

Only LDR & Cat A Questions

CA Final **AFM**
May 26 & Onwards

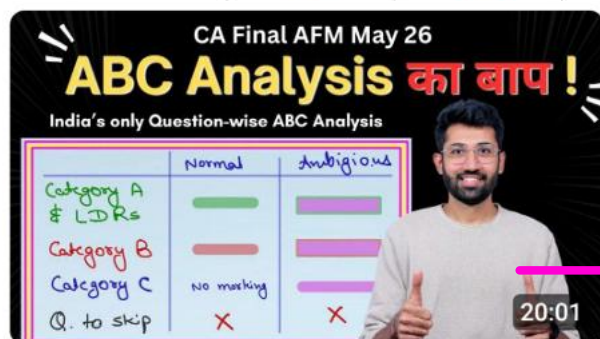
CMA Final **SFM**
May 26 & Onwards

For May - 26

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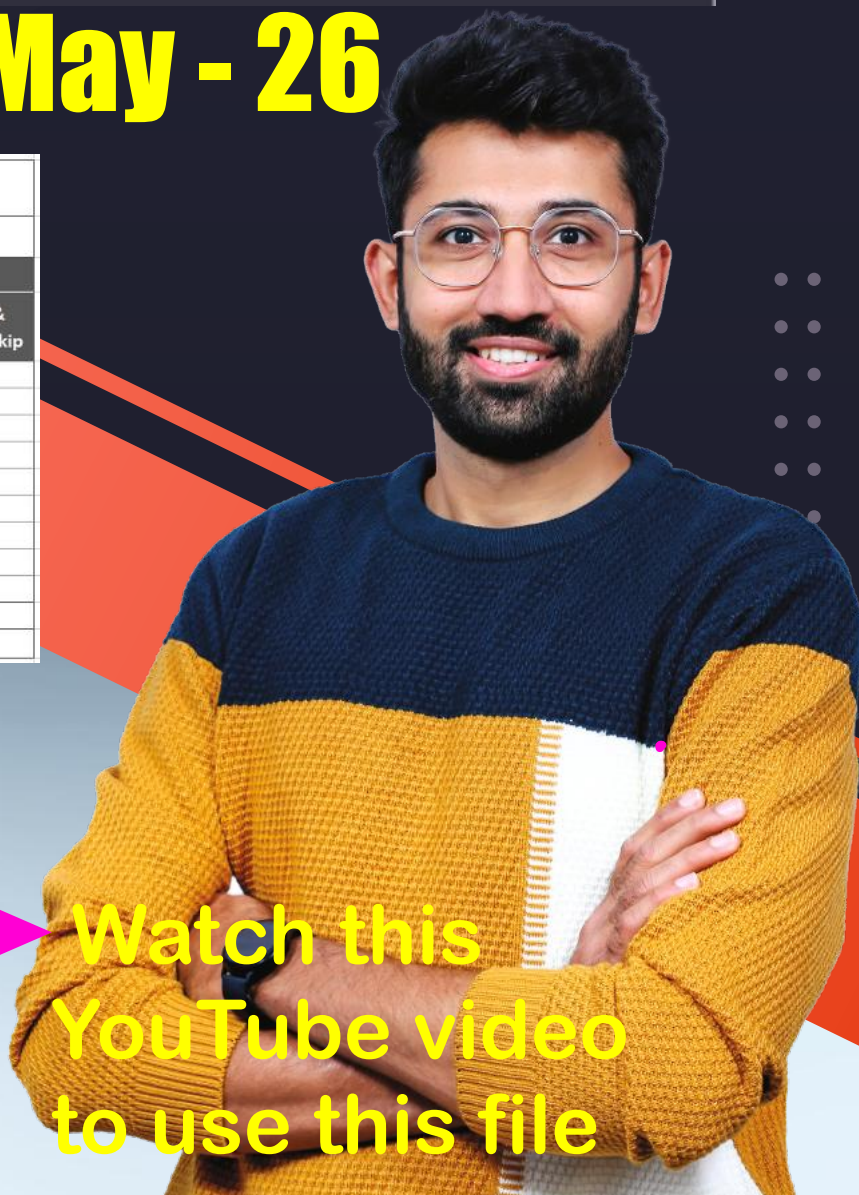
AFM - Question-wise ABC Analysis by Adish Jain CA CFA

Chapter name as per OutScanner	Number of Questions		
	Category A (LDRs)	Category B	Category C & Questions to Skip
Equity & Business Valuation	35	30	23
M&A	14	12	13
Fixed Income	18	18	18
Portfolio Management	24	24	21
Mutual Funds	10	11	5
Derivatives & IRRM	26	26	21
Forex & IFM	39	29	26
Advanced CapBudg	12	14	9
FP & CS, RM and SA	3	4	5
	181	168	141
	37%	34%	29%



AFM ABC Analysis May 26 | AFM LDR Questions ... FA

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OutNotes vs. ICAI Chapters

No.	ICAI Chapter Name	OutNotes Chapter Name
1	Financial Policy & Corporate Strategy	Financial Policy & Corporate Strategy, Risk Management and Security Analysis
2	Risk Management	
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



QUESTION 1:

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:

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

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

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

$$\begin{aligned} \text{Price of share (P}_0\text{)} &= \frac{D_1}{K_e - g} \\ &= \frac{8.268}{0.18 - 0.09} = 91.87 \end{aligned}$$



QUESTION 2:

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:

1. the cost of equity to the company if the market expects a growth rate of 15% p.a.
2. the indicative market price with the same cost of capital and if the anticipated growth rate is 16% p.a.
3. 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 $\frac{₹ 5}{50\%} = ₹ 10$
DPS ₹ 5
PF Ratio 8 times
Market Price ₹ 10 × 8 times = ₹ 80
Computation of cost of equity $= \frac{D_1}{P_0} + g$
 $= \frac{5}{80} + 0.15$
 $= 21.25\%$
2. Market Price $= \frac{D_1}{k_e - g} = \frac{5}{0.2125 - 0.16}$
 $= ₹ 95.24$
3. Market Price $= \frac{D_1}{k_e - g} = \frac{5}{0.20 - 0.18}$
 $= ₹ 250$

**QUESTION 3:**

MTP N 23 | M 18 | N 14 | N 10 | N 08

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:

$$\begin{aligned}
 &= \frac{D_1}{K_e - g} \\
 &= \frac{2(1 + 0.1)}{0.162 - 0.10} \\
 &= 35.48
 \end{aligned}$$

**QUESTION 4:**

M 12 | RTP N 18

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.

- What rate of return an investor can expect to earn assuming that dividends are expected to grow along with earnings at 7.5% per year in perpetuity?
- It is expected that AB co. will earn about 10% on book Equity and shall retain 60% of earnings. In this case, whether, there would be any change in growth rate and cost of Equity?

Solution:

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

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

- Existing $D_1 = ₹ 3.36$

- Existing RR

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

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

$$\text{Existing EPS}_1 = \frac{3.36}{25\%} = ₹ 13.44$$

$$\text{Revised EPS}_1 = \frac{13.44}{1.075} \times 1.06 = 13.25$$

$$\begin{aligned}
 \text{Revised } D_1 &= 13.25 \times (1 - 0.60) \\
 &= 5.3
 \end{aligned}$$

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

Self-note: In this question, we will have to particularly remember the flow of removing the old growth of and adding the new growth at EPS Level. It is not done in any other question.



QUESTION 5:

N 22 | M 21 | M 19 | N 12 | N 09 | RTP

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)	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	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:

$$\begin{aligned}
 \text{(a) Assets T/O Ratio} &= \frac{\text{Sales}}{\text{Total Assets}} \\
 1.1 &= \frac{\text{T/O}}{600} \\
 \text{Sales} &= 660
 \end{aligned}$$

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

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

Sustainable growth rate = RR × ROE

$$= (1 - 0.1667)$$

$$= 0.8333 \times 0.078$$

$$= 6.5\%$$

(c) Using Gordon's formula

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

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

$$= \frac{0.52(1.065)}{0.15 - 0.065} = 6.51$$

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

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



QUESTION 6:

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	3.33
2	20%	4.8	0.694	3.33
3	20%	5.76	0.579	3.34
4	20%	6.91	0.482	3.33
5	19%	8.23	0.402	3.31
6	18%	9.71	0.335	3.25
7	17%	11.36	0.279	3.17
7	-	$\frac{11.36 \times (1.16)}{0.20 - 0.16} = 329.44$	0.279	91.91
				114.97

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

Self-note: The question does not specify the percentage of decline in linear growth every year. **Point of learning** is that we assumed it to be 1% every year and validated our assumption with the given data of PVFs.

**QUESTION 7:**

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:

- 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%.

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

**QUESTION 8:**

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

$$\begin{aligned}
 \text{a) Expected Share Price as on 2008 (P}_{2008}) &= \frac{D_{2009}}{K_e - g} \\
 &= \frac{4.224 \times (1.06) \times 65\%}{0.123 - 0.06} \\
 &= \text{€ } 46.19 \text{ per share}
 \end{aligned}$$

$$\begin{aligned}
 \text{b) Expected Share Price Today:} &= 3.549 + 46.19 \times 0.521 \\
 &= \text{€ } 27.61 \text{ per share}
 \end{aligned}$$



QUESTION 9:

M 16 | RTP

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:

- MV of share before declaring project

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

$$= \frac{2 \times 1.06}{0.08 - 0.06} = ₹ 106$$

MV of share after declaring project

$$P_0 = \frac{D_4}{K_e - g} \times \frac{1}{(1 + k_e)^3}$$

$$= \frac{2.5}{0.08 - 0.07} \times \frac{1}{(1 + 0.08)^3}$$

$$= 198.46$$

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 10:

S 25

ABC Ltd.'s share is currently traded at the price of ₹ 192.50 per share. Mr. Roni is planning to purchase the shares of the company. For this purpose, he has taken the services of a financial analyst to know whether the price of ABC Ltd. is fairly priced. The analyst has assembled the following information:

- The before-tax required rates of return on ABC Ltd. debt, preferred stock, and common stock are 8.60%, 11%, and 13%, respectively.
- The company's target capital structure is 20% debt, 30% preferred stock and 50% Common stock.
- The market value of the company's debt is ₹ 275 million and its valued at ₹ 120 million.
- ABC Ltd. 's free cash flow to the firm (FCFF) for the year just ended is ₹ 125 million. FCFF is expected to grow at a constant rate of 8% for the foreseeable future.
- The tax rate is 30%.
- ABC Ltd. has 20 million outstanding common shares.

Equity & Business Valuation

You are required to -

- As a financial analyst, on the basis of value per share, advise Mr. Roni whether he should purchase the shares of the company at market price or not.
- Assume, we are to get same value of equity as calculated in (i) for using FCFE approach, calculate free cash flow to the equity (FCFE) for the year just ended, if FCFE is expected to grow at a constant rate of 8.50% for the foreseeable future.

Calculation up to 2 decimal points.

Solution:

Working Notes:

- (I) Calculation of WACC

$$= 8.60\% (1 - 0.30) \times 20\% + 11\% \times 30\% + 13\% \times 50\% \\ = 11\%$$

- (II) Value of Firm based on FCFF

$$= \frac{125 \text{ Million} (1.08)}{0.11 - 0.08} = \frac{135 \text{ Million}}{0.03} = ₹ 4500 \text{ Million}$$

- (i) To decide whether the value of share is justified let us compute the value per share based on FCFF as follows:

Value of Firm	₹ 4500 Million
Less: Value of Company's Debt	₹ 275 Million
Less: Value of Company's Preferred Stock	₹ 120 Million
Value of Equity Shares	₹ 4105 Million
No. of Equity Shares	20 Million
Value of Per Equity Share	₹ 205.25

Advise: Mr. Roni should purchase share at this price as it is underpriced.

- (ii) Computation of Free Cash Flow to Equity

Value of one Equity Share as per FCFF ₹ 205.25

Accordingly, by using Growth Model formula we can find the FCFE per share as follows:

$$205.25 = \frac{\text{FCFE}(1.085)}{0.13 - 0.085}$$

FCFE per share = ₹ 8.51

No. of Equity Shares outstanding 20 million

FCFE of the ABC Ltd. shall be ₹ 8.51 x 20 million = ₹ 170.20 million

Alternatively, this calculation can be made on the total capital instead of per share basis as follows:

$$4105 = \frac{\text{FCFE}(1.085)}{0.13 - 0.085}$$

FCFE = ₹ 170.25 million



QUESTION 11:

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

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

Solution:

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

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

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 :

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

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

Calculation of value per share using dividend discount model:

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

From the above we can see that value of share as per dividend discount model is more than the value as per FCFE 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 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 FCFE 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 12:

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

Calculating FCFF

Year	1	2	3	4	5
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 the firm is : ₹ 11720.94 Crore



QUESTION 13:

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 14:

MTP N 24

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.
- No depreciable assets are held by the ABC Startup.

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

	CF 1	CF 2	CF 3	TV 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

b) Base Case Scenario

	CF 1	CF 2	CF 3	TV 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

c) Worst Case Scenario

	CF 1	CF 2	CF 3	TV 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:

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

$$= ₹ 1,61,73,293$$



QUESTION 15:

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	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:

$$= \text{Annual CF} \times \text{PVAF}_{(14\%, 6 \text{ years})} + \text{Disposal Value} \times \text{PVAF}_{(14\%, 6 \text{th year})}$$

$$= 4,00,000 \times 3.888 + 1,50,000 \times 0.456$$

$$= 16,23,600$$

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

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.



QUESTION 16:

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.

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 there is no growth and the 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 asset and hence they will offset each other. Also, there will be no new working capital requirement.

$$\text{PAT or FCFE} = 1,400$$

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

Value of company after the strategy

Value of Fixed Assets:

Years	Opening	Depreciation	Closing	Capex
-------	---------	--------------	---------	-------

Equity & Business Valuation

	(a)	(b)	(c)	(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.



QUESTION 17:

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
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	7,000	2,550
To Taxation	2,030	820		-	-
To Distributable Profit	3,770	1,510		-	-
Total	7,000	2,550	Total	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.
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 × (1.25) ⁴]	3662.11	11362.11
Plant & Machinery	2800	
Account Receivable	2400	
Stock	2100	
Bank / Cash	400	
<u>Liabilities</u>		
Long term loan	-1,000	-3,000
Sundry Creditors	-1,100	
Bank Overdraft	-100	
Tax Payable	-400	
Dividend Payable	-400	
Net Asset Value		8362.11

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

Year	Profit
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.

(2) Dividend Valuation Model:

$$DPS_0 = \frac{760}{40} = ₹ 19 \text{ per shares}$$

$$\begin{aligned} K_e \text{ using CAPM} &= R_f + \beta_j (R_m - R_f) \\ &= 10\% + 1.05(16\% - 10\%) \\ &= 16.3\% \end{aligned}$$

$$\begin{aligned}
 P_0 &= \frac{D_1}{K_e - g} \\
 &= \frac{19 \times 1.12}{0.163 - 0.12} \\
 &= 494.88
 \end{aligned}$$

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 18:

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:

in crores

Particulars	ICL	SVL
Net Sales	4,545	1,500
PBIT	2,980	720
Interest	750	25
Provision for Tax	1,440	445
PAT	790	250
Dividends	235	125

Particulars	ICL		SVL	
Fixed Assets				
Land & 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	

Equity & Business Valuation

Provision for dividends	60	470	50	240
Net Assets		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

Solution:

a) Net Worth Method

Calculation of Net worth of SVL

	(In ₹ crores)	
<u>Assets</u>		
L&B [190 × 2.1970]	417.43	
P&M	350	
F&F	10	
CA	580	1357.43
<u>Liabilities</u>		
Creditors	130	
OD	10	
PFT	50	
PFD	50	
Borrowings	105	345
Net worth		1012.43

Calculation of Estimated Average PAT:

$$\begin{aligned}
 \text{Total profit on next 5 years} &= \text{Current PAT} \times \text{PVAF (15\%, 5 years)} \\
 &= 250 \times 7.7537 \\
 &= 1938.43 \\
 \text{Average profit for 1 year} &= \frac{1938.43}{5}
 \end{aligned}$$

$$= 387.69$$

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

$$\text{Value of company per share} = \frac{1400.12}{12.5}$$

$$= 112.01$$

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

Or

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

b) Dividend Growth Formula

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

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

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

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

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

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

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



QUESTION 19:

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

Equity & Business Valuation

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
Add: Profit from new operation		
Sales	70,00,000	
Less: Material Cost	-20,00,000	
Add: Labour Cost	-16,00,000	
Add: 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

$$\text{Value of business: } \frac{1,10,22,000}{12\%} = 9,18,50,000$$

- Market Price per equity share

Particulars	Amount
PAT	1,10,22,000
Less: Preference Dividend	7,20,000
EAES	1,03,02,000
÷ No of Shares	50,00,000
EPS	2.0604
× PE Ratio	6
Market price per share	12.36

Self-note: Rather than considering the reported PAT, the suggested answer has considered future maintainable PAT for calculating market price.

**QUESTION 20:**

SM | RTP | MTP N 19

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%.

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

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

$$\begin{aligned}\text{Interest \& fixed Dividend coverage Ratio} &= \frac{\text{PAT} + \text{Int on Debt}}{\text{Int on Debt} + \text{Pref Div}} \\ &= \frac{15,80,800 + 7,68,000}{7,68,000 + 3,20,000} \\ &= 2.16\end{aligned}$$

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

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 21:

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?
- What inference could you draw?

Solution:

- 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 22:

M 25 | N 20 | SM | MTP M 24

On the basis of the following information:

Current dividend (D_0)	₹2.50
Discount rate (k)	10.50%
Growth rate (g)	2%

- a. Calculate the present value of stock of ABC Ltd.
 b. Is its stock overvalued if stock price is ₹35, ROE = 9% and EPS (E_0) = ₹2.25? Show detailed calculation using
1. PE Multiple Approach
 2. Earning Growth Model (using discount rate of 10.5%) – This part in brackets was added in MTP M 24.

Solution:

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

$$V_0 = \frac{D_1}{K_e - g}$$

$$= \frac{2.50 \times 1.02}{0.105 - 0.02}$$

$$= ₹ 30$$

- 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 ($1/\text{RoE}$) = $1/9\%$	11.11 times
Market Price per Share	₹ 25.00

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

Self-note: Suggested answers calculated PE Ratio using RoE, rather than K_e .

- (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 = $\frac{EPS (1 + g)}{RoE - g}$	$= ₹ 2.25 \times 1.02 / (0.09 - 0.02)$ ₹ 32.79

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

Self-note: Suggested answer used RoE, rather than K_e in Gordon's formula.

Alternative Solution: In MPT M 24, discounting rate of 10.5% was specified in part 2 (b) of the question.

Particulars	
Actual Stock Price	₹ 35.00
Discounting Rate	10.5%
EPS	₹ 2.25
Growth Rate	2%
Market Price per Share = $\frac{EPS (1 + g)}{k_e - g}$	$= ₹ 2.25 \times 1.02 / (0.105 - 0.02)$ = ₹ 27

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



QUESTION 23:

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:

- 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: Logically, we should divest Unit II because even for lower earnings, it is being sold at a same value as Unit I. However suggested answer suggested divestment of Unit 1.

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

**QUESTION 24:**

S 25

PN Limited submits the following details for the financial year ended on 31st March 2025:

Number of Equity Shares	1,50,000
Current market price per share	₹ 12
10% Debts	₹ 2,00,000
Cash and Cash Equivalents	₹ 5,00,000
Gross Profit	₹ 12,00,000
Indirect Expenses (Excluding Depreciation & Interest)	₹ 5,00,000
Depreciation	₹ 30,000
Risk – free rate of return	7%
Market rate of return	16%
Beta of the Company	0.8
Applicable Tax Rate	20%

On the basis of above details, you are required to calculate the following:

1. Cost of Equity of the company using CAPM.
2. Earnings Per Share (EPS) of the company.
3. Equity value of the company if applicable EBIDTA multiple is 4.
4. Enterprise Value of the company.

Calculation up to 2 decimal points.

Solution:

- (i) Cost of Equity using CAPM
 $7\% + 0.8(16\% - 7\%) = 14.20\%$

(ii) Earning Per Share (EPS)

(₹)

Gross Profit	12,00,000
Less: Indirect Expenses	5,00,000
EBIDTA	7,00,000
Less: Depreciation	30,000
	6,70,000
Less: Interest on Debt (10% on ₹ 2,00,000)	20,000
	6,50,000
Less: Tax @20%	1,30,000
Profit After Tax (PAT)	5,20,000
Number of Equity Shares	1,50,000
Earnings Per Share (EPS)	3.47

(iii) Equity Value of the Company

EBITDA	₹ 7,00,000
EBITDA multiple	4
Capitalized Value or Enterprise Value	₹ 28,00,000
Less: Outstanding Debts	₹ 2,00,000
Equity Value	₹ 26,00,000

Self-note: Suggested answer made a mistake of not adding add Vash & cash equivalents to the Capitalised value while calculating Equity value.

(iv) Enterprise Value of company

Number of Equity Shares	1,50,000
Current Market Price (CMP)	₹ 12
Market Capitalization	₹ 18,00,000
Add: Outstanding Debts	₹ 2,00,000
Less: Cash and Cash Equivalent	₹ 5,00,000
Enterprise Value	₹ 15,00,000

Self-note: The EV calculated in this part is actual EV, where EV calculated in (iii) part of the question was Fair EV



QUESTION 25:

M 25 | SM Illustration

ZIO is a small-to-medium-sized privately held company specializing in electrical equipment manufacturing and is seeking additional investors. Below are key financial indicators to assist in evaluating the investment potential:

- Break-even Achieved: The Company has reached its break-even point this year.
- EBITDA: 110 Lakh, including an extraordinary gain of 16 Lakh.
- Pending Adjustments: 38 Lakh in preliminary sales promotion costs are yet to be written off.
- Unlevered Beta: 1.5 (based on the industry benchmark).
- Capital Structure: Debt-to-Equity Ratio of 30:70.

- Risk-Free Rate: 6% (based on liquid bonds).
- Market Rate of Return: 12% (internal industry assessment).
- Equity Value (EV): The EV is to be taken at a multiple of 8 on EBITDA.
- The pre-tax cost of debt is 12.45% and assume a tax regime of 30%.

The Future Cash Flows (FCFs) for the next three years are as follows:

Years	1	2	3
Future cash flows (₹ lakhs)	150	200	220

Future cash flows are discounted at Weighted Average Cost of Capital (WACC)

PV Factor at 15% & 14% are as under -

Years	1	2	3
PVF @ 15%	0.870	0.756	0.658
PVF @ 14%	0.877	0.769	0.675

Solution:

The levered beta of the company will be $1.5[1+(1-0.3)*30/70] = 1.95$

The adjusted EBITDA would be ₹ 110 Lakh – ₹ 16 Lakh – ₹ 38 Lakh
= ₹ 56 Lakh

The EV will be multiple of 8 on the ₹ 56 Lakh obtained above = ₹ 448 Lakh

The Cost of equity in accordance with CAPM = $R_f + \beta (R_m - R_f)$

= $6\% + 1.95 (12\% - 6\%) = 17.70\%$

The WACC = Cost of Equity + Cost of Debt

= $17.70 (70/100) + 12.45 (1-0.3) (30/100) = 15.00\%$

Finally, the future cash flows can be discounted at the WACC obtained above as under –

	Y1	Y2	Y3
Future Cash flows	150	200	220
Discount factor	0.870	0.756	0.658
PVs of cash flows	130.50	151.20	144.76
Value of the Firm			426.46



QUESTION 26:

N 21

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
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.

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

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

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

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

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

4. 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 27:**

J 26 | 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 28:**

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
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:

Calculation of WACC:

$$k_e = R_f + \beta \times (R_m - R_f) \\ = 8 + 0.90 \times 10 = 17\%$$

$$k_d = 10 \times (1 - 0.30) = 7.00\%$$

$$\text{WACC} = 17 \times \frac{170}{250} + 7 \times \frac{80}{250} = 13.80\%$$

Now, calculating EBIT using EVA:

$$\text{EVA} = \text{EBIT} \times (1 - t) - \text{Invested Capital} \times \text{WACC}$$

$$31,10,000 = [\text{EBIT} \times (1 - 0.3)] - (2,50,00,000 \times 0.1380)$$

$$\text{EBIT} = ₹ 93,71,429$$

Calculation of profit after Tax (₹)

Operating Profit	93,71,429
Less: Interest	8,00,000
Profit before Tax	85,71,429
Less: Tax @ 30%	25,71,429
Profit after Tax	60,00,000



QUESTION 29:

M 25 | 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:

Calculation of EBIT

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

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

$$\text{EBIT} = 120$$

Calculation of K_o

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

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

$$= 10\%$$

$$\text{EVA} = [120 (1 - 0.30)] - (700 \times 10\%)$$

$$= 14 \text{ Lakhs}$$

**QUESTION 30:**

J 26 | M 18 | N 20 | M 18 | SM | 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 Net Operating Profit after Tax of ₹ 84 Crore. The rate on 365 days Government bond is 10 percent per annum. Market 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:

	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 in the absence of information.

**QUESTION 31:**

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

Equity & Business Valuation

EAT	280	1300
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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

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 32:

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:

$$(a) \quad \text{Number of Shares} = 10,00,000 \times \frac{1}{2}$$

$$= 500,000 \text{ shares}$$

$$\begin{aligned} \text{Issue Price} &= \frac{20,00,000}{5,00,000} = ₹ 4 \\ \text{Ex – right price} &= \frac{P_0 \times n_0 + P_1 \times n_1}{n_0 + n_1} \\ &= \frac{13 \times 10,00,000 + 20,00,000}{15,00,000} \\ &= 10 \\ \text{Value of a Right} &= \text{Ex-right price} - \text{issue price} \\ &= 10 - 4 \\ &= 6 \\ \text{Value of Right per share} &= \frac{10 - 4}{2} \\ &= 3 \text{ per share} \\ (b) \quad \text{Ex-Right price} &= \frac{13 \times 10,00,000 + 20,00,000}{12,50,000} \\ &= 12 \\ \text{Number of shares} &= 10,00,000 \times \frac{1}{4} \\ &= 2,50,000 \text{ shares} \\ \text{Issue Price} &= \frac{20,00,000}{2,50,000} = 8 \\ \text{Value of a right} &= 12 - 8 \\ &= 4 \\ \text{Value of right per share} &= \frac{12 - 8}{4} \\ &= ₹ 1 \\ c) \quad &\text{Calculation of effect of right issue on wealth of Shareholder with 100 shares:} \\ &\text{Wealth of shareholder before right issue:} \\ &\quad \text{Value of Shares} \quad [100 \times 13] \quad 1300 \\ &\text{Wealth of shareholder when 1:2 right shares:} \\ &\quad \text{Value of shares} \quad [150 \times 10] \quad 1500 \\ &\quad \text{Less: Cash paid} \quad [50 \times 4] \quad \underline{(200)} \\ &\quad \quad \quad \underline{1300} \\ &\text{Wealth of shareholder when 1:4 right shares:} \\ &\quad \text{Value of shares} \quad [125 \times 12] \quad 1500 \\ &\quad \text{Less: Cash paid} \quad [25 \times 8] \quad \underline{(200)} \\ &\quad \quad \quad \underline{1300} \end{aligned}$$

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 33:

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'

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

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 34:

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

$$\begin{aligned}
 \text{No. of share bought back} &= \frac{\text{Buy Back Amount}}{\text{Buy Back Price}} \\
 &= \frac{100 \text{ lacs} \times 27\%}{x} = \frac{27 \text{ lacs}}{x} \\
 \text{Post Buy back no. of shares} &= \text{Pre buyback no. of shares} - \text{no. of shares bought back} \\
 &= 10 \text{ lacs} - \frac{27 \text{ lacs}}{x} \\
 \text{Post Buy Back MP} &= 1.1x \\
 \text{Market capitalization after buyback} &= \text{MPS after buy back} \times \text{No. shares after buy back} \\
 210 \text{ lacs} &= 1.1x \times \left[10 \text{ lacs} - \frac{27 \text{ lacs}}{x} \right] \\
 x &= 21.79 \\
 (b) \quad \text{No. of shares to be repurchased} &= \frac{27,00,000}{21.79} = 1,23,910 \\
 (c) \quad \text{Post Buy Back EPS} &= \frac{10,00,000 \times 3}{10,00,000 - 1,23,910} \\
 &= 3.42 \\
 \text{EPS will increase from ₹ 3 to ₹ 3.42 due to buy back}
 \end{aligned}$$

**QUESTION 35:**

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:

$$\text{Current Market Price of Share} = ₹ 200 \times 15 = ₹ 3,000$$

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

$$\text{No. of Shares proposed for Buyback} = 20\% \text{ of } 1 \text{ crore} = 20 \text{ Lakh}$$

$$\text{Post Buy back per share (₹)} = ₹ 3,057$$

$$\text{Pre \& Post buyback PE Ratio} = 15 \text{ times}$$

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

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

$$\text{Post buyback EAT} = ₹ 203.80 \times 80 \text{ Lakh} = ₹ 16,304 \text{ Lakh}$$

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

$$\text{Pre buyback PAT} = ₹ 200 \times 1 \text{ crore} = 20,000 \text{ Lakh}$$

$$\text{Pre buyback PBT} = \frac{20,000}{(1 - 0.30)} = ₹ 28571.429 \text{ Lakh}$$

Particulars	
Pre buyback PBT	₹ 28571.429 Lakhs
Less: Post buyback PBT	₹ 23291.429 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 36:

J 26 | N 13 | M 18

T Ltd., a listed company on stock exchange, currently has 84% promoter 4 holding i.e. 126 Lakh shares. Profit after Tax is 9.60 Crores. Free Float market capitalization is 38.40 Crores. As per SEBI guidelines promoters have to restrict their holding to 75% to avoid delisting from the stock exchange. Board of Directors has decided not to delist the share but to comply with the SEBI guidelines by issuing bonus shares to minority shareholders while maintaining the same P/E Ratio.

You are required to calculate:

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

Solution:

Self-note: The information regarding the promoters' holding is sometimes ambiguously given in the question as capitalization rate.

Mergers, Acquisition & Corporate Restructuring



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
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**QUESTION 2:**

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:

$$\text{a) EPS} = \frac{\text{PAT}}{n}$$

$$\text{M Co Ltd.} = \frac{80,00,000}{16,00,000} = 5$$

$$\text{N Co Ltd.} = \frac{24,00,000}{4,00,000} = 6$$

$$\text{b) Swap Ratio Based on MPS} = \frac{160}{200} = 0.80$$

$$\begin{aligned} \text{Post-merger EPS} &= \frac{80,00,000 + 24,00,000}{16,00,000 + 4,00,000 \times 0.80} \\ &= 5.4167 \end{aligned}$$

- c) Exchange ratio where earnings should not be diminished should be based on EPS

$$\text{Pre-merger EPS of M Co. Ltd.} = \frac{₹ 80,00,000}{16,00,000} = ₹ 5$$

$$\text{Pre-merger EPS of N Co. Ltd.} = \frac{₹ 24,00,000}{4,00,000} = ₹ 6$$

Exchange ratio where earnings will be maintained = 6:5 or 1.2

Justification:

$$\begin{aligned} \text{Post-merger EPS} &= \frac{80,00,000 + 24,00,000}{16,00,000 + 4,00,000 \times 1.2} \\ &= ₹ 5 \end{aligned}$$

For M Ltd:	Post-merger EPS	= ₹ 5	
	Pre-merger EPS	= ₹ 5	
For N Ltd:	Post-merger Earnings	= 4,00,000 × 1.2 × 5	= 24,00,000
	Pre-merger earnings		= 24,00,000

Hence, No loss of earnings

- d) Same as (c)
e) Same as (c)



QUESTION 3:

M 25 | 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:

- a) Pre-merger earnings of BL = 5 × 2,00,000
= 10,00,000

Calculating Pre-merger PAT of SPL using post-merger EPS:

$$\begin{aligned} \text{Post-merger EPS} &= \frac{\text{PAT}_{\text{BL}} + \text{PAT}_{\text{SPL}}}{n_{\text{BL}} + n_{\text{SPL}} \times \text{ER}} \\ 5.5 &= \frac{10,00,000 + \text{PAT}_{\text{SPL}}}{2,00,000 + 50,000 \times \frac{4}{5}} \\ \text{PAT}_{\text{SPL}} &= 3,20,000 \end{aligned}$$

$$\text{Premerger EPS of SPL} = \frac{3,20,000}{50,000} = ₹ 6.4 \text{ per share}$$

- b) Premerger MPS of SPL = 6.4 × 10 = ₹ 64

- c) Exchange ratio to maintain EPS = $\frac{\text{EPS of SPL}}{\text{EPS of BL}} = 6.4:5$

$$\text{Number of shares to be issued to SPL} = 50,000 \times \frac{6.4}{5} = 64,000 \text{ shares}$$

Self-note: While solving part (a) of the question, we have assumed that there is no synergy in earnings.

**QUESTION 4:**

N 24 | M 16 | RTP

The CEO of a company thinks that shareholders always look for EPS. Therefore, he considers maximization of EPS as his company's objective. His company's current Net profits are ₹ 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%.

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:

$$\frac{80,00,000 + 15,75,000 - \text{Cash per share} \times 50,000 \times 0.15 \times (1 - 0.3)}{20,00,000} = 4$$

$$\text{Cash per share} = 100$$

**QUESTION 5:**

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:

- The number of equity shares to be issued by A Ltd. for acquisition of T Ltd.
- What is the EPS of A Ltd. after the acquisition?
- 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 S Ltd. rose by 10% on BSE. Mr. X, an investor, having 10,000 shares of S Ltd. is having another investment opportunity, which yields annual return of 14% is seeking your advise whether he needs to offload the shares in the market or accept the shares from B Ltd.

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 = $31.3 \times 0.5 = 15.65$

	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 6:**

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

$MPS = \frac{\text{Market Capitalization}}{\text{No of shares}}$	$\frac{75,00,000}{1,00,000} = ₹ 75$	$\frac{90,00,000}{60,000} = ₹ 150$
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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 7:

N 18 | M 10 | RTP

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.

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;

a. Net Consideration payable.

- b. No. of shares to be issued by T Ltd.
- c. EPS of T Ltd. after acquisition.
- d. Expected market price per share of T Ltd. after acquisition.
- e. 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
Less: Tax @ 30%	-102.86	-25.71
EAT	240.00	60.00

$$\text{Post-merger EPS} = \frac{240 + 60}{12 + 2.59} = 20.56$$

$$\text{d) Pre-merger EPS} = \frac{240 \text{ lacs}}{12 \text{ Lacs}} = 20$$

$$\text{Pre-merger PE Ratio} = \frac{220}{20} = 11$$

$$\text{Post-merger MPS} = 20.56 \times 11 = 226.16$$

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 8:

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

× Split Ratio = $100/5 = 20$

No. of shares = 1,05,00,000

EPS = $\frac{1,60,00,000}{1,05,00,000} = 1.524$

BVPS = $\frac{16,00,00,000}{1,05,00,000} = 15.24$


QUESTION 9:

J 26 | 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	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	50	-
Total Assets	5,120	52,500

You are required to

- Calculate Swap ratio based on the above weights;
- As certain the number of Shares to be issued to Weak Bank;
- Prepare Balance Sheet after merger; and
- Calculate CAR and Gross NPA of Strong Bank after merger.

Solution:

- 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
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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 10:

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:

- Maximum exchange ratio acceptable to the shareholders of C Ltd:

Post-merger MPS = Pre-merger MPS of C Ltd.

$$\left[\frac{96 + 30}{20 + 14 \times ER} \right] \times 7 = 38.4$$

$$ER = 0.212:1$$

- Minimum exchange ratio acceptable to the shareholders of D Ltd:

Equivalent MPS = Pre-merger MPS of D Ltd.

$$\left[\frac{(96 + 30) \times 9}{20 + 14 \times ER} \right] \times ER = 15$$

$$ER = 0.325:1$$


QUESTION 11:

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) (Ignore Synergy)		15	10

You are required to determine:

- 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

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	$15 \times 8 = 120$	$10 \times 5 = 50$
Pre-merger MV = MPS × n	$120 \times 15 = 1800$	$50 \times 16 = 800$

- 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 12:

M 21 | RTP

Long Ltd., is planning to acquire Tall Ltd., with the following data available for both the companies:

	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

As per an estimate Tall Ltd., is expected to have steady growth of earnings and dividends to the tune of 6% per annum. However, under the new management the growth rate is likely to be enhanced to 8% per annum without additional investment.

You are required to:

- Calculate the net cost of acquisition by Long Ltd., if ₹ 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.

Solution:

- a) Net cost of acquisition shall be computed as follows:

Cash paid per share	₹ 60
---------------------	------

Less: Pre-merger MPS of Tall Ltd	₹ 50
Gain\loss per share	₹ 10
× n of shares	18,00,000
Net Cost of acquisition of Tall Ltd.	₹ 1,80,00,000

(ii) Net Cost of acquisition in case of exchange of shares:

$$\begin{aligned} \text{Calculation of cost of Equity of Tall Ltd.} &= \frac{D_1}{P_0} + g \\ &= \frac{3}{50} + 0.06 = 12\% \\ \text{Growth rate after acquisition} &= 8\% \\ \text{Value of Tall Ltd. after merger} &= \frac{3}{0.12 - 0.08} = 75 \\ \text{Post-merger MPS} &= \frac{180 \times 30,00,000 + 75 \times 18,00,000}{36,00,000} \\ &= ₹ 187.50 \text{ per share} \\ \text{Equivalent MPS} &= 187.50 \times 1/3 = ₹ 62.5 \end{aligned}$$

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

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 13:

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:

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

$$= \frac{0.6}{20} + 7 = 10\%$$

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

c) Pre-merger PE Ratio of AFC Ltd. = $\frac{100}{8} = 12.50$

$$\text{Post-merger MPS} = \frac{8 \times 10,00,000 + 2.5 \times 5,00,000 - (22 \times 5,00,000 \times 10\%)}{10,00,000} \times 12.5$$

$$= 101.875$$

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 14:

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?

Solution:

- 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
	₹ 1,26,00,000
÷ No. of Shares	4,00,000
Minimum Price	₹ 31.50



QUESTION 15:

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 $[6 \text{ lakhs} \times (100 - 25)]$	450
Pref shares claim reduced $[2 \text{ lakhs} \times (100 - 50)]$	100
Debentures holder agree to forego	26
Trade creditors $(300 \times 25\%)$	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

**QUESTION 1:**

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 _s
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 2:**

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:
 1. Approximate Method

2. Precise Method

Solution:

- a) Self-Note: In the absence of information regarding maturity of bonds, it can be assumed as irredeemable. FV assumed as ₹ 100.

$$\text{Coupon} = 100 \times 10\% = ₹ 10$$

$$\text{Calculation of existing yield} = \frac{10}{110} = 9.09\%$$

$$\text{Revised yield} = 9.09\% + 1\% = 10.09\%$$

$$\text{Revised MP} = \frac{10}{10.09\%} = ₹ 99.11$$

- b) Value of bond = $375 \times \text{PVAF}_{(3\%, 4 \text{ periods})} + 10,000 \times \text{PVF}_{(3\%, 4\text{th period})}$
= 10,273.88

- c) (1) Approx method:

$$\begin{aligned} \text{Periodic Coupon} &= 10,000 \times 7.5\% \times 6/12 \\ &= ₹ 375 \end{aligned}$$

$$\begin{aligned} \text{Periodic YTM} &= \frac{\text{Coupon} + \frac{\text{RV} - \text{IP}}{n}}{\frac{\text{RV} + \text{IP}}{2}} \\ &= \frac{375 + \frac{10,000 - 9,000}{4}}{\frac{9,000 + 10,000}{2}} \\ &= 6.58\% \text{ per 6 month.} \\ \text{Annual YTM} &= 6.58\% \times 2 \\ &= 13.16\% \end{aligned}$$

- (2) Precise Method:

The YTM of this Bond using IRR method as follows:

$$₹ 375 \times \text{PVIFA}_{(\text{YTM}\%, 4)} + ₹ 10,000 \times \text{PVIF}_{(\text{YTM}\%, 4)} = ₹ 9,000$$

Calculation of PV of CFs at 6% :

$$\begin{aligned} &= 375 \times \text{PVAF}_{(6\%, 4 \text{ periods})} + 10,000 \times \text{PVF}_{(6\%, 4\text{th period})} \\ &= ₹ 9219.38 \end{aligned}$$

Calculation of PV of CFs at 7%:

$$\begin{aligned} &= 375 \times \text{PVAF}_{(7\%, 4 \text{ periods})} + 10,000 \times \text{PVF}_{(7\%, 4\text{th period})} \\ &= ₹ 8900.13 \end{aligned}$$

Calculating precise yield using interpolation:

6%		₹ 9,219.38
? = x		₹ 9,000
7%		₹ 8,900.13

Calculating x:

$$\frac{x - 6}{7 - 6} = \frac{9,000 - 9219.38}{8900.13 - 9219.38}$$

$$\begin{aligned} x &= 6.69\% \text{ per 6m} \\ \text{Annual YTM} &= 6.69\% \times 2 \\ &= 13.38\% \text{ p.a.} \end{aligned}$$



QUESTION 3:

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% :

$$\begin{aligned} &= 100 \times \text{PVA}_{(11\%, 10 \text{ years})} + 850 \times \text{PVF}_{(11\%, 10 \text{th year})} \\ &= 100 \times 5.890 + 1,000 \times 0.352 \\ &= 941 \end{aligned}$$

Calculation of PV of CFs at 13%:

$$\begin{aligned} &= 100 \times \text{PVA}_{(13\%, 10 \text{ years})} + 850 \times \text{PVF}_{(13\%, 10 \text{th year})} \\ &= 100 \times 5.426 + 1,000 \times 0.295 \\ &= 837.6 \end{aligned}$$

Calculating precise yield using interpolation:

$$\begin{array}{rcl} 11\% & \text{—————} & 941 \\ ? = x & & 850 \\ 13\% & \text{—————} & 837.6 \end{array}$$

Calculating x:

$$\begin{aligned} \frac{x - 11}{13 - 11} &= \frac{850 - 941}{837.6 - 941} \\ x &= 12.76\% \end{aligned}$$

The spread from comparable bond = 12.76% - 11.80% = 0.96%



QUESTION 4:

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 $12 + 2 = 14\%$

$$\begin{aligned}\text{Intrinsic Value} &= 150 \times \text{PVA}_{(14\%, 5 \text{ years})} + 1,000 \times \text{PV}_{(14\%, 5 \text{ years})} \\ &= 514.96 + 519.37 \\ &= 1,034.33\end{aligned}$$

$$\begin{aligned}\text{Current Yield} &= \frac{\text{Coupon}}{\text{CMP}} \\ &= \frac{150}{1,025.86} = 14.62\%\end{aligned}$$

$$\begin{aligned}\text{YTM} &= \frac{150 + \frac{1,000 - 1,025.86}{5}}{\frac{1,000 + 1,025.86}{2}} = \frac{144.828}{1,012.96} \\ &= 14.30\%\end{aligned}$$



QUESTION 5:

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%

- 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:

$$\begin{aligned} \text{IV} &= 90 \times \text{PVF}_{(12\%,1)} + 90 \times \text{PVF}_{(11.62\%,2)} + 90 \times \text{PVF}_{(11.33\%,3)} + 90 \times \text{PVF}_{(11.06\%,4)} + 90 \times \text{PVF}_{(10.80\%,5)} \\ &\quad + 1,000 \times \text{PVF}_{(10.80\%,5)} \\ &= 80.36 + 72.23 + 65.22 + 59.16 + 53.89 + 598.80 \\ &= ₹ 929.67 \end{aligned}$$

$$\begin{aligned} \text{Expected Price} &= \text{Intrinsic Value} \times \text{Beta Value} \\ &= 929.66 \times 1.10 \\ &= ₹ 1,022.63 \end{aligned}$$

- 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 6:

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:

$$\begin{aligned} \text{Periodic YTM} &= \frac{I + \frac{\text{RV} - \text{IP}}{n}}{\frac{\text{RV} + \text{IP}}{2}} \\ &= \frac{50 + \frac{1,000 - 1,000}{32}}{\frac{1,000 + 1,000}{2}} = 5\% \text{ per 6m} \end{aligned}$$

$$\text{Annualized YTM} = 5 \times 2 = 10\% \text{ p.a.}$$

- Value of bond on 30th June 2018 (excluding coupon) $= 50 \times \text{PVAF}_{(6\%, 15 \text{ period})} + 1000 \times \text{PVF}_{(6\%, 15 \text{ period})}$
 $= 50 \times 9.712 + 1000 \times 0.417$

$$\begin{aligned}
 &= 902.6 \\
 \text{Value of bond on 30}^{\text{th}} \text{ June 2018} &= 902.6 + 50 \\
 \text{(including coupon)} &= ₹ 952.6 \\
 \text{Dirty Price of bond on 1}^{\text{st}} \text{ March 2018} &= \frac{952.6}{1 + 0.06 \times \frac{4}{6}} \\
 &= ₹ 915.96 \\
 \text{Coupon Accrued for 2M} &= 1,000 \times 10\% \times \frac{2}{12} \\
 &= ₹ 16.67 \\
 \text{Amount to be paid to complete the transaction is} &= ₹ 915.96. \\
 \text{Amount paid for accrued interest} &= ₹ 16.67 \\
 \text{Amount paid for bond's basic value (clean price)} &= ₹ 899.29
 \end{aligned}$$

**QUESTION 7:**

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 8:**

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

$$\text{Spot Rate}_{(0 \times 1)}: 91,000 = \frac{1,00,000}{(1 + r_1)^1}$$

$$r_1 = 9.89\%$$

$$\text{Forward Rate}_{(1 \times 2)}: 99,000 = \frac{10,500}{(1.0989)} + \frac{1,10,500}{(1.0989)(1 + r_2)}$$

$$r_2 = 12.42\%$$

$$\text{Forward Rate}_{(2 \times 3)}: 99,500 = \frac{11,000}{1.0989} + \frac{11,000}{(1.0989)(1.1242)} + \frac{1,11,000}{(1.0989)(1.1242)(1 + r_3)}$$

$$r_3 = 11.50\%$$

$$\text{Forward Rate}_{(3 \times 4)}: 99,900 = \frac{11,500}{1.0989} + \frac{11,500}{(1.0989)(1.1242)} + \frac{11,500}{(1.0989)(1.1242)(1.1150)}$$

$$+ \frac{1,11,500}{(1.0989)(1.1242)(1.1150)(1 + r_4)}$$

$$r_4 = 12.77\%$$



QUESTION 9:

S 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:

PV of Initial cash OF:

After-tax call premium [30,000 × (1,000 – 1,150) × (1 – 0.40)]	(27,00,000)
Floatation cost of new bonds	(4,25,000)
Post-tax over-lapping interest for 2m @ old coupon rate [3,00,00,000 × 14% × $\frac{2}{12}$ × (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 initial net cash outflow (A)	(31,15,000)

PV of Annual Incremental Cash IF

Annual savings in after-tax coupon $[3,00,00,000 \times (0.14 - 0.12) \times (1 - 0.40)]$	3,60,000
Annual tax savings in after-tax floatation cost New bond $\frac{4,25,000}{25} \times 0.4 = 6,800$ Less: Old Bond $\frac{3,90,000}{30} \times 0.4 = (5200)$ 1600	
Annual tax loss on discount on issue of old bonds $\frac{9,00,000}{30} \times 0.4$	(12,000)
Annual Net Cash IF for next 25 years	3,49,600
× PVAF _(8%, 25 years)	10.675
PV of Annual CF Savings (B)	37,31,980

$$\begin{aligned}
 \text{NPV of Bond refunding} &= (B) - (A) \\
 &= 37,31,980 - 31,15,000 \\
 &= 6,16,980
 \end{aligned}$$

**QUESTION 10:**

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

2. By Intrinsic Value Method.

3. 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

(a) CMP of Bond = 9431.5

(b) Macaulay's duration = $\frac{40103.35}{9431.5} = 4.252$ years

c) Volatility = $\frac{4.252}{1 + 0.10} = 3.865$

(d) 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%

$$\begin{aligned}
 (V_-) &= 850 \times \text{PVAF}_{(8\% 5 \text{ years})} + 10,000 \times \text{PVAF}_{(8\%, 5 \text{th years})} \\
 &= 850 \times 3.993 + 10000 \times 0.681 \\
 &= ₹ 10204.05
 \end{aligned}$$

$$\begin{aligned}
 \text{Convexity} &= \frac{V_+ + V_- - 2V_0}{2V_0 \times (\Delta Y)^2} \\
 &= \frac{8734.25 + 10204.05 - 2 \times 9431.5}{2 \times 9431.5 \times (0.02)^2} \\
 &= 9.980
 \end{aligned}$$

$$\begin{aligned}
 \text{Convexity Adjustment} &= C \times (\Delta Y)^2 \times 100 \\
 &= 9.98 \times (0.02)^2 \times 100 = 0.399\%
 \end{aligned}$$

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

Decrease in YTM = 200 bps i.e., 2%

% Increase in MP = $3.864 \times 2\%$

= 7.73%

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

Bond Value at YTM of 8% = ₹ 10204.05

3. Macaulay's Duration and Convexity Adjustment:

Δ in price = $[-3.864 \times (-0.02) + 9.98 \times (-0.02)^2] \times 100$

= + 8.13%

Expected price = $9,431.5 + 8.13\% = 10,198.28$



QUESTION 11:

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

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.
- 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?
- 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

Year	CFs	PVF @ 9%	DCF (w)	W (%)	years $\times$ w
------	-----	----------	---------	-------	------------------

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)

$$D_L = D_A$$

$$6 = 6.86 \times 0.45 + 5.84 \times X + 4.24 \times (1 - 0.45 - X)$$

$$X = 36.31\% \quad : \text{Weight of Bond B}$$

$$(1 - 0.45 - X) = 18.69\% \quad : \text{Weight of Bond C}$$

(iii)

$$\begin{aligned} \text{Duration} &= 7.15 \times 0.45 + 6.03 \times 0.3631 + 4.27 \times 0.1869 \\ &= 6.21 \text{ years} \end{aligned}$$

∴ Duration of portfolio ≠ duration of scheduled outflow

∴ portfolio is not immunised

- (iv) $6 = 7.15 \times 0.45 + 6.03 \times X + 4.27 \times (1 - 0.45 - X)$
 $X = 24.66\%$: Weight of Bond B
 $0.55 - X = 30.34\%$: Weight of Bond C

**QUESTION 12:**

N 21

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

- 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:

- (i) 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:

$$\begin{aligned}
 PV &= ₹ 15.28 \times PVIFA(10\%, 5) + ₹ 100 \times PVIF(10\%, 5) \\
 &= ₹ 15.28 \times 3.7908 + ₹ 100 \times 0.6209 \\
 &= ₹ 120
 \end{aligned}$$

$$\text{Thus, Break Even price} = \frac{₹ 120}{₹ 20} = 6/- \text{ per share}$$

- (ii) The ideal period in which BIL should convert and dispose of share will be 01.01.23 to 30.06.25 as during this period the market price of share is most likely to exceed its Break-even price.

**QUESTION 13:**

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

$$= \text{Market Price of one Equity Share} \times \text{Conversion Ratio}$$

$$= ₹ 30 \times 25 = ₹ 750$$
- Market Conversion Price

$$= \frac{\text{Market Price of Convertible Debenture}}{\text{Conversion Ratio}}$$

$$= \frac{1000}{25} = ₹ 40$$
- Conversion Premium per share

$$= \text{Market Conversion Price} - \text{Market Price of Equity Share}$$

$$= ₹ 40 - ₹ 30 = ₹ 10$$
- 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

$$= \frac{\text{Premium over straight value (₹)}}{\text{Straight Value of Bond}}$$

$$= \frac{1000 - 800}{800} = 25\%$$

(f) Favorable income differential per share:

$$= \frac{\text{Coupon Interest from Debenture} - \text{Conversion Ratio} \times \text{Dividend Per Share}}{\text{Conversion Ratio}}$$

$$= \frac{90 - 25 \times 1}{25} = ₹ 2.6$$

(g) 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 14:

M 17 | N 09

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

$$= \text{Conversion Ratio} \times \text{Market Price}$$

$$= 2 \times ₹ 42 = ₹ 84$$

(Or ₹ 67,20,000)

(ii) Conversion Premium

$$(\text{₹ } 100 / \text{₹ } 84) - 1 = 19.05\%$$

(Or ₹ 12,80,000 or ₹ 16 per share)

(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	<u>73,60,000</u>
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



QUESTION 15:

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:

$$\begin{aligned} \text{Holding period Yield} &= \frac{\text{FV} - \text{IP}}{\text{IP}} \times 100 \\ &= \frac{1,00,000 - 97,550}{97,550} = 2.512\% \end{aligned}$$

$$\begin{aligned} \text{Effective Annualized} &= (1 + 0.02512)^{12/3} - 1 \\ &= 10.433\% \end{aligned}$$

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

Self-note: While calculating the total cost of fund, brokerage & stamp duty costs are simply annualised.



QUESTION 16:

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:

$$\begin{aligned}
 \text{(a) Discount Yield} &= \frac{\text{FV} - \text{CMP}}{\text{FV}} \times \frac{360}{n} \times 100 \\
 6 &= \frac{100 - \text{CMP}}{100} \times \frac{360}{45} \times 100 \\
 \text{IP} &= 99.25
 \end{aligned}$$

$$\begin{aligned}
 \text{(b) BEY} &= \frac{100 - 99.25}{99.25} \times \frac{365}{45} \times 100 \\
 &= 6.129\% \text{ or } 6.13\%
 \end{aligned}$$

$$\begin{aligned}
 \text{(c) Holding period yield} &= \frac{\text{FV} - \text{IP}}{\text{IP}} \times 100 \\
 &= \frac{100 - 99.25}{99.25} \times 100 = 0.756\% \\
 \text{Effective Annual return} &= [(1 + 0.00756)^{365/45} - 1] \times 100 \\
 &= [1.06299 - 1] \times 100 \\
 &= 6.299\% \text{ or } 6.3\%
 \end{aligned}$$



QUESTION 17:

M 25 | SM

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 18:

J 26 | 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:

- (a) Dirty Price = clean price + Accrued Interest

$$= 99.42 + 100 \times 10\% \times \frac{262}{360}$$

$$= 106.70$$
- (b) Start Proceed
- $$\text{Total Dirty Price of securities} = \frac{8,00,00,000}{100} \times 106.70$$

$$= 8,53,60,000$$

$$\begin{aligned}\text{Amount of loan taken} &= 8,53,60,000 \times 98\% \\ &= 8,36,52,800\end{aligned}$$

(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>

Portfolio Management

**QUESTION 1:**

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)	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:

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	$= 15\% \times 57.14\% + (-2.33\%) \times 42.86\% = 7.57\%$	

Portfolio Management

- 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
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	$1,00,000 \times 220 = 220 \text{ Lakhs}$	$50,000 \times 290 = 145 \text{ Lakhs}$
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

$$\text{Variance } (\sigma^2) = \sum (P \times D_x^2) = ₹ 456.25$$

$$\text{Standard Deviation } (\sigma) \text{ in ₹} = \sqrt{456.25} = ₹ 21.36$$

$$\text{Standard Deviation } (\sigma) \text{ in \%} = \frac{21.36}{220} = 9.71\%$$

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

$$\text{Variance } (\sigma^2) = \sum (P \times D_y^2) = ₹ 196.75$$

$$\text{Standard Deviation } (\sigma) \text{ in ₹} = \sqrt{196.75} = ₹ 14.03$$

$$\text{Standard Deviation } (\sigma) \text{ in \%} = \frac{14.03}{290} = 4.84\%$$



QUESTION 2:

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

Portfolio Management

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 = $13.99 \times 60\% + 16.19 \times 40\% = 14.87\%$

Covariance of A & B = $\frac{-96.37}{6} = -16.06$

Risk of Portfolio = $\sqrt{(32.21 \times 0.6)^2 + (24.43 \times 0.4)^2 + 2 \times 0.6 \times 0.4 \times (-16.06)}$
 $= \sqrt{461.28} = 21.48$

(c)

- (d) On the basis of Return 'B' is preferable and on the basis of Risk 'Portfolio Investment' is preferable over the individual stocks.



QUESTION 3:

M 25

Security	Risk (σ)	Weights
R	20%	0.8
S	50%	0.2

Calculation upto two decimal places.

From the information given above, you are required to calculate Portfolio Standard Deviations, if-

- Securities returns are independent.
- Securities returns are perfectly negatively correlated.
- Securities returns are perfectly positively correlated

Solution:



QUESTION 4:

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?

Solution:

- let the weight of developed stock = W_D

$$E(R_P) = E(R_D) \times W_D + E(R_A) \times W_A$$

$$10.5\% = 10 \times W_D + 15 \times (1 - W_D)$$

$$10.5 = 10 W_D + 15 - 15 W_D$$

$$-4.5 = -5 W_D$$

$0.9 = W_D$: Developed Country

$$0.1 = 1 - W_D \quad : \text{Economy A}$$

$$\begin{aligned} \text{(ii) S.D.} &= \sqrt{(16 \times 0.90)^2 + (30 \times 0.1)^2 + 2 \times 16 \times 0.10 \times 30 \times 0.90 \times 0.30} \\ &= 15.57 \end{aligned}$$

$$(iii) \quad \text{share Ratio} = \frac{R_p - R_f}{\sigma_p}$$

Before inclusion of stock of Economy A = $\frac{10 - 3}{16} = 0.438$

After inclusion of stock of Economy A $= \frac{10.5 - 3}{15.57} = 0.482$

Due to inclusion of stock of economy A, sharpe ratio of funds will increase from 0.438 to 0.482



QUESTION 5:

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	$P \times X$	d_x	$P \times d_x^2$	Y	$P \times Y$	d_y	$P \times d_y^2$	$P \times D_x \times D_y$
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 = $12.55 \times 0.50 + 12.1 \times 0.50 = 12.325\%$

$$\text{Correlation} = \frac{\text{Cov}(x,y)}{\sigma_x \times \sigma_y} = \frac{-144.25}{12.95 \times 11.27} = -0.988$$

$$\text{S.D.P} = \sqrt{(12.95 \times 0.50)^2 + (11.27 \times 0.50)^2 + 2 \times 12.95 \times 0.50 \times 11.27 \times 0.50 \times -0.98} \\ = 1.26$$

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 6:

M 23 | M 09

An investor has two portfolios known to be on minimum variance set for a population of three securities A, B and C having below mentioned weights:

	WA	WB	WC
Portfolio X	0.3	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.

$$\begin{aligned}\text{Amount invested in B} &= 4,000 \times \frac{43.75}{43.75 + 30} = ₹ 2,373 \\ \text{Amount invested in C} &= 4,000 \times \frac{30}{43.75 + 30} = ₹ 1,627\end{aligned}$$

**QUESTION 7:**

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

$$\bar{x} = \frac{39.73}{3} = 13.24 \quad \bar{y} = \frac{62.74}{3} = 20.91$$

$$\begin{aligned} \text{Beta of the share} &= \frac{\sum xy - n \times \bar{x} \times \bar{y}}{\sum x^2 - n \times \bar{x}^2} \\ &= \frac{851.36 - 3 \times 13.24 \times 20.91}{662.36 - 3 \times 13.24^2} = 0.150 \text{ times} \end{aligned}$$

Observation: Based on the beta value of the company and the analysis of returns, it can be concluded that changes in the return on share of Jay kay Ltd. are less affected by changes in market returns.



QUESTION 8:

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?
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 = $1.6 \times 20\% + 1 \times 20\% + -0.3 \times 20\% + 2 \times 20\% + 0.6 \times 20\%$
= 0.980 times
- (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 times
- (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 9:**

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	$\sqrt{1,625} = 40.31$	$\sqrt{2,925} = 54.08$

Portfolio Management

(ii) 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:

Beta of the portfolio (β_p) $= 0.8 \times 0.25 + 1.2 \times 0.40 + 0 \times 0.35$
 $= 0.68$

Systematic variance of PF $= \sigma_m^2 \times \beta_p^2$
 $= (25)^2 \times (0.68)^2$
 $= 289$

Unsystematic Variance of PF $= \sigma_{EA}^2 \times W_A^2 + \sigma_{EB}^2 \times W_B^2 + \sigma_{ERF}^2 \times W_{ERF}^2$
 $= (35)^2 \times (0.25)^2 + (45)^2 \times (0.40)^2 + 0$
 $= 400.56$

Total variance of the PF $= 400.56 + 289$
 $= 689.56$

Total S.D. of the PF $= \sqrt{689.56} = 26.26$



QUESTION 10:

S 25 | SM | RTP

The following details are given for TC and PC Limited stocks and Nifty Index for a period of one year:

	TC Limited	PC Limited	Nifty Index
Average return	0.12	0.18	0.6
Variance of return	5.8	4.8	2.10
Beta	0.8	0.7	
Proportion of allocated fund	50%	50%	
Correlation Co-efficient	0.4814		
Co-efficient of determination	0.2317		

You are required to

- Calculate the systematic and unsystematic risk for the companies'
- Calculate portfolio risk.
- If the of fund allocation is changed to 60:40 for TC Limited and PC Limited respectively, advise whether it is preferable or not.

Calculation up to 3 decimal points.

Solution:

- (i) Calculation of Systematic and Unsystematic Risk:

	TC Ltd.		PC Ltd.	
Systematic Risk ($\beta^2 \sigma_m^2$)	Variance	$= (0.8)^2(2.10)$ $= 1.344$	Variance	$= (0.7)^2(2.10)$ $= 1.029$
	SD	$= \sqrt{1.344}$ $= 1.159\%$	SD	$= \sqrt{1.029}$

			= 1.014%
Unsystematic Variance (Total Risk – Systematic Risk)	Variance = 5.80 – 1.344 = 4.456 SD = $\sqrt{4.456}$ = 2.111%	Variance = 4.80 – 1.029 = 3.771 SD = $\sqrt{3.771}$ = 1.942	

(ii) Portfolio Risk

Self-note: Risk of the portfolio can be calculated using both the models: Markowitz and Sharpe Index. The suggested answer used Markowitz whereas the model more logical use is Sharpe Index. The answer from both will be same and if the final answer is correct, the marks will be allotted for solution done using any of the models.

Alternative 1: Markowitz Model:

$$\begin{aligned}\text{Covariance of TC \& PC as per Sharpe} &= \beta_1 \beta_2 \sigma_m^2 \\ &= 0.8 \times 0.7 \times 2.10 \\ &= 1.176\end{aligned}$$

Accordingly,

$$\begin{aligned}\sigma_p^2 &= (0.50)^2(5.80) + (0.50)^2(4.80) + 2 \times 1.176 \times 0.50 \times 0.50 \\ &= 3.238 \\ \sigma_p &= \sqrt{3.238} \\ &= 1.800\%\end{aligned}$$

Alternative 2: Sharpe Index Model:

$$\begin{aligned}\text{Portfolio Beta} &= 0.8 \times 0.50 + 0.6 \times 0.50 \\ &= 0.750 \text{ times}\end{aligned}$$

$$\begin{aligned}\text{Systematic variance of PF} &= \sigma_m^2 \times \beta_p^2 \\ &= 2.1 \times (0.750)^2 \\ &= 1.181\end{aligned}$$

$$\begin{aligned}\text{Unsystematic Variance of PF} &= \sigma_{EA}^2 \times W_A^2 + \sigma_{EB}^2 \times W_B^2 \\ &= 4.456 \times (0.5)^2 + 3.771 \times (0.5)^2 \\ &= 2.057\end{aligned}$$

$$\begin{aligned}\sigma_p^2 &= 1.181 + 2.057 \\ &= 3.238\end{aligned}$$

$$\begin{aligned}\sigma_p &= \sqrt{3.238} \\ &= 1.800\%\end{aligned}$$

(iii) If Fund allocation is changed to 60% and 40% then Portfolio Risk shall be

$$\begin{aligned}\text{Exiting Return (50:50)} &= 0.50 \times 0.12 + 0.50 \times 0.18 = 0.06 + 0.09 \\ &= 15\%\end{aligned}$$

$$\text{Existing Risk (50:50)} = 1.800\%$$

$$\begin{aligned}\text{Revised Return (60:40)} &= 0.60 \times 0.12 + 0.40 \times 0.18 \\ &= 14.40\%\end{aligned}$$

$$\text{Revised Risk (60:40)} = \sqrt{(5.80) \times (0.60)^2 + (4.80) \times (0.40)^2 + 2 \times 1.176 \times 0.60 \times 0.40}$$

$$= 3.421$$

$$\begin{aligned}\sigma_P &= \sqrt{3.421} \\ &= 1.85\end{aligned}$$

Advice: It is not advisable to change the allocated fund ratio as return is decreased from 15% to 14.40% and portfolio risk is increased from 1.80% to 1.85%.



QUESTION 11:

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?
- 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:

$$\begin{aligned}\text{(i)} \quad \beta_s &= r_{(s,m)} \times \frac{\sigma_s}{\sigma_m} \\ \beta_A &= 0.60 \times \frac{0.20}{0.15} = 0.8 \\ \beta_B &= 0.95 \times \frac{0.18}{0.15} = 1.14 \\ \beta_C &= 0.75 \times \frac{0.12}{0.15} = 0.6\end{aligned}$$

$$\begin{aligned}\text{(ii)} \quad r_{(A,B)} &= r_{(A,m)} \times r_{(B,m)} \\ r_{(A,B)} &= \frac{\text{Cov}_{(A,B)}}{\sigma_A \times \sigma_B}\end{aligned}$$

$$\text{Hence, } r_{(A,m)} \times r_{(B,m)} = \frac{\text{Cov}_{(A,B)}}{\sigma_A \times \sigma_B}$$

$$\begin{aligned}\text{For Cov}_{(A,B)}: \quad 0.60 \times 0.95 &= \frac{\text{Cov}_{(A,B)}}{20 \times 18} \\ \text{Cov}_{AB} &= 205.2\end{aligned}$$

$$\begin{aligned}\text{For Cov}_{(B,C)}: \quad 0.95 \times 0.75 &= \frac{\text{Cov}_{(B,C)}}{18 \times 12} \\ \text{Cov}_{BC} &= 153.9\end{aligned}$$

$$\text{For Cov}_{(A,C)}: 0.60 \times 0.75 = \frac{\text{Cov}_{(A,C)}}{20 \times 12}$$

$$\text{Cov}_{BC} = 108$$

(iii) Risk of the portfolio:

$$\begin{aligned} \text{Variance} &= (\sigma_A W_A)^2 + (\sigma_B W_B)^2 + (\sigma_C W_C)^2 + 2 \times W_A \times W_B \times \text{Cov}_{AB} \\ &\quad + 2 \times W_B \times W_C \times \text{Cov}_{BC} + 2 \times W_C \times W_A \times \text{Cov}_{CA} \\ &= (20 \times (1/3))^2 + (18 \times (1/3))^2 + (12 \times (1/3))^2 \\ &\quad + 2 \times (1/3) \times (1/3) \times 205.2 \\ &\quad + 2 \times (1/3) \times (1/3) \times 153.9 \\ &\quad + 2 \times (1/3) \times (1/3) \times 108 \\ &= 200.24 \end{aligned}$$

$$\text{S.D.} = \sqrt{200.24} = 14.15$$

$$(iv) \quad \text{Beta of the portfolio} = \frac{0.80 + 1.14 + 0.6}{3} = 0.847$$

$$(v) \quad \text{Total Variance} = 200.24$$

$$\begin{aligned} \text{Systematic Variance} &= \beta_p^2 \times \sigma_m^2 \\ &= (0.847)^2 \times (15)^2 \\ &= 161.42 \end{aligned}$$

$$\text{Systematic S.D.} = \sqrt{161.42} = 12.705$$

$$\begin{aligned} \text{Unsystematic Variance} &= \text{Total Variance} - \text{System Variance} \\ &= 200.24 - 161.42 \\ &= 38.82 \end{aligned}$$

$$\text{Unsystematic S.D.} = 6.23$$



QUESTION 12:

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

Portfolio Management

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 =

$$R_A = \alpha + \beta_A \times R_m$$

$$\bar{Y} = \alpha + \beta_A \times \bar{X}$$

$$15 = 0.506 \times 12 + \alpha$$

$$8.928 = \alpha$$

$$\text{Equation of Characteristics Line for Security X: } R_A = 0.506 \times R_m + 8.928$$



QUESTION 13:

M 25 | 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 × X	D _x	P × d _x ²	Security A (y)	P × Y	D _y	Pd × 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

$$\begin{aligned}\text{Beta} &= \frac{\text{Cov}(x,y)}{\text{Var}(x)} \\ &= \frac{106.2}{78.96} = 1.345\end{aligned}$$

$$\begin{aligned}R_j \text{ on stock A} &= R_f + \beta(R_m - R_f) \\ &= 11 + 1.345 \times (10.2 - 11) \\ &= 9.924\%\end{aligned}$$

Calculating Required rate of return as per CAPM for Security B

Economic Scenario	Prob	M(x)	B(y)	P _y y	dg	Pdx dy
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

$$\begin{aligned}\text{Beta} &= \frac{\text{Cov}(x,y)}{\text{Var}(x)} \\ &= \frac{106.68}{78.96} = 1.351\end{aligned}$$

$$\begin{aligned}R_j \text{ on stock B} &= 11 + 1.351 \times (10.2 - 11) \\ &= 9.92\%\end{aligned}$$

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 14:

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)]
$IV = \frac{D_1}{K_e - g}$	$\frac{3 \times (1.09)}{0.185 - 0.09} = 34.42$	$\frac{2.5 \times (1.07)}{0.156 - 0.07} = 31.10$
Advice:	Since MPS (₹ 40) > IV (₹ 34.42) ∴ company should sell since overvalued	Since MPS (₹ 40) > IV (₹ 31.10) ∴ company should sell since overvalued



QUESTION 15:

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?
- 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 16:**

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%.
- The Security Market Line (SML), if the risk free rate is 7.5% and market return is equally likely to be 7% or 25%.
- 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)

$$\begin{aligned}
 4 &= 7\beta_A + \alpha \\
 40 &= 25\beta_A + \alpha \\
 \hline
 -36 &= -18\beta_A \\
 \beta_A &= 2 \text{ Times}
 \end{aligned}$$

For Defensive Stock:

$$\begin{aligned}
 E(R_D) &= \beta_D \times R_m + \alpha \\
 9\% &= 7 \times \beta_D + \alpha \\
 18\% &= 25 \times \beta_D + \alpha \\
 \hline
 -9 &= -18\beta_D \\
 0.5 &= \beta_D
 \end{aligned}$$

(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

Defensive

$$4 = 7\beta_A + \alpha$$

$$9 = 7\beta_A + \alpha$$

$$4 = 7 \times 2 + \alpha$$

$$9 = 7 \times 0.50 + \alpha$$

$$\alpha = -10$$

$$\alpha = 5.5$$



QUESTION 17:

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:

- (i) 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

$$R_m = \frac{D_1 + P_1 - P_0}{P_0} \times 100$$

$$= \frac{11,600 + 1,46,000 - 1,36,000}{1,36,000} \times 100 = 15.88\%$$

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 $\beta_p = \frac{0.9 + 0.8 + 0.6 + 0.4}{4} = 0.675$

$$\text{Average } R_p = 12 + 0.675 (15.88 - 12)$$

$$= 14.62\%$$



QUESTION 18:

J 26 | M 15 | SM

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:

Portfolio Management

Alternative Answer 1:

(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%

Alternative Answer 2 (SM M 26):

i) Calculating weighted average β_P :

Particulars of Securities (1)	Cost ₹ (2)	Market price ₹ (3)	Dividend ₹ (4)	Capital Gain ₹ (5)	Beta (6)	(3) x (6)
Gold Ltd.	10,000	9,800	1,725	-200	0.6	5,880
Silver Ltd.	15,000	16,200	1,000	1,200	0.8	12,960
Bronz Ltd.	14,000	20,000	700	6,000	0.6	12,000
GOI Bonds	36,000	34,500	3,600	-1,500	0.01	345
Total	75,000	80,500	7,025	5,500		31,185

$$\beta \text{ of the Portfolio} = \frac{31,185}{80,500} = 0.387$$

Using GOI Bond we can compute Risk Free Rate of Return as follows:

$$R_f = \frac{(34,500 - 36,000) + 3,600}{36,000} = 0.0583 \text{ i.e. } 5.83\%$$

Now we can calculate Market Return (R_m) using average return of the portfolio as follows:

$$R_p = R_f + \beta(R_m - R_f)$$

$$15.7\% = 5.83\% + 0.387(R_m - 5.83\%)$$

$$R_m = 31.33\%$$

ii) Expected rate of return in each security using CAPM:

	$R_f + \beta(R_m - R_f)$
Gold Ltd	$5.83 + 0.60(31.33 - 5.83) = 21.13\%$
Silver Ltd	$5.83 + 0.80(31.33 - 5.83) = 26.23$
Bronze	$5.83 + 0.60(31.33 - 5.83) = 21.13$
GOI	$5.83 + 0.01(31.33 - 5.83) = 6.09\%$



QUESTION 19:

MTP M 24

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

Portfolio Management

- 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

$$= 0.6 \times 19,600/1,53,980 + 0.8 \times 30,400/1,53,980 + 0.60 \times 32,000/1,53,980 + 0.01 \times 71,980/1,53,980 = 0.364$$

$$\text{Average Return on Portfolio} = (8,910 + 3,980) / 1,50,000 \times 100\% = 8.593\%$$

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 20:

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:

- (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:

Sec A: $15 = 10 + 0.80 \times FRP_1 + 0.60 \times FRP_2$

Multiplying the above equation with 2:

Sec A: $30 = 20 + 1.60 \times FRP_1 + 1.20 \times FRP_2$ ----- (i)

Sec B: $20 = 10 + 1.50 \times FRP_1 + 1.20 \times FRP_2$ ----- (ii)

$$\begin{array}{r} \text{---} \quad \text{---} \quad \text{---} \\ 10 = 10 + 0.1 FRP_1 + 0 \\ FRP_1 = 0\% \\ FRP_2 = 8.33\% \end{array}$$



QUESTION 21:

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.

You are required to calculate

- Variance of the Funds
- Coefficient of Determination of the Funds

Solution:

	Growth	Balanced	Regular
a) Sharpe Ratio $= \frac{E(r) - R_f}{\sigma_p}$	$-0.15 = \frac{7.5 - 9}{\sigma_G}$ $\sigma_G = 10\%$ $\sigma_G^2 = 100\%$	$-0.36 = \frac{6.3 - 9}{\sigma_B}$ $\sigma_B = 7.5\%$ $\sigma_B^2 = 56.25\%$	$-0.48 = \frac{5.4 - 9}{\sigma_R}$ $\sigma_R = 7.5\%$ $\sigma_R^2 = 56.25\%$

Portfolio Management

b) Treynor ratio $= \frac{E(R) - R_f}{\beta_p}$	$-2 = \frac{7.5 - 9}{\beta_G}$ $\beta_G = 0.75 \text{ times}$	$-3 = \frac{7.5 - 9}{\beta_B}$ $\beta_B = 0.9 \text{ times}$	$-4.8 = \frac{7.5 - 9}{\beta_R}$ $\beta_R = 0.75 \text{ times}$
$\beta_s = r_{(s,m)} \times \frac{\sigma_s}{\sigma_m}$	$0.75 = r_{G,m} \times \frac{10}{7.1}$ $r_{G,m} = 0.5325$	$0.9 = r_{B,m} \times \frac{7.5}{7.1}$ $r_{B,m} = 0.852$	$0.75 = r_{R,m} \times \frac{7.5}{7.1}$ $r_{R,m} = 0.710$
Coefficient of determination	$r_{G,m}^2 = 0.2836$	$r_{B,m}^2 = 0.7259$	$r_{R,m}^2 = 0.504$



QUESTION 61:

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

Solution:

Working Notes:

	Smart	Growth
a. Jenson 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]	$R_f = 8.5 - 7.14 \times \beta_S$	$R_f = 9.1 - 7.75 \times \beta_G$
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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: This question has two points of learning:

1. 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).
2. Treynor's Ratio should also be converted from decimals to percentage, because the returns used in Treynor's formula are in percentage.



QUESTION 62:

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:

- a. variance of return from MFX, MFY and market return,
- b. portfolio return, beta, portfolio variance and portfolio standard deviation,
- c. expected return, systematic risk and unsystematic risk; and
- d. Sharpe ratio, Treynor ratio and Alpha of MFX, MFY and Portfolio Mix

Solution:

(i) Variance of Return

$$MF_x = 4.80$$

Portfolio Management

$$MF_y = 4.25$$

$$MIX = 3.10$$

(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

$$MF_x = \sqrt{3.663} = 1.914$$

$$MF_y = \sqrt{2.529} = 1.590$$

$$\text{PF MIX} = \sqrt{3.181} = 1.784$$

Systematic Risk

Unsystematic Variance = Total – Systematic Variance

$$MF_x = 4.8 - 3.663 = 1.137$$

$$MF_y = 4.25 - 2.529 = 1.722$$

$$\text{PF MIX} = 4.472 - 3.181 = 1.291$$

Unsystematic Standard deviation

$$MF_x = \sqrt{1.137} = 1.066$$

$$MF_y = \sqrt{1.721} = 1.312$$

$$\text{PF MIX} = \sqrt{1.291} = 1.136$$

(iv) Sharpe Ratio = $\frac{E(r) - R_f}{\sigma_p}$

$$MF_X = 15 - 10 / 2.19 = 2.281$$

$$MF_Y = 14 - 10 / 2.0616 = 1.940$$

$$PF \text{ MIX} = 14.6 - 10 / 2.115 = 2.175$$

Treynor Ratio = $\frac{E(r) - R_f}{\beta}$

$$MF_X = \frac{15 - 10}{1.087} = 4.60$$

$$MF_Y = \frac{14 - 10}{0.9032} = 4.43$$

$$PF \text{ MIX} = \frac{14.6 - 10}{1.013} = 4.54$$

Jenson Alpha = $E(R) - R(j)$

$$MF_X = 15 - 12.17 = 2.83\%$$

$$MF_Y = 14 - 11.81 = 2.19\%$$

$$PF \text{ MIX} = 14.6 - 12.03 = 2.57\%$$

**QUESTION 63:**

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
- 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:

- 10 days later-being the 1st day of rebalancing if NIFTY falls to 5122.96.
- 10 days further from the above date if the NIFTY touches 5539.04.

Solution:

Self-note: Below question has 2 ambiguities:

1. Floor value for CPPI plan is not specifically given.
2. Equity vs Bond investment for Buy & Hold Plan is not specified.

Portfolio Management

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.

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:

$$\text{Equity} = 1,80,000 \times \frac{5539.04}{5326} = 1,87,200$$

$$\text{Value of debt} = 1,20,000$$

$$\text{Total Value of portfolio} = 3,07,200$$

Ideal values as per policy

$$\text{Equity} = 3,07,200 \times 60\% = 1,84,320$$

$$\text{Debt} = 3,02,400 - 1,84,320 = 1,22,880$$

Indira should sell the equity of Rs. 2,880 and invest the amount in bonds.



QUESTION 64:

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:

- Equity Beta (β_E),
- 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.
- Whether the new Equity Beta (β_E) justifies increase in its value on account of leverage?

Solution:

- Equity Beta

$$\begin{aligned}\beta_A &= \text{Weighted Average Beta of Division} \\ &= 1.20 \times 0.26 + 1.45 \times 0.74 = 1.385\end{aligned}$$

$$\beta_F = \beta_e \times \frac{E}{E+D} + \beta_d \times \frac{D}{E+D}$$

$$1.385 = \beta_e \times \frac{410}{580} + 0.24 \times \frac{170}{580}$$

$$1.385 = 0.7069 \beta_e + 0.0703$$

$$\beta_e = 1.86$$

- 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:

$$B_f = \beta_e \times \frac{200}{580} + 0.35 \times \frac{170}{580} + 0.40 \times \frac{210}{580}$$

$$1.385 = 0.3448 \beta_e + 0.1026 + 0.1448$$

$$\beta_e = 3.3 \text{ times}$$

- (iii) With the increase of leverage the equity Beta increases from 1.86 to 3.3 as financial risk faced by ESHF increase

Mutual Funds



QUESTION 1:

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	0.80
Amount payable on shares	8.32
Expenditure accrued	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

The listed shares were purchased when index was 7100

and the Present index is 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 2:

J 26 | N 18 | M 13 | RTP

Stork Capital, a SEBI Registered Mutual Fund, launched its first New Offer (NFO) on June 1, 2024, with a face value of ₹ 10 per unit. The fund received subscriptions for 180 lakh units.

An underwriting agreement was in place with Griffin Securities Ltd., which agreed to underwrite the entire issue of 200 lakh units for a commission of 2.0%.

The fund's financial activities are summarized below:

- Initial investments in various capital market instruments amounted to ₹ 1,780 lakhs.
- Marketing expenses for the NFO were ₹ 25 lakhs.
- During the financial year ended March 31, 2025, the fund sold securities with a cost of ₹ 250 lakhs for ₹ 280 lakhs.
- The fund subsequently purchased new securities for ₹ 265 lakhs.
- Management expenses are regulated by SEBI and cannot exceed 0.50% of the average funds invested during the year. The actual management expenses incurred were ₹ 5.50 lakhs, of which ₹ 50,000 was outstanding at year-end.
- Dividends earned on investments amounted to ₹ 5.0 lakhs, of which ₹ 40,000 was yet to be collected.
- The fund's policy is to distribute 80% of all realized earnings (capital gains and dividends).
- The market value of the investment portfolio as of March 31, 2025, was ₹ 2,150.50 lakhs.

Required: Determine the closing per unit Net Asset Value (NAV) of the fund as on March 31, 2025. Show all necessary workings.

Note: Round off all calculations to two decimal places.

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 3:

S 25 | 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

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.

- 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:

- 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:

$$= \frac{\text{Net Assets}}{\text{Number of units}}$$

$$= \frac{1,32,20,000 - 5,00,000}{10,00,000} = 12.72$$

- (c) Annualized Return = $\frac{\text{NAV}_1 - \text{NAV}_0 + D + CG}{\text{NAV}_0}$

$$= \frac{13.22 - 10}{10} = 32.2\%$$

Or $= \frac{(12.72 - 10) + 0.5}{10} = 32.2\%$



QUESTION 4:

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	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):

$$\begin{aligned} \text{MF A:} \quad 0.09733 &= \left[\left(\frac{10.5 - 10}{10} \right) + 0.03 \right] \times \frac{365}{n} \\ n &= 300 \text{ days} \end{aligned}$$

$$\begin{aligned} \text{MF B:} \quad -0.11185 &= \left[\left(\frac{22.8 - 25}{25} \right) + 0.05 \right] \times \frac{365}{n} \\ n &= 124 \text{ days} \end{aligned}$$

$$\begin{aligned} \text{MF C:} \quad 0.15 &= \left[\left(\frac{20.8 - 20}{20} \right) + 0.04 \right] \times \frac{365}{n} \\ n &= 195 \text{ days} \end{aligned}$$

Self-note: Note that given dividend yield has been assumed as periodic dividend yield.

- 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

$$\begin{aligned} \text{Total Yield (\%)} &= \frac{\text{Total Yield (₹)}}{\text{Total Investment}} \\ &= \frac{29,000}{11,00,000} \times 100 = 2.64\% \end{aligned}$$

f) If past 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 5:**

S 25 | 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 = $\frac{0.90 + 0.75 + 9.10 - 8.50}{8.50} = 26.47\%$

- (ii) If all dividends and capital gain are reinvested into additional units at ₹ 8.75 per unit the position would be.

$$\text{Total amount of dividend} = (0.90 + 0.75) \times 200 = ₹ 330$$

$$\text{Additional units reinvested} = \frac{₹ 330}{8.75} = 37.71 \text{ Units}$$

$$\text{Closing number of units} = 200 + 37.71 = 237.71$$

$$\begin{aligned} \text{Return} &= \frac{(\text{NAV}_1 \times n_1) - (\text{NAV}_0 \times n_0)}{(\text{NAV}_0 \times n_0)} \\ &= \frac{237.71 \times 9.10 - 200 \times 8.50}{200 \times 8.50} \\ &= 27.24\% \end{aligned}$$

(ii) Second option is preferable as the return is higher in this case



QUESTION 6:

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. Ambiguity is that Dividend plan is assumed as dividend reinvestment plan.

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 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 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

$$\text{Annual Return} = \frac{(\text{NAV}_1 \times n_1) - (\text{NAV}_0 \times n_0)}{(\text{NAV}_0 \times n_0)} \times 100 \times \frac{12}{60}$$

$$6.4 = \frac{44 \times 1.5x - 10,00,000}{10,00,000} \times 100 \times \frac{12}{60}$$

$$X = 20,000$$

$$\text{Issue Price} = \frac{10,00,000}{20,000} = 50$$



QUESTION 7:

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

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: Though, the question did not specifically mention it, but this is a reinvestment plan since number of units have changed from 5,000 to 6271.98 units.

Method 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

$$6,271.98 = 5,277.78 + \frac{13722.23}{\text{NAV}_2}$$

$$\text{NAV}_2 = 13.80$$

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:

$$6271.98 = \frac{5277.78 \times (2 + 0.6)}{X} + 5277.78$$

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 8:

S 25 | M 21 | N 18

In 2024, Mr. Raj, an investor made a lump sum investment in an equity mutual fund that had an entry load of ₹ 0.05 per unit. By the end of the year, the NAV appreciated by 13.60%. Additionally, the fund declared a total capital gain and dividend of 5.00 per unit, which were reinvested at a year-end NAV of ₹ 25. As a result, the investor held 15,000 units at year-end.

The fund also charges an exit load of 1% if redeemed within 1 year. The investor is in the 20% tax bracket. Inflation rate during the year is 4.50%.

You are required to:

1. Calculate the number of units purchased by Mr. Raj at the beginning of the investment.
2. Calculate the NAV per unit and the total investment amount made by Mr. Raj at the beginning of the year.
3. Appraise the return percentage and the real return percentage, if Mr. Raj decided to exit the investment at the end of the year.

Calculation up to 2 decimal points.

Solution:

- (i) Let X be the number of units purchased at the beginning of the year, then

$$X + \frac{5.00 X}{25} = 15,000$$

$$X = 12,500 \text{ units}$$

Thus, 12,500 units was purchased by Mr. Raj at the beginning of investment.

- (ii) Let NAV per unit in the beginning of the year is N then

$$N \times 1.1360 = 25,$$

$$N = ₹ 22.01$$

Thus, NAV per unit at the beginning of the year is ₹ 22.01 and total investment made by Mr. Raj is:

$$= (22.01 + 0.05) \times 12,500$$

$$= ₹ 2,75,750$$

(iii) If Mr. Raj decided to exit then Return and Real Return in percentage terms shall be computed as follows:

NAV at the end	₹ 25
No. of Units	15000
Amount Redeemable	₹ 3,75,000
Less: Exit Load	₹ 3,750
Amount Received on Redemption of Units	₹ 3,71,250
Total Amount Realized	₹ 3,71,250
Less: Initial Investment	₹ 2,75,750
Return	₹ 95,500
Less: Tax @ 20%	₹ 19,100
Net Return	₹ 76,400
Return in Percentage Terms (₹ 76,400/ ₹ 2,75,750)	27.71%
Real Return in Percentage Terms (27.71%/1.045)	26.52%
Or Real Return $\frac{1+0.2771}{1+0.045} - 1 =$	22.21%



QUESTION 9:

M 25 | N 20 | N 15 | 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:

	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

+	Dividend Equal ⁿ recd on Issue	0.459	←	6	←	0.0765
	Income till April end	23.409		306		0.0765
+	Income of May	34.425	→	306	→	0.1125
		57.834		306		0.189
-	Dividend Equal ⁿ paid on Redempt ⁿ	(0.567)	←	(3)	←	0.189
	Income till May end	57.267		303		0.189
+	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

Derivatives & Interest Rate Risk Management

**QUESTION 1:**

RTP N 20

Mr. SG sold five 4-Month Nifty Futures on 1st February 2020 for ₹ 9,00,000. At the time of losing 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:

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

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

$$= ₹ 180000$$

- b. Calculation of Nifty Index Spot Price:

$$\begin{aligned} \text{FP} &= \text{SP} \times [1 + (r - y) \times n] \times 75 \\ 1,80,000 &= \text{SP} \times [1 + (0.09 - 0.06) \times 4/12] \times 75 \\ 2,376.24 &= \text{SP} \end{aligned}$$

- c. Maximum contango/Backwardation

$$\begin{aligned} \text{spot} &= 2376.24 \\ \text{future} &= 2400 \text{ (180000/75)} \\ S \text{ (2376.24)} &< F \text{ (2400)} \\ \therefore \text{market is in contango} \\ \text{Max. contango} &= \text{Basis} \\ &= S - F \\ &= 2376.24 - 2400 = - 23.76 \end{aligned}$$

- 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

**QUESTION 2:**

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.

- 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.

Solution:

i) $FP = S_0 \times [1 + (r - y) \times n]$

$$= 119500 \times [1 + (0.095 - 0.03) \times 91/365]$$

$$= 1,21,436.55$$

$$\text{Since AFP (₹ } 1225 \times 100) > \text{FFP (₹ } 121437)$$

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	- 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 3:

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 4:

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:

1. Interpret the position of trader in the cash market.
2. How to mitigate the risk of fall in price.
3. How to use the futures market.
4. 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:
 - a. ₹ 72/Kg
 - b. ₹ 67/Kg

Solution:

- (a) Rice trader is having long position in cash market
- (b) The risk of fall in price can be mitigated by hedging this position by taking a position in derivatives market.
- (c) 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

(d) 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 5:

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) Current portfolio Beta = $\frac{\beta_x \times MV_x + \beta_y \times MV_y}{\text{Total Value of Portfolio}}$

$$= \frac{85 \text{ lakhs} \times 1.6 + 15 \times 0}{100}$$

$$= 1.36 \text{ times}$$

- (ii) 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)

= - 2% i.e., market fell by 2%

Value of Nifty Futures after 3 months

= 100 - 2% = 98

Loss on long nifty futures

= 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.



QUESTION 6:

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:

- To hedge his market exposure Mr. P should take short position in the Nifty Futures.

$$\begin{aligned} \text{No. of Contract of Nifty Future} &= V_p \times \frac{\beta_T - \beta_P}{F \times M} \\ &= 700 \times 1000 \times \frac{(0 - 1.25)}{17500 \times 50} \\ &= 1 \text{ contract short} \end{aligned}$$

- Profit or loss of Mr. P during the expiry of September 2021 Futures:

- 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

- 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 7:

S 25 | 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

$$\text{Beta of the portfolio} = \frac{1.5 \times 2,20,000 + 2 \times (-2,00,000)}{2,20,000 - 2,00,000} = -3.5$$

$$\text{No. of contracts to hedge:} = V_p \times \frac{\beta_T - \beta_p}{F \times M} = \frac{20,000 \times [0 - (-3.5)]}{1,000} = +70 = 70 \text{ contracts long}$$

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 8:

M21 | N 20 | N 07 | RTP

BSE	5000
Value of portfolio	₹10,10,000
Risk free interest rate	9% p.a.
Dividend yield on Index	6% p.a.
Beta of portfolio	1.5

We assume that a future contract on the BSE index with four months maturity is used to hedge the value of portfolio over next three months. One future contract is for delivery of 50 times the index.

Based on the above information calculate:

- Price of future contract.
- The gain on short futures position if index turns out to be 4,500 in three months.

Solution:

$$\begin{aligned}
 \text{(i) Price of Index future} &= S_0 \times [1 + (r - y) \times n] \\
 &= 5,000 \times \left[1 + (0.09 - 0.06) \frac{4}{12} \right] \\
 &= 5,050
 \end{aligned}$$

$$\text{Price of future contract} = 5050 \times 50 \text{ multiplier} = 2,52,500$$

$$\begin{aligned}
 \text{(ii) No. of contracts to short} &= V_p \times \frac{\beta_T - \beta_p}{F \times M} \\
 &= 10,10,000 \times \frac{0 - 1.50}{5050 \times 50} \\
 &= -6 \text{ i.e., 6 contracts short}
 \end{aligned}$$

$$\text{Price of index futures of the end of 3m} = 4500 \times [1 + (0.09 - 0.06) \times \frac{1}{12}] = 4511.25$$

$$\begin{aligned}
 \text{Gain on short futures position} &= 6 \text{ contract} \times 50 \text{ times} \times (5050 - 4511.25) \\
 &= ₹ 1,61,625
 \end{aligned}$$



QUESTION 9:

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:

- 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

- Since the Beta of existing portfolio is 1.40, the systematic risk of the current portfolio is 1.40.

- 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 = $20000 \text{ lakhs} \times 32.14\% = ₹6,428 \text{ lakh}$ and Risk Free securities to be acquired for the same amount.

- 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		

- Number of Nifty Contract to be sold:
$$= V_p \times \frac{\beta_T - \beta_p}{F \times M}$$
$$= \frac{20,000 \text{ lakh} \times (0.95 - 1.40)}{8,250 \times 210}$$
$$= - 519 \text{ contracts}$$

- (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 10:

N 24 | M 13 | RTP

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:

- (a) 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

- (b) Theoretical value of Nifty futures for February 2013

$$\begin{aligned}
 FP &= S_0 \times e^{rt} \\
 &= 5900 \times e^{0.105 \times 58/365} \\
 &= 5900 \times e^{0.01668} \\
 &= 5900 \times 1.01682 \\
 &= 5999.24
 \end{aligned}$$

Self-note: Ambiguity is while calculating the time period till expiry (t) of futures contract, 1st of Jan is not included.

- (c) Number of contracts to sell for full hedge:

$$\begin{aligned}
 \text{No. of contracts:} &= V_p \times \frac{\beta_T - \beta_p}{F \times M} \\
 &= 18,854,860 \times \frac{0 - 0.849}{5999.24 \times 200} \\
 &= -13.34 \text{ contracts} \\
 &\sim 13 \text{ contracts short}
 \end{aligned}$$

- (d) Number of contracts if portfolio beta is to be reduced to 0.6

$$\begin{aligned}
 &= 18,854,860 \times \frac{0.60 - 0.849}{5999.12 \times 200} \\
 &= 3.91 \text{ contracts} \\
 &\sim 4 \text{ contracts short}
 \end{aligned}$$

- (e) Revised Portfolio Beta if 4 Future contracts are sold to investor (i.e., long position by investor):

$$\begin{aligned}
 \text{No. of contracts:} &= V_p \times \frac{\beta_T - \beta_p}{F \times M} \\
 4 &= 18,854,860 \times \frac{\beta_T - 0.849}{5999.24 \times 200} \\
 \beta_p &= 1.104 \text{ times}
 \end{aligned}$$



QUESTION 11:

M 25 | 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

You are required to calculate:

4. 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
5. Net profit/loss on each of the contracts

Solution:

1. 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:

$$\begin{aligned}\text{On long Position} &= (9,140 - 9,170) \times 50 \\ &= 1,500 \text{ Loss} \\ \text{On Short Position} &= (9,170 - 9,140) \times 50 \\ &= 1,500 \text{ Profit}\end{aligned}$$

J 26 | S 25 | N 20 | M 19 | N 11 | N 09 | N 08 | RTP

Transactions executed:

- Additional Information:**

- Required:

- ### Solution:

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**QUESTION 13:**

J 26

A speculator purchases BFL Ltd. May Futures (lot of 125 shares) at 7750 and chooses to Write BFL 7790 May call option with a premium of ₹ 30 (lot of 125 shares). As on May 18, spot prices rise and so the futures price and call premium. Futures price rise to 7780. Call premium also rises to ₹ 36. Brokerage for the transaction is 0.02% for the transaction value of futures and strike price net of call premium for options.

You are required to calculate:

- Profit / Loss on Futures net of transaction costs.
- Profit / Loss on options net of transaction costs.
- Overall profit from both the positions net of costs.
- Total Brokerage cost.

Solution:**QUESTION 14:**

M 22 | N 18 | N 12 | N 10

Derivatives & Interest Rate Risk Management

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.
- 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

- 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 $150 - 150 = 0$

- 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

- To get the value of option as 14 on maturity, the share price should be: $150 + 14 = 164$

Self-note: This question doesn't belong to any concept of OutNotes. It is a simple question based on the concepts of probability and valuation.



QUESTION 15:

N 23 | M 11 | RTP

The following information is available pertaining to shares of Omni Limited:

Current Market Price	₹ 420
Strike Price	₹ 450
Maximum Price in 3m time	₹ 525
Minimum Price in in 3m time	₹ 378
Continuously Compounded Rate of Return (p.a.) (%)	8%
e^{rt}	1.0202

- Calculate the 3 months call option by using Binomial Method and Risk Neutral Method. Are the calculated values under both the models are same?
- What will be the value as per binomial model if given option is a put option?
- State also clearly the basis of Valuation of options under these models.

Solution:

- 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 = 450	$S_d = 378$	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	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 $R = e^{rt} = e^{0.08 \times 3/12} = e^{0.02} = 1.0202$

$$420 = \frac{p \times 525 + (1 - p) \times 378}{1.0202}$$

$$P = 34.34\%$$

$$1 - P = 1 - 34.34\% = 65.66\%$$

$$V_c = \frac{75 \times 0.3434 + 0 \times 0.6566}{1.0202} = ₹ 25.25$$

$$\text{Value of call option (X)} = ₹ 25.24$$

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:

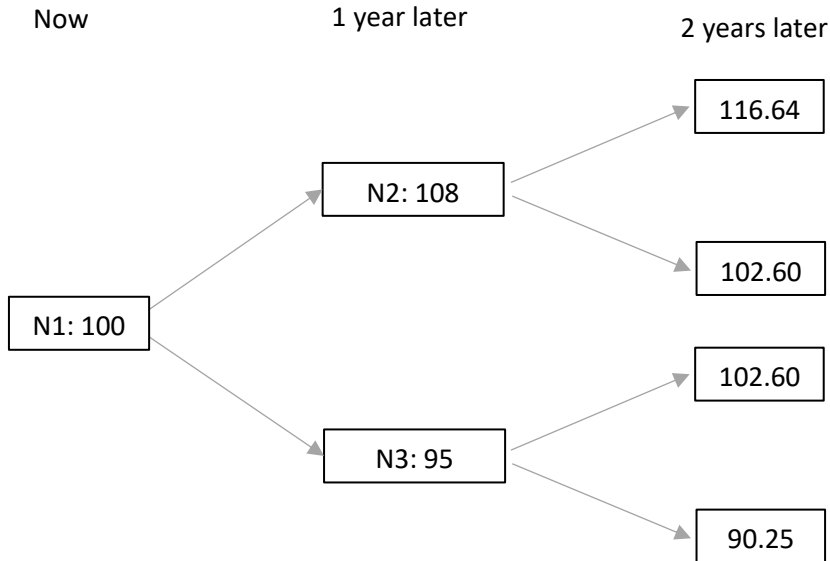
- 1) Binomial model uses an approach called "Risk less Hedge Approach" to find the price of the option, by creating a portfolio which will have same value at expiration irrespective of any price. Hedge means to create an equal and opposite position for protecting the value of portfolio.
- 2) In Risk 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 16:

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 :

$$\begin{aligned}
 R &= e^{rt} \\
 &= e^{0.05 \times 12/12} = e^{0.05} = 1.05127 \\
 u &= \frac{108}{100} = 1.08 \\
 d &= \frac{95}{100} = 0.95
 \end{aligned}$$

$$p = \frac{R-d}{U-d} = \frac{1.05127 - 0.95}{1.08 - 0.95}$$

$$= \frac{0.10127}{0.13} = 0.7790$$

$$1 - P = 0.2210$$

Expected Pay offs: = Max [Intrinsic Value, Discounted Value]

$$\text{At } N_2 = \text{Max} \left[(108 - 98), \left(\frac{18.64 \times 0.7790 + 4.60 \times 0.2210}{1.05127} \right) \right] = 14.78$$

$$\text{At } N_3 = \text{Max} \left[(0), \left(\frac{4.60 \times 0.7790 + 0 \times 0.2210}{1.05127} \right) \right] = 3.41$$

$$\text{At } N_1 = \text{Max} \left[(100 - 98), \left(\frac{14.78 \times 0.7790 + 3.41 \times 0.2210}{1.05127} \right) \right] = 11.67$$



QUESTION 17:

SM

- 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: $V_s + V_p = V_c + \frac{E}{e^{rt}}$

$$380 + V_p = 10.518 + \frac{400}{e^{0.05 \times 3/12}}$$

$$380 + V_p = 405.549$$

$$V_p = 25.55$$

(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 $N(d_2)$:

$$d_2 = d_1 - \sigma\sqrt{t}$$

$$0.125 - 0.22\sqrt{3/12} = 0.015$$

$$N(d_2) : \text{Area of } 0.015 = 0.5060$$

$$\text{Value of call option} = 398.08 \times 0.5418 - \frac{400}{e^{0.05 \times 3/12}} \times 0.5060$$

$$= 218.864 - 199.886$$

$$= 18.978$$



QUESTION 18:

S 25 | 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%
- $$\frac{NP \times (RR - PR) \times n}{1 + RR \times n}$$
- $$\frac{60 \text{ Cr.} \times (0.096 - 0.093) \times 3/12}{1 + 0.096 \times 3/12}$$
- $$= 439453.125 \text{ Cr. Gain}$$
- (ii) RR turns out to be 8.8%
- $$\frac{60 \text{ Cr.} \times (0.088 - 0.093) \times 3/12}{1 + 0.088 \times 3/12}$$
- $$= -733855.1859 \text{ Cr. Loss}$$



QUESTION 19:

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%

- What is Forward Rate Agreement (FRA) for Yen?
- What should be 3 months FRA rate at 3 months forward?
- 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) FRA on Yen is Nil

Self-note: Above answer is as per suggested which has an ambiguity is that the $FR_{3 \times 6}$ on Yen is not NIL.

- (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

$$\left(1 + S_{12} \times \frac{12}{12} \right) = \left(1 + S_6 \times \frac{6}{12} \right) \times \left(1 + \text{Fair FR} \times \frac{6}{12} \right)$$

$$\left(1 + 0.065 \times \frac{12}{12} \right) = \left(1 + 0.05 \times \frac{6}{12} \right) \left(1 + \text{Fair FR} \times \frac{6}{12} \right)$$

$$1.065 = 1.025 \left(1 + \text{Fair FR} \times \frac{6}{12} \right)$$

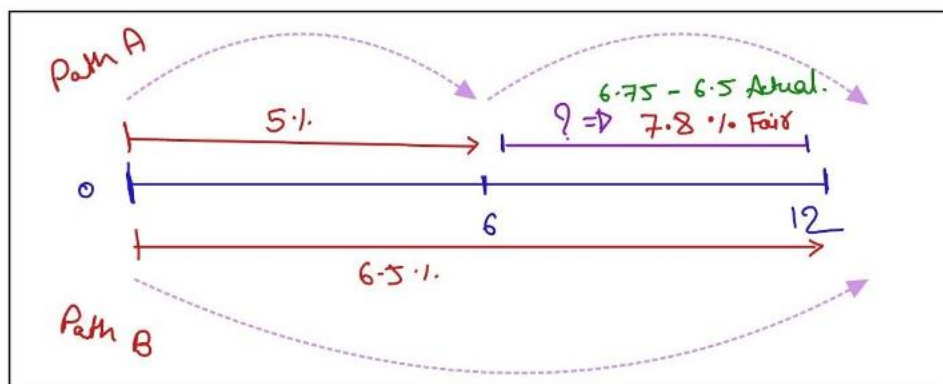
$$\text{Fair FR} = 7.80\%$$

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

$$= 1065 - 1059.59 = \$ 5.41$$



QUESTION 20:

J 26

Name	Status	Principal Amount (₹ in mn)	Duration of loan/deposit (time)	Interest rates of Borrowing/ Lending	Strike Rate (PLR)	Premium (%) (lump sum)	If PLR rate at the end of first 6-months (Reset Period)
AB Ltd.	Borrower	₹ 5.00	5 Years	PLR + 0.5	8% p.a.	0.4%	10% p.a.
XY Ltd.	Depositor	₹ 2.00	3 Years	PLR - 0.5	8% p.a.	0.5%	6% p.a.

You are required to:

- Elaborate the strategy to be adopted by both the companies to hedge against the risk of interest rate fluctuations.
- Premium paid/received based on the strategy to be adopted in (i) using 8% p.a. as the reference rate.
- Net Gain / loss due to hedging to both the companies.

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 21:

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.

Derivatives & Interest Rate Risk Management

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

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. Despite corrections, dates given in the question remain unaligned!

- 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	- 1,24,317		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			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.

$$\begin{aligned}
 &= \frac{1,03,10,971}{500,00,000} \times \frac{365}{1096} \times 100 \\
 &= 6.87\% \text{ p.a.}
 \end{aligned}$$



QUESTION 22:

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:
(i) 4.5% (ii) 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 (Spot Market)	(11,25,000) (50,000,000 × 4.5% × 6/12)	(16,25,000) (50,000,000 × 6.5% × 6/12)
Gain/(Loss) on FRA (Derivatives Market)	(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:

$$\begin{aligned} \text{No. of Contracts} &= \frac{\text{Amount of Borrowing}}{\text{Contract Size}} \times \frac{\text{Borrowing period of Loan}}{\text{Borrowing period of Futures}} \\ &= \frac{€ 50,000,000}{€ 50,000} \times \frac{6}{3} = 2000 \text{ Contracts to borrow} \end{aligned}$$

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)	162500

	$[2,000 \times 50,000 \times (4.5 - 5.85) \% \times 3/12]$	$[2,000 \times 50,000 \times (6.5 - 5.85) \% \times 3/12]$
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 23:

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:

- a) Position of XY Ltd = Long i.e., Contract to borrow.

Calculation of actual interest rate (RR):

$$\begin{aligned} \text{Gain} &= \frac{NP \times (RR - FR) \times n/12}{1 + RR \times n/12} \\ 9,78,952.52 &= \frac{1,00,00,00,000 \times (RR - 0.082) \times 3/12}{1 + RR \times 3/12} \\ RR &= 0.086 \text{ or } 8.6\% \end{aligned}$$

Self-note: Since, XY Ltd had a gain on settlement, it means that FR would be lower than RR. It means $RR - FR$ i.e., gain would be a positive number.

- b) Position of XY Ltd = Long i.e., Contract to borrow.

Calculation of actual interest rate (RR):

$$\begin{aligned} -9,80,872.98 &= \frac{1,00,00,00,000 \times (RR - 0.082) \times 3/12}{1 + RR \times 3/12} \\ RR &= 0.078 \text{ or } 7.8\% \end{aligned}$$

Self-note: Since, XY Ltd had a loss on settlement, it means that FR would be higher than RR. It means $RR - FR$ i.e., loss would be a negative number.



QUESTION 24:

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.



QUESTION 25:

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%

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:

- 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 26:

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?
- 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:

- 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 amount 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 27:

N 24 | N 10 | M 18 | N 17 | RTP

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
Monday	8.15%	22,358	10,01,53,740
		1,53,740	

$$\begin{aligned}
 \text{Interest under floating leg (₹):} & 1,53,740 \\
 - \text{Net settlement} & (317) \\
 \text{Interest under fixed leg (₹):} & 1,53,423 \\
 \text{Interest under fixed leg (\%):} & = \frac{153423}{10,00,00,000} \times \frac{365}{7} \times 100 \\
 & = 8\%
 \end{aligned}$$



QUESTION 28:

M 11 | RTP

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%	9%
B Inc	8%	10%

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%)

Foreign Exchange & International Financial Management



QUESTION 1:

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 2:

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
---------------------	---------	---------

$$\begin{aligned}\text{Loss due to delay} &= (\text{₹ } 26.0719 - \text{₹ } 25.9806) \times 25,00,000 \\ &= 2,28,250\end{aligned}$$



QUESTION 3:

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:

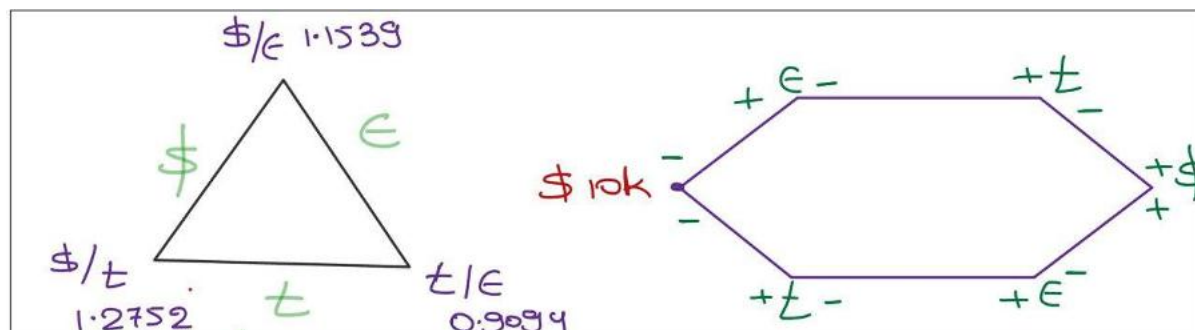
Dealer	Quote
A	EUR/USD 1.1539
B	EUR/GBP 0.9094
C	GBP/USD 1.2752

Is there an opportunity of gain from these quotes?

Solution:

A	\$ / €	1.1539
B	GBP/€	0.9094
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 \$

$$= 7881.10 \times 1.2752 = \$ 10050$$

$$\text{Arbitrage profit} = \$ 10050 - \$ 10000$$

$$= \$ 50$$



QUESTION 4:

M 18 | RTP | SM

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/₹		USD/SGD	
Spot/September	0300/0400	1 st month forward	48/49
Spot/October	1100/1300	2 nd month forward	96/97
Spot/November	1900/2200	3 rd month forward	138/140
Spot/December	2700/3100		
Spot/January	3500/4000		

Calculate the rate to be quoted to the importer by assuming an exchange margin of 5 paisa

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



QUESTION 5:

M 25 | 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 2months 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:

- a. Bid: $46.00 + 1.00 = 47.00$
 Ask: $46.25 + 1.25 = 47.75$
- b. $\frac{\text{₹ } 25,00,000}{\text{₹ } 47} = \$ 53191.49$
- c. $\text{US\$ } 200,000 \times \text{₹ } 46.25 = \text{₹ } 9,250,000$
- d.
- | | Spot | 2m Fwd |
|-----------------------|---------------------------------|---------------------------------|
| | $\$ 69,000 \times \text{₹ } 46$ | $\$ 69,000 \times \text{₹ } 47$ |
| | ₹ 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 6:

S 25 | N 16 | RTP | SM

On April 3, 2016, a Bank quotes the following:

Spot exchange Rate US \$1	INR 66.2525	INR 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:

- a. Calculation of swap points for 2 Months and 15 days

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 | <u>115</u> | <u>138</u> |

Forward exchange rate on 20th June 2016

66.264

67.6083

c. Calculation of forward premium / discount on base currency

$$= \frac{F - S}{\frac{F + S}{2}} \times \frac{12}{n} \times 100$$

Premium: Bid: $\frac{66.264 - 66.2525}{66.2583} \times \frac{12}{2.5} \times 100 = 0.0833\%$

Ask: $\frac{67.6083 - 67.5945}{67.6014} \times \frac{12}{2.5} \times 100 = 0.0980\%$

Self-note: Since, the question has asked to calculate the premium or discount on the average rate, therefore the denominator of the formula has been modified.



QUESTION 7:

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:

$$S_0 = ₹ 75.60$$

$$F = ₹ 75.20$$

i) Rate of discount on USD $= \frac{F - S}{S} \times 100 \times \frac{365}{60}$

$$= \frac{75.20 - 75.60}{75.60} \times 100 \times \frac{365}{60}$$

$$= - 3.22\% \text{ p.a. i.e., discount}$$

ii) Probable loss of operating profit $= (75.20 - 75.50) \times 5,00,000$

$$= ₹ - 1,50,000$$



QUESTION 8:

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:

$$\text{INR/US \$} = ₹ 62.22$$

$$\text{JPY/US\$} = \text{JPY } 102.34$$

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

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
 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 9:

S 25 | 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 10:

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
	(7,800,000/650)	(1,02,300/10.23)	(95,920/11.99)

Sales	₹ 3,213,844.25 (7,800,000/2.427)	₹ 4,736,111.11 (102300/0.0216)	₹ 5,388,764.04 (9520/0.0178)
VC	(2,700,000)	(3,950,000)	(4,080,000)
Contribution	5,13,844.25	7,86,111.11	1,308,764.04

Total Contribution = 26,08,719.4

Total Sales = 1,33,38,719.4

Average count 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 count 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 country to sales ratio is higher in that case



QUESTION 11:

N 19 | N 12 N 17 | M 04 | SM

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:

- 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

$$= ₹ 72.50 \times \left(\frac{1 + 0.06 \times 3/12}{1 + 0.0275 \times 3/12} \right)$$

$$= ₹ 73.0850$$

Self-note: The interest rate given in the question is quarterly compounded, therefore, logically the questions should be solved using the **Discrete compounding Formula**. But since, Period of contract and Compounding

period of interest rate is same therefore, even **Simple Interest-based Formula** will also give the same answer. Therefore suggested answer solved the questions using Simple Interest-based Formula.

$$\begin{aligned}
 \text{c) Rate of premium} &= \frac{F - S}{S} \times 100 \times \frac{12}{3} \\
 &= \frac{73.09 - 72.50}{72.50} \times 100 \times \frac{12}{3} \\
 &= + 3.26\%
 \end{aligned}$$



QUESTION 12:

M 16 | SM

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/£

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:

$$\begin{aligned}
 \text{Fwd Can\$/£} &= \frac{S(1 + r_p n)}{(1 + r_b n)} \\
 &= 2.50 \frac{(1 + 0.15 \times 6/12)}{(1 + 0.12 \times 6/12)} \\
 &= \text{CA\$ 2.5354/£}
 \end{aligned}$$

$$\begin{aligned}
 \text{Pound receipt of forward rate} &= \frac{\text{CA\$500,000}}{\text{CA\$2.5354}} \\
 &= \text{£ 197207.54} \\
 &\sim \text{£ 197208}
 \end{aligned}$$

(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% = CA\$ 2.4/£

$$\text{Inflow based on spot rate after 6M} = \frac{\text{CA\$5,00,000}}{\text{CA\$2.40}} = \text{£ 2,08,333}$$

$$\text{Loss to UK exporter} = 1,97,208 - \text{£ 2,08,333} = - \text{£ 11,125}$$

(iii) Remains unchanged

Expected spot rate = CA\$ 2.5/£

$$\text{Inflow based on spot rate after 6M} = \frac{\text{CA\$5,00,000}}{\text{CA\$2.50}} = \text{£ 2,00,000}$$

$$\text{Less to UK exporter} = 1,97,208 - \text{£ 2,00,000} = - \text{£ 2,792}$$



QUESTION 13:

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:

- 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.

- 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

- Borrow CA\$ 1,000 for 9% @ 3 months

$$\begin{aligned} \text{Outflow at end of 3M} &= \text{CA\$ 1,000} \left(\frac{1 + 0.09 \times 3}{12} \right) \\ &= \text{CA\$ 1,022.5} \end{aligned}$$

- Sell CA\$ 1,000 @ CA\$ 0.665 and receive DM

$$\begin{aligned} &= \frac{1000}{0.665} = \text{DM 1503.76} \end{aligned}$$

- Invest DM 1,503.76 @ 7% for 3M

$$\begin{aligned} &= 1,503.760 \left(1 + 0.07 \times \frac{3}{12} \right) \\ &= 1,530.08 \end{aligned}$$

- Sell DM 1,530.08 @ CA\$ 0.670 and receive CA\$

$$\begin{aligned} &= \text{DM 1,530.08} \times \text{CA\$ 0.670} \\ &= \text{CA\$ 1025.15} \end{aligned}$$

- 5) Profit CA\$ 1025.15 – CA\$ 1022.5
Profit = CA\$ 2.65



QUESTION 14:

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.

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

Dollar receipts using fwd rates = € 5,90,000 × \$ 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:

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 15:

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

$$\text{Sell } \$ 20,00,000 \text{ @ } ₹/\$ 42.50 \text{ and receive ₹:}$$

$$= \$ 20,00,000 \times ₹ 42.50 = ₹ 8,50,00,000$$

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 \$:

$$= \$ 2,238,902$$

$$\text{Nominal rate of return} = \frac{22,38,902 - 20,00,000}{20,00,000} = 11.95\%$$

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

$$\text{d) Nominal return to Indian investor} = \frac{3,765 - 3,256}{3,256} \times 100 = 15.63\%$$

Calculating real return:

$$(1 + r_{\text{real}}) (1 + r_{\text{inflation}}) = (1 + r_{\text{nominal}})$$

$$(1 + r_{\text{real}}) (1 + 0.09) = (1 + 0.1563)$$

$$r_{\text{real}} = 6.08\%$$



QUESTION 16:

N 15 | SM

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. Fcs1.5076/1.5120
One month forward	1.5150/ 1.5160
Two months forward	1.5250 / 1.5270
Three months forward	1.5415/ 1.5445

and in the interbank market US dollars were quoted as under:

Spot	USD 1 = ₹ 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	$= \frac{₹ 49.8655}{\text{SWF } 1.5150}$	= 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 17:

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:

(iii) Cost to importer in respect to extension of forward contract.

(iv) New Forward contract rate.

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	₹ 60.2675
Loss per \$	₹ 0.7325
	<u>× \$20,000</u>
Customer pay to banks	₹ 14,650

(ii)	₹/\$ spot Ask Rate	60.6300
	Add: Premium (0.98%)	<u>+ 0.5942</u>
	3M Forward	61.2242
	Add: Margin @ 0.15%	<u>0.0918</u>
		61.3160
	Rounded off	61.3150

Self-note: In the absence of information, it is assumed that extension request is made on the due date of the contract. This is because the exchange rates prevailing on due dates are given in the question.



QUESTION 18:

J 26 | 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

(ii) 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 19:

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.

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

Foreign Exchange & International Financial Management

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

Self-note: The question has the ambiguity that the contract that expired in March is quoted in the market in April which is practically not possible.



QUESTION 20:

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:

- (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) = ₹ 68.27	₹ 68.27 × \$ 149031.297 = ₹ 1,01,74,367
€	₹ 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) = ₹ 90.97	₹ 90.97 × £ 56,338.028 = ₹ 51,25,070

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 21:

J 26 | 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 @ 4% <u>0.0017</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 22:

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:

a. To cover payables in the forward market and

- b. 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 3m		\$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: In SM M 26, a note has been inserted regarding interest of cancellation charges (₹ 45,000) that it can also be considered for 3m. Logically it should be considered.



QUESTION 23:

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\$. 10,000,000 is due on April 1, 2015.

Market information as at January 1, 2015 is:

Exchange rates US\$/INR		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

$$\begin{aligned} \text{Rupee inflow after 3M} &= \frac{\$ 1,00,00,000}{\$ 0.016129} \\ &= ₹ 62,00,01,240 \end{aligned}$$

- (2) Currency futures

On 1st Jan:

$$\begin{aligned} \text{No. of contracts} &= \frac{\$1,00,00,000 / 0.016118}{₹2,48,16,975} \\ &= 25 \\ &= \text{i.e., 25 contracts long of ₹ @ } \$/\text{₹ } 0.016118 \end{aligned}$$

On 1st April 2015

- Gain/(loss) on futures:

$$\begin{aligned} \text{Gain in \$:} &= (\$0.016134 - 0.016118) \times 25 \text{ contracts} \times 24,86,975 \\ &= \$ 9,926.79 \end{aligned}$$

$$\text{Gain in ₹ :} = \$ 9,926.79 / \$ 0.016136 = ₹ 615,195 \text{ (Inflow)}$$

- Settlement of foreign currency payable or receivable

$$\begin{aligned} \text{Sell US\$ 10,000,000 @ } \$/\text{₹ } 0.016136 &= \frac{\$1,00,00,000}{\$0.016136} \\ &= ₹ 61,97,32,276 \text{ (inflow)} \end{aligned}$$

- Int. On margin = ₹ 22,500 × 25 contracts × 7% × $\frac{3}{12}$

$$= ₹ 9,843.75 \text{ (outflow)}$$

$$\text{Net Inflow} = 6,15,195 + 61,97,32,276 - 9,843.75 = ₹ 62,03,37,627$$

- 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 24:

M 25 | 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%

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/£

× £ 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.

Self-note: Ambiguity in this question is that the suggested answer assumed the given interest rates are assumed to be periodic (not per annum).



QUESTION 25:

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

6 months' forward rate USD 1.5455 –1.5609

The borrowing rates in U.K. and U.S. are 7% and 6% respectively and the deposit rates are 5.5% and 4.5% respectively.

Currency options are available under which one option contract is for GBP 12,500. The option premium for GBP at a strike price of USD 1.70/GBP is USD 0.037 (call option) and USD 0.096 (put option) for 6 months period.

The company has 3 choices:

- a) Forward cover
- b) Money market cover, and
- c) 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 26:

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:

- Forward Hedge
- Buy 3 months call, X-145.20
- Sell 3 months put, X = 145.20
- 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
------------------------------	------------

Foreign Exchange & International Financial Management

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 27:

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, $\therefore$ 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 28:

M 23 | N 20 | N 18

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

	In Billion
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

In Billion

₹ Outflow today	₹ 200
Exchange Rate	$\$/₹ 0.014$
\$ Outflow	\$ 2.8
Int. @ 5% for 6M	$\$ 0.07$
\$ Inflow after 6M	\$ 2.87
Forward Rate	$\$/₹ 0.013$
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 29:

M 22 | N 08 | RTP

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.

- Justify why the offer from the foreign branch should be accepted?
- Based on the present market condition company is not interested to take the risk of currency fluctuations and wanted to hedge with an additional 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 ₹		₹ 11,66,550

Add: Commission charges (₹)	$\$ 15,000 \times 2\% \times \frac{180}{360} \times 75$	₹ 11,250
Add: Interest on commission for 2 quarters	$\text{₹ } 11,250 \times 19\% + \frac{180}{360}$	₹ 1,069
Total outflow after 6m in ₹ [A + B]		₹ 11,78,869

Advise: Option 2 is cheaper by ₹ 12,34,413 – ₹ 11,78,869 = ₹ 55,544. Hence, the offer may be accepted.

Self-note: Ambiguity is that the suggested answer missed to consider compounding effect on interest on commission charges.

- (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.



QUESTION 30:

N 18

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 ₹	₹ 3610

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 31:

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

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)	<u>\$ 1.5475</u>
	<u>£ 3,231</u>

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	<u>€ 4,449</u>
€ inflow after 3m	€ 5,97,699
÷ Exchange Rate (€/£ ask)	<u>€ 1.815</u>
£ inflow after 3m	<u>£ 3,29,311</u>

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 32:

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.

1. 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:
 - a. Each company invests/finances its own cash balances/deficits in local currency independently.
 - b. Cash balances are pooled immediately in India and the net balances are invested/borrowed for the 30 days period.
2. 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 33:

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%.

1. You are required to find out the investment worth of the project by
 - a. Home Currency Approach

b. Foreign Currency Approach

2. 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 34:

M 25 | 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

Notional 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)
Notional Profit		₹ 22,71,15,000

Actual Total cost in ₹ = Notional Revenue – Notional Profit

= ₹ 48,00,00,000 – 22,71,15,000

= ₹ 25,28,85,000

Actual Cost in \$ = $\frac{₹ 25,28,85,000}{₹ 48} = \$ 52,68,437.5$

NPV from the project = \$ 1,20,00,000 - \$ 52,68,438 = \$ 67,31,562

Advise: Since positive NPV Therefore, project is viable



QUESTION 35:

S 25 | 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:

	Net Cash Flows (in lakhs)			
Years	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

Foreign Exchange & International Financial Management

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)

Decision: Proposal should not be accepted as NPV is negative.

Self-note: Ambiguity in this question is that since cost (\$) of bulk importing the leather from US has already been considered once, therefore no point of again deducting the cost (₹) of purchase of leather from India. It is actually double counting of cost.



QUESTION 36:

N 24

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:

- The following swap arrangement can be entered by True Life Inc.
 - Swap a US\$ loan today at an agreed rate with any party to obtain Indian Rupees (₹) to make initial investment.

- (2) After one year swap back the Indian Rupees with US\$ at the agreed rate. In Such Case the company is exposed only on the profit earned from the project.

(ii) **With the Swap**

	Year 0 (Million US\$)	Year 1 (Million US\$)
Buy ₹8000 million at spot rate of 1 US\$ = ₹80	(100.00)	-----
Swap ₹8000 million back at agreed rate of ₹ 80		100.00
sell ₹1600 million at 1 US\$ = ₹84		19.05
Interest on \$100 loan @6% for one year		(6.00)
	(100.00)	113.05

Net result is a net receipt of US\$ 13.05 million

Without the swap

	Year 0 (Million US\$)	Year 1 (Million US\$)
Buy 8000 million at spot rate of 1 US\$ = ₹80	(100.00)	
Sell 9600 million at 1 US\$ = ₹84		114.29
Interest on \$100 loan @6% for one year		(6.00)
	(100.00)	108.29

Net result is a net receipt of US\$ 8.29 million.

Decision: Since the net receipt is higher in swap option the company should opt for the same.



QUESTION 37:

M 21 | N 19 | M 14 | RTP

A multinational company is planning to set up a subsidiary company in India (where hitherto it was exporting) in view of growing demand for its product and competition from other MNCs. The initial project cost (consisting of Plant and Machinery including installation) is estimated to be US\$ 500 million. The net working capital requirements are estimated at US\$ 50 million. The company follows straight line method of depreciation. Presently, the company is exporting two million units every year at a unit price of US\$ 80, its variable cost per unit being US\$ 40.

The Chief Financial Officer has estimated the following operating cost and other data in respect of proposed project:

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;
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%.

Foreign Exchange & International Financial Management

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 × \$80)	120
Less: Variable cost	(1.5 × \$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 38:

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.

EBITDA 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 be paid annually. The loan will be repaid at the end of 15 years 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

Foreign Exchange & International Financial Management

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>
Adjusted Present Value	<u>11.982 lakhs</u>

Advise: Since adjusted NPV is negative at USD 11.98 lakh. The project is not viable.



QUESTION 39:

J 26 | 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:

- Expected market price of share at the time of issue of GDR is ₹ 360 (Face Value ₹ 100)
- Each GDR will represent two underlying Shares.
- The issue shall be priced at 10% discount to the market price.
- Expected exchange rate is INR/USD 72.
- Dividend is expected to be paid at the rate of 20% with growth rate of 12%.
 - You, as a financial consultant, are required to compute the number of GDRs to be issued and cost of the GDR.
 - What is your suggestion if the company receives an offer from a US Bank willing to provide an equivalent loan with an interest rate of 12%?
 - How much company can save by choosing the option as recommended by you?

Solution:

Net Issue Size	\$ 8.82 million
Issue Price per GDR in ₹ (360 × 2 × 90%)	₹ 648
Issue Price per GDR in \$ (₹ 648/ ₹ 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) = $(20 \times 2)/72 = \$ 0.5556$
Net Proceeds Per GDR = \$ 8.82
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

**QUESTION 1:**

SM | M 18 | PM

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.



QUESTION 2:

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

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

Solution:

Self-note: Life of Project Y is missing. But it has to be 3 years only for it to be comparable with Project X.

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 Hillier's model:

Project X

SD of CFs of individual years:

$$\text{Years 1} = \sqrt{(30 - 48.5)^2 0.30 + (50 - 48.5)^2 0.40 + (65 - 48.5)^2 0.30}$$

$$= ₹ 13.61 \text{ lacs}$$

$$\begin{aligned} \text{Year 2} &= \sqrt{(30 - 41.5)^2 0.30 + (40 - 41.5)^2 0.40 + (55 - 41.5)^2 0.30} \\ &= ₹ 9.76 \text{ lacs} \end{aligned}$$

$$\begin{aligned} \text{Year 3} &= \sqrt{(30 - 41.5)^2 0.30 + (40 - 41.5)^2 0.40 + (55 - 41.5)^2 0.30} \\ &= ₹ 5.94 \text{ lacs} \end{aligned}$$

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 3:

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

The firm uses a 10% discount rate for this type of investment. Required:

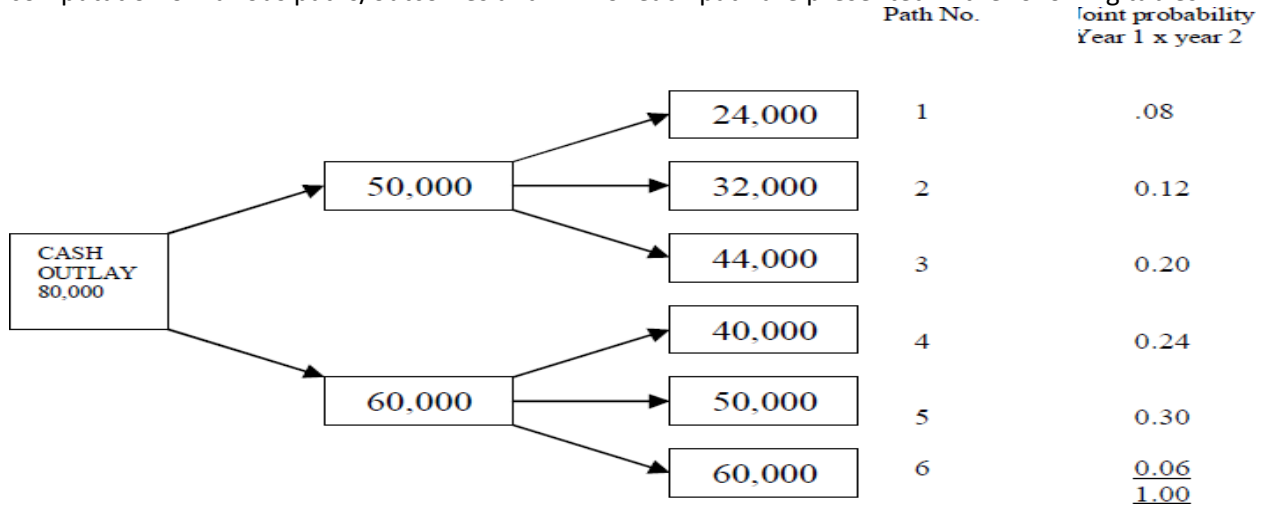
- Construct a decision tree for the proposed investment project and calculate the expected net present value (NPV).
- What net present value will the project yield, if worst outcome is realized? What is the probability of occurrence of this NPV?
- What will be the best outcome and the probability of that occurrence?

d. Will the project be accepted?

(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 x 0.909 = 45,450	24,000 x 0.826 = 19,824	65,274	80,000	- 14,726
2	45,450	32,000 x 0.826 = 26,432	71,882	80,000	- 8,118
3	45,450	44,000 x 0.826 = 36,344	81,794	80,000	1,794
4	60,000 x 0.909 = 54,540	40,000 x 0.826 = 33,040	87,580	80,000	7,580
5	54,540	50,000 x 0.826 = 41,300	95,840	80,000	15,840
6	54,540	60,000 x 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 4:

S 26 | 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.

$$\begin{aligned} 0 &= -10,00,000 + \frac{20,000 \times (60 - C)}{1.1} + \frac{30,000 \times (60 - C)}{1.21} + \frac{30,000 \times (60 - C)}{1.331} \\ C &= ₹ 44.74 \end{aligned}$$

$$\text{Increase in Cost price to make NPV zero} = \left(\frac{44.74 - 40}{40} \times 100 \right) = 11.85\%$$

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.

$$0 = -10,00,000 + \frac{V \times (60 - 40)}{1.1} + \frac{1.5V \times (60 - 40)}{1.21} + \frac{1.5V \times (60 - 40)}{1.331}$$

$$V = 15263.76 \text{ units}$$

$$\text{Decrease in Sales price to make NPV zero} = (15,263.76 - 20,000)/20,000 = 23.68\%$$

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.

$$0 = -\text{Initial OF} + \frac{20,000 \times (60 - 40)}{1.1} + \frac{30,000 \times (60 - 40)}{1.1^2} + \frac{30,000 \times (60 - 40)}{1.1^3}$$

$$\text{Initial OF} = ₹ 13,10,293$$

$$\text{Increase in Initial OF to make NPV zero} = 3,10,293/10,00,000 = 31.03\%.$$

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 5:

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 6:

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:

- The firm's cost of equity capital is 18%;
- Cost of debt is 9%;
- 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:

- To find out the viability of the project; and
- 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.

**QUESTION 7:**

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 nominal 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. 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 8:

S 25

SS Company is considering the replacement of its existing machine with a new machine. The Purchase price of the New machine is ₹ 26 Lakhs and its expected Life is 8 years. The company follows straight-line method of depreciation on the original investment (scrap value is not considered for the purpose of depreciation). The other expenses to be incurred for the New Machine are as under:

1. Installation Charges ₹ 9,000
2. Fees paid to the consultant for his advice to buy New Machine ₹ 6,000.
3. Additional Working Capital required ₹ 17,000. (will be released after 8 years)

The written down value of the existing machine is ₹ 76,000, and its Cash Salvage Value is ₹ 12,500. The dismantling of this machine would cost ₹ 4,500. The Annual Earnings (before tax but after depreciation) from the New Machine would amount to ₹ 3,15,000. Income tax rate is 35%. The Company's required Rate of Return is 13%.

You are required to advise on the viability of the proposal.

$$\text{PVIF (13\%, 8)} = 0.376 \quad \text{PVIFA (13\%, 8)} = 4.80$$

Solution:

1. Computation of Annual Depreciation-

Particulars	₹
Purchase Price	26,00,000
Add: 1. Installation Charges	9,000
2. Fees Paid to Consultant for Advice	6,000

Total Cost of New Machine	[A]	26,15,000
Net Proceeds of Sale (12,500 – 4,500)	[B]	8,000
Less: WDV		76,000
Capital Loss due to Sale		68,000
Tax savings on Capital Loss @35%	[C]	23,800
Working Capital Outflow	[D]	17,000
Net Initial Cash Outflow	[A - B – C + D]	26,00,200

2. Computation of Annual CFATs-

Particulars	₹
Annual Earnings	3,15,000
Less-Tax @35%	1,10,250
Earning after Tax	2,04,750
Add-Depreciation on New Machine	3,26,875
Annual Cash Savings	5,31,625

3. Computation of Net Present Value

Particulars	Period	Cash Flow (₹)	PVF @13%	PV (₹)
Initial Net Outflow	0	- 26,00,200	1	26,00,200
Annual CFAT	1-8	5,31,625	4.8	25,51,800
Working Capital Realized	8	17,000	0.376	6,392
NPV of the Proposal				(42,008)

Decision: Since NPV of the project is negative it is not viable.

**QUESTION 9:**

M 25

BC Ltd. is contemplating on buying a new machine at ₹ 70,00,000 with an additional working capital requirement of ₹ 10,00,000. The machine is expected to have an economic useful life of 5 years, with no salvage value. The company follows the straight line method of depreciation and same is accepted for tax purposes. The machine is expected to generate an incremental increase in the before tax cash operating income of ₹ 25,00,000 (in real terms) per year for a period of 5 years.

The relevant tax rate is 35%. Inflation is expected to be 6% per year and the firms cost of capital in real term is 10% per year. Assuming that the working capital requirement will remain unchanged throughout the period, in spite of inflation.

Advise the company whether the machine should be purchased or not.

Show your NPV calculation in real term.

Calculation upto two decimal places.

PV Factor at 10% & 6% are as under:

	1	2	3	4	5
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Advanced Capital Budgeting

10%	0.909	0.826	0.751	0.683	0.621
6%	0.943	0.89	0.84	0.792	0.747

Solution:

- Cash Outflow (Initial Outlay) = ₹ 70,00,000 + ₹ 10,00,000 = ₹ 80,00,000
- Cash Flow After Tax and Present Value

Particulars	(₹)
Incremental cash operating income	25,00,000
Less: Taxes (0.35)	8,75,000
CFAT	16,25,000
PVAF for 5 years at 10%	3.790
PV of Cash Inflow	61,58,750

- PV of tax shield due to Depreciation

Tax saving due to Depreciation per year	14,00,000
Tax rate	35%
Tax saving per year for five years	4,90,000

PV of tax shield due to depreciation

Years	Tax saving (Nominal)	Inflation Factor at 6%	Real Tax Saving	PVF @ 10%	PV (₹)
1	4,90,000	0.943	4,62,070	0.909	4,20,021.63
2	4,90,000	0.890	4,36,100	0.826	3,60,218.60
3	4,90,000	0.840	4,11,600	0.751	3,09,111.60
4	4,90,000	0.792	3,88,080	0.683	2,65,058.64
5	4,90,000	0.747	3,66,030	0.621	2,27,304.63
Present Value of tax shield due to Depreciation					15,81,715.10

- PV of Release of Working Capital

	(₹)
Release of Working Capital at the end of 5 th year	10,00,000
Inflation Factor at 6% at the end of 5 th year	0.747
Cash Inflow in real terms	7,47,000
PVF @ 10% at the end of 5 th year	0.621
Present Value of Inflow	4,63,887

- Calculation of NPV

Particulars	Present Value (₹)
Initial Outlay	(80,00,000)
Present Value of CFAT	61,58,750
Present Value tax shield on Dep	15,81,715.10
Present Value Release of Working	4,63,887

2,04,352.10

Recommendation: The Company should purchase the machine as the NPV of real cash flow is positive.

**QUESTION 10:**

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

Depreciation = ₹ 10,00,000 ÷ 5 = ₹ 2,00,000

Incremental cash inflow:

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

Conclusion: Machine should not be upgraded.

Replacement Decision:

Advanced Capital Budgeting

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:

- a Depreciation = ₹ 20,50,000 ÷ 5 = ₹ 4,10,000
 b 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 11:

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:

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
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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 12:

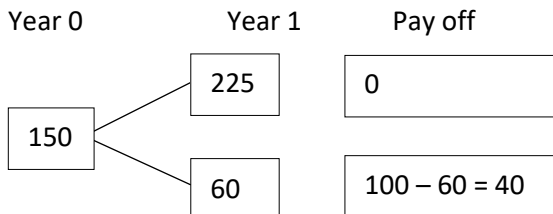
J 26 | N 24 | M 17 | PM | SM

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 is 8%, what will be the value of the abandonment option and the value of the project with abandonment (Put) option?

Solution:

Decision Tree showing payoff:



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:

$$\begin{aligned} \text{Present value of expected pay off} &= [0 \times p + 40 \times (1-p)]/1.08 \\ &= [0 \times 61.82\% + 40 \times 38.18\%]/1.08 \\ &= ₹ 14.1389\text{Cr.} \end{aligned}$$

$$\begin{aligned} \text{The Value of project with abandonment option} &= [225 \times 61.82\% + 100 \times 38.18\%]/1.08 \\ &= 164.2019 \end{aligned}$$



QUESTION 13:

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

$$\ln(1.336) = 0.2897, e^{1.0005} = 0.3677 \text{ and } e^{-1.17} = 0.3104$$

$$N(2.389) = 0.9916, N(2.188) = 0.9857, N(1.2315) = 0.8910, N(-0.7735) = 0.2196$$

Solution:

SM Solution:

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. 0.268

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

$$C = S N(d_1)e^{-df} - Ee^{-rt} N(d_2)$$

$$d_1 = \frac{\ln(S/E) + [R - D + (\frac{1}{2})\sigma^2] t}{\sigma\sqrt{t}}$$

$$d_2 = d_1 - \sigma\sqrt{t}$$

Accordingly,

$$d_1 = \frac{\ln(16.7/12.5) + [0.078 - 0.0667 + (\frac{1}{2})(0.268)] 15}{\sqrt{0.268} \sqrt{15}}$$

$$d_1 = \frac{0.2897 + (0.1453)15}{0.5177 \times 3.8730}$$

$$d_1 = \frac{0.2897 + 2.1795}{2.005}$$

$$d_1 = \frac{2.4692}{2.005} = 1.2315$$

$$d_2 = 1.2315 - 2.005$$

$$d_2 = -0.7735$$

$$N(d_1) = 0.8910$$

$$N(d_2) = 0.2196$$

Value of Patent

$$= 16.7 \times e^{-0.0667 \times 15} \times 0.8910 - 12.5 \times e^{-0.078 \times 15} \times 0.2196$$

$$= 16.7 \times 0.3677 \times 0.8910 - 12.5 \times 0.3104 \times 0.2196$$

$$= 5.471 - 0.852 = 4.619$$

Thus, the value of patents is \$ 4.619 million

Logical Solution:

To value the patent, we shall use Black Scholes Model for option pricing as follows:

Advanced Capital Budgeting

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. 0.00268
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

$$d_1 = \frac{\ln\left(\frac{S}{E}\right) + \left(r - y + \frac{\sigma^2}{2}\right)t}{\sigma\sqrt{t}}$$

$$= \frac{\ln\left(\frac{16.7}{12.5}\right) + \left[0.078 - 0.0667 + \left(\frac{0.002681}{2}\right)\right]15}{\sqrt{0.00268} \sqrt{15}}$$

$$= 2.389$$

$$N(d_1) = 0.9916$$

$$d_2 = d_1 - \sigma\sqrt{t}$$

$$= 2.389 - 0.2001$$

$$= 2.188$$

$$N(d_2) = 0.9857$$

Value of Patent

$$C = \frac{S}{e^{yt}} \times N(d_1) - \frac{E}{e^{rt}} \times N(d_2)$$

$$= \frac{16.7}{e^{0.0667 \times 15}} \times 0.9916 - \frac{12.5}{e^{0.078 \times 15}} \times 0.9857$$

$$= 16.7 \times 0.3677 \times 0.9916 - 12.5 \times 0.3104 \times 0.9857$$

$$= 2.2645$$

Thus, the value of patents is \$ 2.2645 million

Financial Policy & Corp Strategy, Risk Mgmt and Security Analysis

**QUESTION 1:**

N 20 | MTP M 23

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:

- a) Amount of External Fund Requirement

	In ₹
Capital invested in business (1400 – 200)	1200
Additional funds required $1200 \times 20\%$ (A)	240
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 $[720 \times 3/4]$	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

$$\begin{aligned}
 \text{Calculation of revised Debt to Equity Ratio} &= \frac{\text{LT + ST Debt}}{\text{Equity}} \\
 &= \frac{400 + 80 + 300}{500 + 14.4 + 145.6} \\
 &= 1.18 \text{ times}
 \end{aligned}$$

After raising funds as per above table, the debt-to-equity ratio has not exceeded 1.5 times.



QUESTION 2:

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 $\times$ 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 converted to 4 days' SD.



QUESTION 3:

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:

- The value of exponent for 15 days EMA.
- The exponential moving average (EMA) of NIFTY during the above period. (Calculations to be done up to 2 decimals only).
- 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.