after Tax		12,640	14,714	16,953	19,372	21,984
Add back Depreciation		16,000	16,000	16,000	16,000	16,000
Initial Investment	-80,000	28,640	30,714	32,953	35,372	37,984
Working Capital Investment	-6,000					
Change in WC		-480	-518	-560	-605	-653
Loan Capital						-6,000
Sale of Subsidiary						2,000
	-86,000	28,160	30,196	32,393	34,767	33,331

Expected Exchange Rates

Year	Rate
0	2.5
1	$2.50 \times 1.05 = 2.63$
2	$2.50 \times (1.05)^2 = 2.76$

3	$2.50 \times (1.05)^3 = 2.89$
4	$2.50 \times (1.05)^4 = 3.04$
5	$2.50 \times (1.05)^5 = 3.19$

Calculation of Tax paid in India

Year	1	2	3	4	5
PBT (Fr)	15,800	18,392	21,191	24,215	27,480
Tax @ 10%	1,580	1,839	2,119	2,422	2,748
Exchange rate	2.63	2.76	2.89	3.04	3.19
Tax in India (₹ '000)	601	666	733	797	861

Calculation Net Present Value (NPV) for VK Ltd.'s subsidiary at parent company level

Year	0	1	2	3	4	5
Project Cash Flows (Fr. '000)	-80,000	28,160	30,196	32,393	34,767	33,331
Exchange Rate (Fr./₹)	2.50	2.63	2.76	2.89	3.04	3.19
Cash Invested from India (₹ '000)	-32,000	--	--	--	--	--
Cash Received in India (₹ '000)	--	10,707	10,941	11,209	11,437	10,449
Tax in India (₹ '000)		601	666	733	797	861
Lost export after tax (₹ '000)	-32,000	10,106	10,275	10,476	10,640	9,588
Parent Cash Flow	-32,000	9,282	9,426	9,602	9,740	8,661
PVF	1.000	0.893	0.797	0.712	0.636	0.567
	-32,000	8,289	7,513	6,837	6,195	4,911
NPV						1,745

Decision: Since NPV of the project is positive it should be accepted.



QUESTION 91:

N 20

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 years term loan of USD 150 lakhs at an interest rate of 6 per cent per annum. The interest is to 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

Solution:

Calculating CFAT for base case NPV

(in USD lakh)

Particulars	0-10	11-20
EBITDA	33	33
Less: Depreciation (250/10)	(25)	0
EBIT or PBT	8	33
Less: Tax @ 30%	(2.4)	(9.9)
EAT	5.6	23.1
Add: Depreciation	25	0
CFAT	30.6	23.1
PVAF	5.650	7.469-5.650 = 1.819
PV of Inflows	172.89	42.019
PV of Total Inflows	214.9089	
PV of Initial Outflow	(250)	
Base case NPV	35.0911	

Calculating PV of tax benefit on interest (in lakh USD):

Amount of loan for 15 years	150
Int cost (150 × 6%)	9
Tax Benefit on Int (9 × 30%)	2.70
PVAF (8%, 15)	<u>8.559</u>
PV of tax benefit on Interest	<u>23.109</u>

Pre-tax K_d : $\frac{5.6}{(1 - 30\%)} = 8\%$

Calculating Adjusted NPV:

Base case NPV	- 35.091 lakhs
Add: PV of tax benefit on Interest	<u>+ 23.109 lakhs</u>
	<u>11.982 lakhs</u>

Advise: Since adjusted NPV is negative at USD 11.98 lakh. The project is not viable.



QUESTION 92:

M 24 | M 22 | M 21 | M 18 | N 14 | RTP

M/s. Raghu Ltd. is interested in expanding its operation and planning to install manufacturing plant at US. It requires 8.82 million USD (net of issue expenses/ floatation cost) to fund the proposed project. GDRs are proposed to be issued to finance this project. The estimated floatation cost of GDRs is 2%.

Additional information:

- (i) Expected market price of share at the time of issue of GDR is ₹ 360 (Face Value ₹ 100)

- (ii) Each GDR will represent two underlying Shares.
- (iii) The issue shall be priced at 10% discount to the market price.
- (iv) Expected exchange rate is INR/USD 72.
- (v) Dividend is expected to be paid at the rate of 20% with growth rate of 12%.
 - a. You, as a financial consultant, are required to compute the number of GDRs to be issued and cost of the GDR.
 - b. 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%?
 - c. How much company can save by choosing the option as recommended by you?

Solution:

Net Issue Size	\$ 8.82 million
Issue Price per GDR in ₹ ($360 \times 2 \times 90\%$)	₹ 648
Issue Price per GDR in \$ ($\text{₹ } 648 / \text{₹ } 72$)	\$ 9.00
Net Proceeds per GDR in \$ ($\$9 - 2\%$)	\$ 8.82

- (1) (a) Number of GDR to be issued

$$= \frac{\$ 8.82 \text{ Mn}}{\$ 8.82} = 1 \text{ Mn GDR}$$

- (b) Dividend Per GDR (D_1) = $(20 \times 2) / 72 = \$ 0.5556$

$$\text{Net Proceeds Per GDR} = \$ 8.82$$

$$\text{Cost of GDR} = \frac{0.5556}{8.82} + 0.12 = 18.30\%$$

- (2) 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.
- (3) If the offer is accepted there will be net saving of 6.30%.

Advanced Capital Budgeting Decisions





QUESTION 1

SM | M 13 | PM

Skylark Airways is planning to acquire a light commercial aircraft for flying class clients at an investment of ₹ 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 factors relating to airline operations. The company wants to know:

- The expected NPV of this venture assuming independent probability distribution with 6 percent risk free rate of interest.
- The possible deviation in the expected value.
- How would standard deviation of the present value distribution help in Capital Budgeting decisions?

Solution:

$$a) \quad E(CF_1) = 14 \times 0.1 + 18 \times 0.2 + 25 \times 0.4 + 40 \times 0.3 \\ = 27 \text{ lacs}$$

$$E(CF_2) = 15 \times 0.1 + 20 \times 0.3 + 32 \times 0.4 + 45 \times 0.2 \\ = 29.3 \text{ lacs}$$

$$E(CF_3) = 18 \times 0.2 + 25 \times 0.5 + 35 \times 0.2 + 48 \times 0.1 \\ = 27.9 \text{ lacs}$$

E(NPV):

Expected CFs	PVF @ 6%	Total PV
27.0	0.943	25.461
29.3	0.890	26.077
27.9	0.840	23.436
PV of E(CFs)		74.974
Less: Cash outflow		50.000
E(NPV)		24.974

- Possible deviation in the expected value

SD of $E(CF_1)$:

X	P	$D_x = X - \bar{X}$	$P \times D_x^2$
14	0.1	-13	16.9
18	0.2	-9	16.2
25	0.4	-2	1.6
40	0.3	13	50.7
			85.4

$$SD_1 = \sqrt{85.4} = 9.2412 \text{ lacs}$$

SD of $E(CF_2)$:

X	P	$D_x = X - \bar{X}$	$P \times D_x^2$
15	0.1	-14.3	20.45
20	0.3	-9.3	25.95
32	0.4	2.7	2.92
45	0.2	15.7	49.30
			98.60

$$SD_2 = \sqrt{98.61} = 9.9303 \text{ lacs}$$

SD of $E(CF_3)$:

X	P	$D_x = X - \bar{X}$	$P \times D_x^2$
18	0.2	-9.9	19.60
25	0.5	-2.9	4.21
35	0.2	7.1	10.08
48	0.1	20.1	40.40
			74.29

$$SD_2 = \sqrt{74.29} = 8.6192 \text{ lacs}$$

Standard deviation of $E(NPV)$:

$$\begin{aligned} \sigma_{NPV} &= \sqrt{\left(\frac{9.2412}{1.06^1}\right)^2 + \left(\frac{9.9303}{1.06^2}\right)^2 + \left(\frac{8.6192}{1.06^3}\right)^2} \\ &= ₹ 14.3696 \text{ lacs} \end{aligned}$$

- c) Standard deviation is a statistical measure of dispersion; it measures the deviation from a central number i.e. the mean.

In the context of capital budgeting decisions especially where we take up two or more projects giving somewhat similar mean cash flows, by calculating standard deviation in such cases, we can measure in each case the extent of variation. It can then be used to identify which of the projects is least risky in terms of variability of cash flows.

A project, which has a lower coefficient of variation will be preferred if sizes are heterogeneous.

Besides this, if we assume that probability distribution is approximately normal, we are able to calculate the probability of a capital budgeting project generating a net present value less than or more than a specified amount.



QUESTION 2

SM | PM

Cyber Company is considering two mutually exclusive projects. Investment outlay of both the projects is ₹ 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 (₹)	
		Project A	Project B
Good	0.3	6,00,000	5,00,000
Normal	0.4	4,00,000	4,00,000
Worse	0.3	2,00,000	3,00,000

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

Solution:

Project A

$$E(CF_A) = 0.3 (6,00,000) + 0.4 (4,00,000) + 0.3 (2,00,000) \\ = 4,00,000$$

$$PV \text{ of } E(CF_A) = 4,00,000 \times 4.100 \\ = 16,40,000$$

$$E(NPV_A) = 16,40,000 - 5,00,000 = 11,40,000$$

$$\sigma \text{ of } E(CF_A) = \sqrt{0.3 \times (6,00,000 - 4,00,000)^2 + 0.4 \times (4,00,000 - 4,00,000)^2 + 0.3 \times (2,00,000 - 4,00,000)^2} \\ = 1,54,919.33$$

Project B

$$E(CF_B) = 0.3 (5,00,000) + 0.4 (4,00,000) + 0.3 (3,00,000) \\ = 4,00,000$$

$$PV \text{ of } E(CF_B) = 4,00,000 \times 4.100 \\ = 16,40,000$$

$$E(NPV_B) = 16,40,000 - 5,00,000 = 11,40,000$$

$$\sigma \text{ of } E(CF_B) = \sqrt{0.3 \times (5,00,000 - 4,00,000)^2 + 0.4 \times (4,00,000 - 4,00,000)^2 + 0.3 \times (3,00,000 - 4,00,000)^2} \\ = 77,459.66$$

Recommendation: 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.

**QUESTION 3**

SM | PM

only on dci

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 coefficient of variation as a measure of risk.
- Which measure is more appropriate in this situation and why?

Solution:

- On the basis of standard deviation, Project X be chosen because it is less risky than Project Y and on the basis of return (i.e., NPV), Project Y should be chosen because it has higher return than project X.

$$b) \quad CV_x = \frac{SD}{ENPV} = \frac{90,000}{122,000} = 0.738$$

$$CV_y = \frac{120,000}{225,000} = 0.533$$

On the basis of Co-efficient of Variation (C.V.) Project X appears to be riskier and hence Y should be accepted.

- c) However, the NPV method in such conflicting situation is best because the NPV method is in compatibility of the objective of wealth maximisation in terms of time value



QUESTION 4

SM | M 18 | PM

only on calci

KLM Ltd. is considering taking up one of the two projects-Project-K and Project-S. Both the projects having same life require equal investment of ₹ 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 ₹)	Probability	Cash Flow (in ₹)	Probability
11	0.10	09	0.10
13	0.20	13	0.25
15	0.40	17	0.30
17	0.20	21	0.25
19	0.10	25	0.10

Required:

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

Solution:

Project K

$$\text{Expected Net Cash Flow} = (0.10 \times 11) + (0.20 \times 13) + (0.40 \times 15) + (0.20 \times 17) + (0.10 \times 19) \\ = 15$$

$$\sigma^2 = 0.10(11 - 15)^2 + 0.20(13 - 15)^2 + 0.40(15 - 15)^2 + 0.20(17 - 15)^2 + 0.10(19 - 15)^2 \\ = 4.8$$

$$\sigma = \sqrt{4.8} = 2.19$$

Project S

$$\text{Expected Net Cash Flow} = (0.10 \times 9) + (0.25 \times 13) + (0.30 \times 17) + (0.25 \times 21) + (0.10 \times 25) \\ = 17$$

$$\sigma^2 = 0.1(9 - 17)^2 + 0.25(13 - 17)^2 + 0.30(17 - 17)^2 + 0.25(21 - 17)^2 + 0.10(25 - 17)^2 \\ = 20.8$$

$$\sigma = \sqrt{20.8} = 4.56$$

Calculation of Coefficient of Variation

$$\text{Coefficient of Variation} = \frac{\text{Standard Deviation}}{\text{Mean}}$$

$$\text{Project K} = \frac{2.19}{15} = 0.146$$

$$\text{Project S} = \frac{4.56}{17} = 0.268$$

Project S is riskier as it has higher Coefficient of Variation.

*CF ?
or
NPV ?
Not possible
as life is
missing.*



QUESTION 5

SM | PM

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

Project X: Investment (year 0) ₹ 70 lakhs

Probability weights	0.30	0.40	0.30
Years	₹ lakhs	₹ lakhs	₹ lakhs
1	30	50	65
2	30	40	55
3	30	40	45

Project Y: Investment (year 0) ₹ 80 lakhs.

Probability weighted	Annual cash flows through life
	₹ lakhs
0.20	40
0.50	45
0.30	50

missing?
it has to be 3y.
so that it can
be compared with
Project X.

- 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.

Solution:

NPV.

- a) NPV of Project X.: (in ₹ lacs)

Year	Expected CF	PVF	PV
1	$(30 \times 0.3) + (50 \times 0.4) + (65 \times 0.3) = 48.5$	0.909	44.09
2	$(30 \times 0.3) + (40 \times 0.4) + (55 \times 0.3) = 41.5$	0.826	34.28
3	$(30 \times 0.3) + (40 \times 0.4) + (45 \times 0.3) = 38.5$	0.751	28.91
	Total PV of E(CFs)		107.28
	Less: PV Outflows		-70
	Expected NPV		37.28

NPV of Project Y: (in ₹ lacs)

Year	Expected CF	PVAF	PV
1 - 3	$(40 \times 0.2) + (45 \times 0.5) + (50 \times 0.3) = 45.5$	2.487	113.16
	Less: PV Outflows		-80
	Expected NPV		33.16

Project X is a better project as it has a higher NPV.

- b) Calculation of Standard deviation as per Hiller's model:

Project X

SD of CFs of individual years:

$$\begin{aligned}
 \text{Years 1} &= \sqrt{(30 - 48.5)^2 \cdot 0.30 + (50 - 48.5)^2 \cdot 0.40 + (65 - 48.5)^2 \cdot 0.30} \\
 &= ₹ 13.61 \text{ lacs}
 \end{aligned}$$

$$\begin{aligned}\text{Year 2} &= \sqrt{(30 - 41.5)^2 0.30 + (40 - 41.5)^2 0.40 + (55 - 41.5)^2 0.30} \\ &= ₹ 9.76 \text{ lacs}\end{aligned}$$

$$\begin{aligned}\text{Year 3} &= \sqrt{(30 - 41.5)^2 0.30 + (40 - 41.5)^2 0.40 + (55 - 41.5)^2 0.30} \\ &= ₹ 5.94 \text{ lacs}\end{aligned}$$

Standard Deviation about the expected value

$$\begin{aligned}&= \sqrt{\left(\frac{13.61}{1.1^1}\right)^2 + \left(\frac{9.76}{1.1^2}\right)^2 + \left(\frac{5.94}{1.1^3}\right)^2} \\ &= ₹ 15.43 \text{ lacs}\end{aligned}$$

Project Y:

SD of CFs of individual years:

$$\begin{aligned}\text{Year 1 - 3} &= \sqrt{(40 - 45.5)^2 0.20 + (45 - 45.5)^2 0.50 + (50 - 45.5)^2 0.30} \\ &= ₹ 3.50 \text{ lacs}\end{aligned}$$

Standard Deviation about the expected value

$$\begin{aligned}&= \sqrt{\left(\frac{3.5}{1.1^1}\right)^2 + \left(\frac{3.5}{1.1^2}\right)^2 + \left(\frac{3.5}{1.1^3}\right)^2} \\ &= ₹ 5.03 \text{ lacs}\end{aligned}$$

Analysis: Project Y is less risky as its Standard Deviation is less than Project X.



QUESTION 6

SM | PM

only one of the two projects can be selected.

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

Project A		Project B	
NPV estimates (₹)	Probability	NPV estimates (₹)	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.

Solution:

- Statement showing computation of expected net present value of Projects A and B:

Project A			Project B		
NPV	Probability	Expected Value	NPV	Probability	Expected

Estimate			Estimate		Value
15,000	0.2	3,000	15,000	0.1	1,500
12,000	0.3	3,600	12,000	0.4	4,800
6,000	0.3	1,800	6,000	0.4	2,400
3,000	0.2	600	3,000	0.1	300
	1.0	E(NPV) = 9,000		1.0	E(NPV) = 9,000

- b) Computation of Standard deviation of each project

Project A

P	X	$D_x = (X - \bar{X})$	$P \times D_x^2$
0.2	15,000	6,000	72,00,000
0.3	12,000	3,000	27,00,000
0.3	6,000	- 3,000	27,00,000
0.2	3,000	- 6,000	72,00,000
Variance =			1,98,00,000

Standard Deviation of Project A = $\sqrt{1,98,00,000} = ₹ 4,450$

Project B

P	Y	$D_y = (Y - \bar{Y})$	$P \times D_y^2$
0.1	15,000	6,000	36,00,000
0.4	12,000	3,000	36,00,000
0.4	6,000	- 3,000	36,00,000
0.1	3,000	- 6,000	36,00,000
Variance			1,44,00,000

Standard Deviation of Project B = $\sqrt{1,44,00,000} = ₹ 3,795$

- c) Computation of profitability Index of each project

Profitability index = Discount cash inflow / Initial outlay

$$\text{Project A} = \frac{9,000 + 36,000}{36,000} = 1.25 \text{ times}$$

$$\text{Project B} = \frac{9,000 + 36,000}{30,000} = 1.30 \text{ times}$$

- d) Measurement of risk is made by the possible variation of outcomes around the expected value and the decision will be taken in view of the variation in the expected value where two projects have the same expected value, the decision will be the project which has smaller variation in expected value. In the selection of one of the two projects A and B, Project B is preferable because the possible profit which may occur is subject to less variation (or dispersion). Much higher risk is lying with project A



QUESTION 7

SM | PM

Following are the estimates of the net cash flows and probability of a new project of M/s X Ltd.

	Year	P = 0.3	P = 0.5	P = 0.2
Initial investment	0	4,00,000	4,00,000	4,00,000
Estimated net after tax cash 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 X Ltd. 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 X Ltd?

Solution:

→ calculate NPV again. using E(CF) approach

- a) Expected cash flows:

Year	Net cash flows	PVF \ PVAF	DCF
0	$4,00,000 \times 1 = 4,00,000$	1.000	-4,00,000
1 to 5	$1,00,000 \times 0.3 + 1,10,000 \times 0.5 + 1,20,000 \times 0.2 = 1,09,000$	3.791	4,13,219
5	$20,000 \times 0.3 + 50,000 \times 0.5 + 60,000 \times 0.2 = 43,000$	0.621	26,703
NPV			39,922

- b) ENPV of the worst case

$$\begin{aligned}
 \text{Annual CFS} &= 1,00,000 \times 3.791 = ₹ 3,79,100 \\
 \text{Salvage Value} &= 20,000 \times 0.621 = ₹ 12,420 \\
 \text{ENPV} &= - 4,00,000 + 3,79,100 + 12,420 = - ₹ 8,480
 \end{aligned}$$

ENPV of the best case

$$\begin{aligned}
 \text{Annual CFS} &= 1,20,000 \times 3.791 = ₹ 4,54,920 \\
 \text{Salvage Value} &= 60,000 \times 0.621 = ₹ 37,260 \\
 \text{ENPV} &= - 4,00,000 + 4,54,920 + 37,260 = ₹ 92,180
 \end{aligned}$$

- c) Dependent probability = 0.3
Independent probability = $(0.3)^5 = 0.00243$

- d) The base case NPV = $- 4,00,000 + (1,10,000 \times 3.79) + (50,000 \times 0.621)$
= 48,060

$$\begin{aligned}
 E(\text{NPV}) &= 0.30 \times (- 8,480) + 0.5 \times 48,060 + 92,180 \times 0.20 \\
 &= ₹ 39,922
 \end{aligned}$$

$$\begin{aligned}
 \text{SD of } E(\text{NPV}) &= \sqrt{0.3 \times (-8,480 - 39,922)^2 + 0.5 \times (48,060 - 39,922)^2 + 0.2 \times (92,180 - 39,922)^2} \\
 &= ₹ 35,807
 \end{aligned}$$

$$\begin{aligned}\text{CV of E(NPV)} &= 35,800/39,922 \\ &= 89.69\%\end{aligned}$$

e) Risk adjusted out of cost of capital of X Ltd. = 10% - 1% = 9%. NPV

Year	E(CF)	PV @ 9%	DCF
0	(-) 4,00,000	1.000	- 4,00,000
1 to 5	1,09,000	3.890	4,24,010
5	43,000	0.650	27,950
		ENPV =	51,960

Therefore, the project should be accepted



QUESTION 8

SM | M 10 | PM

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

Annual cash inflow (₹)	20,000	30,000	40,000
Probability	0.1	0.7	0.2

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

↳ dependent.

Solution:

The expected cash flows of the project are as follows:

Year	P = 0.1	P = 0.7	P = 0.2	Total (₹)
0	-10,000	-70,000	-20,000	-1,00,000
1 - 5	2,000	21,000	8,000	31,000
5	0	14,000	6,000	20,000

a) NPV based on expected cash flows would be as follows:

$$\begin{aligned}&= -1,00,000 + \frac{31,000}{(1+0.20)^1} + \frac{31,000}{(1+0.20)^2} + \frac{31,000}{(1+0.20)^3} + \frac{31,000}{(1+0.20)^4} + \frac{31,000}{(1+0.20)^5} \\ &= ₹ 746.52\end{aligned}$$

b) For the worst case, the cash flows from the cash flow column farthest on the left are used to calculate NPV

$$\begin{aligned}&= -1,00,000 + \frac{40,000}{(1+0.20)^1} + \frac{40,000}{(1+0.20)^2} + \frac{40,000}{(1+0.20)^3} + \frac{40,000}{(1+0.20)^4} + \frac{40,000}{(1+0.20)^5} + \frac{30,000}{(1+0.20)^5} \\ &= ₹ 31,680.81\end{aligned}$$

c) If the cash flows are perfectly dependent, then the low cash flow in the first year will mean a low cash flow in every year. Thus, the possibility of the worst case occurring is the probability of getting ₹ 20,000 net cash flow in year 1 is 10%.



QUESTION 9

SM | PM

XYZ Ltd. is considering a project for which the following estimates are available:

	₹
Initial Cost of the project	10,00,000
Sales price/unit	60
Cost/unit	40
Sales volumes	
Year 1	20000 units
Year 2	30000 units
Year 3	30000 units

Discount rate is 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 volume
- Initial outlay and
- Project lifetime

Taxation may be ignored.

Solution:

Calculation of Base NPV

$$\begin{aligned} \text{NPV} &= -10,00,000 + \frac{20,000 \times (60 - 40)}{1.1} + \frac{30,000 \times (60 - 40)}{1.1^2} + \frac{30,000 \times (60 - 40)}{1.1^3} \\ &= ₹ 3,10,293/- \end{aligned}$$

Measurement of sensitivity is as follows:

a) Sales Price:

Let the sale price/Unit be S so that the project would break even with 0 NPV.

$$\begin{aligned} 0 &= -10,00,000 + \frac{20,000 \times (S - 40)}{1.1} + \frac{30,000 \times (S - 40)}{1.21} + \frac{30,000 \times (S - 40)}{1.331} \\ S &= ₹ 55.26 \end{aligned}$$

Decrease in Sales price to make NPV zero = $(60 - 55.26)/60 = 7.9\%$

Alternative Solution:

If sale Price decreased by say 10%, then NPV (at Sale Price of ₹ 60 – ₹ 6 = ₹ 54)

$$\begin{aligned} \text{NPV} &= -10,00,000 + \frac{20,000 \times 14}{(1.1)^1} + \frac{30,000 \times 14}{(1.1)^2} + \frac{30,000 \times 14}{(1.1)^3} \\ &= -82,796 \end{aligned}$$

$$\text{NPV decrease (\%)} = \frac{3,10,293 - (-82,796)}{3,10,293} \times 100 = 126.68\%$$

(b) Unit Cost:

Let the cost price/Unit be C so that the project would break even with 0 NPV.

$$0 = -10,00,000 + \frac{20,000 \times (60 - C)}{1.1} + \frac{30,000 \times (60 - C)}{1.21} + \frac{30,000 \times (60 - C)}{1.331}$$

$$C = ₹ 44.74$$

$$\text{Increase in Cost price to make NPV zero} = \left(\frac{44.74 - 40}{40} \times 100 \right) = 11.85\%$$

Alternative Solution:

If unit cost increased by say 10%. The new NPV will be as follows:

$$\begin{aligned} \text{NPV} &= -10,00,000 + \frac{20,000 \times 16}{(1.1)^1} + \frac{30,000 \times 16}{(1.1)^2} + \frac{30,000 \times 16}{(1.1)^3} \\ &= ₹ 48,234 \end{aligned}$$

$$\text{NPV decrease (\%)} = \frac{3,10,293 - (48,234)}{3,10,293} \times 100 = 84.46\%$$

c) Sales volume:

Let the Sales volume of 1st year be V. Therefore 2nd and 3rd year be 1.5V so that the project would break even with 0 NPV.

$$\begin{aligned} 0 &= -10,00,000 + \frac{V \times (60 - 40)}{1.1} + \frac{1.5V \times (60 - 40)}{1.21} + \frac{1.5V \times (60 - 40)}{1.331} \\ V &= 15263.76 \text{ units} \end{aligned}$$

$$\text{Decrease in Sales price to make NPV zero} = (15,263.76 - 20,000)/20,000 = 23.68\%$$

Alternative Solution:

If sale volume decreased by say 10%. The new NPV will be as follows:

$$\begin{aligned} \text{NPV} &= -10,00,000 + \frac{18000 \times 20}{(1.1)^1} + \frac{27000 \times 20}{(1.1)^2} + \frac{27000 \times 20}{(1.1)^3} \\ &= 1,79,263 \end{aligned}$$

$$\text{NPV decrease (\%)} = \frac{3,10,293 - 1,79,263}{3,10,293} \times 100 = 42.22\%$$

d) Initial Outlay

Initial Outlay to the project would break even with 0 NPV.

$$\begin{aligned} 0 &= -\text{Initial OF} + \frac{20,000 \times (60 - 40)}{1.1} + \frac{30,000 \times (60 - 40)}{1.1^2} + \frac{30,000 \times (60 - 40)}{1.1^3} \\ \text{Initial OF} &= ₹ 13,10,293 \end{aligned}$$

$$\text{Increase in Initial OF to make NPV zero} = 3,10,293/10,00,000 = 31.03\%.$$

Alternative Solution:

If initial outlay increased by say 10%. The new NPV will be as follows:

$$\begin{aligned} \text{NPV} &= -11,00,000 + \frac{20000 \times 20}{(1.1)^1} + \frac{30000 \times 20}{(1.1)^2} + \frac{30000 \times 20}{(1.1)^3} \\ &= 2,10,293 \end{aligned}$$

$$\text{NPV decrease (\%)} = \frac{3,10,293 - 2,10,293}{3,10,293} \times 100 = 32.22\%$$

e) Project lifetime

Present value of CFS for 1st two years.

$$\begin{aligned}\text{NPV} &= -10,00,000 + \frac{20,000 \times 20}{1.1} + \frac{30,000 \times 20}{1.21} \\ &= -1,40,496\end{aligned}$$

To make the NPV Zero, the project needs to run for some part of the third year such that the present value of CFs of is ₹ 1,40,496.

It can be computed as follows:

$$\begin{aligned}\text{PV of CFs of year 3} &= \frac{30,000 \times 20}{1.331} \\ &= 4,50,789\end{aligned}$$

$$\begin{aligned}\text{Part of year 3, the project needs to run} &= \frac{1,40,496}{4,50,789} \\ &= 0.312 \text{ years}\end{aligned}$$

$$\text{Total project life to make NPV zero} = 2.312 \text{ years}$$

$$\text{The requisite percentage fall is} = \frac{(2.312 - 3)}{3} \times 100 = -22.93\%$$



QUESTION 10

SM | PM | M 17

Years	Cost of Plant	Recurring Cost	Savings
0	10,000		
1		4,000	12,000
2		5,000	14,000

The cost of capital is 9%. Measure the sensitivity of the project to changes in the levels of plant value, running cost and savings (considering each factor at a time) such that the NPV becomes zero. The P.V. factor at 9% are as under:

Year	Factor
0	1
1	0.917
2	0.842

Which factor is the most sensitive to affect the acceptability of the project?

Solution:

$$\begin{aligned}\text{NPV} &= -10,000 + (12,000 - 4,000) \times 0.917 + (14,000 - 5,000) \times 0.842 \\ &= 4914\end{aligned}$$

Sensitivity Analysis

a) To make NPV zero, increase of Plant Value by ₹ 4,914

$$= \frac{4,914}{10,000} \times 100 = 49.14\%$$

b) To make NPV Zero, Running Cost should be:

Let's assume 1st year's cost to be X

Therefore, 2nd year's cost will be $5,000/4,000 \times X = 1.25X$

$$\begin{aligned}0 &= -10,000 + (12,000 - X) \times 0.917 + (14,000 - 1.25X) \times 0.842 \\ X &= 6495.05\end{aligned}$$

$$\begin{aligned}\text{Increase in cost (\%)} &= \frac{6495.05 - 4,000}{4,000} \times 100 \\ &= 62.38\%\end{aligned}$$

c) To make NPV Zero, Savings should be:

Let's assume 1st year's savings to be X

Therefore, 2nd year's cost will be $14,000/12,000 \times X = 1.1667X$

$$0 = -10,000 + (X - 4,000) \times 0.917 + (1.1667X - 5,000) \times 0.842$$

$$X = 9412.64$$

$$\begin{aligned}\text{Increase in cost (\%)} &= \frac{9412.64 - 12,000}{12,000} \times 100 \\ &= 21.56\%\end{aligned}$$

Hence, savings factor is the most sensitive to affect the acceptability of the project as in comparison of other two factors a slight % change in this fact shall more affect the NPV than others.

Alternative Solution:

Sensitivity Analysis

a. If the initial project cost is varied adversely by say 10%*.

$$\text{NPV (Revised)} = (\text{₹ } 4,914 - \text{₹ } 1,000) = 3,914$$

$$\text{Change in NPV} = \frac{4,914 - 3,914}{4,914} = 20.35\%$$

b. If Annual Running Cost is varied by say 10%*.

$$\begin{aligned}\text{NPV (Revised)} &= \text{₹ } 4,914 - \text{₹ } 400 \times 0.917 - \text{₹ } 500 \times 0.843 \\ &= \text{₹ } 4,126\end{aligned}$$

$$\text{Change in NPV} = \frac{4,914 - 4,126}{4,914} = 16.04\%$$

c. If Saving is varied by say 10%*.

$$\begin{aligned}\text{NPV (Revised)} &= \text{₹ } 4,914 - \text{₹ } 1,200 \times 0.917 - \text{₹ } 1,400 \times 0.843 \\ &= \text{₹ } 2,634\end{aligned}$$

$$\text{Change in NPV} = \frac{4,914 - 2,634}{4,914} = 46.40\%$$

Hence, Savings is the most sensitive factor to affect the acceptability of the project.

Self-note: Any percentage of variation other than 10% can also be assumed.



QUESTION 11

SM | N 13 | PM

Reverse cal ka rate
wo safe isse NPV 0 = 16%.

The 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 that 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 ₹ 60/- per unit

Annual Cash Flow ₹ 57,500/-

Condsi pu.
Sales p.v.

(Sales pu.
- VC p.u.)

NPV zero hone

ke liye k. ko 60%
se increase krna padega.

Some moughat
of FC.

FC ko 7.8416% change
kone se NPV zero
aa jayega.

Advanced Capital Budgeting

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

Solution:

- a) Initial Investment

IRR = 16% (Given)

At IRR, NPV shall be zero, therefore

$$\begin{aligned}\text{Initial Cost of Investment} &= \text{PVAF (16\%, 5)} \times \text{Cash Flow (Annual)} \\ &= 3.274 \times ₹ 57,500 \\ &= ₹ 1,88,255\end{aligned}$$

- b) Net Present Value (NPV)

$$\begin{aligned}\text{Let Cost of Capital be X, then } \frac{16 - X}{X} &= 60\% \\ X &= 10\%\end{aligned}$$

Thus, NPV of the project

$$\begin{aligned}&= \text{Annual Cash Flow} \times \text{PVAF (10\%, 5)} - \text{Initial Investment} \\ &= ₹ 57,500 \times 3.791 - ₹ 1,88,255 \\ &= ₹ 29,727.50\end{aligned}$$

- c) Annual Fixed Cost

Let change in the Fixed Cost which makes NPV zero is X. Then,

$$\begin{aligned}₹ 29,727.50 - 3.791X &= 0 \\ \text{Thus } X &= ₹ 7,841.60\end{aligned}$$

Let original Fixed Cost be Y

$$\begin{aligned}\text{then, } Y \times 7.8416\% &= ₹ 7,841.60 \\ Y &= ₹ 1,00,000\end{aligned}$$

Thus, Fixed Cost is equal to ₹ 1,00,000

- d) Estimated Annual Units of Sales

$$\text{Selling Price per unit} = \frac{60}{100\% - 70\%} = ₹ 200$$

$$\begin{aligned}\frac{\text{Annual Cash Flow} + \text{Fixed Cost}}{\text{P/V Ratio}} &= \text{Sales Value} \\ \frac{57,500 + 1,00,000}{0.70} &= 2,25,000\end{aligned}$$

$$\text{Sales in Units} = \frac{2,25,000}{200} = 1,125 \text{ units}$$

- e) Break Even Units = $\frac{\text{Fixed Cost}}{\text{Contribution Per Unit}}$

$$= \frac{1,00,000}{140} = 714.285 \text{ units}$$

**QUESTION 12**

SM | PM

Hint for dep'n.
(note in NB)

Unnat Ltd. is considering investing ₹ 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 ₹ 30.00 per unit. It is expected that the variable costs to be ₹ 16.50 per unit and fixed costs to be ₹ 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:

- sale price;
- sales volume;
- variable cost;
- 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.

Solution:

Calculation of NPV

$$\begin{aligned}
 &= - ₹ 50,00,000 + [2,00,000 (\text{₹ } 30 - \text{₹ } 16.50) - \text{₹ } 10,00,000] \text{PVIFA} (12\%, 5) \\
 &= - ₹ 50,00,000 + [2,00,000 (\text{₹ } 13.50) - \text{₹ } 10,00,000] 3.605 \\
 &= ₹ 11,28,500
 \end{aligned}$$

Measurement of Sensitivity Analysis

a) Sales Price:

Let the sale price/Unit be S so that the project would break even with 0 NPV.

$$\text{₹ } 50,00,000 = [2,00,000 (S - \text{₹ } 16.50) - \text{₹ } 10,00,000] \text{PVAF} (12\%, 5)$$

$$\text{₹ } 50,00,000 = [2,00,000 \times S - \text{₹ } 33,00,000 - \text{₹ } 10,00,000] 3.605$$

$$S = ₹ 28.43$$

$$\text{which represents a fall of } (30 - 28.43)/30 = 5.23\%$$

b) Sales volume:

Let V be the sale volume so that the project would break even with 0 NPV.

$$\text{₹ } 50,00,000 = [V (\text{₹ } 30 - \text{₹ } 16.50) - \text{₹ } 10,00,000] \text{PVAF} (12\%, 5)$$

$$\text{₹ } 50,00,000 = [V (\text{₹ } 13.50) - \text{₹ } 10,00,000] 3.605$$

$$V = 1,76,812 \text{ which represents a fall of } (2,00,000 - 1,76,812)/2,00,000 = 11.59\%$$

c) Variable Cost:

Let the variable cost be V so that the project would break even with 0 NPV.

$$\therefore ₹ 50,00,000 = [2,00,000(₹ 30 - V) - ₹ 10,00,000] \text{ PVAF}(12\%, 5)$$

$$₹ 50,00,000 = [₹ 60,00,000 - 2,00,000 V - ₹ 10,00,000] 3.605$$

$$V = ₹ 18.07 \text{ which represents a fall of } (18.07 - 16.50)/16.50 = 9.51\%$$

d) Expected Net Present Value

$$\text{Expected Unit} = (1,75,000 \times 0.30) + (2,00,000 \times 0.60) + (2,25,000 \times 0.10) = 1,95,000$$

$$E(\text{NPV}) = [1,95,000 \times ₹ 13.50 - ₹ 10,00,000] 3.605 - ₹ 50,00,000 = ₹ 8,85,163$$

NPV in worst cases:

$$[1,75,000 \times ₹ 13.50 - ₹ 10,00,000] 3.605 - ₹ 50,00,000 = - ₹ 88,188$$

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.



QUESTION 13

N 24

PQ Ltd. expects sales of ₹ 100 lakhs in year 1. The same will increase by ₹ 20 lakhs per year over the next four years. At the end of 5 years the project would be wound up. The Depreciation will be charged at 20% p.a. on straight line method.

The expenses excluding the depreciation will be 40% of the sales. There will be no salvage value of the plant. PQ Ltd. proposes to invest in the plant an amount where the Net Present Value will be Zero.

Corporate Tax rate is 30%.

You are required to calculate the investment which can be made in the plant.

Solution:

	Sales	Cost	- Depn	- Tax	+ Depn	= CFAT
Sales : 1 :	100	40	- 0.2	- 0.07	+ 0.2	50.40 + 0.06P
2 :	120	48	- 0.2	- 0.07	+ 0.2	58.80 + 0.06P
3 :	140	56	- 0.2	- 0.07	+ 0.2	67.20 + 0.06P
4 :	160	64	- 0.2	- 0.07	+ 0.2	75.60 + 0.06P
5 :	180	72	- 0.2	- 0.07	+ 0.2	84.00 + 0.06P
						294 + 0.3P

Since the rate of discount is missing, therefore, we will assume the rate to be zero and consider the total of above CFAT as present value of CFAT

NPV of P @ NPV of 2070

$$\text{NPV} = \text{PV (CF)} - \text{PV (Co)}$$

$$0 = 294 + 0.3P - P$$

$$P = ₹ 420 \text{ lakhs}$$

**QUESTION 14**

SM | PM

The Textile Manufacturing Company Ltd. is considering one of two mutually exclusive proposals, Projects M and N, which require cash outlays of ₹ 8,50,000 and ₹ 8,25,000 respectively. The certainty-equivalent (C.E) approach is used in incorporating risk in capital budgeting decisions. The current yield on government bonds is 6% and this is used as the risk free rate. The expected net cash flows and their certainty equivalents are as follows: R_F .

Project M			Project N	
Year-end	Cash Flow ₹	C.E.	Cash Flow ₹	C.E.
1	4,50,000	0.8	4,50,000	0.9
2	5,00,000	0.7	4,50,000	0.8
3	5,00,000	0.5	5,00,000	0.7

Present value factors of ₹ 1 discounted at 6% at the end of year 1, 2 and 3 are 0.943, 0.890 and 0.840 respectively.
Required:

- Which project should be accepted?
- If risk adjusted discount rate method is used, which project would be appraised with a higher rate and why?

Solution:

- a) Statement Showing the Net Present Value of Project M

Year	CFs (₹) (a)	C.E. (b)	Adjusted CFs (₹) (c) = (a) x (b)	PVF at 6% (d)	DCFs (₹) (e) = (c) x (d)
1	4,50,000	0.8	3,60,000	0.943	3,39,480
2	5,00,000	0.7	3,50,000	0.89	3,11,500
3	5,00,000	0.5	2,50,000	0.84	2,10,000
Total					8,60,980
Less: Initial Investments					8,50,000
NPV					10,980

Statement Showing the Net Present Value of Project N

Year	CFs (₹) (a)	C.E. (b)	Adjusted CFs (₹) (c) = (a) x (b)	PVF at 6% (d)	DCFs (₹) (e) = (c) x (d)
1	4,50,000	0.9	4,05,000	0.943	3,81,915
2	4,50,000	0.8	3,60,000	0.890	3,20,400
3	5,00,000	0.7	3,50,000	0.840	2,94,000
Total					9,96,315
Less: Initial Investments					8,25,000
NPV					1,71,315

Decision: Since the net present value of Project N is higher, so the project N should be accepted.

- b) Certainty - Equivalent (C.E.) Co-efficient of Project M (2.0) is lower than Project N (2.4). This means Project M is riskier than Project N as "higher the riskiness of a cash flow, the lower will be the CE factor". If risk adjusted discount rate (RADR) method is used, Project M would be analysed with a higher rate.

RADR is based on the premise that riskiness of a proposal may be taken care of, by adjusting the discount rate. The cash flows from a more risky proposal should be discounted at a relatively higher discount rate as compared to other proposals whose cash flows are less risky. Any investor is basically risk averse. However, he may be ready to take risk provided he is rewarded for undertaking risk by higher returns. So, more risky the investment is, the greater would be the expected return. The expected return is expressed in terms of discount rate which is also the minimum required rate of return generated by a proposal if it is to be accepted. Therefore, there is a positive correlation between risk of a proposal and the discount rate.



QUESTION 15

SM | PM

Determine the risk adjusted net present value of the following projects:

	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	1.2	0.8	0.4

The Company selects the risk-adjusted rate of discount on the basis of the coefficient of variation:

Coefficient of Variation	Risk-Adjusted Rate of Return	PVF of 1 to 5 years At riskadjusted rate of discount
0.0	10%	3.791
0.4	12%	3.605
0.8	14%	3.433
1.2	16%	3.274
1.6	18%	3.127
2.0	22%	2.864
More than 2.0	25%	2.689

Solution:

Statement showing the determination of the risk adjusted net present value

Projects	Net cash outlays	Coeff of variation	Risk adjusted rate	Annual cash inflow	PV factor 1-5 years	Discounted cash inflow	Net present value
a	b	c	d	e	f	g = e x f	g - b
X	2,10,000	1.20	16%	70,000	3.274	2,29,180	19,180
Y	1,20,000	0.80	14%	42,000	3.433	1,44,186	24,186
Z	1,00,000	0.40	12%	30,000	3.605	1,08,150	8,150



QUESTION 16

SM | PM | M 16

New Projects Ltd. is evaluating 3 projects, P-I, P-II, P-III. Following information is available in respect of these projects:

	P-I	P-II	P-III
Cost	₹ 15,00,000	₹ 11,00,000	₹ 19,00,000
Inflows-Year 1	6,00,000	6,00,000	4,00,000
Year 2	6,00,000	4,00,000	6,00,000

Year 3	6,00,000	5,00,000	8,00,000
Year 4	6,00,000	2,00,000	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:

- Find out the risk-adjusted discount rate (RADR) for these projects.
- Which project is the best?

Solution:

- The risk free rate of interest and risk factor for each of the projects are given. The risk adjusted discount rate (RADR) for different projects can be found on the basis of CAPM as follows:

$$= R_f + (k_o - R_f) \text{ Risk Factor}$$

$$\text{For P-I} = 0.10 + (0.15 - 0.10) 1.80 = 19\%$$

$$\text{For P-II} = 0.10 + (0.15 - 0.10) 1.00 = 15\%$$

$$\text{For P-III} = 0.10 + (0.15 - 0.10) 0.60 = 13\%$$

- The three projects can now be evaluated at 19%, 15% and 13% discount rate as follows:

Project P-I

Annual Inflows	₹ 6,00,000
PVAF (19 %, 4)	2.639
PV of Inflows	₹ 15,83,400
Less: Cost of Investment	₹ 15,00,000
Net Present Value	₹ 83,400

Project P-II

Year	Cash Inflow (₹)	PVF @ 15%	PV (₹)
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
Total Present Value of Inflows			12,67,800
Less: Cost of Investment			11,00,000
Net Present Value			1,67,800

Project P-III

Year	Cash Inflow (₹)	PVF @ 13%	PV (₹)
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
Total Present Value of Inflows			21,13,800
Less: Cost of Investment			19,00,000
Net Present Value			2,13,800

Project P-III has highest NPV. So, it should be accepted by the firm



QUESTION 17

SM | N 10 | PM | N 16

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Advanced Capital Budgeting

A firm has projected the following cash flows from a project under evaluation:

Year	₹ lakhs
0	(70)
1	30
2	40
3	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%.

Show how the viability of the project is to be evaluated.

Solution:

Nominal rate = $(1 + 0.1) \times (1 + 0.1) - 1 = 0.155$ i.e., 15.5%

Year	Nominal cash flows	PVF @ 15.50%	PV of cash flows
1	30	0.866	25.98
2	40	0.749	29.96
3	30	0.649	19.47
Total Present Value of Inflows			75.41
Less: Cash out flow			70
NPV			5.41

Advise: With positive NPV, the project is financially viable.



QUESTION 18

N 20 | N 19 | SM | PM

KLM Ltd. requires ₹ 15,00,000 for a new project.

Useful life of project is 3 years.

Salvage value - NIL.

Depreciation is ₹ 5,00,000 p.a.

Given below are projected revenues and costs (excluding depreciation) ignoring inflation:

Year	1	2	3
Revenues in ₹	10,00,000	13,00,000	14,00,000
Costs in ₹	5,00,000	6,00,000	6,50,000

Applicable tax rate is 35%. Assume cost of capital to be 14% (after tax). The inflation rates for revenues and costs are as under:

Year	Revenues %	Costs %
1	9	10
2	8	9
3	6	7

PVF at 14%, for 3 years = 0.877, 0.769 and 0.675

Show amount to the nearest rupee in calculations.

You are required to calculate net present value of the project.

Solution:

a. Inflation adjusted Revenues

Year	Revenues (₹)	Revenues (Inflation Adjusted) (₹)
1	10,00,000	10,00,000(1.09) = 10,90,000

2	13,00,000	$13,00,000(1.09)(1.08) = 15,30,360$
3	14,00,000	$14,00,000(1.09)(1.08)(1.06) = 17,46,965$

b. Inflation adjusted Costs

Year	Costs (₹)	Costs (Inflation Adjusted) (₹)
1	5,00,000	$5,00,000(1.10) = 5,50,000$
2	6,00,000	$6,00,000(1.10)(1.09) = 7,19,400$
3	6,50,000	$6,50,000(1.10)(1.09)(1.07) = 8,33,905$

c. Tax Benefit on Depreciation = ₹ 5,00,000 × 0.35 = ₹ 1,75,000

d. Calculation of DCF:

Particulars	Year1	Year2	Year3
Revenue	10,90,000	15,30,360	17,46,965
Less: Cost	5,50,000	7,19,400	8,33,905
Less: Depreciation	5,00,000	5,00,000	5,00,000
PBT	40,000	3,10,960	4,13,060
Less: Tax	14,000	1,08,836	1,44,571
PAT	26,000	2,02,124	2,68,489
Add: Depreciation	5,00,000	5,00,000	5,00,000
CFAT	5,26,000	7,02,124	7,68,489
X PVF	0.877	0.769	0.675
DCF	4,61,302	5,39,933	5,18,730

$$\text{NPV} = -15,00,000 + 4,61,302 + 5,39,933 + 5,18,730$$

$$= ₹ 19,965$$



QUESTION 19

SM | PM

A firm has an investment proposal, requiring an outlay of ₹ 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 ₹ 50,000 and 0.6 probability that cash inflow after tax will be ₹ 60,000. The probability assigned to cash inflow after tax for the year 2 is as follows:

The cash inflow year 1	₹ 50,000		₹ 60,000	
The cash inflow year 2	Probability		Probability	
	₹ 24,000	0.2	₹ 40,000	0.4
	₹ 32,000	0.3	₹ 50,000	0.5
	₹ 44,000	0.5	₹ 60,000	0.1

dependent

The firm uses a 10% discount rate for this type of investment. Required:

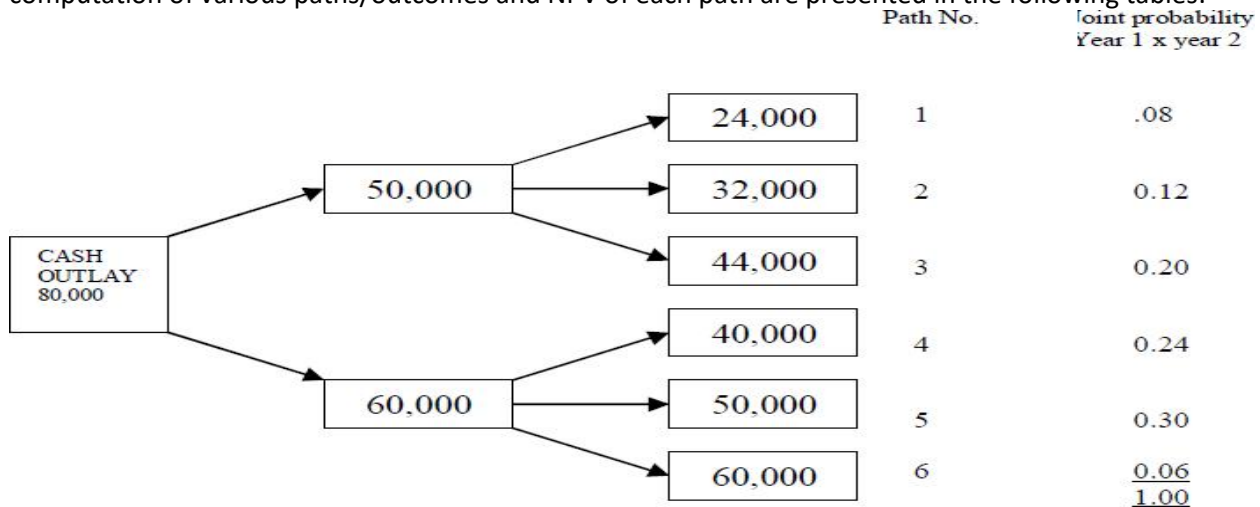
- Construct a decision tree for the proposed investment project and calculate the expected net present value (NPV).
- What net present value will the project yield, if worst outcome is realized? What is the probability of occurrence of this NPV?
- What will be the best outcome and the probability of that occurrence?
- Will the project be accepted?

Advanced Capital Budgeting

(Note: 10% discount factor 1 year 0.909; 2 year 0.826)

Solution:

- a) 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:



The Net Present Value (NPV) of each path at 10% discount rate is given below:

Path	PV (Year 1 CFs) (₹)	PV (Year 2 CFs) (₹)	PV (CF IFs)	Cash OF	NPV
1	$50,000 \times 0.909 = 45,450$	$24,000 \times 0.826 = 19,824$	65,274	80,000	- 14,726
2	45,450	$32,000 \times 0.826 = 26,432$	71,882	80,000	- 8,118
3	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	54,540	$50,000 \times 0.826 = 41,300$	95,840	80,000	15,840
6	54,540	$60,000 \times 0.826 = 49,560$	1,04,100	80,000	24,100

Statement showing Expected Net Present Value

z	NPV (₹)	Joint Probability	Expected NPV
1	- 14,726	0.08	- 1,178.08
2	- 8,118	0.12	- 974.16
3	1,794	0.20	358.80
4	7,580	0.24	1,819.20
5	15,840	0.30	4,752.00
6	24,100	0.06	1,446.00
			6,223.76

- b) If the worst outcome is realized the project will yield NPV of – ₹ 14,726. The probability of occurrence of this NPV is 8%
- c) The best outcome will be path 6 when the NPV is at ₹ 24,100. The probability of occurrence of this NPV is 6%.
- d) The project should be accepted because the expected NPV is positive at ₹ 6,223.76 based on joint probability.



QUESTION 20

It is a common sense based question. doesn't relate to any topic in the out notes

only on celci

SM | M 11 | PM

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

Cash Flow in ₹	-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	0.10	0.20	0.40	0.20	0.10
Project B					
Cash Flow (₹)	-10000	-4000	15000	5000	10000
Probability	0.10	0.15	0.40	0.25	0.10

Which project should be selected and why?

Solution:

Evaluation of project utilizes of Project A

Cash flow(in ₹)	Project B		
	Probability	Utility	Utility value
-15,000	0.10	-100	-10
-10,000	0.20	-60	-12
15,000	0.40	40	16
10,000	0.20	30	6
5,000	0.10	20	2
			2

Evaluation of project utilizes of Project B

Cash flow(in ₹)	Project B		
	Probability	Utility	Utility value
-10,000	0.10	-60	-6
-4,000	0.15	-3	-0.45
15,000	0.40	40	16
5,000	0.25	20	5
10,000	0.10	30	3
			17.55

Project B should be selected as its expected utility is more.



QUESTION 21

SM | PM

A & Co. is contemplating whether to replace an existing machine or to spend money on overhauling it. A & Co. currently pays no taxes. The replacement machine costs ₹ 90,000 now and requires maintenance of ₹ 10,000 at the end of every year for eight years. At the end of 8 years, it would have a salvage value of ₹ 20,000 and would be sold. The existing machine requires increasing amounts of maintenance each year and its salvage value fall each year as follows:

Advanced Capital Budgeting

Year	Maintenance (₹)	Salvage (₹)
Present	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 & Co. is 15%.

Required:

When should the company replace the machine?

(Notes: Present value of an annuity of Re. 1 per period for 8 years at interest rate of 15% : 4.4873; present value of Re. 1 to be received after 8 years at interest rate of 15% : 0.3269).

Solution:

A & Co: Equivalent Annual Cost of (EAC) of new machine

	₹
Cost of new machine now	90,000
Add: PV of annual repairs @ ₹ 10,000 per annum for 8 years (₹ 10,000 x 4.4873)	44,873
Less: PV of salvage value at the end of 8 years (₹20,000 x 0.3269)	6,538
PV of Net CFs related to new machine	1,28,335
÷ PVAF _(15%, 8 years)	4.4873
Equivalent annual cost (EAC) of buying & operating the machine	28,600

PV of cost of replacing the old machine in each of 4 years with new machine

Scenario	Year	Cashflow	PVF at 15%	PV
Replace immediately	0	(40,000)	1	(40,000)
	1 to 4	28,600	2.855	81,652
				41,652
Replace after 1 year	1	10,000 – 25,000 = -15,000	0.870	- 13,044
	2 to 4	28,600	1.985	56,783
				43,739
Replace after 2 years	1	10,000	0.870	8,696
	2	20,000 – 15,000 = 5,000	0.756	3,780
	3 and 4	28,600	1.229	35,157
				47,633
Replace after 3 years	1	10,000	0.870	8,696
	2	20,000	0.756	15,123
	3	30,000 – 10,000 = 20,000	0.658	13,150
	4	28,600	0.572	16,352
				53,321
Replace after 4 years	1	10,000	0.870	8,696

	2	20,000	0.756	15,123
	3	30,000	0.658	19,725
	4	40,000	0.572	22,870
				66,414

Advice: The company should replace the old machine immediately because the PV of cost of replacing the old machine with new machine is least.



QUESTION 22

SM | N 08 | PM

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

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

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.

Solution:

Upgrading Decision:

Incremental initial cash outflow: Upgradation Cost = 10,00,000

Incremental cash inflow:

c Depreciation – in case machine is upgraded
₹ 10,00,000 ÷ 5 = ₹ 2,00,000

Year	Existing Machine	Upgraded Machine			Incremental CFAT	PVF	DCF
	(a) EAT/CFAT	(b) EAT	(c) Dep	(d) CFAT			
1	5,00,000	5,50,000	2,00,000	7,50,000	2,50,000	0.87	2,17,500
2	5,40,000	5,90,000	2,00,000	7,90,000	2,50,000	0.756	1,89,000
3	5,80,000	6,10,000	2,00,000	8,10,000	2,30,000	0.658	1,51,340
4	6,20,000	6,50,000	2,00,000	8,50,000	2,30,000	0.572	1,31,560
5	6,60,000	7,00,000	2,00,000	9,00,000	2,40,000	0.497	1,19,280
Total P.V. of incremental CFAT							8,08,680
Less: Incremental Cash Outflows							-10,00,000
Incremental NPV							-1,91,320

Advanced Capital Budgeting

Conclusion: Machine should not be upgraded.

Replacement Decision:

Incremental initial cash outflow:

Cost	20,00,000
Add: Installation cost	50,000
Total Cost	20,50,000
Less: Disposal of old machine (₹ 50,000 – 40% tax)	- 30,000
Initial Incremental Cash Outflow	20,20,000

Incremental cash inflow:

Working Note:

- c ~~Depreciation – in case machine is upgraded~~
~~₹ 10,00,000 ÷ 5 = ₹ 2,00,000~~
- d Depreciation – in case new machine is installed
 ₹ 20,50,000 ÷ 5 = ₹ 4,10,000
- e Old existing machine – Book Value is zero. So, no depreciation.

Year	Existing Machine	Replaced Machine			Incremental CFAT	PVF	DCF
	(a) EAT/CFAT	(b) EAT	(c) Dep	(d) CFAT			
1	5,00,000	6,00,000	4,10,000	10,10,000	5,10,000	0.87	4,43,700
2	5,40,000	6,40,000	4,10,000	10,50,000	5,10,000	0.756	3,85,560
3	5,80,000	6,90,000	4,10,000	11,00,000	5,20,000	0.658	3,42,160
4	6,20,000	7,40,000	4,10,000	11,50,000	5,30,000	0.572	3,03,160
5	6,60,000	8,00,000	4,10,000	12,10,000	5,50,000	0.497	2,73,350
Total P.V. of Incremental CFAT							17,47,930
Less: Incremental Cash Outflows							-20,20,000
Incremental NPV							-2,72,070

Conclusion: Machine should not be replaced.



QUESTION 23

SM

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This question is actually choosing between the two machines

Company X 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 ₹ 1,50,000 and will last for 3 years. It costs ₹ 40,000 per year to run. Machine B is an 'economy' model costing only ₹ 1,00,000, but will last only for 2 years, and costs ₹ 60,000 per year to run. ~~These are real cash flows.~~ The costs are forecasted in rupees of constant purchasing power. Ignore tax. Opportunity cost of capital is 10 per cent. Which machine company X should buy?

Solution:

Statement showing the evaluation of two machines

Machines	A	B
Purchase cost (₹):	1,50,000	1,00,000
(a)		

Life of machines (years)		3	2
Running cost of machine per year (₹):	(b)	40,000	60,000
PVAF for 3 years @ 10% PVAF for 2 years @ 10%	(c)	2.486	1.735
Present value of running cost of machines (₹): (d = b x c)		99,480	1,04,100
Cash outflow of machines (₹):	(f = d + e)	2,49,480	2,04,100
Equivalent present value of annual cash outflow	(f / c)	1,00,381.4	1,17,637.04

Should Buy machine A -



QUESTION 24

SM | PM

Company Y is operating an elderly machine that is expected to produce a net cash inflow of ₹40,000 in the coming year and ₹ 40,000 next year. Current salvage value is ₹ 80,000 and next year's value is ₹ 70,000. The machine can be replaced now with a new machine, which costs ₹ 1,50,000, but is much more efficient and will provide a cash inflow of ₹ 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.

Solution:

Statement showing present value of cash inflow of new machine when it replaces elderly machine now

PV of Cash Inflow of 3 years (80,000 x 2.487)	₹ 1,98,960
Less: Purchase Cost of New Machine	₹ 1,50,000
NPV of New Machine	₹ 48,960

Since NPV of New Machine is positive, it should be purchased.

Timing Decision:

Replace Now

Current Realizable Value	₹ 80,000
NPV of New Machine	₹ 48,960
Total PV of Net CFs of 3 years	₹ 1,28,960

Replace after 1 Year

Cash Inflow for Year 1	₹ 40,000
Realisable Value of Old Machine	₹ 70,000
NPV of New Machine	₹ 48,960
Total NPV after 1 Year	₹ 1,58,960
Total PV of Net CFs of 4 years (158880/1.1)	₹ 1,44,509

Advise: Since Total NPV is higher in case of Replacement after one year Machine should be replaced after 1 year.

Self-note: Ambiguity is that if you replace after a year, the total inflow and outflow of four years are being considered, which is not comparable with 'replacing now' which has CFs of only three years.



QUESTION 25

M 24 | SM | M 12 | PM

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:

Advanced Capital Budgeting

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

Solution:

One Year Replacement Cycle

Year	Replacement Cost	Maintenance & Repair	Residual Value	Net cash Flow	PVF @ 15%	DCF
0	-60,000			-60,000	1.0000	-60,000.00
1		-16,000	32,000	16,000	0.8696	13,913.60
PV of Cashflows of 1 year ÷ PVAF (15%, 1 year)						-46,086.40 0.8696
EAC						-52,997.24

Two Years Replacement Cycle

Year	Replacement Cost	Maintenance & Repair	Residual Value	Net cash Flow	PVF @ 15%	DCF
0	-60,000			-60,000	1	-60,000.00
1		-16,000		-16,000	0.8696	-13,913.60
2		-22,000	24,000	2,000	0.7561	1,512.20
PV of Cashflows of 2 years ÷ PVAF (15%, 2 years)						-72,401.40 1.6257
EAC						-44,535.52

Three Years Replacement Cycle

Year	Replacement Cost	Maintenance & Repair	Residual Value	Net cash Flow	PVF @ 15%	DCF
0	-60,000			-60,000	1	-60,000.00
1		-16,000		-16,000	0.8696	-13,913.60
2		-22,000		-22,000	0.7561	-16,634.20
3		-28,000	16,000	-12,000	0.6575	-7,890.00
PV of Cashflows of 3 years ÷ PVAF (15%, 3 years)						-98,437.80 2.2832
EAC						-43,113.96

Four Years Replacement Cycle

Year	Replacement Cost	Maintenance & Repair	Residual Value	Net cash Flow	PVF @ 15%	DCF
0	-60,000			-60,000	1	-60,000.00
1		-16,000		-16,000	0.8696	-13,913.60
2		-22,000		-22,000	0.7561	-16,634.20
3		-28,000		-28,000	0.6575	-18,410.00
4		-36,000	8,000	-28,000	0.5718	-16,010.40
PV of Cashflows of 4 years ÷ PVAF (15%, 4 years)						-1,24,968.20 2.855
EAC						-43,771.70

Since EAC is least in case of replacement cycle of 3 years hence machine should be replaced after every three years.



QUESTION 26

SM | PM

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 ₹ 55,000. Resale value of used bike at current in market is as follows:

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.(₹)	Petrol Repair Maintenance etc.(₹)
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.

Solution:

In this question the effect of increasing running cost and decreasing resale value have to be weighted up to against the purchase cost of bike. For this purpose, we shall compute Equivalent Annual Cost (EAC) of replacement in different years shall be computed and compared.

Year	Road Taxes(₹)	Petrol etc. (₹)	Total (₹)	PVF @10%	PV (₹)	Cumulative PV (₹)	PV of Resale Price (₹)	Net Outflow (₹)
1	3,000	30,000	33,000	0.909	29,997	29,997	31,815	(1,818)
2	3,000	35,000	38,000	0.826	31,388	61,385	17,346	44,039

3	3,000	43,000	46,000	0.751	34,546	95,931	6,759	89,172
---	-------	--------	--------	-------	--------	--------	-------	--------

Computation of EACs

Year	Purchase Price of Bike (₹)	Net Out flow(₹)	Total Outflow (₹)	PVAF @ 10%	EAC (₹)
1	55,000	(1,818)	53,182	0.909	58,506
2	55,000	44,039	99,039	1.735	57,083
3	55,000	89,172	1,44,172	2.486	57,993

Thus, from above table it is clear that EAC is least in case of 2 years, hence bike should be replaced every two years.



QUESTION 27

SM

A Company named Roby's cube decided to replace the existing Computer system of their organisation. Original cost of old system was ₹25,000 and it was installed 5 years ago. Current market value of old system is ₹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 ₹50,000. Estimated Salvage value of the new system is ₹1,000. Estimated cost savings with new system is ₹5,000 per year. Increase in sales with new system is assumed at 10% per year based on original total sales of ₹100000. Company follows straight line method of depreciation. Cost of capital of the company is 10% whereas tax rate is 30 %. Should the existing machine is replaced?

Solution:

a. Book Value of Old Machine: $= 25,000 - 25,000/10 \times 5$
 $= ₹ 12,500$

Tax savings on Capital Loss from sale: $= [5,000 - 12,500] \times 0.30$
 $= ₹ 2,250$

Initial Net cash outflow $= 50,000 - [2,250 + 5,000]$
 $= ₹ 42,750$

b. Incremental annual cash inflow:

Incremental Sales	$1,00,000 \times 10\%$	10,000
Add: Savings in Cost		5,000
Less: Incremental Depreciation	$49,000/5 - 25,000/10$	- 7,300
Incremental PBT		7,700
Less: Tax @ 30%		- 2,310
Incremental PAT		5,390
Add: Incremental Depreciation		7,300
Incremental CFAT		12,690

c. Incremental Salvage Value $= 1,000 - 0 = 1,000$

d. Incremental Net present value:

Years		CFs	PVF / PVAF	DCF
1	Initial OF	- 42,750	1.000	- 42,750
1 - 5	Annual IFs	12,690	3.791	48,108

5	Terminal Cash IF	1,000	0.621	621
NPV				5,979

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



QUESTION 28

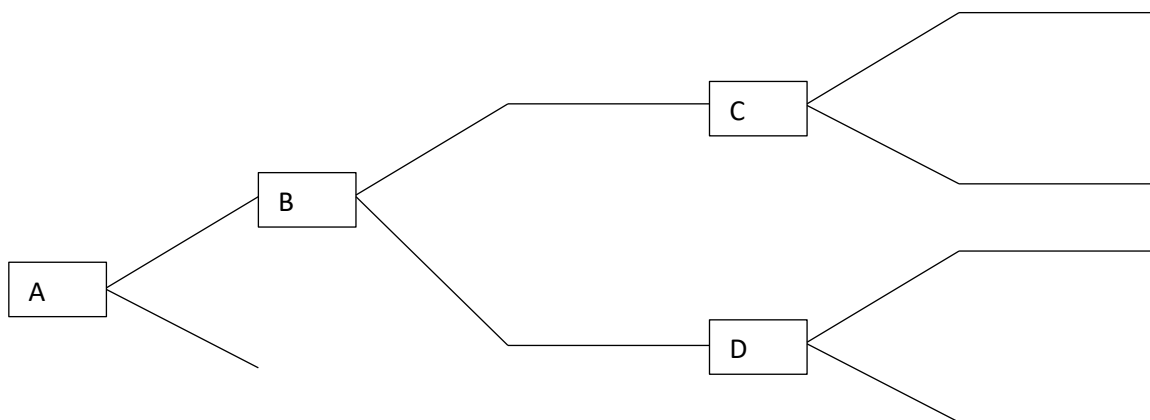
SM

try to understand on calci

L & R Limited wishes to develop new virus-cleaner software. The cost of the pilot project would be ₹ 2,40,000. Presently, the chances of the product being successfully launched on a commercial scale is rated at 50%. In case it does succeed, L&R can invest a sum of ₹ 20 lacs to market the product. Such an effort can generate perpetually, an annual net after tax cash income of ₹ 4 lacs.

Even if the commercial launch fails, they can make an investment of a smaller amount of ₹ 12 lacs with the hope of gaining perpetually a sum of ₹ 1 lac. Evaluate the proposal, adopting decision tree approach. The discount rate is 10%.

Solution:



Evaluation

At Decision Point C: The choice is between investing ₹ 20 lacs for a perpetual benefit of ₹ 4 lacs and not to invest. The preferred choice is to invest, since the capitalized value of benefit of ₹ 4 lacs (at 10%) adjusted for the investment of ₹ 20 lacs, yields a net benefit of ₹ 20 lacs.

At Decision Point D: The choice is between investing ₹ 12 lacs, for a similar perpetual benefit of ₹ 1 lac. and not to invest. Here the invested amount is greater than capitalized value of benefit at ₹ 10 lacs. There is a negative benefit of ₹ 2 lacs. Therefore, it would not be prudent to invest.

At Outcome Point B: Evaluation of EMV is as under (₹ in lacs).

Outcome	Amount	Prob	Result
Success	20	0.5	10
Failure	0	0.5	0
Net Result			10

EMV at B is, therefore, ₹10 lacs.

At A: Decision is to be taken based on preferences between two alternatives. The first is to test, by investing ₹ 2,40,000 and reap a benefit of ₹ 10 lacs. The second is not to test, and thereby losing the opportunity of a possible gain.

The preferred choice is, therefore, investing a sum of ₹ 2,40,000 and undertaking the test.



QUESTION 29

SM

only on calci

XYZ Ltd. is considering a project "A" with an initial outlay of ₹ 14,00,000 and the possible three cash inflow attached with the project as follows: (₹'000)

	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 whether project should be accepted or not.

Solution:

Year	PVF @9%	Worst Case		Most likely		Best case	
		Cash Flow '000	PV '000	Cash Flow '000	PV '000	Cash Flow '000	PV '000
0	1	(1400)	(1400)	(1400)	(1400)	(1400)	(1400)
1	0.917	450	412.65	550	504.35	650	596.05
2	0.842	400	336.80	450	378.90	500	421.00
3	0.772	700	540.40	800	617.60	900	694.80
NPV			-110.15		100.85		311.85

Now suppose that CEO of XYZ Ltd. is bit confident about the estimates in the first two years, but not sure about the third year's high cash inflow. He is interested in knowing what will happen to traditional NPV if 3rd year turn out the bad contrary to his optimism.

The NPV in such case will be as follows:

$$= -₹1400000 + \frac{550000}{(1 + 0.09)} + \frac{450000}{(1 + 0.09)^2} + \frac{700000}{(1 + 0.09)^3}$$

$$= ₹ 23871$$

Thus, CEO's concern is well founded that, as a worst case in the third year alone yield a marginally positive NPV.



QUESTION 30

N 24 | M 17 | PM | SM

sell off

assumed to be exercising option.

A firm is considering a proposal to set up a cement manufacturing plant with an initial investment of ₹ 150 crore. The firm has the option to abandon the project after one year by selling it to a competitor for ₹ 100 crore. If the market conditions are unfavorable and the demand is low, the project's value will decline by 60%. However, if the market conditions turn out to be favorable and the demand for cement is high, the value of the project at the end of year 1 will increase by 50%.

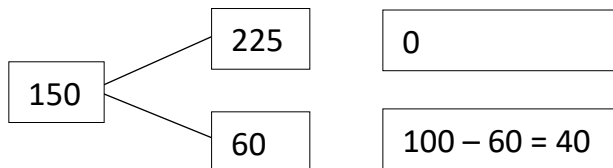
Given that the risk free rate of interest as 8%, what will be the value of the abandonment option and the value of the project with abandonment (Put) option?

Put

Solution:

Decision Tree showing payoff:

Year 0 Year 1 Pay off



calculate probability of high demand (P) using risk neutral method:

$$150 = [225 \times p + 60 \times (1-p)]/1.08$$

$$p = 61.82\%$$

$$1 - p = 38.18\%$$

The value of abandonment option will be as follows:

$$\begin{aligned} \text{Present value of expected pay off} &= [0 \times p + 40 \times (1-p)]/1.08 \\ &= [0 \times 61.82\% + 40 \times 38.18\%]/1.08 \\ &= ₹ 14.1389\text{Cr.} \end{aligned}$$

$$\begin{aligned} \text{The Value of project with abandonment option} &= [225 \times 61.82\% + 100 \times 38.18\%]/1.08 \\ &= 164.2019 \end{aligned}$$

Self-note: Time period of expected pay-off is not specified.



QUESTION 31

SM

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.

Given

$$\ln(1.336) = 0.2897$$

$$e^{1.0005} = 0.3677 \text{ and } e^{-1.17} = 0.3104 \text{ and } N(2.389) = 0.9916 \text{ and } N(2.188) = 0.9857$$

Solution:

ICAI Solution:

$$N(1.2315) = 0.8910$$

$$N(-0.7735) = 0.2196$$

call option
C.O.F. (C.E)
 σ_F
PV(Cash IF)
So.

Advanced Capital Budgeting

To value the patent, we shall use Black Scholes Model for option pricing as follows:

S (Spot Price) = The Present Value of Cashflows = \$16.7 million

E (Exercise Price) = Cost of Development Formula = \$ 12.5 million

σ^2 (Variance of Cash flow) = 26.8% i.e. ~~0.27~~

R (Risk Free Rate of Return) = 7.8%

D (Expected cost of Delays) = $\frac{1}{15} = 0.0667$ i.e. 6.67% → $\frac{16.7}{15} = 1.1133$ p.a.

Value call option

$$d_1 = \frac{\ln\left(\frac{S}{E}\right) + \left(\frac{\sigma^2}{2}\right)t}{\sigma\sqrt{t}}$$

$$= \frac{\ln\left(\frac{16.7}{12.5}\right) + \left[0.078 - 0.0667 + \left(\frac{0.268}{2}\right)\right]15}{\sqrt{0.268} \sqrt{15}}$$

$$= 1.2315$$

$$N(d_1) = 0.8910$$

$$d_2 = d_1 - \sigma\sqrt{t}$$

$$= 1.2315 - 2.005$$

$$= -0.7735$$

$$N(d_2) = 0.2196$$

Value of Patent

$$C = S \times e^{-df} \times N(d_1) - E \times e^{-rt} \times N(d_2)$$

$$= 16.7 \times e^{-0.0667 \times 15} \times 0.8910 - 12.5 \times e^{-0.078 \times 15} \times 0.2196$$

$$= 16.7 \times 0.3677 \times 0.8910 - 12.5 \times 0.3104 \times 0.2196$$

$$= 4.619$$

Thus, the value of patents is \$ 4.619 million

Yield : $\frac{\text{Div}}{S_0} : \frac{1.1133}{16.7} = 6.67\%$

Logical Solution:

To value the patent, we shall use Black Scholes Model for option pricing as follows:

S (Spot Price) = The Present Value of Cashflows = \$16.7 million

E (Exercise Price) = Cost of Development Formula = \$ 12.5 million

σ^2 (Variance of Cash flow) = 26.8% i.e. 0.27

R (Risk Free Rate of Return) = 7.8%

D (Expected cost of Delays) = $\frac{1}{15} = 0.0667$ i.e. 6.67%

Value call option

$$d_1 = \frac{\ln\left(\frac{S}{E}\right) + \left(\frac{\sigma^2}{2}\right)t}{\sigma\sqrt{t}}$$

$$= \frac{\ln\left(\frac{16.7}{12.5}\right) + \left[0.078 - 0.0667 + \left(\frac{0.002681}{2}\right)\right]15}{\sqrt{0.00268} \sqrt{15}}$$

$$= 2.389$$

$$N(d_1) = 0.9916$$

$$d_2 = d_1 - \sigma\sqrt{t}$$

$$\begin{aligned}
 &= 2.389 - 0.2001 \\
 &= 2.188 \\
 N(d_2) &= 0.9857
 \end{aligned}$$

Value of Patent

$$\begin{aligned}
 C &= \frac{S}{e^{yt}} \times N(d_1) - \frac{E}{e^{rt}} \times N(d_2) \\
 &= \frac{16.7}{e^{0.0667 \times 15}} \times 0.9916 - \frac{12.5}{e^{0.078 \times 15}} \times 0.9857 \\
 &= 16.7 \times 0.3677 \times 0.9916 - 12.5 \times 0.3104 \times 0.9857 \\
 &= 2.2645
 \end{aligned}$$

Thus, the value of patents is \$ 2.2645 million



QUESTION 32

SM

Suppose MIS Ltd. is considering installation of solar electricity generating plant for light the staff quarters. The plant shall cost ₹ 2.50 crore and shall lead to saving in electricity expenses at the current tariff by ₹ 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 ₹ 12 lakh or ₹ 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.

Solution:

Here we shall evaluate NPV in two possible situations:

(1) As on Today

$$\text{At cost of Capital of 10\%, the PV of saving forever} = \frac{21 \text{ lakhs}}{0.10} = ₹ 2.1 \text{ crore}$$

$$\text{NPV} = ₹ 2.1 \text{ crore} - ₹ 2.5 \text{ crore} = - ₹ 0.4 \text{ crore}$$

Since NPV is negative, it does not worth to accept the project.

(2) After one Year

After one year these are two possible situations, either rate of electricity decreases or increase.

(a) If price of electricity increases

$$\text{At cost of Capital of 10\%, the PV of saving forever} = \frac{35 \text{ lakh}}{0.10} = ₹ 3.50 \text{ crore}$$

$$\begin{aligned}
 \text{The position of the NPV at year 1 will be} &= ₹ 3.50 \text{ crore} - ₹ 2.50 \text{ crore} \\
 &= ₹ 1 \text{ crore}
 \end{aligned}$$

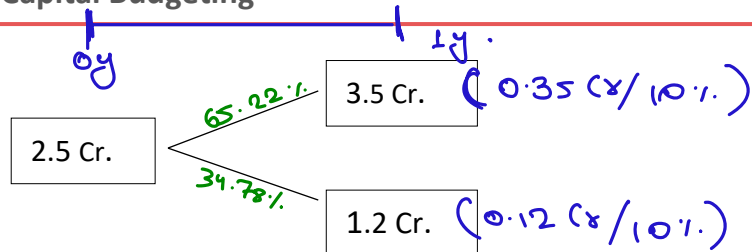
(b) If the price of electricity decreases

$$\text{At cost of Capital of 10\%, the PV of saving forever} = \frac{12 \text{ lakh}}{0.10} = ₹ 1.20 \text{ crore}$$

$$\begin{aligned}
 \text{The position of the NPV at year 1 will be} &= ₹ 1.20 \text{ crore} - ₹ 2.5 \text{ crore} \\
 &= - ₹ 1.3 \text{ crore}
 \end{aligned}$$

Diagrammatically it can be shown below

Advanced Capital Budgeting



calculate probability of high demand (P) using risk neutral method:

$$2.5 = [3.5 \times p + 1.2 \times (1-p)]/1.08$$

$$p = 65.22\%$$

$$1 - p = 34.78\%$$

$$\begin{aligned} \text{Hence, PV of expected NPV Today} &= [\text{₹ } 1 \text{ crore} \times .6522 + (- \text{₹ } 1.30 \text{ crore}) \times 0.3478]/1.08 \\ &= \text{₹ } 0.1852 \text{ Cr.} \end{aligned}$$

Thus, it shall be advisable to wait and see as NPV may turn out to be positive after one year.

Additional Practice Questions

Practice Question 1

RTP M 15

TMC is a venture capital financier. It received a proposal for financing requiring an investment of ₹45 crore which returns ₹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.

Solution:

Probability of project success

$$= (1 - 0.28) \times (1 - 0.25) \times (1 - 0.22) \times (1 - 0.18) \times (1 - 0.18) \times (1 - 0.10) \\ = 0.255$$

Probability of project will fail = $1 - 0.255 = 0.745$

Cost of equity using CAPM, $K_e = R_f + \beta (R_m - R_f)$
 $= 6\% + 7 \times (8\% - 6\%) = 20\%$

Net present value of the project:

Expected Cash Inflow: $(600 \text{ Cr.} \times 0.255 + 0 \times 0.745)$	153 Cr.
$\times \text{PVF (20\%, 6 years)}$	0.335
PV of Expected Inflows	51.255 Cr.
Less: PV of Initial Outflow	45 Cr.
NPV	6.255 Cr.

Since expected NPV of the project is positive it should be accepted.

Practice Question 2

M 21

M/s. SKPD Ltd. employs certainty-equivalent approach in the evaluation of risky investments. The finance department of the company has developed the following information regarding a new project:

Year	Expected CFAT (₹)	Certainty equivalent quotient
0 (Initial Outlays)	300,000	1.0
1	140,000	0.8
2	130,000	0.7
3	120,000	0.6
4	115,000	0.4
5	80,000	0.3

Following is the other information:

- a. The firm's cost of equity capital is 18%;

Advanced Capital Budgeting

- b. Cost of debt is 9%,
 c. Present risk-free rate of interest in the Market on the treasury bonds is 6%, which will rise by 200 basis points from 4th year onwards.

Year (t)	1	2	3	4	5
PVIF (6%, t)	0.943	0.890	0.840	0.792	0.747
PVIF (8%, t)	0.926	0.857	0.794	0.735	0.681

You are required to:

- a. To find out the viability of the project; and
 b. To advise on the popularity of this method.

Solution:

- a. Statement Showing the Net Present Value of Project

Year end	CFs (a)	C.E. (b)	Adjusted CFs (c) = (a x b)	Applicable PVIF (d)	Present Value ₹ (e) = (c x d)
1	1,40,000	0.8	112,000	0.943	1,05,616
2	1,30,000	0.7	91,000	0.890	80,990
3	1,20,000	0.6	72,000	0.840	60,480
4	1,15,000	0.4	46,000	0.735	33,810
5	80,000	0.3	24,000	0.681	16,344
Total PV of Cash Flows					2,97,240
Less: Initial Investment					3,00,000
Net Present Value					- 2,760

Decision: Since the net present value of the Project is negative, it should not be accepted.

- b. In Certainty Equivalent approach we incorporate risk to adjust the cash flows of a proposal so as to reflect the risk element and also adjust future cash flows rather than discount rates. But the procedure for reducing the forecasts of cash flows is implicit and likely to be inconsistent from one investment to another. Therefore, it is not popular.

Practice Question 3

Old SM

Determine NPV of the project with the following information:

Initial Outlay of project	₹ 40,000
Annual revenues (Without inflation)	₹ 30,000
Annual costs excluding depreciation (Without inflation)	₹ 10,000
Useful life	4 years
Salvage value	Nil
Tax Rate	50%
Cost of Capital (Including inflation premium of 10%)	12%

Solution:

Annual Cash Flow of project is

$$= (\text{₹ } 30,000 - \text{₹ } 10,000) (1 - 0.50) + \text{₹ } 10,000 \times 0.50 = \text{₹ } 15,000$$

It would be inconsistent to discount these real cash flows at 12% (nominal rate of return).

There are two alternatives:

NPV using (i) approach: restate the cash flow in nominal term and discount at 12%

Nominal Cash Flow = (1 + Inflation Rate) Real Cash Flows

Year	Real Cash Flows	Nominal Cash flows
1	15000	$15,000 \times 1.10 = 16,500$
2	15,000	$15,000 \times (1.10)^2 = 18,150$
3	15,000	$15,000 \times (1.10)^3 = 19,965$
4	15,000	$15,000 \times (1.10)^4 = 21,962$

NPV using nominal discounting rate 12%

$$= \frac{16,500}{(1.12)} + \frac{18,150}{(1.12)^2} + \frac{19,965}{(1.12)^3} + \frac{21,962}{(1.12)^4} = 40,000$$

$$= ₹ 17,369 \text{ (Approx)}$$

NPV using (ii) approach: Restate the discount rate in real terms and use this to discount the real cash flows

$$\text{Real Discount Rate} = \frac{1 + \text{Nominal Discount Rate}}{1 + \text{Inflation Rate}} - 1$$

$$= \frac{1 + 0.12}{1 + 0.10} - 1 = 0.0182 \text{ i.e. } 1.8\%$$

Accordingly, NPV of the project

$$= \frac{15,000}{(1.0182)} + \frac{15,000}{(1.0182)^2} + \frac{15,000}{(1.0182)^3} + \frac{15,000}{(1.0182)^4} - 40,000$$

$$= ₹ 57,367 - ₹ 40,000 = ₹ 17,367 \text{ (Approx)}$$

Practice Question 4

N 21

XYZ Ltd. is considering to replace the existing computer system of their organization. Original cost of the system was ₹ 2,50,000 and it was installed 5 years ago. Current market value of the old system is ₹ 50,000. The life of the old system is 10 years. Present cost of the new system is ₹ 5,00,000 with estimated Salvage by value of ₹ 10,000/-. The life of the new system is 5 years.

Estimated cost savings with the new computer system is ₹ 50,000 per year. Increase in sales with new system is assumed to be 10% per year based on original total sales of ₹ 10,00,000.

XYZ Ltd. follows straight-line method of depreciation. Cost of capital of the company is 12% whereas applicable income tax rate is 30%.

You are required to advise XYZ Lt. on acceptance of the replacement proposal.

Given PVIF(12%, 5) = 0.567; PVIFA (12%, 5) = 3.605.

Solution:

Working Notes:

a. Initial Outlay

Cost of new System	₹ 5,00,000
Less: Salvage value of existing system	₹ 50,000
Less: Tax Saving on STCL $[1,25,000 - 50,000] \times 0.30$	₹ 22,500
	₹ 4,27,500

b. Depreciation on New System

Cost of New System Less: S	₹5,00,000
	₹10,000
	₹4,90,000
Tenure	5years
Depreciation per year	₹98,000

c. Increase in Profit

Cost Saving	₹50,000
Increase in sales each year Total increase in	₹1,00,000
Profit	₹1,50,000

d. Calculation of Annual Cash flow

Increase in Profit	₹ 1,50,000
Less: Increased Dep. (₹ 98,000 – ₹ 25,000)	₹73,000
	₹ 77,000
Tax @ 30%	₹ 23,100
	₹ 53,900
Add: Depreciation	₹ 73,000
Annual Cash flow	₹ 1,26,900

NPV of Replacement Decision

PV of Cash Flows (Annual) $1,26,900 \times 3.605$	₹ 4,57,474.50
PV of Salvage Value of New System $0.567 \times ₹ 10,000$	₹5,670.00
	₹ 4,63,144.50
Less: Initial Outlay	₹ 4,27,500.00
	₹ 35,644.50

Since NPV is positive the computer system should be replaced.

Practice Question 5

PM

You own an unused gold mine that will cost ₹ 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 ₹ 5,000 an ounce, and each year the price is equally likely to rise or fall by ₹ 500 from its level at the start of year. The extraction cost is ₹4,600 an ounce and the discount rate is 10 per cent.

Required:

- Should you open the mine now or delay one year in the hope of a rise in the gold price?
- 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.

Solution:

- (i) Assume we open the mine now at $t = 0$. Taking into account the distribution of possible future price of gold over the next three years, we have

$$\begin{aligned}
 \text{NPV} &= -\text{Rs. } 10,00,000 + \frac{1,000 \times [(0.5 \times 5,500 + 0.5 \times 4,500) - 4,600]}{1.10} + \\
 &= \frac{1000 \times [(0.5)^2 (6,000 + 5,000 + 5,000 + 4,000) - 4,600]}{(1.10)^2} + \\
 &\quad \frac{1,000 \times [(0.5)^3 (6,500 + 5,500 + 5,500 + 4,500 + 4,500 + 5,500 + 4,500 + 3,500) - 4,600]}{(1.10)^3} \\
 &= -\text{₹ } 5,260
 \end{aligned}$$

Because the NPV is negative, we should not open the mine at $t = 0$. It does not make sense to open the mine at any price less than or equal to ₹ 5,000 per ounce.

- (ii) Assume that we delay one year until $t = 1$, and open the mine if the price is ₹ 5,500.

At that point:

$$\begin{aligned}
 \text{NPV} &= (-)\text{₹ } 10,00,000 + \frac{1000 [(0.5 \times 6000 + 0.5 \times 5000) - 4600]}{1.10} + \\
 &\quad \frac{1000 [((0.5)^2 \times (6500 + 5500 + 5500 + 4500)) - 4600]}{(1.10)^2} + \\
 &\quad \frac{1000 \times [(0.5)^3 (7000 + 6000 + 6000 + 5000 + 5000 + 6000 + 5000 + 4000) - 4600]}{(1.10)^3} \\
 &= \text{₹ } 12,38,167
 \end{aligned}$$

If the price at t_1 reaches ₹ 5,500, then expected price for all future periods is ₹ 5,500.

NPV at $t_0 = 12,38,167/1.10 = \text{₹ } 11,25,606$

If the price rises to ₹ 5,500 at $t = 1$, we should open the mine at that time. The expected NPV of this strategy is:

$$(0.50 \times 11,25,606) + (0.50 \times 0) = \text{₹ } 5,62,803$$

As already stated, mine should not be opened if the price is less than or equal to ₹ 5,000 per ounce.

If the price at t_1 reaches ₹ 4,500, then expected price for all future periods is ₹ 4,500. In that situation we should not open the mine.

- (b) Suppose we open the mine at $t = 0$, when the price is ₹ 5,000. At $t = 2$, there is a 0.25 probability that the price will be ₹ 4,000. Then since the price at $t = 3$ cannot rise above the extraction cost, the mine should be closed. If we open the mine at $t = 0$, when the price was ₹ 5,000 with the closing option the NPV will be:

$$\begin{aligned}
 \text{NPV} &= -\text{Rs. } 10,00,000 + \sum_{t=1}^2 \frac{(5,000 - 4,600)1,000}{(1.10)^t} \\
 &\quad \frac{0.125 \times [1,900 + 900 + 900 + 900 - 100 - 100] \times 1,000}{(1.10)^3} \\
 &= \text{₹ } 1,07,438
 \end{aligned}$$

Therefore, the NPV with the abandonment option (i.e. savings) is ₹ 1,07,438. The value of the abandonment option is:

$$0.125 \times 1,000 \times (100+1100) / (1.10)^3 = ₹ 1,12,697$$

The NPV of strategy (2), that to open the mine at $t = 1$, when price rises to ₹ 5,500 per ounce, even without abandonment option, is higher than option 1. Therefore, the strategy (2) is preferable.

Under strategy 2, the mine should be closed if the price reaches ₹ 4,500 at $t = 3$, because the expected profit is $(₹ 4,500 - 4,600) \times 1,000 = - ₹ 1,00,000$.

$$\text{The value of the abandonment option is: } 0.125 \times (1,00,000) / (1.10)^4 = ₹ 8,538$$

Note: Students may also assume that the price of the gold remains at ₹ 5,000 to solve the

Practice Question 6

A company is considering bidding for the exclusive rights to undertake a project, which will initially cost ₹35 lakh. The company has forecast the following end of year cash flows for the four-year project.

Year	1	2	3	4
Cash flow (₹ in lakhs)	20	15	10	5

The relevant cost of capital for this project is 11% and the risk-free rate is 4.5%. The likely volatility (standard deviation) of the cash flows is estimated to be 50%.

Solution:

NPV without any option to delay the decision

Year	0	1	2	3	4
Cash flow (₹ in lakhs)	-35	20	15	10	5
PVIF @ 11%	1	0.9	0.81	0.73	0.66
PV of cash flows (₹ in lakhs)	-35	18	12.2	7.3	3.3

So, NPV = ₹ 5.8 lakh.

Supposing the company does not have to make the decision right now but can wait for two years before it needs to make the decision.

NPV with the option to delay the decision for two years.

Year	3	4	5	6
Cash flow (₹ in lakhs)	20	15	10	5
PVIF @ 11%	0.73	0.66	0.59	0.54
PV of cash flows (₹ in lakhs)	14.6	9.9	5.9	2.7

Total PV = $14.6 + 9.9 + 5.9 + 2.7 = ₹ 33.1$ lakh

Variables to be used in the BSOP model

Asset value (P_a) = $\$14.6m + \$9.9m + \$5.9m + \$2.7m = \$33.1m$

Exercise price (P_e) = $\$35m$

Exercise date (t) = 2 years

Risk free rate (r) = 4.5%

Volatility (s) = 50%

Using Black Scholes Option Pricing formula, we can calculate:

$d_1 = 0.40$; $d_2 = -0.31$; $N(d_1) = 0.6554$ and $N(d_2) = 0.3783$

$$\begin{aligned} \text{Therefore, } C &= S_1 N(d_1) - Ke^{-rt} N(d_2) \\ &= 33.1 \times 0.6554 - 35 \times e^{-0.045 \times 2} \times 0.3783 \\ &= ₹9.6 \text{ lakh} \end{aligned}$$

Based on the facts that the company can delay its decision by two years and a high volatility, it can bid as much as ₹9.6 lakh instead of ₹5.8 lakh for the exclusive rights to undertake the project. The increase in value reflects the time before the decision has to be made and the volatility of the cash flows.

Practice Question 7

X Ltd. is evaluating an investment proposal which has uncertainty associated with all three major factors: the initial investment or original cost, the useful life and the annual cash flows. The probability distribution of the three variables are as follows:

Original cost		Useful life		Annual cash flows	
Value (₹ lakh)	Probability	Value (years)	Probability	Value (₹ Lakh)	Probability
9.00	0.10	7.00	0.20	2.00	0.20
7.00	0.60	6.00	0.40	2.50	0.40
6.00	0.30	5.00	0.40	1.50	0.10
				1.00	0.30

The firm's cost of capital is 15% and the risk-free rate of return is 12%. Suppose the finance manager feels that these two values are likely to remain unchanged during the life of the project.

Conduct simulation trials and determine the NPV. Advice on the acceptability of the project. The random numbers are:

The random numbers are:

Original Cost	52	37	82	69	98	96	33	50	88	90
Useful Life	6	63	57	2	94	52	69	33	32	30
Annual Cashflow	50	28	68	36	90	62	27	50	18	36

Solution:

Calculation of cumulative Probability

Original cost			Useful life			Annual cash flows		
Value (₹ lakh)	Prob.	Cumulative Prob.	Value (years)	Prob.	Cumulative Prob.	Value (₹ lakh)	Prob.	Cumulative Prob.
9.00	0.10	0.10	7.00	0.20	0.20	2.00	0.20	0.20
7.00	0.60	0.70	6.00	0.40	0.60	2.50	0.40	0.60
6.00	0.30	1.00	5.00	0.40	1.00	1.50	0.10	0.70
						1.00	0.30	1.00

Calculation of random number intervals

Original cost			Useful life			Annual cash flows		
Value (₹ lakh)	Cumulative Prob.	Random No.	Value (years)	Cumulative Prob.	Random No.	Value (₹ lakh)	Cumulative Prob.	Random No.
9.00	0.10	0-9	7.00	0.20	0-19	2.00	0.20	0-19
7.00	0.70	10-69	6.00	0.60	20-59	2.50	0.60	20-59
6.00	1.00	70-99	5.00	1.00	60-99	1.50	0.70	60-69
						1.00	1.00	70-99

Simulation Trials

Run	Original cost ₹		Useful life (Years)		Annual Cashflow ₹		NPV ₹
	Random No.	Value	Random No.	Value	Random No.	Value	
1	52	7	6	7	50	2.5	4.41
2	37	7	63	5	28	2.5	2.01
3	82	6	57	6	68	1.5	0.17
4	69	7	2	7	36	2.5	4.41
5	98	6	94	5	90	1.0	-2.4
6	96	6	52	6	62	1.5	0.17
7	33	7	69	5	27	2.5	2.01
8	50	7	33	6	50	2.5	3.28
9	88	6	32	6	18	2.0	2.22
10	90	6	30	6	36	2.5	4.28
Expected NPV							20.56

As the NPV is positive, the firm may accept the investment proposal.

Practice Question 8

Particulars	Profit if there is strong demand	Profit/(loss) in case of weak demand
Option A	4,000	(1,000)
Option B	1,500	500
Probability of demand	0.3	0.7

- What would be the decision based on expected values? If no information about demands were available?
- What is the value of perfect information about demand?

Solution:

- If there were no information to help with the decision, the project with the higher EV of profit would be selected.

Probability	Project A		Project B	
	Profit	EV	Profit	EV
0.3	4,000	1,200	1,500	450
0.7	(1,000)	(700)	500	350
1.0		500		800

Analysis: Project B would be selected. This is clearly the better option if demand turns out to be weak. However, if demand were to turn out to be strong, Project A would be more profitable. There is a 30% chance that this could happen.

- Perfect information will indicate for certain whether demand will be weak or strong. If demand is forecasted 'weak' Project B would be selected. If demand is forecasted as 'strong', Project A would be selected, and perfect information would improve the profit from ₹1,500, which would have been earned by selecting B to ₹4,000.

Forecast demand	Probability	Project chosen	Profit	EV of
Weak	0.7	B	500	350
Strong	0.3	A	4,000	1,200

EV of profit with perfect information				1,550
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The Value of Perfect Information derives from the 0.3 probability that if demand is going to be strong, the information would reveal this fact, and the decision is changed from 'choose B' to 'choose A' thereby earning ₹2,500 more profit. The EV of the Value of Perfect Information is therefore $0.3 \times ₹2,500 = ₹750$. Another way of making this same calculation is as follows:

EV of profit without Perfect Information (i.e., choose B all the time)	₹ 800
EV of profit with Perfect Information	₹ 1,550
Value of Perfect Information	₹ 750

Analysis: Provide that the information does not cost more than ₹ 750 to collect, it would be worth having.

Practice Question 9

A manager is trying to decide which of the three mutually exclusive projects to undertake. Each of the projects could lead to varying net profits which are classified as outcomes I, II and III. The manager has constructed the following pay-off table or matrix (a conditional profit table).

Net profit if outcome turns out to be:

Project	I	II	III
A ₹	50,000	65,000	80,000
B ₹	70,000	60,000	75,000
C ₹	90,000	80,000	55,000
Probability	0.2	0.6	0.2

Which project should be undertaken?

Solution:

If the project with the highest EV of profit were chosen, this would be project C.

Outcome	Probability	Project A EV	Project B EV	Project C EV
I	0.2	10,000	14,000	18,000
II	0.6	39,000	36,000	48,000
III	0.2	16,000	15,000	11,000
	1.0	65,000	65,000	77,000

However, if the maximum criterion were applied, the assessment would be as follows:

Project Selected	The worst outcome that could happen	Profit ₹
A	I	50,000
B	II	60,000
C	III	55,000

Analysis: By choosing B, we are 'guaranteed' a profit of at least ₹ 60,000, which is more than we would get from project A or C if the worst outcome were to occur for them. The decision would therefore be to choose project B.

Practice Question 10

A manager is trying to decide which of the three mutually exclusive projects to undertake. Each of the projects could lead to varying net profits which are classified as outcomes I, II and III. The manager has constructed the following pay-off table or matrix (a conditional profit table).

Net profit if outcome turns out to be:

Outcomes		Project		
(Net profit)	Probability	A	B	C

Advanced Capital Budgeting

I (Worst)	0.2	50,000	70,000	90,000
II (Most likely)	0.5	85,000	75,000	1,00,000
III (Best)	0.3	1,30,000	1,40,000	1,10,000

Which project should be undertaken? Which project is profitable, if minimax regret rule is applicable?

Solution:

If the project with the highest EV of profit were chosen, this would be project C. ₹

Outcome	Probability	Project A EV	Project B EV	Project C EV
I (Worst)	0.2	10,000	14,000	18,000
II (Most likely)	0.5	42,500	37,500	50,000
III (Best)	0.3	39,000	42,000	33,000
	1.0	91,500	93,500	1,01,000

A table of regrets can be compiled, as follows, showing the amount of profit that might be foregone for each project, depending on whether the outcome is I, II or III.

Outcome	Project		
	A	B	C
Worst	[90,000 – 50,000] = 40,000	[90,000 – 70,000] = 20,000	[90,000 – 90,000] = 0
Most likely	[1,00,000 - 85,000] = 15,000	[1,00,000 - 75,000] = 25,000	[1,00,000 – 1,00,000] = 0
Best	[1,40,000 - 1,30,000] = 10,000	[1,40,000 – 1,40,000] = 0	[1,40,000-1,10,000] = 30,000

Analysis: The maximum regret is 40,000 with project A, 25,000 with B and 30,000 with C. The lowest of these three maximum regrets is 25,000 with B, and so project B would be selected if the minimax regret rule is used.

Note: The minimax regret rule aims to minimize the regret from making the wrong decision. Regret is the opportunity lost through making the wrong decision.

Risk Management & Security Analysis



**QUESTION 1:**

M 18

Neel holds 1 Crore Shares of XY Ltd. whose Market Price Standard Deviation is 2% per day. Assuming 252 Trading Days in a Year, determine Maximum Loss Level over the period of 1 trading day and 10 trading days with 99% Confidence Level. Assuming Share Prices are normally for level of 99%, the equivalent Z Score from Normal Table of Cumulative Area shall be 2.33.

Solution:

For level of 99% confidence, the equivalent Z score from Normal table of Cumulative Area is 2.33.

Calculating maximum loss over 1 trading day:

$$Z = \frac{(x - \bar{x}) \text{ i.e. maximum loss}}{\sigma}$$

$$2.33 = \frac{\text{maximum loss}}{2\%}$$

$$\text{Maximum loss (\%)} = 4.66\%$$

$$\text{Maximum loss (₹)} = 1 \text{ Cr.} \times 4.66\%$$

$$= ₹ 4,66,000$$

Calculating maximum loss over 10 trading day:

$$\begin{aligned} \text{S.D of 1 day} &= 2\% \\ \text{Variance of 1 day} &= 2^2 = 4\% \\ \text{Variance of 10 days} &= 4 \times 10 = 40\% \\ \text{S.D. of 10 days} &= \sqrt{40} = 6.32\% \\ Z &= \frac{(x - \bar{x}) \text{ i.e. maximum loss}}{\sigma} \\ 2.33 &= \frac{\text{maximum loss}}{6.32\%} \\ \text{Maximum loss (\%)} &= 14.73\% \\ \text{Maximum loss (₹)} &= 10,00,000 \times 14.73\% \\ &= ₹ 1,47,300 \end{aligned}$$

**QUESTION 2:**

N 19 | SM

Consider a Portfolio consisting of 2 Crores Investment in Shares of X Ltd and 2 Crores Investment in Shares of A Ltd. 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?

Solution:

$$\begin{aligned} \text{Variance of portfolio of 1 day} &= (1 \times 0.5)^2 + (1 \times 0.5)^2 + 2 \times 1 \times 0.5 \times 1 \times 0.5 \times 0.3 \\ &= 0.6500 \end{aligned}$$

$$\begin{aligned} \text{Variance of portfolio of 10 days} &= 0.6500 \times 10 \\ &= 6.50 \end{aligned}$$

$$\text{S.D. of portfolio of 10 days} = \sqrt{6.50} = 2.55$$

Calculating Value at Risk for the portfolio:

$$Z = \frac{(x - \bar{x}) \text{ i.e. maximum loss}}{\sigma}$$

$$2.33 = \frac{\text{Maximum loss}}{2.55\%}$$

$$\text{Maximum loss (\%)} = 5.9415\%$$

$$\text{Maximum loss (₹)} = ₹ 4,00,00,000 \times 5.9415\%$$

$$= 23,766 \text{ Cr.}$$



QUESTION 3:

MTP M 21

ABC Ltd. is considering a project X, which is normally distributed and has mean return of Rs. 2 crores 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

Solution:

For calculating probability of financial difficulty, we shall calculate the area under Normal Curve corresponding to the Z Score obtained from the following equation:

$$Z = \frac{x - \bar{x}}{\sigma}$$

$$= \frac{-1 \text{ Cr.} - 2 \text{ Cr.}}{1.6 \text{ Cr.}}$$

$$= -1.875$$

Finding probability value (area) for the z score of 1.875 using interpolation:

$$\frac{1.875 - 1.87}{1.88 - 1.87} = \frac{X - 0.4693}{0.4699 - 0.4693}$$

$$X = 46.96\%$$

The probability of financial difficulty, i.e., probability of having loss more than 1 crore:

$$= 50\% - 46.96\% = 3.04\%$$



QUESTION 4:

M 23

Mr. Bull is a rational risk taker. He takes his position in a single stock for 4 days in a week. He does not take a position on Friday to avoid weekend effect and takes position only for four days in a week i.e. Monday to Thursday. He transfers the amount on Monday morning and withdraws the balance on Friday morning. He desires to make a maximum investment where Value At Risk (VAR) should not exceed the balance lying in his bank account. The

position by his manager, as per standing instructions, is taken on the free balance lying in the bank account in the morning on each Monday.

On Monday morning (before opening of the capital market) he has transferred an amount of ₹ 11 Crore to his bank account. A fixed deposit also matured on this Monday. The maturity amount of ₹ 63,42,560 was also credited to his account by the bank in the morning of the Monday. However, Mr. Bull received the intimation of the same in the evening. The bank needs a minimum balance of ₹ 1,000 all the time. The value of Z score, at the required confidence level of 99% is 2.33

The other information with respect to stocks X & Y, which are under consideration for this week is as under:

X		Y	
Return	Probability	Return	Probability
6	0.10	4	0.10
7	0.25	6	0.20
8	0.30	8	0.40
9	0.25	10	0.20
10	0.10	12	0.10

You are required to recommend a single stock, where maximum investment can be made

Solution:

$$\begin{aligned}\text{Maximum loss that Mr. can take} &= 11,00,00,000 + 63,42,560 - 1,000 \\ &= 11,63,41,560\end{aligned}$$

Calculating SD of X & Y

P_X	X	$X \times P$	$P \times d_X^2$	P_Y	Y	$Y \times P$	$P \times d_Y^2$
0.10	6	0.60	0.40	0.10	4	0.40	1.60
0.25	7	1.75	0.25	0.20	6	1.20	0.80
0.30	8	2.40	-	0.40	8	3.20	-
0.25	9	2.25	0.25	0.20	10	2.00	0.80
0.10	10	1.00	0.40	0.10	12	1.20	1.60
		8.00	1.30			8.00	4.80

	X	Y
1 day Variance	1.3	4.8
4 days Variance	$1.3 \times 4 = 5.2$	$4.8 \times 4 = 19.2$
4 days SD	$\sqrt{5.2} = 2.28$	$\sqrt{19.2} = 4.38$
Maximum Loss (%) [SD × 2.33]	$2.28 \times 2.33 = 5.3124\%$	$4.38 \times 2.33 = 10.2054\%$
Maximum Investment (₹)	$\frac{11,63,41,560}{5.3124\%} = ₹ 219 \text{ Cr.}$	$\frac{11,63,41,560}{10.2054\%} = ₹ 114 \text{ Cr.}$

Recommendation: Maximum Investments can be made in Stock X of ₹ 219 Crores.

Self-note: There is an ambiguity in the question about the number of days for which returns are given in the table. Generally, the return data is assumed annual, therefore SD calculated using such data will also be SD for 365 days.

In this question however, Institute has solved it assuming that given return data is for a day hence, the SD calculated using such data will also be daily and therefore, it is be converted to 4 days' SD.



QUESTION 5:

N 20

On Tuesday morning (before opening of the capital market) an investor, while going through his bank statement, has observed that an amount of 7 lakhs is lying in his bank account. This amount is available use from Tuesday till Friday. The Bank requires a minimum balance of ₹ 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 percent.

Given:

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.80	0.09
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.989
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.992	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936

You are required to determine maximum possible investment

Solution:

S.D. for 1 day = 1.5%

Variance for 1 day = $(1.5)^2 = 2.25$

Variance for 4 days = $2.25 \times 4 = 9\%$

S.D. for 4 days = $\sqrt{9} = 3\%$

At confidence level of 99%, equivalent z score = 2.33

$$Z = \frac{(x - \bar{x}) \text{ i.e. maximum loss}}{\sigma}$$

$$2.33 = \frac{\text{Maximum loss}}{3\%}$$

Maximum loss (%) = 6.99%

Maximum loss (₹) = 7,00,000 – 1,000
= 6,99,000

$$\begin{aligned} \text{Maximum amount of Investment} &= \frac{6,99,000}{6.99\%} \\ &= 1,00,00,000 \end{aligned}$$



QUESTION 6:

N 20 MTP

TRC Cables Ltd. (an Indian Company) is in the business of manufacturing Electrical Cables and Data Cables including Fibre 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, aluminium 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 makes 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.

Solution:

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

1. Financial Risks: TRC is exposed to following financial risks:
 - a. Currency Risk: Since most of the Receipts and Payments of TRC are denominated in non-INR currencies it is exposed to Currency Risk.
 - b. Commodity Risk: As major constituents of production of TRC are commodities such copper, aluminium etc. it is subject to Commodity Risk.
 - c. Interest Rate Risk: As TRC borrows and invest money in short-term instruments it is exposed to Interest Rate Risk.
 - d. Counter Party Risk: Due to relaxation of norms for granting credits certainly the receivable amount must have increased resulting in increased in Credit Risk.
 - e. 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.
 - f. 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.
2. 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 honour the same.



QUESTION 7:

M 24 | M 22

Closing Values of NIFTY Index from 3rd to 12th day of month of January 2022 were as follows:

Days	Date	Closing Nifty Value
1	03-01-2022	17626
2	04-01-2022	17805
3	05-01-2022	17925
4	06-01-2022	17746
5	07-01-2022	17813
6	10-01-2022	18003
7	11-01-2022	18056
8	12-01-2022	18212

The simple moving average of NIFTY Index for the month of December 2021 was 17174.

You are required to calculate:

- a. The value of exponent for 15 days EMA.
- b. The exponential moving average (EMA) of NIFTY during the above period. (Calculations to be done up to 2 decimals only).

c. Analyse the buy & sell signal on the basis of your calculations.

Solution:

a) Value of exponent for 15 days EMA:
$$= \frac{2}{n + 1}$$
$$= \frac{2}{16} = 0.125$$

b) Exponent (a) = 0.125

$$1 - a = 0.875$$

P_t = Price Today

$$EMA_t = P_t \times a + EMA_{(t-1)} \times (1 - a)$$

Date	Sensex (P_t)	$P_t \times a$	$EMA_{(t-1)} \times (1 - a)$	EMA
		[A]	[B]	[A + B]
03-01-2022	17626	2,203.25	15,027.25	17,230.50
04-01-2022	17805	2,225.63	15,076.69	17,302.32
05-01-2022	17925	2,240.63	15,139.53	17,380.16
06-01-2022	17746	2,218.25	15,207.64	17,425.89
07-01-2022	17813	2,226.63	15,247.65	17,474.28
10-01-2022	18003	2,250.38	15,290.00	17,540.38
11-01-2022	18056	2,257.00	15,347.83	17,604.83
12-01-2022	18212	2,276.50	15,404.23	17,680.73

c) A buy (bullish) signal is generated when actual price line (NIFTY in the give case) rises through the moving average, while a sell a (bearish) signal is generated when actual NIFTY level declines through the moving averages. In the case under consideration the price line of NIFTY never breaches the 15-day EMA line. In fact it is hovering around the 15-day EMA line only.



QUESTION 8:

N 19 | M 18 | N 09 | RTP

Closing values of BSE Sensex from 6th to 17th day of the month of January of the year 200x were as follows:

Days	Date	Day	Sensex
1	6	THU	34522
2	7	FRI	34925
3	8	SAT	No trading
4	9	SUN	No trading
5	10	MON	35222
6	11	TUE	36000
7	12	WED	36400
8	13	THU	37000
9	14	FRI	No trading
10	15	SAT	No trading
11	16	SUN	No trading
12	17	MON	38000

Calculate Exponential Moving Average (EMA) of Sensex during the above period. The 30 days simple moving average of Sensex can be assumed as 35,000. The value of exponent for 30 days EMA is 0.062.

Solution:

Exponent (a) = 0.062

$1 - a = 0.938$

P_t = Price Today

$EMA_t = P_t \times a + EMA_{(t-1)} \times (1 - a)$

Days	Sensex (P_t)	$P_t \times a$	$EMA_{(t-1)} \times (1 - a)$	EMA
		[A]	[B]	[A + B]
6	34,522	2,140.36	32,830 (35,000 $\times$ 0.938)	34,970.36
7	34,925	2,165.35	32,802.20 (34,970.36 $\times$ 0.938)	34,967.55
10	35222	2,183.76	32,799.56	34,983.32
11	36000	2,232.00	32,814.35	35,046.35
12	36400	2,256.80	32,873.48	35,130.28
13	37000	2,294.00	32,952.20	35,246.20
17	38000	2,356.00	33,060.94	35,416.94

Conclusion – The market is bullish. 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.



QUESTION 9:

N 08 | RTP

The closing value of Sensex for the month of October, 2007 is given below

Date	Closing Sensex Value
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 week 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

Solution:

Date	Closing Sensex	Sign of price change	
01-10-2007	2800		
03-10-2007	2780	–	(1)
04-10-2007	2795	+	(2)
05-10-2007	2830	+	
08-10-2007	2760	-	(3)
09-10-2007	2790	+	(4)
10-10-2007	2880	+	
11-10-2007	2960	+	
12-10-2007	2990	+	
15-10-2007	3200	+	
16-10-2007	3300	+	
17-10-2007	3450	+	
19-10-2007	3360	-	(5)
22-10-2007	3290	-	
23-10-2007	3360	+	(6)
24-10-2007	3340	-	(7)
25-10-2007	3290	-	
29-10-2007	3240	-	
30-10-2007	3140	-	
31-10-2007	3260	+	(8)

Total of sign of price changes (r) = 08

No of Positive changes = n1 = 11

No. of Negative changes = n2 = 08

Calculation of σ

$$\begin{aligned}
 \sigma &= \sqrt{\frac{2n_1n_2(2n_1n_2 - n_1 - n_2)}{(n_1 + n_2)^2(n_1 + n_2 - 1)}} \\
 &= \sqrt{\frac{2 \times 11 \times 8(2 \times 11 \times 8 - 11 - 8)}{(11 + 8)^2(11 + 8 - 1)}} \\
 &= 2.06
 \end{aligned}$$

Calculation of μ

$$\begin{aligned}
 \mu &= \frac{2 \times n_1 n_2}{n_1 + n_2} + 1 \\
 &= \frac{2 \times 11 \times 8}{11 + 8} + 1 = 10.26
 \end{aligned}$$

Calculating relevant degree of freedom:

$$\begin{aligned}
 \text{No. of change} &= \text{no. of prices} - 1 \\
 &= 20 - 1 = 19
 \end{aligned}$$

$$\begin{aligned}
 \text{Degree of freedom} &= \text{No. of change} - 1 \\
 &= 19 - 1 = 18
 \end{aligned}$$

Hence relevant degree of freedom = 18

Run test at 5% level of significance at 18 degrees of freedom:

$$\begin{aligned}
 \text{Upper Limit} &= \mu + \sigma t \\
 &= 10.26 + 2.06 \times 2.101 \\
 &= 14.589
 \end{aligned}$$

$$\begin{aligned}
 \text{Lower limit} &= \mu - \sigma t \\
 &= 10.26 - 2.06 \times 2.101 \\
 &= 5.93
 \end{aligned}$$

Run test at 10% level of significance at 18 degrees of freedom:

$$\begin{aligned}
 \text{Upper limit} &= 10.26 + 1.734 \times 2.06 \\
 &= 13.832
 \end{aligned}$$

$$\begin{aligned}
 \text{Lower limit} &= 10.26 - 1.734 \times 2.06 \\
 &= 6.688
 \end{aligned}$$

Conclusion: As seen number of runs (r) lies between these limits. Hence, the market exhibits weak form of efficiency.



QUESTION 10:

N 20

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	33513.79	33438.03	33453.99

2	33453.64	33478.11	33427.82	33434.83
3	33414.06	33440.29	33397.65	33431.93
4	33434.94	33446.18	33377.78	33383.41
5	33372.92	33380.27	33352.12	33370.93
6	33375.85	33389.49	33331.42	33340.75
7	33340.89	33340.89	33310.95	33330.98
8	33326.84	33340.91	33306.17	33335.08
9	33307.16	33328.22	33296.43	33301.97
10	33298.64	33318.60	33254.28	33259.03
11	33260.04	33228.85	33241.66	33251.53
12	33255.92	33289.46	33249.46	33285.89
13	33288.86	33535.67	33255.98	33329.28
14	33335.00	33346.21	33276.72	33284.17
15	33293.83	33310.86	33278.54	33298.78
16	33300.02	33337.79	33300.02	33325.38
17	33323.36	33356.34	33322.44	33329.95
18	33322.81	33345.98	33317.44	33319.67
19	33317.51	33321.18	33294.19	33302.32
20	33290.86	33324.96	33279.62	33319.61

You are required:

To test the Weak Form of Market Efficiency using Auto-Correlation test, taking time lag of 10 days.

Solution:

Period 1	Closing prices	Absolute Change (x)	Period 2	Closing prices	Absolute Change (y)
1	33,453.99		11	33,251.53	
2	33,434.83	-19.16	12	33,285.89	34.36
3	33,431.93	-2.90	13	33,329.28	43.39
4	33,383.41	-48.52	14	33,284.17	-45.11
5	33,370.93	-12.48	15	33,298.78	14.61
6	33,340.75	-30.18	16	33,325.38	26.60
7	33,330.98	-9.77	17	33,329.95	4.57
8	33,335.08	4.10	18	33,319.67	-10.28
9	33,301.97	-33.11	19	33,302.32	-17.35
10	33,259.03	-42.94	20	33,319.61	17.29

Calculation of Correlation

X	d_x	d_x^2	Y	d_y	d_y^2	$d_x d_y$
-19.16	2.50	6.25	34.36	26.80	718.24	67.00
-2.90	18.76	351.94	43.39	35.83	1,283.79	672.17
-48.52	-26.86	721.46	-45.11	-52.67	2,774.13	1,414.72
-12.48	9.18	84.27	14.61	7.05	49.70	64.72
-30.18	-8.52	72.59	26.60	19.04	362.52	-162.22

-9.77	11.89	141.37	4.57	-2.99	8.94	-35.55
4.10	25.76	663.58	-10.28	-17.84	318.27	-459.56
-33.11	-11.45	131.10	-17.35	-24.91	620.51	285.22
-42.94	-21.28	452.84	17.29	9.73	94.67	-207.05
-194.96		2,625.40	68.08		6,230.77	1,639.45

$$\bar{X} = \frac{-194}{9} = -21.66$$

$$\bar{Y} = \frac{68.08}{9} = 7.56$$

$$\sigma_x = \sqrt{\frac{2625.40}{9}} = 17.08$$

$$\sigma_y = \sqrt{\frac{6230.77}{9}} = 26.31$$

$$\text{Cov}_{xy} = \frac{1639.45}{9} = 182.16$$

$$\begin{aligned} \text{Correlation} &= \frac{\text{COV}}{\sigma_x \sigma_y} \\ &= \frac{182.16}{17.08 \times 26.31} = 0.405 \end{aligned}$$

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.

Multiple Choice Questions



1. FINANCIAL POLICY AND CORPORATE STRATEGY

BoS Knowledge Portal:

1. is the springboard for wealth creation.
 - A. Investment in highly risky securities.
 - B. **Capital investment**
 - C. Foreign Exchange Risk Management
 - D. None of the above

2. The primary objective of investors in a world of economic uncertainty is.....
 - A. **to select investment and financial opportunities that will give them maximum expected returns at minimum risks.**
 - B. to select investment and financial opportunities that will give them maximum expected returns at maximum risks.
 - C. to select investment and financial opportunities that will give them minimum expected returns at maximum risks.
 - D. None of the above

3. The Strategic financial management is
 - A. Backward looking
 - B. Report-focused discipline
 - C. Forward-looking subject of financial management
 - D. **All of the above**

2. RISK MANAGEMENT

BoS Knowledge Portal:

1. Which type of risk is primarily faced by a company when it ventures into a new industry or geographical area with completely different laws and regulations?
 - A. Operational Risk
 - B. Compliance Risk**
 - C. Currency Risk
 - D. Financial Risk
2.is associated with diffusion of economic crisis throughout a market, asset class or geographic region.
 - A. Systematic Risk
 - B. Unsystematic Risk
 - C. Contagion Risk**
 - D. Credit Risk
3. Which of the following techniques can be used to manage counter party risk?
 - A. Local sourcing of raw materials and labour.
 - B. Evaluating countrys macro-economic conditions.
 - C. Rapid action in the event of any likelihood of defaults.
 - D. Entering into joint ventures.
4. Which type of risk occurs when a counter party fails to honour their obligations?
 - A. Interest Rate Risk
 - B. Currency Risk
 - C. Credit Risk
 - D. Political Risk
5.is associated with diffusion of economic crisis throughout a market, asset class or geographic region.
 - A. Systematic Risk
 - B. Unsystematic Risk
 - C. Contagion Risk
 - D. Credit Risk
6. One year VaR [Value at risk] of a portfolio is Rs. 10 crores with a confidence level of 95%. This means.....
 - A. There is a 5% probability that the loss will be Rs. 10 crores at the end of the year
 - B. The loss will not exceed Rs. 9.5 crores during valuation anytime during the year
 - C. The worst expected portfolio loss over one year will not exceed Rs. 10 crore with 95% confidence
 - D. The investor can presume that there is a 95% chance of loss over one trading year will exceed Rs. 10 crore

3.ADVANCED CAPITAL BUDGETING DECISIONS

BoS Knowledge Portal:

1. Sensitivity analysis is useful in decision making because:
 - A. It shows the probabilities associated with each outcome.
 - B. **It tells the user how much critical each input is for the Output value.**
 - C. It allows to calculate the probable results under different scenarios.
 - D. The results of Sensitivity Analysis are reliable.
2. When the risk is high, the cash flow under certainty equivalent coefficient is:
 - A. Higher
 - B. **Lower**
 - C. No impact
 - D. None of the above
3. The firm expects an NPV of Rs. 10,000 if the economy is exceptionally strong (30% probability), an NPV of Rs. 4,000 if the economy is normal (40% probability), and an NPV of Rs. 2,000 if the economy is exceptionally weak (30% probability). Expected Net present value is _____.
 - A. **Rs. 5,200**
 - B. Rs. 6,000
 - C. Rs. 5,000
 - D. Rs. 6,200
4. Expected cash flows are calculated as:
 - A. Sum of likely cash flow of the project.
 - B. **Sum of likely cash flow of project multiplied by probability of respective cash flows.**
 - C. Sum of likely cash flow of project divided by probability of cash flow.
 - D. none of these
5. Which of the following critical factor is generally overlooked by capital budgeting decision makers.
 - A. Quantitative factors
 - B. **Qualitative factors**
 - C. Time factor
 - D. Discounting factor
6. Scenario Analysis is considered under scenarios such as:
 - A. Worst Case Scenario
 - B. Base Case Scenario
 - C. Best Case Scenario
 - D. **All of the above**
7. Variance measures....
 - A. **How far each number in the set is from the mean.**
 - B. The mean of a given data set.

Multiple Choice Questions

- C. Return on Investment
 - D. Level of risk borne for every percent of expected return.
8. Certainty Equivalent approach is:
- A. Guaranteed return from an investment after adjusting for certainty equivalent coefficient.**
 - B. Return that is expected over the lifetime of a project.
 - C. Equivalent to Net Present Value.
 - D. An important component in Decision Tree Analysis.

4. SECURITY ANALYSIS

BoS Knowledge Portal:

1. Which of the following technique is not used for economic analysis?
 - A. Barometer/Indicator Approach
 - B. Economic Model Building Approach
 - C. **Mixed Forecasting**
 - D. Economic Model Building Approach
2. As per the Dow Jones Theory the Secondary movement of stock prices last from.....
 - A. one year to three years.
 - B. three weeks to three months.
 - C. day to day.
 - D. None of these
3. An efficient capital market is one in which.....
 - A. Taxes are irrelevant.
 - B. Security prices reflect available information.
 - C. Securities always offer a positive rate of return to investors.
 - D. Security prices are guaranteed (by the SEBI) to be fair.
4. Which factor significantly influences the demand in consumer products industries?
 - A. Interest rate
 - B. Discount rate
 - C. Inflation rate
 - D. None of the above
5. Which of the following is a drawback of the Anticipatory Surveys technique used in economic analysis?
 - A. Survey results guarantee that intentions surveyed would materialize.
 - B. They are regarded as forecasts per se, as there can be a consensus approach by the investor for exercising his opinion.
 - C. Both of (a) and (b)
 - D. None of the above
6. Which of the following factor affects industry analysis?
 - A. Product Lifecycle
 - B. Government Attitude
 - C. State of Competition in the Industry
 - D. All of these

MTP N 24

You are an investment analyst working for a financial advisory firm. You have been asked to analyze the bond market's yield curve to assist your clients in making investment decisions. The yield curve represents the relationship between the interest rates (yield) and the time to maturity for debt securities, usually government bonds.

Multiple Choice Questions

For simplicity, assume the following yield data for government bonds over various maturities (measured in years):

Yield Curve Table

Maturity (Years)	Yield (%)
1 Year	3.00%
2 Years	4.00%
3 Years	5.00%
5 Years	6.00%
7 Years	6.40%
10 Years	7.00%
15 Years	7.40%
30 Years	7.60%

Based on above case scenario answer the following questions:

1. The main characteristic of a normal yield curve is.....

- (a) Short-term yields are higher than long-term yields.
- (b) Short-term yields are lower than long-term yields.
- (c) Yields remain the same across all maturities.
- (d) Yields fluctuate randomly over different maturities.

Ans. (b)

2. Based on the revised yield data, what is the yield spread between the 10-year bond and the 1-year bond?

- (a) 2.0%
- (b) 3.5%
- (c) 4.0%
- (d) 5.0%

Ans. (c)

3. An inverted yield curve typically indicates.....

- (a) Economic growth
- (b) Economic uncertainty
- (c) An upcoming recession
- (d) Inflationary pressure

Ans. (c)

4. If an investor is looking to invest for 2 years starting 3 years from now, the forward rate he would expect shall be.....

- (a) 7.41%
- (b) 7.52%
- (c) 7.76%
- (d) 7.93%

Ans. (b)

5. If an investor is looking to invest for 2 years starting 5 years from now, the forward rate he would expect shall be.....

- (a) 7.41%
- (b) 7.52%
- (c) 7.76%

(d) 7.93%

Ans. (a)

RTP N 23

You are a financial analyst at a prominent investment firm and have been tasked with empirically verifying the weak form of Efficient Market Hypothesis (EMH) Theory for the XYZ Stock Index, a collection of diverse stocks. You decided to conduct three different tests to assess whether the stock market follows the principles of the weak form of EMH.

Test 1:

For the past five years, you collected daily price changes of the stocks in the XYZ Stock Index. You calculated correlation coefficients for different lag periods and analyzed whether past price changes exhibit any significant correlation with future price changes. You considered price changes to be serially independent. The results indicated that most autocorrelation coefficients are close to zero and statistically insignificant, suggesting those past price changes do not predict future price changes.

Test 2:

You further investigated the randomness of price changes in the XYZ Stock Index. Analyzing the sequence of daily price changes, you count the number of runs where price changes are consistently positive or negative. Upon comparing the observed number of runs with the expected number based on randomness, you find that they align closely, supporting the idea that price changes follow a random pattern.

Test 3:

To examine the efficacy of trading strategies based on historical price trends, you implemented a simple trading rule for the XYZ Stock Index. The rule involves buying when the price crosses a moving average of 5% threshold and selling when it crosses another 7% threshold. Over a period of testing, you computed the returns generated by the trading strategy. The results revealed that the returns are not consistently better than random chance, implying that past price trends do not reliably predict future price movements.

Conclusion:

After conducting the three tests the evidence supports the weak form of Efficient Market Theory for the XYZ Stock Index you concluded that past price trends do not reliably predict future price movements.

Based on the above information answer the following questions:

1. Test 1 is
 - A. **Serial Correlation test**
 - B. Filter Rules test
 - C. Run test
 - D. Variance Ratio test
2. Test 2 is
 - A. Serial Correlation test
 - B. Filter Rules test
 - C. **Run test**
 - D. Variance Ratio test
3. Test 3 is
 - A. Serial Correlation test
 - B. **Filter Rules test**
 - C. Run test

Multiple Choice Questions

- D. Variance Ratio test.
4. The Filter Rule Test should not be applied for buy and hold strategy if.....
- A. the behaviour of stock price changes is predictable.
 - B. the behaviour of stock price changes is dependent on past trends.
 - C. the behaviour of stock price changes is correlated.
 - D. the behaviour of stock price changes is random.**
5. Results of your studies support the.....
- A. Semi-strong EMH Theory
 - B. Strong EMH Theory
 - C. Random Walk Theory**
 - D. Markowitz Theory

MTP M 24

Suppose you are a financial consultant and following 3 clients have approached to you seeking advice on the investment to be made in securities. All these clients have different background and risk appetite as well as perception to the market.

- Client A wants to invest in Fixed income avenues and therefore he is looking at the credit rating of the securities as well as financial ratios such as interest coverage, earning power etc and the general prospect of the industry.
- Client B wants to earn a fixed income over a period of time by holding the security till its maturity.
- Client C wants to earn more by taking more risk. Therefore, he is more interested to invest in stocks. He believes that Price reflects all information found in the record of past prices and volumes.

On the basis of above information, choose the most appropriate answer to the MCQs.

1. The main factor to be considered in selecting fixed income avenue for client A shall be.....
- (a) Yield to maturity
 - (b) Risk of Default**
 - (c) Tax Shield
 - (d) Liquidity
2. The main factor that have to be evaluated in the selection of Bond for Client B shall be.....
- (a) Yield to maturity**
 - (b) Risk of Default
 - (c) Tax Shield
 - (d) Liquidity
3. If Weak form efficiency is prevailing in the market then which approach is best for selection of Equity Shares?
- (a) Technical Analysis
 - (b) Fundamental Analysis**
 - (c) Random selection Analysis
 - (d) None of the above.

5. SECURITY VALUATION

BoS Knowledge Portal:

- The value a zero coupon with a maturity of three years and a maturity value of Rs 1,000 discounted at 7% is
A. Rs. 816.30
 B. Rs. 901.94
 C. Rs. 966.18
 D. Rs. 1000
- A debenture of Rs. 10000 carrying 15% coupon rate is quoted in the market at Rs.13500. The current yield on this debenture will be:
 A. 13.50%
 B. 15%
C. 11.11%
 D. 10%
- The annual interest of a bond divided by its face value is called the bond's.....
 A. Coupon Rate
 B. Face value
 C. Maturity
 D. Yield to maturity
- Which of the following is not a money market instrument?
 A. Commercial paper
 B. Participatory certificates
 C. Warrant
 D. Treasury Bills
- A Ltd. issued commercial paper worth ₹ 10 crores as per the following details:
 Date of issue: 15th June, 2022
 Maturity period: 73 days
 No. of days in a year: 365 days
 Interest rate: 15% p.a.
 Intermediary charges: 0.1% of Net Receipts
 The net amount received by the company on such issue of CP shall be approximately.....
 A. ₹ 9,69,90,291
 B. ₹ 9,70,87,379
 C. ₹ 9,69,77,379
 D. ₹ 9,69,00,000
- The following information is related to two bonds same in other respects:
 Price of Bond A = Rs. 101
 Price of Bond B = Rs. 120
 Coupon Rate of Bond A =14%

Multiple Choice Questions

Coupon Rate of Bond B = 15%

If both the bonds are redeemable at a Premium of 10% after 2 years and the required yield on this category of Bonds is 16% then best avenue for investment shall be.....

- A. **Bond A**
- B. Bond B
- C. Any of the two Bonds
- D. Neither of the two Bonds

N 24

Z Ltd. paid a dividend of 5 for the current year. The dividend is expected to grow at 25% for the next 6 years and at 10% per annum thereafter. The return of government bond is 13% per annum and market return is expected to be around 20%. The correlation between market return and Z Ltd. share return is 0.3733. The standard deviation of market return and Z Ltd. shares is 12% and 18% respectively.

Round off to two decimal places.

From the information given above, choose the correct answer to the Question no. 1 to 5:

1. What is the present value at the end of 4th year?

- A. ₹23.71
- B. ₹12.56
- C. **₹6.53**
- D. ₹6.99

Self-note: Question has not specified the amount of which PV is to be calculated.

2. What is the intrinsic value of Z Ltd. shares?

- A. **₹156.69**
- B. ₹303.14
- C. ₹349.62
- D. ₹341.30

3. What is the expected return of Z Ltd shares?

- A. 15%
- B. 23.92%
- C. **16.92%**
- D. 16.5%

4. What is value in perpetuity at the start of the 6th year?

- A. ₹156.69
- B. **₹303.14**
- C. ₹ 349.62
- D. ₹341.30

5. If current market price of the shares is 315 than stock is

- A. **Over valued**
- B. Under valued
- C. Fairly valued
- D. Cannot be determined

N 24

The following information is available in respect of Bond 1 and Bond 2

	Bond 1	Bond 2
Face value, redeemable value at par	₹1000	₹1000
Coupon rate, payable annually (%)	6%	10%
Time to maturity (years)	5	3

An investor has the portfolio consisting of 75% of Bond 1 and 25% of Bond 2. The current YTM's prevailing in the market is 10%.

Year (n):	1	2	3	4	5
PVIF (10%, n):	0.9091	0.8264	0.7513	0.6830	0.6209

From the information given above, choose the correct answer to the Question no. 6 to 9:

- What should be the price and duration of Bond-2?
 - ₹ 826.43 and 2.49
 - ₹ 1,000 and 2.74
 - ₹ 924.85 and 2.74
 - ₹ 1000 and 2.49
- New price of the portfolio if YTM changes from 10% of 10.5% based on the duration is:
 - ₹ 870.12
 - ₹ 902.36
 - ₹ 1832.23
 - ₹ 1864.45
- What should be the price and duration of Bond – 1?
 - ₹ 848.34 and 4.43
 - ₹ 811.09 and 4.38
 - ₹ 1,227.44 and 4.43
 - ₹ 658.15 and 3.90.
- What will be the price sensitivity of the portfolio?
 - 4.027
 - 2.491
 - 3.643
 - 3.981

6. PORTFOLIO MANAGEMENT

BoS Knowledge Portal:

1. Risk Premium is:
 - A. **Extra rate of return expected by the Investors as a reward for bearing extra risk.**
 - B. Equivalent to the rate of Government Securities.
 - C. Return provided to equity shareholders.
 - D. Risk free rate of return.

2. Arbitrage Pricing Theory was developed by.....
 - A. William Sharpe
 - B. Harry Markowitz
 - C. **Stephan Ross**
 - D. Black Scholes

3. What is the common hypothesis for Traditional and Modern Theories of Portfolio Management.
 - A. Both approaches use statistical methods.
 - B. Both approaches are based on judgement.
 - C. **Both approaches are based on hypothesis that a portfolio reduces risk by diversification.**
 - D. None of these.

4. According to the CAPM, the intercept of Security Market Line (SML) should be equal to.....
 - A. **zero.**
 - B. the expected risk premium on the market portfolio.
 - C. the risk-free rate.
 - D. the expected return on the market portfolio.

5. Calculation of Coefficient of Variance depends on:
 - A. Standard Deviation
 - B. Expected Return
 - C. Expected cash flow
 - D. **All of the above**

N 24 RTP

Two friends, Mr. A and Mr. N were discussing the risks of market. While Mr. A is sort of risk averse, Mr. N is an aggressive investor and believes in taking risks.

Mr. N said we cannot diversify the market risk at all, and he quoted the Modern Portfolio Approach. Both friends analyze the market data for the few months and came out with expected returns on two stocks for a particular market.

Market Return	Aggressive	Defensive
7%	4%	9%
25%	40%	18%

Based on the above scenario, answer the following questions:

1. The Beta of Defensive stock is.....
 - (a) 2

- (b) 0.5
- (c) 4
- (d) 1

Ans. (b)

2. If the market return is equally likely to be 7% or 25% then expected return of Aggressive stock shall be.....

- (a) 18%
- (b) 13.50%
- (c) 22%
- (d) 11%

Ans. (c)

3. The Alpha of the Defensive stocks is.....

- (a) -10%
- (b) 22%
- (c) 5.50%
- (d) 12%

Ans. (c)

4. The Modern Portfolio Theory was propounded by

- (a) William Sharpe
- (b) Black Scholes
- (c) Stephen Ross
- (d) Harry Markowitz

Ans. (d)

5. As per Capital Market Line (CML) Theory the Portfolios lying on the CML over the market portfolio are called

- (a) Lending Portfolios
- (b) Borrowing Portfolios
- (c) Diversified Portfolios
- (d) Risk- Free Portfolios

Ans. (c)

7. SECURITIZATION

BoS Knowledge Portal:

1. The main objective of creating a Special Purpose Vehicle (SPV) in the securitization process is.....
 - A. to acquire legal and beneficial interest in the assets.
 - B. to issue securities to the investors.
 - C. **to remove the asset from the balance sheet of the originator.**
 - D. to write off the asset as bad debt from the balance sheet of the originator.
2.is the process of repackaging or rebundling of illiquid assets into marketable securities.
 - A. Diversification
 - B. **Securitization**
 - C. Structured finance
 - D. Tokenization

RTP N 23:

Grow More Ltd. an NBFC is in the need of funds and hence it sold its receivables to MAC Financial Corporation (MFC) for ₹ 100 million. MFC created a trust for this purpose called General Investment Trust (GIT) through which it issued securities carrying a different level of risk and return to the investors. Further, this structure also permits the GIT to reinvest surplus funds for short term as per their requirement.

MFC also appointed a third party, Safeguard Pvt. Ltd. (SPL) to collect the payment due from obligor(s) and passes it to GIT. It will also follow up with defaulting obligor and if required initiate appropriate legal action against them.

Based on above scenario, answer the following questions:

1. The securitized instrument issued for ₹ 100 million by the GIT falls under category of
 - A. Pass Through certificate (PTCs)
 - B. **Pay Through Security (PTS)**
 - C. Stripped Security
 - D. Debt Fund.
2. In the above scenario, the Originator is.....
 - A. Grow More Ltd.
 - B. **MAC Financial Corporation (MFC)**
 - C. General Investment Trust (GIT)
 - D. Safeguard Pvt. Ltd.
3. In the above scenario, the General Investment Trust (GIT) is a/an.....
 - A. Obligor
 - B. Originator
 - C. **Special Purpose Vehicle (SPV)**
 - D. Receiving and Paying Agent (RPA)
5. In the above scenario, the Safeguard Pvt. Ltd. (SPL) is a/an.....
 - A. Obligor
 - B. Originator

- C. Special Purpose Vehicle (SPV)
 - D. **Receiving and Paying Agent (RPA)**
6. Which of the following statement holds true?
- A. When Yield to Maturity in market rises, prices of Principle Only (PO) Securities tend to rise.
 - B. When Yield to Maturity in market rises, prices of Principle Only (PO) Securities tend to fall.
 - C. When Yield to Maturity in market falls, prices of Principle Only (PO) Securities tend to fall.
 - D. **When Yield to Maturity in market falls, prices of Principle Only (PO) Securities remain the same.**

8. MUTUAL FUNDS

BoS Knowledge Portal:

1. The lower the..... of the Index Fund, higher the accuracy the more predictable return is.
 - A. Alpha
 - B. Beta
 - C. **Tracking Error**
 - D. Exist Load

2. The major difference between open-ended and close-ended mutual fund schemes is that.....
 - A. in Open Ended Schemes, investors can only make entry and exit during pre-specified intervals.
 - B. Close-ended schemes allow investors to redeem their investments at any time.
 - C. Open-ended schemes have a limited life, while close-ended schemes have an indefinite redemption period.
 - D. **Open-ended schemes have an indefinite redemption period, while close-ended schemes have a limited life.**

3. Which of the following Business Parks has launched India's first Real Estate Investment Trust (REIT)?
 - A. Galaxy Business Parks
 - B. DLF Cyber City
 - C. Patni Knowledge Parks
 - D. **Embassy Office Parks**

MTP N 24

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 ₹ 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 at the rate of opening NAV plus an entry load of ₹ 0.04. The NAV has appreciated by 25% during the year.

Assume the face value of the unit as ₹ 10.00.

Based on the above Case Scenario, answer the following questions:

1. The Opening NAV of the Asset Management Company shall be
 - (a) ₹ 20.24
 - (b) ₹ 19.96
 - (c) ₹ 18.75
 - (d) ₹ 17.65

Ans. (b)

2. The Number of the units purchased shall be
 - (a) 18750
 - (b) 17500
 - (c) 20450
 - (d) 20000

Ans. (d)

3. Original amount of the investment shall be

- (a) ₹ 4,00,000
- (b) ₹ 6,50,000
- (c) ₹ 3,55,000
- (d) ₹ 5,65,000

Ans. (a)

4. Which of the following statement about Expense ratio is/ are incorrect:

- (i) It is the percentage of income that were spent to run a mutual fund.
- (ii) It includes advisory fees, travel costs, registrar fees , custodian fees, etc.
- (iii) It includes Brokerage costs for trading of Portfolio.
- (iv) High Expense Ratio can seriously undermine the performance of a mutual fund scheme.

- (a) (i), (ii), (iii)
- (b) (i), (iii)
- (c) only (iii)
- (d) only (i)

Ans. (c)

5.considers and uses downside deviation instead of total standard deviation in denominator.

- (a) Expense Ratio
- (b) Sharpe Ratio
- (c) Treynor Ratio
- (d) Sortino Ratio

Ans. (d)

9.DERIVATIVES ANALYSIS AND VALUATION

BoS Knowledge Portal:

1. ABC Masala Co. purchase jeera to make its products. The company is concerned that prices may rise prior to building inventory for festivals sales. Analysts project that price per quintal could vary from Rs. 52,000 to Rs. 70,000. A September futures contract can be obtained with a Rs. 65,000 purchase prices. What is ABC's risk in this situation?
 - A. Coca prices will rise above Rs. 65,000 and Tingley will purchase its coca at a price of Rs. 65,000.
 - B. **Coca prices will decline below Rs. 65,000 and Tingley will have to purchase coca at Rs. 65,000.**
 - C. Coca prices will hit Rs. 65,000 and the contract was a waste of time.
 - D. ABC Co. has no risk in this situation.

2. Which of the following is true regarding a forward contract?
 - A. It is standardized.
 - B. The contracting parties negotiate only on the price.
 - C. The contracting parties negotiate only on quantity and quality.
 - D. **Both parties negotiate on quality, quantity, place, and price.**

3. Which of the following position provides protection from a decrease in prices of a share?
 - A. Buying of Future Contracts in the share.
 - B. Buying Call Option in the share.
 - C. **Selling of Future Contracts in the share.**
 - D. Selling Put Option in the share.

4. What is the purpose of trading in futures?
 - A. Only for speculation.
 - B. Only for hedging.
 - C. **Both for speculation and hedging.**
 - D. Only for arbitraging.

5. The maximum possible loss for a covered call writer is.....
 - A. Option premium.
 - B. Current price of the underlying asset.
 - C. Strike price.
 - D. **Initial investment Net of Premium.**

6. The spot price of an investment is Rs. 3,000 and the risk-free rate for all maturities (with continuous compounding) is 10% p.a.. Suppose the asset provides an income of Rs. 200 at the end of the first year and at the end of the second year, then three-year forward price shall be
 ($e^{0.10} = 1.1052$, $e^{0.20} = 1.2214$ and $e^{0.30} = 1.3499$)
 - A. Rs. 1,967
 - B. **Rs. 3,584**

- C. Rs. 4,515
D. Rs. 4,050
7. As per Real Option in Capital Budgeting any commitment to disinvest upon the action of another party is called.
A. Long Call
B. Long Put
C. **Short Call**
D. Short Put
8. Which of the following is a traditional method for an Indian farmer to sell wheat?
A. Forward Contract
B. Future Contract
C. **Spot Market**
D. Capital Market
9. The spot price of an investment asset that provides no income is Rs. 3000 and the risk-free rate for all maturities (with yearly compounding) is 10%. The three- year forward price of same investment shall be.....
A. **Rs. 3,993**
B. Rs. 4,050
C. Rs. 4,020
D. Rs. 4,034
10. Which among the following derivative product is not traded in an exchange at all?
A. Futures
B. Options
C. **Forwards**
D. None of these
11. A short forward contract on share of A Ltd. that was negotiated some time ago will expire in 3 months and has a delivery price of Rs. 4,000. The current forward price for three-month forward contract is Rs. 4,200 and the 3-month risk-free interest rate (with monthly compounding) is 6%. The value of the same short forward contract will be.....
A. Rs. 200
B. -Rs. 200
C. Rs. 197.03
D. **-Rs. 197.03**
12. In a future contract the term Basis is.....
A. **The difference between the prevailing spot price and the futures price.**
B. The difference between the current market price and the strike price.
C. The difference between the long position and the short position.
D. The difference between the initial margin and the maintenance margin.

Multiple Choice Questions

13. When an investor buys back the same amount of futures contracts that he sold earlier is called.....
- A. **closing out the position.**
 - B. going long of the futures.
 - C. opening a new position.
 - D. None of these
14. Which amongst the following is not a Greek for Options Pricing
- A. Delta
 - B. Gamma
 - C. Theta
 - D. **Kho**
15. A put option on a company's stock has an exercise price of Rs. 200. On the delivery date, the stock is trading at Rs. 240 per share. What should the investor who has paid Rs. 20 for the option do?
- A. **Not exercise the option and lose Rs. 20.**
 - B. Not exercise the option and lose Rs. 60.
 - C. Exercise the option and gain Rs. 20.
 - D. Exercise the option and gain Rs. 40.
16. Mr. A a speculator shorts 1000 shares of X Ltd. when the share price was Rs. 50 and closes out the position after 3 months when the share price was Rs. 43. The company pays a dividend of Rs. 3 per share during the 3 months. The gain of Mr. A will be
- A. Rs. 1,000
 - B. **Rs. 4,000**
 - C. Rs. 7,000
 - D. Rs. 3,000

N 24

Based on the following information, choose the correct answer from the following questions:

Situation	Action	Exercise Price	Premium	Spot Price
I	Exercised	140	20	160
II	Exercised	200	15	175
III	Lapsed	300	25	400

From the information given above, choose the correct answer to the Question no. 10 to 12:

1. In situation I, the investor's position and amount of profit or loss is:
- A. Put option and ₹20
 - B. Call option and ₹0
 - C. Put option and ₹0
 - D. Call option and ₹20

2. In Situation III, the investor's position and the amount of profit / loss is:
 - A. Put option, ₹(25)
 - B. Call option, ₹75
 - C. Short position, ₹100
 - D. Long position, ₹(100)
3. In situation II, the investor's position and the amount of profit / loss is:
 - A. Put option and ₹10
 - B. Call option and ₹10
 - C. Put option and ₹25
 - D. Call option and ₹25

MTP N 24

Suppose you are a risk manager at a financial institution, and your company has loaned a significant amount of ₹ 500 crore to company X Ltd. for a period of 3 years at 6-month at MCLR plus 200 bps. You are concerned about X Ltd.'s ability to repay the debt due to recent market volatility. To protect your institution from potential default, you decide to purchase a Credit Default Swap (CDS) from ABC Bank Ltd. for same notional amount at a premium quoted at 1% per year through cash settlement.

On the respective reset dates for the same period actual MCLR interest rate comes out as follows:

Reset	MCLR
1	9.75%
2	10.00%
3	10.25%
4	10.35%
5	10.50%
6	10.60%

Based on above case scenario answer the following questions:

1. The primary purpose of a Credit Default Swap (CDS) is.....
 - (a) to increase the value of bonds.
 - (b) to protect against default risk of a debt obligation.
 - (c) to provide guaranteed profit to the buyer.
 - (d) to create a new form of loan.

Ans. (b)
2. Which of the following statements is true about CDS contracts?
 - (a) CDS contracts cannot be used for speculation.
 - (b) CDS contracts are governed by government regulations.
 - (c) CDS contracts are private agreements between two parties.
 - (d) CDS contracts eliminate all risks for the buyer.

Ans. (c)
3. Which organization publishes the guidelines and rules for conducting Credit Default Swap transactions?
 - (a) Federal Reserve
 - (b) International Swap and Derivative Association (ISDA)
 - (c) Securities and Exchange Commission (SEC)
 - (d) World Trade Organization (WTO)

Multiple Choice Questions

Ans. (b)

4. Assuming no default occurs the total premium your company will pay during the designated loan period shall be.....

(a) ₹ 5 crore
(b) ₹ 10 crore
(c) ₹ 15 crore
(d) ₹ 30 crore

Ans. (c)

5. Suppose if the lender defaults somewhere in the beginning of third year of loan (after payment of interest upto 2 years) and the market value of a reference loans falls to 75% of its par value, then ABC Bank will pay your companyin a cash settlement.

(a) ₹ 15 crore
(b) ₹ 30 crore
(c) ₹ 125 crore
(d) ₹ 500 crore

Ans. (c)

MTP N 24

You as an investor purchased a 4-month European Call Option on the equity shares of X Ltd. for ₹ 10, of which the current market price is ₹ 132 per share and the exercise price ₹ 150. You expect the price to range between ₹ 120 to ₹ 190. The expected share price of X Ltd. and related probability is given below:

Expected Price (₹)	120	140	160	180	190
Probability	0.05	0.20	0.50	0.10	0.15

Based on above case scenario answer the following questions:

- Expected price of share of X Ltd. at the end of 4 months shall be.....
 - ₹ 160.00
 - ₹ 160.50
 - ₹ 158.00
 - ₹ 140.00
- Suppose if the exercise price prevails at the end of 4 months the Value of Call Option shall be.....
 - ₹ 0
 - ₹ 18
 - ₹ 10
 - ₹ 14
- In case the option is held to its maturity, the expected value of the call option shall be.....
 - ₹ 0
 - ₹ 18
 - ₹ 10
 - ₹ 14
- In the given different scenarios of expected prices of share of X Ltd. at the time of maturity the option shall be in-the-money in scenarios.
 - two

- b. three
 - c. five
 - d. In none of the scenario
5. In the given different scenarios of expected prices of share of X Ltd. at the time of maturity the option shall be at-the-money in scenarios.
- a. two
 - b. three
 - c. five
 - d. In none of the scenario

10. FOREIGN EXCHANGE EXPOSURE & RISK MANAGEMENT

BoS Knowledge Portal:

1. US dollar is quoted today as: spot \$ 1 = Rs. 80 and six months forward \$1 = Rs. 84. The annualized forward margin is.....
A. **10%**
B. 5%
C. 3%
D. 6%
2.Theory substantiates that the expected disparity between the exchange rate of two currencies is approximately equal to the difference between their countries' nominal interest rates.
A. Interest Rate Parity
B. Purchasing Power Parity
C. **International Fisher Effect (IFE)**
D. None of these
3. Suppose Hari approaches a forex dealer who loads INR 1.00 margin on the interbank rate for travel related remittances. If in the interbank market the USD is quoted at INR 85.46 - 85.50 then Mr. Hari
A. can buy travel card at INR 84.46.
B. can buy travel card at INR 84.50.
C. can buy travel card at INR 86.46.
D. **can buy travel card at INR 86.50.**
4. If USD/INR spot is trading at 83.2000 and one year Swap annualized premium is trading at 6.8% then what would be the net outright rate
A. 77.4500
B. 77.5524
C. 88.4500
D. **88.8576**
5. How does a deficit in current account affect the exchange rate of a country?
A. Appreciation of home currency
B. **Depreciation of home currency**
C. No impact on the exchange rate
D. It depends on the size of the deficit
6. 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.
7. On October 10, 2022, the Spot exchange rate is INR / USD = INR 66.2525- INR 67.5945 and the two months swap points are 125 and 195. What would be the foreign exchange rate after 2 months?
- A. INR / USD = INR 66.2620 – INR 67.6070
- B. INR / USD = INR 66.2400 – INR 67.5750
- C. INR / USD = INR 66.2330 – INR 67.5820
- D. **INR / USD = INR 66.2650 – INR 67.6140**
8. US dollar is quoted today as: spot \$ 1 = INR 80 and six months forward \$1 = INR 83.
- A. This means \$ is at discount
- B. This means future of rupee is uncertain
- C. This means future of rupee is unclear
- D. **This means \$ is at premium**
9. 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.
- A. Forward contract
- B. Futures contract
- C. **Option contract**
- D. Swaps
10. An Indian exporter expecting a remittance of USD 5 Million, planning to hedge his position by option contracts should.....
- A. buy Call Option in USD.
- B. **buy Put Option in USD.**
- C. buy Call Option in INR.
- D. buy Put Option in INR.
11. Combination of two fixed floating currency swaps to fixed to fixed currency swap is called?
- A. Vanilla Swap
- B. **Circus Swap**
- C. Extendible Swap
- D. Roller-Coaster Swaps
12. A Trader sold 20 lots of USD/INR in an exchange (1 lot = \$ 1000) via currency futures. He dealt at a future price of INR 78/\$ for 3 months. Currently future price is trading at INR 82/\$. The M2M (Mark to Market) of trader in the exchange shall be.....
- A. INR 4000
- B. INR 8000

Multiple Choice Questions

- C. **INR 80000**
- D. INR 40000

MTP M 24

On 1 October 2023 Mr. X an exporter enters into a forward contract with a BNP Bank to sell US\$ 1,00,000 on 31 December 2023 at ` 85.40/\$. However, due to the request of the importer, Mr. X received the amount on 28 November 2023. Mr. X requested the bank the take delivery of the remittance on 30 November 2023 i.e., before due date. The inter-banking rates on 28 November 2023 was as follows:

Spot ` 85.22/85.27

One Month Premium 10/15

Note: (1) Consider 365 days in a year.

(2) Prevailing Prime Lending Rate is 12%

Based on above case scenario, choose the most appropriate answer of the following:

1. The bank may accept the request of customer of delivery before due date of forward contract provided the customer is ready to bear the loss if any consisting of.....
 - A. Swap Difference
 - B. Interest on Outlay of Fund
 - C. Swap Difference Plus Interest on Outlay of Fund
 - D. **Fixed Charges Plus Swap Difference and Interest on Outlay of Fund**
2. In case of early delivery bank shall charge interest on outlay of fund at a rate not less than.....
 - A. 8%
 - B. 10%
 - C. **12%**
 - D. 18%
3. Swap Difference for US\$ 1,00,000 is.....
 - A. ₹ 5,000
 - B. **₹ 20,000**
 - C. ₹ 18,000
 - D. ₹ 8,000
4. Interest on outlay of funds shall be approximately.....
 - A. ₹ 92 payable by X
 - B. **₹ 183 payable by X**
 - C. ₹ 183 payable by Bank
 - D. ₹ 122 payable by Bank
5. Net inflow to Mr. X is approximately.....
 - A. ₹ 85,42,183
 - B. ₹ 85,20,000
 - C. **₹ 85,19,817**
 - D. ₹ 85,40,000

11. INTERNATIONAL FINANCIAL MANAGEMENT

BoS Knowledge Portal:

- Which of the following factors are crucial in multinational capital budgeting?
 - Cash flows from domestic projects.
 - Profits remitted to the host country.
 - Effect of foreign exchange risk on the parent firm's cash flow.**
 - Changes in rates of inflation in the parent country.
- 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.**

MTP M 24

A US parent company has subsidiaries in France, Germany, UK and Italy. The amounts due to and from the affiliates is converted into a common currency viz. US dollar and entered in the following matrix.

Inter Subsidiary Payments Matrix

(US \$ Thousands)

		Paying affiliate				
		France	Germany	UK	Italy	Total
Receiving affiliate	France	---	80	120	200	400
	Germany	120	---	80	160	360
	UK	160	120	---	140	420
	Italy	200	60	120	---	380
	Total	480	260	320	500	1560

The treasurer of US Parent company is suggesting that by applying Multilateral Netting system the company can save a lot of transfer/ exchange costs. The company's Board agreed with Treasurer's proposal.

From the above case scenario, choose the most appropriate answer of following MCQs.

- Before applying Multilateral Netting it is necessary to apply.....
 - Unilateral Netting
 - Bilateral Netting**
 - Multilateral Netting
 - Interest Rate Swapping
- Through Multinational Netting these transfers will be reduced to
 - \$ 50,000
 - \$ 100,000
 - \$ 150,000
 - \$ 200,000**

Multiple Choice Questions

3. The Net Payment/ Net Receipts for France after netting off shall be.....
- A. Net Receipt \$ 40,000
 - B. Net Payment \$ 80,000**
 - C. Net Payment \$ 40,000
 - D. Net Receipt \$ 80,000
4. The Net Payment/ Net Receipts for Italy after netting off shall be.....
- A. Net Receipt \$ 60,000
 - B. Net Payment \$ 120,000**
 - C. Net Payment \$ 60,000
 - D. Net Receipt \$ 120,000
5. Suppose if the transfer charges are 0.01% of the amount transferred then by applying multilateral netting techniques there will be reduction in overall cost of transfer by
- A. US \$ 136**
 - B. US \$ 156
 - C. US \$ 1,360
 - D. US \$ 1,560

12. INTEREST RATE RISK MANAGEMENT

BoS Knowledge Portal:

1. Which of the following contract involves the notional principal for the purpose of exchange of liabilities.
 - A. Currency Swap
 - B. **Plain Vanilla Swap**
 - C. Forward Contract
 - D. None of these

2. The primary difference between an interest rate swap contract and a forward contract can be on account of.....
 - A. underlying
 - B. time of payment
 - C. daily marking to the market
 - D. **number of exchanges**

3. Suppose A Ltd. is entering into an interest rate swap with a notional principal of Rs. 10,00,00,000. At the beginning of the swap the initial amount of money the counterparties must exchange.....
 - A. **Rs. 0**
 - B. Rs. 5,000,000
 - C. The future value of Rs.10,00,00,000
 - D. Rs. 10,00,00,000 discounted

13. BUSINESS VALUATION

BoS Knowledge Portal:

1.method involves valuation as per determination of the cost of group of assets and liabilities of equivalent company in the open market.
 - A. Net Asset Value
 - B. Net Realizable Value
 - C. **Replaceable Value**
 - D. None of the above

2.approach attempts to identify multi-industry companies that are undervalued and would have more value if separated from each other.
 - A. Economic Value Added Method
 - B. Market Value Added Method
 - C. **Chop-Shop Method**
 - D. None of the above

3. X Ltd. made a net profit of Rs. 50,00,000 and incurred expenses of Rs. 15,00,000. The number of issued Equity shares is 10,00,000. The company has a debt of Rs. 5,00,000. The market related details are as follows: $R_f = 10\%$ Market Rate of Return = 15% $\beta = 1.2$ The per share Earning Value of the company shall be.....
 - A. Rs. 31.25
 - B. Rs. 21.88
 - C. **Rs. 312.50**
 - D. Rs. 218.75

14. MERGERS, ACQUISITIONS & CORPORATE RESTRUCTURING

BoS Knowledge Portal:

1. A merger that combines companies deal with the same product but in separate markets is called a.....
 - A. **Market extension merger.**
 - B. pure conglomerate merger.
 - C. vertical merger.
 - D. reverse merger.

2. Which type of merger happens when two companies that have buyer-seller relationship (or potential buyer-seller relationship) come together?
 - A. Horizontal Merger
 - B. **Vertical Merger**
 - C. Conglomerate Merger
 - D. Congeneric Merger

3. The general reason for a divestiture, such as a sell-off or spin-off may be.....
 - A. Synergy
 - B. Economics of scale
 - C. **Reverse synergy**
 - D. None of these

15. STARTUP FINANCE

BoS Knowledge Portal:

1. The vendor financing in startup involves.....
 - A. borrowing funds from customer to lend funds to the company.
 - B. borrowing funds from customer to purchase products from the company.
 - C. lending funds to customer so that he can purchase products from different vendor.
 - D. **lending funds to customer so that he can purchase products from the company itself.**

2. In corporate restructuring when a company sells shares of the new company in market by making a public offer is called.
 - A. Sell off
 - B. Spin Off
 - C. Split up
 - D. **Equity Carve Outs**

3. Which among the following is not a method to approach a pitch presentation?
 - A. Introduction of the team
 - B. The market size of the product
 - C. Explaining the approach to be followed to solve a problem
 - D. **Method to be followed by the firm to bootstrap**

4. Which of the following can not be considered as a potential source of startup financing?
 - A. Bank loans
 - B. Personal financing
 - C. Crowdfunding
 - D. **Government grants**

Values of e^x & $\ln$

X	E^x	$\ln(1+x)$
0.01	1.01005	- 4.60517
0.02	1.02020	- 3.91202
0.03	1.03045	- 3.50656
0.04	1.04081	- 3.21888
0.05	1.05127	- 2.99573
0.06	1.06184	- 2.81341
0.07	1.07251	- 2.65926
0.08	1.08329	- 2.52573
0.09	1.09417	- 2.40795
0.10	1.10517	- 2.30259
0.11	1.11628	- 2.20727
0.12	1.12750	- 2.12026
0.13	1.13883	- 2.04022
0.14	1.15027	- 1.96611
0.15	1.16183	- 1.89712
0.16	1.17351	- 1.83258
0.17	1.18530	- 1.77196
0.18	1.19722	- 1.71480
0.19	1.20925	- 1.66073
0.20	1.22140	- 1.60944
0.21	1.23368	- 1.56065
0.22	1.24608	- 1.51413
0.23	1.25860	- 1.46968
0.24	1.27125	- 1.42712
0.25	1.28403	- 1.38629
0.26	1.29693	- 1.34707
0.27	1.30996	- 1.30933
0.28	1.32313	- 1.27297
0.29	1.33643	- 1.23787
0.30	1.34986	- 1.20397
0.31	1.36343	- 1.17118
0.32	1.37713	- 1.13943
0.33	1.39097	- 1.10866
0.34	1.40495	- 1.07881
0.35	1.41907	- 1.04982
0.36	1.43333	- 1.02165
0.37	1.44773	- 0.99425
0.38	1.46228	- 0.96758
0.39	1.47698	- 0.94161
0.40	1.49182	- 0.91629
0.41	1.50682	- 0.89160
0.42	1.52196	- 0.86750
0.43	1.53726	- 0.84397
0.44	1.55271	- 0.82098
0.45	1.56831	- 0.79851
0.46	1.58407	- 0.77653
0.47	1.59999	- 0.75502
0.48	1.61607	- 0.73397
0.49	1.63232	- 0.71335
0.50	1.64872	- 0.69315

X	E^x	$\ln(1+x)$
0.51	1.66529	- 0.67334
0.52	1.68203	- 0.65393
0.53	1.69893	- 0.63488
0.54	1.71601	- 0.61619
0.55	1.73325	- 0.59784
0.56	1.75067	- 0.57982
0.57	1.76827	- 0.56212
0.58	1.78604	- 0.54473
0.59	1.80399	- 0.52763
0.60	1.82212	- 0.51083
0.61	1.84043	- 0.49430
0.62	1.85893	- 0.47804
0.63	1.87761	- 0.46204
0.64	1.89648	- 0.44629
0.65	1.91554	- 0.43078
0.66	1.93479	- 0.41552
0.67	1.95424	- 0.40048
0.68	1.97388	- 0.38566
0.69	1.99372	- 0.37106
0.70	2.01375	- 0.35667
0.71	2.03399	- 0.34249
0.72	2.05443	- 0.32850
0.73	2.07508	- 0.31471
0.74	2.09594	- 0.30111
0.75	2.11700	- 0.28768
0.76	2.13828	- 0.27444
0.77	2.15977	- 0.26136
0.78	2.18147	- 0.24846
0.79	2.20340	- 0.23572
0.80	2.22554	- 0.22314
0.81	2.24791	- 0.21072
0.82	2.27050	- 0.19845
0.83	2.29332	- 0.18633
0.84	2.31637	- 0.17435
0.85	2.33965	- 0.16252
0.86	2.36316	- 0.15082
0.87	2.38691	- 0.13926
0.88	2.41090	- 0.12783
0.89	2.43513	- 0.11653
0.90	2.45960	- 0.10536
0.91	2.48432	- 0.09431
0.92	2.50929	- 0.08338
0.93	2.53451	- 0.07257
0.94	2.55998	- 0.06188
0.95	2.58571	- 0.05129
0.96	2.61170	- 0.04082
0.97	2.63794	- 0.03046
0.98	2.66446	- 0.02020
0.99	2.69123	- 0.01005
1.00	2.71828	-

X	E^x	$\ln(1+x)$
1.01	2.74560	0.00995
1.02	2.77319	0.01980
1.03	2.80107	0.02956
1.04	2.82922	0.03922
1.05	2.85765	0.04879
1.06	2.88637	0.05827
1.07	2.91538	0.06766
1.08	2.94468	0.07696
1.09	2.97427	0.08618
1.10	3.00417	0.09531
1.11	3.03436	0.10436
1.12	3.06485	0.11333
1.13	3.09566	0.12222
1.14	3.12677	0.13103
1.15	3.15819	0.13976
1.16	3.18993	0.14842
1.17	3.22199	0.15700
1.18	3.25437	0.16551
1.19	3.28708	0.17395
1.20	3.32012	0.18232
1.21	3.35348	0.19062
1.22	3.38719	0.19885
1.23	3.42123	0.20701
1.24	3.45561	0.21511
1.25	3.49034	0.22314
1.26	3.52542	0.23111
1.27	3.56085	0.23902
1.28	3.59664	0.24686
1.29	3.63279	0.25464
1.30	3.66930	0.26236
1.31	3.70617	0.27003
1.32	3.74342	0.27763
1.33	3.78104	0.28518
1.34	3.81904	0.29267
1.35	3.85743	0.30010
1.36	3.89619	0.30748
1.37	3.93535	0.31481
1.38	3.97490	0.32208
1.39	4.01485	0.32930
1.40	4.05520	0.33647
1.41	4.09596	0.34359
1.42	4.13712	0.35066
1.43	4.17870	0.35767
1.44	4.22070	0.36464
1.45	4.26311	0.37156
1.46	4.30596	0.37844
1.47	4.34924	0.38526
1.48	4.39295	0.39204
1.49	4.43710	0.39878
1.50	4.48169	0.40547

Tables

particular
value z .

→ avg.

Z values between μ and X

z	00	01	02	03	04	05	06	07	80	09
0.00	-	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.10	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.20	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.30	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.40	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.50	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.60	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.70	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.80	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.90	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.00	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.10	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.20	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.30	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.40	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.50	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.60	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.70	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.80	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.90	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.00	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.10	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.20	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.30	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.40	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.50	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.60	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.70	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.80	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.90	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.00	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990
3.10	0.4990	0.4991	0.4991	0.4991	0.4992	0.4992	0.4992	0.4992	0.4993	0.4993
3.20	0.4993	0.4993	0.4994	0.4994	0.4994	0.4994	0.4994	0.4995	0.4995	0.4995
3.30	0.4995	0.4995	0.4995	0.4996	0.4996	0.4996	0.4996	0.4996	0.4996	0.4997
3.40	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4998
3.50	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998
3.60	0.4998	0.4998	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.70	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.80	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.90	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000