

CA FINAL
AFM QCracker
**ADVANCED FINANCIAL
MANAGEMENT**



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Risk Management

Question 1

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

Solution

The standard deviation of the daily change in the investment in each asset is ₹ 2,00,000 i.e. 2 lakhs. The variance of the portfolio's daily change is

$$V = 2^2 + 2^2 + 2 \times 0.3 \times 2 \times 2 = 10.4$$

$$\sigma \text{ (Standard Deviation)} = \sqrt{10.4} = ₹ 3.22 \text{ lakhs}$$

Alternatively, it can also be computed as follows:

$$= (1)^2(0.50)^2 + (1)^2(0.50)^2 + 2(1)(1)(0.3)(0.50)(0.50) = 0.25 + 0.25 + 0.15 = 0.65\%$$

$$\sigma \text{ (Standard Deviation)} = = 0.80623\%$$

$$\sigma \text{ (Standard Deviation) in Amount} = ₹ 400 \text{ lakhs} \times 0.80623\% = ₹ 3.22 \text{ lakhs}$$

Accordingly, the standard deviation of the 10-day change is ₹ 3.22 lakhs $\times \sqrt{10} = ₹ 10.18 \text{ lakh}$

From the Normal Table we see that z score for 1% is 2.33. This means that 1% of a normal distribution lies more than 2.33 standard deviations below the mean. The 10-day 99 percent value at risk is therefore $2.33 \times ₹ 10.18 \text{ lakh} = ₹ 23.72 \text{ lakh}$

Question 2

ABC Ltd. is considering a project X, which is normally distributed and has mean return of Rs. 2 crore with Standard Deviation of Rs. 1.60 crore.

In case ABC Ltd. loses on any project more than Rs. 1.00 crore there will be financial difficulties. Determine the probability the company will be in financial difficulty.

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

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

Solution

For calculating probability of financial difficulty, we shall calculate the area under Normal Curve corresponding to the Z Score obtained from the following equation (how many SD is away from Mean

$$\text{Value of financial difficulty): } z = \frac{x - \mu}{\sigma} = \frac{-1.00\text{crore} - 2.00\text{crore}}{1.60\text{crore}} = -1.875 \text{ say } 1.875$$

Corresponding area from Z Score Table by using interpolation shall be found as follows:

Z Score	Area under Normal Curve
1.87	0.4693
1.88	0.4699
0.01	0.0006

The corresponding value of 0.005 Z score = $0.005 \times 0.0006 / 0.01 = 0.0003$

Thus the Value of 1.875 shall be = $0.4693 + 0.0003 = 0.4696$

Thus the probability the company shall be in financial difficulty is $0.5 - 0.4696 = 0.0304$ or 3.04%



Advanced Capital Budgeting Decisions

Question 1

Determine NPV of the project with the following information:

Initial Outlay of project	₹ 40,000
Annual Cash Flow from the Project (Without inflation)	₹ 15,000
Useful life	4 years
Cost of Capital (Including inflation premium of 10%)	12%

Solution:

Annual Cash Flow of project is ₹ 15,000.

It would be inconsistent to discount these real cash flows at 12% (nominal rate of return). There are two alternatives:

- (i) Either to restate the cash flow in nominal term and discount at 12% or
- (ii) Restate the discount rate in real terms and use this to discount the real cash flows.

NPV using (i) approach

Since inflation rate is 10% a year, real cash flows may be stated in nominal cash flows as follows:

Nominal Cash Flow = (1+Inflation Rate) Real Cash Flows

Year	Real Cash Flows	Nominal Cash flows
1	15000	$15,000 \times 1.10 = 16,500$
2	15,000	$15,000 \times (1.10)^2 = 18,150$
3	15,000	$15,000 \times (1.10)^3 = 19,965$
4	15,000	$15,000 \times (1.10)^4 = 21,962$

NPV using nominal discounting rate 12%

$$\frac{16,500}{(1.12)} + \frac{18,150}{(1.12)^2} + \frac{19,965}{(1.12)^3} + \frac{21,962}{(1.12)^4} - 40,000$$

$$= ₹ 14,732 + ₹ 14,469 + ₹ 14,211 + ₹ 13,957 - ₹ 40,000 = ₹ 17,369 \text{ (Approx)}$$

NPV using (ii) approach

To compute NPV using (ii) approach, we shall need real discount rate, which shall be computed as follows:

$$\text{Real Discount Rate} = \frac{1 + \text{Nominal Discount Rate}}{1 + \text{Inflation Rate}} - 1$$

$$\text{Real Discount Rate} = \frac{1 + 0.12}{1 + 0.10} - 1 = 0.0182 \text{ i.e. } 1.8\%$$

Accordingly NPV of the project

$$\frac{15,000}{(1.0182)} + \frac{15,000}{(1.0182)^2} + \frac{15,000}{(1.0182)^3} + \frac{15,000}{(1.0182)^4} - 40,000$$

$$= ₹ 14,732 + ₹ 14,469 + ₹ 14,210 + ₹ 13,956 - ₹ 40,000 = ₹ 57,367 - ₹ 40,000 = ₹ 17,367 \text{ (Approx)}$$

Question 2

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

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

Applicable Tax Rate is 60% and cost of capital is 10% (including inflation premium).

Calculate NPV of the project if inflation rates for revenues & costs are as follows:

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

Solution:

Computation of Annual Cash Flow

(i) Inflation adjusted Revenues

Year	Revenues (₹)	Revenues (Inflation Adjusted) (₹)
1	6,00,000	6,00,000(1.10) = 6,60,000
2	7,00,000	7,00,000(1.10)(1.09) = 8,39,300
3	8,00,000	8,00,000(1.10)(1.09)(1.08) = 10,35,936
4	8,00,000	8,00,000(1.10)(1.09)(1.08)(1.07) = 11,08,452

(ii) Inflation adjusted Costs

Year	Revenues (₹)	Revenues (Inflation Adjusted) (₹)
1	3,00,000	3,00,000(1.12) = 3,36,000
2	4,00,000	4,00,000(1.12)(1.10) = 4,92,800
3	4,00,000	4,00,000(1.12)(1.10)(1.09) = 5,37,152
4	4,00,000	4,00,000(1.12)(1.10)(1.09)(1.08) = 5,80,124

(iii) Tax Benefit on Depreciation = ₹ 2,00,000 × 0.60 = ₹ 1,20,000

(iv) Net Profit after Tax

Year	Revenues (Inflation Adjusted) (₹)(1)	Costs (Inflation Adjusted) (₹)(2)	Net Profit (₹) (3) = (1) - (2)	Tax (₹) (4) = 60% of (3)	Net after Profit (₹) (3) - (4)
1	6,60,000	3,36,000	3,24,000	1,94,400	1,29,600
2	8,39,300	4,92,800	3,46,500	2,07,900	1,38,600
3	10,35,936	5,37,152	4,98,784	2,99,270	1,99,514
4	11,08,452	5,80,124	5,28,328	3,16,997	2,11,331

(v) Present Value of Cash Inflows

Year	Net after Profit (₹)	Tax Benefit on Depreciation (₹)	Cash Inflow (₹)	PVF@ 10%	PV (₹)
1	1,29,600	1,20,000	2,49,600	0.909	2,26,886
2	1,38,600	1,20,000	2,58,600	0.826	2,13,604
3	1,99,514	1,20,000	3,19,514	0.751	2,39,955
4	2,11,331	1,20,000	3,31,331	0.683	2,26,299
					9,06,744

NPV = ₹ 9,06,744 - ₹ 8,00,000 = ₹ 1,06,744

Question 3

Possible net cash flows of Projects A and B at the end of first year and their probabilities are given below. Discount rate is 10 per cent. For both the projects, initial investment is ₹ 10,000. Calculate the expected net present value for each project. State which project is preferable?

Possible Event	Project A		Project B	
	Cash Flow (₹)	Probability	Cash Flow (₹)	Probability
A	8,000	0.10	24,000	0.10
B	10,000	0.20	20,000	0.15
C	12,000	0.40	16,000	0.50
D	14,000	0.20	12,000	0.15
E	16,000	0.10	8,000	0.10

Solution:**Calculation of Expected Value for Project A and Project B**

Project A				Project B		
Possible Event	Cash Flow (₹)	Probability	Expected Value (₹)	Cash Flow (₹)	Probability	Expected Value (₹)
A	8,000	0.10	800	24,000	0.10	2,400
B	10,000	0.20	2,000	20,000	0.15	3,000
C	12,000	0.40	4,800	16,000	0.50	8,000
D	14,000	0.20	2,800	12,000	0.15	1,800
E	16,000	0.10	1,600	8,000	0.10	800
ENCF			12,000			16,000

The Net Present Value for Project A is $(0.909 \times ₹ 12,000 - ₹ 10,000) = ₹ 908$

The Net Present Value for Project B is $(0.909 \times ₹ 16,000 - ₹ 10,000) = ₹ 4,544$.

Question 4

Probabilities for net cash flows for 3 years of a project are as follows:

Year 1		Year 2		Year 3	
Cash Flow (₹)	Probability	Cash Flow (₹)	Probability	Cash Flow (₹)	Probability
2,000	0.1	2,000	0.2	2,000	0.3
4,000	0.2	4,000	0.3	4,000	0.4
6,000	0.3	6,000	0.4	6,000	0.2
8,000	0.4	8,000	0.1	8,000	0.1

Calculate the expected net present value of the project using 10 per cent discount rate if the Initial Investment of the project is ₹ 10,000.

Solution:

Calculation of Expected Value

Year 1			Year 2			Year 3		
Cash Flow (₹)	Prob.	Expected Value (₹)	Cash Flow (₹)	Prob.	Expected Value (₹)	Cash Flow (₹)	Prob.	Expected Value (₹)
2,000	0.1	200	2,000	0.2	400	2,000	0.3	600
4,000	0.2	800	4,000	0.3	1200	4,000	0.4	1,600
6,000	0.3	1,800	6,000	0.4	2400	6,000	0.2	1,200
8,000	0.4	3,200	8,000	0.1	800	8,000	0.1	800
ENCF		6,000			4,800			4,200

The present value of the expected value of cash flow at 10 per cent discount rate has been determined as follows:

$$\text{Present Value of cash flow} = \frac{6,000}{(1+10)^1} + \frac{4,800}{(1+10)^2} + \frac{4,200}{(1+10)^3}$$

$$= (6,000 \times 0.909) + (4,800 \times 0.826) + (4,200 \times 0.751) = ₹ 12,573$$

$$\text{Expected Net Present value} = \text{Present Value of cash flow} - \text{Initial Investment}$$

$$= ₹ 12,573 - ₹ 10,000 = ₹ 2,573.$$

Question 5

Calculate Variance and Standard Deviation of Project A and Project B on the basis of following information:

Possible Event	Project A		Project B	
	Cash Flow (₹)	Probability	Cash Flow (₹)	Probability
A	8,000	0.10	24,000	0.10
B	10,000	0.20	20,000	0.15
C	12,000	0.40	16,000	0.50
D	14,000	0.20	12,000	0.15
E	16,000	0.10	8,000	0.10

Solution:**Calculation of Expected Value for Project A and Project B**

Project A				Project B		
Possible Event	Cash Flow (₹)	Probability	Expected Value (₹)	Cash Flow (₹)	Probability	Expected Value (₹)
A	8,000	0.10	800	24,000	0.10	2,400
B	10,000	0.20	2,000	20,000	0.15	3,000
C	12,000	0.40	4,800	16,000	0.50	8,000
D	14,000	0.20	2,800	12,000	0.15	1,800
E	16,000	0.10	1,600	8,000	0.10	800
ENCF			12,000			16,000

Project A:

$$\text{Variance } (\sigma^2) = (8,000 - 12,000)^2 \times (0.1) + (10,000 - 12,000)^2 \times (0.2) + (12,000 - 12,000)^2 \times (0.4) + (14,000 - 12,000)^2 \times (0.2) + (16,000 - 12,000)^2 \times (0.1)$$

$$= 16,00,000 + 8,00,000 + 0 + 8,00,000 + 16,00,000 = 48,00,000$$

$$\text{Standard Deviation } (\sigma) = \sqrt{\text{Variance}(\sigma^2)} = \sqrt{48,00,000} = 2,190.90$$

Project B:

$$\text{Variance}(\sigma^2) = (24,000 - 16,000)^2 \times (0.1) + (20,000 - 16,000)^2 \times (0.15) + (16,000 - 16,000)^2 \times (0.5) + (12,000 - 16,000)^2 \times (0.15) + (8,000 - 16,000)^2 \times (0.1)$$

$$= 64,00,000 + 24,00,000 + 0 + 24,00,000 + 64,00,000 = 1,76,00,000$$

$$\text{Standard Deviation } (\sigma) = \sqrt{\text{Variance}(\sigma^2)} = \sqrt{1,76,00,000} = 4,195.23$$

Question 6

Calculate Coefficient of Variation of Project A and Project B based on the following information:

Possible Event	Project A		Project B	
	Cash Flow (₹)	Probability	Cash Flow (₹)	Probability
A	10,000	0.10	26,000	0.10
B	12,000	0.20	22,000	0.15
C	14,000	0.40	18,000	0.50
D	16,000	0.20	14,000	0.15
E	18,000	0.10	10,000	0.10

Solution:**Calculation of Expected Value for Project A and Project B**

Project A				Project B		
Possible Event	Cash Flow (₹)	Probability	Expected Value (₹)	Cash Flow (₹)	Probability	Expected Value (₹)
A	10,000	0.10	1,000	26,000	0.10	2,600
B	12,000	0.20	2,400	22,000	0.15	3,300
C	14,000	0.40	5,600	18,000	0.50	9,000
D	16,000	0.20	3,200	14,000	0.15	2,100
E	18,000	0.10	1,800	10,000	0.10	1,000
ENCF			14,000			18,000

Project A

$$\begin{aligned}\text{Variance } (\sigma^2) &= (10,000 - 14,000)^2 \times (0.1) + (12,000 - 14,000)^2 \times (0.2) + (14,000 - 14,000)^2 \times (0.4) + \\ &+ (16,000 - 14,000)^2 \times (0.2) + (18,000 - 14,000)^2 \times (0.1) \\ &= 16,00,000 + 8,00,000 + 0 + 8,00,000 + 16,00,000 = 48,00,000 \\ \text{Standard Deviation } (\sigma) &= \sqrt{\text{Variance}(\sigma^2)} = \sqrt{48,00,000} = 2,190.90\end{aligned}$$

Project B:

$$\begin{aligned}\text{Variance}(\sigma^2) &= (26,000 - 18,000)^2 \times (0.1) + (22,000 - 18,000)^2 \times (0.15) + (18,000 - 18,000)^2 \times (0.5) + \\ &+ (14,000 - 18,000)^2 \times (0.15) + (10,000 - 18,000)^2 \times (0.1) \\ &= 64,00,000 + 24,00,000 + 0 + 24,00,000 + 64,00,000 = 1,76,00,000 \\ \text{Standard Deviation } (\sigma) &= \sqrt{\text{Variance}(\sigma^2)} = \sqrt{1,76,00,000} = 4,195.23\end{aligned}$$

Projects	Coefficient of variation	Risk	Expected Value
A	$\frac{2190.90}{14000} = 0.1565$	Less	Less
B	$\frac{4195.23}{18000} = 0.2331$	More	More

In project A, risk per rupee of cash flow is ₹ 0.16 while in project B, it is ₹ 0.23. Therefore, Project A is better than Project B.

Question 7

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

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

Calculate Net Present Value of the project based on Risk free rate and also on the basis of Risks adjusted discount rate.

Solution:

The Present Value of the Cash Flows for all the years by discounting the cash flow at 7% is calculated as below:

Year	Cash flows (₹ in lakhs)	Discounting Factor @ 7%	Present value of Cash Flows (₹ In Lakhs)
1	25	0.935	23.38
2	60	0.873	52.38
3	75	0.816	61.20
4	80	0.763	61.04
5	65	0.713	46.35
Total of Present value of Cash flows			244.34
Less: Initial investment			100.00
Net Present Value (NPV)			144.34

Now, when the risk-free rate is 7% and the risk premium expected by the Management is 7%, then risk adjusted discount rate is 7% + 7% = 14%.

Discounting the above cash flows using the Risk Adjusted Discount Rate would be as below:

Year	Cash flows (₹ in Lakhs)	Discounting Factor @ 14%	Present Value of Cash Flows (₹ in lakhs)
1	25	0.877	21.93
2	60	0.769	46.14
3	75	0.675	50.63
4	80	0.592	47.36
5	65	0.519	33.74
Total of Present value of Cash flows			199.79
Less: Initial investment			100.00
Net present value (NPV)			99.79

Question 8

If Investment proposal costs ₹ 45,00,000 and risk free rate is 5%, calculate net present value under certainty equivalent technique.

Year	Expected cash flow (₹)	Certainty Equivalent coefficient
1	10,00,000	0.90
2	15,00,000	0.85
3	20,00,000	0.82
4	25,00,000	0.78

Solution:

$$\text{NPV} = \frac{10,00,000 \times (0.90)}{(1.05)} + \frac{15,00,000 \times (0.85)}{(1.05)^2} + \frac{20,00,000 \times (0.82)}{(1.05)^3} + \frac{25,00,000 \times (0.78)}{(1.05)^4} - 45,00,000$$

$$= ₹5,34,570$$

Question 9

X Ltd. is considering its new project with the following details:

Sr. No.	Particulars	Figures
1	Initial capital cost	₹ 400 Cr.
2	Annual unit sales	5 Cr.
3	Selling price per unit	₹ 100
4	Variable cost per unit	₹ 50
5	Fixed costs per year	₹ 50 Cr.
6	Discount Rate	6%

Required:

1. Calculate the NPV of the project.
2. Compute the impact on the project's NPV considering a 2.5 per cent adverse variance in each variable. Which variable is having maximum effect?

Consider Life of the project as 3 years.

Solution:**1. Calculation of Net Cash Inflow per year**

	Particulars	Amount (₹)
A	Selling price per unit	100
B	Variable cost per unit	50
C	Contribution per unit (A - B)	50
D	Number of units sold per year	5 Cr.
E	Total Contribution (C × D)	₹ 250 Cr.
F	Fixed cost per year	₹ 50 Cr.
G	Net cash inflow per year (E - F)	₹ 200 Cr.

Calculation of Net Present Value (NPV) of the Project

Year	Year Cash Flow (₹ in Cr.)	PV factor @ 6%	Present Value(PV) (₹ in Cr.)
0	(400.00)	1.000	(400.00)
1	200.00	0.943	188.60
2	200.00	0.890	178.00
3	200.00	0.840	168.00
Net Present Value			134.60

Here, NPV represent the most likely outcomes and not the actual outcomes. The actual outcome can be lower or higher than the expected outcome.

2. Sensitivity Analysis considering 2.5 % Adverse Variance in each variable

Particulars		Base	Initial capital cost increased to ₹ 410 crore	Selling Price per Unit Reduced to ₹ 97.5	Variable Cost Per Unit increased to ₹ 51.25	Fixed Cost Per Unit increased to ₹ 51.25	Units sold per year reduced to 4.875 crore
		(₹)	(₹)	(₹)	(₹)	(₹)	(₹)
A	Selling price per unit	100	100	97.5	100	100	100
B	Variable cost per unit	50	50	50	51.25	50	50
C	Contribution per unit (A - B)	50	50	47.5	48.75	50	50
		(₹ in Cr.)	(₹ in Cr.)	(₹ in Cr.)	(₹ in Cr.)	(₹ in Cr.)	(₹ in Cr.)
D	Number of units sold per year (units in Crores)	5	5	5	5	5	4.875
E	Total Contribution (C × D)	250	250	237.5	243.75	250	243.75
F	Fixed cost per year	50	50	50	50	51.25	50

G	Net Cash Inflow per year (E - F)	200	200	187.5	193.75	198.75	193.75
H	PV of Net cash Inflow per year ($G \times 2.673$)	534.60	534.60	501.19	517.89	531.26	517.89
I	Initial capital cost	400	410	400	400	400	400
J	NPV (H - I)	134.60	124.60	101.19	117.89	131.26	117.89
K	Percentage Change in NPV	-	-7.43%	-24.82%	-12.41%	-2.48%	-12.41%

The above table shows that by changing one variable at a time by 2.5% (adverse) while keeping the others constant, the impact in percentage terms on the NPV of the project can be calculated. Thus, the change in selling price has the maximum effect on the NPV by 24.82%.

Question 10

XYZ Ltd. is considering a project "A" with an initial outlay of ₹ 14,00,000 and the possible three cash inflow attached with the project as follows:

Particulars	Year 1	Year 2	Year 3
Worst case	450	400	700
Most likely	550	450	800
Best case	650	500	900

Assuming the cost of capital as 9%, determine NPV in each scenario. If XYZ Ltd is certain about the most likely result in first two years but uncertain about the third year's cash flow, analyze what will be the NPV expecting worst scenario in the third year.

Solution:

The possible outcomes will be as follows:

Year	PVF @ 9%	Worst Case		Most likely		Best case	
		Cash Flow	PV	Cash Flow	PV	Cash Flow	PV
		(₹ '000)	(₹ '000)	(₹ '000)	(₹ '000)	(₹ '000)	(₹ '000)
0	1	(1,400)	(1,400)	(1,400)	(1,400)	(1,400)	(1,400)
1	0.917	450	412.65	550	504.35	650	596.05
2	0.842	400	336.80	450	378.90	500	421.00
3	0.772	700	540.40	800	617.60	900	694.80
NPV			-110.15		100.85		311.85

If XYZ Ltd. is certain about the most likely result in first two years but uncertain about the third year's cash flow, then, NPV expecting worst case scenario is expected in the third year will be as follows:

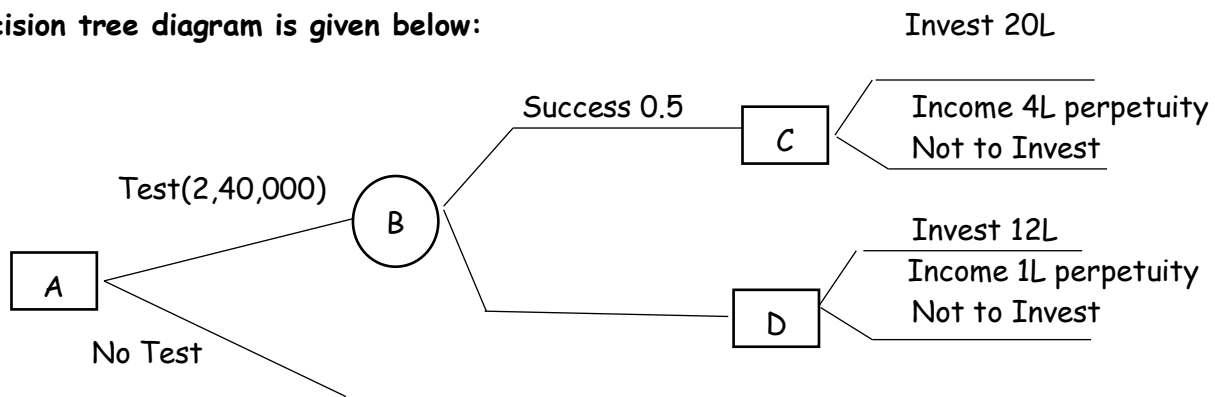
$$\begin{aligned}
 &= -₹14,00,000 + \frac{5,50,000}{(1+0.09)} + \frac{4,50,000}{(1+0.09)^2} + \frac{7,00,000}{(1+0.09)^3} \\
 &= -₹14,00,000 + ₹5,04,587 + ₹3,78,756 + ₹5,40,528 = ₹23,871
 \end{aligned}$$

Question 11

L & R Limited wishes to develop new virus-cleaner software. The cost of the pilot project would be ₹ 2,40,000. Presently, the chances of the product being successfully launched on a commercial scale are rated at 50%. In case it does succeed, L&R can invest a sum of ₹ 20 lacs to market the product. Such an effort can generate perpetually, an annual net after tax cash income of ₹ 4 lacs. Even if the commercial launch fails, they can make an investment of a smaller amount of ₹ 12 lacs with the hope of gaining perpetually a sum of ₹ 1 lac. Evaluate the proposal, adopting decision tree approach. The discount rate is 10%.

Solution:

Decision tree diagram is given below:



Evaluation

At Decision Point C: The choice is between investing ₹ 20 lacs for a perpetual benefit of ₹ 4 lacs and not to invest. The preferred choice is to invest, since the capitalized value of benefit of ₹ 4 lacs (at 10%) adjusted for the investment of ₹ 20 lacs, yields a net benefit of ₹ 20 lacs.

At Decision Point D: The choice is between investing ₹ 12 lacs, for a similar perpetual benefit of ₹ 1 lac, and not to invest. Here the invested amount is greater than capitalized value of benefit at ₹ 10 lacs. There is a negative benefit of ₹ 2 lacs. Therefore, it would not be prudent to invest.

At Outcome Point B: Evaluation of EMV is as under (₹ in lacs).

Outcome	Amount (₹)	Probability	Result (₹)
Success	20.00	0.50	10.00
Failure	0.00	0.50	00.00
Net result			10.00

Question 12

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

Solution:

Step I. Net cash outflow at beginning (assumed at current time) [Present values of cost]:

Cost of New system - Sale value of old system (50,000 - 5,000)	45000
(+/-) Tax payable on sale of old system or Tax savings on sale	(2250)
	42,750

Tax Payable or Tax savings = (Book value of old system - Sale value of old system) × Tax Rate

Step II. Estimated change in cash flows per year if replacement decision is implemented.

Change in sales (10,00,000 × 10%)	10,000
+/- Change in operating costs	5,000
- Change in Depreciation (₹ 49,000/5 - ₹ 25,000/10)	(7,300)
Total	97,700
- Tax Rate (30%)	29,310
Total	68,390
+ Change in Depreciation	7,300
Change in cash flows if replacement decision is taken	12,690

Step III. Calculate NPV

Present value of yearly cash flows	xx
+ Present value of estimated salvage of new system	xx
- Present value of costs	(xx)

Present value of benefits = Present value of yearly cash flows + Present value of estimated salvage of new system

$$= ₹ 12,690 \times PVIFA (10\%, 5) + ₹ 1,000 \times PVIF (10\%, 5) = ₹ 48,723$$

Net present value = Present value of benefits - Present value of costs

$$= ₹ 48,723 - ₹ 42,750 = ₹ 5,973$$

Step IV. Decision rule: Since NPV is positive we should accept the proposal to replace the machine.

Question 13

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

	Year 1	Year 2	Year 3
Operating Cost	₹ 1,80,000	₹ 2,10,000	₹ 2,38,000
Resale Value	₹ 2,80,000	₹ 2,30,000	₹ 1,68,000

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

Solution:

NPV if taxi is kept for 1 Year

$$= - ₹ 4,00,000 - ₹ 1,80,000 (0.909) + ₹ 2,80,000 (0.909) = - ₹ 3,09,100$$

NPV if taxi is kept for 2 Year

$$= - ₹ 4,00,000 - ₹ 1,80,000 \times 0.909 + ₹ 20,000 \times 0.826 = - ₹ 5,47,100$$

NPV if taxi is kept for 3 Year

$$= - ₹ 4,00,000 - ₹ 1,80,000 \times 0.909 - ₹ 2,10,000 \times 0.826 - ₹ 70,000 \times 0.751 = - ₹ 7,89,650$$

Since above NPV figures relate to different periods, there are not comparable. to make them comparable we shall use concept of EAC as follows:

EAC of 1 year: $3,09,100 / 0.909 = ₹3,40,044$

EAC of 2 year: $5,47,100 / 1.735 = ₹3,15,331$

EAC of 3 year: $7,89,650 / 2.486 = ₹3,17,639$

Since lowest EAC is for 2 year; Hence the optimum replacement cycle to replace taxi in 2 years.

Question 14

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

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

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

- The expected NPV of this venture assuming independent probability distribution with 6 per cent risk free rate of interest.
- The possible deviation in the expected value.
- How would standard deviation of the present value distribution help in Capital Budgeting decisions?

Solution:

(i) Expected NPV

(₹ in lakhs)

Year I			Year II			Year III		
CFAT	P	CF×P	CFAT	P	CF×P	CFAT	P	CF×P
14	0.1	1.4	15	0.1	1.5	18	0.2	3.6
18	0.2	3.6	20	0.3	6.0	25	0.5	12.5
25	0.4	10.0	32	0.4	12.8	35	0.2	7.0
40	0.3	<u>12.0</u>	45	0.2	<u>9</u>	48	0.1	<u>4.8</u>
	x or CF	<u>27.0</u>		x or CF	<u>29.3</u>			x or CF <u>27.9</u>

NPV	PV factor @ 6%	Total PV
27	0.943	25.461
29.3	0.890	26.077
27.9	0.840	<u>23.436</u>
	PV of cash inflow	74.974
	Less: Cash outflow	<u>50.000</u>
	NPV	<u>24.974</u>

(ii) Possible deviation in the expected value

Year I				
$X - \bar{X}$	$X - \bar{X}$	$(X - \bar{X})^2$	P_1	$(X - \bar{X})^2 P_1$
14 - 27	-13	169	0.1	16.9
18 - 27	-9	81	0.2	16.2
25 - 27	-2	4	0.4	1.6
40 - 27	13	169	0.3	50.7
				85.4

$$\sigma_1 = \sqrt{85.4} = 9.241$$

Year II				
$X - \bar{X}$	$X - \bar{X}$	$(X - \bar{X})^2$	P_2	$(X - \bar{X})^2 \times P_2$
15-29.3	-14.3	204.49	0.1	20.449
20-29.3	-9.3	86.49	0.3	25.947
32-29.3	2.7	7.29	0.4	2.916
45-29.3	15.7	246.49	0.2	49.298
				98.61

$$\sigma_2 = \sqrt{98.61} = 9.930$$

Year III				
$X - \bar{X}$	$X - \bar{X}$	$(X - \bar{X})^2$	P_3	$(X - \bar{X})^2 \times P_3$
18-27.9	-9.9	98.01	0.2	19.602
25-27.9	-2.9	8.41	0.5	4.205
35-27.9	7.1	50.41	0.2	10.082
48-27.9	20.1	404.01	0.1	40.401
				74.29

$$\sigma_3 = \sqrt{74.29} = 8.619$$

Standard deviation about the expected value:

$$\sigma = \sqrt{\frac{85.4}{(1.06)^2} + \frac{98.61}{(1.06)^4} + \frac{74.29}{(1.06)^6}} = 14.3696$$

- (iii) Standard deviation is a statistical measure of dispersion; it measures the deviation from a central number i.e. the mean.

In the context of capital budgeting decisions especially where we take up two or more projects giving somewhat similar mean cash flows, by calculating standard deviation in such cases, we can measure in each case the extent of variation. It can then be used to identify which of the projects is least risky in terms of variability of cash flows.

A project, which has a lower coefficient of variation will be preferred if sizes are heterogeneous. Besides this, if we assume that probability distribution is approximately normal we are able to calculate the probability of a capital budgeting project generating a net present value less than or more than a specified amount.

Question 15

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

Situation	Probabilities	Cash Flow (₹)	
		Project A	Project B
Good	0.3	6,00,000	5,00,000
Normal	0.4	4,00,000	4,00,000
Worse	0.3	2,00,000	3,00,000

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

Solution:**Project A**

Expected Net Cash flow (ENCF)

$$0.3 (6,00,000) + 0.4 (4,00,000) + 0.3 (2,00,000) = 4,00,000$$

$$\sigma^2 = 0.3 (6,00,000 - 4,00,000)^2 + 0.4 (4,00,000 - 4,00,000)^2 + 0.3 (2,00,000 - 4,00,000)^2$$

$$\sigma = \sqrt{24,00,00,00,000}$$

$$\sigma = 1,54,919.33$$

Present Value of Expected Cash Inflows = $4,00,000 \times 4.100 = 16,40,000$

$$\text{NPV} = 16,40,000 - 5,00,000 = 11,40,000$$

Project B

$$\text{ENCF} = 0.3 (5,00,000) + 0.4 (4,00,000) + 0.3 (3,00,000) = 4,00,000$$

$$\sigma^2 = 0.3 (5,00,000 - 4,00,000)^2 + 0.4 (4,00,000 - 4,00,000)^2 + 0.3 (3,00,000 - 4,00,000)^2$$

$$\sigma = \sqrt{6,00,00,00,000}$$

$$\sigma = 77,459.66$$

Present Value of Expected Cash Inflows = $4,00,000 \times 4.100 = 16,40,000$

$$\text{NPV} = 16,40,000 - 5,00,000 = 11,40,000$$

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

Question 16

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

Project	Expected NPV (₹)	Standard deviation
X	1,22,000	90,000
Y	2,25,000	1,20,000

- Which project will you recommend based on the above data?
- Explain whether your opinion will change, if you use coefficient of variation as a measure of risk.
- Which measure is more appropriate in this situation and why?

Solution:

- (i) On the basis of standard deviation project X be chosen because it is less risky than Project Y having higher standard deviation.
- (ii) $CV_x = \frac{SD}{ENPV} = \frac{90,000}{1,22,000} = 0.738$
 $CV_y = \frac{1,20,000}{2,25,000} = 0.533$
 On the basis of Co-efficient of Variation (C.V.) Project X appears to be riskier and hence Y should be accepted.
- (iii) However, the NPV method in such conflicting situation is best because the NPV method is in compatibility of the objective of wealth maximisation in terms of time value.

Question 17

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:

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

Solution:**Calculation of Variance and Standard Deviation****Project K**

Expected Net Cash Flow

$$= (0.10 \times 11) + (0.20 \times 13) + (0.40 \times 15) + (0.20 \times 17) + (0.10 \times 19)$$

$$= 1.1 + 2.6 + 6 + 3.4 + 1.9 = 15$$

$$\sigma^2 = 0.10(11 - 15)^2 + 0.20(13 - 15)^2 + 0.40(15 - 15)^2 + 0.20(17 - 15)^2 + 0.10(19 - 15)^2$$

$$= 1.6 + 0.8 + 0 + 0.8 + 1.6 = 4.8$$

$$\sigma = \sqrt{4.8} = 2.19$$

Project S

Expected Net Cash Flow

$$= (0.10 \times 9) + (0.25 \times 13) + (0.30 \times 17) + (0.25 \times 21) + (0.10 \times 25)$$

$$= 0.9 + 3.25 + 5.1 + 5.25 + 2.5 = 17$$

$$\sigma^2 = 0.1(9 - 17)^2 + 0.25(13 - 17)^2 + 0.30(17 - 17)^2 + 0.25(21 - 17)^2 + 0.10(25 - 17)^2$$

$$= 6.4 + 4 + 0 + 4 + 6.4 = 20.8$$

$$\sigma = \sqrt{20.8} = 4.56$$

Calculation of Coefficient of Variation

$$\text{Coefficient of Variation} = \frac{\text{Standard Deviation}}{\text{Mean}}$$

$$\text{Project K} = 2.19/15 = 0.146$$

$$\text{Project S} = 4.56/17 = 0.268$$

Project S is riskier as it has higher Coefficient of Variation.

Question 18

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 and analyse the inherent risk of the projects.

Solution:

(a) Calculation of NPV of XY Co.:

Project X		Cash flow	PVF	PV
Year				
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
				107.28
	NPV: $(107.28 - 70.00) =$			(+) 37.28

Project Y (For 1-3 Years)

1-3	$(40 \times 0.2) + (45 \times 0.5) + (50 \times 0.3)$	45.5	2.487	113.16
	NPV $(113.16 - 80.00)$			(+) 33.16

Calculation of Standard deviation σ

As per Hiller's model

Project X

1	$\sqrt{(30 - 48.5)^2 0.30 + (50 - 48.5)^2 0.40 + (65 - 48.5)^2 0.30}$	$= \sqrt{185.25}$	$= 13.61$
2	$\sqrt{(30 - 41.5)^2 0.30 + (40 - 41.5)^2 0.40 + (55 - 41.5)^2 0.30}$	$= \sqrt{95.25}$	$= 9.75$
3	$\sqrt{(30 - 38.5)^2 0.30 + (40 - 38.5)^2 0.40 + (45 - 38.5)^2 0.30}$	$= \sqrt{35.25}$	$= 5.94$

$$\text{Standard Deviation about the expected value} = \sqrt{\frac{185.25}{(1+1.10)^2} + \frac{95.25}{(1+1.10)^4} + \frac{35.25}{(1+1.10)^6}} = \sqrt{238.06} = 15.43$$

$$\text{Project Y (For 1-3 Years): } \sqrt{(40 - 45.5)^2 0.20 + (45 - 45.5)^2 0.50 + (50 - 45.5)^2 0.30} = \sqrt{12.25} = 3.50$$

Standard Deviation about the expected value

$$= \sqrt{\frac{12.25}{(1+0.10)^2} + \frac{12.25}{(1+0.10)^4} + \frac{12.25}{(1+0.10)^6}} = \sqrt{\frac{12.25}{1.21} + \frac{12.25}{1.4641} + \frac{12.25}{1.7716}} = \sqrt{10.12 + 8.37 + 6.61} = \sqrt{25.4} = 5.03$$

Analysis: Project Y is less risky as its Standard Deviation is less than Project X.

Question 19

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

Project A		Project B	
NPV estimates (₹)	Probability	NPV estimates (₹)	Probability
15,000	0.2	15,000	0.1
12,000	0.3	12,000	0.4
6,000	0.3	6,000	0.4
3,000	0.2	3,000	0.1

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

Solution:

(i) Statement showing computation of expected net present value of Projects A and B:

Project A			Project B		
NPV Estimate (₹)	Probability	Expected Value	NPV Estimate	Probability	Expected Value
15,000	0.2	3,000	15,000	0.1	1,500
12,000	0.3	3,600	12,000	0.4	4,800
6,000	0.3	1,800	6,000	0.4	2,400
3,000	0.2	600	3,000	0.1	300
	1.0	EV = 9,000		1.0	EV = 9,000

(ii) **Computation of Standard deviation of each project**

Project A

P	X	(X - EV)	P (X - EV) ²
0.2	15,000	6,000	72,00,000
0.3	12,000	3,000	27,00,000
0.3	6,000	- 3,000	27,00,000
0.2	3,000	- 6,000	<u>72,00,000</u>
			Variance = <u>1,98,00,000</u>

Standard Deviation of Project A = $\sqrt{1,98,00,000}$ = ₹4,450

Project B

P	X	(X - EV)	P (X - EV) ²
0.1	15,000	6,000	36,00,000
0.4	12,000	3,000	36,00,000
0.4	6,000	- 3,000	36,00,000
0.1	3,000	- 6,000	<u>36,00,000</u>
			Variance = <u>1,44,00,000</u>

Standard Deviation of Project B = $\sqrt{1,44,00,000}$ = ₹3,795

(iii) **Computation of profitability of each project**

Profitability index = Discount cash inflow / Initial outlay

In case of Project A: PI = $(9,000 + 36,000) / 36,000 = 45,000 / 36,000 = 1.25$

In case of Project B: PI = $(9,000 + 30,000) / 30,000 = 39,000 / 30,000 = 1.30$

- (iv) Measurement of risk is made by the possible variation of outcomes around the expected value and the decision will be taken in view of the variation in the expected value where two projects have the same expected value, the decision will be the project which has smaller variation in expected value. In the selection of one of the two projects A and B, Project B is preferable because the possible profit which may occur is subject to less variation (or dispersion). Much higher risk is lying with project A.

Question 20

Following are the estimates of the net cash flows and probability of a new project of M/s X Ltd.:

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

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

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

Should the project be accepted by X Ltd?

Solution:

(a) (i) **Expected cash flows:-**

Year			Net cash flows	P.V.	PV. @ 10%
0	(4,00,000 × 1)	=	(-)4,00,000	1.000	(-)4,00,000
1 to 4	(1,00,000×0.3 + 1,10,000 × 0.5 + 1,20,000 × 0.2)	=	1,09,000	3.170	3,45,530
5	[1,09,000 + (20,000 × 0.3 + 50,000 × 0.5 + 60,000 × 0.2)]	=	1,52,000	0.621	94,392
	NPV =				39,922

(ii) **ENPV of the worst case**

$1,00,000 \times 3.790 = ₹ 3,79,000$ (Students may have 3.791 also the values will change accordingly)

$20,000 \times 0.621 = ₹ 12,420/-$

$ENPV = (-) 4,00,000 + 3,79,000 + 12,420 = (-) ₹ 8,580/-$

ENPV of the best case

$ENPV = (-) 4,00,000 + 1,20,000 \times 3.790 + 60,000 \times 0.621 = ₹ 92,060/-$.

(iii) (a) Required probability = 0.3

(b) Required probability = $(0.3)^5 = 0.00243$

(iv) The base case NPV = $(-) 4,00,000 + (1,10,000 \times 3.79) + (50,000 \times 0.621) = ₹ 47,950/-$

$ENPV = 0.30 \times (-) 8580 + 0.5 \times 47950 + 92060 \times 0.20 = ₹ 39,813/-$

Therefore,

$\sigma_{ENPV} = \sqrt{0.3(-8580-39813)^2 + 0.5(47950-39813)^2 + 0.2(92,060-39813)^2} = ₹ 35,800/-$

Therefore, $CV = 35,800/39,813 = 0.90$

(v) Risk adjusted out of cost of capital of X Ltd. = 10% - 1% = 9%.

NPV

Year	Expected net cash flow	PV @ 9%	
0	(-) 4,00,000	1.000	(-) 4,00,000
1 to 4	1,09,000	3.240	3,53,160
5	1,52,000	0.650	98,800
		ENPV =	51,960

Therefore, the project should be accepted.

Question 21

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

Annual cash inflow (₹)	20,000	30,000	40,000
Probability	0.1	0.7	0.2

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

You are required to:

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

Solution:

The expected cash flows of the project are as follows:

Year	Pr = 0.1	Pr = 0.7	Pr = 0.2	Total
	₹	₹	₹	₹
0				-1,00,000
1	2,000	21,000	8,000	31,000
2	2,000	21,000	8,000	31,000
3	2,000	21,000	8,000	31,000
4	2,000	21,000	8,000	31,000
5	2,000	21,000	8,000	31,000
5	0	14,000	6,000	20,000

(i) NPV based on expected cash flows would be as follows:

$$\begin{aligned}
 &= -₹1,00,000 + \frac{₹31,000}{(1+0.20)^1} + \frac{₹31,000}{(1+0.20)^2} + \frac{₹31,000}{(1+0.20)^3} + \frac{₹31,000}{(1+0.20)^4} + \frac{₹31,000}{(1+0.20)^5} + \frac{₹20,000}{(1+0.20)^5} \\
 &= -₹1,00,000 + ₹25,833.33 + ₹21,527.78 + ₹17,939.81 + ₹14,949.85 + ₹12,458.20 + ₹8,037.55 \\
 &\text{NPV} = ₹746.52
 \end{aligned}$$

- (ii) For the worst case, the cash flows from the cash flow column farthest on the left are used to calculate NPV

$$= -₹1,00,000 + \frac{₹20,000}{(1+0.20)^1} + \frac{₹20,000}{(1+0.20)^2} + \frac{₹20,000}{(1+0.20)^3} + \frac{₹20,000}{(1+0.20)^4} + \frac{₹20,000}{(1+0.20)^5} + \frac{0}{(1+0.20)^5}$$

$$= -₹100,000 + ₹16,666.67 + ₹13,888.89 + ₹11,574.07 + ₹9,645.06 + ₹8,037.76$$

$$= \text{NPV} = -₹40,187.76$$

For the best case, the cash flows from the cash flow column farthest on the right are used to calculate NPV

$$= -₹1,00,000 + \frac{₹40,000}{(1+0.20)^1} + \frac{₹40,000}{(1+0.20)^2} + \frac{₹40,000}{(1+0.20)^3} + \frac{₹40,000}{(1+0.20)^4} + \frac{₹40,000}{(1+0.20)^5} + \frac{₹30,000}{(1+0.20)^5}$$

$$= ₹1,00,000 + ₹33,333.33 + ₹27,777.78 + ₹23,148.15 + ₹19,290.12 + ₹16,075.10 + ₹12,056.33$$

$$\text{NPV} = ₹31,680.81$$

- (iii) If the cash flows are perfectly dependent, then the low cash flow in the first year will mean a low cash flow in every year. Thus, the possibility of the worst case occurring is the probability of getting ₹20,000 net cash flow in year 1 is 10%.

Question 22

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:

- (a) Sales Price/unit (b) Unit cost (c) Sales volume (d) Initial outlay and (e) Project lifetime
Taxation may be ignored.

Solution:

Calculation of NPV

$$\text{NPV} = -1,00,000 + \frac{20,000 \times 20}{1.1} + \frac{30,000 \times 20}{1.21} + \frac{30,000 \times 20}{1.331}$$

$$= -₹10,00,000 + ₹3,63,636 + ₹4,95,868 + ₹4,50,789$$

$$= ₹13,10,293 - ₹10,00,000$$

$$= ₹3,10,293$$

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.

$$\therefore 10,00,000 = \frac{20,000 \times (S - 40)}{1.1} + \frac{30,000 \times (S - 40)}{1.21} + \frac{30,000 \times (S - 40)}{1.331}$$

$$S - 40 = ₹ 10,00,000 / ₹ 65,514$$

$$S - 40 = ₹ 15.26$$

$$S = ₹ 55.26 \text{ which represents a fall of } (60 - 55.26) / 60$$

$$\text{Or } 0.079 \text{ or } 7.9\%$$

Alternative Method

$$\frac{10,00,000 \times 20}{13,10,293} = ₹ 15.26$$

$$S = ₹ 40 + ₹ 15.26 = ₹ 55.26$$

Alternative Solution

If sale Price decreased by say 10%, then NPV (at Sale Price of ₹ 60 - ₹ 6 = ₹ 54)

$$\begin{aligned} \text{NPV} &= -10,00,000 + \frac{20,000 \times 14}{(1.1)^1} + \frac{30,000 \times 14}{(1.1)^2} + \frac{30,000 \times 14}{(1.1)^3} \\ &= -₹ 10,00,000 + ₹ 2,54,545 + ₹ 3,47,107 + ₹ 3,15,552 = - ₹ 82,796 \end{aligned}$$

$$\text{NPV decrease (\%)} = \frac{3,10,293 - (-82,796)}{3,10,293} \times 100 = 126.68\%$$

(b) Unit Cost:-

If sales price = ₹ 60 the cost price required to give a margin of ₹ 15.26 is (₹ 60 - ₹ 15.26) or ₹ 44.74

$$\text{which would represent a rise of } 11.85\% \text{ i.e., } \frac{44.74 - 40}{40} \times 100$$

Alternative Solution

If unit cost increased by say 10%. The new NPV will be as follows:

$$\begin{aligned} \text{NPV} &= -10,00,000 + \frac{20,000 \times 16}{(1.1)^1} + \frac{30,000 \times 16}{(1.1)^2} + \frac{30,000 \times 16}{(1.1)^3} \\ &= -₹ 10,00,000 + ₹ 2,90,909 + ₹ 3,96,694 + ₹ 3,60,631 = ₹ 48,234 \end{aligned}$$

$$\text{NPV decrease (\%)} = \frac{3,10,293 - (48,234)}{3,10,293} \times 100 = 84.46\%$$

(c) Sales volume:-

The requisite percentage fall is:-

$$3,10,293 / 13,10,293 \times 100 = 23.68\%$$

Alternative Solution

If sale volume decreased by say 10%. The new NPV will be as follows:

$$\begin{aligned} \text{NPV} &= -10,00,000 + \frac{18,000 \times 20}{(1.1)^1} + \frac{27,000 \times 20}{(1.1)^2} + \frac{27,000 \times 20}{(1.1)^3} \\ &= -₹ 10,00,000 + ₹ 3,27,272 + ₹ 4,46,281 + ₹ 4,05,710 = ₹ 1,79,263 \end{aligned}$$

$$\text{NPV decrease (\%)} = \frac{3,10,293 - 1,79,263}{3,10,293} \times 100 = 42.22\%$$

(d) Since PV of inflows remains at ₹13,10,293 the initial outlay must also be the same.

Percentage rise = $3,10,293/10,00,000 \times 100 = 31.03\%$.

Alternative Solution

If initial outlay increased by say 10%. The new NPV will be as follows:

$$\text{NPV} = - ₹ 11,00,000 + \frac{20,000 \times 20}{(1.1)^1} + \frac{30,000 \times 20}{(1.1)^2} + \frac{30,000 \times 20}{(1.1)^3}$$

$$= - ₹ 11,00,000 + ₹ 3,63,636 + ₹ 4,95,868 + ₹ 4,50,789 = ₹ 2,10,293$$

$$\text{NPV decrease (\%)} = \frac{3,10,293 - 2,10,293}{3,10,293} \times 100 = 32.22\%$$

(e) Present value for 1st two years.

$$= - ₹ 10,00,000 + ₹ 4,00,000 \times 0.909 + ₹ 6,00,000 \times 0.826 = - ₹ 10,00,000 + ₹ 3,63,600 + ₹ 4,95,600$$

$$= - ₹ 10,00,000 + ₹ 8,59,200 = - ₹ 1,40,800$$

The project needs to run for some part of the third year so that the present value of return is ₹ 1,40,800. It can be computed as follows: ∴

(i) $30,000 \text{ units} \times ₹ 20 \times 0.751 = ₹ 4,50,600$

(ii) Per day Production in (₹) assuming a year of 360 days = $₹ 4,50,600/360 = ₹ 1,252$

(iii) Days needed to recover ₹1,40,800 = $₹ 1,40,800/₹ 1,252 = 112$

Thus, if the project runs for 2 years and 112 days then break even would be achieved representing a fall of $[(3 - 2.311)/3] \times 100 = 22.97\%$

Question 23

From the following details relating to a project, analyse the sensitivity of the project to changes in initial project cost, annual cash inflow and cost of capital:

Initial Project Cost (₹)	1,20,000
Annual Cash Inflow (₹)	45,000
Project Life (Years)	4
Cost of Capital	10%

To which of the three factors, the project is most sensitive?

(Use annuity factors: for 10% 3.169 and 11% 3.103).

Solution:

CALCULATION OF NPV

	₹
PV of cash inflows (₹ 45,000 × 3.169)	1,42,605
Initial Project Cost	<u>1,20,000</u>
NPV	<u>22,605</u>

If initial project cost is varied adversely by 10%*

NPV (Revised) (₹ 1,42,605 - ₹ 1,32,000) ₹ 10,605

Change in NPV (₹ 22,605 - ₹ 10,605)/ ₹ 22,605 i.e. 53.08 %

If annual cash inflow is varied adversely by 10%*

Revised annual inflow	₹ 40,500
NPV (Revised) (₹ 40,500 × 3.169) - (₹ 1,20,000)	(+) ₹ 8,345
Change in NPV (₹ 22,605 - ₹ 8,345) / ₹ 22,605	63.08 %

If cost of capital is varied adversely by 10%*

NPV (Revised) (₹ 45,000 × 3.103) - ₹ 1,20,000	(+) ₹ 19,635
Change in NPV (₹ 22,605 - ₹ 19,635) / ₹ 22,605	13.14 %

Conclusion: Project is most sensitive to 'annual cash inflow'.

***Note:** Students may please note that they may assume any other percentage rate other than 10 % say 15%, 20 % 25 % etc.

Question 24

Red Ltd. is considering a project with the following Cash flows:

Years	Cost of Plant	Recurring Cost	Savings
0	10,000		
1		4,000	12,000
2		5,000	14,000

The cost of capital is 9%. Measure the sensitivity of the project to changes in the levels of plant value, running cost and savings (considering each factor at a time) such that the NPV becomes zero. The P.V. factor at 9% are as under:

Year	Factor
0	1
1	0.917
2	0.842

Which factor is the most sensitive to affect the acceptability of the project?

Solution:**P.V. of Cash Flows**

Year 1	Running Cost	₹ 4,000 × 0.917	= (₹ 3,668)
	Savings	₹ 12,000 × 0.917	= ₹ 11,004
Year 2	Running Cost	₹ 5,000 × 0.842	= (₹ 4,210)
	Savings	₹ 14,000 × 0.842	= ₹ 11,788
			₹ 14,914
Year 0	Less: P.V. of Cash Outflow	₹ 10,000 × 1	₹ 10,000
		NPV	₹ 4,914

Sensitivity Analysis

(i) Increase of Plant Value by ₹ 4,914

$$\therefore 4,914/10,000 \times 100 = 49.14\%$$

(ii) Increase in PV of Running Cost by ₹ 4,914

$$4,914/(3,668+4,210)=4,914/7,878 \times 100 = 62.38\%$$

(iii) Fall in PV of Saving by ₹ 4,914

$$4,914 / (11,004 + 11,788) = 4,914 / 22,792 \times 100 = 21.56\%$$

Hence, savings factor is the most sensitive to affect the acceptability of the project as in comparison of other two factors a slight % change in this fact shall more affect the NPV than others.

Alternative Solution

P.V. of Cash Flows

Year 1	Running Cost	₹ 4,000 × 0.917	= (₹ 3,668)
	Savings	₹ 12,000 × 0.917	= ₹ 11,004
Year 2	Running Cost	₹ 5,000 × 0.842	= (₹ 4,210)
	Savings	₹ 14,000 × 0.842	= ₹ 11,788
			₹ 14,914
Year 0	Less: P.V. of Cash Outflow	₹ 10,000 × 1	₹ 10,000
		NPV	₹ 4,914

Sensitivity Analysis

(i) If the initial project cost is varied adversely by say 10%*.

$$\text{NPV (Revised)} (\text{₹ } 4,914 - \text{₹ } 1,000) = \text{₹ } 3,914$$

$$\text{Change in NPV} = (\text{₹ } 4,914 - \text{₹ } 3,914) / \text{₹ } 4,914 = 20.35\%$$

(ii) If Annual Running Cost is varied by say 10%*.

$$\text{NPV (Revised)} (\text{₹ } 4,914 - \text{₹ } 400 \times 0.917 - \text{₹ } 500 \times 0.842)$$

$$= \text{₹ } 4,914 - \text{₹ } 367 - \text{₹ } 421 = \text{₹ } 4,126$$

$$\text{Change in NPV} = (\text{₹ } 4,914 - \text{₹ } 4,126) / \text{₹ } 4,914 = 16.04\%$$

(iii) If Saving is varied by say 10%*.

$$\text{NPV (Revised)} (\text{₹ } 4,914 - \text{₹ } 1,200 \times 0.917 - \text{₹ } 1,400 \times 0.842)$$

$$= \text{₹ } 4,914 - \text{₹ } 1,100 - \text{₹ } 1,179 = \text{₹ } 2,635$$

$$\text{Change in NPV} = (\text{₹ } 4,914 - \text{₹ } 2,635) / \text{₹ } 4,914 = 46.38\%$$

Hence, savings factor is the most sensitive to affect the acceptability of the project.

* Any percentage of variation other than 10% can also be assumed.

Question 25

The Easygoing Company Limited is considering a new project with initial investment, for a product "Survival". It is estimated that IRR of the project is 16% having an estimated life of 5 years.

Financial Manager has studied that project with sensitivity analysis and informed that annual fixed cost sensitivity is 7.8416%, whereas cost of capital (discount rate) sensitivity is 60%.

Other information available are:

Profit Volume Ratio (P/V) is 70%, Variable cost ₹ 60/- per unit Annual Cash Flow ₹ 57,500/-

Ignore Depreciation on initial investment and impact of taxation.

Calculate

- (i) Initial Investment of the Project
- (ii) Net Present Value of the Project
- (iii) Annual Fixed Cost
- (iv) Estimated annual unit of sales
- (v) Break Even Units

Cumulative Discounting Factor for 5 years

8%	9%	10%	11%	12%	13%	14%	15%	16%	17%	18%
3.993	3.890	3.791	3.696	3.605	3.517	3.433	3.352	3.274	3.199	3.127

Solution:

(i) Initial Investment

IRR = 16% (Given)

At IRR, NPV shall be zero, therefore

Initial Cost of Investment = PVAF (16%, 5) × Cash Flow (Annual) = 3.274 × ₹ 57,500 = ₹ 1,88,255

(ii) Net Present Value (NPV)

Let Cost of Capital be X, then $16 - X/X = 60\%$ X=10%

Thus NPV of the project

= Annual Cash Flow × PVAF (10%, 5) - Initial Investment

= ₹ 57,500 × 3.791 - ₹ 1,88,255 = ₹ 2,17,982.50 - ₹ 1,88,255 = ₹ 29,727.50

(iii) Annual Fixed Cost

Let change in the Fixed Cost which makes NPV zero is X. Then,

₹ 29,727.50 - 3.791X = 0

Thus X = ₹ 7,841.60

Let original Fixed Cost be Y then,

$Y \times 7.8416\% = ₹ 7,841.60$

Y = ₹ 1,00,000

Thus Fixed Cost is equal to ₹ 1,00,000

(iv) Estimated Annual Units of Sales

Selling Price per unit = $\frac{60}{100\% - 70\%} = ₹ 200$

$\frac{\text{Annual Cash Flow} + \text{Fixed Cost}}{\text{P/V Ratio}} = \text{Sales Value}$

₹ 57,500 + ₹ 1,00,000 / 0.70 = ₹ 2,25,000

Sales in Units = ₹ 2,25,000 / ₹ 200 = 1,125 units

(v) Break Even Units

$\frac{\text{Fixed Cost}}{\text{Contribution Per Unit}} = \frac{1,00,000}{140} = 714.285 \text{ units}$

Question 26

Unnat Ltd. is considering investing ₹ 50,00,000 in a new machine. The expected life of machine is five years and has no scrap value. It is expected that 2,00,000 units will be produced and sold each year at a selling price of ₹ 30.00 per unit. It is expected that the variable costs to be ₹ 16.50 per unit and fixed costs to be ₹ 10,00,000 per year. The cost of capital of Unnat Ltd. is 12% and acceptable level of risk is 20%.

You are required to measure the sensitivity of the project's net present value to a change in the following project variables:

- (a) sale price;
- (b) sales volume;
- (c) variable cost;
- (d) On further investigation it is found that there is a significant chance that the expected sales volume of 2,00,000 units per year will not be achieved. The sales manager of Unnat Ltd. suggests that sales volumes could depend on expected economic states which could be assigned the following probabilities:

State of Economy	Annual Sales (in Units)	Prob.
Poor	1,75,000	0.30
Normal	2,00,000	0.60
Good	2,25,000	0.10

Calculate expected net present value of the project and give your decision whether company should accept the project or not.

Solution:

Calculation of NPV

$$\begin{aligned} &= - ₹ 50,00,000 + [2,00,000 (₹ 30 - ₹ 16.50) - ₹ 10,00,000] PVIAF (12\%, 5) \\ &= - ₹ 50,00,000 + [2,00,000 (₹ 13.50) - ₹ 10,00,000] 3.605 \\ &= - ₹ 50,00,000 + [₹ 27,00,000 - ₹ 10,00,000] 3.605 = - ₹ 50,00,000 + ₹ 61,28,500 = ₹ 11,28,500 \end{aligned}$$

Measurement of Sensitivity Analysis

(a) Sales Price:-

Let the sale price/Unit be S so that the project would break even with 0 NPV.

$$\therefore ₹ 50,00,000 = [2,00,000 (S - ₹ 16.50) - ₹ 10,00,000] PVIAF (12\%, 5)$$

$$₹ 50,00,000 = [2,00,000S - ₹ 33,00,000 - ₹ 10,00,000] 3.605$$

$$₹ 50,00,000 = [2,00,000S - ₹ 43,00,000] 3.605$$

$$₹ 13,86,963 = 2,00,000S - ₹ 43,00,000$$

$$₹ 56,86,963 = 2,00,000S$$

$$S = ₹ 28.43 \text{ which represents a fall of } (30 - 28.43)/30 \text{ or } 0.0523 \text{ or } 5.23\%$$

(b) Sales volume:-

Let V be the sale volume so that the project would break even with 0 NPV.

$$₹ 50,00,000 = [V (₹ 30 - ₹ 16.50) - ₹ 10,00,000] PVIAF (12\%, 5)$$

$$₹ 50,00,000 = [V (₹ 13.50) - ₹ 10,00,000] PVIAF (12\%, 5)$$

$$₹ 50,00,000 = [₹ 13.50V - ₹ 10,00,000] 3.605$$

$$₹ 13,86,963 = ₹ 13.50V - ₹ 10,00,000$$

$$₹ 23,86,963 = ₹ 13.50V$$

$$V = 1,76,812 \text{ which represents a fall of } (2,00,000 - 1,76,812)/2,00,000 \text{ or } 0.1159 \text{ or } 11.59\%$$

(c) Variable Cost:

Let the variable cost be V so that the project would break even with 0 NPV.

$$₹ 50,00,000 = [2,00,000(₹ 30 - V) - ₹ 10,00,000] PVIAF(12\%,5) \therefore$$

$$₹ 50,00,000 = [₹ 60,00,000 - 2,00,000 V - ₹ 10,00,000] 3.605$$

$$₹ 50,00,000 = [₹ 50,00,000 - 2,00,000 V] 3.605$$

$$₹ 13,86,963 = ₹ 50,00,000 - 2,00,000 V$$

$$₹ 36,13,037 = 2,00,000V$$

$$V = ₹ 18.07 \text{ which represents a fall of } (18.07 - 16.50)/16.50 \text{ or } 0.0951 \text{ or } 9.51\%$$

(d) Expected Net Present Value

$$(1,75,000 \times 0.30) + (2,00,000 \times 0.60) + (2,25,000 \times 0.10) = 1,95,000$$

$$NPV = [1,95,000 \times ₹ 13.50 - ₹ 10,00,000] 3.605 - ₹ 50,00,000 = ₹ 8,85,163$$

Further NPV in worst and best cases will be as follows:

$$\text{Worst Case: } [1,75,000 \times ₹ 13.50 - ₹ 10,00,000] 3.605 - ₹ 50,00,000 = - ₹ 88,188$$

$$\text{Best Case: } [2,25,000 \times ₹ 13.50 - ₹ 10,00,000] 3.605 - ₹ 50,00,000 = ₹ 23,45,188$$

Thus, there are 30% chances that the rise will be a negative NPV and 70% chances of positive NPV. Since acceptable level of risk of Unnat Ltd. is 20% and there are 30% chances of negative NPV hence project should not be accepted.

Question 27

The Textile Manufacturing Company Ltd., is considering one of two mutually exclusive proposals, Projects M and N, which require cash outlays of ₹ 8,50,000 and ₹ 8,25,000 respectively. The certainty-equivalent (C.E) approach is used in incorporating risk in capital budgeting decisions. The current yield on government bonds is 6% and this is used as the risk free rate. The expected net cash flows and their certainty equivalents are as follows:

Project M			Project N	
Year-end	Cash Flow ₹	C.E.	Cash Flow ₹	C.E.
1	4,50,000	0.8	4,50,000	0.9
2	5,00,000	0.7	4,50,000	0.8
3	5,00,000	0.5	5,00,000	0.7

Present value factors of ₹ 1 discounted at 6% at the end of year 1, 2 and 3 are 0.943, 0.890 and 0.840 respectively. Required:

- Which project should be accepted?
- If risk adjusted discount rate method is used, which project would be appraised with a higher rate and why?

Solution:

(i) Statement Showing the Net Present Value of Project M

Year end	Cash Flow (₹) (a)	C.E. (b)	Adjusted Cash flow (₹) (c) = (a) x (b)	Present value factor at 6% (d)	Total Present value (₹) (e) = (c) x (d)
1	4,50,000	0.8	3,60,000	0.943	3,39,480
2	5,00,000	0.7	3,50,000	0.890	3,11,500
3	5,00,000	0.5	2,50,000	0.840	<u>2,10,000</u>
					8,60,980
Less: Initial Investment					<u>8,50,000</u>
Net Present Value					<u>10,980</u>

Statement Showing the Net Present Value of Project N

Year end	Cash Flow (₹) (a)	C.E. (b)	Adjusted Cash flow (₹) (c) = (a) x (b)	Present value factor (d)	Total Present value (₹) (e) = (c) x (d)
1	4,50,000	0.9	4,05,000	0.943	3,81,915
2	4,50,000	0.8	3,60,000	0.890	3,20,400
3	5,00,000	0.7	3,50,000	0.840	<u>2,94,000</u>
					9,96,315
Less: Initial Investment					<u>8,25,000</u>
Net Present Value					<u>1,71,315</u>

Decision: Since the net present value of Project N is higher, so the project N should be accepted.

(ii) Certainty - Equivalent (C.E.) Co-efficient of Project M (2.0) is lower than Project N (2.4). This means Project M is riskier than Project N as "higher riskiness of a cash flow, lower will be CE factor". If risk adjusted discount rate (RADR) method is used, Project M would be analysed with a higher rate.

RADR is based on the premise that riskiness of a proposal may be taken care of, by adjusting the discount rate. The cash flows from a more risky proposal should be discounted at a relatively higher discount rate as compared to other proposals whose cash flows are less risky. Any investor is basically risk averse. However, he may be ready to take risk provided he is rewarded for undertaking risk by higher returns. So, more risky the investment is, the greater would be the expected return. The expected return is expressed in terms of discount rate which is also the minimum required rate of return generated by a proposal if it is to be accepted. Therefore, there is a positive correlation between risk of a proposal and the discount rate.

Question 28

Determine the risk adjusted net present value of the following projects:

	X	Y	Z
Net cash outlays (₹)	2,10,000	1,20,000	1,00,000
Project life	5 years	5 years	5 years
Annual Cash inflow (₹)	70,000	42,000	30,000
Coefficient of variation	1.2	0.8	0.4

The Company selects the risk-adjusted rate of discount on the basis of the coefficient of variation:

Coefficient of Variation	Risk-Adjusted Rate of Return	P.V. Factor 1 to 5 years At risk adjusted rate of discount
0.0	10%	3.791
0.4	12%	3.605
0.8	14%	3.433
1.2	16%	3.274
1.6	18%	3.127
2.0	22%	2.864
More than 2.0	25%	2.689

Solution:

Statement showing the determination of the risk adjusted net present value

Projects	Net cash outlays	Coefficient of variation	Risk adjusted discount rate	Annual cash inflow	PV factor 1-5 years	Discounted cash inflow	Net present value
	₹			₹		₹	₹
(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii) = (v) x (vi)	(viii) = (vii) x (ii)
X	2,10,000	1.20	16%	70,000	3.274	2,29,180	19,180
Y	1,20,000	0.80	14%	42,000	3.433	1,44,186	24,186
Z	1,00,000	0.40	12%	30,000	3.605	1,08,150	8,150

Question 29

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:

- (i) 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:

$$\text{Required Rate of Return} = I_{Rf} + (k_o - I_{Rf}) \text{ Risk Factor}$$

$$\text{For P-I : RADR} = 0.10 + (0.15 - 0.10) 1.80 = 19\%$$

$$\text{For P-II : RADR} = 0.10 + (0.15 - 0.10) 1.00 = 15\%$$

$$\text{For P-III : RADR} = 0.10 + (0.15 - 0.10) 0.60 = 13\%$$

- (ii) 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 (₹ 6,00,000 × 2.639)	₹ 15,83,400
Less: Cost of Investment	₹ 15,00,000
Net Present Value	₹ 83,400

Project P-II

Year	Cash Inflow (₹)	PVF (15%,n)	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	<u>1,14,400</u>
Total Present Value			12,67,800
Less: Cost of Investment			<u>11,00,000</u>
Net Present Value			<u>1,67,800</u>

Project P-III

Year	Cash Inflow (₹)	PVF (13%,n)	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	<u>7,35,600</u>
Total Present Value			21,13,800
Less: Cost of Investment			<u>19,00,000</u>
Net Present Value			<u>2,13,800</u>

Project P-III has highest NPV. So, it should be accepted by the firm

Question 30

A firm has projected the following cash flows from a project under evaluation:

Year	₹ lakhs
0	(70)
1	30
2	40
3	30

The above cash flows have been made at expected prices after recognizing inflation. The firm's cost of capital is 10%. The expected annual rate of inflation is 5%.

Show how the viability of the project is to be evaluated.

Solution:

It is stated that the cash flows have been adjusted for inflation; hence they are "nominal". The cost of capital or discount rate is "real". In order to be compatible, the cash flows should be converted into "real flow". This is done as below:

Year	Nominal cash flows	Adjusted Inflation* factor	Real cash flows	PVF @ 10%	PV of cash flows
0	(70)	-	(70)	1.000	(70)
1	30	0.952	28.56	0.909	25.96
2	40	0.907	36.28	0.826	29.97
3	30	0.864	25.92	0.751	19.47
				Total	75.40
Less: Cash out flow					<u>70.00</u>
NPV (+)					<u>5.40</u>

* $1/1.05$; $1/(1.05)^2$; $1/(1.05)^3$;

Advise: With positive NPV, the project is financially viable.

Alternatively, instead of converting cash flows into real terms, the discount rate can be converted into nominal rate. Result will be the same.

An alternative solution is presented herewith

Alternative solution:

Year	Nominal cash flows	PVF @ 15.50% adjusted by the inflation factor i.e. 5%*	PV of cash flows
1	30	0.866	25.98
2	40	0.749	29.96
3	30	0.649	<u>19.47</u>
		Cash inflow	75.41
		Less: Cash out flow	<u>70.00</u>
		Net present value	<u>5.41</u>

* $0.909/1.05=0.866$, $0.826/1.1025=0.749$, $0.751/1.1576=0.649$

Advise: With positive NPV, the project is financially viable.

Question 31

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

Year	0	1	2	3
₹ (in lakhs)	(72)	30	40	30

The above cash flows have been made at expected prices after recognizing inflation. The firm's cost of capital is 10%. The expected annual rate of inflation is 5%. Show how the viability of the project is to be evaluated. PVF at 10% for 1-3 years are 0.909, 0.826 and 0.751.

Solution:

Here the given cash flows have to be adjusted for inflation. Alternatively, the discount rate can be converted into nominal rate, as follows:-

Year 1 = $0.909/1.05 = 0.866$; Year 2 = $0.826/(1.05)^2$ or $0.826/1.1025 = 0.749$

Year 3 = $0.751/(1.05)^3 = 0.751/1.1576 = 0.649$

Year	Nominal Cash Flows (₹ in lakhs)	Adjusted PVF as above	PV of Cash Flows (₹ in lakhs)
1	30	0.866	25.98
2	40	0.749	29.96
3	30	0.649	<u>19.47</u>
	Cash Inflow		75.41
	Less: Cash Outflow		<u>72.00</u>
	Net Present Value		<u>3.41</u>

With positive NPV, the project is financially viable.

Alternative Solution

Assumption: The cost of capital given in the question is "Real".

Nominal cost of capital = $(1.10)(1.05) - 1 = 0.155 = 15.50\%$

DCF Analysis of the project

(₹ Lakhs)				
	Period	PVF @15.50%	CF	PV
Investment	0	1	-72	-72.00
Operation	1	0.866	30	+25.98
---do---	2	0.750	40	+30.00
---do---	3	0.649	30	<u>+19.47</u>
NPV				<u>+3.45</u>

The proposal may be accepted as the NPV is positive.

Question 32

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:

(i) 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

(ii) 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

(iii) Tax Benefit on Depreciation = ₹ 5,00,000 × 0.35 = ₹ 1,75,000

(iv) Net Profit after Tax

Year	Revenues (Inflation Adjusted) (₹) (1)	Costs (Inflation Adjusted) (₹) (2)	Net Profit (₹) (3) = (1) - (2)	Tax (₹) (4) = 35% of (3)	Profit after Tax (₹) (3) - (4)
1	10,90,000	5,50,000	5,40,000	1,89,000	3,51,000
2	15,30,360	7,19,400	8,10,960	2,83,836	5,27,124
3	17,46,965	8,33,905	9,13,060	3,19,571	5,93,489

(v) Present Value of Cash Inflows

Year	Net Profit after tax (₹)	Tax Benefit on Depreciation (₹)	Cash Inflow (₹)	PVF@ 14%	PV (₹)
1	3,51,000	1,75,000	5,26,000	0.877	4,61,302
2	5,27,124	1,75,000	7,02,124	0.769	5,39,933
3	5,93,489	1,75,000	7,68,489	0.675	5,18,730
					15,19,965

$$NPV = ₹ 15,19,965 - ₹ 15,00,000 = ₹ 19,965$$

Question 33

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:

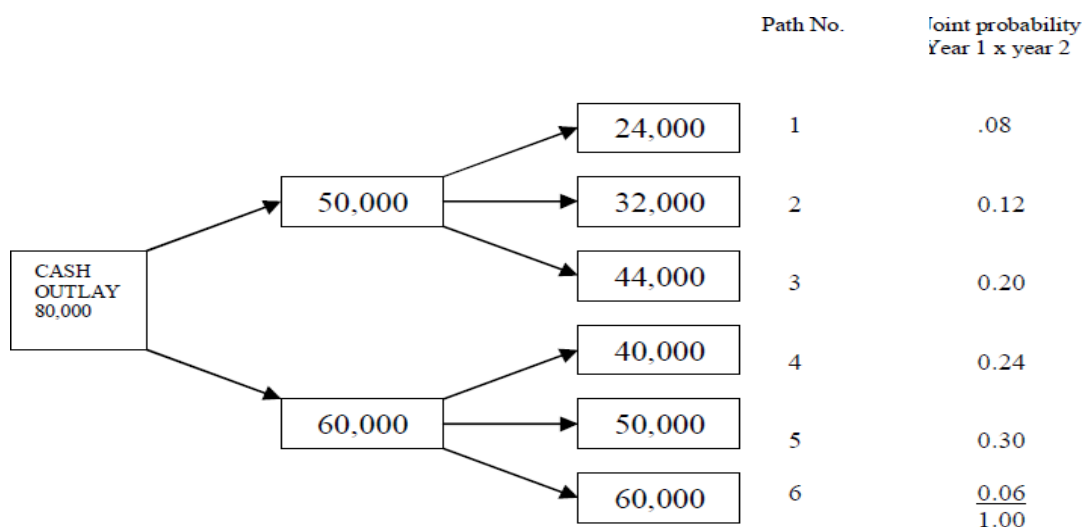
The cash inflow year 1	₹ 50,000		₹ 60,000	
The cash inflow year 2	Probability		Probability	
	₹ 24,000	0.2	₹ 40,000	0.4
	₹ 32,000	0.3	₹ 50,000	0.5
	₹ 44,000	0.5	₹ 60,000	0.1

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?
- Will the project be accepted?
(Note: 10% discount factor 1 year 0.909; 2 year 0.826)

Solution:

- 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	Year 1 Cash Flows (₹)	Year 2 Cash Flows (₹)	Total Cash Inflows (PV) (₹)	Cash Inflows NPV (₹)	
1	50,000x.909 = 45,450	24,000x.826 = 19,824	65,274	80,000	(—) 14,726
2	45,450	32,000x.826 = 26,432	71,882	80,000	(—) 8,118
3	45,450	44,000x.826 = 36,344	81,794	80,000	1,794
4	60,000x.909 = 54,540	40,000x.826 = 33,040	87,580	80,000	7,580
5	54,540	50,000x.826 = 41,300	95,840	80,000	15,840
6	54,540	60,000x.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	<u>1,446.00</u>
			<u>6,223.76</u>

- (ii) If the worst outcome is realized the project will yield NPV of - ₹ 14,726. The probability of occurrence of this NPV is 8% and a loss of ₹ 1,178 (path 1).
- (iii) The best outcome will be path 6 when the NPV is at ₹ 24,100. The probability of occurrence of this NPV is 6% and a expected profit of ₹ 1,446.
- (iv) The project should be accepted because the expected NPV is positive at ₹ 6,223.76 based on joint probability.

Question 34

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

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

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

Project A					
Cash Flow (₹)	-15000	-10000	15000	10000	5000
Probability	0.10	0.20	0.40	0.20	0.10
Project B					
Cash Flow (₹)	-10000	-4000	15000	5000	10000
Probability	0.10	0.15	0.40	0.25	0.10

Which project should be selected and why ?

Solution:

Evaluation of project utilizes of Project A and Project B

Cash flow (in ₹)	Project A		
	Probability	Utility	Utility value
-15,000	0.10	-100	-10
-10,000	0.20	-60	-12
15,000	0.40	40	16
10,000	0.20	30	6
5,000	0.10	20	<u>2</u>
			<u>2</u>

Cash flow (in ₹)	Project B		
	Probability	Utility	Utility value
-10,000	0.10	-60	-6
-4,000	0.15	-3	-0.45
15,000	0.40	40	16
5,000	0.25	20	5
10,000	0.10	30	<u>3</u>
			<u>17.55</u>

Project B should be selected as its expected utility is more.

Question 35

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

Year	Maintenance (₹)	Salvage (₹)
Present	0	40,000
1	10,000	25,000
2	20,000	15,000
3	30,000	10,000
4	40,000	0

The opportunity cost of capital for A & Co. is 15%.

Required: When should the company replace the machine?

(Notes: Present value of an annuity of Re. 1 per period for 8 years at interest rate of 15% : 4.4873; present value of Re. 1 to be received after 8 years at interest rate of 15% : 0.3269).

Solution:

A & Co. Equivalent cost of (EAC) of new machine

		₹
(i)	Cost of new machine now	90,000
	Add: PV of annual repairs @ ₹ 10,000 per annum for 8 years (₹ 10,000 × 4.4873)	
		<u>44,873</u>
		1,34,873
	Less: PV of salvage value at the end of 8 years (₹20,000×0.3269)	6,538
		<u>1,28,335</u>
	Equivalent annual cost (EAC) (₹ 1,28,335/4.4873)	<u>28,600</u>

PV of cost of replacing the old machine in each of 4 years with new machine

Scenario	Year	Cash Flow	PV @ 15%	PV
		(₹)		(₹)
Replace Immediately	0	(28,600)	1.00	(28,600)
		40,000	1.00	<u>40,000</u>
				<u>11,400</u>
Replace in one year	1	(28,600)	0.870	(24,882)
	1	(10,000)	0.870	(8,700)
	1	25,000	0.870	<u>21,750</u>
				<u>(11,832)</u>

Replace in two years	1	(10,000)	0.870	(8,700)
	2	(28,600)	0.756	(21,622)
	2	(20,000)	0.756	(15,120)
	2	15,000	0.756	<u>11,340</u>
				<u>(34,102)</u>
Replace in three years	1	(10,000)	0.870	(8,700)
	2	(20,000)	0.756	(15,120)
	3	(28,600)	0.658	(18,819)
	3	(30,000)	0.658	(19,740)
	3	10,000	0.658	<u>6,580</u>
				<u>(55,799)</u>
Replace in four years	1	(10,000)	0.870	(8,700)
	2	(20,000)	0.756	(15,120)
	3	(30,000)	0.658	(19,740)
	4	(28,600)	0.572	(16,359)
	4	(40,000)	0.572	<u>(22,880)</u>
				<u>(82,799)</u>

Advice: The company should replace the old machine immediately because the PV of cost of replacing the old machine with new machine is least.

Alternatively, optimal replacement period can also be computed using the following table:

Scenario	Year	Cashflow	PV at 15%	PV
Replace immediately	0	(40,000)	1	(40,000)
	1 to 4	28,600	2.855	81,652
				41,652
Replace after 1 year	1	10,000	0.870	8,696
	1	(25,000)	0.870	(21,739)
	2 to 4	28,600	1.985	56,783
				43,739
Replace after 2 years	1	10,000	0.870	8,696
	2	20,000	0.756	15,123
	2	(15,000)	0.756	(11,342)
	3 and 4	28,600	1.229	35,157
				47,633

Replace after 3 years	1	10,000	0.870	8,696
	2	20,000	0.756	15,123
	3	30,000	0.658	19,725
	3	(10,000)	0.658	(6,575)
	4	28,600	0.572	16,352
				53,321
Replace after 4 years	1	10,000	0.870	8,696
	2	20,000	0.756	15,123
	3	30,000	0.658	19,725
	4	40,000	0.572	22,870
				66,414

Question 36

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 per cent.

P.V.F. of 15%, 5 = 0.870, 0.756, 0.658, 0.572 and 0.497. You are required to advise the company as to which alternative is to be adopted.

Solution:

(A)	Cash Outflow	₹
	(i)	In case machine is upgraded:
		Upgradation Cost
		<u>10,00,000</u>
	(ii)	In case new machine installed:
		Cost
		20,00,000
		Add: Installation cost
		<u>50,000</u>
		Total Cost
		20,50,000
		Less: Disposal of old machine
		₹ 50,000 - 40% tax
		<u>30,000</u>
		Total Cash Outflow
		<u>20,20,000</u>

Working Note:

- (i) Depreciation - in case machine is upgraded
 $\text{₹ } 10,00,000 \div 5 = \text{₹ } 2,00,000$
- (ii) Depreciation - in case new machine is installed
 $\text{₹ } 20,50,000 \div 5 = \text{₹ } 4,10,000$
- (iii) Old existing machine - Book Value is zero. So, no depreciation.

(B) Cash Inflows after Taxes (CFAT)

Year	Old Existing Machine	Upgraded Machine			
	(i) EAT/CFAT ₹	(ii) EAT ₹	(iii) DEP ₹	(iv) CFAT ₹	= (iv)-(i) Incremental CFAT ₹
1	5,00,000	5,50,000	2,00,000	7,50,000	2,50,000
2	5,40,000	5,90,000	2,00,000	7,90,000	2,50,000
3	5,80,000	6,10,000	2,00,000	8,10,000	2,30,000
4	6,20,000	6,50,000	2,00,000	8,50,000	2,30,000
5	6,60,000	7,00,000	2,00,000	9,00,000	2,40,000

Cash Inflow after Taxes (CFAT)

Year		New Machine		
	(vi) EAT ₹	(vii) DEP ₹	(viii) CFAT ₹	(ix) = (viii) - (i) Incremental CFAT (₹)
1	6,00,000	4,10,000	10,10,000	5,10,000
2	6,40,000	4,10,000	10,50,000	5,10,000
3	6,90,000	4,10,000	11,00,000	5,20,000
4	7,40,000	4,10,000	11,50,000	5,30,000
5	8,00,000	4,10,000	12,10,000	5,50,000

P.V. AT 15% - 5 Years - on Incremental CFAT

Year	Upgraded Machine			New Machine		
	Incremental CFAT ₹	PVF	Total P.V. ₹	Incremental CFAT	PVF	Total PV ₹
1	2,50,000	0.870	2,17,500	5,10,000	0.870	4,43,700
2	2,50,000	0.756	1,89,000	5,10,000	0.756	3,85,560
3	2,30,000	0.658	1,51,340	5,20,000	0.658	3,42,160
4	2,30,000	0.572	1,31,560	5,30,000	0.572	3,03,160
5.	2,40,000	0.497	1,19,280	5,50,000	0.497	2,73,350
Total P.V. of CFAT			8,08,680			17,47,930
Less: Cash Outflows			10,00,000			20,20,000*
N.P.V. =			-1,91,320			- 2,72,070

*Acquisition Cost (including installation cost)	₹ 20,50,000
Less: Salvage Value of existing machine net of Tax	<u>₹ 30,000</u>
	<u>₹ 20,20,000</u>

As the NPV in both the new (alternative) proposals is negative, the company should continue with the existing old Machine.

Question 37

Company X is forced to choose between two machines A and B. The two machines are designed differently but have identical capacity and do exactly the same job. Machine A costs ₹ 1,50,000 and will last for 3 years. It costs ₹ 40,000 per year to run. Machine B is an 'economy' model costing only ₹ 1,00,000, but will last only for 2 years, and costs ₹ 60,000 per year to run. These are real cash flows. The costs are forecasted in rupees of constant purchasing power. Ignore tax. Opportunity cost of capital is 10 per cent. Which machine company X should buy?

Solution:

Statement showing the evaluation of two machines

Machines	A	B
Purchase cost (₹): (i)	1,50,000	1,00,000
Life of machines (years)	3	2
Running cost of machine per year (₹): (ii)	40,000	60,000
Cumulative present value factor for 1-3 years @ 10% (iii)	2.486	-
Cumulative present value factor for 1-2 years @ 10% (iv)	-	1.735
Present value of running cost of machines (₹): (v)	99,440	1,04,100
	[(ii) × (iii)]	[(ii) × (iv)]
Cash outflow of machines (₹): (vi) = (i) + (v)	2,49,440	2,04,100
Equivalent present value of annual cash outflow	1,00,338	1,17,637
	[(vi) ÷ (iii)]	[(vi) ÷ (iv)]

Decision: Company X should buy machine A since its equivalent cash outflow is less than machine B.

Question 38

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

Solution:

Stmnt showing present value of cash inflow of new machine when it replaces elderly machine now

NPV of New Machine

PV of Cash Inflow (80000 × 2.486)	₹ 1,98,880
Less: Purchase Cost of New Machine	<u>₹ 1,50,000</u>
	<u>₹ 48,880</u>

Since NPV of New Machine is positive, it should be purchased.

Timing Decision

Replace Now

Current Realizable Value	₹ 80,000
NPV of New Machine	₹ 48,880
Total NPV	<u>₹ 1,28,880</u>

Replace after 1 Year

Cash Inflow for Year 1	₹ 40000
Realisable Value of Old Machine	₹ 70000
NPV of New Machine	₹ 48,880
Total NPV after 1 Year	<u>₹ 1,58,880</u>
PV of Total NPV (158880/1.1)	₹ 1,44,436

Advise: Since Total NPV is higher in case of Replacement after one year Machine should be replaced after 1 year.

Question 39

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:

Working Notes: First of all, we shall calculate cash flows for each replacement cycle as follows:

One Year Replacement Cycle

Year	Replacement Cost	Maintenance & Repair	Residual Value	Net cash Flow
0	(60,000)	-	-	(60,000)
1	-	(16,000)	32,000	16,000

Two Years Replacement Cycle

Year	Replacement Cost	Maintenance & Repair	Residual Value	Net cash Flow
0	(60,000)	-	-	(60,000)
1	-	(16,000)	-	(16,000)
2	-	(22,000)	24,000	2,000

Three Years Replacement Cycle

Year	Replacement Cost	Maintenance & Repair	Residual Value	Net cash Flow
0	(60,000)	-	-	(60,000)
1	-	(16,000)	-	(16,000)
2	-	(22,000)	-	(22,000)
3	-	(28,000)	16,000	(12,000)

Four Years Replacement Cycle

Year	Replacement Cost	Maintenance & Repair	Residual Value	Net cash Flow
0	(60,000)	-	-	(60,000)
1	-	(16,000)	-	(16,000)
2	-	(22,000)	-	(22,000)
3	-	(28,000)	-	(28,000)
4	-	(36,000)	8,000	(28,000)

Now we shall calculate NPV for each replacement cycles

		1 Year		2 Years		3 Years		4 Years	
Year	PVF @ 15%	Cash Flows	PV	Cash Flows	PV	Cash Flows	PV	Cash Flows	PV
0	1	-60,000	-60,000	-60,000	-60,000	-60,000	-60,000	-60,000	-60,000
1	0.8696	16,000	13,914	-16,000	-13,914	-16,000	-13,914	-16,000	-13,914
2	0.7561	-	-	2,000	1,512	-22,000	-16,634	-22,000	-16,634
3	0.6575	-	-	-	0	-12,000	-7,890	-28,000	-18,410
4	0.5718	-	-	-	0		0	-28,000	-16,010
			-46,086		-72,402		-98,438		-1,24,968

Replacement Cycles	EAC (₹)
1 Year	46,086/0.8696
2 Years	72,402/1.6257
3 Years	98,438/2.2832
4 Years	1,24,968/2.855

Since EAC is least in case of replacement cycle of 3 years hence machine should be replaced after every three years.

Question 40

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

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

Period	₹
1 Year old	35,000
2 Year old	21,000
3 Year old	9,000

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

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

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

Solution:

In this question the effect of increasing running cost and decreasing resale value have to be weighted upto against the purchase cost of bike. For this purpose, we shall compute Equivalent Annual Cost (EAC) of replacement in different years shall be computed and compared.

Year	Road Taxes (₹)	Petrol etc. (₹)	Total (₹)	PVF @10%	PV (₹)	Cumulative PV (₹)	PV of Resale Price (₹)	Net Outflow (₹)
1	3,000	30,000	33,000	0.909	29,997	29,997	31,815	(1,818)
2	3,000	35,000	38,000	0.826	31,388	61,385	17,346	44,039
3	3,000	43,000	46,000	0.751	34,546	95,931	6,759	89,172

Computation of EACs

Year	Purchase Price of Bike (₹)	Net Outflow (₹)	Total Outflow (₹)	PVAF @ 10%	EAC (₹)
1	55,000	(1,818)	53,182	0.909	58,506
2	55,000	44,039	99,039	1.735	57,083
3	55,000	89,172	1,44,172	2.486	57,993

Thus, from above table it is clear that EAC is least in case of 2 years, hence bike should be replaced every two years.

Question 41

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

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

The annual costs of the two plants are as follows:

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

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

Note: 10 percent interest tables

	20 Years	15 Years
Present value of ₹ 1	0.1486	0.2394
Annuity of ₹ 1 (capital recovery factor with 10% interest)	8.511	7.605

Solution:

Working Notes:

Calculation of Equivalent Annual Cost

	Machine A	Machine B
Cash Outlay	₹ 24,00,000	₹ 40,00,000
Less: PV of Salvage Value		
4,00,000 × 0.1486	₹ 59,440	
4,00,000 × 0.2394		₹ 95,760
Annuity Factor	8.511	7.605
	₹ 2,75,016	₹ 5,13,408

Computation of Cost Per Unit

	Machine A	Machine B
Annual Output (a)	2500 × 60 × 200	2500 × 60 × 400
	= 3,00,00,000	= 6,00,00,000
Annual Cost (b)	₹	₹
Wages	1,00,000	1,40,000
Indirect Material	4,80,000	6,00,000
Repairs	80,000	1,00,000
Powers	2,40,000	2,80,000
Fixed Cost	60,000	80,000
Equivalent Annual Cost	<u>2,75,016</u>	<u>5,13,408</u>
Total	<u>12,35,016</u>	<u>17,13,408</u>
Cost Per Unit (b)/(a)	0.041167	0.02860

Decision: As the unit cost is less in proposed Plant B, it may be recommended that it is advantageous to acquire Plant B.

Question 42

XYZ Ltd., an infrastructure company is evaluating a proposal to build, operate and transfer a section of 35 kms. of road at a project cost of ₹ 200 crores to be financed as follows:

Equity Shares Capital ₹ 50 crores, loans at the rate of interest of 15% p.a. from financial institutions ₹ 150 crores.

The Project after completion will be opened to traffic and a toll will be collected for a period of 15 years from the vehicles using the road. The company is also required to maintain the road during the above 15 years and after the completion of that period, it will be handed over to the Highway authorities at zero value.

It is estimated that the toll revenue will be ₹ 50 crores per annum and the annual toll collection expenses including maintenance of the roads will amount to 5% of the project cost.

The company considers to write off the total cost of the project in 15 years on a straight line basis.

For Corporate Income- tax purposes the company is allowed to take depreciation @ 10% on WDV basis. The financial institutions are agreeable for the repayment of the loan in 15 equal annual instalments - consisting of principal and interest.

Calculate Project IRR and Equity IRR. Ignore Corporate taxation. Explain the difference in Project IRR and Equity IRR.

Solution:

Computation of Project IRR

Project IRR is computed by using the following equation:

Where,

CO_0 = Cash outflow at time zero

CF_i = Net cash inflow at different points of time

N = Life of the project and

R = Rate of discount (IRR)

$CO_0 = ₹ 200 \text{ crores}$

$CF_i = ₹ 40 \text{ crores p.a. for 15 years [Refer to working note (i)]}$

Therefore,

$$200 \text{ Crore} = 40 \text{ crores} / (1+r)^{15}$$

The estimate of IRR cash inflow of the project for both these rates is as follows:

$$\text{At } 18\% = ₹ 40 \text{ crores} \times \text{PVAF}(18\%, 15 \text{ years}) = ₹ 40 \text{ crores} \times 5.092 = ₹ 203.68 \text{ crores}$$

$$\text{At } 19\% = ₹ 40 \text{ crores} \times \text{PVAF}(19\%, 15 \text{ years}) = ₹ 40 \text{ crores} \times 4.876 = ₹ 195.04 \text{ crores}$$

The exact IRR by interpolating between 18% and 19% is worked out as follows:

$$\text{IRR} = 18\% + \frac{203.68 \text{ Crores} - 200 \text{ Crores}}{203.68 \text{ Crores} - 195.04 \text{ Crores}} \times 1 = 18\% + \frac{3.68 \text{ Crores}}{8.64 \text{ Crores}} \times 1 = 18\% + 0.426\% = 18.43\%$$

Therefore, the IRR of the project is 18.43%.

Working Notes:

(i). Net cash inflow of the project

Cash inflow

Toll revenue 50 crores p.a. for 15 years

Cash outflow

Toll collection expenses including maintenance of the roads 10 crores p.a. for 15 years
(5% of ₹ 200 crores)

Net cash inflow 40 crores p.a. for 15 years

Note: Since corporate taxes is not payable. The impact of depreciation need not be considered.

Computation of Equity IRR

Equity IRR is computed by using the following equation:

$$\text{Cash inflow at zero date from equity shareholders} = \frac{\text{Cash Inflow available for equity shareholders}}{(1+r)^n}$$

Where,

r = Equity IRR

n = Life of the project

Here, Cash inflow at zero date from equity shareholders = ₹ 50 crores

Cash inflow for equity shareholders = ₹ 14.35 crores p.a.

(Refer to working note)

Therefore:

$$50 \text{ Crores} = \frac{14.35 \text{ Crores}}{(1+r)^n}$$

The estimated NPV of the project at 25% = ₹ 14.35 crores $\times$ 3.859 = ₹ 55.3766 crores.

The estimated NPV of the project at 30% = ₹ 14.35 crores $\times$ 3.268 = ₹ 46.896 crores

IRR by using Interpolation Formula will be

$$= 25\% + \frac{55.377 - 50}{55.3766 - 46.896} \times 5\% = 25\% + \frac{5.377}{8.4806} \times 5\% = 25\% + 3.17\% = 28.17\%$$

Equated annual instalment (i.e. principal + interest) of loan from financial institution:

Amount of loan from financial institution	₹ 150 crores
Rate of interest	15% p.a.
No. of years	15
Cumulative discount factor for 1-15 years	5.847

Hence, equated yearly instalment will be ₹ 150 crores/5.847 i.e. ₹ 25.65 crores.

Cash inflow available for equity shareholders

Net cash inflow of the project	₹ 40.00 crores
[Refer to working note (i)]	
Equated yearly instalment of the project	₹ 25.65 crores
[Refer to working note (ii)]	
Cash inflow available for equity shareholders	₹ 14.35 crores

Difference in Project IRR and Equity IRR:

The project IRR is 18.4% whereas Equity IRR is 28%. This is attributed to the fact that XYZ Ltd. is earning 18.4% on the loan from financial institution but paying only 15%. The difference between the return and cost of funds from financial institution has enhanced equity IRR.

3.4% (18.4% - 15%) earnings on ₹ 150 cr goes to equity shareholders who have invested ₹ 50 crore.

Question 43

ABC Chemicals is evaluating two alternative systems for waste disposal, System A and System B, which have lives of 6 years and 4 years respectively. The initial investment outlay and annual operating costs for the two systems are expected to be as follows:

	System A	System B
Initial Investment Outlay	₹5 million	₹4 million
Annual Operating Costs	₹1.5 million	₹1.6 million
Salvage Value	₹1 million	₹0.5 million

If the hurdle rate is 15%, which system should ABC Chemicals choose?

The PVIF @ 15% for the six years are as below:

Year	1	2	3	4	5	6
PVIF	0.8696	0.7561	0.6575	0.5718	0.4972	0.4323

Solution:**PV of Total Cash Outflow under System A**

	₹
Initial Outlay	50,00,000
PV of Annual Operating Cost (1-6 years) $15,00,000 \times 3.7845$	56,76,750
Less: PV of Salvage Value $₹ 10,00,000 \times 0.4323$	<u>(4,32,300)</u>
	<u>1,02,44,450</u>
PVAF (15%, 6)	3.7845
Equivalent Annual Cost $(1,02,44,450/3.7845)$	27,06,949

PV of Total Cash Outflow under System B

Initial Outlay	40,00,000
PV of Annual Operating Cost (1-4 years) $16,00,000 \times 2.855$	45,68,000
Less: PV of Salvage Value ₹ $5,00,000 \times 0.5718$	(2,85,900)
	82,82,100
PVAF (15%, 4)	2.855
Equivalent Annual Cost $(82,82,100/2.855)$	29,00,911

Since Equivalent Annual Cost (EAC) is least in case of system A hence same should be opted.

Question 44 (ACB)

[NOV 20]

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

The following information is available:

The initial investment will be in purchase of equipment costing USD 250 lakhs. The economic life of the equipment is 10 years. The depreciation on the equipment will be charged on straight line method.

EBIDTA to be collected from the Toll Road is projected to be USD 33 lakhs per annum for a period of 20 years. To encourage investment Nepalese government is offering a 15 year term loan of USD 150 lakhs at an interest rate of 6 per cent per annum. The interest is to be paid annually. The loan will be repaid at the end of 15 year in one tranche.

The required rate of return for the project under all equity financing is 12 per cent per annum. Post tax cost of debt is 5.6 per cent per annum. Corporate Tax Rate is 30 per cent.

All cash Flows will be in USD. Ignore inflation. You are required to advise the management on the viability of the proposal by using Adjusted Net Present Value method.

Given

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

Solution:

Net Present Value (All Equity Financed) - Base NPV

Particulars	Period	USD Lakhs	PVF @ 12%	PV (USD Lakhs)
Initial Investment	0	(250.00)	1.000	(250.000)
EBIDTA	1 to 20	33.00	7.469	246.477
Tax	1 to 20	(9.90)	7.469	(73.943)
Depreciation	1 to 10	(25.00)		
Tax Saving on Dep	1 to 10	7.50	5.650	42.375
NPV				(35.091)

Present Value of Impact of Financing by Debt

Particulars	Period	USD Lakhs	PVF @ 8%	PV (USD Lakhs)
Loan	0	150.00	1.000	150.000
Interest	1 to 15	(9.00)	8.559	(77.031)
Tax Saving on Interest	1 to 15	2.70	8.559	23.109
Repayment of Principal	15	(150.00)	0.315	(47.250)
NPV				48.828

Adjusted Present Value of the Project

= Base NPV + PV of Impact of Financing = - US\$ 35.091 + US \$ 48.828 lakh = US\$ 13.737 lakh

Advise: Since APV is positive, TL Ltd. should accept the project.

Alternatively, if instead of PV of overall impact of Financing the PV of impact of tax shield on Interest is considered then APV shall be computed as follows:

= Base NPV + PV of Tax Shield on Interest = - US \$ 35.091 + US \$ 23.109 lakh = - US \$ 11.982 lakh

Advise: Since APV is negative, TL Ltd. should not accept the project.



Security Analysis

Question 1 Closing values of NSE Sensex from 6th to 17th day of the month of January of the year 2020 were as follows:

Days	Date	Day	Sensex
1	6	THU	14522
2	7	FRI	14925
3	8	SAT	No Trading
4	9	SUN	No Trading
5	10	MON	15222
6	11	TUE	16000
7	12	WED	16400
8	13	THU	17000
9	14	FRI	No Trading
10	15	SAT	No Trading
11	16	SUN	No Trading
12	17	MON	18000

Calculate Exponential Moving Average (EMA) of Sensex during the above period. The previous day exponential moving average of Sensex can be assumed as 15,000. The value of exponent for 31 days EMA is 0.062. Give detailed analysis on the basis of your calculations.

Solution

Date	1 Sensex	2 EMA for Previous day	3 (1-2)	4 (3 × 0.062)	5 (EMA 2 + 4)
6	14522	15000	(478)	(29.636)	14970.364
7	14925	14970.364	(45.364)	(2.812)	14967.55
10	15222	14967.55	254.45	15.776	14983.32
11	16000	14983.32	1016.68	63.034	15046.354
12	16400	15046.354	1353.646	83.926	15130.28
13	17000	15130.28	1869.72	115.922	15246.202
17	18000	15246.202	2753.798	170.735	15416.937

Conclusion - The market is bullish. The market is likely to remain bullish for short term to medium term if other factors remain the same. On the basis of this indicator (EMA) the investors/brokers can take long position.

Question 2

The closing value of a Stock Market Index for the month of October, 2007 is given below:

Date Closing	Index Value
1.10.07	2800
3.10.07	2780
4.10.07	2795
5.10.07	2830
8.10.07	2760
9.10.07	2790
10.10.07	2880
11.10.07	2960
12.10.07	2990
15.10.07	3200
16.10.07	3300
17.10.07	3450
19.10.07	3360
22.10.07	3290
23.10.07	3360
24.10.07	3340
25.10.07	3290
29.10.07	3240
30.10.07	3140
31.10.07	3260

You are required to test the weak form of efficient market hypothesis by applying the run test at 5% and 10% level of significance.

Following values can be used:

Value of t at 5% is 2.101 at 18 degrees of freedom Value of t at 10% is 1.734 at 18 degrees of freedom

Solution

Date	Closing Index	Sign of Price Charge
1.10.07	2800	
3.10.07	2780	-
4.10.07	2795	+
5.10.07	2830	+
8.10.07	2760	-
9.10.07	2790	+
10.10.07	2880	+
11.10.07	2960	+
12.10.07	2990	+
15.10.07	3200	+
16.10.07	3300	+
17.10.07	3450	+
19.10.07	3360	-
22.10.07	3290	-
23.10.07	3360	+
24.10.07	3340	-
25.10.07	3290	-
29.10.07	3240	-
30.10.07	3140	-
31.10.07	3260	+

Total of sign of price changes (r) = 8

No of Positive changes = $n_1 = 11$

No. of Negative changes = $n_2 = 8$

$$\mu_r = \frac{2n_1n_2}{n_1 + n_2} + 1$$

$$\mu = \frac{2 \times 11 \times 8}{11 + 8} + 1 = 176/19 + 1 = 10.26$$

$$\sigma = \sqrt{\frac{2n_1n_2(2n_1n_2 - n_1 - n_2)}{(n_1 + n_2)^2(n_1 + n_2 - 1)}}$$

$$\sigma = \sqrt{\frac{(2 \times 11 \times 8)(2 \times 11 \times 8 - 11 - 8)}{(11 + 8)^2(11 + 8 - 1)}} = \sqrt{\frac{176 \times 157}{(19)^2(18)}}$$

$$= \sqrt{4.252} = 2.06$$

Since too few runs in the case would indicate that the movement of prices is not random. We employ a two- tailed test the randomness of prices.

Test at 5% level of significance at 18 degrees of freedom using t- table

$$\text{Lower limit} = \mu - t \times \sigma = 10.26 - 2.101 \times 2.06 = 5.932$$

$$\text{Upper limit} = \mu + t \times \sigma = 10.26 + 2.101 \times 2.06 = 14.588$$

Test at 10% level of significance at 18 degrees of freedom using t- table

$$\text{Lower limit} = 10.26 - 1.734 \times 2.06 = 6.688$$

$$\text{Upper limit} = 10.26 + 1.734 \times 2.06 = 13.832$$

As seen r lies between these limits. Hence, the market exhibits weak form of efficiency.

*For a sample of size n , the t distribution will have $n-1$ degrees of freedom.

Question 3

[JAN 21]

Mr. X is of the opinion that market has recently shown the Weak Form of Market Efficiency. In order to test the validity of his impression he has collected the following data relating to the movement of the SENSEX for the last 20 days.

Days	Open	High	Low	Close
1	33470.94	33513.79	33438.03	33453.99
2	33453.64	33478.11	33427.82	33434.83
3	33414.06	33440.29	33397.65	33431.93
4	33434.94	33446.18	33377.78	33383.41
5	33372.92	33380.27	33352.12	33370.93
6	33375.85	33389.49	33331.42	33340.75
7	33340.89	33340.89	33310.95	33330.98
8	33326.84	33340.91	33306.17	33335.08
9	33307.16	33328.22	33296.43	33301.97
10	33298.64	33318.60	33254.28	33259.03
11	33260.04	33228.85	33241.66	33251.53
12	33255.92	33289.46	33249.46	33285.89
13	33288.86	33535.67	33255.98	33329.28
14	33335.00	33346.21	33276.72	33284.17
15	33293.83	33310.86	33278.54	33298.78
16	33300.02	33337.79	33300.02	33325.38
17	33323.36	33356.34	33322.44	33329.95
18	33322.81	33345.98	33317.44	33319.67
19	33317.51	33321.18	33294.19	33302.32
20	33290.86	33324.96	33279.62	33319.61

You are required: To test the Weak Form of Market Efficiency using Auto-Correlation test, taking time lag of 10 days.

Solution

Period 1	Closing Prices	Change	Period 2	Closing Prices	Change
1	33453.99		11	33251.53	
2	33434.83	-19.16	12	33285.89	34.36
3	33431.93	- 2.90	13	33329.28	43.39
4	33383.41	- 48.52	14	33284.17	- 45.11
5	33370.93	- 12.48	15	33298.78	14.61
6	33340.75	- 30.18	16	33325.38	26.6
7	33330.98	-9.77	17	33329.95	4.57
8	33335.08	4.1	18	33319.67	-10.28
9	33301.97	- 33.11	19	33302.32	-17.35
10	33259.03	- 42.94	20	33319.61	17.29

X	Y	X ²	Y ²	XY
-19.16	34.36	367.11	1180.61	-658.34
-2.90	43.39	8.41	1882.69	-125.83
-48.52	-45.11	2354.19	2034.91	2188.74
-12.48	14.61	155.75	213.45	-182.33
-30.18	26.6	910.83	707.56	-802.79
-9.77	4.57	95.45	20.88	-44.65
4.1	-10.28	16.81	105.68	-42.15
-33.11	-17.35	1096.27	301.02	574.46
-42.94	17.29	1843.84	298.94	-742.43
$\Sigma X = -194.96$	$\Sigma Y = 68.08$	$\Sigma X^2 = 6848.66$	$\Sigma Y^2 = 6745.74$	$\Sigma XY = 164.68$
$X = -21.66$	$Y = 7.56$			

$$b = \frac{\Sigma XY - n\bar{X}\bar{Y}}{\Sigma X^2 - n(\bar{X})^2} = \frac{164.68 - 9(-21.66)(7.56)}{6848.66 - 9(-21.66)^2} = 0.624$$

$$a = Y - bX = 7.56 - 0.624(-21.66) = 21.08$$

$$r^2 = \frac{a\Sigma Y + b\Sigma X - n(\bar{Y})^2}{\Sigma Y^2 - n(\bar{Y})^2} = \frac{21.08(68.08) + 0.624(164.68) - 9(7.56)^2}{6745.74 - 9(7.56)^2}$$

$$r^2 = 0.164 \quad r = 0.405$$

There is moderate degree of correlation between the returns of two periods hence it can be concluded that the market does not show the weak form of efficiency.

Question 4**[MAY 22]**

Closing Values of NIFTY Index from 3rd to 12th day of the month of January 2022 were as follows

Days	Date	Closing Values of NIFTY Index
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 (i) The value of exponent for 15 days EMA. (ii) The exponential moving average (EMA) of NIFTY during the above period. (Calculations to be done up to 2 decimals only) (iii) Analyse the buy & sell signal on the basis of your calculations

Solution

(i) Value of Exponent for 15 Days $EMA = 2/n+1 = 0.125$

(ii) $EMA_t = a \times P_t + (1 - a) (EMA_{(t-1)})$ Where, a = exponent, P_t = Price of today

Date	Sensex	EMA for Previous day (EMA (t - 1))	1-2	3 × 0.125	EMA 2 + 4
	1	2	3	4	5
03/01/2022	17626	17174	452	56.50	17230.50
04/01/2022	17805	17230.50	574.50	71.81	17302.31
05/01/2022	17925	17302.31	622.69	77.84	17380.15
06/01/2022	17746	17380.15	365.85	45.73	17425.88
07/01/2022	17813	17425.88	387.12	48.39	17474.27
10/01/2022	18003	17474.27	528.73	66.09	17540.36
11/01/2022	18056	17540.36	515.64	64.45	17604.82
12/01/2022	18212	17604.82	607.18	75.90	17680.71

(iii) 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.



Security Valuation

Question 1

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%, compute the price of the share today using both Dividend Growth Model and Walter's Model.

Solution

The company earnings and dividend per share after a year are expected to be:

$$\text{EPS} = ₹ 137.8 \times 0.15 = ₹ 20.67$$

$$\text{Dividend} = 0.40 \times 20.67 = ₹ 8.27$$

$$\text{The growth in dividend would be: } g = 0.6 \times 0.15 = 0.09$$

a. As per Dividend Growth Model

$$\text{Perpetual growth model Formula: } P_0 = \frac{\text{Dividend}}{K_e - g} = \frac{8.27}{0.18 - 0.09} = ₹ 91.89$$

b. Walter's approach showing relationship between dividend and share price can be expressed by following formula

$$P_0 = \frac{\text{DPS} + (\text{EPS} - \text{DPS}) \frac{\text{ROE}}{K_e}}{k_e}$$
$$V_c = \frac{8.27 + \frac{0.15}{0.18} (20.67 - 8.27)}{0.18} = \frac{18.60}{0.18} = ₹ 103.35$$

Question 2

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 are 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:

(i) Number of shares to be issued: 5,00,000

$$\text{Subscription price } ₹ 20,00,000 / 5,00,000 = ₹ 4$$

$$\text{Ex-right Price} = (₹ 13,00,000 + ₹ 20,00,000) / 15,00,000 = ₹ 10$$

$$\text{Value of a Right} = ₹ 10 - ₹ 4 = ₹ 6$$

$$\text{Value of a Right Per Share Basis} = (₹ 10 - ₹ 4) / 2 = ₹ 3$$

(ii) Subscription price ₹ 20,00,000 / 2,50,000 = ₹ 8

Ex-right Price = (₹1,30,00,000 + ₹20,00,000)/12,50,000 = ₹12

Value of a Right = ₹ 12 - ₹ 8 = ₹ 4

Value of a Right Per Share Basis = (₹ 12 - ₹ 8)/4 = ₹1

(iii) Calculation of effect of right issue on wealth of Shareholder's wealth who is holding 100 shares.

(a) When firm offers one share for two shares held.

Value of Shares after right issue (150 X ₹ 10) ₹ 1,500

Less: Amount paid to acquire right shares (50 X ₹ 4) ₹ 200

₹ 1,300

(b) When firm offers one share for every four shares held.

Value of Shares after right issue (125 X ₹ 12) ₹ 1,500

Less: Amount paid to acquire right shares (25 X ₹ 8) ₹ 200

₹ 1,300

(c) Wealth of Shareholders before Right Issue ₹ 1,300

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

Question 3

MNP Ltd. has declared and paid annual dividend of ₹ 4 per share. It is expected to grow @ 20% for the next two years and 10% thereafter. The required rate of return of equity investors is 15%. Compute the current price at which equity shares should sell.

Note: Present Value Interest Factor (PVIF) @ 15%: For year 1 = 0.8696; For year 2 = 0.7561

Solution

$$D_0 = ₹ 4$$

$$D_1 = ₹ 4 (1.20) = ₹ 4.80$$

$$D_2 = ₹ 4 (1.20)^2 = ₹ 5.76$$

$$D_3 = ₹ 4 (1.20)^2 (1.10) = ₹ 6.336$$

$$P = \frac{D_1}{(1+k_e)} + \frac{D_2}{(1+k_e)^2} + \frac{TV}{(1+k_e)^2}$$

$$TV = \frac{D_3}{k_e - g} = \frac{6.336}{0.15 - 0.10} = 126.72$$

$$P = \frac{4.80}{(1+0.15)} + \frac{5.76}{(1+0.15)^2} + \frac{126.72}{(1+0.15)^2}$$

$$= 4.80 \times 0.8696 + 5.76 \times 0.7561 + 126.72 \times 0.7561 = 104.34$$

Question 4

On the basis of the following information:

Current dividend (D_0) = ₹ 2.50

Discount rate (k) = 10.5%

Growth rate (g) = 2%

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

Solution:

(i) Present Value of the stock of ABC Ltd. Is: $V_0 = \frac{2.50(1.02)}{0.105 - 0.02} = 30$

(ii) (A) Value of stock under the PE Multiple Approach

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

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

(B) 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 $[\text{EPS} \times (1+g)]/(\text{RoE} - g)$ $= ₹ 2.25 \times 1.02/0.07$	₹ 32.79

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

Question 5

X Limited, just declared a dividend of ₹ 14.00 per share. Mr. B is planning to purchase the share of X Limited, anticipating increase in growth rate from 8% to 9%, which will continue for three years. He also expects the market price of this share to be ₹ 360.00 after three years.

You are required to determine:

- maximum amount Mr. B should pay for shares, if he requires a rate of return of 13% per annum.
- maximum price Mr. B will be willing to pay for share, if he is of the opinion that the 9% growth can be maintained indefinitely and require 13% rate of return per annum.
- price of share at the end of three years, if 9% growth rate is achieved and assuming other conditions remaining same as in (ii) above.

Calculate rupee amount up to two decimal points.

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

Solution

i. Expected dividend for next 3 years.

Year 1 (D_1) ₹ 14.00 (1.09) = ₹ 15.26

Year 2 (D_2) ₹ 14.00 (1.09)² = ₹ 16.63

Year 3 (D_3) ₹ 14.00 (1.09)³ = ₹ 18.13

Required rate of return = 13% (K_e)

Market price of share after 3 years = (P_3) = ₹ 360

The present value of share: $P_0 = \frac{15.26}{(1+0.13)} + \frac{16.63}{(1+0.13)^2} + \frac{18.13}{(1+0.13)^3} + \frac{360}{(1+0.13)^3}$

$P_0 = 15.26(0.885) + 16.63(0.783) + 18.13(0.693) + 360(0.693)$

$P_0 = 13.50 + 13.02 + 12.56 + 249.48$

$P_0 = ₹ 288.56$

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

willing be to pay is $P_0 = \frac{D_1}{(K_e - g)} = \frac{₹15.26}{(0.13 - 0.09)} = \frac{₹15.26}{0.04} = ₹381.50$

iii. Assuming that conditions mentioned above remain same, the price expected after 3 years will be:

$P_3 = \frac{D_4}{(K_e - g)} = \frac{D_3(1.09)}{0.13 - 0.09} = \frac{18.13 \times 1.09}{0.04} = \frac{19.76}{0.04} = ₹494$

Question 6

Piyush Ltd presently pay a dividend of Re. 1.00 per share and has a share price of ₹ 20.00.

- If this dividend were expected to grow at a rate of 12% per annum forever, what is the firm's expected or required return on equity using a dividend-discount model approach?
- Instead of this situation in part (i), suppose that the dividends were expected to grow at a rate of 20% per annum for 5 years and 10% per year thereafter. Now what is the firm's expected, or required, return on equity?

Solution

(i) Firm's Expected or Required Return on Equity

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

Now, $D_1 = D_0 (1 + g)$ or ₹ 1 (1 + 0.12) or ₹ 1.12,

$P_0 = ₹ 20$ and $g = 12\%$ per annum

Therefore, $K_e = \frac{1.12}{20} + 12\% = ₹ 17.6\%$

(ii) Firm's Expected or Required Return on Equity

$$P_0 = \frac{1.20}{(1+K_e)^1} + \frac{1.44}{(1+K_e)^2} + \frac{1.73}{(1+K_e)^3} + \frac{2.07}{(1+K_e)^4} + \frac{2.49}{(1+K_e)^5} + \frac{2.49(1+0.10)}{K_e - 0.10} \times \frac{1}{(1+K_e)^5}$$

By trial and error we are required to find out K_e

Now, assume $K_e = 18\%$ then we will have

$P_0 = ₹ 1.20 (0.8475) + ₹ 1.44 (0.7182) + ₹ 1.73 (0.6086) + ₹ 2.07 (0.5158) + ₹ 2.49 (0.4371) + ₹ 2.74 (0.4371) \times 1/0.18 - 0.10 = ₹ 1.017 + ₹ 1.034 + ₹ 1.053 + ₹ 1.068 + ₹ 1.09 + ₹ 14.97 = ₹ 20.23$

Since present value of dividend stream is more than required it indicates that K_e is greater than 18%.

Now, assume $K_e = 19\%$ we will have

$P_0 = ₹ 1.20 (0.8403) + ₹ 1.44 (0.7061) + ₹ 1.73 (0.5934) + ₹ 2.07 (0.4986) + ₹ 2.49 (0.4190) + ₹ 2.74 (0.4190) \times 1/0.10 - 0.19 = ₹ 1.008 + ₹ 1.017 + ₹ 1.026 + ₹ 1.032 + ₹ 1.043 + ₹ 12.76 = ₹ 17.89$

Since the market price of share (expected value of dividend stream) is ₹ 20. Therefore, the discount rate is closer to 18% than it is to 19%, we can get the exact rate by **interpolation** by using the following formula:

$$K_e = LR + \frac{NPV \text{ at LR}}{NPV \text{ at LR} - NPV \text{ at HR}} \times \Delta r$$

$$K = 18\% + \frac{(Rs.20.23 - Rs.20)}{Rs.20.23 - Rs.17.89} \times 1\% = 18\% + \frac{Rs.0.23}{Rs.2.34} \times 1\% = 18\% + 0.10\% = 18.10\%$$

Therefore, the firm's expected, or required, return on equity is 18.10%. At this rate the present discounted value of dividend stream is equal to the market price of the share.

Question 7

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

(₹ in lakhs)	
Equity share capital (₹ 100 each)	80
8% Preference share capital	40
12% Debentures	64
Reserves	32

Sun Ltd., earns a profit of ₹ 32 lakhs annually on an average before deduction of income-tax, which works out to 35%, and interest on debentures.

Normal return on equity shares of companies similarly placed is 9.6% provided:

(a) Profit after tax covers fixed interest and fixed dividends at least 3 times.

(b) Capital gearing ratio is 0.75.

(c) 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:

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

Solution

(a) Calculation of Profit after tax (PAT)

	₹
Profit before interest and tax (PBIT)	32,00,000
Less: Debenture interest (₹ 64,00,000 × 12/100)	7,68,000
Profit before tax (PBT)	24,32,000
Less: Tax @ 35%	8,51,200
Profit after tax (PAT)	15,80,800
Less: Preference Dividend	
(₹ 40,00,000 × 8/100)	3,20,000
Equity Dividend (₹ 80,00,000 × 8/100)	6,40,000
Retained earnings (Undistributed profit)	6,20,800

Calculation of Interest and Fixed Dividend Coverage

$$= \frac{\text{PAT} + \text{Debenture interest}}{\text{Debenture interest} + \text{Preference dividend}} \text{ or } \frac{\text{PAT} + \text{Debenture Interest Net of Tax}}{\text{Debenture interest} + \text{Preference dividend}}$$

$$= \frac{15,80,800 + 7,68,000}{7,68,000 + 3,20,000} \text{ or } \frac{15,80,800 + 4,99,200}{7,68,000 + 3,20,000} = \frac{23,48,800}{10,88,000} \text{ or } \frac{20,80,000}{10,88,000} = 2.16 \text{ times or } 1.91 \text{ times}$$

(b) Calculation of Capital Gearing Ratio

$$\text{Capital Gearing Ratio} = \frac{\text{Fixed interest bearing funds}}{\text{Equity shareholders' funds}}$$

$$= \frac{\text{Preference Share Capital} + \text{Debentures}}{\text{Equity Share Capital} + \text{Reserves}} = \frac{40,00,000 + 64,00,000}{80,00,000 + 32,00,000} = \frac{1,04,00,000}{1,12,00,000} = 0.93$$

(c) Calculation of Yield on Equity Shares:

Yield on equity shares is calculated at 50% of profits distributed and 5% on undistributed profits:

	(₹)
50% on distributed profits (₹ 6,40,000 × 50/100)	3,20,000
5% on undistributed profits (₹ 6,20,800 × 5/100)	<u>31,040</u>
Yield on equity shares	<u>3,51,040</u>

$$\text{Yield on equity shares \%} = \frac{\text{Yield on shares}}{\text{Equity share capital}} \times 100 = \frac{3,51,040}{80,00,000} \times 100 = 4.39\% \text{ or } 4.388\%$$

Calculation of Expected Yield on Equity shares

- a. Interest and fixed dividend coverage of Sun Ltd. is 2.16 times but the industry average is 3 times. Therefore, risk premium is added to Sun Ltd. Shares @ 1% for every 1 time of difference.

$$\text{Risk Premium} = 3.00 - 2.16 (1\%) = 0.84 (1\%) = 0.84\%$$

- b. Capital Gearing ratio of Sun Ltd. is 0.93 but the industry average is 0.75 times. Therefore, risk premium is added to Sun Ltd. shares @ 2% for every 1 time of difference.

$$\text{Risk Premium} = (0.75 - 0.93) (2\%) = 0.18 (2\%) = 0.36\%$$

	(%)
Normal return expected	9.60
Add: Risk premium for low interest and fixed dividend coverage	0.84
Add: Risk premium for high interest gearing ratio	<u>0.36</u>
	<u>10.80</u>

Value of Equity Share

$$= \frac{\text{Actual Yield}}{\text{Expected yield}} \times \text{Paid-up value of share} = \frac{4.39}{10.80} \times 100 = ₹40.65$$

Question 8

ABC Ltd. has been maintaining a growth rate of 10 percent in dividends. The company has paid dividend @ ₹ 3 per share. The rate of return on market portfolio is 12 percent and the risk free rate of return in the market has been observed as 8 percent. The Beta co-efficient of company's share is 1.5.

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

Solution

CAPM formula for calculation of Expected Rate of Return is :

$$ER = R_f + \beta (R_m - R_f) = 8 + 1.5 (12 - 8) = 8 + 1.5 (4) = 8 + 6 = 14\% \text{ or } 0.14$$

Applying Dividend Growth Model for the calculation of per share equilibrium price: $(P_0) = \frac{D_1}{K_e - g} = \frac{3(1.10)}{0.14 - 0.10} = 82.5$

Question 9

A Company pays a dividend of ₹ 2.00 per share with a growth rate of 7%. The risk free rate is 9% and the market rate of return is 13%. The Company has a beta factor of 1.50. However, due to a decision of the Finance Manager, beta is likely to increase to 1.75. Find out the present as well as the likely value of the share after the decision.

Solution

In order to find out the value of a share with constant growth model, the value of K_e should be ascertained with the help of 'CAPM' model as follows:

$$K_e = R_f + \beta (K_m - R_f)$$

$$K_e = 0.09 + 1.5 (0.13 - 0.09) = 0.15 \text{ or } 15\%$$

$$\text{and the value of the share as per constant growth model is } P_0 = \frac{D_1}{(K_e - g)} = \frac{2.00(1.07)}{(0.15 - 0.07)} = ₹ 26.75$$

However, if the decision of finance manager is implemented, the beta (β) factor is likely to increase to 1.75 therefore, K_e would be

$$K_e = R_f + \beta (K_m - R_f) = 0.09 + 1.75 (0.13 - 0.09) = 0.16 \text{ or } 16\%$$

$$\text{The value of share is } = \frac{2.00(1.07)}{(0.16 - 0.07)} = ₹ 23.78$$

Question 10

Calculate the value of share from the following information:

Profit after tax of the company	₹ 290 crores
Equity capital of company	₹ 1,300 crores
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

Solution

$$\text{No. of Shares} = ₹ 1,300 \text{ crores} / ₹ 40 = 32.5 \text{ Crores}$$

$$\text{EPS} = \text{PAT} / \text{No. of shares}$$

$$\text{EPS} = ₹ 290 \text{ crores} / 32.50 \text{ crores} = ₹ 8.923 \text{ crores}$$

$$\text{FCFE} = \text{Net income} - [(1-b) (\text{capex} - \text{dep}) + (1-b) (\Delta \text{WC})]$$

$$\text{FCFE} = 8.923 - [(1-0.27) (47-39) + (1-0.27) (3.45)]$$

$$= 8.923 - [5.84 + 2.5185] = 0.5645$$

$$\text{Cost of Equity} = R_f + \beta (R_m - R_f)$$

$$= 8.7 + 0.1 (10.3 - 8.7) = 8.86\%$$

$$P_0 = \frac{\text{FCFE}(1+g)}{(k_e - g)} = \frac{0.5645(1.08)}{(0.0886 - 0.08)} = \frac{0.60966}{0.0086} = ₹ 70.89$$

Question 11

Shares of Voyage Ltd. are being quoted at a price-earning ratio of 8 times. The company retains ₹ 5 per share which is 45% of its Earning Per Share.

You are required to compute

- The cost of equity to the company if the market expects a growth rate of 15% p.a.
- If the anticipated growth rate is 16% per annum, calculate the indicative market price with the same cost of capital.
- If the company's cost of capital is 20% p.a. & the anticipated growth rate is 19% p.a., Calculate the market price per share.

Solution:

i. Cost of Capital

Retained earnings (45%)	₹ 5 per share
Dividend (55%)	₹ 6.11 per share
EPS (100%)	₹ 11.11 per share
P/E Ratio	8 times
Market price	₹ 11.11 × 8 = ₹ 88.88

$$\text{Cost of equity capital} = \left(\frac{\text{Div}}{\text{Price}} \times 100 \right) + \text{Growth\%} = \frac{6.11}{88.88} \times 100 + 15\% = 21.87\%$$

$$\text{ii. Market Price} = \frac{\text{Dividend}}{\text{Cost of Capital(\%)} - \text{GrowthRate(\%)}} = \frac{6.11}{(21.87 - 16)\%} = ₹ 104.08 \text{ per share}$$

$$\text{iii. Market Price} = \frac{6.11}{(20 - 19)\%} = ₹ 611.00 \text{ per share}$$

Question 12

Following Financial data are available for PQR Ltd. for the financial 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

Workings:

Asset turnover ratio = 1.1

Total Assets = ₹ 600

Turnover ₹ 600 lakhs × 1.1 = ₹ 660 lakhs

Effective interest rate = Interest/Liabilities = 8%

Liabilities = ₹ 125 lakhs + 50 lakhs = 175 lakh

Interest = ₹ 175 lakhs × 0.08 = ₹ 14 lakh

Operating Margin = 10%

Hence operating cost = (1 - 0.10) ₹ 660 lakhs = ₹ 594 lakh

Dividend Payout = 16.67%

Tax rate = 40%

i. Income statement

	(₹ Lakhs)
Sale	660
Operating Exp	594
EBIT	66
Interest	14
EBT	52
Tax @ 40%	20.80
EAT	31.20
Dividend @ 16.67%	5.20
Retained Earnings	26.00

ii. $SGR = b \times r$

$ROE = \frac{PAT}{NW}$ and $NW = ₹ 100 \text{ lakh} + ₹ 300 \text{ lakh} = 400 \text{ lakh}$

$ROE = \frac{31.2 \text{ lakhs}}{400 \text{ lakhs}} \times 100 = 7.8\%$

$SGR = 0.078(1 - 0.1667) = 6.5\%$

iii. Calculation of fair price of share using dividend discount model $P_0 = \frac{D_0(1+g)}{k_e - g}$

Dividends = ₹5.2lakhs/₹10lakhs = ₹0.52

Growth Rate = 6.5%

Hence $P_0 = \frac{0.52(1+0.065)}{0.15-0.065} = ₹0.5538/0.085 = ₹6.51$

iv. Since current market price of share is ₹ 14, the share is overvalued. Hence the investor should not invest in the company.

Question 13

M/s X Ltd. has paid a dividend of ₹ 2.50 per share on a face value of ₹ 10 in the financial year ending on 31st March, 2009. The details are as follows:

Current market price of share	₹ 60
Growth rate of earnings and dividends	10%
Beta of share	0.75
Average market return	15%
Risk free rate of return	9%

Calculate the intrinsic value of the share.

Solution

Using CAPM $k = R_f + \beta (R_m - R_f) = 9\% + 0.75 (15\% - 9\%) = 13.5\%$

Intrinsic Value $P_0 = \frac{D_1}{k - g} = \frac{2.5 \times 1.1}{0.135 - 0.10} = \frac{2.75}{0.035} = ₹78.57$

Question 14

Mr. A is thinking of buying shares at ₹ 500 each having face value of ₹ 100. He is expecting a bonus at the ratio of 1: 5 during the fourth year. Annual expected dividend is 20% and the same rate is expected to be maintained on the expanded capital base. He intends to sell the shares at the end of seventh year at an expected price of ₹ 900 each. Incidental expenses for purchase and sale of shares are estimated to be 5% of the market price. He expects a minimum return of 12% per annum.

Should Mr. A buy the share? If so, what maximum price should he pay for each share? Assume no tax on dividend income and capital gain.

Solution

P.V. of dividend stream and sales proceeds

Year	Dividend/ Sale	PVF (12%)	PV (₹)
1	₹ 20/-	0.893	17.86
2	₹ 20/-	0.797	15.94
3	₹ 20/-	0.712	14.24
4	₹ 24/-	0.636	15.26
5	₹ 24/-	0.567	13.61

6	₹ 24/	0.507	12.17
7	₹ 24/	0.452	10.85
7	₹ 1026/- (₹ 900 × 1.2 × 0.95)	0.452	463.75
			₹ 563.68
	Less : - Cost of Share (₹ 500 × 1.05)		₹ 525.00
	Net gain		₹ 38.68

Since Mr. A is gaining ₹ 38.68 per share, he should buy the share.

Maximum price Mr. A should be ready to pay is ₹ 563.68 which will include incidental expenses. So the maximum price should be ₹ 563.68 × 100/105 = ₹ 536.84

Question 15

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.

(i) What is the equilibrium price of the equity stock of Platinum Ltd.?

(ii) 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:

(i) Equilibrium price of Equity using CAPM

$$= 9\% + 1.2(13\% - 9\%) = 9\% + 4.8\% = 13.8\%$$

$$P = \frac{D_1}{K_e - g} = \frac{2.00(1.07)}{0.138 - 0.07} = 2.14 / 0.068 = ₹31.47$$

(ii) New Equilibrium price of Equity using CAPM

$$= 11\% + 1.3(15\% - 11\%) = 11\% + 5.2\% = 16.20\%$$

$$P = \frac{D_1}{K_e - g} = \frac{2.00(1.10)}{0.162 - 0.10} = ₹35.48$$

Alternatively, if all the factors are taken separately then solution will be as follows:

i. Inflation Premium increase by 2%. This raises R_x to 15.80%. Hence, new equilibrium price will be

$$= \frac{2.00(1.07)}{0.158 - 0.07} = ₹24.32$$

ii. Expected Growth rate increases by 3%. Hence, revised growth rate stands at 10%:

$$= \frac{2.00(1.10)}{0.138 - 0.10} = ₹57.89$$

iii. Beta rises to 1.3. Hence, revised cost of equity shall be:

$$= 9\% + 1.3(13\% - 9\%) = 9\% + 5.2\% = 14.2\%$$

$$\text{As a result, New Equilibrium price shall be: } P = \frac{D_1}{K_e - g} = \frac{2.00(1.07)}{0.142 - 0.07} = ₹29.72$$

Question 16

SAM Ltd. has just paid a dividend of ₹ 2 per share and it is expected to grow @ 6% p.a. After paying dividend, Board declared to take up project by retaining next three annual dividends. It is expected that this project is of same risk as the existing projects. The results of this project will start coming from 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. Show that the market value of the share is affected by the decision of the Board. Also show as to how the investor can maintain his target receipt from the investment for first 3 years and improved income thereafter, given that the cost of capital of the firm is 8%.

Solution

$$\text{Value of share at present} = \frac{D_1}{k_e - g} = \frac{2(1.06)}{0.08 - 0.06} = ₹106$$

However, if Board implement its decision, no dividend would be payable for 3 years and the dividend for year 4 would be ₹ 2.50 and growing at 7% p.a. The price of the share, in this case, now would be:

$$P_0 = \frac{2.50}{0.08 - 0.07} \times \frac{1}{(1 + 0.08)^3} = ₹198.46$$

So, the price of the share is expected to increase from ₹ 106 to ₹ 198.45 after the announcement of the project. The investor can take up this situation as follows:

Expected market price after 3 years	$= \frac{2.50}{0.08 - 0.07}$	= ₹ 250.00
Expected market price after 2 years	$= \frac{2.50}{0.08 - 0.07} \times \frac{1}{(1 + 0.08)^2}$	= ₹ 231.48
Expected market price after 1 years	$= \frac{2.50}{0.08 - 0.07} \times \frac{1}{(1 + 0.08)}$	= ₹ 214.33

In order to maintain his receipt at least ₹ 2,000 for first 3 year, he would sell

10 shares in first year @ ₹ 214.33 for	₹ 2,143.30
9 shares in second year @ ₹ 231.48 for	₹ 2,083.32
8 shares in third year @ ₹ 250 for	₹ 2,000.00

At the end of 3rd year, he would be having 973 shares valued @ ₹ 250 each i.e. ₹ 2,43,250. On these 973 shares, his dividend income for year 4 would be @ ₹ 2.50 i.e. ₹ 2,432.50.

So, if the project is taken up by the company, the investor would be able to maintain his receipt of at least ₹ 2,000 for first three years and would be getting increased income thereafter.

Question 17

XYZ Ltd. paid a dividend of ₹ 2 for the current year. The dividend is expected to grow at 40% for the next 5 years and at 15% per annum thereafter. The return on 182 days T-bills is 11% per annum and the market return is expected to be around 18% with a variance of 24%.

The co-variance of XYZ's return with that of the market is 30%. You are required to calculate the required rate of return and intrinsic value of the stock.

Solution

$$\beta = \frac{\text{Covariance of Market Return and Security Return}}{\text{Variance of Market Return}} = \beta = \frac{30\%}{24\%}$$

$$\text{Expected Return} = R_f + \beta(R_m - R_f) = 11\% + 1.25(18\% - 11\%) = 11\% + 8.75\% = 19.75\%$$

Intrinsic Value

Year	Dividend (₹)	PVF (19.75%,n)	Present Value (₹)
1	2.80	0.835	2.34
2	3.92	0.697	2.73
3	5.49	0.582	3.19
4	7.68	0.486	3.73
5	10.76	0.406	4.37
			16.36

$$\text{PV of Terminal Value} = \frac{10.76(1.15)}{0.1975 - 0.15} \times 0.46 = ₹ 105.77$$

$$\text{Intrinsic Value} = ₹ 16.36 + ₹ 105.77 = ₹ 122.13$$

Question 18

Rahul Ltd. has surplus cash of ₹ 100 lakhs and wants to distribute 27% of it to the shareholders. The company decides to buy back shares. The Finance Manager of the company estimates that its share price after re-purchase is likely to be 10% above the buyback price-if the buyback route is taken. The number of shares outstanding at present is 10 lakhs and the current EPS is ₹ 3.

You are required to determine:

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

Solution

- Let P be the buyback price decided by Rahul Ltd.

Market Capitalisation after Buyback

1.1P (Original Shares - Shares Bought Back)

$$= 1.1P \left(10\text{lakhs} - \frac{27\% \text{ of } 100\text{lakhs}}{P} \right)$$

$$= 11\text{ lakhs} \times P - 27\text{ lakhs} \times 1.1 = 11\text{ lakhs} P - 29.7\text{ lakhs}$$

Again, 11 lakhs P - 29.7 lakhs
or 11 lakhs P = 210 lakhs + 29.7 lakhs
or P = 239.7/11 = ₹21.79 per share

ii. **Number of Shares to be Bought Back :-**

= ₹27 lakhs/₹21.79 = 1.24 lakhs (Approx.) or 123910 share

iii. **New Equity Shares:-**

10 lakhs - 1.24 lakhs = 8.76 lakhs or 1000000 - 123910 = 876090 shares

$$\therefore \text{EPS} = \frac{3 \times 10 \text{ lakhs}}{8.76 \text{ lakhs}} = ₹3.43$$

Thus, EPS of Rahul Ltd., increases to ₹ 3.43

Question 19

Nominal value of 10% bonds issued by a company is ₹100. The bonds are redeemable at ₹ 110 at the end of year 5. Determine the value of the bond if required yield is (i) 5%, (ii) 5.1%, (iii) 10% and (iv) 10.1%.

Solution

Case (i) Required yield rate = 5%

Year	Cash Flow ₹	DF (5%)	Present Value ₹
1-5	10	4.330	43.30
5	110	0.784	86.24
Value of bond			129.54

Case (ii) Required yield rate = 5.1%

Year	Cash Flow ₹	DF (5.1%)	Present Value ₹
1-5	10	4.317	43.17
5	110	0.780	85.80
Value of bond			128.97

Case (iii) Required yield rate = 10%

Year	Cash Flow ₹	DF (10%)	Present Value ₹
1-5	10	3.791	37.91
5	110	0.621	68.31
Value of bond			106.22

Case (iv) Required yield rate = 10.1%

Year	Cash Flow ₹	DF (10%)	Present Value ₹
1-5	10	3.791	37.91
5	110	0.621	68.31
Value of bond			106.22

Question 20

An investor is considering the purchase of the following Bond:

Face value	₹ 100
Coupon rate	11%
Maturity	3 years

- (i) If he wants a yield of 13% what is the maximum price, he should be ready to pay for?
(ii) If the Bond is selling for ₹ 97.60, what would be his yield?

Solution**i. Calculation of Maximum price**

$$\begin{aligned}
&= ₹ 11 \times PVIFA (13\%, 3) + ₹ 100 \times PVIF (13\%, 3) \\
&= ₹ 11 \times 2.361 + ₹ 100 \times 0.693 = ₹ 25.97 + ₹ 69.30 = ₹ 95.27
\end{aligned}$$

ii. Calculation of yield

$$\begin{aligned}
&\text{At 12\% the value} = ₹ 11 \times PVIFA (12\%, 3) + 100 \times PVIF (12\%, 3) \\
&= ₹ 11 \times 2.402 + ₹ 100 \times 0.712 = ₹ 26.42 + ₹ 71.20 = ₹ 97.62
\end{aligned}$$

It bond is selling at ₹ 97.60 which is more than fair value, YTM of the bond would be less than 13%. This value is almost equal to amount price of ₹ 97.60. Therefore, the YTM of the bond would be 12%.

Question 21

Calculate 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.

Solution

- (i) Current yield = (Coupon Interest / Market Price) X 100
 $(10/110) \times 100 = 9.09\%$
If current yield go up by 1% i.e. 10.09 the market price would be
 $10.09 = 10 / \text{Market Price} \times 100$
Market Price = ₹ 99.11
- (ii) Market Price of Bond = P.V. of Interest + P.V. of Principal
= ₹ 1,394 + ₹ 8,885 = ₹ 10,279

Question 22

A convertible bond with a face value of ₹ 1,000 is issued at ₹ 1,350 with a coupon rate of 10.5%. The conversion rate is 14 shares per bond. The current market price of bond and share is ₹ 1,475 and ₹ 80 respectively. What is the premium over conversion value?

Solution

Conversion rate is 14 shares per bond. Market price of share ₹ 80

Conversion Value $14 \times ₹ 80 = ₹ 1120$

Market price of bond = ₹ 1475

Premium over Conversion Value $(₹ 1475 - ₹ 1120) = \frac{355}{1120} \times 100 = 31.7\%$

Question 23

Saranam Ltd. has issued convertible debentures with coupon rate 12%. Each debenture has an option to convert to 20 equity shares at any time until the date of maturity. Debentures will be redeemed at ₹ 100 on maturity of 5 years. An investor generally requires a rate of return of 8% p.a. on a 5-year security. As an investor when will you exercise conversion for given market prices of the equity share of (i) ₹ 4, (ii) ₹ 5 and (iii) ₹ 6.

Cumulative PV factor for 8% for 5 years : 3.993. PV factor for 8% for year 5 : 0.681

Solution

If Debentures are not converted its value is as under: -

	PVF @ 8 %	₹
Interest - ₹ 12 for 5 years	3.993	47.92
Redemption - ₹ 100 in 5 th year	0.681	<u>68.10</u>
		<u>116.02</u>

Value of equity shares: -

Market Price	No.	Total
₹ 4	20	₹ 80
₹ 5	20	₹ 100
₹ 6	20	₹ 120

Hence, unless the market price is ₹ 6 conversion should not be exercised.

Question 24

The data given below relates to a convertible bond:

Face value	₹ 250
Coupon rate	12%
No. of shares per bond	20
Market price of share	₹ 12
Straight value of bond	₹ 235
Market price of convertible bond	₹ 265

Calculate: (i) Stock value of bond. (ii) The percentage of downside risk. (iii) The conversion premium (iv) The conversion parity price of the stock.

Solution

i. **Stock value or conversion value of bond** = $12 \times 20 = ₹ 240$

ii. **Percentage of the downside risk**

$$= \frac{265 - 235}{235} = 0.1277 \text{ or } 12.77\% \quad \text{or} \quad = \frac{265 - 240}{265} = 0.1132 \text{ or } 11.32\%$$

This ratio gives the percentage price decline experienced by the bond if the stock becomes worthless.

iii. **Conversion Premium** = $\frac{\text{Market Price} - \text{Conversion Value}}{\text{Conversion Value}} \times 100 = \frac{265 - 240}{240} \times 100 = 10.42\%$

iv. **Conversion Parity Price** = $\frac{\text{Bond Price}}{\text{No. of Shares on Conversion}} = 265 / 20 = 13.25$

This indicates that if price of shares rises to ₹ 13.25 from ₹ 12 investor will neither gain nor lose on buying the bond and exercising it.

Question 25

ABC Ltd. has ₹ 300 million, 12 per cent bonds outstanding with six years remaining to maturity. Since interest rates are falling, ABC Ltd. is contemplating of refunding these bonds with a ₹ 300 million issue of 6 year bonds carrying a coupon rate of 10 per cent. Issue cost of the new bond will be ₹ 6 million and the call premium is 4 per cent. ₹ 9 million being the unamortized portion of issue cost of old bonds can be written off no sooner the old bonds are called off. Marginal tax rate of ABC Ltd. is 30 per cent. You are required to analyse the bond refunding decision.

Solution

(i) **Calculation of initial outlay:-**

	₹ (million)
a. Face value	300
Add:- Call premium	12
Cost of calling old bonds	312
b. Gross proceed of new issue	300
Less: Issue costs	<u>6</u>
Net proceeds of new issue	<u>294</u>

- c. Tax savings on call premium and unamortized cost 0.30 (12 + 9) 6.3
 $\therefore$ Initial outlay = ₹ 312 million - ₹ 294 million - ₹ 6.3 million = ₹ 11.7 million

(ii) Calculation of net present value of refunding the bond: -

Saving in annual interest expenses	<u>₹ (million)</u>
[300 × (0.12 - 0.10)]	6.00
Less:- Tax saving on interest and amortization	
0.30 × [6 + (9-6)/6]	1.95
Annual net cash saving	4.05
 PVIFA (7%, 6 years)	 4.766
 $\therefore$ Present value of net annual cash saving	 ₹ 19.30 million
Less:- Initial outlay	<u>₹ 11.70 million</u>
Net present value of refunding the bond	<u>₹ 7.60 million</u>

Decision: The bonds should be refunded

Question 26

The following data are available for a bond

Face value	₹ 1,000
Coupon Rate	16%
Years to Maturity	6
Redemption value	₹ 1,000
Yield to maturity	17%

What is the current market price, duration and volatility of this bond? Calculate the expected market price, if increase in required yield is by 75 basis points.

Solution

(a) Calculation of Market price:

$$= 160 (\text{PVIAF } 17\%, 6) + 1,000 (\text{PVIF } 17\%, 6)$$

$$= 160 (3.589) + 1,000 (0.390) = 574.24 + 390 = 964.24$$

(b) Duration

Year	Cash flow	P.V. @ 17%		Proportion of bond value	Proportion of bond value x time (years)
1	160	0.855	136.80	0.142	0.142
2	160	0.731	116.96	0.121	0.246
3	160	0.624	99.84	0.103	0.309
4	160	0.534	85.44	0.089	0.356
5	160	0.456	72.96	0.076	0.380
6	1160	0.390	<u>452.40</u>	<u>0.469</u>	<u>2.814</u>
			<u>964.40</u>	<u>1.000</u>	<u>4.247</u>

Duration of the Bond is 4.247 years

$$(c) \text{ Volatility of the bonds} = \frac{\text{Duration}}{(1 + \text{yields})} = \frac{4.247}{1.17} = 3.63$$

(d) The expected market price if increase in required yield is by 75 basis points.

$$= ₹ 964.4 \times .75 (3.63/100) = ₹ 26.2558$$

Hence expected market price is ₹ 964.40 - ₹ 26.2558 = ₹ 938.1442

Hence, the market price will decrease

Question 27

Mr. A will need ₹ 1,00,000 after two years for which he wants to make one time necessary investment now. He has a choice of two types of bonds. Their details are as below:

	Bond X	Bond Y
Face value	₹ 1,000	₹ 1,000
Coupon	7% payable annually	8% payable annually
Years to maturity	1	4
Current price	₹ 972.73	₹ 936.52
Current yield	10%	10%

Advice Mr. A whether he should invest all his money in one type of bond or he should buy both the bonds and, if so, in which quantity? Assume that there will not be any call risk or default risk.

Solution**Duration of Bond X**

Year	Cash flow	P.V. @ 10%		Proportion of bond value	Proportion of bond value x time (years)
1	1070	0.909	972.63	1.000	1.000

Duration of the Bond is 1 year

Duration of Bond Y

Year	Cash flow	P.V. @ 10%		Proportion of bond value	Proportion of bond value x time (years)
1	80	0.909	72.72	0.077	0.077
2	80	0.826	66.08	0.071	0.142
3	80	0.751	60.08	0.064	0.192
4	1080	0.683	<u>737.64</u>	<u>0.788</u>	<u>3.152</u>
			<u>936.52</u>	<u>1.000</u>	<u>3.563</u>

Duration of the Bond is 3.563 years

Let x_1 be the investment in Bond X and therefore investment in Bond Y shall be $(1 - x_1)$. Since the required duration is 2 years the proportion of investment in each of these two securities shall be computed as follows:

$$2 = x_1 + (1 - x_1) 3.563$$

$$x_1 = 0.61$$

Accordingly, the proportion of investment shall be 61% in Bond X and 39% in Bond Y respectively.

Amount of investment

Bond X	Bond Y
PV of ₹ 1,00,000 for 2 years @ 10% x 61%	PV of ₹ 1,00,000 for 2 years @ 10% x 39%
= ₹ 1,00,000 (0.826) x 61% = ₹ 50,386	= ₹ 1,00,000 (0.826) x 39% = ₹ 32,214
No. of Bonds to be purchased = ₹ 50,386 / ₹ 972.63 = 51.80 i.e. approx. 52 bonds	No. of Bonds to be purchased = ₹ 32,214 / ₹ 936.52 = 34.40 i.e. approx. 34 bonds

Note: Investor has to keep money invested for two years. Therefore, investor can invest in both bonds with the assumption that Bond X will be reinvested for another one year on same returns.

Question 28

RBI sold a 91-day T-bill of face value of ₹ 100 at an yield of 6%. What was the issue price?

Solution

Let the issue price be X

By the terms of the issue of the T-bills:

$$6\% = \frac{100 - x}{x} \times \frac{365}{91} \times 100 = ₹ 98.53$$

Question 29

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. Securities invested will have 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%. (discuss)
- minimum period for company to breakeven its investment expenditure overtime value of money.

Solution

i. $(₹20,00,000 \times \frac{9}{100} \times \frac{P}{12}) - ₹50,000 = ₹1,00,000$

$P = 10 \text{ months}$

ii. Break-Even its investment expenditure: $(₹20,00,000 \times \frac{9}{100} \times \frac{P}{12}) - ₹50,000 = 0$

$P = 3.33 \text{ months}$

Question 30

Z Co. Ltd. issued commercial paper worth ₹10 crores as per following details:

Date of issue : 16th January, 2019

Date of maturity: 17th April, 2019

No. of days: 91 and Interest rate: 12.04% p.a.

What was net amount received by company on issue of CP? (Charges of intermediary may be ignored)

Solution

The company had issued commercial paper worth ₹10 crores

No. of days Involves = 91 days

Interest rate applicable = 12.04 % p.a.

Interest for 91 days = $12.04\% \times \frac{91 \text{ Days}}{365 \text{ Days}} = 3.002\%$

= or ₹ 10 crores $\times \frac{3.002}{100 + 3.002} = ₹29,14,507$

= or ₹ 29.14507 Lakhs

∴ Net amount received at the time of issue:- ₹ 10.00 Crores - ₹ 0.29151 Crores = ₹ 9.70849 Crores

Question 31

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 (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
- Repayment at maturity. (Consider 360 days in a year)

Solution

(i) **Dirty Price** = Clean Price + Interest Accrued

$$= 99.42 + \frac{100 \times 10\% \times 262}{360} = 106.70$$

(ii) **First Leg (Start Proceed)**

$$\begin{aligned} &= \text{Nominal Value} \times \frac{\text{Dirty Price}}{100} \times \frac{100 - \text{Initial Margin}}{100} \\ &= ₹8,00,00,000 \times \frac{106.70}{100} \times \frac{100 - 2}{100} = ₹8,36,52,800 \end{aligned}$$

Second Leg (Repayment at Maturity) = Start Proceed + Repo Interest

$$= ₹ 8,36,52,800 + (83652800 \times 5.65\% \times 14/360) = ₹ 8,38,36,604$$

Question 32

[OLD PM]

A share of Tension-free Economy Ltd. is currently quoted at, price earnings ratio of 7.5 times. Retained earnings per share being 37.5% is ₹ 3 per share.

- The company's cost of equity, if investors expect annual growth rate of 12%.
- If anticipated growth rate is 13% p.a., calculate indicated market price, with same cost of capital.
- If the company's cost of capital is 18% and anticipated growth rate is 15% p.a., calculate the market price per share, assuming other conditions remain the same.

Solution

1) Calculation of cost of Capital

Retained Earnings	37.5%	₹3 per share
Dividend*	62.5%	₹5 per share
EPS	100%	₹8 per share
P/E ratio	7.5 times	

Market price is ₹ 7.5 × 8 = ₹ 60 per share

Cost of equity capital = (Dividend/ price × 100) + growth % = (5/60 × 100) + 12% = 20.33%

- Market Price = 5 / (20.33% - 13%) = 5 / 7.33% = ₹ 68.21 per share.
- Market price = 5 / (18% - 15%) = 5 / 3% = ₹ 166.66 per share

Question 33**[OLD 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, 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. Firm has beta of 1.40 currently, and is expected to have a beta of 1.10 after 2008. Market risk premium is 5.5%. Treasury bond rate is 6.25%.

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

Solution

The expected rate of return on equity after 2008 = $0.0625 + 1.10(0.055) = 12.3\%$

The dividends from 2003 onwards can be estimated as:

Year	2003	2004	2005	2006	2007	2008	2009
Earnings Per Share (€)	2.1	2.415	2.78	3.19	3.67	4.22	4.48
Dividends Per Share (€)	0.69	0.794	0.913	1.048	1.206	1.387	2.91

- (i) The price as of 2008 = $\text{€ } 2.91 / (0.123 - 0.06) = \text{€ } 46.19$
- (ii) The required rate of return up to 2008 = $0.0625 + 1.4(0.055) = 13.95\%$. The dividends up to 2008 are discounted using this rate as follow:

Year	PV of Dividend
2004	$0.794 / 1.1395 = 0.70$
2005	$0.913 / (1.1395)^2 = 0.70$
2006	$1.048 / (1.1395)^3 = 0.70$
2007	$1.206 / (1.1395)^4 = 0.72$
2008	$1.387 / (1.1395)^5 = 0.72$
Total	3.54

The current price = $\text{€ } 3.54 + \text{€ } 46.19 / (1.1395)^5 = \text{€ } 27.58$. * Values have been rounded off.

Question 34**[OLD PM]**

XYZ company has current earnings of ₹ 3 per share with 5,00,000 shares outstanding. The company plans to issue 40,000, 7% convertible preference shares of ₹ 50 each at par. The preference shares are convertible into 2 shares for each preference shares held. The equity share has a current market price of ₹ 21 per share.

- i. What is preference share's conversion value?
- ii. What is conversion premium?
- iii. 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.
- iv. If profits after tax increases by ₹ 1 million what will be the basic EPS (a) before conversion and (b) on a fully diluted basis?

Solution

(a) Conversion value of preference share = Conversion Ratio $\times$ Market Price = $2 \times ₹ 21 = ₹ 42$

(b) Conversion Premium $(₹50 / ₹ 42) - 1 = 19.05\%$

(c) Effect of the issue on basic EPS

	₹
Before Conversion	
Total (after tax) earnings ₹ $3 \times 5,00,000$	15,00,000
Dividend on Preference shares	<u>1,40,000</u>
Earnings available to equity holders	<u>13,60,000</u>
No. of shares	5,00,000
EPS	2.72
On Diluted Basis	
Earnings	15,00,000
No of shares $(5,00,000 + 80,000)$	5,80,000
EPS	2.59

(d) EPS with increase in Profit

	₹
Before Conversion	
Earnings	25,00,000
Dividend on Pref. shares	<u>1,40,000</u>
Earning for equity shareholders	<u>23,60,000</u>
No. of equity shares	5,00,000
EPS	4.72
On Diluted Basis	
Earnings	25,00,000
No. of shows	5,80,000
EPS	4.31

Question 35**[RTP NOV 18]**

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 are 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

(i) Number of shares to be issued: 5,00,000 Subscription price = ₹ 20,00,000 / 5,00,000 = ₹ 4 Ex-right Price=(₹1,30,00,000 + ₹20,00,000)/15,00,000 = ₹10 Value of a Right = ₹ 10 - ₹ 4 = ₹ 6 Value of a Right Per Share Basis =(₹ 10 - ₹ 4)/2 = ₹3	(ii) Number of shares to be issued: 2,50,000 Subscription price ₹ 20,00,000 / 2,50,000 = ₹ 8 Ex-right Price = (₹1,30,00,000 + ₹20,00,000)/12,50,000 = ₹12 Value of a Right = ₹ 12 - ₹ 8 = ₹ 4 Value of Right Per Share Basis = (₹ 12 - ₹ 8)/4 = ₹1

(iii) Calculation of effect of right issue on wealth of Shareholder's wealth who is holding 100 shares.

(a) When firm offers one share for two shares held.

Value of Shares after right issue (150 X ₹ 10)	₹ 1,500
Less: Amount paid to acquire right shares (50 X ₹ 4)	<u>₹ 200</u>
	<u>₹ 1,300</u>

(b) When firm offers one share for every four shares held.

Value of Shares after right issue (125 X ₹ 12)	₹ 1,500
Less: Amount paid to acquire right shares (25 X ₹ 8)	<u>₹ 200</u>
	<u>₹ 1,300</u>

(c) Wealth of Shareholders before Right Issue ₹ 1,300

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

Question 36

[RTP MAY 22]

Mr. A is holding 1000 shares of face value of ₹ 100 each of M/s. ABC Ltd. He wants to hold these shares for long term and have no intention to sell.

On 1st January 2020, M/s XYZ Ltd. has made short sales of M/s. ABC Ltd.'s shares and approached Mr. A to lend his shares under Stock Lending Scheme with following terms:

- Shares to be borrowed for 3 months from 01-01-2020 to 31-03-2020,
- Lending Charges/Fees of 1% to be paid every month on the closing price of the stock quoted in Stock Exchange and
- Bank Guarantee will be provided as collateral for the value as on 01-01-2020.

Other Information: (a) Cost of Bank Guarantee is 8% per annum, (b) On 29-02-2020 M/s ABC Ltd.'s share quoted in Stock Exchange on various dates are as follows:

Date	Share Price in Scenario-1 Bullish	Share Price in Scenario-1 Bullish
01-01-2020	1000	1000
31-01-2020	1020	980
29-02-2020	1040	960
31-03-2020	1050	940

You are required to find out:

- Earning of Mr. A through Stock Lending Scheme in both the scenarios,
- Total Earnings of Mr. A during 01-01-2020 to 31-03-2020 in both the scenarios, if dividend income per share is Rs 25.
- What is the Profit or loss to M/s. XYZ by shorting the shares using through Stock Lending Scheme in both the scenarios?

Solution

Earnings of Mr. A through stock lending scheme

		Scenario 1	Scenario 2
(i)	Lending fee		
	31-01-20 1020 × 1% and 980 × 1%	10.20	9.80
	29-02-20 1040 × 1% and 960 × 1%	10.40	9.60
	31-03-20 1050 × 1% and 940 × 1%	10.50	9.40
	Earnings from lending per Share (A)	31.10	28.80
	Total No. of Shares	1000	1000
	Total Earning from Lending	31,100	28,800
(ii)	Dividend income per Share (B)	25.00	25.00
	Total earnings per share (A) + (B)	56.10	53.80
	Total No. of Shares	1000	1000
	Total Earning	<u>56,100</u>	<u>53,800</u>
(iii)	Gain on shortening the shares		
	(1,050 - 1,000) and (1,000 - 940)	(50.00)	60.00
	Lending fees paid	(31.10)	(28.80)
	Bank guarantee charges @ 8%	(20.00)	(20.00)
	Gain Per Share	<u>(101.10)</u>	11.20
	Total No. of Shares	1000	1000
	Total Gain on shortening the shares	(1,01,100)	11,200

Question 37**[RTP MAY 22]**

V Following is the information for the options free bond:

Face value of the bond	₹ 1,000
Coupon rate	7%
Terms of Maturity	7 years
Yield to Maturity	8%

You are required to calculate:

- (i) Market price of the bond and duration.
(ii) If there is an increase in yield by 35 basis points, what would be the price of bond?

Present Value	t1	t2	t3	t4	t5	t6	t7
PVIF0.07,t	0.935	0.874	0.817	0.764	0.714	0.667	0.623
PVIF0.08,t	0.926	0.857	0.794	0.735	0.681	0.631	0.584

Solution:

(i) Market price and duration of Bond

$$= 70 (\text{PVIAF } 8\%, 7) + 1,000 (\text{PVIF } 8\%, 7)$$

$$= 70 (5.208) + 1,000 (0.584) = 364.56 + 584.00 = 948.56$$

(2) Duration of Bond

Period (A)	Cash flow (₹) (B)	PVF@ 8% (C)	PV (₹) (D) = (B) × (C)	(E) = (A) × (D)
1	70	0.926	64.82	64.82
2	70	0.857	59.99	119.98
3	70	0.794	55.58	166.74
4	70	0.735	51.45	205.80
5	70	0.681	47.67	238.35
6	70	0.631	44.17	265.02
7	1,070	0.584	624.88	4374.16
			948.56	5434.87

Duration of the Bond is = $5434.87 / 948.56 = 5.73$ years

(ii) Price of Bond if increase in yield by 35 basis points

Period	Cash flow (₹)	PVF@8.35%	PV (₹)
1	70	0.923	64.61
2	70	0.852	59.64
3	70	0.786	55.02
4	70	0.726	50.82
5	70	0.670	46.90
6	70	0.618	43.26
7	1,070	0.570	<u>609.90</u>
			<u>930.15</u>

Alternatively, if the same increase in yield is linked with duration as computed in sub part (i), then

answer will be computed as follows: Volatility of Bond = $\frac{\text{Duration}}{1 + \text{YTM}} = 5.73/1 + 0.08 = 5.306$

The expected market price if increase in yield is by 35 basis points.

= ₹ 948.56 × 0.35 (5.306/100) = ₹ 17.62

Hence expected market price is ₹ 948.56 - ₹ 17.62 = ₹ 930.94

Hence, the market price will decrease with increase in the yield.

Question 38

[RTP MAY 20]

M/s Agfa Industries is planning to issue a debenture series on the following terms:

Face Value	₹ 100
Term of maturity	10 years
Years	Yearly Coupon rate
1 - 4	9%
5 - 8	10%
9 - 10	14%

The current market rate on similar debentures is 15 percent per annum. The Company proposes to price the issue in such a manner that it can yield 16 percent compounded rate of return to the investors. The Company also proposes to redeem the debentures at 5 percent premium on maturity. Determine the issue price of the debentures.

Solution

Years	Cash out flow (₹)	PVIF @ 16%	PV
1	9	.862	7.758
2	9	.743	6.687
3	9	.641	5.769
4	9	.552	4.968
5	10	.476	4.76
6	10	.410	4.10
7	10	.354	3.54
8	10	.305	3.05
9	14	.263	3.682
10	14 + 105 = 119	.227	3.178 + 23.835
			71.327

The issue price of the debentures will be the sum of present value of interest payments during 10 years of its maturity and present value of redemption value of debenture. Thus the debentures should be priced at ₹ 71.327

Question 39**[RTP MAY 19]**

Based on credit rating of bonds, Mr. Z has decided to apply 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. Bond has five years to maturity and coupon rate on bond is 15% p.a. payable annually. Next interest payment is due one year from today and 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 he invest in the bond? Also calculate the current yield and the Yield to Maturity (YTM) of the bond.

Solution

The appropriate discount rate for valuing the bond for Mr. Z is: $R = 9\% + 3\% + 2\% = 14\%$

Time	CF	PVIF 14% PV (CF)	PV (CF)
1	150	0.877	131.55
2	150	0.769	115.35
3	150	0.675	101.25
4	150	0.592	88.80
5	1150	0.519	596.85
		$\Sigma PV (CF) \text{ i.e. } P =$	1033.80

Since, the current market value is less than the intrinsic value; Mr. Z should buy the bond.

Current yield = Annual Interest / Price = $150 / 1025.86 = 14.62\%$

The YTM of the bond is calculated as follows: @ 15%

$$P = 150 \times PVIFA(15\%, 4) + 1150 \times PVIF(15\%, 5) \\ = 150 \times 2.855 + 1150 \times 0.497 = 428.25 + 571.55 = 999.80$$

@ 14% As found in sub part (a) $P_0 = 1033.80$

$$\text{By interpolation we get} = 14\% + \frac{7.94}{7.94 - (-26.06)} \times (15\% - 14\%) = 14\% + \frac{7.94}{34}\%$$

$$YTM = 14.23\%$$

Question 40

[MTP APRIL 18/MTP MAY 20]

ABC Ltd. issued 9%, 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 every next year in further for the same tenure. This bond has a beta value of 1.02 and is more popular in the market due to less credit risk. Calculate (i) Intrinsic value of bond (ii) Expected price of bond in the market.

Solution

(i) Intrinsic value of Bond

PV of Interest + PV of Maturity Value of Bond

Forward rate of interests

1st Year 12%

2nd Year 11.25%

3rd Year 10.75%

$$\text{PV of Interest} = \frac{90}{(1+0.12)} + \frac{90}{(1+0.12)(1+0.1125)} + \frac{90}{(1+0.12)(1+0.1125)(1+0.1075)} = ₹ 217.81$$

$$\text{PV of Maturity Value of Bond} = \frac{1000}{(1+0.12)(1+0.1125)(1+0.1075)} = ₹ 724.67$$

$$\text{Intrinsic Value of Bond} = ₹ 217.81 + ₹ 724.67 = ₹ 942.48$$

$$(ii) \text{ Expected Price} = \text{Intrinsic Value} \times \text{Beta Value} = ₹ 942.48 \times 1.02 = ₹ 961.33$$

Question 41

[OLD PM]

Name of Security	Face Value ₹	Maturity Date	Coupon Rate	Coupon Date(s)
Zero coupon	10,000	31st March, 2023	N.A.	N..A.
T-Bill	1,00,000	20th June, 2013	N.A.	N.A.
10.71% GOI 2023	100	31st March, 2023	10.71	31st March
10 % GOI 2018	100	31st March, 2018	10.00	31st March & 30th September

On 31st March, 2013, following information about Bonds is available:

Calculate:

- If 10 years yield is 7.5% p.a. what price the Zero Coupon Bond would fetch on 31st March, 2013?
- What will be the annualized yield if the T-Bill is traded @ 98500?
- If 10.71% GOI 2023 Bond having yield to maturity is 8%, what price would it fetch on April 1, 2013 (after coupon payment on 31st March)?
- If 10% GOI 2018 Bond having yield to maturity is 8%, what price would it fetch on April 1, 2013 (after coupon payment on 31st March)?

Solution

a. Rate used for discounting shall be yield. Accordingly, ZCB shall fetch: $= \frac{10000}{(1+0.075)^{10}} = 4,852$

b. The day count basis is actual number days / 365. Accordingly annualized yield shall be:

$$\text{Yield} = \frac{\text{FV} - \text{Price}}{\text{Price}} \times \frac{365}{\text{No. of Days}} = \frac{100000 - 98500}{98500} \times \frac{365}{81} = 6.86\%$$

Note: Alternatively, it can also be computed on 360 days a year.

c. Price GOI 2023 would fetch:

$$\begin{aligned} &= ₹ 10.71 \text{ PVA} (8\%, 10) + ₹ 100 \text{ PVF} (8\%, 10) \\ &= ₹ 10.71 \times 6.71 + ₹ 100 \times 0.4632 \\ &= ₹ 71.86 + ₹ 46.32 = ₹ 118.18 \end{aligned}$$

d. Price GOI 2018 Bond would fetch:

$$\begin{aligned} &= ₹ 5 \text{ PVA} (4\%, 10) + ₹ 100 \text{ PVF} (4\%, 10) \\ &= ₹ 5 \times 8.11 + ₹ 100 \times 0.6756 = 40.55 + 67.56 = 108.11 \end{aligned}$$

Question 42**[OLD PM]**

- (a) Consider two bonds, one with 5 years to maturity and the other with 20 years to maturity. Both the bonds have a face value of ₹ 1,000 and coupon rate of 8% (with annual interest payments) and both are selling at par. Assume that the yields of both the bonds fall to 6%, whether the price of bond will increase or decrease? What percentage of this increase / decrease comes from a change in the present value of bond's principal amount and what percentage of this increase / decrease comes from a change in the present value of bond's interest payments?

Solution

- (a) If yield of the bond falls price will always increase. This can be shown by following calculation.

If yield falls to 6%

Price of 5yr. bond	Current price of 20 year bond
₹ 80 (PVIFA 6%, 5yrs.) + ₹ 1000 (PVIF 6%, 5yrs.)	₹ 80 (PVIFA 6%, 20) + ₹ 1,000 (PVIF 6%, 20)
₹ 80 (4.212) + ₹ 1000 (0.747) = ₹ 336.96 + ₹ 747.00 = ₹ 1,083.96	₹ 80 (11.47) + ₹ 1,000 (0.312) = ₹ 917.60 + ₹ 312.00 = ₹ 1229.60
Increase in 5 year's bond price = ₹ 83.96	So increase in bond price is ₹ 229.60

PRICE INCREASE DUE TO CHANGE IN PV OF PRINCIPAL

5 yrs. Bond	20 yrs. Bond
₹ 1,000 (PVIF 6%, 5) - ₹ 1,000 (PVIF 8%, 5)	₹ 1,000 (PVIF 6%, 20) - ₹ 1,000 (PVIF 8%, 20)
₹ 1,000 (0.747) - ₹ 1,000 (0.681)	₹ 1,000 (0.312) - ₹ 1,000 (0.214)
₹ 747.00 - ₹ 681.00 = ₹ 66.00	₹ 312.00 - ₹ 214.00 = ₹ 98.00
& change in price due to change in PV of Principal	& change in price due to change in PV of Principal
(₹ 66 / ₹ 83.96) × 100 = 78.6%	(₹ 98 / ₹ 229.60) × 100 = 42.68%

PRICE CHANGE DUE TO CHANGE IN PV OF INTEREST

5 yrs. Bond	20 yrs. Bond
₹ 80 (PVIFA 6%, 5) - ₹ 80 (PVIFA 8%, 5)	₹ 80 (PVIFA 6%, 20) - ₹ 80 (PVIFA 8%, 20)
₹ 80 (4.212) - ₹ 80 (3.993)	₹ 80 (11.47) - ₹ 80 (9.82)
₹ 336.96 - ₹ 319.44 = ₹ 17.52	₹ 917.60 - ₹ 785.60 = ₹ 132
% change in price = $\frac{17.52}{83.96} \times 100 = 20.86\%$	& change in price = $\frac{132}{229.60} \times 100 = 57.49\%$

Question 43

[OLD PM]

John inherited the following securities on his uncle's death:

Types of Security	Nos.	Annual Coupon %	Maturity Years	Yield %
Bond A (₹ 1,000)	10	9	3	12
Bond B (₹ 1,000)	10	10	5	12
Preference shares C (₹ 100)	100	11	*	13*
Preference shares D (₹ 100)	100	12	*	13*

*likelihood of being called at a premium over par.

Compute the current value of his uncle's portfolio.

Solution

Computation of current value of John's portfolio

(i) 10 Nos. Bond A, ₹ 1,000 par value, 9% Bonds maturity 3 years:

Current value of interest on bond A		
1-3 years: ₹ 900 × Cumulative P.V. @ 12% (1-3 years)		
= ₹ 900 × 2.402	2,162	
Add: Current value of amount received on maturity of Bond A		
End of 3rd year: ₹ 1,000 × 10 × P.V. @ 12% (3rd year)		
= ₹ 10,000 × 0.712	<u>7,120</u>	9,282

(ii) 10 Nos. Bond B, ₹ 1,000 par value, 10% Bonds maturity 5 years:

Current value of interest on bond B		
1-5 years: ₹ 1,000 × Cumulative P.V. @ 12% (1-5 years)		
= ₹ 1,000 × 3.605	3,605	
Add: Add: Current value of amount received on maturity of Bond B		
End of 5th year: ₹ 1,000 × 10 × P.V. @ 12% (5th year)		
= ₹ 10,000 × 0.567	<u>5,670</u>	9,275

(iii) 100 Preference shares C, ₹ 100 par value, 11% coupon

$= \frac{11\% \times 100 \text{ Nos} \times 100}{13\%} = 1,100 / 0.13$	8,462	

(iv) 100 Preference shares D, ₹ 100 par value, 12% coupon

$= \frac{12\% \times 100 \text{ Nos} \times 100}{13\%} = 1,200 / 0.13$	9,231	17,693

Total current value of his portfolio [(i) + (ii) + (iii) + (iv)]

36,250

Question 44

[OLD PM]

Pet feed plc has outstanding, a high yield Bond with following features:

Face Value	£ 10,000
Coupon	10%
Maturity Period	6 Years
Special Feature	Company can extend the life of Bond to 12 years.

Presently the interest rate on equivalent Bond is 8%.

- If an investor expects that interest will be 8%, six years from now then how much he should pay for this bond now.
- Now suppose, on the basis of that expectation, he invests in the Bond, but interest rate turns out to be 12%, six years from now, then what will be his potential loss / gain if the company extends the life of Bond for another 6 years.

Solution:

(a) If the current interest rate is 8%, the company will not extent the duration of Bond and the maximum amount the investor would ready to pay will be:

$$= £1,000 \text{ PVIAF } (8\%, 6) + £10,000 \text{ PVIF } (8\%, 6)$$

$$= £1,000 \times 4.623 + £10,000 \times 0.630$$

$$= £4,623 + £ 6,300 = £ 10,923$$

(b) If the current interest rate is 12%, the company will extent the duration of Bond. After six years the value of Bond will be:

$$= £1,000 \text{ PVIAF } (12\%, 6) + £10,000 \text{ PVIF } (12\%, 6)$$

$$= £1,000 \times 4.111 + £10,000 \times 0.507 = £4,111 + £5,070$$

$$= £9,181$$

Thus, potential loss will be £9,181 - £10,923 = £ 1,742

Question 45**[RTP MAY 18]**

XL Ispat Ltd. has made an issue of 14 per cent non-convertible debentures on January 1, 2007. These debentures have a face value of ₹ 100 and is currently traded in the market at a price of ₹ 90.

Interest on these NCDs will be paid through post-dated cheques dated June 30 and December 31. Interest payments for the first 3 years will be paid in advance through post-dated cheques while for the last 2 years post-dated cheques will be issued at the third year. The bond is redeemable at par on December 31, 2011 at the end of 5 years.

Required: (i) Estimate the current yield and YTM of the bond. (ii) Calculate the duration of the NCD. (iii) Assuming that intermediate coupon payments are, not available for reinvestment calculate the realised yield on the NCD.

Solution:

(i) Current yield = $7/90 \times 12/6 = 0.1555$ or 15.55%

YTM can be determined from the following equation

$$7 \times PVIFA(YTM, 10) + 100 \times PVIF(YTM, 10) = 90$$

Let us discount the cash flows using two discount rates 7.5% and 9% as follows:

Year	Cash Flows	PVF@7.50%	PV@7.50%	PVF@9%	PV@9%
0	-90	1	-90	1	-90
1	7	0.930	6.51	0.917	6.419
2	7	0.865	6.055	0.842	5.894
3	7	0.805	5.635	0.772	5.404
4	7	0.749	5.243	0.708	4.956
5	7	0.697	4.879	0.650	4.550
6	7	0.648	4.536	0.596	4.172
7	7	0.603	4.221	0.547	3.829
8	7	0.561	3.927	0.502	3.514
9	7	0.522	3.654	0.460	3.220
10	107	0.485	51.90	0.422	45.154
			6.560		-2.888

Let us discount the cash flows using two discount rates 7.50% and 9% as follows:

Now we use interpolation formula:

$$= 7.50 + \frac{6.560}{6.560 - (-2.888)} \times 1.50\% = 7.50 + \frac{6.560}{9.448} \times 1.50\%$$

YTM = 8.541% or 8.54%

The duration can be calculated as follows:

Year	Cash Flow	PVF@ 8.54%	PV @ 8.54%	Proportion of NCD value	Proportion of NCD value × time
1	7	0.921	6.447	0.0717	0.0717
2	7	0.849	5.943	0.0661	0.1322
3	7	0.782	5.474	0.0608	0.1824
4	7	0.721	5.047	0.0561	0.2244
5	7	0.664	4.648	0.0517	0.2585
6	7	0.612	4.284	0.0476	0.2856
7	7	0.563	3.941	0.0438	0.3066
8	7	0.519	3.633	0.0404	0.3232
9	7	0.478	3.346	0.0372	0.3348
10	107	0.441	47.187	0.5246	5.2460
			89.95		7.3654

Duration = 7.3654 half years i.e. 3.683 years.

(ii) Realized Yield can be calculated as follows: $90 \left(1 + \frac{R}{100}\right)^5 = 170$

Therefore R = 13.58%

Question 46**[OLD PM]**

MP Ltd. issued 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: (i) What was the YTM of MP Ltd. bonds as on January 1, 2010? (ii) What amount you should pay to complete the transaction? Of that amount how much should be accrued interest and how much would represent bonds basic value.

Solution

(i) Since the bonds were sold at par, the original YTM was 10%.

YTM = Interest/Principal = 100/1000 = 10%

(ii) Price of the bond as on 1st July, 2018 = ₹ 50 × 9.712 + ₹ 1,000 × 0.417
= ₹ 485.60 + ₹ 417 = ₹ 902.60

Total value of the bond on the next interest date = ₹ 902.60 + ₹ 50 = ₹ 952.60

Therefore, Value of bond at purchase date = ₹ 952.60 × $\frac{1}{(1+0.12 \times 4/12)}$ = ₹ 916.40

The amount to be paid to complete the transaction is ₹ 916.40. Out of this amount ₹ 16.67 represent accrued interest* and ₹ 899.73 represent the bond basic value.

Accrued Interest can be calculated as follows: Accrued Interest on Bonds = $1,000 \times \frac{10}{100} \times \frac{2}{12} = 16.67$

Question 47**[NOV 18/MTP NOV 21]**

M/s Transindia Ltd. is contemplating 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 ₹ 1,140 and had initially collected proceeds of ₹ 2.91 crores due to a discount of ₹ 30 per bond. The initial floating cost was ₹ 3,60,000. 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 ₹ 4,00,000. 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 their proceeds, then used to retire old bonds, the company expects a two months period of overlapping interest during which interest must be paid on both the old and new bonds. What is the feasibility of refunding bonds?

Solution**NPV for bond refunding**

PV of annual cash flow savings (W.N. 2) (3,49,600 × PVIFA 8%, 25) i.e. 10.675	37,31,980
Less: Initial investment (W.N. 1)	29,20,000
NPV	8,11,980

Recommendation: Refunding of bonds is recommended as NPV is positive.

Working Notes:**1) Initial investment:**

(a)	Call Premium		
	Before tax $(1,140 - 1,000) \times 30,000$	42,00,000	
	Less tax @ 40%	<u>16,80,000</u>	
	After tax cost of call prem.		25,20,000
(b)	Flotation Cost		4,00,000
(c)	Overlapping Interest		
	Before tax $(0.14 \times 2/12 \times 3 \text{ crores})$	7,00,000	
	Less: tax @ 40%	<u>2,80,000</u>	4,20,000
(d)	Tax saving on unamortised discount on old bond $25/30 \times 9,00,000 \times 0.4$		(3,00,000)
(e)	Tax savings from unamortised floatation		
	Cost of old bond $25/30 \times 3,60,000 \times 0.4$		<u>(1,20,000)</u>
			<u>29,20,000</u>

2) Annual cash flow savings:

(a)	Old bond		
	(i) Interest cost $(0.14 \times 3 \text{ crores})$	42,00,000	
	Less tax @ 40%	<u>16,80,000</u>	25,20,000
	(ii) Tax savings from amortisation of discount $9,00,000/30 \times 0.4$		(12,000)
	(iii) Tax savings from amortization of floatation cost $3,60,000/30 \times 0.4$		<u>(4,800)</u>
	Annual after tax cost payment under old Bond (A)		<u>25,03,200</u>
(b)	New Bond		
	(i) Interest cost before tax $(0.12 \times 3 \text{ crores})$	36,00,000	
	Less tax @ 40%	<u>14,40,000</u>	
	After tax interest		21,60,000
	(ii) Tax savings from amortization of floatation cost $(0.4 \times 4,00,000/25)$		<u>(6,400)</u>
	Annual after tax payment under new Bond (B)		<u>21,53,600</u>
	Annual Cash Flow Saving (A) - (B)		<u>3,49,600</u>

Question 48**[RTP NOV 19/MTP MARCH 18/MTP APRIL 19]**

A hypothetical company ABC Ltd. issued a 10% Debenture (Face Value of ₹ 1000) of the duration of 10 years is currently trading at ₹ 850 per debenture. The bond is convertible into 50 equity shares being currently quoted at ₹17 per share.

If yield on equivalent comparable bond is 11.80%, then calculate the spread of yield of the above bond from this comparable bond.

The relevant present value table is as follows.

Present Values	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10
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

Conversion Price = ₹ 50 × 17 = ₹ 850

Intrinsic Value = ₹ 850

Accordingly the yield (r) on the bond shall be: ₹ 850 = ₹ 100 PVAF (r, 10) + ₹ 1000 PVF (r, 10)

Let us discount the cash flows by 11%

$850 = 100 \text{ PVAF}(11\%, 10) + 1000 \text{ PVF}(11\%, 10)$

$850 = 100 \times 5.890 + 1000 \times 0.352 = 91$

Now let us discount the cash flows by 13%

$850 = 100 \text{ PVAF}(13\%, 10) + 1000 \text{ PVF}(13\%, 10)$

$850 = 100 \times 5.426 + 1000 \times 0.295 = -12.40$

Accordingly, IRR

$11\% + \frac{90.90}{90.90 - (-12.40)} \times (13\% - 11\%)$

$11\% + \frac{90.90}{103.30} \times (13\% - 11\%) = 12.76\%$

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

Question 49**[RTP NOV 20]**

Today being 1st January 2019, Ram is considering to purchase an outstanding Corporate Bond having a face value of ₹ 1,000 that was issued on 1st January 2017 which has 9.5% Annual Coupon and 20 years of original maturity (i.e. maturing on 31 st December 2027). Since the bond was issued, the interest rates have been on downside and it is now selling at a premium of ₹ 125.75 per bond. Determine the prevailing interest on the similar type of Bonds if it is held till the maturity which shall be at Par.

PV Factors:

	1	2	3	4	5	6	7	8	9
6%	0.943	0.890	0.840	0.792	0.747	0.705	0.665	0.627	0.592
8%	0.926	0.857	0.794	0.735	0.681	0.630	0.583	0.540	0.500

Solution

To determine the prevailing rate of interest for the similar type of Bonds we shall compute the YTM of this Bond using IRR method as follows:

YTM can be determined from the following equation

$$₹ 95 \times PVIFA (YTM, 9) + ₹ 1000 \times PVIF (YTM, 9) = ₹ 1125.75$$

Let us discount the cash flows using two discount rates 8% and 10% as follows:

Year	Cash Flows	PVF@6%	PV@6%	PVF@8%	PV@8%
0	-1125.75	1	-1125.75	1	-1125.75
1	95	0.943	89.59	0.926	87.97
2	95	0.890	84.55	0.857	81.42
3	95	0.840	79.80	0.794	75.43
4	95	0.792	75.24	0.735	69.83
5	95	0.747	70.97	0.681	64.70
6	95	0.705	66.98	0.630	59.85
7	95	0.665	63.18	0.583	55.39
8	95	0.627	59.57	0.540	51.30
9	1095	0.592	<u>648.24</u>	0.500	<u>547.50</u>
			<u>112.37</u>		<u>-32.36</u>

Now we use interpolation formula

$$6.00\% + \frac{112.37}{112.37 - (-32.36)} \times 2.00\%$$

$$6.00\% + \frac{112.37}{144.73} \times 2.00\% = 6.00\% + 1.553\%$$

YTM = 7.553% say 7.55%

Thus, prevailing interest rate on similar type of Bonds shall be approx. 7.55%.

Question 50

[MTP March 21]

The following data are available for three bonds A, B and C. These bonds are used by a bond portfolio manager to fund an outflow scheduled in 6 years. Current yield is 9%. All bonds have face value of Rs.100 each and will be redeemed at par. Interest is payable annually.

Bond	Maturity (Years)	Coupon rate
A	10	10%
B	8	11%
C	5	9%

- Calculate the duration of each bond.
- Advise the percentage amount to bond portfolio manager to be invested in bonds B and C to immunise the portfolio and he has been asked to keep 45% of the portfolio money in Bond A.
- Evaluate whether the portfolio is still immunized if after the portfolio has been formulated, an interest rate change occurs, increasing the yield to 11%. N
New duration of bonds are: Bond A = 7.15 Years, Bond B = 6.03 Years and Bond C = 4.27 years.

- iv. Advise the new percentage of B and C bonds that are needed to immunize the portfolio. Bond A remaining at 45% of the portfolio.

Present values be used as follows :

Present Values	1	2	3	4	5
PVIF0.09	0.917	0.842	0.772	0.708	0.650

Present Values	6	7	8	9	10
PVIF0.09	0.596	0.547	0.502	0.460	0.4224

Solution:

(i) Calculation of Bond Duration

Year	Cash flow	P.V. @ 9%		Proportion of bond value	Proportion of bond value x time (years)
1	10	0.917	9.17	0.086	0.086
2	10	0.842	8.42	0.079	0.158
3	10	0.772	7.72	0.073	0.219
4	10	0.708	7.08	0.067	0.268
5	10	0.650	6.50	0.061	0.305
6	10	0.596	5.96	0.056	0.336
7	10	0.547	5.47	0.051	0.357
8	10	0.502	5.02	0.047	0.376
9	10	0.460	4.60	0.043	0.387
10	110	0.4224	46.46	0.437	4.370
			106.40	1.000	6.862

Duration of the bond is 6.862 years or 6.86 year

Bond B

Year	Cash flow	P.V. @ 9%		Proportion of bond value	Proportion of bond value x time (years)
1	11	0.917	10.087	0.091	0.091
2	11	0.842	9.262	0.083	0.166
3	11	0.772	8.492	0.076	0.228
4	11	0.708	7.788	0.070	0.280
5	11	0.650	7.150	0.064	0.320
6	11	0.596	6.556	0.059	0.354
7	11	0.547	6.017	0.054	0.378
8	111	0.502	55.772	0.502	4.016
			111.224	1.000	5.833

Duration of the bond B is 5.833 years or 5.84 years

Bond C

Year	Cash flow	P.V. @ 9%		Proportion of bond value	Proportion of bond value x time (years)
1	9	0.917	8.253	0.082	0.082
2	9	0.842	7.578	0.076	0.152
3	9	0.772	6.948	0.069	0.207
4	9	0.708	6.372	0.064	0.256
5	109	0.650	70.850	0.709	3.545
			100.00	1.000	4.242

Duration of the bond C is 4.242 years or 4.24 years

(ii) Amount of Investment required in Bond B and C

Period required to be immunized	6.000 Year
Less: Period covered from Bond A	3.087 Year
To be immunized from B and C	2.913 Year

Let proportion of investment in Bond B and C is b and c respectively then

$$b + c = 0.55 \quad (1)$$

$$5.883b + 4.242c = 2.913 \quad (2)$$

On solving these equations, the value of b and c comes 0.3534 or 0.3621 and 0.1966 or 0.1879 respectively and accordingly, the % of investment of B and C is 35.34% or 36.21% and 19.66 % or 18.79% respectively.

(iii) With revised yield the Revised Duration of Bond stands

$$0.45 \times 7.15 + 0.36 \times 6.03 + 0.19 \times 4.27 = 6.20 \text{ year}$$

No portfolio is not immunized as the duration of the portfolio has been increased from 6 years to 6.20 years.

(iv) New percentage of B and C bonds that are needed to immunize the portfolio.

Period required to be immunized	6.0000 Year
Less: Period covered from Bond A	3.2175 Year
To be immunized from B and C	2.7825 Year

Let proportion of investment in Bond B and C is b and c respectively, then $b + c = 0.55$

$$6.03b + 4.27c = 2.7825 \quad b = 0.2466$$

On solving these equations, the value of b and c comes 0.2466 and 0.3034 respectively and accordingly, the % of investment of B and C is 24.66% or 25% and 30.34 % or 30.00% respectively.

Question 51

You are interested in buying some equity stocks of RK Ltd. The company has 3 divisions operating in different industries. Division A captures 10% of its industries sales which is forecasted to be Rs. 50 crore for the industry. Division B and C captures 30% and 2% of their respective industry's sales, which are expected to be Rs. 20 crore and Rs. 8.5 crore respectively. Division A traditionally had a 5% net income margin, whereas divisions B and C had 8% and 10% net income margin respectively. RK Ltd. has 3,00,000 shares of equity stock outstanding, which sell at Rs. 250.

The company has not paid dividend since it started its business 10 years ago. However, from the market sources you come to know that RK Ltd. will start paying dividend in 3 years time and the pay-out ratio is 30%. Expecting this dividend, you would like to hold the stock for 5 year. By analysing the past financial statements, you have determined that RK Ltd.'s required rate of return is 18% and that P/E ratio of 10 for the next year and on ending P/E ratio of 20 at the end of the fifth year are appropriate.

Evaluate:

- (i) Whether you will be in purchasing RK Ltd. equity at this time based on your one year forecast?
- (ii) Price you will like to pay for the stock of RK Ltd if you expect earnings to grow @ 15% continuously. Ignore taxation.

PV factors are given below:

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

Solution

Working Notes:

Computation of Earning Per Share (EPS)

Particulars		Amount (Rs.)
Margin of Division A	(Rs. 50 crore x 10% x 5%)	25,00,000
Margin of Division B	(Rs. 20 crore x 30% x 8%)	48,00,000
Margin of Division C	(Rs. 8.5 crore x 2% x 10%)	1,70,000
		74,70,000
No. of Equity Shares		3,00,000
EPS		Rs. 24.90

(i) Market Price based on One Year Forecast

Expected Market Price at the end of the year = Rs. 24.90 x 10 = Rs. 249

PV of the Expected Price = Rs. 249 x 0.847 = Rs. 210.90

I would NOT like to purchase the share as the expected market price of shares is less than its current price of Rs. 250.

(ii) If Earning is expected to grow @ 15%

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

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

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

Total PV of Inflows = Rs. 20.22 + Rs. 251.61 = Rs. 271.83

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

Question 52

[MTP APRIL 21]

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

(i) For finding expected market price first we shall calculate Intrinsic Value of Bond as follows:

PV of Interest + PV of Maturity Value of Bond Forward rate of interests

1st Year	12%
2nd Year	11.62%
3rd Year	11.33%
4th Year	11.06%
5th Year	10.80%

$$\begin{aligned} \text{PV of interest} &= \frac{\text{Rs } 90}{(1+0.12)} + \frac{\text{Rs } 90}{(1+0.1162)^2} + \frac{\text{Rs } 90}{(1+0.1133)^3} + \frac{\text{Rs } 90}{(1+0.1106)^4} + \frac{\text{Rs } 90}{(1+0.1080)^5} \\ &= \text{Rs. } 90 \times 0.8929 + \text{Rs. } 90 \times 0.8026 + \text{Rs. } 90 \times 0.7247 + \text{Rs. } 90 \times 0.6573 + \text{Rs. } 90 \times 0.5988 \\ &= \text{Rs. } 80.36 + \text{Rs. } 72.23 + \text{Rs. } 65.22 + \text{Rs. } 59.16 + \text{Rs. } 53.89 = \text{Rs. } 330.86 \end{aligned}$$

$$\begin{aligned} \text{PV of Maturity Value of Bond} &= \text{Rs. } 1000 / (1+0.1080)^5 \\ &= \text{Rs. } 1,000 \times 0.5988 = \text{Rs. } 598.80 \end{aligned}$$

$$\begin{aligned} \text{Intrinsic value of Bond} &= \text{Rs. } 330.86 + \text{Rs. } 598.80 = \text{Rs. } 929.66 \\ \text{Expected Price} &= \text{Intrinsic Value} \times \text{Beta Value} = \text{Rs. } 929.66 \times 1.10 = \text{Rs. } 1,022.63 \end{aligned}$$

(ii) The given yield curve is inverted yield curve.

The main reason for this shape of curve is expectation for forth coming recession when investors are more interested in Short-term rates over the long term.

Question 53

[NOV 20/SIMILAR MTP APRIL 22]

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 (a) By Macaulay's Duration based estimate (b) By Intrinsic Value Method.

Given

Years	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

(i) Current Market Price of Bond

$$\begin{aligned} &= ₹ 850 (\text{PVIAF } 10\%, 5) + ₹ 10,000 (\text{PVIF } 10\%, 5) \\ &= ₹ 850 (3.79) + ₹ 10,000 (0.621) = ₹ 3,221.50 + ₹ 6,210 = ₹ 9,431.5 \end{aligned}$$

(ii) Macaulay's Duration

Year	Cash flow	P.V. @ 10%		Proportion of bond value	Proportion of bond value x time (years)
1	850	0.909	772.65	0.082	0.082
2	850	0.826	702.10	0.074	0.148
3	850	0.751	638.35	0.068	0.204
4	850	0.683	580.55	0.062	0.248
5	10,850	0.621	6,737.85	0.714	3.57
			9431.50	1.000	4.252

Duration of the Bond is 4.252 years

(iii) Volatility of Bond = Volatility of Bonds = $\frac{\text{Duration}}{(1 + \text{YTM})} = 4.252 / 1.10 = 3.865$

(iv) Convexity of Bond = $C \times (\Delta Y)^2 \times 100$, where $C = \frac{V_+ + V_- - 2V_0}{2V_0 (\Delta Y)^2}$

Year	Cash flow	P.V. @ 8%		P.V @12%	
1	850	0.926	787.10	0.892	758.20
2	850	0.857	728.45	0.797	677.45
3	850	0.794	674.90	0.712	605.20
4	850	0.735	624.75	0.636	540.60
5	10,850	0.681	7388.85	0.567	6,151.95
			10204.05		8,733.40

$C^* = \frac{10,204.05 + 8,733.40 - 2 \times 9,431.50}{2 \times 9,431.50 \times (0.02)^2} = \frac{74.45}{7.5452} = 9.867$

Convexity of Bond = $9.867 \times (0.02)^2 \times 100 = 0.395\%$

(v) The expected market price if decrease in YTM by 200 basis points.

(a) By Macaulay's duration-based estimate

= ₹ 9431.50 × 2 (3.865 / 100) = ₹ 729.05

Hence expected market price is ₹ 9431.50 + ₹ 729.05 = ₹ 10,160.55

Hence, the market price will increase.

(b) By Intrinsic Value method

Intrinsic Value at YTM of 10%	₹ 9,431.50
Intrinsic Value at YTM of 8%	₹ 10,204.05
Price increased by	₹ 772.55

Hence, expected market price is ₹ 10,204.05

Question 54

Following are the yields on Zero Coupon Bonds (ZCB) having a face value of ₹ 1,000

Maturity (Years)	Yield to Maturity (YTM)
1	10%
2	11%
3	12%

Assume that the term structure of interest rate will remain the same. You are required to (i) Calculate the implied one year forward rates (ii) Expected Yield to Maturity and prices of one year and two-year Zero-Coupon Bonds at the end of the first year.

Solution:

(i) Calculation of Forward Rates

Maturity	YTM (%)	PVIF	Face value	Price	Forward rate	
1	10	0.909	1,000	909.09		
2	11	0.812	1,000	811.62	0.1201 i.e.	12.01%
3	12	0.712	1,000	711.78	0.1403 i.e.	14.03%

(ii) Calculation of Expected Prices and YTM

Maturity	Forward rate	Face value	Price	YTM	
2	0.1201	1,000	$\frac{1000}{1 + 0.1201} = 892.78$	0.1201 i.e.	12.01%
3	0.1403	1,000	$\frac{1000}{(1 + 0.1201)(1 + 0.1403)} = 782.93$	0.1302* i.e.	13.02%

$$* \sqrt{\frac{1000}{782.93}} - 1 = 0.1302$$

Question 55

[MTP OCT 22]

From following information, compute effective rate of interest per annum as well as total cost of funds to Nirmal Ltd., which is planning a Commercial Paper (CP) issue:

Issue Price of CP	4,87,750
Face Value	5,00,000
Maturity Period	3 Months

Issue Expenses:

Brokerage	0.15% for 3 months
Rating Charges	0.55% p.a.
Stamp Duty	0.20% for 3 months

Solution

$$\text{Nominal Interest or Bond Equivalent Yield} = 100 \times \frac{F-P}{P} \times \frac{12}{M}$$

$$100 \times \frac{5,00,000 - 4,87,750}{4,87,750} \times \frac{12}{3} = 10.05\% \text{ p.a.}$$

$$\text{Formula of EAR} = \left(1 + Y \times \frac{\text{Number of Days/ Months}}{365/12}\right)^{\frac{365/12}{\text{Number of Days/ Months}}} - 1$$

$$\text{Effective Interest Rate} = (1 + 0.1005/4)^4 - 1 = 10.435\% \text{ p.a.}$$

Cost of Funds to the Company

Effective Interest	10.435%
Brokerage (0.150 × 4)	0.60%
Rating Charge	0.55%
Stamp duty (0.20 × 4)	<u>0.80%</u>
	<u>12.385%</u>

Question 56

[MTP MAY 23]

The Balance Sheet of M/s. Sundry Ltd. as on 31-03-2020 is follows: (₹ in lakhs)

Liabilities	₹	Assets	₹
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: (i) The amount of External Fund Requirement (EFR) (ii) The amount to be raised from Short Term, Long Term and Equity funds.

Solution

(i) External Funds Requirement (EFR):

(₹ in lakhs)

	(₹)
Expected sales (₹ 600 + 20% of ₹ 600)	720.00
Profit margin @ 4%	28.80
Dividend payout ratio @ 50%	14.40
Balance to be ploughed back (A)	14.40
Additional funds required (₹ 1400 - ₹ 200*) × 0.20 (B)	240.00
Balance to be met from external source (B - A)	225.60

*As current liabilities shall also be increased proportionately with increase in sales.

(ii) Amount to be raised from different sources with following conditions:

- ✓ Sales to short term loans and payables & provisions 4:3
- ✓ Ratio of fixed assets to long term loans 1.5
- ✓ Debt equity ratio should not exceed 1.5

(1) Amount to be raised from short term funds:

	(₹ in lakhs)
New amount of short-term loans and payables & provision $3/4 \times 720$	540
Less: Existing Amount of short-term loans and payables & provision $(200 \times 1.2) + 300$	540
Amount to be raised from short term funds	Nil

(2) Amount to be raised from Long term funds:

	(₹ in lakhs)
New fixed assets $(₹ 600 + 20\% \text{ of } ₹ 600)$	720
New long-term loans $(₹ 720 / 1.5)$	480
Less: Existing long-term loans	400
Amount to be raised from Long term funds	80

(3) Amount to be raised from equity funds:

	(₹ in lakhs)
Amount to be raised from external sources	225.60
Less: Amount to be raised from short term funds	----
Less: Amount to be raised from Long term funds	80.00
Balance amount to be raised from equity funds	145.60

Question 57**[RTP MAY 19]**

The directors of Implant Inc. wishes to make an equity issue to finance a \$ 10 m (million) expansion scheme which has an expected Net Present Value of \$ 2.2 m and to re - finance an existing \$ 6 m 15% Bonds due for maturity in 5 years' time. For early redemption of these bonds there is a \$ 3,50,000 penalty charges. The Co. has also obtained approval to suspend these pre - emptive rights and make a \$ 15 m placement of shares which will be at a price of \$ 0.5 per share. The floatation cost of issue will be 4% of Gross proceeds. Any surplus funds from issue will be invested in IDRs which is currently yielding 10% per year.

The Present capital structure of Co. is as under:

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

Current share price is \$ 2 per share and debenture price is \$ 103 per debenture. Cost of capital of Co. is 10%. It may be further presumed that stock market is semi-strong form efficient and no information about the proposed use of funds from the issue has been made available to the public. You are required to calculate expected share price of company once full details of the placement and to which the finance is to be put, are announced.

Solution:

In semi - strong form of stock market, the share price should accurately reflect new relevant information when it is made publicly available including Implant Inc. expansion scheme and redemption of the term loan.

1. The existing Market Value	\$ 2 × 7,000,000	\$ 14,000,000
2. The new investment has an expected NPV		\$ 2,200,000
3. Proceeds of New Issue		\$ 15,000,000
4. Issue Cost of shares		(\$ 600,000)
5. Gain/ Loss on early redemption of bonds		
PV of Benefit of early redemption Interest of \$ 900,000 (\$ 6,000,000 × 15 %) × 3.791	3,411,900	
PV of Repayment in 5 years \$ 6,000,000 × 0.621	3,726,000	
	7,137,900	
Redemption Cost Now	(6,000,000)	
6. Penalty charges	(350,000)	787,900
Expected Total Market value		31,387,900
New No. of shares (30 Million + 7 Million)		3,70,00,000
Expected Share Price of Company		\$ 0.848

Question 58 (Old course question)

AXY Ltd. is able to issue commercial paper of 100,00,000 every 4 months at a yield rate of 12.5% p.a. The cost of placement of commercial paper issue is ₹ 5,000 per issue. XYZ Ltd. is required to maintain line of credit 300,000 in bank balance. The applicable income tax rate for XYZ Ltd. is 30%. What is the cost of funds (after taxes) to XYZ Ltd. for commercial paper issue? The maturity of commercial paper is four months.

Solution

Since Commercial Paper is a discount instrument, it shall be issued at discounted price. Accordingly, answer shall be as follows:

$$\text{Issue Price} = \frac{100,00,000}{1 + (12.5\% + 4/12)} = ₹ 96,00,000$$

	₹
Issue Price	96,00,000
Less: Issue Expenses	5,000
Less: Minimum Balance	3,00,000
Net Amount Received	92,95,000

$$\text{Cost of Funds} = \frac{(4,00,000 + 5,500)(1 - 0.30)}{92,95,500} \times \frac{12}{4} \times 100 = 9.16\%$$

Question 59 (Nov 2019 Question)

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

Particulars	(₹ in crores)
PBIT	5.00
Less: Interest on Debt (10%)	1.00
PBT	4.00
Less: Tax @ 25%	1.00
PAT	3.00
No. of outstanding shares of 10 each	40 lakhs
EPS (₹)	7.5
Market price of share (₹)	75
P/E ratio	10 Times

TS Ltd. has an undistributed reserves of * 8 crores. The company requires * 3 crores for the purpose of expansion which is expected to earn the same rate of return on capital employed as present. However, if the debt to capital employed ratio is higher than 35%, then P/E ratio is expected to decline to 8 Times and rise in the cost of additional debt to 14%. Given this data which of the following options the company would prefer, and why?

Option (1): If the required amount is raised through debt, and

Option (2): If the required amount is raised through equity and the new shares will be issued at a price of 25 each.

Note: Present all amounts in crores in 4 decimals.

Solution

Working Notes

(1) Calculation of Return on Capital Employed (ROCE)

	(₹ in crores)
Capital Employed:	
Share Capital (10 x 40 lakhs)	4
Reserves	8
Debt (1 cr. x 100/10)	10
	22
PBIT	5
ROCE	22.73%

(2) Revised PBIT

Existing Capital Employed	22
Additional	3
Revised Capital Employed	25
ROCE	22.73%
Revised PBIT	5.6825

(3) New Debt/Equity

Existing Debt	10
Additional Under Option (i)	3
Total Debt	13
Total Equity	12

New Debt to Capital Employed Ratio = $13/25 = 0.52$

So, P/E Ratio to be reduced to 8 times

(4) Debt to Capital Employed Ratio in Option (ii) = $10/25 = 0.40$

So, P/E Ratio to be reduced to 8 times in this case also

(5) Number of additional shares to be issued in case of Option (ii)

Funds to be raised = ₹3 crore

Price per share = ₹ 25

No. of additional shares to be issued ₹3 crore/ ₹25 = ₹ 12 lakhs

Particulars	Option (i)	Option (ii)
PBIT (Revised) (₹ Crore)	5.6825	5.6825
Less: Interest on Debt	1.42	1.00
PBT (Crore)	4.2625	4.6825
Tax @ 25% (Crore)	1.0656	1.1706
PAT (₹ Crore)	3.1969	3.5119
No. of shares outstanding	40 lakhs	52 lakhs
EPS	₹7.99	₹6.75
P/E Ratio	8	8
New Share Price	₹63.92	₹54.00

Decision: Since the MPS is expected to be more in the case of additional financing done through debt. Hen Option (i) is preferred.

Question 60

[NOV 20]

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

Particulars	Proposal No. 1	Proposal No 2
Target Assets to Sales Ratio	0.65	0.62
Target Net Profit Margin (%)	4	5
Target Debt Equity Ratio (DER)	2:3	4:1
Target Retention Ratio (of Earnings) (%)	75	-
Annual Dividend (₹ In Lakhs)	-	0.30
New Equity Raised (₹ in Lakhs)	-	1

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

Solution**Sustainable Growth Rate under Proposal 1**

Sales (Given)		₹ 30 Lakhs
Total Assets	₹ 30 Lakhs × 0.65	₹ 19.50 Lakhs
Net Profit	₹ 30 Lakhs × 4%	₹ 1.20 Lakhs

$$\text{Equity Multiplier} = \frac{\text{Equity}}{\text{Equity} + \text{Deb}} = \frac{12 \text{ Lakhs}}{12 \text{ Lakhs} + 8 \text{ Lakhs}} = 0.60$$

$$\text{ROE (1.20 Lakhs / 19.50 Lakhs)} \times 0.60 \times 100 = 3.69\%$$

$$\text{Sustainable Growth Rate} = \text{ROE} \times \text{Retention Ratio} = 3.69\% \times 0.75 = 2.77\%$$

Sustainable Growth Rate under Proposal 2

$$\text{New Equity} = ₹ 12 \text{ Lakhs} + ₹ 1 \text{ Lakh} = ₹ 13 \text{ Lakhs}$$

$$\text{New Debt} = ₹ 13 \text{ Lakhs} \times 4 = ₹ 52 \text{ Lakhs}$$

$$\text{Total Assets} = ₹ 13 \text{ Lakhs} + ₹ 52 \text{ Lakhs} = ₹ 65 \text{ Lakhs}$$

Sales	₹ 65 Lakhs / 0.62	₹ 104.84 Lakhs
Net Profit	₹ 104.84 Lakhs × 5%	₹ 5.242 Lakhs
Equity Multiplier	Equity = 13 Lakhs Equity + Debt = 13 Lakhs + 52 Lakhs	0.2
ROE =	$\frac{5.242 \text{ Lakhs} \times 0.20 \times 100}{65 \text{ Lakhs}}$	1.613%
Retention Ratio	$\frac{5.242 \text{ Lakhs} - 0.30 \text{ Lakhs}}{5.242 \text{ Lakhs}}$	0.943

$$\text{Sustainable Growth Rate} = \text{ROE} \times \text{Retention Ratio} = 1.613\% \times 0.943 = 1.52\%$$



Portfolio Management

Question 1

The following details are given for X and Y companies' stocks and the Bombay Sensex for a period of one year. Calculate the systematic and unsystematic risk for the companies' stocks. If equal amount of money is allocated for the stocks what would be the portfolio risk?

	X Stock	Y Stock	Sensex
Average return	0.15	0.25	0.06
Variance of return	6.30	5.86	2.25
β	0.71	0.685	
Correlation Co-efficient	0.424		
Co-efficient of determination (r^2)	0.18		

Solution

Company X:

Systematic risk = $\beta_i^2 \times \text{Variance of market index} = (0.71)^2 \times 2.25 = 1.134$

Unsystematic risk (E_i^2) = Total variance of security return - Systematic Risk = $6.30 - 1.134 = 5.166$

Company Y:

Systematic risk = $\beta_i^2 \times \sigma_m^2 = (0.685)^2 \times 2.25 = 1.056$

Unsystematic risk = Total variance of the security return - systematic risk = $5.86 - 1.056 = 4.804$

Portfolio Risk = $[(0.5 \times 0.71 + 0.5 \times 0.685)^2 \times 2.25] + [(0.5)^2(5.166) + (0.5)^2(4.804)]$
= $[(0.355 + 0.3425)^2 \times 2.25] + [(1.292 + 1.201)] = 1.0946 + 2.493 = 3.5876$

Question 2

A company's beta is 1.40. The market return is 14% and the risk free rate is 10%.

- What is the expected return of the company's stock based on CAPM.
- If the risk premium on the market goes up by 2.50% points, what would be the revised expected return on this stock?

Solution

- Computation of expected return based on CAPM

$$R_j = R_f + \beta (R_m - R_f) = 10\% + 1.40 (14\% - 10\%) = 10\% + 5.6\% = 15.6\%$$

- Computation of expected return if the market risk premium goes up by 2.50% points

The return from the market goes up by 2.50% i.e. $14\% + 2.50\% = 16.50\%$

Expected Return based on CAPM is given by

$$R_j = 10\% + 1.40 (16.5\% - 10\%) = 10\% + 1.40 \times 6.5\% = 10\% + 9.10\% = 19.10\%$$

Question 3

The risk premium for the market is 10%. Assuming Beta values of Security K are 0, 0.25, 0.42, 1.00 and 1.67. Compute the risk premium on Security K.

Solution

Market Risk Premium is 10%

β Value of K	Risk Premium of K
0.00	0%
0.25	2.50%
0.42	4.20%
1.00	10.00%
1.67	16.70%

Question 4

Treasury Bills give a return of 5%. Market Return is 13%

- (i) What is the market risk premium
(ii) Compute the β Value and required returns for the following combination of investments.

Treasury Bill	100	70	30	0
Market	0	30	70	100

Solution Risk Premium $R_m - R_f = 13\% - 5\% = 8\%$

β is the weighted average investing in portfolio consisting of market $\beta = 1$ and treasury bills ($\beta = 0$)

Portfolio	Treasury Bills: Market	β	$R_j = R_f + \beta \times (R_m - R_f)$
1	100:0	0	$5\% + 0(13\% - 5\%) = 5\%$
2	70:30	$0.7(0) + 0.3(1) = 0.3$	$5\% + 0.3(13\% - 5\%) = 7.40\%$
3	30:70	$0.3(0) + 0.7(1) = 0.7$	$5\% + 0.7(13\% - 5\%) = 10.60\%$
4	0:100	1	$5\% + 1.0(13\% - 5\%) = 13\%$

Question 5

Pearl Ltd. expects that considering current market prices, the equity shareholders as per Moderate Approach, should get a return of at least 15.50% while current return on market is 12%. RBI has closed the latest auction for ₹ 2500 crores of 182 day bills for the lowest bid of 4.3% although there were bidders at a higher rate of 4.6% also for lots of less than ₹ 10 crores. What is Pearl Ltd's Beta?

Solution Determining Risk free rate: Two risk free rates are given. The aggressive approach would be to consider 4.6% while the conservative approach would be to take 4.3%. If we take the moderate value then the simple average of the two i.e. 4.45% would be considered

Application of CAPM $R_j = R_f + \beta (R_m - R_f) = 15.50\% = 4.45\% + \beta (12\% - 4.45\%)$

$$\beta = \frac{15.50\% - 4.45\%}{12\% - 4.45\%} = \frac{11.05}{7.55} = 1.464$$

Question 6

The following information is available with respect of Jaykay Ltd.

Year	Jay Kay Limited		Market		Return on Govt. Bonds
	Average Share Price (₹)	DPS (₹)	Average Index	Dividend Yield (%)	
2002	242	20	1812	4	6
2003	279	25	1950	5	5
2004	305	30	2258	6	4
2005	322	35	2220	7	5

Compute Beta Value of the company as at the end of 2005. What is your observation?

Solution

(1) Computation of Beta Value

Calculation of Returns

$$\text{Returns} = \frac{D_1 + (P_1 - P_0)}{P_0} \times 100$$

Year	Returns
2002 - 2003	$\frac{25 + (279 - 242)}{242} \times 100 = 25.62\%$
2003 - 2004	$\frac{30 + (305 - 279)}{279} \times 100 = 20.07\%$
2004 - 2005	$\frac{35 + (322 - 305)}{305} \times 100 = 17.05\%$

Calculation of Returns from market index

Year	% of Index Appreciation	Dividend Yield %	Total Return %
2002 - 2003	$\frac{1950 - 1812}{1812} \times 100 = 7.62\%$	5%	12.62%
2003 - 2004	$\frac{2258 - 1950}{1950} \times 100 = 15.79\%$	6%	21.79%
2004 - 2005	$\frac{2220 - 2258}{2258} \times 100 = (-)1.68\%$	7%	5.32%

Computation of Beta

Year	X	Y	XY	y ²
2002-2003	25.62	12.62	323.32	159.26
2003-2004	20.07	21.79	437.33	474.80
2004-2005	17.05	5.32	90.71	28.30
	62.74	39.73	851.36	662.36

$$\bar{X} = \frac{62.74}{3} = 20.91, \quad \bar{Y} = \frac{39.73}{3} = 13.24$$

$$\beta = \frac{\sum XY - n\bar{X}\bar{Y}}{\sum Y^2 - n(\bar{Y})^2} = \frac{851.36 - 3(20.91)(13.24)}{662.36 - 3(13.24)^2} = \frac{851.36 - 830.55}{662.36 - 525.89} = \frac{20.81}{136.47} = 0.15$$

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

Question 7

Information related to an investment is as follows:

Risk free rate 10%

Market Return 15%

Beta 1.2

- (i) What would be the return from this investment?
- (ii) If the projected return is 18%, is the investment rightly valued?
- (iii) What is your strategy?

Solution

- (i) Required rate of Return as per CAPM is given by $R_j = R_f + \beta(R_m - R_f)$
 $= 10 + 1.2 (15 - 10) = 16\%$
- (ii) Since projected return is 18%, the stock is not rightly valued rather undervalued as return as per CAPM less than Projected Return.
- (iii) Had this Project Return is considered as expected return, the decision should be to BUY share.

Question 8

The expected returns and Beta of three stocks are given below

Stock	A	B	C
Expected Return (%)	18	11	15
Beta Factor	1.7	0.6	1.2

If the risk free rate is 9% and the expected rate of return on the market portfolio is 14% which of the above stocks are over, under or correctly valued in the market? What shall be the strategy?

Solution Required Rate of Return is given by $R_j = R_f + \beta (R_m - R_f)$

For Stock A, $R_j = 9 + 1.7 (14 - 9) = 17.50\%$

Stock B, $R_j = 9 + 0.6 (14 - 9) = 12.00\%$

Stock C, $R_j = 9 + 1.2 (14 - 9) = 15.00\%$

Required Return %	Expected Return %	Valuation	Decision
17.50%	18.00%	Under Valued	Buy
12.00%	11.00%	Over Valued	Sell
15.00%	15.00%	Correctly Valued	Hold

Question 9

With the help of following data determine the return on the security X.

Factor	Risk Premium associated with the Factor	β_i
Market	4%	1.3
Growth Rate of GDP	1%	0.3
Inflation	-4%	0.2

Risk Free Rate of Return is 8%.

Solution

Expected Return = $R_f + \lambda_1\beta_1 + \lambda_2\beta_2 + \lambda_3\beta_3 = 8\% + 1.3 \times 4\% + 0.3 \times 1\% + 0.2 \times (-4\%) = 8\% + 5.2\% + 0.3\% - 0.8\% = 12.7\%$

Question 10

A stock costing ₹ 120 pays no dividends. The possible prices that the stock might sell for at the end of the year with the respective probabilities are:

Price	Probability
115	0.1
120	0.1
125	0.2
130	0.3
135	0.2
140	0.1

Required:

- (i) Calculate the expected return. (ii) Calculate the Standard deviation of returns.

Solution

- (i) Here, the probable returns have to be calculated using the formula

$$R = \frac{D}{P_0} + \frac{P_1 - P_0}{P_0}$$

Calculation of Probable Returns

Possible prices (P_1)	$P_1 - P_0$	$[(P_1 - P_0) / P_0] \times 100$
₹	₹	Return (per cent)
115	-5	-4.17
120	0	0.00
125	5	4.17
130	10	8.33
135	15	12.50
140	20	16.67

Calculation of Expected Returns

Possible return	Probability	Product
X_i	$p(X_i)$	$X_i \cdot p(X_i)$
-4.17	0.1	-0.417
0.00	0.1	0.000
4.17	0.2	0.834
8.33	0.3	2.499
12.50	0.2	2.500
16.67	0.1	1.667
		$X = \underline{7.083}$

(ii) Calculation of Standard Deviation of Returns

Probable return X_i	Probability $p(X_i)$	Deviation $(X_i - X)$	Deviation squared $(X_i - X)^2$	Product $(X_i - X)^2 p(X_i)$
-4.17	0.1	-11.253	126.63	12.66
0.00	0.1	-7.083	50.17	5.017
4.17	0.2	-2.913	8.49	1.698
8.33	0.3	1.247	1.56	0.467
12.50	0.2	5.417	29.34	5.869
16.67	0.1	9.587	91.91	9.191
				$\sigma^2 = \underline{34.902}$

Variance, $\sigma^2 = 34.902$ per cent

Standard deviation, $\sigma = \sqrt{34.902} = 5.908$ per cent

Question 11

Following information is available in respect of expected dividend, market price and market condition after one year.

Market condition	Probability	Market Price	Dividend per share
		₹	₹
Good	0.25	115	9
Normal	0.50	107	5
Bad	0.25	97	3

The existing market price of equity share is ₹ 106 (F.V. ₹ 1), which is cum 10% bonus debenture of ₹ 6 each, per share.

M/s. X Finance Company Ltd. had offered the buy-back of debentures at face value.

Find out the expected return and variability of returns of the equity shares if buyback offer is accepted by the investor.

And also advise-Whether to accept buy-back offer?

Solution

The Expected Return of the equity share may be found as follows:

Market Condition	Probability	Total Return	Cost (*)	Net Return
Good	0.25	₹ 124	₹ 100	₹ 24
Normal	0.50	₹ 112	₹ 100	₹ 12
Bad	0.25	₹ 100	₹ 100	₹ 0

$$\text{Expected Return} = (24 \times 0.25) + (12 \times 0.50) + (0 \times 0.25) = 12 = (12/100) \times 100 = 12\%$$

The variability of return can be calculated in terms of standard deviation.

$$VSD = 0.25 (24 - 12)^2 + 0.50 (12 - 12)^2 + 0.25 (0 - 12)^2$$

$$= 0.25 (12)^2 + 0.50 (0)^2 + 0.25 (-12)^2 = 36 + 0 + 36$$

$$SD = \sqrt{72}$$

$$SD = 8.485 \text{ or say } 8.49$$

(*) The present market price of the share is ₹ 106 cum bonus 10% debenture of ₹ 6 each; hence the net cost is ₹ 100.

M/s X Finance company has offered the buyback of debenture at face value. There is reasonable 10% rate of interest compared to expected return 12% from the market. Considering the dividend rate and market price the creditworthiness of the company seems to be very good. The decision regarding buy-back should be taken considering the maturity period and opportunity in the market. Normally, if the maturity period is low say up to 1 year better to wait otherwise to opt buy back option.

Question 12

Mr. A is interested to invest ₹ 1,00,000 in the securities market. He selected two securities B and D for this purpose. The risk return profile of these securities are as follows :

Security	Risk (σ)	Expected Return (ER)
B	10%	12%
D	18%	20%

Co-efficient of correlation between B and D is 0.15.

You are required to calculate the portfolio return of the following portfolios of B and D to be considered by A for his investment.

- 100 percent investment in B only;
- 50 percent of the fund in B and the rest 50 percent in D;
- 75 percent of the fund in B and the rest 25 percent in D; and
- 100 percent investment in D only.

Also indicate that which portfolio is best for him from risk as well as return point of view?

Solution

Substituting the respective values we get,

(i) All funds invested in B

$$E_p = 12\%$$

$$\sigma_p = 10\%$$

(ii) 50% of funds in each of B & D

$$E_p = 0.50 \times 12\% + 0.50 \times 20\% = 16\%$$

$$\sigma_p^2 = (0.50)^2(10\%)^2 + (0.50)^2(18\%)^2 + 2(0.50)(0.50)(0.15)(10\%)(18\%)$$

$$\sigma_p^2 = 25 + 81 + 13.5 = 119.50$$

$$\sigma_p = 10.93\%$$

(iii) 75% in B and 25% in D

$$E_p = 0.75 \times 12\% + 0.25 \times 20\% = 14\%$$

$$\sigma_p^2 = (0.75)^2(10\%)^2 + (0.25)^2(18\%)^2 + 2(0.75)(0.25)(0.15)(10\%)(18\%)$$

$$\sigma_p^2 = 56.25 + 20.25 + 10.125 = 86.625$$

$$\sigma_p = 9.31\%$$

(iv) All funds in D

$$E_p = 20\%$$

$$\sigma_p = 18.0\%$$

Portfolio	(i)	(ii)	(iii)	(iv)
Return	12	16	14	20
σ	10	10.93	9.31	18

In the terms of return, we see that portfolio (iv) is the best portfolio. In terms of risk we see that portfolio (iii) is the best portfolio.

Question 13

Consider the following information on two stocks, A and B :

Year	Return on A (%)	Return on B (%)
2006	10	12
2007	16	18

You are required to determine:

- The expected return on a portfolio containing A and B in the proportion of 40% and 60% respectively.
- The Standard Deviation of return from each of the two stocks.
- The covariance of returns from the two stocks.
- Correlation coefficient between the returns of the two stocks.
- The risk of a portfolio containing A and B in the proportion of 40% and 60%.

Solution

(i) Expected return of the portfolio A and B $E(A) = (10 + 16) / 2 = 13\%$

$$E(B) = (12 + 18) / 2 = 15\%$$

$$R_p = \sum_{i=1}^n X_i R_i = 0.4(13) + 0.6(15) = 14.2\%$$

(ii) Stock A:

$$\text{Variance} = 0.5 (10 - 13)^2 + 0.5 (16 - 13)^2 = 9$$

$$\text{Standard deviation} = \sqrt{9} = 3\%$$

Stock B:

$$\text{Variance} = 0.5 (12 - 15)^2 + 0.5 (18 - 15)^2 = 9$$

$$\text{Standard deviation} = 3\%$$

(iii) Covariance of stocks A and B

$$\text{Cov}_{AB} = 0.5 (10 - 13) (12 - 15) + 0.5 (16 - 13) (18 - 15) = 9$$

(iv) Correlation of coefficient

$$r_{AB} = \text{Cov}_{AB} / \sigma_A \sigma_B = 9 / 3 \times 3 = 1$$

(v) Portfolio Risk

$$\sigma_p = \sqrt{X_A^2 \sigma_A^2 + X_B^2 \sigma_B^2 + 2X_A X_B (\sigma_A \sigma_B \sigma_{AB})}$$

$$= \sqrt{(0.4)^2 (3)^2 + (0.6)^2 (3)^2 + 2(0.4)(0.6)(3)(3)(1)}$$

$$= \sqrt{1.44 + 3.24 + 4.32}$$

$$= 3\%$$

Question 14 Following is the data regarding six securities:

	A	B	C	D	E	F
Return (%)	8	8	12	4	9	8
Risk (Standard deviation)	4	5	12	4	5	6

(i) Assuming three will have to be selected, state which ones will be picked.

(ii) Assuming perfect correlation, show whether it is preferable to invest 75% in A and 25% in C or to invest 100% in E.

Solution

(i) Security A has a return of 8% for a risk of 4, whereas B and F have a higher risk for the same return. Hence, among them A dominates.

For same degree of risk 4, security D has only a return of 4%. Hence, D is also dominated by A.

Securities C and E remain in reckoning as they have a higher return though with higher degree of risk. Hence, the ones to be selected are A, C & E.

(ii) The average values for A and C for a proportion of 3 : 1 will be :

$$\text{Risk} = (3 \times 4) + (1 \times 12) / 4 = 6\%$$

$$\text{Return} = (3 \times 8) + (1 \times 12) / 4 = 9\%$$

Therefore:	75% A	E
	25% C	—
Risk	6	5
Return	9%	9%

For the same 9% return the risk is lower in E. Hence, E will be preferable.

Question 15

The historical rates of return of two securities over the past ten years are given. Calculate the Covariance and the Correlation coefficient of the two securities:

Years:	1	2	3	4	5	6	7	8	9	10
Security 1:	12	8	7	14	16	15	18	20	16	22
(Return per cent)										
Security 2:	20	22	24	18	15	20	24	25	22	20
(Return per cent)										

Solution

Calculation of Covariance

Year	X	X - $\bar{X}$	(X - $\bar{X}$) ²	Y	Y - $\bar{Y}$	(Y - $\bar{Y}$) ²	Product of Deviations
1	12	-2.8	7.84	20	-1	1	2.8
2	8	-6.8	46.24	22	1	1	-6.8
3	7	-7.8	60.84	24	3	9	-23.4
4	14	-0.8	0.64	18	-3	9	2.4
5	16	1.2	1.44	15	-6	36	-7.2
6	15	0.2	0.04	20	-1	1	-0.2
7	18	3.2	10.24	24	3	9	9.6
8	20	5.2	27.04	25	4	16	20.8
9	16	1.2	1.44	22	1	1	1.2
10	22	7.2	51.84	20	-1	1	-7.2
$\bar{X} = 148/10 = 14.8$			$\Sigma = 207.60$	$\bar{Y} = 210/10 = 21$			$\Sigma = 84.00$

$$\text{Covariance between X and Y} = \frac{\sum (X - \bar{X})(Y - \bar{Y})}{n} = -8/10 = -0.8$$

$$\text{Standard Deviation of Security 1 } \sigma_1 = \sqrt{\frac{(R_1 - \bar{R}_1)^2}{N}} = \sqrt{\frac{207.60}{10}} = \sqrt{20.76} = 4.56$$

$$\text{Standard Deviation of Security 2 } \sigma_2 = \sqrt{\frac{(R_2 - \bar{R}_2)^2}{N}} = \sqrt{\frac{84}{10}} = \sqrt{8.40} = 2.90$$

$$\text{Co-relation between 2 securities } (r_{xy}) = \frac{\text{Covariance between X and Y}}{\sigma_X \times \sigma_Y} = (-0.8 / 4.56 \times 2.90) = -0.0605$$

Question 16

An investor has decided to invest ₹ 1,00,000 in shares of 2 companies, namely, ABC and XYZ. Projections of returns from shares of the two companies along with their probabilities are as follows:

Probability	ABC(%)	XYZ(%)
0.20	12	16
0.25	14	10
0.25	-7	28
0.30	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

Probability	ABC (%)	XYZ (%)	1X2 (%)	1X3 (%)
(1)	(2)	(3)	(4)	(5)
0.20	12	16	2.40	3.2
0.25	14	10	3.50	2.5
0.25	-7	28	-1.75	7.0
0.30	28	-2	8.40	-0.6
Average return			<u>12.55</u>	<u>12.1</u>

Hence the expected return from ABC = 12.55% and XYZ is 12.1%

Probability	$(ABC - \overline{ABC})$	$(ABC - \overline{ABC})^2$	1X3	$(XYZ - \overline{XYZ})$	$(XYZ - \overline{XYZ})^2$	(1)X(6)
(1)	(2)	(3)	(4)	(5)	(6)	
0.20	-0.55	0.3025	0.06	3.9	15.21	3.04
0.25	1.45	2.1025	0.53	-2.1	4.41	1.10
0.25	-19.55	382.2025	95.55	15.9	252.81	63.20
0.30	15.45	238.7025	<u>71.61</u>	-14.1	198.81	<u>59.64</u>
			<u>167.75</u>			<u>126.98</u>

$$\sigma^2_{ABC} = 167.75(\%)^2 ; \sigma_{ABC} = 12.95\%$$

$$\sigma^2_{XYZ} = 126.98(\%)^2 ; \sigma_{XYZ} = 11.27\%$$

(ii) In order to find risk of portfolio of 2 shares, covariance between the two is necessary here.

Probability	(ABC- $\bar{ABC}$)	(XYZ- $\bar{XYZ}$)	2X3	1X4
(1)	(2)	(3)	(4)	(5)
0.20	-0.55	3.9	-2.145	-0.429
0.25	1.45	-2.1	-3.045	-0.761
0.25	-19.55	15.9	-310.845	-77.71
0.30	15.45	-14.1	-217.845	<u>-65.35</u>
				<u>-144.25</u>

$$\sigma_P^2 = (0.5^2 \times 167.75) + (0.5^2 \times 126.98) + 2 \times (-144.25) \times 0.5 \times 0.5$$

$$\sigma_P^2 = 41.9375 + 31.745 - 72.125$$

$$\sigma_P^2 = 1.5575 \text{ or } 1.56(\%)$$

$$\sigma_P = \sqrt{1.56} = 1.25\%$$

$$E(R_P) = (0.5 \times 12.55) + (0.5 \times 12.1) = 12.325\%$$

Hence, the return is 12.325% with the risk of 1.25% for the portfolio. Thus, the portfolio results in the reduction of risk by the combination of two shares.

(iii) For constructing the minimum risk portfolio the condition to be satisfied is

$$\text{Optimal Weights: } W_X = \frac{\sigma_Y^2 - \text{COV}_{XY}}{\sigma_X^2 + \sigma_Y^2 - 2\text{COV}_{XY}} \text{ and } W_Y = 1 - W_X$$

$$\% \text{ ABC} = \frac{126.98 - (-144.25)}{126.98 + 167.75 - [2 \times (-144.25)]} = 271.23 / 583.23 = 0.46 \text{ or } 46\%$$

$$\% \text{ ABC} = 46\%, \text{ XYZ} = 54\%$$

Question 17

The following information are available with respect of Krishna Ltd.

Year	Krishna Ltd share price	Dividend per Share	Average Market Index	Dividend Yield	Return on Govt. bonds
	₹	₹			
2012	245	20	2013	4%	7%
2013	253	22	2130	5%	6%
2014	310	25	2350	6%	6%
2015	330	30	2580	7%	6%

Compute Beta Value of the Krishna Ltd. at the end of 2015 and state your observation.

Solution

(i) Computation of Beta Value

Calculation of Returns

$$\text{Returns} = \frac{D_1 + (P_1 - P_0)}{P_0} \times 100$$

Year	Returns
2012 - 13	$= \frac{22 + (253 - 245)}{245} \times 100 = 12.24\%$
2013 - 14	$= \frac{25 + (310 - 253)}{253} \times 100 = 32.41\%$
2014 - 15	$= \frac{30 + (330 - 310)}{310} \times 100 = 16.13\%$

Calculation of Returns from market Index

Year	% of Index Appreciation	Dividend Yield %	Total Return %
2012-13	$\frac{(2130 - 2013)}{2013} \times 100 = 5.81\%$	5%	10.81%
2013 - 14	$\frac{(2350 - 2130)}{2130} \times 100 = 10.33\%$	6%	16.33%
2014 - 15	$\frac{(2580 - 2350)}{2350} \times 100 = 9.79\%$	7%	16.79%

Computation of Beta

Year	Krishna Ltd. (X)	Market Index (Y)	XY	Y ²
2012-13	12.24%	10.81%	132.31	116.86
2013-14	32.41%	16.33%	529.25	266.67
2014-15	16.13%	16.79%	270.82	281.90
Total	60.78%	43.93%	932.38	665.43

Average Return of Krishna Ltd. = $60.78/3 = 20.26\%$

Average Market Return = $43.93/3 = 14.64\%$

$$\text{Beta } (\beta) = \frac{\sum XY - n\bar{X}\bar{Y}}{\sum Y^2 - (n\bar{Y})^2} = \frac{932.38 - 3 \times 20.26 \times 14.64}{665.43 - 3(14.64)^2} = 1.897$$

(ii) Observation

	Expected Return (%)	Actual Return (%)	Action
2012 - 13	$6\% + 1.897(10.81\% - 6\%) = 15.12\%$	12.24%	Sell
2013 - 14	$6\% + 1.897(16.33\% - 6\%) = 25.60\%$	32.41%	Buy
2014 - 15	$6\% + 1.897(16.79\% - 6\%) = 26.47\%$	16.13%	Sell

Question 18 The distribution of return of security 'F' and the market portfolio 'P' is given below:

Probability		Return %
	F	P
0.30	30	-10
0.40	20	20
0.30	0	30

You are required to calculate the expected return of security 'F' and the market portfolio 'P', the covariance between the market portfolio and security and beta for the security.

Solution Security F

Prob(P)	R _f	PxR _f	Deviations of F (R _f - ER _f)	(Deviation) ² of F	(Deviations) ² P _x
0.3	30	9	13	169	50.7
0.4	20	8	3	9	3.6
0.3	0	0	-17	289	86.7
		ER _f =17			Var _f =141

$$\text{STDEV } \sigma_f = \sqrt{141} = 11.87$$

Market Portfolio, P

R _M %	P _M	Exp. Return R _M x P _M	Dev. of P (R _M -ER _M)	(Dev. of P) ²	(Dev.) ² P _M	(Deviation of F) x (Deviation of P)	Dev. of F x Dev. of P x P
-10	0.3	-3	-24	576	172.8	-312	-93.6
20	0.4	8	6	36	14.4	18	7.2
30	0.3	9	16	256	76.8	-272	-81.6
		ER _M =14			Var _M =264 σ _M =16.25		=Co Var P _M =- 168

$$\text{Beta} = \frac{\text{Co Var PM}}{\sigma_M^2} = -168/264 = -.636$$

Question 19

Given below is information of market rates of Returns and Data from two Companies A and B:

	Year 2007	Year 2008	Year 2009
Market (%)	12.0	11.0	9.0
Company A (%)	13.0	11.5	9.8
Company B (%)	11.0	10.5	9.5

You are required to determine the beta coefficients of the Shares of Company A and Company B.

Solution

Company A:

Year	Return % (Rs)	Market return % (Rm)	Deviation Rs	Deviation Rm	D Rs x D Rm	Rm ²
1	13.0	12.0	1.57	1.33	2.09	1.77
2	11.5	11.0	0.07	0.33	0.02	0.11
3	<u>9.8</u>	<u>9.0</u>	-1.63	-1.67	<u>2.72</u>	<u>2.79</u>
	<u>34.3</u>	<u>32.0</u>			<u>4.83</u>	<u>4.67</u>

Average Ra = 11.43

Average Rm = 10.67

Covariance = 4.83/3=1.61

$$\text{Variance } (\sigma_m^2) = \frac{\sum [R_m - \bar{R}_m]^2}{N} = 4.67/3 = 1.557$$

$$B = 1.61/1.557 = 1.03$$

Company B:

Year	Return % (Rb)	Market return % (Rm)	Deviation R(b)	Deviation Rm	D Rb x D Rm	Rm ²
1	11.0	12.0	0.67	1.33	0.89	1.77
2	10.5	11.0	0.17	0.33	0.06	0.11
3	<u>9.5</u>	<u>9.0</u>	-0.83	-1.67	<u>1.39</u>	<u>2.79</u>
	<u>31.0</u>	<u>32.0</u>			<u>2.34</u>	<u>4.67</u>

Covariance=2.34/3=0.78

$$\text{Variance } (\sigma_m^2) = \frac{\sum [R_m - \bar{R}_m]^2}{N} = 4.67/3 = 1.557$$

$$\beta = 0.78/1.557 = 0.50$$

Question 20

The returns on stock A and market portfolio for a period of 6 years are as follows:

Year	Return on A (%)	Return on market portfolio (%)
1	12	8
2	15	12
3	11	11
4	2	-4
5	10	9.5
6	-12	-2

You are required to determine:

- (i) Characteristic line for stock A (ii) The systematic and unsystematic risk of stock A.

Solution

Characteristic line is given by $y = a + \beta R_m$

Return on A (Y)	Return on market (X)	xy	x ²	(x - $\bar{x}$)	(x - $\bar{x}$) ²	(y - $\bar{y}$)	(y - $\bar{y}$) ²
12	8	96	64	2.25	5.06	5.67	32.15
15	12	180	144	6.25	39.06	8.67	75.17
11	11	121	121	5.25	27.56	4.67	21.81
2	-4	-8	16	-9.75	95.06	-4.33	18.75
10	9.5	95	90.25	3.75	14.06	3.67	13.47
-12	-2	24	4	-7.75	60.06	-18.33	335.99
38	34.5	508	439.25		240.86		497.34

$$\bar{y} = 38/6 = 6.33$$

$$\bar{x} = 34.5/6 = 5.75$$

$$\beta = \frac{\sum xy - n\bar{x}\bar{y}}{\sum x^2 - n\bar{x}^2} = \frac{508 - 6(5.75)(6.33)}{439.25 - 6(5.75)^2} = \frac{508 - 218.385}{439.25 - 198.375} = 289.615/240.875 = 1.202$$

$$a = \bar{y} - \beta\bar{x} = 6.33 - 1.202(5.75) = -0.58$$

Hence the characteristic line is $-0.58 + 1.202 (R_m)$

$$\text{Total Risk of Market} = \sigma_m^2 = \frac{\sum (x - \bar{x})^2}{n} = 240.86/6 = 40.14(\%)$$

$$\text{Total Risk of Stock} = 497.34/6 = 82.89(\%)$$

$$\text{Systematic Risk} = \beta^2 \sigma^2 = (1.202)^2 \times 40.14 = 57.99(\%)$$

$$\text{Unsystematic Risk is} = \text{Total Risk} - \text{Systematic Risk} = 82.89 - 57.99 = 24.90(\%)$$

Question 21

The rates of return on the security of Company X and market portfolio for 10 periods are given below:

Period	Return of Security X (%)	Return on Market Portfolio (%)
1	20	22
2	22	20
3	25	18
4	21	16
5	18	20
6	-5	8
7	17	-6
8	19	5
9	17	6
10	20	11

- (i) What is the beta of Security X? (ii) What is the characteristic line for Security X?

Solution

Period	R_X	R_M	$R_X - \bar{R}_X$	$R_M - \bar{R}_M$	$(R_X - \bar{R}_X)(R_M - \bar{R}_M)$	$(R_M - \bar{R}_M)^2$
1	20	22	5	10	50	100
2	22	20	7	8	56	64
3	25	18	10	6	60	36
4	21	16	6	4	24	16
5	18	20	3	8	24	64
6	-5	8	-20	-4	80	16
7	17	-6	2	-18	-36	324
8	19	5	4	-7	-28	49
9	-7	6	-22	-6	132	36
10	20	11	5	-1	-5	1
	150	120			357	706
	ΣR_X	ΣR_M			$\Sigma (R_X - \bar{R}_X)(R_M - \bar{R}_M)$	$\Sigma (R_M - \bar{R}_M)^2$

$$\bar{R}_X = 15 \quad \bar{R}_M = 12$$

$$\sigma^2_M = \frac{\Sigma [R_M - \bar{R}_M]^2}{n} = 706/10 = 70.60$$

$$\text{Cov}_{XM} = \frac{\Sigma [R_X - \bar{R}_X][R_M - \bar{R}_M]}{n} = 357/10 = 35.70$$

$$\text{Beta}_X = \text{Cov}_{XM} / \sigma^2_M = 35.70/70.60 = 0.505$$

$$(ii) \bar{R}_X = 15 \quad \bar{R}_M = 12$$

$$y = a + \beta x$$

$$15 = a + 0.505 \times 12$$

$$\text{Alpha } (a) = 15 - (0.505 \times 12) = 8.94\%$$

Characteristic line for security X = $a + \beta \times R_M$

Where, R_M = Expected return on Market Index

$\therefore$ Characteristic line for security X = $8.94 + 0.505 R_M$

Question 22

Expected returns on two stocks for particular market returns are given in the following table:

Market Return	Aggressive	Defensive
7%	4%	9%
25%	40%	18%

You are required to calculate:

- The Betas of the two stocks.
- Expected return of each stock, if the market return is equally likely to be 7% or 25%.
- The Security Market Line (SML), if the risk free rate is 7.5% and market return is equally likely to be 7% or 25%.
- The Alphas of the two stocks.

Solution

(a) The Betas of two stocks:

$$\text{Aggressive stock} - (40\% - 4\%)/(25\% - 7\%) = 2$$

$$\text{Defensive stock} - (18\% - 9\%)/(25\% - 7\%) = 0.50$$

(b) Expected returns of the two stocks:-

$$\text{Aggressive stock} - 0.5 \times 4\% + 0.5 \times 40\% = 22\%$$

$$\text{Defensive stock} - 0.5 \times 9\% + 0.5 \times 18\% = 13.5\%$$

(c) Expected return of market portfolio = $0.5 \times 7\% + 0.5 \times 25\% = 16\%$

$$\text{Market risk prem.} = 16\% - 7.5\% = 8.5\% \therefore$$

$$\text{SML is, required return} = 7.5\% + \beta_i 8.5\% \therefore$$

(d) $R_s = \alpha + \beta R_m$

For Aggressive Stock $22\% = \alpha_A + 2(16\%)$ $\alpha_A = -10\%$	For Defensive Stock $13.5\% = \alpha_D + 0.50(16\%)$ $\alpha_D = 5.5\%$

Question 23

A study by a Mutual fund has revealed the following data in respect of three securities:

Security	σ (%)	Correlation with Index, ρ_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

(i) Sensitivity of each stock with market is given by its beta.

$$\text{Standard deviation of market Index} = 15\%$$

$$\text{Variance of market Index} = 0.0225$$

$$\text{Beta of stocks} = \frac{(r_{sm}) \times \sigma_s}{\sigma_m}$$

$$A = 20 \times 0.60/15 = 0.80$$

$$B = 18 \times 0.95/15 = 1.14$$

$$C = 12 \times 0.75/15 = 0.60$$

(ii) Covariance between any 2 stocks $= \beta_1 \beta_2 \sigma_m^2$

Covariance matrix

Stock/Beta	0.80	1.14	0.60
A	400.000	205.200	108.000
B	205.200	324.000	153.900
C	108.000	153.900	144.000

(iii) Total risk of the equally weighted portfolio (Variance) =

$$400(1/3)^2 + 324(1/3)^2 + 144(1/3)^2 + 2(205.20)(1/3)^2 + 2(108.0)(1/3)^2 + 2(153.900)(1/3)^2 = 200.244$$

(iv) β of equally weighted portfolio $= \beta_p = \sum \beta_i / N = 0.80 + 1.14 + 0.60 / 3 = 0.8467$

(v) Systematic Risk $\beta_p^2 \sigma_m^2 = (0.8467)^2 (15)^2 = 161.302$

$$\text{Unsystematic Risk} = \text{Total Risk} - \text{Systematic Risk} = 200.244 - 161.302 = 38.942$$

Question 24

Mr. X owns a portfolio with the following characteristics:

	Security A	Security B	Risk Free security
Factor 1 sensitivity	0.80	1.50	0
Factor 2 sensitivity	0.60	1.20	0
Expected Return	15%	20%	10%

It is assumed that security returns are generated by a two factor model.

- 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) Mr. X's position in the two securities are +1.50 in security A and -0.5 in security B. Hence the portfolio sensitivities to the two factors:-

$$b \text{ prop. 1} = 1.50 \times 0.80 + (-0.50 \times 1.50) = 0.45$$

$$b \text{ prop. 2} = 1.50 \times 0.60 + (-0.50 \times 1.20) = 0.30$$

(ii) Mr. X's revised position:-

$$\text{Security A } ₹ 3,00,000 / ₹ 1,00,000 = 3$$

$$\text{Security B } -₹ 1,00,000 / ₹ 1,00,000 = -1$$

$$\text{Risk free asset } -₹ 100000 / ₹ 100000 = -1$$

$$b \text{ prop. } 1 = 3.0 \times 0.80 + (-1 \times 1.50) + (-1 \times 0) = 0.90$$

$$b \text{ prop. } 2 = 3.0 \times 0.60 + (-1 \times 1.20) + (-1 \times 0) = 0.60$$

(iii) Expected Return = Risk Free Rate of Return + Risk Premium

Let λ_1 and λ_2 are the Value Factor 1 and Factor 2 respectively.

Accordingly

$$15 = 10 + 0.80 \lambda_1 + 0.60 \lambda_2$$

$$20 = 10 + 1.50 \lambda_1 + 1.20 \lambda_2$$

On solving equation, the value of $\lambda_1 = 0$, and risk premium of factor 2 for Securities A & B shall be as follows:

<u>Using Security A's Return</u>	<u>Alternatively using Security B's Return</u>
Total Return = 15% = 10% + 0.60 λ_2	Total Return = 20% = 10 + 1.20 λ_2
Risk Premium (λ_2) = 5% / 0.60 = 8.33%	Risk Premium = 10% / 1.20 = 8.33%

Question 25

Mr. Tempest has the following portfolio of four shares:

Name	Beta	Investment ₹ Lac.
Oxy Rin Ltd.	0.45	0.80
Boxed Ltd.	0.35	1.50
Square Ltd.	1.15	2.25
Ellipse Ltd.	1.85	4.50

The risk-free rate of return is 7% and the market rate of return is 14%. Required.

(i) Determine the portfolio return. (ii) Calculate the portfolio Beta.

Solution Market Risk Premium (A) = 14% - 7% = 7%

Share	Beta	Risk Premium (Beta × A) %	Risk Free Return %	Return %	Return ₹
Oxy Rin Ltd.	0.45	3.15	7	10.15	8,120
Boxed Ltd.	0.35	2.45	7	9.45	14,175
Square Ltd.	1.15	8.05	7	15.05	33,863
Ellipse Ltd.	1.85	12.95	7	19.95	89,775
Total Return					1,45,933

Total Investment ₹ 9,05,000

(i) Portfolio Return = (₹1,45,933 / ₹9,05,000) × 100 = 16.13%

(ii) Portfolio Beta

Portfolio Return = Risk Free Rate + Risk Premium × β = 16.13%

$$7\% + 7\beta = 16.13\%$$

$$\beta = 1.30$$

Alternative Approach

First we shall compute Portfolio Beta using the weighted average method as follows:

$$\begin{aligned}\text{Beta}_P &= 0.45 \times 0.80/9.05 + 0.35 \times 1.50/9.05 + 1.15 \times 2.25/9.05 + 1.85 \times 4.50/9.05 \\ &= 0.45 \times 0.0884 + 0.35 \times 0.1657 + 1.15 \times 0.2486 + 1.85 \times 0.4972 \\ &= 0.0398 + 0.058 + 0.2859 + 0.9198 = 1.3035\end{aligned}$$

Accordingly,

(i) Portfolio Return using CAPM formula will be as follows:

$$\begin{aligned}R_P &= R_F + \beta_P(R_M - R_F) \\ &= 7\% + 1.3035(14\% - 7\%) = 7\% + 1.3035(7\%) = 7\% + 9.1245\% = 16.1245\%\end{aligned}$$

(ii) Portfolio Beta : As calculated above 1.3035

Question 26

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:

	MFX	MFY	Mix
MFX	4.800	4.300	3.370
MFY	4.300	4.250	2.800
Mix	3.370	2.800	3.100

You are required to calculate:

- (i) variance of return from MFX, MFY and market return,
- (ii) portfolio return, beta, portfolio variance and portfolio standard deviation,
- (iii) expected return, systematic risk and unsystematic risk; and
- (iv) Sharpe ratio, Treynor ratio and Alpha of MFX, MFY and Portfolio Mix.

Solution

$$(i) \quad \text{Covariance between X and X} = \frac{\sum(X - \bar{X})(X - \bar{X})}{n} = \frac{\sum(x - \bar{x})^2}{n} = \text{Variance of X}$$

$$\text{VarianceX} = 4.800$$

$$\text{VarianceY} = 4.250$$

$$\text{VarianceM} = 3.100$$

(ii) Portfolio return, beta, variance and standard deviation

$$\text{Weight of MFX in portfolio} = 1,20,000/2,00,000 = 0.60$$

$$\text{Weight of MFY in portfolio} = 80,000/2,00,000 = 0.40$$

$$\text{Accordingly Portfolio Return: } 0.60 \times 15\% + 0.40 \times 14\% = 14.60\%$$

Beta of each Fund

$$\beta = \text{Cov}(\text{Fund}, \text{Market}) / \text{Variance of Market}$$

$$\beta_x = 3.370 / 3.100 = 1.087$$

$$\beta_y = 2.800 / 3.100 = 0.903$$
Portfolio Beta

$$0.60 \times 1.087 + 0.40 \times 0.903 = 1.013$$

Portfolio Variance: $\sigma_{xy}^2 = w_x^2 \sigma_x^2 + w_y^2 \sigma_y^2 + 2w_x w_y \text{Cov}_{x,y}$

$$= (0.60)^2 (4.800) + (0.40)^2 (4.250) + 2(0.60)(0.40)(4.300) = 4.472$$

Portfolio Standard Deviation: $\sigma_{xy} = \sqrt{4.472} = 2.115$

(iii) Expected Return, Systematic and Unsystematic Risk of Portfolio

Portfolio Return = $10\% + 1.0134(12\% - 10\%) = 12.03\%$

MF X Return = $10\% + 1.087(12\% - 10\%) = 12.17\%$

MF Y Return = $10\% + 0.903(12\% - 10\%) = 11.81\%$

Systematic Risk = $\beta^2 \sigma^2$ Accordingly, Systematic Risk of MFX = $(1.087)^2 \times 3.10 = 3.663$ Systematic Risk of MFY = $(0.903)^2 \times 3.10 = 2.528$ Systematic Risk Portfolio = $(1.013)^2 \times 3.10 = 3.181$	Unsystematic Risk = Total Risk - Systematic Risk Accordingly, Unsystematic Risk of MFX = $4.80 - 3.663 = 1.137$ Unsystematic Risk of MFY = $4.250 - 2.528 = 1.722$ Unsystematic Risk Portfolio = $4.472 - 3.181 = 1.291$

(iv) Sharpe and Treynor Ratios and Alpha

Sharpe Ratio	Treynor Ratio	Alpha
MFX = $15\% - 10\% / \sqrt{4.800} = 2.282$	MFX = $15\% - 10\% / 1.087 = 4.60$	MFX = $15\% - 12.17\% = 2.83\%$
MFY = $14\% - 10\% / \sqrt{4.250} = 1.94$	MFY = $14\% - 10\% / 0.903 = 4.43$	MFY = $14\% - 11.81\% = 2.19\%$
Portfolio = $14.6\% - 10\% / 2.115 = 2.175$	Portfolio = $14.6\% - 10\% / 1.0134 = 4.54$	Portfolio = $14.6\% - 12.03\% = 2.57\%$

Question 27

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

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

Solution Capital Asset Pricing Model (CAPM) formula: $E_R = R_f + \beta (R_m - R_f)$

$$= 10 + [1.2 (15 - 10)] = 10 + 1.2 (5) = 10 + 6 = 16\% \text{ or } 0.16$$

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

$$E_R = D_1 / P_0 + g \text{ or } 0.16 = 3(1.12) / P_0 + 0.12 = 84$$

Question 28

The following information is available in respect of Security X

Equilibrium Return	15%
Market Return	15%
7% Treasury Bond Trading at	\$140
Covariance of Market Return and Security Return	225%
Coefficient of Correlation	0.75

You are required to determine the Standard Deviation of Market Return and Security Return.

Solution

First we shall compute the β of Security X.

Risk Free Rate = Coupon Payment / Current Market Price = $7/140 = 5\%$

Assuming equilibrium return to be equal to CAPM return then:

$$15\% = R_f + \beta_X(R_m - R_f)$$

$$15\% = 5\% + \beta_X(15\% - 5\%)$$

$$\beta_X = 1$$

(i) Standard Deviation of Market Return $\beta_m = \text{Cov}_{X,m} / \sigma_m^2 = 225\% / \sigma_m^2 = 1$ $\sigma_m^2 = 225$ $\sigma_m = \sqrt{225} = 15\%$	(ii) Standard Deviation of Security Return $\beta_X = \frac{(r_{sm}) \times \sigma_s}{\sigma_m} = \sigma_X / 15 \times 0.75 = 1$ $\sigma_X = 15 / 0.75 = 20\%$

Question 29

Assuming that shares of ABC Ltd. and XYZ Ltd. are correctly priced according to Capital Asset Pricing Model. The expected return from and Beta of these shares are as follows:

Share	Beta	Expected return
ABC	1.2	19.8%
XYZ	0.9	17.1%

You are required to derive Security Market Line.

Solution CAPM = $R_f + \beta (R_m - R_f)$

Accordingly

$$R_{ABC} = R_f + 1.2 (R_m - R_f) = 19.8$$

$$R_{XYZ} = R_f + 0.9 (R_m - R_f) = 17.1$$

$$19.8 = R_f + 1.2 (R_m - R_f) \text{ -----(1)}$$

$$17.1 = R_f + 0.9 (R_m - R_f) \text{ -----(2)}$$

Deduct (2) from (1)

$$2.7 = 0.3 (R_m - R_f)$$

$$R_m - R_f = 9$$

$$R_f = R_m - 9$$

Substituting in equation (1)

$$19.8 = (R_m - 9) + 1.2 (R_m - R_m + 9)$$

$$19.8 = R_m - 9 + 10.8$$

$$19.8 = R_m + 1.8$$

Then $R_m = 18\%$ and $R_f = 9\%$

$$\text{Security Market Line} = R_f + \beta (\text{Market Risk Premium}) = 9\% + \beta \times 9\%$$

Question 30

A Ltd. has an expected return of 22% and Standard deviation of 40%. B Ltd. has an expected return of 24% and Standard deviation of 38%. A Ltd. has a beta of 0.86 and B Ltd. has a beta of 1.24. The correlation coefficient between the return of A Ltd. and B Ltd. is 0.72. The Standard deviation of the market return is 20%. Suggest:

- (i) Is investing in B Ltd. better than investing in A Ltd.?
- (ii) If you invest 30% in B Ltd. and 70% in A Ltd., what is your expected rate of return and portfolio Standard deviation?
- (iii) What is the market portfolios expected rate of return and how much is the risk-free rate?
- (iv) What is the beta of Portfolio if A Ltd.'s weight is 70% and B Ltd.'s weight is 30%?

Solution

- (i) A Ltd. has lower return and higher risk than B Ltd. Hence, investing in B Ltd. is better than in A Ltd. because the return is higher and the risk is lower. However, investing in both will yield diversification advantage.

- (ii) $r_{AB} = 0.22 \times 0.7 + 0.24 \times 0.3 = 0.226$ i.e. 22.6%

$$\sigma^2_{AB} = 0.402 \times 0.72 + 0.382 \times 0.32 + 2 \times 0.7 \times 0.3 \times 0.72 \times 0.40 \times 0.38 = 0.1374$$

$$\sigma_{AB} = \sqrt{\sigma^2_{AB}} = \sqrt{0.1374} = 0.37 = 37\%$$

- (iii) This risk-free rate will be the same for A and B Ltd. Their rates of return are given as follows:

$$r_A = 22 = r_f + (r_m - r_f) 0.86$$

$$r_B = 24 = r_f + (r_m - r_f) 1.24$$

$$r_A - r_B = -2 = (r_m - r_f) (-0.38)$$

$$r_m - r_f = -2 / -0.38 = 5.26\%$$

$$r_A = 22 = r_f + (5.26) 0.86$$

$$r_f = 17.48\%$$

$$r_B = 24 = r_f + (5.26) 1.24$$

$$r_f = 17.48\%$$

$$r_m - 17.48 = 5.26$$

$$r_m = 22.74\%$$

- (iv) $\beta_{AB} = \beta_A \times W_A + \beta_B \times W_B = 0.86 \times 0.7 + 1.24 \times 0.3 = 0.974$

Question 31

XYZ Ltd. has substantial cash flow and until the surplus funds are utilised to meet the future capital expenditure, likely to happen after several months, are invested in a portfolio of short-term equity investments, details for which are given below:

Investment	No. of shares	Beta	Market price per share ₹	Expected dividend yield
I	60,000	1.16	4.29	19.50%
II	80,000	2.28	2.92	24.00%
III	1,00,000	0.90	2.17	17.50%
IV	1,25,000	1.50	3.14	26.00%

The current market return is 19% and the risk free rate is 11%. Required to:

- Calculate the risk of XYZ's short-term investment portfolio relative to that of the market;
- Whether XYZ should change the composition of its portfolio.

Solution (i) Computation of Beta of Portfolio

Investment	No. of shares	Market Price	Market Value	Dividend Yield	Dividend	Composition	β	Weighted β
I	60,000	4.29	2,57,400	19.50%	50,193	0.2339	1.16	0.27
II	80,000	2.92	2,33,600	24.00%	56,064	0.2123	2.28	0.48
III	1,00,000	2.17	2,17,000	17.50%	37,975	0.1972	0.90	0.18
IV	1,25,000	3.14	3,92,500	26.00%	1,02,050	0.3566	1.50	0.53
			11,00,500		2,46,282	1.0000		1.46

Return of the Portfolio = $2,46,282 / 11,00,500 = 0.2238$

Beta of Port Folio 1.46

Market Risk implicit

$$0.2238 = 0.11 + \beta \times (0.19 - 0.11)$$

$$\text{Or, } 0.08 \beta + 0.11 = 0.2238$$

$$\beta = 0.2238 - 0.11 / 0.08 = 1.42$$

Market β implicit is 1.42 while the port folio β is 1.46. Thus the portfolio is marginally risky compared to the market.

- The decision regarding change of composition may be taken by comparing the dividend yield (given) and the expected return as per CAPM as follows:

For investment I Rs	=	$.11 + (.19 - .11) 1.16 = 20.28\%$
For investment II, Rs	=	$.11 + (.19 - .11) 2.28 = 29.24\%$
For investment III, Rs	=	$.11 + (.19 - .11) .90 = 18.2\%$
For investment IV, Rs	=	$.11 + (.19 - .11) 1.50 = 23\%$

Comparison of dividend yield with the expected return Rs shows that the dividend yields of investment I, II and III are less than the corresponding expected return. So, these investments are over-priced and should be sold by the investor. However, in case of investment IV, the dividend yield is more than the corresponding expected return, so, XYZ Ltd. should increase its proportion.

Question 32

A company has a choice of investments between several different equity oriented mutual funds. The company has an amount of ₹1 crore to invest. The details of the mutual funds are as follows:

Mutual Fund	Beta
A	1.6
B	1.0
C	0.9
D	2.0
E	0.6

Required:

- If the company invests 20% of its investment in each of the first two mutual funds and an equal amount in the mutual funds C, D and E, what is the beta of the portfolio?
- If the company invests 15% of its investment in C, 15% in A, 10% in E and the balance in equal amount in the other two mutual funds, what is the beta of the portfolio?
- If the expected return of market portfolio is 12% at a beta factor of 1.0, what will be the portfolios expected return in both the situations given above?

Solution With 20% investment in each MF Portfolio Beta is the weighted average of the Betas of various securities calculated as below:

(i)

Investment	Beta (β)	Investment (₹ Lacs)	Weighted Investment
A	1.6	20	32
B	1.0	20	20
C	0.9	20	18
D	2.0	20	40
E	0.6	20	12
		<u>100</u>	<u>122</u>
Weighted Beta (β) = 1.22			

(ii) With varied percentages of investments portfolio beta is calculated as follows:

Investment	Beta (β)	Investment (₹ Lacs)	Weighted Investment
A	1.6	15	24
B	1.0	30	30
C	0.9	15	13.5
D	2.0	30	60
E	0.6	10	6
		<u>100</u>	<u>133.5</u>
Weighted Beta (β) = 1.335			

- Expected return of portfolio with pattern of investment as in case (i) = $12\% \times 1.22$ i.e. 14.64%
Expected Return with pattern of investment as in case (ii) = $12\% \times 1.335$ i.e., 16.02%.

Question 33

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 Fund will be compensated for risk undertaken due to inclusion of stocks of Economy A in the portfolio comparing with investment in developed country's stocks only.

Solution

- Let the weight of stocks of Economy A be expressed as w , then
 $(1-w) \times 10.0 + w \times 15.0 = 10.5$
i.e. $w = 0.1$ or 10%.
- Variance of portfolio shall be:
 $(0.9)^2 (0.16)^2 + (0.1)^2 (0.30)^2 + 2(0.9)(0.1)(0.16)(0.30)(0.30) = 0.02423$
Standard deviation is $(0.02423)^{\frac{1}{2}} = 0.15565$ or 15.6%.
- The Sharpe ratio will improve by approximately 0.04, as shown below:
Sharpe Ratio = Expected Return - Risk Free Rate of Return / Standard Deviation
Investment only in developed countries: $= 10-3/16 = 0.437$
With inclusion of stocks of Economy A: $10.5-3/15.6 = 0.481$

Question 34

Mr. FedUp wants to invest an amount of ₹ 520 lakhs and had approached his Portfolio Manager. The Portfolio Manager had advised Mr. FedUp to invest in the following manner:

Security	Moderate	Better	Good	Very Good	Best
Amount (in ₹ Lakhs)	60	80	100	120	160
Beta	0.5	1.00	0.80	1.20	1.50

You are required to advise Mr. FedUp in regard to the following, using Capital Asset Pricing Methodology:

- Expected return on the portfolio, if the Government Securities are at 8% and the NIFTY is yielding 10%.
- Advisability of replacing Security 'Better' with NIFTY.

Solution

- (i) Average $\beta = 0.50 \times 60/520 + 1.00 \times 80/520 + 0.80 \times 100/520 + 1.20 \times 120/520 + 1.50 \times 160/520 = 1.104$
As per CAPM = $0.08 + 1.104(0.10 - 0.08) = 0.10208$ i.e. 10.208%
- (ii) As computed above the expected return from Better is 10% same as return from Nifty, hence there will be no difference even if the replacement of security is made. The main logic behind this neutrality is that the beta of security 'Better' is 1 which clearly indicates that this security shall yield same return as market return.

Question 35

Your client is holding the following securities:

Particulars of Securities	Cost	Dividends/Interest	Market price	Beta
	₹	₹	₹	
Equity Shares:				
Gold Ltd.	10,000	1,725	9,800	0.6
Silver Ltd.	15,000	1,000	16,200	0.8
Bronze Ltd.	14,000	700	20,000	0.6
GOI Bonds	36,000	3,600	34,500	0.01

Average return of the portfolio is 15.7%, calculate:

- (i) Expected rate of return in each, using the Capital Asset Pricing Model (CAPM).
(ii) Risk free rate of return.

Solution

Particulars of Securities	Cost ₹	Dividend	Capital gain
Gold Ltd.	10,000	1,725	-200
Silver Ltd.	15,000	1,000	1,200
Bronz Ltd.	14,000	700	6,000
GOI Bonds	36,000	3,600	-1,500
Total	75,000	7,025	5,500

Expected rate of return on market portfolio (R_m)

$$= (\text{Dividend Earned} + \text{Capital appreciation} / \text{Initial investment}) \times 100$$
$$= (\text{₹}7,025 + \text{₹}5,500 / \text{₹}75,000) \times 100 = 16.7\%$$

Risk free return

$$\text{Average of Betas} = 0.6 + 0.8 + 0.6 + 0.01 / 4 = 0.5$$

$$\text{Average return} = \text{Risk free return} + \text{Average Betas} (\text{Expected return} - \text{Risk free return})$$

$$15.7 = \text{Risk free return} + 0.50 (16.7 - \text{Risk free return})$$

$$\text{Risk free return} = 14.7\%$$

Expected Rate of Return for each security is Rate of Return = $R_f + B (R_m - R_f)$

Gold Ltd. = $14.7 + 0.6 (16.7 - 14.7) = 15.90\%$

Silver Ltd. = $14.7 + 0.8 (16.7 - 14.7) = 16.30\%$

Bronz Ltd. = $14.7 + 0.6 (16.7 - 14.7) = 15.90\%$

GOI Bonds = $14.7 + 0.01 (16.7 - 14.7) = 14.72\%$

* Alternatively, it can also be computed as follows:

Particulars of Securities (1)	Cost ₹ (2)	Market price (3)	Dividend ₹ (4)	Capital Gain ₹ (5)	Beta (6)	(3) × (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

β of the Portfolio = $31,185/80,500 = 0.387$

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

$R_f = (34,500 - 36,000) + 3,600/36,000 = 0.0583$ i.e 5.83%

Question 36

A holds the following portfolio:

Share/Bond	Beta	Initial Price	Dividends	Market Price at end of year
		₹	₹	₹
Epsilon Ltd.	0.8	25	2	50
Sigma Ltd.	0.7	35	2	60
Omega Ltd.	0.5	45	2	135
GOI Bonds	0.01	1,000	140	1,005

Calculate:

- The expected rate of return of each security using Capital Asset Pricing Method (CAPM)
- The average return of his portfolio.

Risk-free return is 14%.

Solution (i) Expected rate of return

	Total Investments	Dividends	Capital Gains
Epsilon Ltd.	25	2	25
Sigma Ltd.	35	2	25
Omega Ltd.	45	2	90
GOI Bonds	1,000	140	_5
	1,105	146	145

Expected Return on market portfolio = $(146 + 145)/1105 = 26.33\%$

$$\text{CAPM } E(R_p) = R_F + \beta [E(R_M) - R_F]$$

Epsilon Ltd	$14 + 0.8[26.33 - 14] =$	23.86%
Sigma Ltd.	$14 + 0.7[26.33 - 14] =$	22.63%
Omega Ltd.	$14 + 0.5[26.33 - 14] =$	20.17%
GOI Bonds	$14 + 0.01[26.33 - 14] =$	14.12%

(ii) Average Return of Portfolio = $23.86 + 22.63 + 20.17 + 14.12 / 4 = 80.78 / 4 = 20.20\%$

Alternatively, $0.8 + 0.7 + 0.5 + 0.01 / 4 = 2.01 / 4 = 0.5025$

$14 + 0.5025 (26.33 - 14) = 14 + 6.20 = 20.20\%$

Question 37

Your client is holding the following securities:

Particulars of Securities	Cost ₹	Dividends ₹	Market Price ₹	BETA
Equity Shares:				
Co. X	8,000	800	8,200	0.8
Co. Y	10,000	800	10,500	0.7
Co. Z	16,000	800	22,000	0.5
PSU Bonds	34,000	3,400	32,300	0.2

Assuming a Risk-free rate of 15%, calculate:

- Expected rate of return in each, using the Capital Asset Pricing Model (CAPM).
- Simple Average return of the portfolio

Solution Calculation of expected return on market portfolio (R_m)

Investment	Cost (₹)	Dividends (₹)	Capital Gains (₹)
Shares X	8,000	800	200
Shares Y	10,000	800	500
Shares Z	16,000	800	6,000
PSU Bonds	34,000	3,400	-1,700
	68,000	5,800	5,000

$$R_m = (5,800 + 5,000 + 68,000) \times 100 = 15.88\%$$

Calculation of expected rate of return on individual security:

Shares X	$15 + 0.8 (15.88 - 15.0)$	= 15.70%
Shares Y	$15 + 0.7 (15.88 - 15.0)$	= 15.62%
Shares Z	$15 + 0.5 (15.88 - 15.0)$	= 15.44%
PSU Bonds	$15 + 0.2 (15.88 - 15.0)$	= 15.18%

Calculation of the Average Return of the Portfolio: $= 15.70 + 15.62 + 15.44 + 15.18 / 4 = 15.49\%$

Question 38

An investor is holding 1,000 shares of Fatlass Company. Presently the rate of dividend being paid by the company is ₹ 2 per share and the share is being sold at ₹ 25 per share in the market. However, several factors are likely to be changed during the course of the year as indicated below:

	Existing	Revised
Risk free rate	12%	10%
Market risk premium	6%	4%
Beta value	1.4	1.25
Expected growth rate	5%	9%

In view of the above factors whether the investor should buy, hold or sell the shares? And why?

Solution

On basis of existing and revised factors, rate of return and price of share is to be calculated.

Existing rate of return = $R_f + \text{Beta} (R_m - R_f) = 12\% + 1.4 (6\%) = 20.4\%$

Revised rate of return = $10\% + 1.25 (4\%) = 15\%$

Price of share (original) $P_0 = \frac{D + (1+g)}{K_e - g} = \frac{2(1.05)}{0.204 - 0.05} = 2.10/0.154 = ₹13.63$

Price of share (Revised): $P_0 = \frac{2(1.09)}{0.15 - 0.09} = 2.18/0.06 = ₹36.33$

In case of existing market price of ₹ 25 per share, rate of return (20.4%) and possible equilibrium price of share at ₹ 13.63, this share needs to be sold because share is overpriced (₹ 25 - 13.63) by ₹ 11.37. However, under changed scenario where growth of dividend has been revised at 9% and return though decreased at 15% but possible price of share is to be at ₹ 36.33 and therefore, in order to expect price appreciation to ₹ 36.33 investor should hold shares, if other things remain the same

Question 39

An investor is holding 5,000 shares of X Ltd. Current year dividend 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 On basis of existing and revised factors, rate of return and price of share is to be calculated.

Existing rate of return = $R_f + \text{Beta} (R_m - R_f) = 12\% + 1.3 (5\%) = 18.5\%$

Revised rate of return = $10\% + 1.4 (4\%) = 15.60\%$

Price of share (original): $P_0 = \frac{D + (1+g)}{K_e - g} = \frac{3(1.09)}{0.185 - 0.09} = 3.27/0.095 = ₹34.42$

Price of share (Revised) $P_0 = \frac{2.50(1.07)}{0.156 - 0.07} = 2.675/0.086 = ₹31.10$

Market price of share of ₹ 40 is higher in comparison to current equilibrium price of ₹ 34.42 and revised equity price of ₹ 31.10. Under this situation investor should sell the share.

Question 40

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

	WA	WB	WC
Portfolio X	0.30	0.40	0.30
Portfolio Y	0.20	0.50	0.30

- (i) 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?
- (ii) 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 (i) Investment committed to each security would be:-

	A (₹)	B (₹)	C (₹)	Total (₹)
Portfolio X	1,500	2,000	1,500	5,000
Portfolio Y	600	1,500	900	3,000
Combined Portfolio	2,100	3,500	2,400	8,000
∴ Stock weights	0.26	0.44	0.30	

- (ii) The equation of critical line takes the following form:- $WB = a + bWA$
 Substituting the values of WA & WB from portfolio X and Y in above equation, we get
 $0.40 = a + 0.30b$, and $0.50 = a + 0.20b$

Solving above equation we obtain the slope and intercept, $a = 0.70$ and $b = -1$ and thus, the critical line is $WB = 0.70 - WA$

If half of the funds is invested in security A then, $WB = 0.70 - 0.50 = 0.20$

Since $WA + WB + WC = 1$

$WC = 1 - 0.50 - 0.20 = 0.30$

∴ Allocation of funds to security B = $0.20 \times 8,000 = ₹ 1,600$, and

Security C = $0.30 \times 8,000 = ₹ 2,400$

Question 41

X Co., Ltd., invested on 1.4.2009 in certain equity shares as below:

Name of Co.	No. of shares	Cost (₹)
M Ltd.	1,000 (₹ 100 each)	2,00,000
N Ltd.	500 (₹ 10 each)	1,50,000

In September, 2009, 10% dividend was paid out by M Ltd. and in October, 2009, 30% dividend paid out by N Ltd. On 31.3.2010 market quotations showed a value of ₹ 220 and ₹ 290 per share for M Ltd. and N Ltd. respectively.

On 1.4.2010, investment advisors indicate (a) that the dividends from M Ltd. and N Ltd. for the year ending 31.3.2011 are likely to be 20% and 35%, respectively and (b) that the probabilities of market quotations on 31.3.2011 are as below:

Probability factor	Price/share of M Ltd.	Price/share of N Ltd.
0.2	220	290
0.5	250	310
0.3	280	330

You are required to:

- Calculate the average return from the portfolio for the year ended 31.3.2010;
- Calculate the expected average return from the portfolio for the year 2010-11; and
- Advise X Co. Ltd., of the comparative risk in the two investments by calculating the standard deviation in each case.

Solution Workings:

Calculation of return on portfolio for 2009-10	(Calculation in ₹ / share)		
	M	N	
Dividend received during the year	10	3	
Capital gain/loss by 31.03.10			
Market value by 31.03.10	220	290	
Cost of investment	200	300	
Gain/loss	20	(-)10	
Yield	30	(-)7	
Cost	200	300	
% return	15%	(-)2.33%	
Weight in the portfolio	57	43	
Weighted average return			7.55%

Calculation of estimated return for 2010-11			
Expected dividend	20	3.5	
Capital gain by 31.03.11			
$(220 \times 0.2) + (250 \times 0.5) + (280 \times 0.3) - 220 = (253 - 220)$	33	-	
$(290 \times 0.2) + (310 \times 0.5) + (330 \times 0.3) - 290 = (312 - 290)$	-	22	
Yield	53	25.5	
*Market Value 01.04.10	220	290	
% return	24.09%	8.79%	
*Weight in portfolio $(1,000 \times 220) : (500 \times 290)$	60.3	39.7	
Weighted average (Expected) return			18.02%
(*market value on 31.03.10 is used as base for calculating yield for 10-11)			

(i) Average Return from Portfolio for the year ended 31.03.2010 is 7.55%.

(ii) Expected Average Return from portfolio for the year 2010-11 is 18.02%

(iii) **M Ltd.**

Exp. market value	Exp. gain	Exp. div.	Exp Return (1)	Prob. Factor (2)	(1) X (2)	Dev.	Square of dev. (3)	(2) X (3)
220	0	20	9.09	0.2	1.82	-15.01	225.30	45.06
250	30	20	22.73	0.5	11.37	-1.37	1.88	0.94
280	60	20	36.36	0.3	10.91	12.26	150.31	45.09
					24.10			$\sigma^2 M = 91.09$

Standard Deviation (σM) = 9.54%

N Ltd.

Exp. market value	Exp. gain	Exp. div.	Exp Return (1)	Prob. Factor (2)	(1) X (2)	Dev.	Square of dev. (3)	(2) X (3)
290	0	3.5	1.21	0.2	0.24	-7.58	57.46	11.49
310	20	3.5	8.10	0.5	4.05	-0.69	0.48	0.24
330	40	3.5	15.00	0.3	4.50	6.21	38.56	11.57
					8.79			$\sigma^2 N = 23.30$

Standard Deviation (σN) = 4.83%

Share of company M Ltd. is more risky as the S.D. is more than company N Ltd.

Question 42 An investor holds two stocks A and B. An analyst prepared ex-ante probability distribution for possible economic scenarios and conditional returns for two stocks and market index as shown below:

Economic scenario	Probability	Conditional Returns %		
		A	B	Market
Growth	0.40	25	20	18
Stagnation	0.30	10	15	13
Recession	0.30	-5	-8	-3

The risk free rate during the next year is expected to be around 11%. Determine whether the investor should liquidate his holdings in stocks A and B or on the contrary make fresh investments in them. CAPM assumptions are holding true.

Solution

Expected Return on stock A = $(0.40)(25) + 0.30(10) + 0.30(-5) = 11.5\%$

Expected Return on 'B' = $(0.40 \times 20) + (0.30 \times 15) + 0.30 \times (-8) = 10.1\%$

Expected Return on Market index = $(0.40 \times 18) + (0.30 \times 13) + 0.30 \times (-3) = 10.2\%$

Variance of Market index = $(18 - 10.2)^2 (0.40) + (13 - 10.2)^2 (0.30) + (-3 - 10.2)^2 (0.30) = 78.96\%$

Covariance of stock A and Market Index M

$(25 - 11.5) (18 - 10.2)(0.40) + (10 - 11.5) (13 - 10.2) (0.30) + (-5 - 11.5) (-3 - 10.2)(0.30) = 106.20$

Covariance of stock B and Market index M

$(20 - 10.1) (18 - 10.2)(0.40) + (15 - 10.1)(13 - 10.2)(0.30) + (-8 - 10.1)(-3 - 10.2)(0.30) = 30.89 + 4.12 + 71.67 = 106.68$

Beta for stock A = $\frac{\text{Cov}(AM)}{\text{Var}M} = 106.20 / 78.96 = 1.345$

Beta for Stock B = $\frac{\text{Cov}(BM)}{\text{Var}M} = 106.68 / 78.96 = 1.351$

Required Return for A = $11\% + 1.345(10.2 - 11)\% = 9.924\%$

Required Return for B = $11\% + 1.351(10.2 - 11)\% = 9.92\%$

Alpha for Stock A = $E(A) - R(A)$ i.e. $11.5\% - 9.924\% = 1.576\%$

Alpha for Stock B = $E(B) - R(B)$ i.e. $10.1\% - 9.92\% = 0.18\%$

Since stock A and B both have positive Alpha, therefore, they are underpriced. The investor should make fresh investment in them.

Question 43

Following are the details of a portfolio consisting of three shares:

Share	Portfolio weight	Beta	Expected return in %	Total variance
A	0.20	0.40	14	0.015
B	0.50	0.50	15	0.025
C	0.30	1.10	21	0.100

Standard Deviation of Market Portfolio Returns = 10%

You are given the following additional data:

Covariance (A, B) = 0.030; Covariance (A, C) = 0.020; Covariance (B, C) = 0.040

Calculate the following:

- The Portfolio Beta
- Residual variance of each of the three shares
- Portfolio variance using Sharpe Index Model
- Portfolio variance (on the basis of modern portfolio theory given by Markowitz)

Solution

(i) Portfolio Beta = $0.20 \times 0.40 + 0.50 \times 0.50 + 0.30 \times 1.10 = 0.66$

(ii) Residual Variance

Systematic Risk	Residual Variance
$B^2_A \times \sigma^2_M = (0.40)^2(0.01) = 0.0016$	A $0.015 - 0.0016 = 0.0134$
$B^2_B \times \sigma^2_M = (0.50)^2(0.01) = 0.0025$	B $0.025 - 0.0025 = 0.0225$
$B^2_C \times \sigma^2_M = (1.10)^2(0.01) = 0.0121$	C $0.100 - 0.0121 = 0.0879$

(iii) Portfolio variance using Sharpe Index Model

Systematic Variance of Portfolio = $(0.10)^2 \times (0.66)^2 = 0.004356$

Unsystematic Variance of Portfolio = $0.0134 \times (0.20)^2 + 0.0225 \times (0.50)^2 + 0.0879 \times (0.30)^2$
 $= 0.014072$

Total Variance = $0.004356 + 0.014072 = 0.018428$

(iv) Portfolio variance on the basis of Markowitz Theory

$= (W_A \times W_A \times \sigma^2_A) + (W_A \times W_B \times \text{Cov}_{AB}) + (W_A \times W_C \times \text{Cov}_{AC}) + (W_B \times W_A \times \text{Cov}_{AB}) + (W_B \times W_B \times \sigma^2_B) + (W_B \times W_C \times \text{Cov}_{BC}) + (W_C \times W_A \times \text{Cov}_{CA}) + (W_C \times W_B \times \text{Cov}_{CB}) + (W_C \times W_C \times \sigma^2_C)$

$= (0.20 \times 0.20 \times 0.015) + (0.20 \times 0.50 \times 0.030) + (0.20 \times 0.30 \times 0.020) + (0.20 \times 0.50 \times 0.030) + (0.50 \times 0.50 \times 0.025) + (0.50 \times 0.30 \times 0.040) + (0.30 \times 0.20 \times 0.020) + (0.30 \times 0.50 \times 0.040) + (0.30 \times 0.30 \times 0.10)$

$= 0.0006 + 0.0030 + 0.0012 + 0.0030 + 0.00625 + 0.0060 + 0.0012 + 0.0060 + 0.0090 = 0.0363$

Question 44

Ramesh wants to invest in stock market. He has got the following information about individual securities:

Security	Expected Return	Beta	σ^2_{ci}
A	15	1.5	40
B	12	2	20
C	10	2.5	30
D	09	1	10
E	08	1.2	20
F	14	1.5	30

Market index variance is 10 percent and the risk free rate of return is 7%. What should be the optimum portfolio assuming no short sales?

Solution

Securities need to be ranked on the basis of excess return to beta ratio from highest to the lowest.

Security	R_i	β_i	$R_i - R_f$	$\frac{R_i - R_f}{\beta_i}$
A	15	1.5	8	5.33
B	12	2	5	2.5
C	10	2.5	3	1.2
D	9	1	2	2
E	8	1.2	1	0.83
F	14	1.5	7	4.67

Ranked Table:

Security	ER - RF	β	USR	$\frac{(ER - R_f) \beta}{USR}$	Cumulative of Column 5	$\frac{\beta^2}{USR}$	Cumulative of Column 7	C
A	8	1.5	40	0.30	0.30	0.056	0.056	1.923
F	7	1.5	30	0.35	0.65	0.075	0.131	2.814
B	5	2	20	0.50	1.15	0.20	0.331	2.668
D	2	1	10	0.20	1.35	0.10	0.431	2.542
C	3	2.5	30	0.25	1.60	0.208	0.639	2.165
E	1	1.2	20	0.06	1.66	0.072	0.711	2.047

$$C = \frac{\sigma_m^2 \times \sum \left(\frac{ER - R_f}{USR} \right) \beta}{1 + \left(\sigma_m^2 \times \sum \frac{\beta^2}{USR} \right)} = \frac{\sigma_m^2 \times \text{Column 6}}{1 + (\sigma_m^2 \times \text{Column 8})}$$

$CA = 10 \times 0.30 / [1 + (10 \times 0.056)] = 1.923$	$CF = 10 \times 0.65 / [1 + (10 \times 0.131)] = 2.814$
$CB = 10 \times 1.15 / [1 + (10 \times 0.331)] = 2.668$	$CD = 10 \times 1.35 / [1 + (10 \times 0.431)] = 2.542$
$CC = 10 \times 1.60 / [1 + (10 \times 0.639)] = 2.165$	$CE = 10 \times 1.66 / [1 + (10 \times 0.711)] = 2.047$

Cut off point is 2.814

$$Z \text{ value} = \frac{\beta}{\text{USR}} (\text{Treynor ratio} - \text{Cut off Point})$$

$Z_A = 15/40(5.33-2.814)=0.09435$	$Z_F = 15/30(4.67-2.814)=0.0928$
$X_A = 0.09435/[0.09435+0.0928]=50.41\%$	$X_F = 0.0928/[0.09435+0.0928]=49.59\%$

Funds to be invested in security A & F are 50.41% and 49.59% respectively.

Question 45 A Portfolio Manager (PM) has the following four stocks in his portfolio:

Security	No. of Shares	Market Price per share (₹)	β
VSL	10,000	50	0.9
CSL	5,000	20	1.0
SML	8,000	25	1.5
APL	2,000	200	1.2

Compute the following:

- Portfolio beta.
- If the PM seeks to reduce the beta to 0.8, how much risk free investment should he bring in?
- If the PM seeks to increase the beta to 1.2, how much risk free investment should he bring in?

Solution (i)

Security	No. of shares (1)	Market Price of Per Share (2)	(1) × (2)	% to total (w)	β (x)	wx
VSL	10000	50	500000	0.4167	0.9	0.375
CSL	5000	20	100000	0.0833	1	0.083
SML	8000	25	200000	0.1667	1.5	0.250
APL	2000	200	400000	0.3333	1.2	0.400
			1200000	1		1.108

Portfolio beta 1.108

(ii) Required Beta

0.8

It should become (0.8 / 1.108)

72.2 % of present portfolio

If ₹ 12,00,000 is 72.20%, the total portfolio should be ₹ 12,00,000 × 100/72.20 or ₹ 16,62,050

Additional investment in zero risk should be (₹ 16,62,050 - ₹ 12,00,000) = ₹ 4,62,050

Revised Portfolio will be

Security	No. of shares (1)	Market Price of Per Share (2)	(1) × (2)	% to total (w)	β (x)	wx
VSL	10000	50	500000	0.3008	0.9	0.271
CSL	5000	20	100000	0.0602	1	0.060
SML	8000	25	200000	0.1203	1.5	0.180
APL	2000	200	400000	0.2407	1.2	0.289
Risk free asset	46205	10	462050	0.2780	0	0
			1662050	1		0.800

(iii) To increase Beta to 1.2

Required beta 1.2

It should become 1.2 / 1.108 108.30% of present beta

If 1200000 is 108.30%, the total portfolio should be $1200000 \times 100/108.30$

= 1108033 say 1108030

Additional investment should be (-) 91967 i.e. Divest ₹ 91970 of Risk Free Asset

Revised Portfolio will be

Security	No. of shares (1)	Market Price of Per Share (2)	(1) × (2)	% to total (w)	β (x)	wx
VSL	10000	50	500000	0.4513	0.9	0.406
CSL	5000	20	100000	0.0903	1	0.090
SML	8000	25	200000	0.1805	1.5	0.271
APL	2000	200	400000	0.3610	1.2	0.433
Risk free asset	-9197	10	-91970	-0.0830	0	0
			1108030	1		1.20

Portfolio beta = 1.20

Question 46 A has portfolio having following features:

Security	β	Random Error σ_{ei}	Weight
L	1.60	7	0.25
M	1.15	11	0.30
N	1.40	3	0.25
K	1.00	9	0.20

You are required to find out the risk of the portfolio if the standard deviation of the market index (σ_m) is 18%.

Solution

Beta of Portfolio = $1.60 \times 0.25 + 1.15 \times 0.30 + 1.40 \times 0.25 + 1.00 \times 0.20$

= $0.4 + 0.345 + 0.35 + 0.20 = 1.295$

The Standard Deviation (Risk) of the portfolio is

= $[(1.295)^2(18)^2 + (0.25)^2(7)^2 + (0.30)^2(11)^2 + (0.25)^2(3)^2 + (0.20)^2(9)^2]^{\frac{1}{2}}$

= $[543.36 + 3.0625 + 10.89 + 0.5625 + 3.24]^{\frac{1}{2}} = [561.115]^{\frac{1}{2}} = 23.69\%$

Question 47

Mr. Tamarind intends to invest in equity shares of a company the value of which depends upon various parameters as mentioned below:

Factor	Beta	Expected value in %	Actual value in %
GDP	1.20	7.70	7.70
Inflation	1.75	5.50	7.00
Interest rate	1.30	7.75	9.00
Stock market index	1.70	10.00	12.00
Industrial production	1.00	7.00	7.50

If the risk free rate of interest be 9.25%, how much is the return of the share under Arbitrage Pricing Theory?

Solution

Return of the stock under APT

Factor	Actual value in %	Expected value in %	Difference	Beta	Diff. × Beta
GNP	7.70	7.70	0.00	1.20	0.00
Inflation	7.00	5.50	1.50	1.75	2.63
Interest rate	9.00	7.75	1.25	1.30	1.63
Stock index	12.00	10.00	2.00	1.70	3.40
Ind. Production	7.50	7.00	0.50	1.00	0.50
					8.16
Risk free rate					9.25
Return under APT					17.41

Question 48

The total market value of the equity share of O.R.E. Company is ₹ 60,00,000 and the total value of the debt is ₹ 40,00,000. The treasurer estimate that the beta of the stock is currently 1.5 and that the expected risk premium on the market is 10 per cent. The treasury bill rate is 8 per cent.

Required:

- What is the beta of the Company's existing portfolio of assets?
- Estimate Company's Cost of capital and discount rate for expansion of company's present business.

Solution

$$(i) \quad \beta_{\text{asset}} = \beta_{\text{equity}} \times \frac{V_E}{V_0} + \beta_{\text{debt}} \times \frac{V_D}{V_0}$$

Note: Since β_{debt} is not given it is assumed that company debt capital is virtually riskless.

If company's debt capital is riskless than above relationship become:

$$\text{Here } \beta_{\text{equity}} = 1.5; \quad \beta_{\text{asset}} = \beta_{\text{equity}} \times \frac{V_E}{V_0}$$

$$\text{As } \beta_{\text{debt}} = 0 \quad V_E = ₹ 60 \text{ lakhs.} \quad V_D = ₹ 40 \text{ lakhs.} \quad V_0 = ₹ 100 \text{ lakhs.}$$

$$\text{Asset Beta} = 1.5 \times 60 \text{ lakhs} / 100 \text{ lakhs} = 0.9$$

- (ii) (a) If only equity is used to finance the expansion, the Cost of Capital for discounting company's expansion of existing business shall be computed as follows:
 Company's cost of equity = $R_f + \beta_A \times \text{Market Risk premium}$
 Where R_f = Risk free rate of return
 β_A = Beta of company assets
 Therefore, company's cost of equity = $8\% + 0.9 \times 10 = 17\%$ and overall cost of capital shall be 17%.
- (b) Alternatively, if funds expansion are raised for in same proportion as exiting capital structure, then cost of capital shall be computed as follows:
 Cost of Equity = $8\% + 1.5 \times 10 = 23\%$
 Cost of Debt = 8%
 WACC (Cost of Capital) = $23\% \times 3/5 + 8\% \times 2/5 = 17\%$

Question 49

Mr. Nirmal Kumar has categorized all the available stock in the market into the following types:

- (i) Small cap growth stocks
- (ii) Small cap value stocks
- (iii) Large cap growth stocks
- (iv) Large cap value stocks

Mr. Nirmal Kumar also estimated weights of above categories of stocks in market index. Further, the sensitivity of returns on these categories of stocks to the three important factor are estimated to be:

Category of Stocks	Weight in the Market Index	Factor I (Beta)	Factor II (Book Price)	Factor III (Inflation)
Small cap growth	25%	0.80	1.39	1.35
Small cap value	10%	0.90	0.75	1.25
Large cap growth	50%	1.165	2.75	8.65
Large cap value	15%	0.85	2.05	6.75
Risk Premium		6.85%	-3.5%	0.65%

The rate of return on treasury bonds is 4.5% Required:

- (a) Using Arbitrage Pricing Theory, determine the expected return on the market index.
- (b) Using Capital Asset Pricing Model (CAPM), determine the expected return on the market index.
- (c) Mr. Nirmal Kumar wants to construct a portfolio constituting only the 'small cap value' and 'large cap growth' stocks. If the target beta for the desired portfolio is 1, determine the composition of his portfolio.

Solution

- (a) Stock's return

$$\text{Small cap growth} = 4.5 + 0.80 \times 6.85 + 1.39 \times (-3.5) + 1.35 \times 0.65 = 5.9925\%$$

$$\text{Small cap value} = 4.5 + 0.90 \times 6.85 + 0.75 \times (-3.5) + 1.25 \times 0.65 = 8.8525\%$$

$$\text{Large cap growth} = 4.5 + 1.165 \times 6.85 + 2.75 \times (-3.5) + 8.65 \times 0.65 = 8.478\%$$

$$\text{Large cap value} = 4.5 + 0.85 \times 6.85 + 2.05 \times (-3.5) + 6.75 \times 0.65 = 7.535\%$$

Expected return on market index

$$0.25 \times 5.9925 + 0.10 \times 8.8525 + 0.50 \times 8.478 + 0.15 \times 7.535 = 7.7526\%$$

(b) Using CAPM,

$$\text{Small cap growth} = 4.5 + 6.85 \times 0.80 = 9.98\%$$

$$\text{Small cap value} = 4.5 + 6.85 \times 0.90 = 10.665\%$$

$$\text{Large cap growth} = 4.5 + 6.85 \times 1.165 = 12.48\%$$

$$\text{Large cap value} = 4.5 + 6.85 \times 0.85 = 10.3225\%$$

Expected return on market index

$$= 0.25 \times 9.98 + 0.10 \times 10.665 + 0.50 \times 12.45 + 0.15 \times 10.3225 = 11.33\%$$

(c) Let us assume that Mr. Nirmal will invest $X_1\%$ in small cap value stock and $X_2\%$ in large cap growth stock

$$X_1 + X_2 = 1$$

$$0.90 X_1 + 1.165 X_2 = 1$$

$$0.90 X_1 + 1.165(1 - X_1) = 1$$

$$0.90 X_1 + 1.165 - 1.165 X_1 = 1$$

$$0.165 = 0.265 X_1$$

$$0.165/0.265 = X_1$$

$$0.623 = X_1, X_2 = 0.377$$

62.3% in small cap value

37.7% in large cap growth.

Question 50

The following are the data on five mutual funds:

Fund	Return	Standard Deviation	Beta
A	15	7	1.25
B	18	10	0.75
C	14	5	1.40
D	12	6	0.98
E	16	9	1.50

You are required to compute Reward to Volatility Ratio and rank these portfolio using:

- Sharpe method and
- Treynor's method

assuming the risk free rate is 6%.

Solution

$$\text{Sharpe Ratio} \quad S = (R_p - R_f)/\sigma_p$$

$$\text{Treynor Ratio} \quad T = (R_p - R_f)/\beta_p$$

Reward to Variability (Sharpe Ratio)

Mutual Fund	R_p	R_f	$R_p - R_f$	σ_p	Reward to Variability	Ranking

A	15	6	9	7	1.285	2
B	18	6	12	10	1.20	3
C	14	6	8	5	1.60	1
D	12	6	6	6	1.00	5
E	16	6	10	9	1.11	4

Reward to Volatility (Treynor Ratio)

Mutual Fund	Rp	Rf	Rp - Rf	β_p	Reward to Volatility	Ranking
A	15	6	9	1.25	7.2	2
B	18	6	12	0.75	16	1
C	14	6	8	1.40	5.71	5
D	12	6	6	0.98	6.12	4
E	16	6	10	1.50	6.67	3

Question 51

Five portfolios experienced the following results during a 7- year period:

Portfolio	Average Annual Return (Rp) (%)	Standard Deviation (Sp)	Correlation with the market returns (r)
A	19.0	2.5	0.840
B	15.0	2.0	0.540
C	15.0	0.8	0.975
D	17.5	2.0	0.750
E	17.1	1.8	0.600
Market Risk (σ_m)		1.2	
Market rate of Return (R_m)	14.0		
Risk-free Rate (R_f)	9.0		

Rank the portfolios using (a) Sharpe's method, (b) Treynor's method and (c) Jensen's Alpha

Solution

$$\text{Beta} = \frac{(r_{sm}) \times \sigma_s}{\sigma_m}$$

Portfolio	Beta	Expected Return from portfolio (Rp) (%)
A	1.75	17.75
B	0.90	13.50
C	0.65	12.25
D	1.25	15.25
E	0.90	13.50

Portfolio	Sharpe Method		Treynor Method		Jensen's Alpha	
	Ratio	Rank	Ratio	Rank	Ratio	Rank
A	4.00	IV	5.71	V	1.25	V
B	3.00	V	6.67	IV	1.50	IV
C	7.50	I	9.23	I	2.75	II
D	4.25	III	6.80	III	2.25	III
E	4.50	II	9.00	II	3.60	I

Question 52

[RTP MAY 21]

Equity of ABC Ltd. (ABCL) is ₹ 500 Crores, its debt, is worth ₹ 290 Crores. Printer Division segments value is attributable to 64%, which has an Asset Beta (β_p) of 1.55, balance value is applied on Spares and Consumables Division, which has an Asset Beta (β_{sc}) of 1.40 ABCL Debt beta (β_D) is 0.28.

You are required to calculate:

- Equity Beta (β_E),
- Ascertain Equity Beta (β_E), if ABC Ltd. decides to change its Debt Equity position by raising further debt and buying back of equity to have its Debt to Equity Ratio at 1.50. Assume that the present Debt Beta (β_{D1}) is 0.45 and any further funds raised by way of Debt will have a Beta (β_{D2}) of 0.50.
- Whether new Equity Beta (β_E) justifies increase in the value of equity on account of leverage?

Solution

- Equity Beta

To calculate Equity Beta first we shall calculate Weighted Average of Asset Beta as follows:
 $= 1.55 \times 0.64 + 1.40 \times 0.36 = 0.992 + 0.504 = 1.496$

Now we shall compute Equity Beta using the following formula:

$$\beta_{\text{asset}} = \beta_{\text{equity}} \frac{E}{E+D(1-t)} + \beta_{\text{Debt}} \frac{D(1-t)}{E+D(1-t)}$$

Accordingly

$$1.496 = \beta_{\text{Equity}} \left[\frac{500}{500+290} + \beta_{\text{Debt}} \frac{290}{500+290} \right]$$

$$1.496 = \beta_{\text{Equity}} \frac{500}{790} + 0.28 \frac{290}{790}$$

$$\beta_{\text{Equity}} = 2.20$$

- Equity Beta on change in Capital Structure

Amount of Debt to be raised:

Particulars	Value (in ₹ Crore)
Total Value of Firm (Equity ₹ 500 crore + Debt ₹ 290 crore)	790
Desired Debt Equity Ratio	1.50 : 1.00
Desired Debt Level = Total Value x Debt Ratio	474
Less: Value of Existing Debt	(290)
Value of Debt to be Raised	184

Equity after Repurchase = Total value of Firm - Desired Debt Value
 = ₹ 790 Crore - ₹ 474 Crore = ₹ 316 Crore

Weighted Average Beta of ABCL:

Source of Finance	Investment (in ₹ Crore)	Weight	Beta of the Division	Weighted Beta
Equity	316	0.4	$\beta (E = X)$	$0.4x$
Debt - 1	290	0.367	0.45	0.165
Debt - 2	184	0.233	0.50	0.117
	790	Weighted Average Beta		$0.282 + (0.4x)$

$$\beta_{ABCL} = 0.282 + 0.4x$$

$$1.496 = 0.282 + 0.4x$$

$$0.4x = 1.496 - 0.282$$

$$x = 1.214 / 0.4 = 3.035$$

$$\beta_{\text{New Equity}} = 3.035$$

(ii) Yes, it justifies increase as it leads to increase in Value of Equity due to increase in Beta.

Question 53

[MTP NOV 21]

Suppose one of your HNI clients is holding the following portfolio as per his risk appetite:

Particulars	Securities
Equity Shares:	
G Ltd.	1000
S Ltd.	1000
B Ltd.	500
PSU Bonds	20,000

The other data related to each of these securities is as follows:

Cost	Dividends/ Interest	Market price	Beta
₹	₹	₹	
10,000	1,725	9,800	0.6
15,000	1,000	16,200	0.8
28,000	1400	28,300	0.6
1,800	180	1,725	0.10

Your client is interested in investing some more funds in Bonds issued by GOI.

- 1) Estimate the minimum rate of return that your client would expect from these Bonds keeping in view his risk appetite and assuming Market Return as 12.70%.
- 2) Analyze whether this portfolio has out - performed the market or not assuming Risk Free Rate of Return as 7%.

Solution

1) Working Notes: Calculation of Return on each single security

	Cost ₹ (1)	No. of Securities (2)	Total Cost (3) = (1) × (2)	Dividend/ Interest	Capital gain	Total (4)	Total Income (5) = (2) × (4)	Beta (6)	(6) × (3)
G Ltd.	10,000	1000	1,00,00,000	1,725	-200	1,525	15,25,000	0.6	60,00,000
S Ltd.	15,000	1000	1,50,00,000	1,000	1,200	2,200	22,00,000	0.8	1,20,00,000
B Ltd.	28,000	500	1,40,00,000	1,400	300	1,700	8,50,000	0.6	84,00,000
PSU Bonds	1,800	20,000	3,60,00,000	180	-75	105	21,00,000	0.10	36,00,000
Total			7,50,00,000				66,75,000		3,00,00,000

Rate of Return on earned on the Portfolio

(Dividend Earned + Capital appreciation/ Initial investment) X 100

= (₹66,75,000/7,50,00,000) X 100 = 8.90%

Weighted Average Beta of the Portfolio = 3,00,00,000/7,50,00,000 = 0.40

Expected Risk Free Rate of Return using CAPM

8.90% = R_f + 0.40 [12.7% - R_f]

8.90% = R_f + 5.08 - 0.40 R_f

3.82% = 0.60 R_f

R_f = 6.37%

Thus keeping in view present risk appetite, client would expect at least a return of 6.37% on Bonds.

The expected return on the Portfolio using CAPM: = 7% + 0.40 [12.7 - 7%] = 9.28%

- 2) Since the actual return is 8.90% which is quite lower than expected return considering the systematic risk borne by the investor and hence portfolio has not outperformed the market rather has underperformed.

Question 54

[NOV 20/MTP MAY 23]

The following are the details of three mutual funds of MFL:

	Growth Fund	Balanced Fund	Regular Fund	Market
Average Return (%)	7	6	5	9
Variance	92.16	54.76	40.96	57.76
Coefficient of Determination	0.3025	0.6561	0.9604	

The yield on 182 days Treasury Bill is 9 per cent per annum. You are required to:

- Rank the funds as per Sharpe's measure.
- Rank the funds as per Treynor's measure.
- Compare the performance with the market.

Solution

	Growth Fund	Balanced Fund	Regular Fund	Market
Average Return (%)	7	6	5	9
Variance	92.16	54.76	40.96	57.76
Std. Deviation	9.60	7.40	6.40	7.60
Coefficient of Determination	0.3025	0.6561	0.9604	
Coefficient of Correlation	0.55	0.81	0.98	
Beta (β)	$\frac{9.60 \times 0.55}{7.60}$	$\frac{7.40 \times 0.81}{7.60}$	$\frac{6.40 \times 0.98}{7.60}$	
	= 0.695	= 0.789	= 0.825	

(i) Ranking of Funds as per Sharpe Ratio

Sharpe Ratio = Expected return-Risk Free Rate of Return/ Standard Deviation

	Growth Fund	Balanced Fund	Regular Fund
Sharpe Ratio	$\frac{7 - 9}{9.60} = -0.208$	$\frac{6 - 9}{7.40} = -0.405$	$\frac{5 - 9}{6.40} = -0.625$
Ranking	1	2	3

(ii) Ranking of Funds as per Treynor Ratio

Sharpe Ratio = Expected return-Risk Free Rate of Return/ Beta

	Growth Fund	Balanced Fund	Regular Fund
Treynor Ratio	$\frac{7 - 9}{0.695} = -2.878$	$\frac{6 - 9}{0.789} = -3.802$	$\frac{5 - 9}{0.825} = -4.84$
Ranking	1	2	3

(iii) Comparison of performance with the Market

Sharpe Ratio	$\frac{9 - 9}{7.60} = 0$
Treynor Ratio	$\frac{9 - 9}{1} = 0$

Thus, performance of funds is very poor since all values are negative as compared to market performance.

Question 55

[RTP MAY 22]

Mr. A is having 1 lakh shares of M/s. K Ltd. The beta of the company is 1.40. Mr. Y a financial advisor has suggested for having the following portfolio:

Security	Beta	% Holding
L	1.20	10
M	0.75	10
N	0.40	30
O	1.40	50
		100

Market Return is 12% Risk free rate is 8% Required:

You are required to **CALCULATE** the following for the present investment and suggested portfolio:

- (i) Expected return based on CAPM and also
 - 1) If the market return goes up by 2.5%.
 - 2) If the market return goes down by 2.5%
 - 3) If the market is giving a negative return of 2.5%.
- (ii) If probability of market giving negative return is more, please advise Mr. A whether to continue the holdings of M/s. K Ltd. or to buy the portfolio as per the suggestion of Mr. B. If so, why?

Solution Working Notes -

Calculation of Portfolio Beta suggested by Mr. B

Security	Beta	Wt. of Holding	Beta x Wt. of Holding
L	1.20	0.10	0.120
M	0.75	0.10	0.075
N	0.40	0.30	0.120
O	1.40	0.50	0.700
Total		1.00	1.015

Portfolio Beta is 1.015

Calculation of Expected Return based on CAPM at present situation-

Particulars	Risk Free Rate (Rf)	Beta	Market Return	Risk Premium = $R_m - R_f$	Beta X Risk Premium	Expected Return
a	b	c	d	$e = d - b$	$f = c \times e$	$g = b + f$
K Ltd.	8%	1.400	12%	4%	5.600%	13.60%
Portfolio	8%	1.015	12%	4%	4.060%	12.06%

(i) 1) Calculation of Expected Return based on CAPM if market goes up by 2.5%:

Particulars	Risk Free Rate (Rf)	Beta	Market Return	Risk Premium = $R_m - R_f$	Beta X Risk Premium	Expected Return
a	b	c	d	$e = d - b$	$f = c \times e$	$g = b + f$
K Ltd.	8%	1.400	14.50%	6.5	9.100%	17.10%
Portfolio	8%	1.015	14.50%	6.5	6.598%	14.60%

2) Calculation of Expected Return based on CAPM if market goes down by 2.5%:

Particulars	Risk Free Rate (Rf)	Beta	Market Return	Risk Premium = $R_m - R_f$	Beta X Risk Premium	Expected Return
a	b	c	d	$e = d - b$	$f = c \times e$	$g = b + f$
K Ltd.	8%	1.400	9.50%	1.50%	2.100%	10.10%
Portfolio	8%	1.015	9.50%	1.50%	1.523%	9.52%

3) Calculation of Expected Return based on CAPM if market gives negative returns of 2.5%:

Particulars	Risk Free Rate (Rf)	Beta	Market Return	Risk Premium = $R_m - R_f$	Beta X Risk Premium	Expected Return
a	b	c	d	$e = d - b$	$f = c \times e$	$g = b + f$
K Ltd.	8%	1.400	- 2.00%	- 10.5	-14.700	-6.70
Portfolio	8%	1.015	- 2.00%	- 10.5	-10.658	-2.66

(ii) **Advice:** If the probability of market giving negative return is more, it is advisable to Mr. A to buy the portfolio suggested by Mr. B because Beta of the portfolio is less than of K Ltd.

Question 56

[MTP MAY 23]

On the basis of given information, Mr. XLY want to create a portfolio equally as risky as the market and is having ₹ 20,00,000 to invest.

Assets	Investment	Beta
Stock A	₹ 4,00,000	0.70
Stock B	₹ 5,00,000	1.10
Stock C	?	1.60
Debentures(D)	?	0

How do you recommend and interpret the risk scenario and investment in all the securities?

Solution

Let W_A , W_B , W_C and W_D be the weights of Stock A, B, C and Debenture respectively.

$$W_A = 4,00,000 \div 20,00,000 = 0.20$$

$$W_B = 5,00,000 \div 20,00,000 = 0.25$$

$$\text{Now } W_C + W_D = 1 - W_A - W_B = 0.55$$

It is given in the question that Portfolio should be as risky as that of the market. It means Beta of the portfolio should be 1.

Hence,

$$W_A (0.7) + W_B (1.1) + W_C (1.6) + W_D (0) = 1$$

$$0.2 \times 0.7 + 0.25 \times 1.1 + 1.6W_C + W_D \times 0 = 1$$

$$0.14 + 0.275 + 1.6W_C + 0 = 1$$

$$1.6W_C = 1 - 0.415$$

$$1.6W_C = 0.585$$

$$W_C = 0.585/1.6 = 0.3656$$

$$\text{Weight of Debenture } (W_D) = 1 - 0.2 - 0.25 - 0.3656 = 0.1844$$

$$\text{Hence, Amount invested in Stock C} = 0.3656 \times 20,00,000 = ₹ 7,31,200$$

$$\text{Amount invested in Debenture (D)} = 0.1844 \times 20,00,000 = ₹ 3,68,800$$

Thus, amount to be invested in Stock (C) is ₹ 7,31,200 and in Debenture is ₹ 3,68,800.

Question 57 (Nov 24 Exam) A Portfolio Manager (PM) has three mutual funds in his portfolio. Following 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

- (i) Variance of the Funds
- (ii) Coefficient of Determination of the Funds

Solution

(i) Variance of different Funds can be calculated by using Sharpe Ratio as follows:

(a) Growth Fund

Let σ_G be the Standard Deviation of Growth Fund. Accordingly

$$-0.15 = 7.50 - 9.00 / \sigma_G$$

$$\sigma_G = 10$$

$$\text{Hence the variance of Growth Fund } (\sigma_G)^2 = 100$$

(b) Balanced Fund

Let σ_B be the Standard Deviation of Balanced Fund. Accordingly

$$-0.36 = 6.30 - 9.00 / \sigma_B$$

$$\sigma_B = 7.50$$

$$\text{Hence the variance of Growth Fund } (\sigma_B)^2 = 56.25$$

(c) Regular Fund

Let σ_R be the Standard Deviation of Regular Fund. Accordingly

$$-0.48 = 5.40 - 9.00 / \sigma_R$$

$$\sigma_R = 7.50$$

$$\text{Hence the variance of Growth Fund } (\sigma_R)^2 = 56.25$$

(ii) To determine the Coefficient of Determination we need the Coefficient of Correlation which can be determined by computing β using the Treynor Ratio as follows:

(a) Growth Fund

Let β_G be the Beta of Growth Fund. Accordingly

$$-2 = 7.50 - 9.00 / \beta_G$$

$$\beta_G = 0.75$$

$$\text{Since Beta} = \sigma_G \text{Corr}_{G,M} / \sigma_M$$

$$\text{and } \sigma_G = 10 \text{ and } \sigma_M = \sqrt{50.41} = 7.1$$

$$\text{Hence } 0.75 = 10 \text{Corr}_{G,M} / 7.10$$

$$\text{Coefficient of Determination of Growth Fund} = (0.5325)^2 = 0.2836 \text{ or } (0.53)^2 = 0.28$$

(b) Balanced Fund

Let β_B be the Beta of Balanced Fund. Accordingly

$$-3 = 6.30 - 9.00 / \beta_B$$

$$\beta_B = 0.90$$

$$\text{Since Beta} = \sigma_B \text{Corr}_{B,M} / \sigma_M$$

$$\text{and } \sigma_B = 7.50 \text{ and } \sigma_M = \sqrt{50.41} = 7.1$$

$$\text{Hence } 0.90 = 7.50 \text{Corr}_{B,M} / 7.10$$

$$\text{Corr}_{B,M} = 0.852 \text{ or } 0.85 \text{ and}$$

$$\text{Coefficient of Determination of Balanced Fund} = (0.852)^2 = 0.7259 \text{ or } (0.85)^2 = 0.73$$

(c) Regular Fund

Let β_R be the Beta of Regular Fund. Accordingly

$$-4.80 = 5.40 - 9.00 / \beta_R$$

$$\beta_R = 0.75$$

$$\text{Since Beta} = \sigma_R \text{Corr}_{R,M} / \sigma_M$$

$$\text{and } \sigma_R = 7.50 \text{ and } \sigma_M = \sqrt{50.41} = 7.1$$

$$\text{Hence } 0.75 = 7.50 \text{Corr}_{R,M} / 7.10$$

$$\text{Corr}_{R,M} = 0.71 \text{ and}$$

$$\text{Coefficient of Determination of Regular Fund} = (0.71)^2 = 0.5041 \text{ or } 0.50$$



Mutual Fund

Question 1 Mr. A can earn a return of 16 per cent by investing in equity shares on his own. Now he is considering a recently announced equity based mutual fund scheme in which initial expenses are 5.5 per cent and annual recurring expenses are 1.5 per cent. How much should the mutual fund earn to provide Mr. A return of 16 per cent?

Solution

Personal earnings of Mr. A = $R_1 = 16\%$

Mutual Fund earnings = R_2

$$R_2 = \frac{1}{1 - \text{Initial Expenses}(\%)} R_1 + \text{Recurring Expenses}(\%) = \frac{1}{1 - 0.055} 16\% + 1.5\% = 18.43\%$$

Mutual Fund earnings = 18.43%

Question 2

The unit price of Equity Linked Savings Scheme (ELSS) of a mutual fund is ₹ 10/-. The public offer price (POP) of the unit is ₹ 10.204 and the redemption price is ₹ 9.80.

Calculate: (i) Front-end Load (ii) Back end Load

Solution

$$(i) \text{ Front-end Load} = \frac{10.204 - 10.00}{10.00} = 0.0204 \text{ or } 2.04\%$$

$$(ii) \text{ Back end Load} = \frac{10.00 - 9.80}{10.00} = 0.020 \text{ or } 2.00\%$$

Question 3

A mutual fund that had a net asset value of ₹ 20 at the beginning of month - made income and capital gain distribution of ₹ 0.0375 and ₹ 0.03 per share respectively during the month, and then ended the month with a net asset value of ₹ 20.06. Calculate monthly return.

Solution Calculation of Monthly Return on the Mutual Funds

$$= \frac{(\text{₹ } 20.06 - \text{₹ } 20.00) + (\text{₹ } 0.0375 + \text{₹ } 0.03)}{20} = 0.06 + 0.0675/20 = 0.1275/20 = 0.006375$$

Or, $r = 0.6375\% \text{ p.m.}$ Or $= 7.65\% \text{ p.a.}$

Question 4

An investor purchased 300 units of a Mutual Fund at ₹ 12.25 per unit on 31st December, 2009. As on 31st December, 2010 he has received ₹ 1.25 as dividend and ₹ 1.00 as capital gains distribution per unit.

Required:

- (i) The return on the investment if the NAV as on 31st December, 2010 is ₹ 13.00.
- (ii) The return on the investment as on 31st December, 2010 if all dividends and capital gains distributions are reinvested into additional units of the fund at ₹ 12.50 per unit.

Solution

Return for the year (all changes on a per year basis)

Particulars	₹ /Unit
Change in price (₹ 13.00 - ₹ 12.25)	0.75
Dividend received	1.25
Capital gain distribution	1.00
Total Return	3.00

Return on investment $= (3.00 / 12.25) \times 100 = 24.49\%$

Alternatively, it can also be computed as follows:

$$= \frac{(\text{NAV}_t - \text{NAV}_0) + D_1 + DG_1}{\text{NAV}_0} \times 100 = \frac{(13 - 12.25) + 1.25 + 1.00}{12.25} \times 100 = 24.49\%$$

If all dividends and capital gain are reinvested into additional units at ₹ 12.50 per unit the position would be.

Total amount reinvested = ₹ 2.25 × 300 = ₹ 675

Additional units added = ₹ 675 / 12.50 = 54 units

Value of 354 units as on 31-12-2010 = ₹ 4,602

Price paid for 300 units on 31-12-2009 (300 × ₹ 12.25) = ₹ 3,675

$$\text{Return} = \frac{\frac{₹ 4,602 - ₹ 3,675}{₹ 3,675}}{\frac{₹ 3,675}{₹ 3,675}} = \frac{₹ 927}{₹ 3,675} = 25.22\%$$

Question 5

SBI mutual fund has a NAV of ₹ 8.50 at the beginning of the year. At the end of the year NAV increases to ₹ 9.10. Meanwhile fund distributes ₹ 0.90 as dividend and ₹ 0.75 as capital gains.

- (i) What is the fund's return during the year?
- (ii) Had these distributions been re-invested at an average NAV of ₹ 8.75 assuming 200 units were purchased originally. What is the return?

Solution

(i) Normal Return for the year (all changes on a per year basis)

Particulars	₹ /Unit
Change in price (₹ 9.10 - ₹ 8.50)	0.60
Dividend received	0.90
Capital gain distribution	0.75
Total Return	2.25

Return on investment $= (2.25 / 8.50) \times 100 = 26.47\%$

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

Total amount reinvested = ₹ 1.65 × 200 = ₹ 330

Additional units added = ₹ 330 / 8.75 = 37.71 units

Value of 237.71 units at end of year = ₹ 2,163.16

Price paid for 200 units in beginning of the year (200 × ₹ 8.50) = ₹ 1,700

$$\text{Return} = \frac{\text{₹}2,163.16 - \text{₹}1,700}{\text{₹}1,700} = \frac{\text{₹}463.16}{\text{₹}1,700} = 27.24\%$$

Question 6

The following information is extracted from Steady Mutual Fund's Scheme:

- Asset Value at the beginning of the month - ₹ 65.78
- Annualised return -15 %
- Distributions made in the nature of Income & Capital gain (per unit respectively) - ₹ 0.50 and ₹ 0.32

You are required to:

- (i) Calculate the month end net asset value of the mutual fund scheme (limit your answers to two decimals).
- (ii) Provide a brief comment on the month end NAV.

Solution

- (i) Calculation of NAV at the end of month:

Given Annual Return = 15%

Hence Monthly Return = 1.25% (r)

$$r = \frac{(\text{NAV}_t - \text{NAV}_{t-1}) + I_t + G_t}{\text{NAV}_{t-1}}$$

$$0.0125 = \frac{(\text{NAV}_t - 65.78) + 0.50 + 0.32}{65.78}$$

$$0.82 = \text{NAV}_t - ₹ 64.96$$

$$\text{NAV}_t = ₹ 65.78$$

- (ii) There is no change in NAV.

Question 7

Cinderella Mutual Fund has the following assets in Scheme Rudolf at the close of business on 31st March, 2014.

Company	No. of Shares	Market Price Per Share
Nairobi Ltd.	25000	₹ 20
Dakar Ltd.	35000	₹ 300
Senegal Ltd.	29000	₹ 380
Cairo Ltd.	40000	₹ 500

The total number of units of Scheme Rudolf are 10 lacs. The Scheme Rudolf has accrued expenses of ₹ 2,50,000 and other liabilities of ₹ 2,00,000. Calculate the NAV per unit of the Scheme Rudolf.

Solution

Shares	No. of shares	Price	Amount (₹)
Nairobi Ltd.	25,000	20.00	5,00,000
Dakar Ltd.	35,000	300.00	1,05,00,000
Senegal Ltd.	29,000	380.00	1,10,20,000
Cairo Ltd.	40,000	500.00	2,00,00,000
			4,20,20,000
Less: Accrued Expenses			2,50,000
Other Liabilities			2,00,000
Total Value			4,15,70,000
No. of Units			10,00,000
NAV per Unit (4,15,70,000/10,00,000)			41.57

Question 8 A Mutual Fund Co. has the following assets under it on the close of business as on:

		1st February 2012	2nd February 2012
Company	No. of Shares	Market price per share	Market price per share
		₹	₹
L Ltd	20,000	20.00	20.50
M Ltd	30,000	312.40	360.00
N Ltd	20,000	361.20	383.10
P Ltd	60,000	505.10	503.90

Total No. of Units 6,00,000

(i) Calculate Net Assets Value (NAV) of the Fund.

(ii) Following information is given:

Assuming one Mr. A, submits a cheque of ₹ 30,00,000 to the Mutual Fund and the Fund manager of this company purchases 8,000 shares of M Ltd; and the balance amount is held in Bank. In such a case, what would be the position of the Fund?

(iii) Find new NAV of the Fund as on 2nd February 2012.

Solution

(i) NAV of the Fund

$$= \frac{4,00,000 + 93,72,000 + 72,24,000 + 3,03,06,000}{6,00,000} = \frac{4,73,02,000}{6,00,000}$$

$$= ₹ 78.8366 \text{ rounded to } ₹ 78.84$$

(ii) The revised position of fund shall be as follows:

Shares	No. of shares	Price	Amount (₹)
L Ltd.	20,000	20.00	4,00,000
M Ltd.	38,000	312.40	1,18,71,200
N Ltd.	20,000	361.20	72,24,000
P Ltd.	60,000	505.10	3,03,06,000
Cash			<u>5,00,800</u>
			<u>5,03,02,000</u>

$$\text{No. of units of fund} = 6,00,000 + \frac{30,00,000}{78.8366} = 6,38,053$$

(iii) On 2nd February 2012, the NAV of fund will be as follows:

Shares	No. of shares	Price	Amount (₹)
L Ltd.	20,000	20.50	4,10,000
M Ltd.	38,000	360.00	1,36,80,000
N Ltd.	20,000	383.10	76,62,000
P Ltd.	60,000	503.90	3,02,34,000
Cash			<u>5,00,800</u>
			<u>5,24,86,800</u>

$$\text{NAV as on 2nd February 2012} = ₹5,24,86,800 / 6,38,053 = ₹ 82.26 \text{ per unit}$$

Question 9 On 1st April 2009 Fair Return Mutual Fund has the following assets and prices at 4.00 p.m.

Shares	No. of Shares	Market Price Per Share (₹)
A Ltd.	10000	19.70
B Ltd.	50000	482.60
C Ltd.	10000	264.40
D Ltd.	100000	674.90
E Ltd.	30000	25.90
No. of units of funds		8,00,000

Please calculate:

- NAV of the Fund on 1st April 2009.
- Assuming that on 1st April 2009, Mr. X, a HNI, send a cheque of ₹ 50,00,000 to the Fund and Fund Manager immediately purchases 18000 shares of C Ltd. and balance is held in bank. Then what will be position of fund.
- Now suppose on 2 April 2009 at 4.00 p.m. the market price of shares is as follows:

Shares	₹
A Ltd.	20.30
B Ltd.	513.70
C Ltd.	290.80
D Ltd.	671.90
E Ltd.	44.20

Then what will be new NAV.

Solution

(a) **NAV of the Fund.**

$$= \frac{1,97,000 + 2,41,30,000 + 26,44,000 + 6,74,90,000 + 7,77,000}{8,00,000} = \frac{9,52,38,000}{8,00,000}$$

$$= ₹ 119.0475 \text{ rounded to } ₹ 119.05$$

(b) **The revised position of fund shall be as follows:**

Shares	No. of shares	Price	Amount (₹)
A Ltd.	10000	19.70	1,97,000
B Ltd.	50000	482.60	2,41,30,000
C Ltd.	28000	264.40	74,03,200
D Ltd.	100000	674.90	674,90,000
E Ltd.	30000	25.90	7,77,000
Cash			<u>2,40,800</u>
			<u>10,02,38,000</u>

$$\text{No. of units of fund} = 8,00,000 + \frac{50,00,000}{78.8366} = 8,42,000$$

(c) **On 2nd April 2009, the NAV of fund will be as follows:**

Shares	No. of shares	Price	Amount (₹)
A Ltd.	10000	20.30	2,03,000
B Ltd.	50000	513.70	2,56,85,000
C Ltd.	28000	290.80	81,42,400
D Ltd.	100000	671.90	6,71,90,000
E Ltd.	30000	44.20	13,26,000
Cash			<u>2,40,800</u>
			<u>10,27,87,200</u>

$$\text{NAV as on 2nd April 2009} = ₹ 10,27,87,200 / 8,42,000 = ₹ 122.075 \text{ per unit}$$

Question 10

Mr. Sinha has invested in three Mutual fund schemes as per details below:

	Scheme X	Scheme Y	Scheme Z
Date of Investment	01.12.2008	01.01.2009	01.03.2009
Amount of Investment	₹ 5,00,000	₹ 1,00,000	₹ 50,000
Net Asset Value at entry date	₹ 10.50	₹ 10.00	₹ 10.00
Dividend received upto 31.03.2009	₹ 9,500	₹ 1,500	Nil
NAV as at 31.3.2009	₹ 10.40	₹ 10.10	₹ 9.80

You are required to calculate the effective yield on per annum basis in respect of each of the three schemes to Mr. Sinha upto 31.03.2009.

Solution Calculation of effective yield on per annum basis in respect of three mutual fund schemes to Mr. Sinha up to 31-03-2009:

Particulars	MF X	MF Y	MF Z
(a) Investments	₹ 5,00,000	₹ 1,00,000	₹ 50,000
(b) Opening NAV	₹10.50	₹10.00	₹10.00
(c) No. of units (a/b)	47,619.05	10,000	5,000
(d) Unit NAV ON 31-3-2009	₹ 10.40	₹ 10.10	₹ 9.80
(e) Total NAV on 31-3-2009 (c x d)	₹4,95,238.12	₹ 1,01,000	₹ 49,000
(f) Increase / Decrease of NAV (e - a)	(₹ 4,761.88)	₹ 1,000	(₹ 1,000)
(g) Dividend Received	₹ 9,500	₹ 1,500	Nil
(h) Total yield (f + g)	₹ 4,738.12	₹ 2,500	(₹ 1,000)
(i) Number of Days	121	90	31
(j) Effective yield p.a. (h/a x 365/i x 100)	2.859%	10.139%	(-) 23.55%

Question 11

Mr. Y has invested in the three mutual funds (MF) as per the following details:

Particulars	MF 'X'	MF 'Y'	MF 'Z'
Amount of Investment (₹)	2,00,000	4,00,000	2,00,000
Net Assets Value (NAV) at the time of purchase (₹)	10.30	10.10	10
Dividend Received up to 31.03.2018 (₹)	6,000	0	5,000
NAV as on 31.03.2018 (₹)	10.25	10	10.20
Effective Yield per annum as on 31.03.2018 (percent)	9.66	-11.66	24.15

Assume 1 Year =365 days Mr. Y has misplaced the documents of his investment. Help him in finding the date of his original investment after ascertaining the following: (i) Number of units in each scheme;(ii)Total NAV;(iii)Total Yield; and (iv) Number of days investment held.

Solution

(i) Number of Units in each Scheme

MF 'X'	₹ 2,00,000 ₹ 10.30	= 19,417.48
MF 'Y'	₹ 4,00,000 ₹ 10.10	= 39,603.96
MF 'Z'	₹ 2,00,000 ₹10.00	= 20,000.00

(ii) Total NAV on 31.03.2018

MF 'X'	= 19,417.48 x ₹ 10.25	₹ 1,99,029.17
MF 'Y'	= 39,603.96 x ₹ 10.00	₹ 3,96,039.60
MF 'Z'	= 20,000.00 x ₹ 10.20	₹ 2,04,000.00
Total		₹ 7,99,068.77

(iii) Total Yield

	Capital Yield	Dividend Yield	Total
MF 'X'	₹ 1,99,029.17 - ₹ 2,00,000 = - ₹ 970.83	₹ 6,000	₹ 5,029.17
MF 'Y'	₹ 3,96,039.60 - ₹ 4,00,000 = - ₹ 3,960.40	Nil	- ₹ 3,960.40
MF 'Z'	₹ 2,04,000 - ₹ 2,00,000 = ₹ 4,000	₹ 5,000	₹ 9,000.00
Total			₹ 10,068.77

Total Yield = (₹10,068.77/₹8,00,000) × 100 = 1.2586%

(iv) No. of Days Investment Held

	MF 'X'	MF 'Y'	MF 'Z'
Initial Investment (₹)	2,00,000	4,00,000	2,00,000
Yield (₹)	5,029.17	-3,960.40	9,000.00
Yield (%)	2.5146	- 0.9901	4.5
Period of Holding (Days)	$\frac{2.5146}{9.66} \times 365$ = 95 Days	$\frac{-0.9901}{-11.66} \times 365$ = 31 Days	$\frac{4.5}{24.15} \times 365$ = 68 Days

Date of Original Investment 27.12.17 01.03.18 23.01.18

Alternatively following dates can also be considered:

Date of Original Investment 26.12.17 28.02.18 22.01.18

Question 12

Mr. X on 1.7.2007, during the initial offer of some Mutual Fund invested in 10,000 units having face value of ₹ 10 for each unit. On 31.3.2008, the dividend paid by the M.F. was 10% and Mr. X found that his annualized yield was 153.33%. On 31.3.2009, 20% dividend was given.

On 31.3.2010, Mr. X redeemed all his balance of 11,296.11 units when his annualized yield was 73.52%. What are the NAVs as on 31.3.2008, 31.3.2009 and 31.3.2010?

Solution

Yield for 9 months = (153.33 × 9/12) = 115%

Market value of Investments as on 31.03.2008 = 1,00,000/- + (1,00,000 × 115%)
= ₹2,15,000/-

Therefore, NAV as on 31.03.2008 = (2,15,000 - 10,000)/10,000 = ₹20.50

(NAV would stand reduced to the extent of dividend payout, being (10,000 × 10 × 10%) = ₹10,000)

Since dividend was reinvested by Mr. X, additional units acquired = ₹10,000/₹20.50 = 487.80 units

Therefore, units as on 31.03.2008 = 10,000 + 487.80 = 10,487.80

Alternately, units as on 31.03.2008 = (2,15,000/20.50) = 10,487.80]

Dividend as on 31.03.2009 = 10,487.80 × 10 × 0.2 = ₹20,975.60

Let X be the NAV on 31.03.2009, then number of new units reinvested will be ₹ 20,975.60/X.

Accordingly 11296.11 units shall consist of reinvested units and 10487.80 (as on 31.03.2008).

Thus, by way of equation it can be shown as follows:

$$11296.11 = \frac{20975.60}{X} + 10487.80$$

$$\begin{aligned}\text{Therefore, NAV as on 31.03.2009} &= 20,975.60 / (11,296.11 - 10,487.80) \\ &= ₹25.95\end{aligned}$$

$$\begin{aligned}\text{NAV as on 31.03.2010} &= ₹ 1,00,000 (1 + 0.7352 \times 33/12) / 11296.11 \\ &= ₹ 26.75\end{aligned}$$

Question 13

Mr. X on 1.7.2012, during the initial public offer of a Mutual Fund (MF) invested ₹ 1,00,000 at Face Value of ₹ 10. On 31.3.2013, the MF declared a dividend of 10% when Mr. X calculated that his holding period return was 115%. On 31.3.2014, MF again declared a dividend of 20%. On 31.3.2015, Mr. X redeemed all his investment which had accumulated to 11,296.11 units when his holding period return was 202.17%. Calculate the NAVs as on 31.03.2013, 31.03.2014 and 31.03.2015.

Solution

$$\text{Yield for 9 months} = 115\%$$

$$\text{Market value of Investments as on 31.03.2013} = 1,00,000 + (1,00,000 \times 115\%) = ₹ 2,15,000/-$$

$$\text{Therefore, NAV as on 31.03.2013} = (2,15,000 - 10,000) / 10,000 = ₹ 20.50$$

(NAV would stand reduced to the extent of dividend payout, being (₹100,000 × 10%) = ₹ 10,000)

Since dividend was reinvested by Mr. X, additional units acquired = ₹10,000/₹20.50 = 487.80 units

$$\text{Therefore, units as on 31.03.2013} = 10,000 + 487.80 = 10,487.80$$

$$[\text{Alternately, units as on 31.03.2013} = (2,15,000 / 20.50) = 10,487.80]$$

$$\text{Dividend as on 31.03.2014} = 10,487.80 \times 10 \times 0.2 = ₹ 20,975.60$$

Let X be the NAV on 31.03.2014, then number of new units reinvested will be ₹ 20,975.60/X.

Accordingly 11296.11 units shall consist of reinvested units and 10487.80 (as on 31.03.2013). Thus, by way of equation it can be shown as follows:

$$11296.11 = \frac{20975.60}{X} + 10487.80$$

$$\text{Therefore, NAV as on 31.03.2014} = 20,975.60 / (11,296.11 - 10,487.80) = ₹ 25.95$$

$$\text{NAV as on 31.03.2015} = ₹ 1,00,000 (1 + 2.0217) / 11296.11 = ₹ 26.75$$

Question 14

A Mutual Fund having 300 units has shown its NAV of ₹ 8.75 and ₹ 9.45 at the beginning and at the end of the year respectively. The Mutual Fund has given two options:

- (i) Pay ₹ 0.75 per unit as dividend and ₹ 0.60 per unit as a capital gain, or
- (ii) These distributions are to be reinvested at an average NAV of ₹ 8.65 per unit.

What difference would it make in terms of return available and which option is preferable?

Solution

- (i) Returns for the year

(All changes on a Per -Unit Basis)

Change in Price:	₹ 9.45 - ₹8.75 = ₹ 0.70
Dividends received:	₹ 0.75
Capital gains distribution	<u>₹ 0.60</u>
Total reward	<u>₹ 2.05</u>
Holding period reward:	$\frac{₹2.05}{₹8.75} \times 100 = 23.43\%$

- (ii) When all dividends and capital gains distributions are re-invested into additional units of the fund @ (₹ 8.65/unit)

= Dividend + Capital Gains per unit = ₹ 0.75 + ₹ 0.60 = ₹ 1.35

Total received from 300 units = ₹1.35 × 300 = ₹405/-.

Additional Units Acquired

= ₹405/₹8.65 = 46.82 Units.

Total No.of Units

= 300 units + 46.82 units = 346.82 units.

Value of 346.82 units held at the end of the year

= 346.82 units × ₹9.45 = ₹3277.45

Price Paid for 300 Units at the beginning of the year

= 300 units × ₹8.75 = ₹2,625.00

Holding Period Reward

₹ (3277.45 - 2625.00) = ₹652.45

Holding Period Reward

= (₹652.45/₹2625.00) × 100 = 24.85%

Conclusion: Since the holding period reward is more in terms of percentage in option-two i.e., reinvestment of distributions at an average NAV of ₹8.65 per unit, this option is preferable.

Question 15

On 1-4-2012 ABC Mutual Fund issued 20 lakh units at ₹ 10 per unit. Relevant initial expenses involved were ₹ 12 lakhs. It invested the funds so raised in capital market instruments to build a portfolio of ₹ 185 lakhs. During the month of April 2012 it disposed off some of the instruments costing ₹ 60 lakhs for ₹ 63 lakhs and used the proceeds in purchasing securities for ₹ 56 lakhs. Fund management expenses for the month of April 2012 was ₹ 8 lakhs of which 10% was in arrears. In April 2012 the fund earned dividends amounting to ₹ 2 lakhs and it distributed 80% of the realized earnings. On 30-4-2012 the market value of the portfolio was ₹ 198 lakhs.

Mr. Akash, an investor, subscribed to 100 units on 1-4-2012 and disposed off the same at closing NAV on 30-4-2012. What was his annual rate of earning?

Solution

	Amount in ₹ lakhs	Amount in ₹ lakhs	Amount in ₹ lakhs
Opening Bank (200 - 185 -12)	3.00		
Add: Proceeds from sale of securities	63.00		
Add: Dividend received	<u>2.00</u>	68.00	
Deduct:			
Cost of securities purchased	56.00		
Fund management expenses paid (90% of 8)	7.20		
Capital gains distributed = 80% of (63 - 60)	2.40		
Dividend distributed =80% of 2.00	<u>1.60</u>	<u>67.20</u>	
Closing Bank			0.80
Closing market value of portfolio			<u>198.00</u>
			198.80
Less: Arrears of expenses			<u>0.80</u>
Closing Net Assets			<u>198.00</u>
Number of units (Lakhs)			20
Closing NAV per unit (198.00/20)			9.90

Rate of Earning (Per Unit)

	Amount
Income received (₹ 2.40 + ₹ 1.60)/20	₹ 0.20
Loss: Loss on disposal (₹ 200 - ₹ 198)/20	<u>₹ 0.10</u>
Net earning	<u>₹ 0.10</u>
Initial investment	₹ 10.00
Rate of earning (monthly)	1%
Rate of earning (Annual)	12%

Question 16

Sun Moon Mutual Fund (Approved Mutual Fund) sponsored open-ended equity-oriented scheme "Chanakya Opportunity Fund". There were three plans viz. 'A' - Dividend Re-investment Plan, 'B' - Bonus Plan & 'C' - Growth Plan.

At the time of Initial Public Offer on 1.4.1999, Mr. Anand, Mr. Bacchan & Mrs. Charu, three investors invested ₹ 1,00,000 each & chose 'B', 'C' & 'A' Plan respectively.

The History of the Fund is as follows:

Date	Dividend %	Bonus Ratio	Net Asset Value per Unit (F.V. ₹ 10)		
			Plan A	Plan B	Plan C
28.07.2003	20		30.70	31.40	33.42
31.03.2004	70	5 : 4	58.42	31.05	70.05
31.10.2007	40		42.18	25.02	56.15
15.03.2008	25		46.45	29.10	64.28
31.03.2008		1 : 3	42.18	20.05	60.12
24.03.2009	40	1 : 4	48.10	19.95	72.40
31.07.2009			53.75	22.98	82.07

On 31st July all three investors redeemed all the balance units. Calculate annual rate of return to each of the investors.

Consider:

1. Long-term Capital Gain is exempt from Income tax.
2. Short-term Capital Gain is subject to 10% Income tax.
3. Security Transaction Tax 0.2 per cent only on sale/redemption of units.
4. Ignore Education Cess.

Solution

Mrs. Charu Plan A Dividend Reinvestment

(Amount in ₹)

Date	Investment (₹)	Dividend payout (%)	Dividend Re- invested (Closing Units X Face value of '10 X Dividend Payout %)	NAV (₹)	Units	Closing Unit Balance Σ Units
01.04.1999	1,00,000.00			10.00	10,000.00	10,000.00
28.07.2003		20	20,000.00	30.70	651.47	10,651.47
31.03.2004		70	74,560.29	58.42	1,276.28	11,927.75
30.10.2007		40	47,711.00	42.18	1,131.13	13,058.88
15.03.2008		25	32,647.20	46.45	702.85	13,761.73
24.03.2009		40	55,046.92	48.10	1,144.43	14,906.16
Redemption value 14,906.16 × 53.75						8,01,206.10
Less: Security Transaction Tax (STT) is 0.2%						1,602.41
Net amount received						7,99,603.69
Less: Short term capital gain tax @ 10% on 1,144.43 (53.64* - 48.10≈) = 6,340						634
Net of tax						7,98,969.69
Less: Investment						1,00,000.00
						6,98,969.69

*(53.75 - STT @ 0.2%)

≈ This value can also be taken as zero

$$\text{Annual average return (\%)} = \frac{6,98,969.69}{1,00,000} \times \frac{12}{24} \times 100 = 67.64\%$$

Mr. Anand Plan B – Bonus

(Amount in ₹)				
Date	Units	Bonus units	Total Balance	NAV per unit
01.04.1999	10,000		10,000	10
31.03.2004		12,500	22,500	31.05
31.03.2008		7,500	30,000	20.05
24.03.2009		7,500	37,500	19.95

Redemption value 37,500 × 22.98	8,61,750.00
Less: Security Transaction Tax (STT) is 0.2%	1,723.50
Net amount received	8,60,026.50
Less: Short term capital gain tax @ 10%	
7,500 × (22.93† - 19.95≈) = 22,350	2,235.00
Net of tax	8,57,791.50
Less: Investment	1,00,000.00
Net gain	7,57,791.50

†(22.98 - STT @ 0.2%)

≈ This value can also be taken as zero

$$\text{Annual average return (\%)} = \frac{7,57,791.50}{1,00,000} \times \frac{12}{124} \times 100 = 73.33\%$$

Mr. Bacchan Plan C – Growth

Particulars	(Amount in ₹)
Redemption value 10,000 × 82.07	8,20,700.00
Less: Security Transaction Tax (S.T.T) is .2%	1,641.40
Net amount received	8,19,058.60
Less: Short term capital gain tax @ 10%	0.00
Net of tax	8,19,058.60
Less: Investment	1,00,000.00
Net gain	7,19,058.60

$$\text{Annual average return (\%)} = \frac{7,19,058}{1,00,000} \times \frac{12}{124} \times 100 = 69.59\%$$

Note: Alternatively, figure of * and † can be taken as without net of Tax because, as per Proviso 5 of Section 48 of IT Act, no deduction of STT shall be allowed in computation of Capital Gain.

Question 17

A mutual fund company introduces two schemes i.e. Dividend plan (Plan-D) and Bonus plan (Plan-B). The face value of the unit is ₹ 10. On 1-4-2005 Mr. K invested ₹ 2,00,000 each in Plan-D and Plan-B when the NAV was ₹ 38.20 and ₹ 35.60 respectively. Both the plans matured on 31-3-2010.

Particulars of dividend and bonus declared over the period are as follows:

Date	Dividend	Bonus Ratio	Net Asset Value (₹)	
	%		Plan D	Plan B
30-09-2005	10	---	39.10	35.60
30-06-2006	---	1:5	41.15	36.25
31-03-2007	15	---	44.20	33.10
15-09-2008	13	---	45.05	37.25
30-10-2008	---	1:8	42.70	38.30
27-03-2009	16	---	44.80	39.10
11-04-2009	---	1:10	40.25	38.90
31-03-2010	---	---	40.40	39.70

What is the effective yield per annum in respect of the above two plans?

Solution

Plan - D Unit acquired = $2,00,000 / 38.20 = 5235.60$

Date	Units held	Dividend		Reinvestment	New	Total
		%	Amount	Rate	Units	Units
01.04.2005						5235.60
30.09.2005	5235.60	10	5235.60	39.10	133.90	5369.50
31.03.2007	5369.50	15	8054.25	44.20	182.22	5551.72
15.09.2008	5551.72	13	7217.24	45.05	160.20	5711.92
27.03.2009	5711.92	16	9139.07	44.80	204	5915.92
31.03.2010	Maturity Value		(₹ 40.40 X 5915.92)			₹ 2,39,003.17
	Less: Cost of Acquisition					<u>₹ 2,00,000.00</u>
	Total Gain					<u>₹ 39,003.17</u>

∴ Effective Yield = $(₹39,003.17 / ₹2,00,000) \times (1/5) \times 100 = 3.90\%$

Alternatively, it can be computed by using the IRR method as follows:

NPV at 4% = - ₹ 2,00,000 + ₹ 1,96,443 = - ₹ 3,557

NPV at 2% = - ₹ 2,00,000 + ₹ 2,16,473 = ₹ 16,473

IRR = LR + $\frac{\text{NPV at LR}}{\text{NPV at LR} - \text{NPV at HR}} (\text{HR} - \text{LR}) = 2\% + \frac{16473}{16473 - (-3557)} (4\% - 2\%) = 3.645\%$

Plan - B

Date	Particulars	Calculation Working	No. of Units	NAV (₹)
1.4.05	Investment	₹2,00,000/35.60=	5617.98	35.60
30.6.06	Bonus	5617.98/5 =	<u>1123.60</u>	36.25
			6741.58	
30.10.08	"	6741.58/8 =	<u>842.70</u>	38.30
			7584.28	
11.4.09	"	7584.28/10 =	<u>758.43</u>	38.90
			8342.71	
31.3.10	Maturity Value	8342.71 × ₹ 39.70=		3,31,205.59
	Less: Investment			<u>2,00,000.00</u>
	Gain			<u>1,31,205.59</u>

∴ Effective Yield = $(₹1,31,205.59/₹2,00,000) \times (1/5) \times 100 = 13.12\%$

Alternatively, it can be computed by using the IRR method as follows:

NPV at 13% = - ₹ 2,00,000 + ₹ 1,79,765 = - ₹ 20,235

NPV at 8% = - ₹ 2,00,000 + ₹ 2,25,413 = ₹ 25,413

$$\text{IRR} = \text{LR} + \frac{\text{NPV at LR}}{\text{NPV at LR} - \text{NPV at HR}} (\text{HR} - \text{LR}) = 8\% + \frac{25413}{25413 - (-20235)} (13\% - 8\%) = 10.78\%$$

Question 18

A mutual fund made an issue of 10,00,000 units of ₹ 10 each on January 01, 2008. No entry load was charged. It made the following investments:

Particulars	₹
50,000 Equity shares of ₹ 100 each @ ₹ 160	80,00,000
7% Government Securities	8,00,000
9% Debentures (Unlisted)	5,00,000
10% Debentures (Listed)	5,00,000
	98,00,000

During the year, dividends of ₹ 12,00,000 were received on equity shares. Interest on all types of debt securities was received as and when due. At the end of the year equity shares and 10% debentures are quoted at 175% and 90% respectively of face value. Other investments are valued at par.

Find out the Net Asset Value (NAV) per unit given that operating expenses paid during the year amounted to ₹ 5,00,000. Also find out the NAV, if the Mutual fund had distributed a dividend of ₹ 0.80 per unit during the year to the unit holders.

Solution In order to find out NAV, the cash balance at the end of the year is calculated as follows-

Particulars	₹
Cash balance in the beginning	
(₹ 100 lakhs - ₹ 98 lakhs)	2,00,000
Dividend Received	12,00,000
Interest on 7% Govt. Securities	56,000
Interest on 9% Debentures	45,000
Interest on 10% Debentures	50,000
	15,51,000
(-) Operating expenses	5,00,000
Net cash balance at the end	10,51,000
Calculation of NAV	₹
Cash Balance	10,51,000
7% Govt. Securities (at par)	8,00,000
50,000 equity shares @ ₹ 175 each	87,50,000
9% Debentures (Unlisted) at cost	5,00,000
10% Debentures @90%	4,50,000
Total Assets	1,15,51,000
No. of Units	10,00,000
NAV per Unit	₹ 11.55

Calculation of NAV, if dividend of ₹ 0.80 is paid -

Net Assets (₹ 1,15,51,000 - ₹ 8,00,000) ₹ 1,07,51,000

No. of Units 10,00,000

NAV per unit ₹ 10.75

Question 19 Based on following information, determine NAV of regular income scheme per unit basis:

Particulars	₹ Crores
Listed shares at Cost (ex-dividend)	20
Cash in hand	1.23
Bonds and debentures at cost	4.3
Of these, bonds not listed and quoted	1
Other fixed interest securities at cost	4.5
Dividend accrued	0.8
Amount payable on shares	6.32
Expenditure accrued	0.75
Number of units (₹ 10 face value)	20 lacs
Current realizable value of fixed income securities of face value of ₹ 100	106.50
The listed shares were purchased when Index was	1,000
Present index is	2,300
Value of listed bonds and debentures at NAV date	8

There has been a diminution of 20% in unlisted bonds and debentures. Other fixed interest securities are at cost.

Solution

Particulars	Adjusted Values ₹ crores
Equity Shares	46.00
Cash in hand	1.23
Bonds and debentures not listed	0.80
Bonds and debentures listed	8.00
Dividends accrued	0.80
Fixed income securities	4.50
Sub total assets (A)	61.33
Less: Liabilities	
Amount payable on shares	6.32
Expenditure accrued	0.75
Sub total liabilities (B)	7.07
Net Assets Value (A) - (B)	54.26
No. of units	20,00,000
Net Assets Value per unit (₹ 54.26 crore / 20,00,000)	₹ 271.30

Question 20

On 1st April, an open ended scheme of mutual fund had 300 lakh units outstanding with Net Assets Value (NAV) of ₹ 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:

	₹ in lakh
Portfolio value appreciation	425.47
Income of April	22.950
Income for May	34.425
Income for June	45.450

You are required to calculate:

- (i) Income available for distribution;
- (ii) Issue price at the end of April;
- (iii) repurchase price at the end of May; and
- (iv) net asset value (NAV) as on 30th June.

Solution**Calculation of Income available for Distribution**

	Units (Lakh)	Per Unit (₹)	Total (₹ In lakh)
Income from April	300	0.0765	22.9500
Add: Dividend equalization collected on issue	6	0.0765	0.4590
	306	0.0765	23.4090
Add: Income from May		0.1125	34.4250
	306	0.1890	57.8340
Less: Dividend equalization paid on repurchase	3	0.1890	(0.5670)
	303	0.1890	57.2670
Add: Income from June		0.1500	45.4500
	303	0.3390	102.7170
Less: Dividend Paid		0.2373	(71.9019)
	303	0.1017	30.8151

Calculation of Issue Price at the end of April

	₹
Opening NAV	18.750
Add: Entry Load 2% of ₹ 18.750	0.375
	19.125
Add: Dividend Equalization paid on Issue Price	0.0765
	19.2015

Calculation of Repurchase Price at the end of May

	₹
Opening NAV	18.750
Less: Exit Load 2% of ₹ 18.750	(0.375)
	18.375
Add: Dividend Equalization paid on Issue Price	0.1890
	18.564

Closing NAV

		₹ (Lakh)
Opening Net Asset Value (₹ 18.75 × 300)		5625.0000
Portfolio Value Appreciation		425.4700
Issue of Fresh Units (6 × 19.2015)		115.2090
Income Received (22.950 + 34.425 + 45.450)		102.8250
Less: Units repurchased (3 × 18.564)	-55.692	6268.504
Income Distributed	-71.9019	(-127.5939)
Closing Net Asset Value		6140.9101
Closing Units (300 + 6 - 3) lakh		303 lakh
∴ Closing NAV as on 30th June		₹ 20.2670

Question 21 There are two Mutual Funds viz. D Mutual Fund Ltd. and K Mutual Fund Ltd. Each having close ended equity schemes. NAV as on 31-12-2014 of equity schemes of D Mutual Fund Ltd. is ₹ 70.71 (consisting 99% equity and remaining cash balance) and that of K Mutual Fund Ltd. is ₹ 62.50 (consisting 96% equity and balance in cash).

Following is the other information:

Particular	Equity Schemes	
	D Mutual Fund Ltd.	K Mutual Fund Ltd.
Sharpe Ratio	2	3.3
Treynor Ratio	15	15
Standard deviation	11.25	5

There is no change in portfolios during the next month and annual average cost is ₹ 3 per unit for the schemes of both the Mutual Funds.

If Share Market goes down by 5% within a month, calculate expected NAV after a month for the schemes of both the Mutual Funds.

For calculation, consider 12 months in a year and ignore number of days for particular month

Solution Working Notes:

(i) Decomposition of Funds in Equity and Cash Components

	D Mutual Fund Ltd.	K Mutual Fund Ltd.
NAV on 31.12.14	₹ 70.71	₹ 62.50
% of Equity	99%	96%
Equity element in NAV	₹ 70	₹ 60
Cash element in NAV	₹ 0.71	₹ 2.50

(ii) Calculation of Beta

(a) D Mutual Fund Ltd.

$$\text{Sharpe Ratio} = 2 = \frac{E(R) - R_f}{\sigma_D} = \frac{E(R) - R_f}{11.25}$$

$$E(R) - R_f = 22.50$$

$$\text{Treynor Ratio} = 15 = \frac{E(R) - R_f}{\beta_D} = \frac{22.50}{\beta_D}$$

$$\beta_D = 22.50/15 = 1.50$$

(b) K Mutual Fund Ltd.

$$\text{Sharpe Ratio} = 3.3 = \frac{E(R) - R_f}{\sigma_K} = \frac{E(R) - R_f}{5}$$

$$E(R) - R_f = 16.50$$

$$\text{Treynor Ratio} = 15 = \frac{E(R) - R_f}{\beta_K} = \frac{16.50}{\beta_K}$$

$$\beta_K = 16.50/15 = 1.10$$

(iii) Decrease in the Value of Equity

	D Mutual Fund Ltd.	K Mutual Fund Ltd.
Market goes down by	5.00%	5.00%
Beta	1.50	1.10
Equity component goes down	7.50%	5.50%

(iv) Balance of Cash after 1 month

	D Mutual Fund Ltd.	K Mutual Fund Ltd.
Cash in Hand on 31.12.14	₹ 0.71	₹ 2.50
Less: Exp. Per month	₹ 0.25	₹ 0.25
Balance after 1 month	₹ 0.46	₹ 2.25

NAV after 1 month

	D Mutual Fund Ltd.	K Mutual Fund Ltd.
Value of Equity after 1 month		
$70 \times (1 - 0.075)$	₹ 64.75	-
$60 \times (1 - 0.055)$	-	₹ 56.70
Cash Balance	0.46	2.25
	65.21	58.95

Question 22

ANP Plan, a hedge fund currently has assets of ₹ 20 crore. CA. X, the manager of fund charges fee of 0.10% of portfolio asset. In addition to it he charges incentive fee of 2%. The incentive will be linked to gross return each year in excess of the portfolio maximum value since the inception of fund. The maximum value the fund achieved so far since inception of fund about one and half year ago was ₹ 21 crores. You are required to compute fee payable to CA. X, if return on fund this year turns out to be (a) 29%, (b) 4.5%, (c) -1.8%

Solution

(a) If return is 29%

	₹
Fixed fee (A) 0.10% of ₹ 20 crore	2,00,000
New Fund Value ($1.29 \times ₹ 20$ crore)	25.80 crore
Excess Value of best achieved (25.8 crore - 21.0 crore)	4.80 crore
Incentive Fee (2% of 4.80 crores) (B)	9,60,000
Total Fee (A)+(B)	11,60,000

(b) If return is 4.5%

	₹
Fixed (A) 0.10% of ₹ 20 crore	2,00,000
New Fund Value (1.045 x ₹ 20 crore)	20.90 crore
Excess Value of best achieved (20.90 crore -21.00 crore)	(₹ 0.10 crore)
Incentive Fee (as does not exceed best achieved) (B)	Nil
Total Fee (A)+(B)	2,00,000

(c) If return is (-1.8%)

No incentive only fixed fee of ₹ 2,00,000 will be paid

Question 23

Ms. Sunidhi is working with an MNC at Mumbai. She is well versant with the portfolio management techniques and wants to test one of the techniques on an equity fund she has constructed and compare the gains and losses from technique with those from a passive buy and hold strategy. The fund consists of equities only and ending NAVs of fund he constructed for the last 10 months are given below:

Month Ending	NAV (₹/unit)	Month Ending	NAV (₹/unit)
December 2008	40.00	May 2009	37.00
January 2009	25.00	June 2009	42.00
February 2009	36.00	July 2009	43.00
March 2009	32.00	August 2009	50.00
April 2009	38.00	September 2009	52.00

Assume Sunidhi had invested a notional amount of ₹ 2 lakhs equally in the equity fund and a conservative portfolio (of bonds) in the beginning of December 2008 and the total portfolio was being rebalanced each time the NAV of the fund increased or decreased by 15%.

You are required to determine the value of the portfolio for each level of NAV following the Constant Ratio Plan.

Solution Constant Ratio Plan:

Stock Portfolio NAV (₹)	Value of Conservative Portfolio (₹)	Value of aggressive Portfolio (₹)	Total value of Constant Ratio Plan (₹)	Revaluation Action	Total No. of units in aggressive portfolio
40.00	1,00,000	1,00,000	2,00,000	-	2500
25.00	1,00,000	62,500	1,62,500	-	2500
	81,250	81,250	1,62,500	Buy 750 units	3250
36.00	81,250	1,17,000	1,98,250	-	3250
	99,125	99,125	1,98,250	Sell 496.53 units	2753.47
32.00	99,125	88,111.04	1,87,236.04	-	2753.47
38.00	99,125	1,04,631.86	2,03,756.86	-	2753.47
	1,01,878.43	1,01,878.43	2,03,756.86	Sell 72.46 units	2681.01
37.00	1,01,878.43	99,197.37	2,01,075.80	-	2681.01
42.00	1,01,878.43	1,12,602.42	2,14,480.85	-	2681.01
43.00	1,01,878.43	1,15,283.43	2,17,161.86	-	2681.01
50.00	1,01,878.43	1,34,050.50	2,35,928.93	-	2681.01
	1,17,964.47	1,17,964.46	2,35,928.93	Sell 321.72 units	2359.29
52.00	1,17,964.47	1,22,683.08	2,40,647.55	-	2359.29

Hence, the ending value of the mechanical strategy is ₹ 2,40,647.55 and buy & hold strategy is ₹ 2,60,000.

Question 24**[OLD PM / MTP MARCH 19]**

Orange purchased 200 units of Oxygen Mutual Fund at ₹ 45 per unit on 31st December, 2009. In 2010, he received ₹ 1.00 as dividend per unit and a capital gains distribution of ₹ 2 per unit.

Required:

- Calculate the return for the period of one year assuming that the NAV as on 31st December 2010 was ₹ 48 per unit.
- Calculate the return for the period of one year assuming that the NAV as on 31st December 2010 was ₹ 48 per unit and all dividends and capital gains distributions have been reinvested at an average price of ₹ 46.00 per unit. Ignore taxation.

Solution (i) Returns for the year (All changes on a Per -Unit Basis)

Change in Price (₹ 48 - ₹ 45)	₹ 3.00
Dividends received:	₹ 1.00
Capital gains distribution	₹ 2.00
Total reward	₹ 6.00

Holding period reward: $(₹6.00/₹45) \times 100 = 13.33\%$

(ii) When all dividends and capital gains distributions are re - invested into additional units of the fund @ (₹ 46 / unit)

Dividend + Capital Gains per unit = ₹ 1.00 + ₹ 2.00 = ₹ 3.00

Total received from 200 units = ₹ 3.00 × 200 = ₹ 600/-.

Additional Units Acquired = ₹ 600 / ₹ 46 = 13.04 Units.

Total No. of Units = 200 units + 13.04 units = 213.04 units.

Value of 213.04 units held at the end of the year = 213.04 units × ₹ 48 = ₹ 10225.92

Price Paid for 200 Units at the beginning of the year = 200 units × ₹ 45 = ₹ 9000.00

Holding Period Reward (10225.92 - 9000.00) = ₹ 1225.92

Holding Period Reward = $₹1225.92/₹9000 \times 100 = 13.62\%$

Question 24**[OLD PM / RTP MAY 20]**

On 01 - 07 - 2010, Mr. X Invested ₹ 50,000/- at initial offer in Mutual Funds at a face value of ₹ 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 ₹ 0.60 per unit was given. 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

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 = $5,000/18=277.78$ 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 = $5,277.78 \times ₹ 10 \times 0.2 =$	₹ 10,555.56
Capital Gain $(5277.78 \times ₹ 0.60)$	<u>₹ 3,166.67</u>
	<u>₹ 13,722.23</u>

Let X be the NAV on 31.03.2012, then number of new units reinvested will be ₹ 13,722.23 / 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:

$$6271.98 = \frac{13,722.23}{X} + 5,277.78$$

Therefore,

NAV as on 31.03.2012 = ₹ 13,722.23 / (6,271.98 - 5,277.78) = ₹ 13.80

NAV as on 31.03.2013 = ₹ 50,000 (1 + 0.715 × 33 / 12) / 6,271.98 = ₹ 23.65

Question 25

[OLD PM]

Based on the following data, estimate the Net Asset Value (NAV) on per unit basis of a Regular Income Scheme of a Mutual Fund:

	₹ (in lakhs)
Listed Equity shares at cost (ex-dividend)	40.00
Cash in hand	2.76
Bonds & Debentures at cost	8.96
of these, Bonds not listed & not quoted	2.50
Other fixed interest securities at cost	9.75
Dividend accrued	1.95
Amount payable on shares	13.54
Expenditure accrued	1.76

Current realizable value of fixed income securities of face value of ₹ 100 is ₹ 96.50. Number of Units (₹ 10 face value each); 275000

All the listed equity shares were purchased at a time when market portfolio index was 12,500. On NAV date, the market portfolio index is at 19,975.

There has been a diminution of 15% in unlisted bonds and debentures valuation. Listed bonds and debentures carry a market value of ₹ 7.5 lakhs, on NAV date. Operating expenses paid during the year amounted to ₹ 2.24 lakhs.

Solution

Particulars	Adjusted Value
	₹ lakhs
Equity Shares	63.920
Cash in hand	2.760
Bonds and debentures not listed	2.125
Bonds and debentures listed	7.500
Dividends accrued	1.950
Fixed income securities	<u>9.409</u>
Sub total assets (A)	<u>87.664</u>
Less: Liabilities	
- Amount payable on shares	13.54
- Expenditure accrued	<u>1.76</u>
Sub total liabilities (B)	<u>15.30</u>
Net Assets Value (A) - (B)	72.364
No. of units	2,75,000
Net Assets Value per unit (₹ 72.364 lakhs / 2,75,000)	₹ 26.3142

Question 26**[NOV 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	Net Asset Value per Unit	
			Dividend Plan	Bonus Plan
1.04.2015			?	?
31.12.2016		1 : 4 (One unit on 4 units held)	47	40
31.03.2017	12		48	42
31.03.2018	10		50	39
31.12.2018		1 : 5 (One unit on 5 units held)	46	43
31.03.2019	15		45	42
31.03.2020	-	-	49	44

Additional details

Investment (₹)	₹ 9,20,000	₹ 10,00,000
Average Profit (₹)	₹ 27,748.60	
Average Yield (%)		6.40

You are required to calculate the issue price of both the schemes as on 1.04.2015.

Solution**(i) Dividend Plan**

(a) Average Annual gain over a period of 5 Years	27748.60
(b) Total gain over a period of 5 years (a * 5)	138743
(c) Initial Investment	920000
(d) Total value of investment (b + c)	1058743
(e) NAV as on 31.3.2020	49
(f) Number of units at the end of the period as on 31.03.2019 (d / e)	21607

	1	2	3	4 = (2*3)	5	6 = 1/(4 + 5)* 4	7
Period	Units held	Rate	Unit value	Dividend	NAV	New Units*	Balance Units Pre Dividend
31.03.2019	21607	0.15	10	1.5	45	697	20910
31.03.2018	20910	0.1	10	1	50	410	20500
31.03.2017	20500	0.12	10	1.2	48	500	20000

Issue Price as on 01.04.2015 Investment 920000 / Units purchased 20000 (c / i) = ₹ 46

* Let the units issued be X

$X = (\text{Closing Units} / \text{NAV} + \text{Dividend}) \times \text{Dividend}$

(ii) Bonus Plan

(a) Average Yield	0.064
(b) Investment	1000000
(c) Gain over a period of 5 years (a * b * 5)	320000
(d) Market Value as on 31.03.2019 (b + c)	1320000
(e) NAV as on 31.03.2020	44
(f) Total units as on 31.03.2020 (d/e)	30000
(g) No of units as on 31.03.2018 Pre bonus = $30000 * 5 / (5 + 1)$	25000
(h) No of units as on 31.12.2016 Pre bonus = $25000 * 4 / (4 + 1)$	20000
(i) Issue Price as on 01.04.2015 Investment 1000000 / Units purchased 20000 (b / h)	50

Question 28**[MAY 22]**

Mr. D had invested in three mutual funds (MF) as per the following details:

Particulars	MF 'A'	MF 'B'	MF 'C'
Amount of Investment	2,00,000	5,00,000	4,00,000
NAV at the time of purchase	10.00	25.00	20.00
Dividend Yield up to 31.03.2022	3%	5%	4%
NAV as on 31.03.2022	10.50	22.80	20.80
Annualized Yield as on 31.03.2022	9.733%	- 11.185%	15%

Assume 1 Year = 365 Days. Mr. D has misplaced the documents of his investments. You are required to help Mr. D to find out the following:

- Number of units allotted in each scheme,
- Value of his investments as on 31.03.2022,
- Holding period of his investments in number of days as on 31.03.2022
- Dates of original investments
- Total Return on investments,
- Assuming past performance of all three schemes will continue for next one year, what action the investor should take? What will be the expected return for the next one year after the above action?
- Will your answer as above point no. (vi) changes if the Mutual fund charges exit load of 5% if the investment is redeemed within one year? If so, advise the investor what and when the action to be taken to optimise the returns.

Solution (i) Number of Units in each Scheme

MF 'A'	$\frac{\text{₹ } 2,00,000}{\text{₹ } 10.00}$	= 20,000
MF 'B'	$\frac{\text{₹ } 5,00,000}{\text{₹ } 25.00}$	= 20,000
MF 'C'	$\frac{\text{₹ } 4,00,000}{\text{₹ } 20.00}$	= 20,000

(ii) Value of Investment on 31.03.2022

MF 'A'	= 20,000 × ₹ 10.50	₹ 2,10,000
MF 'B'	= 20,000 × ₹ 22.80	₹ 4,56,000
MF 'C'	= 20,000 × ₹ 20.80	₹ 4,16,000
Total		₹ 10,82,000

(iii) Yield on Each Fund

	Capital Yield	Dividend Yield	Total	Yield (%)
MF 'A'	₹ 2,10,000 - ₹ 2,00,000	₹ 6,000	₹ 16,000.00	8.00
	= ₹ 10,000			
MF 'B'	₹ 4,56,000 - ₹ 5,00,000	₹ 25,000	- ₹ 19,000.00	-3.80
	= - ₹ 44,000			
MF 'C'	₹ 4,16,000 - ₹ 4,00,000	₹ 16,000	₹ 32,000.00	8.00
	= ₹ 16,000			
Total			₹ 29,000.00	

No. of Days Investment Held

	MF 'A'	MF 'B'	MF 'C'
Period of Holding (Days)	$\frac{8.00}{9.733} \times 365$	$\frac{-3.80}{-11.185} \times 365$	$\frac{8.00}{15.00} \times 365$
	= 300 Days	= 124 Days	= 195 Days

(iv) Date of Original Investment

	MF 'A'	MF 'B'	MF 'C'
Date of Original Investment	04.06.21	27.11.21	17.09.21

(v) Total Yield = $(29,000 / 11,00,000) \times 100 = 2.636\%$

(vi) If past of all three schemes will continue for next one year, investor should redeem units of MFs 'A' and 'B' and invest the proceeds in MF 'C'. The expected return next will be 15%.

(vii) If the Mutual funds are charging exit load of 5%, if investment is redeemed within one year, then investor should get redeemed units of MF 'B' now and units of MF 'A' after 65 days.

Question 29**[MAY 22]**

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

- In order to find out the NAV, the cash balance at the end of the year is calculated as follows:

Particulars	₹
Cash Balance in Beginning (₹ 100 Lakhs - ₹ 99 Lakhs)	1,00,000
Dividend Received	8,00,000
Interest on 5 % Govt Securities	20,000
Interest on 10 % NCDs	50,000
Interest on 8 % Debentures	80,000
Interim Dividend	<u>2,50,000</u>
	13,00,000
Less: Operating Expenses	<u>3,00,000</u>
Net Cash Balance at the end	<u>10,00,000</u>

Calculation of NAV	₹
Cash Balance	10,00,000
5% Government Securities(at Par)	4,00,000
27,500 equity shares @ ₹ 368 each	1,01,20,000
10% NCDs Unlisted at Cost	5,00,000
8% Listed Debentures @ 120%	12,00,000
Total Assets	1,32,20,000
Number of Units	10,00,000
NAV Per Unit	₹ 13.22

(ii) Calculation of NAV, if dividend of ₹ 0.50 is paid

Net Assets	1,27,20,000
Number of Units	10,00,000
NAV Per Unit	₹ 12.72

(iii) Annualised Return = $13.22 - 10.00/10.00 \times 100 = 32.20\%$

Or

$$= \{[12.72 - 10.22] + 0.50\} / 10.00 \times 100 = 32.20\%$$

Question 30

[MTP OCT 22]

M/s. Strong an AMC has floated a dividend bonus plan on 1st April, 2016 at a certain net asset value (NAV). The fund has a robust growth and has declared a bonus of 1:5 (1 bonus unit for 5 right units held) on 30th September, 2017 and a second bonus of 1:4 (1 bonus unit for 4 right units held) on 30th September 2019. The fund, as on 31st March 2021, has generated an average yield of 17.5%.

Mr. Optimistic has made an investment of ₹ 16 lakhs in the plan before the declaration of the first bonus and remain invested thereafter.

The following information is also available

Date	01.04.2016	30.09.2017	30.09.2019	31.03.2021
NAV	?	85	92	100

CALCULATE the opening NAV, which is required by Mr. Optimistic to calculate the capital appreciation.

Solution

Particulars	
(a) Amount invested by Mr. Optimistic as on 01/04/2016	₹ 16,00,000
(b) Gain during 5 years ($16,00,000 \times 17.5\% \times 5$ years)	₹ 14,00,000
(c) Value of investment as on 31/03/2021 (a + b)	₹ 30,00,000
(d) NAV as on 31/03/2021	₹ 100 per Unit
(e) Total number of units as on 31/03/2021 (c / d)	30000 Units
Total units before second bonus = $30,000 \times 4/5$	24000 Units
Total units before first bonus = $24,000 \times 5/6$	20000 Units
NAV as on 01/04/2016 = $16,00,000 / 20000$	₹ 80 per Unit

Question 31**[MTP OCT 22]**

The Asset Management Company of the mutual fund (MF) has declared a dividend of 9.98% on the units under the dividend reinvestment plan for the year ended 31st March, 2021. The investors are issued additional units for the dividend at the rate of closing Net Asset Value (NAV) for the year as per the conditions of the scheme. The closing NAV was ₹ 24.95 as on 31st March, 2021.

An investor Mr. X who is having 20,800 units at the year-end has made an investment in the units before the declaration of the dividend and at the rate of opening NAV plus an entry load of ₹ 0.04. The NAV has appreciated by 25% during the year. Assume the face value of the unit as ₹ 10.00.

CALCULATE:

- 1) Opening NAV, 2) Number of the units purchased, 3) Original amount of the investment.

Solution

- 1) Let N be the opening NAV, then

$$N (1 + 0.25) = ₹ 24.95$$

$$N = ₹ 19.96 \text{ i.e.,}$$

$$\text{beginning NAV} = ₹ 19.96$$

- 2) Let X be the number of units purchased

$$\text{Then ending units} = 20,800$$

Accordingly,

$$20,800 = X + \frac{0.998X}{24.95}$$

$$20,800 = \frac{24.95 X + 0.998X}{24.95}$$

$$X = 20,000$$

$$\text{Thus, number of units to be purchased} = 20,000$$

- 3) Original Amount of Investment

Initial NAV	₹ 19.96
Entry Load	₹ 0.04
	₹ 20.00
Number of Funds Purchased	20,000
Amount of Investment	₹ 4,00,000

Question 32 (Nov 24 Exam)

Mr. X invested ₹ 1,00,000 at a face value of ₹ 10 per unit in a dividend reinvestment plan in a mutual fund during its initial public offering on 1st July, 2022. On 31st March, 2023, the mutual fund declared a dividend of 10%. At that time Mr. X calculated his holding period return to be 115%

On 31 March, 2024 the mutual fund declared a dividend of 20% and Mr. X redeemed all his investment and calculated his holding period return to be 193.134%.

You are required to calculate

- (i) The NAVs as on 31.03.2023 and 31.03.2024.
- (ii) Calculate the total units redeemed.

Solution

- (i) Yield for 9 months = 115% Market value of Investments as on 31.03.2023
 $= 1,00,000 + (1,00,000 \times 115\%)$
 $= ₹ 2,15,000/-$

Therefore, NAV as on 31.03.2023 = $(2,15,000 - 10,000) / 10,000 = ₹ 20.50$

(NAV would stand reduced to the extent of dividend payout, being $(₹ 1,00,000 \times 10\%)$
 $= ₹ 10,000$

Since dividend was reinvested by Mr. X, additional units acquired:
 $= ₹ 10,000 / ₹ 20.50 = 487.80$ units

Therefore, total units as on 31.03.2023 = $10,000 + 487.80 = 10,487.80$ Alternately, total units
As on 31.03.2023 = $(2,15,000 / 20.50) = 10,487.80$

Dividend as on 31.03.2024 = $10,487.80 \times 10 \times 0.2 = ₹ 20,975.60$

Market Value of Investment as on 31.03.2024

$= ₹ 1,00,000 + ₹ 1,00,000(193.134\%)$
 $= ₹ 2,93,134$

Thus, NAV per Unit as on 31.03.2024 = $₹ (2,93,134 - 20,975.60) / 10,487.80 = ₹ 25.95$

- (ii) Calculation of total numbers of Units redeemed

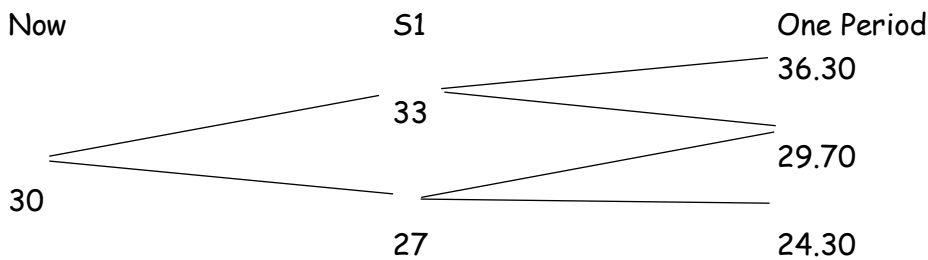
No. of Units issued on 31.03.2024 = $20,975.60 / 25.95 = 808.31$ units

Thus, total number of units redeemed = $10487.80 + 808.31 = 11296.11$ units



Derivatives Analysis and Valuation

Question 1 Following is a two sub-periods tree of 6-months each for the share of CAB Ltd.:



Using the Binomial model, calculate the current fair value of a regular call option on CAB Stock with the following characteristics: Exercise Price = Rs.28, Risk Free Rate = 5 percent pa. You should also indicate the composition of the implied riskless hedge portfolio at the valuation date.

Solution

$$u = 33.00/30.00 = 36.30/33.00 = 1.10$$

$$d = 27.00/30.00 = 24.30/27.00 = 0.90$$

$$r = (1 + .05)^{1/2} = 1.025$$

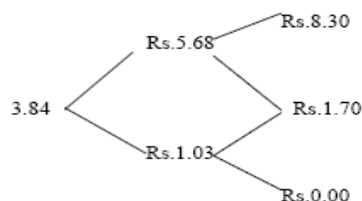
$$p = \frac{r-d}{u-d} = \frac{1.025-0.9}{1.1-0.9} = 0.125/0.20 = 0.625 \text{ (Prob. of increase in Price of Share)}$$

$$\text{Prob. of decrease in Price of Share} = 1 - 0.625 = 0.375$$

$$C_{uu} = \text{Max} [0, 36.30 - 28] = 8.30$$

$$C_{ud} = \text{Max} [0, 29.70 - 28] = 1.70$$

$$C_{dd} = \text{Max} [0, 24.30 - 28] = 0$$



$$C_u = \frac{(0.625)(8.30) + (0.375)(1.70)}{1.025} = \frac{5.1875 + 0.6375}{1.025} = 5.825/1.025 = 5.68$$

$$C_d = \frac{(0.625)(1.70) + (0.375)(0.00)}{1.025} = \frac{1.05995}{1.025} = 1.03$$

$$C_o = \frac{(0.625)(5.68) + (0.375)(1.03)}{1.025} = \frac{3.55 + 0.38625}{1.025} = 3.84$$

The composition of the implied risk-less hedge portfolio at valuation date is called Delta (Δ) and it is calculated as follows:

$$\frac{C_u - C_d}{S_u - S_d}$$

Where,

C_u = Pay-off from Call Option if price of Stock goes up

C_d = Pay-off from Call Option if price of Stock goes down

S_u = Upward price of the Stock

S_d = Downward price of the Stock

Accordingly, the Risk-less Portfolio shall require Δ Share shall be required for writing off one Call Option.

The Δ shall be computed as follows: $\Delta = \frac{5-0}{33-27} = 5/6$

Thus, 5/6 shares shall be held or purchased for writing one Call Option.

Question 2

The current market price of an equity share of Penchant Ltd is ₹ 420. Within a period of 3 months, the maximum and minimum price of it is expected to be ₹ 500 and ₹ 400 respectively. If the risk free rate of interest be 8% p.a., what should be the value of a 3 months Call option under the "Risk Neutral" method at the strike rate of Rs 450? Given $e^{0.02} = 1.0202$

Solution

Let the probability of attaining the maximum price be $p = \frac{e^{rt}-d}{u-d} = \frac{e^{0.02}-\frac{400}{420}}{\frac{500}{420}-\frac{400}{420}} = \frac{1.0202-0.9523}{1.1905-0.9523} = 0.285$

The value of Call Option in ₹ = $\frac{0.285 \times (500 - 450) + 0.715(0)}{1.0202} = \frac{0.285 \times 50}{1.0202} = 13.96$

Question 3

- 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 Black 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

$$\ln(1.0375) = 0.03681$$

$$\ln(0.95) = -0.05129$$

$$\ln(0.9952) = -0.00481$$

$$e^{0.0125} = 1.012578$$

$$e^{0.008333} = 1.0084$$

Solution

(i) Given: TIC Ltd. Current Price = ₹ 415

Exercise rate = 400

Risk free interest rate is = 5% p.a.

SD (Volatility) = 22%

Based on the above bit is calculated value of an option based on Black Scholes Model:

$$d_1 = \frac{\ln \frac{415}{400} + [.05 + \frac{1}{2} (.22)^2] .25}{.22 \sqrt{.25}} = \frac{.03681 + .01855}{.11} = .5032727$$

$$N(d_1) = N(.50327) = 1 - 0.3072 = 0.6928$$

$$N(d_2) = N(.39327) = 1 - 0.3471 = 0.6529$$

$$\begin{aligned} \text{Value of Option} &= 415(.6928) - \frac{400}{e^{(.05)(.25)}} (.6529) \\ &= 287.512 - \frac{400}{1.012578} (.6529) = 29.6 \end{aligned}$$

Since market price of ₹ 25 is less than ₹ 29.60 (as per Black Scholes Valuation model) indicate that option is underpriced, hence worth buying.

(ii) If the current price is taken as ₹ 380 the computations are as follows:

$$d_1 = \frac{\ln \frac{380}{400} + [.05 + \frac{1}{2} (.22)^2] .25}{.22 \sqrt{.25}} = \frac{0.05129 + .01855}{.11} = -0.297636$$

$$d_2 = \frac{\ln \frac{380}{400} + [.05 + \frac{1}{2} (.22)^2] .25}{.22 \sqrt{.25}} = \frac{0.05129 + .00645}{.11} = -0.407636$$

$$N(d_1) = N(-0.297636) = 0.3830$$

$$N(d_2) = N(-0.407636) = 0.3418$$

$$380(.3830) - \frac{400}{e^{(.05)(.25)}} \times (.3418)$$

$$145.54 - \frac{400}{1.012578} (.3418) = 145.54 - 135.02 = ₹ 10.52$$

- (iii) Value of call option = ₹ 10.52
 Current Market Value = ₹ 415
 Present Value of Exercise Price = $400/1.012578=395.03$
 Value of Put Option = $\frac{EP}{e^{rt}} - CMP + \text{Value of Call Option}$
 $395.03 - 380 + 10.52 = 25.55$

- (iv) Since dividend is expected to be paid in two months time we have to adjust the share price and then use Black Scholes model to value the option:
 Present Value of Dividend = $\frac{\text{Dividend}}{e^{rt}} = \frac{10}{e^{0.05 \times \frac{2}{12}}} = \frac{10}{e^{0.00833}} = \frac{10}{1.0084} = 9.917$

Adjusted price of shares is ₹ 408 - 9.917 = ₹ 398.083

This can be used in Black Scholes model

$$d_1 = \frac{\ln \frac{398.083}{400} + [.05 + \frac{1}{2}(.22)^2].25}{.22\sqrt{.25}} = \frac{-.00481 + .01855}{.11} = 0.125$$

$$d_2 = \frac{\ln \frac{398.083}{400} + [.05 + \frac{1}{2}(.22)^2].25}{.22\sqrt{.25}} = \frac{-.00481 + .00645}{.11} = 0.015$$

$$N(d_1) = N(0.125) = .5498$$

$$N(d_2) = N(0.015) = .5060$$

$$\text{Value of Option} = 398(.5498) - \frac{400}{e^{(.05)(.025)}} \times (.5060) = 218.866 - \frac{400}{e^{(.05)(.025)}} \times (.5060)$$

$$218.866 - \frac{400}{1.012578} (.5060) = 218.866 - 199.8858 = 18.98$$

Question 4

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 $\ln(1.336) = 0.2897$

$$e^{-0.1005} = 0.3677 \text{ and}$$

$$e^{-1.17} = 0.3104$$

Solution

The given solution is like valuation of stock option wherein delay in introduction of drug 'Aidrex' shall cause the loss of cashflow which is like payment of dividend.

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

Inputs

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) = $1/15 = 0.0667$ i.e. 6.67%

Value call option

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

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

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

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

Question 5

IPL already in production of Fertilizer is considering a proposal of building a new plant to produce pesticides. Suppose the PV of proposal is ₹ 100 crore without the abandonment option. However, if market conditions for pesticide turns out to be favourable the PV of proposal shall increase by 30%. On the other hand, market conditions remain sluggish the PV of the proposal shall be reduced by 40%. In case company is not interested in continuation of the project it can be disposed of for ₹ 80 crore.

If the risk-free rate of interest is 8% then what will be value of abandonment option.

Solution

Decision Tree showing pay off

Year 0	Year 1	Option Pay off
100	130	0
	60	$80-60=20$

First of all we shall calculate probability of high demand (p) using risk neutral method as follows:

$$8\% = p \times 30\% + (1-p) \times (-40\%)$$

$$0.08 = 0.30p - 0.40 + 0.40p$$

$$p = 0.48/0.70 = 0.686$$

The value of abandonment option will be as follows:

Expected Payoff at Year 1

$$= p \times 0 + [(1-p) \times 20]$$

$$= 0.686 \times 0 + [0.314 \times 20] = ₹ 6.28 \text{ crore}$$

Since expected pay off at year 1 is ₹ 6.28 crore. Present value of expected pay off will be:

$$= 6.28/1.08 = ₹ 5.81 \text{ crore}$$

Question 6 (Lot of Blunders made by ICAI in this Example)

Suppose MIS Ltd. is considering installation of solar electricity generating plant for light the staff quarters. The plant shall cost ₹ 2.50 crore and shall lead to saving in electricity expenses at the current tariff by ₹ 21 lakh per year forever.

However, after one year with change in Government in state, the rate of electricity is subject to change. Accordingly, the saving in electricity can be of ₹ 12 lakh or ₹ 35 lakh per year and forever.

Assuming WACC of MIS Ltd. is 10% and risk-free rate of rate of return is 8%.

Decide whether MIS Ltd. should accept the project or wait and see.

Solution

Here we shall evaluate NPV in two possible situations:

(1) As on Today

At cost of Capital of 10%, the value of saving forever = $21 \text{ lakh} / 10\% = ₹ 2.1 \text{ crore}$

$$\text{NPV} = ₹ 2.1 \text{ crore} - ₹ 2.5 \text{ crore} = - ₹ 0.4 \text{ crore}$$

Since NPV is negative, it does not worth to accept the project.

(2) After one Year

After one year these are two possible situations, either rate of electricity decreases or increases

(a) If price of electricity increases

At cost of Capital of 10%, the value of saving forever = $₹ 35 \text{ lakh} / 0.10 = ₹ 3.50 \text{ crore}$

The position of the NPV will be as follows:

$$= ₹ 3.50 \text{ crore} - ₹ 2.50 \text{ crore} = ₹ 1 \text{ crore}$$

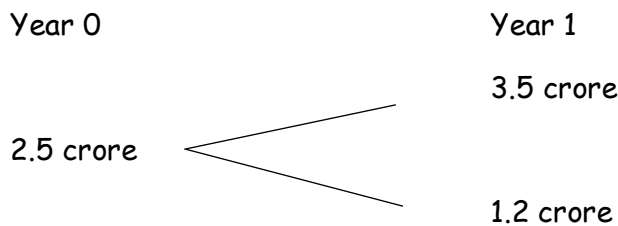
And Rate of Return will be $(3.5/2.5) - 1 = 0.40$ is 40%

(b) If price of electricity decreases, then value of saving forever will be
At cost of Capital of 10%, the value of saving forever = 12 lakh/10% = 1.20 crore

The position of the NPV will be as follows:

= 1.20 crore - 2.5 crore = - 1.3 crore and Rate of Return will be $(1.2/2.5) - 1 = -0.52$ i.e. - 52.00%

Diagrammatically it can be shown below:



Let prob. of price increase be p. Then using Risk Neutral Method, the risk-free rate of return will be equal to expected saving as follows:

$$p \times 0.40 + (1-p) (-0.52) = 0.08$$

$$0.40p - 0.52 + 0.52p = 0.08$$

$$0.92p = 0.60$$

$$p = 0.652$$

Hence, expected pay off = $0.652 \times 1 \text{ crore} + 0.348 \times (-1.30 \text{ crore}) = 19.96 \text{ lakh}$. PV of Pay off after one year = $19.96 \text{ lakh} / 1.08 = 18.48 \text{ lakh}$

Thus, it shall be advisable to wait and see as NPV may turn out to be positive after one year.

Question 7 The 6-months forward price of a security is ₹ 208.18. The borrowing rate is 8% per annum payable with monthly rests. What should be the spot price?

Solution: In case of monthly compounding Interest = $\text{Spot} \left(1 + \frac{R}{100} \right)^t$ where t means number of months

$$208.18 = P (1 + 0.08/12)^6$$

$$\text{Or } 208.18 = P \times 1.0409$$

$$P = 208.18/1.0409 = 200$$

Hence, the spot price should be ₹ 200.

Question 8 The following data relate to Anand Ltd.'s share price:

Current price per share	₹ 1,800
6 months future's price/share	₹ 1,950

Assuming it is possible to borrow money in the market for transactions in securities at 12% per annum, you are required:

- to calculate the theoretical minimum price of a 6-months forward purchase; and
- to explain arbitrage opportunity.

Solution

Calculation of theoretical minimum price of a 6 months forward contract- Theoretical minimum price = $₹ 1,800 + (₹ 1,800 \times 12/100 \times 6/12) = ₹ 1,908$

Arbitrage Opportunity-

The arbitrageur can borrow money @ 12 % for 6 months and buy the shares at ₹ 1,800. At the same time he can sell the shares in the futures market at ₹ 1,950. On the expiry date 6 months later, he could deliver the share and collect ₹ 1,950 pay off ₹ 1,908 and record a profit of ₹ 42 (₹ 1,950 - ₹ 1,908)

Question 9

On 31-8-2011, the value of stock index was ₹ 2,200. The risk-free rate of return has been 8% per annum. The dividend yield on this Stock Index is as under:

Month	Dividend Paid p.a.
January	3%
February	4%
March	3%
April	3%
May	4%
June	3%
July	3%
August	4%
September	3%
October	3%
November	4%
December	3%

Assuming that interest is continuously compounded daily, find out the future price of contract deliverable on 31-12-2011. Given: $e^{0.01583} = 1.01593$

Solution

The duration of future contract is 4 months. The average yield during this period will be:

$$\frac{3\%+3\%+4\%+3\%}{4} = 3.25$$

In case of continuously compounding Interest = $(Spot \times e^{R \times \frac{t}{12/365}})$ where t means number of days/months

Accordingly, future price will be

$$= ₹ 2,200 e^{(0.08 - 0.0325) \times 4/12} = ₹ 2,200 e^{0.01583} = ₹ 2,200 \times 1.01593 = ₹ 2235.05$$

Question 10

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 per annum and the expected annual dividend is 25 percent, payable before expiry.

Also examine arbitrage opportunities.

Solution In case of simple Interest = $\text{Spot} \left(1 + \frac{R \times \frac{t}{12/365}}{100} \right)$ where t means number of days/ months

Future's Price = Spot + cost of carry - Dividend

$$F = 220 + 220 \times (0.15 \times 0.25)^{\dagger} - 0.25^{**} \times 10 = 225.75$$

** Entire 25% dividend is payable before expiry, which is ₹2.50.

Thus, we see that futures price by calculation is ₹225.75 which is quoted at ₹230 in the exchange.

(i) Analysis:

Fair value of Futures less than Actual futures Price:

Futures Overvalued Hence it is advised to sell. Also do Arbitraging by buying stock in the cash market.

Step I

He will buy PQR Stock at ₹220 by borrowing at 15% for 3 months. Therefore, his outflows are:

Cost of Stock	220.00
Add: Interest @ 15 % for 3 months i.e. 0.25 years ($220 \times 0.15 \times 0.25$)	<u>8.25</u>
Total Outflows (A)	<u>228.25</u>

Step II

He will sell March 2000 futures at ₹230. Meanwhile he would receive dividend for his stock.

Hence his inflows are	230.00
Sale proceeds of March 2000 futures	<u>2.50</u>
Total inflows (B)	<u>232.50</u>

$$\text{Inflow} - \text{Outflow} = \text{Profit earned by Arbitrageur} = 232.50 - 228.25 = 4.25$$

Question 11

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

(i) Current future price of the index = $5000 + 5000 (0.09 - 0.06) 4/12 = 5000 + 50 = 5,050$

$$\text{Price of the future contract} = ₹ 50 \times 5,050 = ₹ 2,52,500$$

(ii) Hedge ratio = $1010000 / 252500 \times 1.5 = 6$ contracts

Index after three months turns out to be 4500

$$\text{Future price will be} = 4500 + 4500 (0.09 - 0.06) \times 1/12 = 4,511.25$$

$$\text{Therefore, Gain from the short futures position is} = 6 \times (5050 - 4511.25) \times 50 = ₹1,61,625$$

Question 12

The share of X Ltd. is currently selling for ₹ 300. Risk free interest rate is 0.8% per month. A three-month futures contract is selling for ₹ 312. Develop an arbitrage strategy and show what your riskless profit will be 3 months hence assuming that X Ltd. will not pay any dividend in the next three months.

Solution

The appropriate value of the 3 months futures contract is -

In case of monthly compounding Interest = $\text{Spot} \left(1 + \frac{\frac{R}{12}}{100} \right)^t$ where t means number of months

$$F_0 = ₹ 300 (1.008)^3 = ₹ 307.26$$

Since the futures price exceeds its appropriate value it pays to do the following:-

Action	Initial	Cash flow at
	Cash flow	time T (3 months)
Borrow ₹ 300 now and repay with interest after 3 months	+ ₹ 300	- ₹ 300 (1.008) ³ = - ₹ 307.26
Buy a share	- ₹ 300	ST
Sell a futures contract (F ₀ = 312/-)	0	₹ 312 - ST
Total	₹ 0	₹ 4.74

Such an action would produce a risk less profit of ₹ 4.74.

Question 13

A Mutual Fund is holding the following assets in ₹ Crores :

Investments in diversified equity shares	90.00
Cash and Bank Balances	<u>10.00</u>
	100.00

The Beta of the equity shares portfolio is 1.1. The index future is selling at 4300 level.

The Fund Manager apprehends that the index will fall at the most by 10%. How many index futures he should short for perfect hedging? One index future consists of 50 units. Substantiate your answer assuming the Fund Manager's apprehension will materialize.

Solution

Number of index future to be sold by the Fund Manager is:

$$= \frac{1.1 \times 90,00,00,000}{4,300 \times 50} = 4,605$$

Justification of the answer:

Loss in the value of the portfolio if the index falls by 10% is 90 Crore * 10% = ₹ 9.90 Crore.

$$\text{Gain by short covering of index future is: } \frac{0.1 \times 4,300 \times 50 \times 4,605}{1,00,00,000} = 9.90 \text{ Crore}$$

This justifies the answer. Further, cash is not a part of the portfolio.

Question 14

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:

1. Current portfolio beta
2. 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

Current Beta for share portfolio	= 1.6
Beta for cash	= 0
Current portfolio beta	= $0.85 \times 1.6 + 0 \times 0.15 = 1.36$

(ii) Portfolio beta after 3 months:

$$\text{Beta for portfolio of shares} = \frac{\text{Change in value of portfolio of share}}{\text{Change in value of market portfolio (Index)}} \\ 1.6 = \frac{32}{\text{Change in value of market portfolio (Index)}}$$

$$\text{Change in value of market portfolio (Index)} = (0.032 / 1.6) \times 100 = 2\%$$

Position taken on 100 lakh Nifty futures : Long

Value of index after 3 months	= ₹ 100 lakh $\times$ (1.00 - 0.02)
	= ₹ 98 lakh
Mark-to-market paid	= ₹ 2 lakh

Cash balance after payment of mark-to-market = ₹ 13 lakh

Value of portfolio after 3 months = ₹ 85 lakh $\times$ (1 - 0.032) + ₹ 13 lakh = ₹ 95.28 lakh

Change in value of portfolio	= $\frac{\text{₹}100 \text{ lakh} - \text{₹}95.28 \text{ lakh}}{\text{₹}100 \text{ lakh}} = 4.72\%$
Portfolio beta	= $0.0472 / 0.02 = 2.36$

Question 15

Which position on the index future gives a speculator, a complete hedge against the following transactions:

- (i) The share of Right Limited is going to rise. He has a long position on the cash market of ₹ 50 lakhs on the Right Limited. The beta of the Right Limited is 1.25.
- (ii) The share of Wrong Limited is going to depreciate. He has a short position on the cash market of ₹ 25 lakhs on the Wrong Limited. The beta of the Wrong Limited is 0.90.
- (iii) The share of Fair Limited is going to stagnant. He has a short position on the cash market of ₹ 20 lakhs of the Fair Limited. The beta of the Fair Limited is 0.75.

Solution

Sl. No. (1)	Company Name (2)	Trend (3)	Amount (₹) (4)	Beta (5)	(₹) (6) [(4) × (5)]	Position (7)
(i)	Right Ltd.	Rise	50 lakh	1.25	62,50,000	Short
(ii)	Wrong Ltd.	Depreciate	25 lakh	0.90	22,50,000	Long
(iii)	Fair Ltd.	Stagnant	20 lakh	0.75	<u>15,00,000</u>	Long
					<u>25,00,000</u>	Short

Question 16

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?

Solution

No. of the Future Contract to be obtained to get a complete hedge

$$\frac{10000 \times \text{Rs.}22 \times 1.5 - 5000 \times \text{Rs}40 \times 2}{\text{Rs}1000} = \frac{\text{Rs.}3,30,000 - \text{Rs}4,00,000}{\text{Rs}1000} = 70 \text{ contracts}$$

Thus, by purchasing 70 Nifty future contracts to be long to obtain a complete hedge.

Cash Outlay

$$= 10000 \times ₹ 22 - 5000 \times ₹ 40 + 70 \times ₹ 1,000$$

$$= ₹ 2,20,000 - ₹ 2,00,000 + ₹ 70,000 = ₹ 90,000$$

Cash Inflow at Close Out

$$= 10000 \times ₹ 22 \times 0.98 - 5000 \times ₹ 40 \times 1.03 + 70 \times ₹ 1,000 \times 0.985$$

$$= ₹ 2,15,600 - ₹ 2,06,000 + ₹ 68,950 = ₹ 78,550$$

Gain/ Loss

$$= ₹ 78,550 - ₹ 90,000 = - ₹ 11,450 \text{ (Loss)}$$

Question 17

On January 1, 2013 an investor has a portfolio of 5 shares as given below:

Security	Price	No. of Shares	Beta
A	349.30	5,000	1.15
B	480.50	7,000	0.40
C	593.52	8,000	0.90
D	734.70	10,000	0.95
E	824.85	2,000	0.85

The cost of capital to the investor is 10.5% per annum.

You are required to calculate:

- The beta of his portfolio.
- The theoretical value of the NIFTY futures for February 2013.
- The number of contracts of NIFTY the 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.

No. of days in a year be treated as 365. Given: $\ln(1.105) = 0.0998$ and $e^{(0.015858)} = 1.01598$

Solution:

(i) Calculation of Portfolio Beta

Security	Price of the Stock	No. of shares	Value	Weightage w_i	Beta B_i	Weighted Beta
A	349.30	5,000	17,46,500	0.093	1.15	0.107
B	480.50	7,000	33,63,500	0.178	0.40	0.071
C	593.52	8,000	47,48,160	0.252	0.90	0.227
D	734.70	10,000	73,47,000	0.390	0.95	0.370
E	824.85	2,000	16,49,700	0.087	0.85	0.074
			1,88,54,860			0.849

Portfolio Beta = 0.849

(ii) Calculation of Theoretical Value of Future Contract

$$= ₹ 5900 e^{0.105 \times 58/365} = ₹ 5900 e^{0.01668} = ₹ 5900 \times 1.01598 = ₹ 5,994.28$$

(iii) When total portfolio is to be hedged:

$$\frac{\text{Value of Spot Position requiring hedging}}{\text{Value of Future Contract}} \times \text{Portfolio Beta}$$

$$= \frac{1,88,54,860}{5994.28 \times 200} \times 0.849 = 13.35 \text{ contracts say 14 contracts}$$

(iv) When total portfolio beta is to be reduced to 0.6:

$$\text{Number of Contracts to be sold} = \frac{P(\beta_p - \beta'_p)}{F}$$

$$= \frac{1,88,54,860(0.849 - 0.600)}{5994.28 \times 200} = 3.92 \text{ contracts say 4 contracts}$$

Question 18

Details about portfolio of shares of an investor is as below:

Shares	No. of shares (Lakh)	Price per share	Beta
A Ltd.	3.00	₹ 500	1.40
B Ltd.	4.00	₹ 750	1.20
C Ltd.	2.00	₹ 250	1.60

Investor thinks that the risk of portfolio is very high and wants to reduce the portfolio beta to 0.91.

He is considering two below mentioned alternative strategies:

- Dispose off a part of his existing portfolio to acquire risk free securities, or
- Take appropriate position on Nifty Futures which are currently traded at 8125 and each Nifty points is worth ₹ 200.

You are required to determine:

- portfolio beta,
- the value of risk free securities to be acquired,
- the number of shares of each company to be disposed off,
- the number of Nifty contracts to be bought/sold; and
- the value of portfolio beta for 2% rise in Nifty.

Solution

Shares	No. of shares (lakhs)(1)	Market Price of Share(2)	×(2) (₹ lakhs)	% to total (w)	B(x)	wx
A Ltd.	3.00	500.00	1500.00	0.30	1.40	0.42
B Ltd.	4.00	750.00	3000.00	0.60	1.20	0.72
C Ltd.	2.00	250.00	<u>500.00</u>	<u>0.10</u>	1.60	<u>0.16</u>
			<u>5000.00</u>	1.00		<u>1.30</u>

(1) Portfolio beta 1.30

(2) Required Beta 0.91

Let the proportion of risk free securities for target beta 0.91 = p

$$0.91 = 0 \times p + 1.30 (1 - p)$$

$$p = 0.30 \text{ i.e. } 30\%$$

Shares to be disposed off to reduce beta ($5000 \times 30\%$) ₹ 1,500 lakh and Risk Free securities to be acquired.

(3) Number of shares of each company to be disposed off

Shares	% to total (w)	Proportionate Amount (₹ lakhs)	Market Price Per Share	No. of Shares (Lakh)
A Ltd.	0.30	450.00	500.00	0.90
B Ltd.	0.60	900.00	750.00	1.20
C Ltd.	0.10	150.00	250.00	0.60

(4) Number of Nifty Contract to be sold

$$= \frac{(1.30 - 0.91) \times 5000 \text{ lakh}}{8,125 \times 200} = 120 \text{ contracts}$$

(5) 2% rises in Nifty is accompanied by $2\% \times 1.30$ i.e. 2.6% rise for portfolio of shares

	₹ Lakh
Current Value of Portfolio of Shares	5000
Value of Portfolio after rise	5130
Mark-to-Market Margin paid ($8125 \times 0.020 \times ₹ 200 \times 120$)	39
Value of the portfolio after rise of Nifty	5091
% change in value of portfolio $(5091 - 5000) / 5000$	1.82%
% rise in the value of Nifty	2%
Beta	0.91

Question 19

On April 1, 2015, an investor has a portfolio consisting of eight securities as shown below:

Security	Market Price	No. of Shares	Beta Value
A	29.40	400	0.59
B	318.70	800	1.32
C	660.20	150	0.87
D	5.20	300	0.35
E	281.90	400	1.16
F	275.40	750	1.24
G	514.60	300	1.05
H	170.50	900	0.76

The cost of capital for the investor is 20% p.a. continuously compounded. The investor fears a fall in the prices of the shares in the near future. Accordingly, he approaches you for the advice to protect the interest of his portfolio.

You can make use of the following information:

- 1) The current NIFTY value is 8500.
- 2) NIFTY futures can be traded in units of 25 only.
- 3) Futures for May are currently quoted at 8700 and Futures for June are being quoted at 8850.

You are required to calculate:

- i. the beta of his portfolio.
- ii. the theoretical value of the futures contract for contracts expiring in May and June.
Given ($e^{0.03}=1.03045$, $e^{0.04}=1.04081$, $e^{0.05}=1.05127$)
- iii. the number of NIFTY contracts that he would have to sell if he desires to hedge until June in each of the following cases:
 - (A) His total portfolio
 - (B) 50% of his portfolio
 - (C) 120% of his portfolio

Solution

(i) Beta of the Portfolio

Security	Market Price	No. of Shares	Value	β	Value $\times \beta$
A	29.40	400	11760	0.59	6938.40
B	318.70	800	254960	1.32	336547.20
C	660.20	150	99030	0.87	86156.10
D	5.20	300	1560	0.35	546.00
E	281.90	400	112760	1.16	130801.60
F	275.40	750	206550	1.24	256122.00
G	514.60	300	154380	1.05	162099.00
H	170.50	900	153450	0.76	116622.00
			994450		1095832.30

$$\text{Portfolio Beta} = 10,95,832.30 / 9,94,450 = 1.102$$

(ii) Theoretical Value of Future Contract Expiring in May and June

$$F_{\text{May}} = 8500 \times e^{0.20 \times (2/12)} = 8500 \times e^{0.0333}$$

$e^{0.0333}$ shall be computed using Interpolation Formula as follows:

$e^{0.03}$	= 1.03045
$e^{0.04}$	= 1.04081
$e^{0.01}$	= 0.01036
$e^{0.0033}$	= 0.00342
$e^{0.0067}$	= 0.00694

$$e^{0.0333} = 1.03045 + 0.00342 = 1.03387 \text{ or } 1.04081 - 0.00694 = 1.03387$$

According to the price of the May Contract

$$8500 \times 1.03387 = ₹ 8788$$

Price of the June Contract

$$F_{\text{May}} = 8500 \times e^{0.20 \times (3/12)} = 8500 \times e^{0.05} = 8500 \times 1.05127 = 8935.80$$

(iii) No. of NIFTY Contracts required to sell to hedge until June

$$= \frac{\text{Value of Position to be hedged}}{\text{Value of Future Contract}} \times \beta$$

$$(A) \text{ Total portfolio } \frac{994450}{8850 \times 25} \times 1.102 = 4.953 \text{ say 5 contracts}$$

$$(B) 50\% \text{ of Portfolio } \frac{994450 \times 0.50}{8850 \times 25} \times 1.102 = 2.47 \text{ say 3 contracts}$$

$$(C) 120\% \text{ of Portfolio } \frac{994450 \times 1.20}{8850 \times 25} \times 1.102 = 5.94 \text{ say 6 contracts}$$

Question 20

Sensex futures are traded at a multiple of 50. Consider the following quotations of Sensex futures in the 10 trading days during February, 2009:

Day	High	Low	Closing
4-2-09	3306.4	3290.00	3296.50
5-2-09	3298.00	3262.50	3294.40
6-2-09	3256.20	3227.00	3230.40
7-2-09	3233.00	3201.50	3212.30
10-2-09	3281.50	3256.00	3267.50
11-2-09	3283.50	3260.00	3263.80
12-02-09	3315.00	3286.30	3292.00
14-02-09	3315.00	3257.10	3309.30
17-02-09	3278.00	3249.50	3257.80
18-02-09	3118.00	3091.40	3102.60

Abhishek bought one sensex futures contract on February, 04. The average daily absolute change in the value of contract is ₹ 10,000 and standard deviation of these changes is ₹ 2,000. The maintenance margin is 75% of initial margin.

You are required to determine the daily balances in the margin account and payment on margin calls, if any.

Solution

$$\text{Initial Margin} = \mu + 3\sigma$$

Where μ = Daily Absolute Change σ = Standard Deviation

Accordingly

Initial Margin = ₹ 10,000 + ₹ 6,000 = ₹ 16,000

Maintenance margin = ₹ 16,000 × 0.75 = ₹ 12,000

Day	Changes in future Values (₹)	Margin A/c (₹)	Call Money (₹)
4/2/09	-	16000	-
5/2/09	$50 \times (3294.40 - 3296.50) = -105$	15895	-
6/2/09	$50 \times (3230.40 - 3294.40) = -3200$	12695	-
7/2/09	$50 \times (3212.30 - 3230.40) = -905$	16000	4210
10/2/09	$50 \times (3267.50 - 3212.30) = 2760$	18760	-
11/2/09	$50 \times (3263.80 - 3267.50) = -185$	18575	-
12/2/09	$50 \times (3292 - 3263.80) = 1410$	19985	-
14/2/09	$50 \times (3309.30 - 3292) = 865$	20850	-
17/2/09	$50 \times (3257.80 - 3309.30) = -2575$	18275	-
18/2/09	$50 \times (3102.60 - 3257.80) = -7760$	16000	5485

Question 21

Mr. A purchased a 3 month call option for 100 shares in XYZ Ltd. at a premium of ₹ 30 per share, with an exercise price of ₹ 550. He also purchased a 3 month put option for 100 shares of the same company at a premium of ₹ 5 per share with an exercise price of ₹ 450. The market price of the share on the date of Mr. A's purchase of options, is ₹ 500. Calculate the profit or loss that Mr. A would make assuming that the market price falls to ₹ 350 at the end of 3 months.

Solution

Since the market price at the end of 3 months falls to ₹ 350 which is below the exercise price under the call option, the call option will not be exercised. Only put option becomes viable.

	₹
The gain will be: Gain per share (₹450 - ₹ 350)	<u>100</u>
Total gain per 100 shares	10,000
Cost or premium paid (₹ 30 × 100) + (₹ 5 × 100)	<u>3,500</u>
Net gain	<u>6,500</u>

Question 22

The market received rumour about ABC corporation's tie-up with a multinational company. This has induced the market price to move up. If the rumour is false, the ABC corporation stock price will probably fall dramatically. To protect from this an investor has bought the call and put options.

He purchased one 3 months call with a striking price of ₹ 42 for ₹ 2 premium, and paid Re.1 per share premium for a 3 months put with a striking price of ₹ 40.

- Determine the Investor's position if the tie up offer bids the price of ABC Corporation's stock up to ₹ 43 in 3 months.
- Determine the Investor's ending position, if the tie up programme fails and the price of the stocks falls to ₹ 36 in 3 months.

Solution:

Cost of Call and Put Options

$$= (\text{₹ } 2 \text{ per share}) \times (100 \text{ share call}) + (\text{₹ } 1 \text{ per share}) \times (100 \text{ share put}) = \text{₹ } 2 \times 100 + 1 \times 100 = \text{₹ } 300$$

(i) Price increases to ₹43. Since the market price is higher than the strike price of the call, the investor will exercise it.

$$\begin{aligned} \text{Ending position} &= (- \text{₹ } 300 \text{ cost of 2 option}) + (\text{₹ } 1 \text{ per share gain on call}) \times 100 \\ &= - \text{₹ } 300 + 100 \end{aligned}$$

$$\text{Net Loss} = - \text{₹ } 200$$

(ii) The price of the stock falls to ₹36. Since the market price is lower than the strike price, the investor may not exercise the call option.

$$\begin{aligned} \text{Ending Position} &= (- \text{₹ } 300 \text{ cost of 2 options}) + (\text{₹ } 4 \text{ per stock gain on put}) \times 100 \\ &= - \text{₹ } 300 + 400 \end{aligned}$$

$$\text{Gain} = \text{₹ } 100$$

Question 23

Equity share of PQR Ltd. is presently quoted at ₹ 320. The Market Price of the share after 6 months has the following probability distribution:

Market Price	₹ 180	260	280	320	400
Probability	0.1	0.2	0.5	0.1	0.1

A put option with a strike price of ₹ 300 can be written.

You are required to find out expected value of option at maturity (i.e. 6 months)

Solution**Expected Value of Option**

$(300 - 180) \times 0.1$	12
$(300 - 260) \times 0.2$	8
$(300 - 280) \times 0.5$	10
$(300 - 320) \times 0.1$	Not Exercised*
$(300 - 400) \times 0.1$	<u>Not Exercised*</u>
	<u>30</u>

* If the strike price goes beyond ₹ 300, option is not exercised at all.

In case of Put option, since Share price is greater than strike price Option Value would be zero.

Question 24

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	0.05	0.20	0.50	0.10	0.15

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?

Solution

(i) Expected Share Price

$$\begin{aligned} &= ₹120 \times 0.05 + ₹140 \times 0.20 + ₹160 \times 0.50 + ₹180 \times 0.10 + ₹190 \times 0.15 \\ &= ₹6 + ₹28 + ₹80 + ₹18 + ₹28.50 = ₹160.50 \end{aligned}$$

(ii) Value of Call Option

$$= ₹150 - ₹150 = \text{Nil}$$

(iii) If the option is held till maturity the expected Value of Call Option

Expected price (X)	Value of call (C)	Probability (P)	CP
₹ 120	0	0.05	0
₹ 140	0	0.20	0
₹ 160	₹ 10	0.50	₹ 5
₹ 180	₹ 30	0.10	₹ 3
₹ 190	₹ 40	0.15	<u>₹ 6</u>
Total			<u>₹ 14</u>

Question 25

Mr. X established the following strategy on the Delta Corporation's stock :

- 1) Purchased one 3-month call option with a premium of ₹ 30 and an exercise price of ₹ 550.
- 2) Purchased one 3-month put option with a premium of ₹ 5 and an exercise price of ₹ 450.

Delta Corporation's stock is currently selling at ₹ 500. Determine profit or loss, if the price of Delta Corporation's stock:

- i. remains at ₹ 500 after 3 months.
- ii. falls at ₹ 350 after 3 months.
- iii. rises to ₹ 600.

Assume the option size is 100 shares of Delta Corporation.

Solution:

Total premium paid on purchasing a call and put option

$$= (\text{₹}30 \text{ per share} \times 100) + (\text{₹}5 \text{ per share} \times 100) = 3,000 + 500 = \text{₹}3,500$$

(i) In this case, X exercises neither the call option nor the put option as both will result in a loss for him. Ending value = - ₹3,500 + zero gain = - ₹3,500 i.e Net loss = ₹3,500

(ii) Since the price of the stock is below the exercise price of the call, the call will not be exercised. Only put is valuable and is exercised.

Total premium paid = ₹3,500

$$\text{Ending value} = - \text{₹}3,500 + ₹[(450 - 350) \times 100] = - \text{₹}3,500 + ₹10,000 = \text{₹}6,500$$

$$\therefore \text{Net gain} = \text{₹}6,500$$

(iii) In this situation, the put is worthless, since the price of the stock exceeds the put's exercise price. Only call option is valuable and is exercised.

Total premium paid = ₹3,500

$$\text{Ending value} = -3,500 + [(600 - 550) \times 100]$$

$$\text{Net Gain} = -3,500 + 5,000 = \text{₹}1,500$$

Question 26

The equity share of VCC Ltd. is quoted at ₹ 210. A 3-month call option is available at a premium of ₹ 6 per share and a 3-month put option is available at a premium of ₹ 5 per share.

Ascertain the net payoffs to the option holder of a call option and a put option separately.

- the strike price in both cases in ₹ 220; and
- the share price on the exercise day is ₹ 200,210,220,230,240.

Also indicate the price range at which the call and the put options may be gainfully exercised

Solution

Net payoff for the holder of the call option

					(₹)
Share price on exercise day	200	210	220	230	240
Option exercise	No	No	No	Yes	Yes
Outflow (Strike price)	Nil	Nil	Nil	220	220
Out flow (premium)	6	6	6	6	6
Total Outflow	6	6	6	226	226
Less inflow (Sales proceeds)	-	-	-	230	240
Net payoff	-6	-6	-6	4	14

Net payoff for the holder of the put option

					(₹)
Share price on exercise day	200	210	220	230	240
Option exercise	Yes	Yes	No	No	No
Inflow (strike price)	220	220	Nil	Nil	Nil
Less outflow (purchase price)	200	210	-	-	-
Less outflow (premium)	5	5	5	5	5
Net Payoff	15	5	-5	-5	-5

The call option can be exercised gainfully for any price above ₹226 (₹220 + ₹6) and put option for any price below ₹215 (₹220 - ₹5).

Question 27

Sumana wanted to buy shares of EIL which has a range of ₹ 411 to ₹ 592 a month later. The present price per share is ₹ 421. Her broker informs her that the price of this share can sore up to ₹ 522 within a month or so, so that she should buy a one-month CALL of EIL. In order to be prudent in buying the call, the share price should be more than or at least ₹ 522 the assurance of which could not be given by her broker.

Though she understands the uncertainty of the market, she wants to know the probability of attaining the share price ₹ 592 so that buying of a one-month CALL of EIL at the execution price of ₹522 is justified. Advice her. Take the risk-free interest to be 3.60% for one month and $e^{0.036} = 1.037$.

Solution

$$p = \frac{e^{rt} - d}{u - d}$$

$$e^{rt} = e^{0.036}$$

$$d = 411/421 = 0.976$$

$$u = 592/421 = 1.406$$

$$p = \frac{e^{0.036} - 0.976}{1.406 - 0.976} = \frac{1.037 - 0.976}{0.43} = \frac{0.061}{0.43} = 0.1418$$

Thus probability of rise in price 0.1418

Question 28

Mr. Dayal is interested in purchasing equity shares of ABC Ltd. which are currently selling at ₹ 600 each. He expects that price of share may go upto ₹ 780 or may go down to ₹ 480 in three months. The chances of occurring such variations are 60% and 40% respectively. A call option on the shares of ABC Ltd. can be exercised at the end of three months with a strike price of ₹ 630.

- What combination of share and option should Mr. Dayal select if he wants a perfect hedge?
- What should be the value of option today (the risk free rate is 10% p.a.)?
- What is the expected rate of return on the option?

Solution

- (i) To compute perfect hedge we shall compute Hedge Ratio (Δ) as follows:

$$\Delta = \frac{C_1 - C_2}{S_1 - S_2} = \frac{150 - 0}{780 - 480} = \frac{150}{300} = 0.50$$

Mr. Dayal should purchase 0.50 share for every 1 call option.

- (ii) Value of Option today

If price of share comes out to be ₹ 780 then value of purchased share will be:

Sale Proceeds of Investment (0.50 × ₹ 780) ₹ 390

Loss on account of Short Position (₹ 780 - ₹ 630) ₹ 150

₹ 240

If price of share comes out to be ₹ 480 then value of purchased share will be:

Sale Proceeds of Investment (0.50 × ₹ 480) ₹ 240

Accordingly, Premium say P shall be computed as follows:

$$(\text{₹ } 300 - P) 1.025 = \text{₹ } 240$$

$$P = \text{₹ } 65.85$$

- (iii) Expected Return on the Option

$$\text{Expected Option Value} = (\text{₹ } 780 - \text{₹ } 630) \times 0.60 + \text{₹ } 0 \times 0.40 = \text{₹ } 90$$

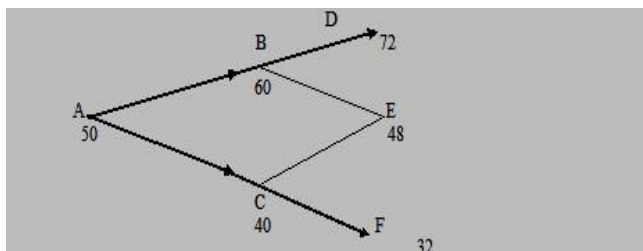
$$\text{Expected Rate of Return} = \frac{90 - 65.85}{65.85} \times 100 = 36.67\%$$

Question 29

Consider a two-year call option with a strike price of ₹ 50 on a stock the current price of which is also ₹ 50. Assume that there are two-time periods of one year and in each year the stock price can move up or down by equal percentage of 20%. The risk-free interest rate is 6%. Using binominal option model, calculate the probability of price moving up and down. Also draw a two-step binomial tree showing prices and payoffs at each node.

Solution

Stock prices in the two step Binominal tree

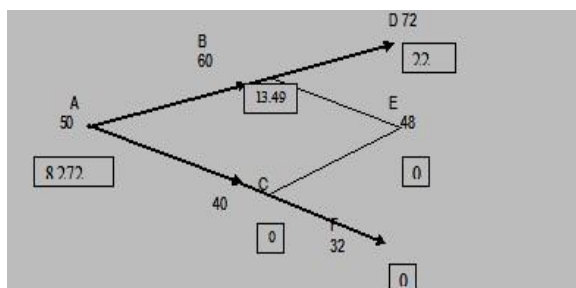


Using the single period model, the probability of price increase is

$$P = \frac{R - d}{u - d} = \frac{1.06 - 0.80}{1.20 - 0.80} = \frac{0.26}{0.40} = 0.65$$

therefore the p of price decrease = $1 - 0.65 = 0.35$

The two step Binominal tree showing price and pay off



The value of an American call option at nodes D, E and F will be equal to the value of European option at these nodes and accordingly the call values at nodes D, E and F will be 22, 0 and 0 using the single period binomial model the value of call option at node B is

$$C = \frac{C_u p + C_d (1 - p)}{R} = \frac{22 \times 0.65 + 0 \times 0.35}{1.06}$$

The value of option at node 'A' is

$$\frac{13.49 \times 0.65 + 0 \times 0.35}{1.06} = 8.272$$

Question 30

The current market price of an equity share of Penchant Ltd is ₹420. Within a period of 3 months, the maximum and minimum price of it is expected to be ₹ 500 and ₹ 400 respectively. If the risk free rate of interest be 8% p.a., what should be the value of a 3 months Call option under the "Risk Neutral" method at the strike rate of ₹ 450?

Given $e^{0.02} = 1.0202$

Solution

Let the probability of attaining the maximum price be p

$$(500 - 420) \times p + (400 - 420) \times (1-p) = 420 \times (e^{0.02} - 1)$$

$$\text{or, } 80p - 20(1 - p) = 420 \times 0.0202$$

$$\text{or, } 80p - 20 + 20p = 8.48$$

$$\text{or, } 100p = 28.48$$

$$p = 0.2848$$

$$\text{The value of Call Option in ₹} = \frac{0.2848 \times (500 - 450)}{1.0202} = \frac{0.2848 \times 50 + 0.7152 \times 0}{1.0202} = 13.96$$

Question 31

From the following data for certain stock, find the value of a call option:

Price of stock now	= ₹ 80
Exercise price	= ₹ 75
Standard deviation of continuously compounded annual return	= 0.40
Maturity period	= 6 months
Annual interest rate	= 12%

Given

Number of S.D. from Mean, (z)	Area of the left or right (one tail)
0.25	0.4013
0.30	0.3821
0.55	0.2912
0.60	0.2743

$$e^{0.12 \times 0.5} = 1.062$$

$$\ln 1.0667 = 0.0646$$

Solution

Applying the Black Scholes Formula,

$$\text{Value of Call Option} = (\text{CMP} \times N(d_1)) - \left(\frac{\text{EP}}{e^{rt}} \times N(d_2) \right)$$

$$d_1 = \frac{\ln \frac{\text{CMP}}{\text{EP}} + (r + \frac{\sigma^2}{2})t}{\sigma \sqrt{t}}$$

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

$$d_1 = \frac{\ln(1.0667) + (0.12 + 0.08)0.5}{0.40 \sqrt{0.5}} = \frac{0.0646 + (0.2)0.5}{0.40 \times 0.7071} = \frac{0.1646}{0.2828} = 0.5820$$

$$d_2 = 0.5820 - 0.2828 = 0.2992$$

$$N(d_1) = N(0.5820)$$

$$N(d_2) = N(0.2992)$$

$$\text{Value of option} = 80N(d_1) - \frac{75}{1.062} \times N(d_2)$$

$$N(d_1) = N(0.5820) = 0.7197$$

$$N(d_2) = N(0.2992) = 0.6176$$

$$\text{Price} = 80 \times 0.7197 - \frac{75}{1.062} \times 0.6176$$

$$= 57.57 - 70.62 \times 0.6176 = 57.57 - 43.61 = ₹13.96$$

Question 32

[RTP MAY18/MTP OCT 21]

TMC Holding Ltd. has a portfolio of shares of diversified companies valued at ₹ 400 crore enters into a swap arrangement with None Bank on the terms that it will get 1.15% quarterly on notional principal of ₹ 400 crore in exchange of return on portfolio which is exactly tracking the Sensex which is presently 21600.

CALCULATE the net payment to be received / paid at the end of each quarter if Sensex turns out to be 21,860, 21,780, 22,080 and 21,960

Solution:

Qtrs.	Sensex	Sensex Return (%)	Amount Payable (₹ Crore)	Fixed Return (Receivable) (₹ Crore)	Net (₹ Crore)
(1)	(2)	(3)	(4)	(5)	(6)
0	21,600	-	-	-	-
1	21,860	1.2037	4.8148	4.6000	- 0.2148
2	21,780	-0.3660	-1.4640	4.6000	6.0640
3	22,080	1.3774	5.5096	4.6000	- 0.9096
4	21,960	-0.5435	-2.1740	4.6000	6.7740

Question 33

[RTP Nov'18/MTP Nov'21/MTP May'23]

Ram holding shares of Reliance Industries Ltd. which is currently selling at ₹ 1000. He is expecting that this price will further fall due to lower than expected level of profits to be announced after one month. As on following option contract are available in Reliance Share.

Strike Price (₹)	Option	Premium (₹)
1030	Call	40
1010	Call	35
1000	Call	30
990	Put	35
970	Put	20
950	Put	8
930	Put	5

Ram is interested in selling his stock holding as he cannot afford to lose more than 5% of its value.

RECOMMEND a hedging strategy with option and show how his position will be protected

Solution

Instead of selling the stock of Reliance Ltd., Ram must cover his Risk by buying or long position in Put Option with appropriate strike price. Since Ram's risk appetite is 5%, the most suitable strike price in Put Option shall be ₹ 950 (₹ 1000 - 5% of ₹ 1000). If Ram does so, the overall position will be as follows:

Spot Price after 1 month	Stock Value	Put Payoff	Initial Cash Flow	Total
$S < 950$	S	$950 - S$	-8	$942 - S$
$S > 950$	S	-	-8	$S - 8$

Thus, from the above, it can be seen that the value of holding of Ram shall never be less than ₹ 942 as Put Option will compensate for loss below spot price of ₹ 950. However, this strategy will involve a cost of ₹ 8.

Question 34

[RTP NOV'20]

Mr. SG sold five 4 - Month Nifty Futures on 1st February 2020 for ₹ 9,00,000. At the time of closing of trading on the last Thursday of May 2020 (expiry), Index turned out to be 2100. The contract multiplier is 75.

Based on the above information calculate:

- The price of one Future Contract on 1st February 2020.
- Approximate Nifty Sensex on 1st February 2020 if the Price of Future Contract on same date was theoretically correct. On the same day Risk Free Rate of Interest and Dividend Yield on Index was 9% and 6% p.a. respectively.
- The maximum Contango / Backwardation.
- The pay - off of the transaction.

Note: Carry out calculation on month basis

Solution

- The price of one Future Contract
Let X be the Price of Future Contract. Accordingly,
 $5 = 3,90,000 / X$
 $X \text{ (Price of One Future Contract)} = ₹ 1,80,000$
- Current Future price of the index = $1,80,000 / 75 = 2400$

In case of simple Interest = $\text{Spot} \left(1 + \frac{R \times \frac{t}{12/365}}{100} \right)$ where t means number of days/ months

If Dividend is given in percentage form, then to calculate Future price: Deduct Dividend percentage from rate of interest

Accordingly, $Y + Y(0.09 - 0.06)4/12 = 2400$
and $Y = 2400 / 1.01 = 2376.24$

Hence Nifty Index on 1st February 2020 shall be approximately 2376.

- (iii) To determine whether the market is in Contango / Backwardation first we shall compute basis as follows: $\text{Basis} = \text{Spot Price} - \text{Future Price}$

If Basis is negative the market is said to be in Contango and when it is positive the market is said to be Backwardation.

Since current Spot Price is 2400 and Nifty Index is 2376, the Basis is negative and hence there is Contango Market and maximum Contango shall be 24 (2400 - 2376).

- (iv) Pay off on the Future transaction shall be $[(2400-2100) \times 375]$ ₹ 112500

The Future seller gains if the Spot Price is less than Futures Contract price as position shall be reversed at same Spot price. Therefore, Mr. SG has gained ₹ 1,12,500/- on the short position taken.

Question 35

[RTP NOV 20]

A Rice Trader has planned to sell 22000 kg of Rice after 3 months from now. The spot price of the Rice is ₹ 60 per kg and 3 months Future on the same is trading at ₹ 59 per kg. Size of the contract is 1000 kg. The price is expected to fall as low as ₹ 56 per kg, 3 months hence.

Required:

- (i) to interpret the position of trader in the Cash Market.
- (ii) to advise the trader the trader should take in Future Market to mitigate its risk of reduced profit.
- (iii) to demonstrate effective realized price for its sale if he decides to make use of future market and after 3 months, spot price is ₹ 57 per kg and future contract price for closing the contract is ₹ 58 per kg

Solution

- (i) Since trader has planned to sell after 3 months now it implies, he is in Long Position in Cash or Spot Market.
- (ii) Since the trader is in Long Position in Cash Market, he can mitigate its risk of reduced profit by hedging his position by selling Rice Futures i.e. Short Position in Future Market.
- (iii) The gain on futures contract = $(₹ 59 - ₹ 58) \times 22,000 \text{ kg.} = ₹ 22,000$ Revenue from the sale of Rice = $22,000 \times ₹ 57 = ₹ 12,54,000$
Total Cash Flow = $₹ 12,54,000 + ₹ 22,000 = ₹ 12,76,000$
Cash Flow per kg. of Rice = $12,76,000/22,000 = ₹ 58$

Question 36

RTP NOV21/MTP OCT 20

A company is long on 10 MT of copper @ ₹ 534 per kg (spot) and intends to remain so for the ensuing quarter. The variance of change in its spot and future prices are 16% and 36% respectively, having correlation coefficient of 0.75. The contract size of one contract is 1,000 kgs.

Required:

- (i) Calculate the Optimal Hedge Ratio for perfect hedging in Future Market.
- (ii) Advice the position to be taken in Future Market for perfect hedging.
- (iii) Determine the number and the amount of the copper futures to achieve a perfect hedge

Solution:

$$(i) \quad \text{Beta (hedge Ratio)} = \frac{\sigma_s}{\sigma_f} \times r_{sf}$$

σ_s = Standard deviation of change in spot price of commodity

σ_f = Standard deviation of change in future price of commodity

r_{sf} = Correlation between change in spot and Future price`

Standard deviation of $\Delta S = \sqrt{16\%} = 4\%$ and

Standard deviation of $\Delta F = \sqrt{36\%} = 6\%$ and

$$H = 0.75 \times 0.04 / 0.06 = 0.5$$

(ii) Since the company is long position in Spot (Cash) Market it shall take Short Position in Future Market.

(iii) Since contract size of one contract is 1,000 Kg,

$$\text{No. of contract to be short} = \frac{10,000 \text{ kgs}}{1,000 \text{ kgs}} \times 0.5 = 5 \text{ contracts}$$

$$\text{Amount} = ₹ 5000 \times 534 = ₹ 26,70,000$$

Question 37**[MTP MARCH 18]**

On 1 April 2015, Sunidhi was holding a portfolio of 10 securities whose value was ₹ 9,94,450, the weighted average of beta of 9 securities was 1.10.

Since she was expecting a fall in the prices of the shares in near future to hedge her portfolio she sold 5 contract of NIFTY Futures (Multiplier of 25) expiring in May 2015, which was trading at 8767.07 on 1 April. Calculate the beta of the 10th security.

Solution

a) To compute the beta of 10th security first we shall compute overall weighted beta as follows: Let weighted β be w , then

$$5 = \frac{994450}{8767.07 \times 25} \times w$$

$$w = 1.102 \text{ approximately}$$

Let beta of 10th security is β then,

$$1.102 = 0.90 \times 1.10 + 0.10 \times \beta$$

$$\beta = 1.12$$

Question 38**[MTP MARCH 21]**

A future contract is available on R Ltd. that pays an annual dividend of ₹ 4 and whose stock is currently priced at ₹ 125. Each future contract calls for delivery of 1,000 shares to stock in one year, daily marking to market. The corporate treasury bill rate is 8%.

Required:

1. Given the above information, what should the price of one future contract be?
2. If the company stock price decreases by 6%, what will be the price of one futures contract?
3. As a result of the company stock price decrease, will an investor that has a long position in one futures contract of R Ltd. realizes a gain or loss? What will be the amount of his gain or loss?

(Ignore margin and taxation, if any)

Solution:

(i) Future Price = Spot + Cost of Carry - Dividend

$$= ₹ 125 + (₹ 125 \times 0.08) - 4 = ₹ 131$$

Price of one future contract = 1000 share $\times$ ₹ 131 = ₹ 1,31,000

(ii) Price decrease by 6 %

Market Price = $125 \times 94\% = 117.50$ Then, price of one future contract

$$= ₹ 117.50 + (₹ 117.50 \times 0.08) - 4 = ₹ 122.90 = ₹ 122.90 \times 1000 = ₹ 1,22,900$$

(iii) If the investor has taken a long position, decrease in price will result in loss for the investor.

Amount of loss will be: ₹ 1,31,000 - ₹ 1,22,900 = ₹ 8,100

Question 39**[DEC 21]**

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

- (i) Please advise Mr. P how to hedge his market exposure using the available data.
- (ii) Calculate the profit or loss of Mr. P during the expiry of September 2021 futures in following situation:
 - a) Nifty Future rise by 10%
 - b) ML Ltd. falls by 5%
- (iii) Is it possible stock as well as nifty to raise or fall at the same percentage? Please state the reason.

Solution

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

$$\text{No. of Contract of Nifty Future to be short} = \frac{1.25 \times ₹ 700 \times 1,000}{17,500 \times 50} = 1$$

(ii)

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

Particulars	If Nifty rises by 10%
Loss on Nifty Futures ($17,500 \times 50 \times 0.10$)	₹ 87,500
Gain on Stock of ML Ltd. ($1.25 \times 0.10 \times ₹ 7,00,000$)	₹ 87,500
Net Gain / (Loss)	Nil

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

Particulars	If ML Ltd. falls by 5%
Gain on Nifty Futures $(17,500 \times 50 \times 0.05)/1.25$	₹ 35,000
Loss on Stock of ML Ltd. $(0.05 \times ₹ 7,00,000)$	₹ 35,000
Net Gain / (Loss)	Nil

(iii) Normally it is not possible that Nifty to rise or fall by same percentage because of systematic risk i.e., Beta may not be the same as of market.

Question 40

A call and put exist on the same stock each of which is exercisable at ₹ 60. They now trade for:

Market price of Stock or stock index ₹ 55

Market price of call ₹ 9

Market price of put ₹ 1

Calculate the expiration date cash flow, investment value, and net profit from:

(i) Buy 1.0 call

(ii) Write 1.0 call

(iii) Buy 1.0 put

(iv) Write 1.0 put

for expiration date stock prices of ₹ 50, ₹ 55, ₹ 60, ₹ 65, ₹ 70.

Solution

Expiration date cash flows

Stock Prices	₹ 50	₹ 55	₹ 60	₹ 65	₹ 70
Buy 1.0 call	0	0	0	-60	-60
Write 1.0 call	0	0	0	60	60
Buy 1.0 put	60	60	0	0	0
Write 1.0 put	-60	-60	0	0	0

Expiration date investment value

Stock Prices	₹ 50	₹ 55	₹ 60	₹ 65	₹ 70
Buy 1.0 call	0	0	0	5	10
Write 1.0 call	0	0	0	-5	-10
Buy 1.0 put	10	5	0	0	0
Write 1.0 put	-10	-5	0	0	0

Expiration date net profits

Stock Prices	₹ 50	₹ 55	₹ 60	₹ 65	₹ 70
Buy 1.0 call	-9	-9	-9	-4	1
Write 1.0 call	9	9	9	4	-1
Buy 1.0 put	9	4	-1	-1	-1
Write 1.0 put	-9	-4	1	1	1

Question 41

A call option on gold with exercise price ₹ 26,000 per ten gram and three months to expire is being traded at a premium of ₹ 1,010 per ten gram. It is expected that in three months' time the spot price might change to ₹ 27,300 or 24,700 per ten gram. At present this option is at - the - money and the rate of interest with simple compounding is 12% per annum. Is the current premium for the option justified? Evaluate the option and comments.

Solution

To determine whether premium is justified we shall compute the value of option by using any of the following models:

By use of Binomial Model

Decision Tree showing pay off

Year 0	3 Months	Pay Off
26,000	27,300	1,300
	24,700	0

First of all we shall calculate probability of high demand (P) using risk neutral method as follows:

$$3\% = p \times 5\% + (1 - p) \times (-5\%)$$

$$0.03 = 0.05p - 0.05 + 0.05p$$

$$P = 0.08 / 0.10 = 0.80$$

The value of call option = $(1300 \times 0.8 + 0 \times 0.2) / 1.03 = ₹1,009.71$ say ₹1,010

Thus, the price of option is justified.

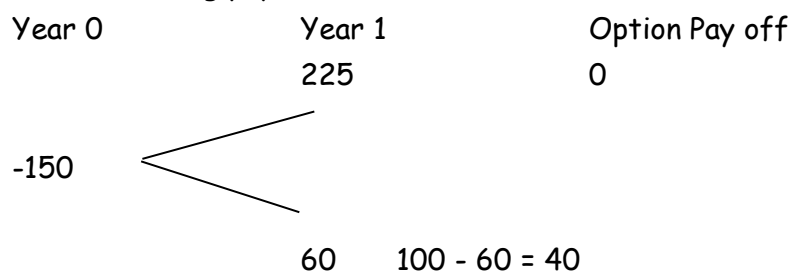
Question 42 (Nov 24 Exam)

A firm is considering a proposal to set up a cement manufacturing plant with an initial investment of ₹ 150 crore. The firm has the option to abandon the project after one year by selling it to a competitor for ₹ 100 crore if the market conditions are unfavorable and the demand is low, the project's value will decline by 60%. However, if the market conditions turn out to be favorable and the demand for cement is high, the value of the project at the end of year 1 will increase by 50%.

Given that the risk free rate of interest as 8%, what will be the value of the abandonment option and the value of the project with abandonment option?

Solution

Decision Tree showing pay off



First of all, we shall calculate probability of high demand (p) using risk neutral method as follows:

$$8\% = p \times 50\% + (1-p) \times (-60\%)$$

$$0.08 = 0.50p - 0.60 + 0.60p$$

$$p = 0.68 / 1.10 = 0.618 \text{ or } 0.62$$

The value of abandonment option will be as follows: Expected Payoff at Year 1
 $= p \times 0 + [(1-p) \times 40] = 0.618 \times 0 + [0.382 \times 40] = ₹ 15.28 \text{ crore}$

Since expected pay off at year 1 is ₹ 15.28 crore. Present value of expected pay off will be:
 $15.28/1.08 = ₹ 14.15 \text{ crore}$

Thus, the value of abandonment option is ₹ 14.15 crore.

Value of Project with abandonment option -

(i) If PVF is not considered

Expected Value of the Project without abandonment option

$= (0.618 \times ₹ 225 \text{ crore} + 0.382 \times ₹ 60 \text{ crore}) - ₹ 150 \text{ crore} = ₹ 11.97 \text{ crore}$

Value of Project with abandonment Option $= ₹ 11.97 \text{ crore} + ₹ 14.15 \text{ crore} = ₹ 26.12 \text{ crore}$

Or

Expected Value of the Project without abandonment option

$= (0.62 \times ₹ 225 \text{ crore} + 0.38 \times ₹ 60 \text{ crore}) - ₹ 150 \text{ crore} = ₹ 12.30 \text{ crore}$

Value of Project with abandonment Option $= ₹ 12.30 \text{ crore} + ₹ 14.15 \text{ crore} = ₹ 26.45 \text{ crore}$

(ii) If PVF is considered

Expected Value of the Project without abandonment option

$= (0.618 \times ₹ 225 \text{ crore} + 0.382 \times ₹ 60 \text{ crore})/1.08 - ₹ 150 \text{ crore} = - ₹ 0.028 \text{ crore OR } - ₹ 0.03$

Value of Project with abandonment Option

$= - ₹ 0.028 \text{ crore} + ₹ 14.15 \text{ crore} = ₹ 14.122 \text{ crore OR } ₹ 14.12 \text{ crore}$

Or

Expected Value of the Project without abandonment option

$= (0.62 \times ₹ 225 \text{ crore} + 0.38 \times ₹ 60 \text{ crore})/1.08 - ₹ 150 \text{ crore} = ₹ 00.28 \text{ crore}$

Value of Project with abandonment Option $= ₹ 0.28 \text{ crore} + ₹ 14.15 \text{ crore} = ₹ 14.43 \text{ crore}$

Question 43 (Nov 24 Exam)

Mohan buys 10,000 shares of X Ltd. @ ₹ 25 per share whose beta value is 1.5 and sells 5,000 shares of A Ltd. @ ₹ 40 per share having a beta value of 2. He obtains a complete hedge by buying 25 Nifty Futures. He closes out his position at the closing price of the next day when the share of X Ltd. has fallen by 4% and Nifty Futures has dropped by 2.50%. In the process he suffered a loss of ₹ 16625.

You are required to determine

- (i) The value of the Nifty future
- (ii) Initial cash outlay
- (iii) Cash inflow at the close out
- (iv) Percentage Gain/loss to Shares of A Ltd. at the time of closure

Solution

- (i) Let N be the value of Nifty Future Contract then:

$$\frac{10000 \times 25 \times 1.50 - 5000 \times 40 \times 2}{N} = 25$$

$$N = -1000$$

Since Mohan has bought Nifty Futures the above value shall be considered as positive i.e. value of per one Nifty Future is ₹ 1000.

Alternatively, it can also be computed as follows:

$$N = 1000$$

Accordingly, the value of Nifty Future is ₹ 1000.

- (ii) Initial Cash Outlay
 $= 10000 \times ₹ 25 + 1000 \times ₹ 25 - 5000 \times ₹ 40$
 $= ₹ 2,50,000 + ₹ 25,000 - ₹ 2,00,000 = ₹ 75,000$

- (iii) Cash inflow at the closeout
 $₹ 75,000 - ₹ 16,625 = ₹ 58,375$

- (iv) Percentage Gain/ loss to Shares of A Ltd. at the time of closure

Let the amount realised from the sale of share of A Ltd. is A.

Accordingly, next day at the time of closing out the position will be as follows:

$$10000 \times ₹ 25 (1 - 0.04) + 25 \times ₹ 1000 \times (1 - 0.025) - A = ₹ 58,375$$

$$A = ₹ 2,06,000$$

Thus, percentage of loss to shares of A Ltd. $= \frac{2,06,000 - 2,00,000}{2,00,000} = 0.03$ i.e. 3%

Alternative presentation- Percentage Gain / Loss to shares of A Ltd. at the time of closure:

Loss suffered by Mohan when he closes out his position at the closing price of the next day		₹ 16,625
Less:		
a. Loss suffered in purchase of shares of X Ltd. $(10,000 \times 25 \times 0.04)$	10,000	
b. Loss suffered in Nifty Futures $(1,000 \times 25 \times 0.025)$	625	₹ 10,625
Loss suffered in sale of shares of A Ltd.		₹ 6,000

Thus, percentage of loss to shares of A Ltd. $= \frac{6,000}{2,00,000} \times 100 = 0.03$ i.e. 3%.

Question 44 (RTP May 25)

Mr. X, is a Senior Portfolio Manager at ABC Asset Management Company. He expects to purchase a portfolio of shares in 90 days. However, he is worried about the expected price increase in shares in coming day and to hedge against this potential price increase he decides to take a position on a 90-day forward contract on the Index. The index is currently trading at 2290. Assuming that the continuously compounded dividend yield on the same index is 1.75% and risk-free rate of interest is 4.16%, you are required to determine:

- (a) The justified forward price on this contract.
- (b) The position Mr. X should take in forward contract on the Index.
- (c) Gain/ loss on the position taken if after 28 days of the purchase of the contract the Index value stands at 2450.
- (d) Gain/ loss on the position taken if at expiration of 90 days the Index Value is 2470.

Note: Take 365 days in a year and value of $e^{0.005942} = 1.005960$, $e^{0.001849} = 1.001851$.

Solution

- (a) The Forward Price shall be $= S_0 e^{n(r - y)}$

Where S_0 = Spot price n = period

r = risk free rate of interest y = dividend yield

Accordingly, Forward Price $= 2290 e^{90/365(0.0416 - 0.0175)}$

$$= 2290 e^{0.005942}$$

$$= 2290(1.005960)$$

$$= 2303.65$$

- (b) Mr. X shall take long position in the Forward Contract on Index.

- (c) Gain/loss on Long Position after 28 days

$$= 2450 - 2290 e^{(0.0416 - 0.0175)28/365}$$

$$= 2450 - 2290 e^{0.001849}$$

$$= 2450 - 2290(1.001851)$$

$$= 2450 - 2294.24$$

$$= 155.76$$

- (d) Gain/loss on Long Position at maturity $= 2470.00 - 2303.65 = 166.35$



Foreign Exchange Exposure And Risk Management

Question 1

Suppose you are a dealer of ABC Bank and on 20.10.2014 you found that balance in your Nostro account with XYZ Bank in London is £65,000 and you had overbought £35,000. During the day following transaction have taken place:

	£
DD purchased	12,500
Purchased a Bill on London	40,000
Sold forward TT	30,000
Forward purchase contract cancelled	15,000
Remitted by TT	37,500
Draft on London cancelled	15,000

What steps would you take, if you are required to maintain a credit Balance of £7,500 in the Nostro A/c and keep as overbought position on £7,500?

Solution:

Exchange Position:

Particulars	Purchase £	Sale £
Opening Balance Overbought	35,000	—
DD Purchased	12,500	—
Purchased a Bill on London	40,000	—
Sold forward TT	—	30,000
Forward purchase contract cancelled	—	15,000
TT Remittance		37,500
Draft on London cancelled	15,000	—
	1,02,500	82,500
Closing Balance Overbought	—	20,000
	1,02,500	1,02,500

Cash Position (Nostro A/c)

	Credit £	Debit £
Opening balance credit	65,000	—
TT Remittance	—	<u>37,500</u>
	65,000	37,500
Closing balance (credit)	—	<u>27,500</u>
	<u>65,000</u>	<u>65,000</u>

To maintain Cash Balance in Nostro Account at £7,500 you have to sell £20,000 in Spot which will bring Overbought exchange position to Nil. Since bank require Overbought position of £7,500 it has to buy the same in forward market.

Question 2

On 1st June 2015 the bank enters into a forward contract for 2 months for selling US\$ 1,00,000 at 65.5000. On 31st July 2015 the spot rate was 65.7500/65.2500. Calculate the amount to be debited in the customer's account.

Solution:

The bank will apply rate originally agreed upon i.e., 65.5000 and will debit the account of the customer with 65,50,000.

Question 3

On 1 October 2015 Mr. X an exporter enters into a forward contract with a BNP Bank to sell US\$ 1,00,000 on 31 December 2015 at 65.40/\$. However, due to the request of the importer, Mr. X received amount on 28 November 2015. Mr. X requested the bank to take delivery of the remittance on 30 November 2015 i.e., before due date. The inter-banking rates on 28 November 2015 was as follows:

Spot	65.22/65.27
One Month Premium	10/15

If bank agrees to take early delivery then what will be net inflow to Mr. X assuming that the prevailing prime lending rate is 18%.

Solution:

Bank will buy from customer at the agreed rate of Rs 65.40. In addition to the same if bank will charge/ pay swap difference and interest on outlay funds.

(a)	Swap Difference	
	Bank Sells at Spot Rate on 28 November 2015	65.22
	Bank Buys at Forward Rate of 31 December 2015 (65.27 + 0.15)	65.42
	Swap Loss per US\$	00.20
	Swap loss for US\$ 1,00,000	20,000
(b)	Interest on Outlay Funds	
	On 28th November Bank sells at	65.22
	It buys from customer at	65.40
	Outlay of Funds per US\$	00.18
	Interest on Outlay fund for US\$ 1,00,000 for 31 days (US\$100000 × 00.18 × 31/365 × 18%)	275.00
(c)	Charges for early delivery	
	Swap loss	20,000.00
	Interest on Outlay fund for US\$ 1,00,000 for 31 days	275.00
		20,275.00
(d)	Net Inflow to Mr. x	
	Amount received on sale (65.40 × 1,00,000)	65,40,000
	Less: Charges for early delivery payable to bank	(20,275)
		65,19,725

Question 5

On 15th January 2015 you as a banker booked a forward contract for US\$ 250000 for your import customer deliverable on 15th March 2015 at 65.3450. On due date customer request you to cancel the contract. On this date quotation for US\$ in the inter-bank market is as follows:

Spot	65.2900/2975 per US\$
Spot/ April	3000/ 3100
Spot/ May	6000/ 6100

Assuming that the flat charges for the cancellation is 100 and exchange margin is 0.10%, then determine the cancellation charges payable by the customer.

Solution:

Bank will sell to customer at the agreed rate of 65.3450.

Since this is sale contract by the bank the contract shall be cancelled at ready buying rate on the date of cancellation as follows:

Spot Buying Rate on 15 March 2015	65.2900
Less: Exchange Margin	<u>0.0653</u>
	<u>65.2247</u>
Rounded to 65.2250	
Dollars sold to customer at	65.3450
Dollars bought from customer	<u>65.2250</u>
Net amount payable by the customer per US\$	<u>0.1200</u>
Amount payable by the customer	
Flat Charges	100.00
Cancellation Charges (0.12 × 250000)	<u>30,000.00</u>
	<u>30,100.00</u>

Question 6

You as a banker has entered into a 3 month's forward contract with your customer to purchase AUD 1,00,000 at the rate of 47.2500. However, after 2 months your customer comes to you and requests cancellation of the contract. On this date quotation for AUD in the market is as follows:

Spot	47.3000/3500 per AUD
1 month forward	47.4500/5200 per AUD

Determine the cancellation charges payable by the customer.

Solution:

The contract shall be cancelled at the 1 month forward sale rate of 47.5200 as follows:

AUD bought from customer under original forward contract at	47.2500
On cancellation it is sold to him at	<u>47.5200</u>
Net amount payable by customer per AUD	<u>00.2700</u>

Thus, total cancellation charges payable by the customer 27,000

Question 7

Suppose you are a banker and one of your export customers has booked a US\$ 1,00,000 forward sale contract for 2 months with you at the rate of 62.5200 and simultaneously you covered yourself in the interbank market at 62.5900. However, on due date, after 2 months your customer comes to you and requests for cancellation of the contract and also requests for extension of the contract by one month. On this date quotation for US\$ in the market was as follows:

Spot	62.6800/62.7200
1 month forward	62.6400/62.7400

Determine the extension charges payable by the customer assuming exchange margin of 0.10% on buying as well as selling.

Solution:**Cancellation**

First the original contract shall be cancelled at Spot Selling Rate as follows:

US\$/ Spot Selling Rate	62.7200
Add: Margin @ 0.10%	0.06272
	62.78272
Rounded off	62.7825
Bank buys US\$ under original contract at	62.5200
Bank Sells at Spot Rate	62.7825
	0.2625

Thus, total cancellation charges payable by the customer for US\$ 1,00,000 is 26,250.

Rebooking

Forward US\$/ Buying Rate	62.6400
Less: Margin @ 0.10%	0.06264
Net amount payable by customer per US\$	62.57736
Rounded off	62.5775

Question 8

Suppose you as a banker entered into a forward purchase contract for US\$ 50,000 on 5th March with an export customer for 3 months at the rate of 59.6000. On the same day you also covered yourself in the market at Rs 60.6025. However, on 5th May your customer comes to you and requests extension of the contract to 5th July. On this date (5th May) quotation for US\$ in the market is as follows:

Spot	59.1300/1400 per US\$
Spot/ 5th June	59.2300/2425 per US\$
Spot/ 5th July	59.6300/6425 per US\$

Assuming a margin 0.10% on buying and selling, determine the extension charges payable by the customer and the new rate quoted to the customer.

Note: Rates to be rounded off to 4 decimals in multiples of 0.0025.

Solution:**(a) Cancellation of Original Contract**

The forward purchase contract shall be cancelled at the for the forward sale rate for delivery June.

Interbank forward selling rate	59.2425
Add: Exchange Margin	<u>0.0592</u>
Net amount payable by customer per US\$	<u>59.3017</u>
Rounded off, the rate applicable is	59.3025

Buying US\$ under original contract at original rate	59.6000
Selling rate to cancel the contract	<u>59.3025</u>
Difference per US\$	<u>00.2975</u>
Exchange difference for US\$ 50,000 payable to the customer is 14,875.	

(b) Rate for booking new contract

The forward contract shall be rebooked with the delivery 15th July as follows:

Forward buying rate (5th July)	59.6300
Less: Exchange Margin	<u>0.0596</u>
	<u>59.5704</u>

Rounded off to 59.5700

Question 9

An importer booked a forward contract with his bank on 10th April for USD 2,00,000 due on 10th June @ 64.4000. The bank covered its position in the market at 64.2800.

The exchange rates for dollar in the interbank market on 10th June and 13th June were:

	10th June	13th June
Spot USD 1=	63.8000/8200	63.6800/7200
Spot/June	63.9200/9500	63.8000/8500
July	64.0500/0900	63.9300/9900
August	64.3000/3500	64.1800/2500
September	64.6000/6600	64.4800/5600

Exchange Margin 0.10% and interest on outlay of funds @ 12%. The importer requested on 14th June for extension of contract with due date on 10th August.

Rates to be rounded off to 4 decimals in multiples of 0.0025.

On 10th June, Bank Swaps by selling spot and buying one month forward.

Calculate: (i) Cancellation rate (ii) Amount payable on \$ 2,00,000 (iii) Swap loss (iv) Interest on outlay of funds, if any (v) New contract rate (vi) Total Cost

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	63.6800
Less: Exchange Margin @ 0.10%	0.0636
	63.6163

Rounded off to 63.6175

(ii) Amount payable on \$ 2,00,000

Bank sells \$2,00,000 @ 64.4000	1,28,80,000
Bank buys \$2,00,000 @ 63.6175	1,27,23,500
Amount payable by customer	1,56,500

(iii) Swap Loss

On 10th June the bank does a swap sale of \$ at market buying rate of 63.8000 and forward purchase for June at market selling rate of 63.9500.

Bank buys at	63.9500
Bank sells at	63.8000
Amount payable by customer	0.1500

Swap Loss for \$ 2,00,000 is = 30,000

(iv) Interest on Outlay of Funds

On 10th June, the bank receives delivery under cover contract at 64.2800 and sell spot at 63.8000.

Bank buys at	64.2800
Bank sells at	63.8000
Amount payable by customer	0.4800

Outlay for \$ 2,00,000 is 96,000

Interest on 96,000 @ 12% for 3 days is 96

(v) New Contract Rate

The contract will be extended at current rate

\$/ Market forward selling Rate for August	64.2500
Add: Exchange Margin @ 0.10%	0.0643
	64.3143

Rounded off to 64.3150

(vi) Total Cost

Cancellation Charges	1,56,500.00
Swap Loss	30,000.00
Interest	96.00
	1,86,596.00

Question 10

The price of a bond just before a year of maturity is \$ 5,000. Its redemption value is \$ 5,250 at the end of the said period. Interest is \$ 350 p.a. The Dollar appreciates by 2% during the said period. Calculate the rate of return.

Solution:

Here we can assume two cases

- (i) If investor is US investor then there will be no impact of appreciation in \$.
- (ii) If investor is from any other nation other than US say Indian then there will be impact of \$ appreciation on his returns.

First we shall compute return on bond which will be common for both investors.

$$\text{Return} = \frac{(\text{Price at end} - \text{Price at beginning}) + \text{Interest}}{\text{Price at beginning}} = \frac{(5250 - 5000) + 350}{5000} = \frac{250 + 350}{5000} = 0.12 \text{ say } 12\%$$

- (i) For US investor the return shall be 12% and there will be no impact of appreciation in \$.

- (ii) If \$ appreciate by 2% then return for non-US investor shall be:

$$(1 + 0.12)(1 + 0.02) - 1 = 1.12 \times 1.02 - 1 = 0.1424 \text{ i.e. } 14.24\%$$

Question 11

ABN-Amro Bank, Amsterdam, wants to purchase Rs 15 million against US\$ for funding their Nostro account with Canara Bank, New Delhi. Assuming the inter-bank, rates of US\$ is 51.3625/3700, what would be the rate Canara Bank would quote to ABN-Amro Bank? Further, if the deal is struck, what would be the equivalent US\$ amount.

Solution:

Here Canara Bank shall buy US\$ and credit to Vostro account of ABN-Amro Bank. Canara Bank's buying rate will be based on the Inter-bank Buying Rate (as this is the rate at which Canara Bank can sell US\$ in the Interbank market)

Accordingly, the Interbank Buying Rate of US\$ will be 51.3625 (lower of two) i.e. $(1/51.3625) = \$ 0.01947$ / Equivalent of US\$ for 15 million at this rate will be
 $= 15,000,000 / 51.3625 = \text{US\$ } 2,92,041.86$

Question 12

XYZ LTD Bank, Amsterdam, wants to purchase Rs 25 million against £ for funding their Nostro account and they have credited LORO account with Bank of London, London. Calculate the amount of £'s credited. Ongoing inter-bank rates are per \$, Rs 61.3625/3700 & per £, \$ 1.5260/70.

Solution:

To purchase Rupee, XYZ LTD Bank shall first sell £ and purchase \$ and then sell \$ to purchase Rupee. Accordingly, rate (£/ask) shall be used.

The available rates are as follows:

(\$/£)bid = \$1.5260 AND (\$/£)ask = \$1.5270

(Rs/\$)bid = 61.3625 AND (Rs/\$)ask = 61.3700

From above available rates we can compute required rate as follows:

$$= (1/1.5260) \times (1/61.3625) = \text{£ } 0.01068 \text{ or } \text{£ } 0.0107$$

Thus, amount of £ to be credited = $25,000,000 \times \text{£ } 0.0107 = \text{£ } 267,500$

Question 13

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:

$$\text{Forward Rate} = \frac{2.50(1+0.075)}{(1+0.060)} = \text{Can\$ } 2.535/\text{£}$$

(i) If spot rate decline by 2%: Spot Rate = Can\$ 2.50 × 1.02 = Can\$ 2.55/£

	£
£ receipt as per Forward Rate (Can \$ 5,00,000/ Can\$ 2.535)	1,97,239
£ receipt as per Spot Rate (Can \$ 5,00,000/ Can\$ 2.55)	1,96,078
Gain due to forward contract	1,161

(ii) If spot rate gains by 4% : Spot Rate = Can\$ 2.50 × 0.96 = Can\$ 2.40/£

	£
£ receipt as per Forward Rate (Can \$ 5,00,000/ Can\$ 2.535)	1,97,239
£ receipt as per Spot Rate (Can \$ 5,00,000/ Can\$ 2.40)	2,08,333
Loss due to forward contract	11,094

(iii) If spot rate remains unchanged

	£
£ receipt as per Forward Rate (Can \$ 5,00,000/ Can\$ 2.535)	1,97,239
£ receipt as per Spot Rate (Can \$ 5,00,000/ Can\$ 2.50)	2,00,000
Loss due to forward contract	2,761

Question 14

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:

(i) Swap Points for 2 months and 15 days

	Bid	Ask
Swap Points for 2 months (a)	70	90
Swap Points for 3 months (b)	160	186
Swap Points for 30 days (c) = (b) - (a)	90	96
Swap Points for 15 days (d) = (c)/2	45	48
Swap Points for 2 months & 15 days (e) = (a) + (d)	115	138

(ii) Foreign Exchange Rates for 20th June 2016

	Bid	Ask
Spot Rate (a)	66.2525	67.5945
Swap Points for 2 months & 15 days (b)	0.0115	0.0138
	66.2640	67.6083

(iii) Annual Rate of Premium

	Bid	Ask
Spot Rate (a)	66.2525	67.5945
Foreign Exchange Rates for 20 th June 2016 (b)	66.2640	67.6083
Premium (c)	0.0115	0.0138
Total (d) = (a) + (b)	132.5165	135.2028
Average (d) / 2	66.2583	67.6014
Premium	$\frac{0.0115}{66.2583} \times \frac{12}{2.5} \times 100$ = 0.0833%	$\frac{0.0138}{67.6014} \times \frac{12}{2.5} \times 100$ = 0.0980%

Question 15

JKL Ltd., an Indian company has an export exposure of JPY 10,000,000 receivable August 31, 2014. Japanese Yen (JPY) is not directly quoted against Indian Rupee.

The current spot rates are:

INR/US \$ = 62.22

JPY/US\$ = JPY 102.34

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:

Since the direct quote for ¥ and is not available it will be calculated by cross exchange rate as follows: $62.22/102.34 = 0.6080$

Spot rate on date of export 1¥ = 0.6080

Expected Rate of ¥ for August 2014 = 0.5242 (65/¥124)

Forward Rate of ¥ for August 2014 = 0.6026 (66.50/¥110.35)

(i) Calculation of expected loss without hedging

Value of export at the time of export (0.6080 × ¥10,000,000)	60,80,000
Estimated payment to be received on Aug. 2014 (0.5242 × ¥10,000,000)	52,42,000
Loss	8,38,000

Hedging of loss under Forward Cover

Value of export at the time of export (0.6080 × ¥10,000,000)	60,80,000
Payment to be received under Forward Cover (0.6026 × ¥10,000,000)	60,26,000
Loss	54,000

By taking forward cover loss is reduced to 54,000.

(ii) Actual Rate of ¥ on August 2014 = 0.5977 (66.25/¥110.85)

Value of export at the time of export (0.6080 × ¥10,000,000)	60,80,000
Estimated payment to be received on Aug. 2014 (0.5977 × ¥10,000,000)	59,77,000
Loss	1,03,000

The decision to take forward cover is still justified

Question 16

You sold Hong Kong Dollar 1,00,00,000 value spot to your customer at 5.70 & covered yourself in London market on the same day, when the exchange rates were

US\$ 1 = H.K.\$ 7.5880 / 7.5920

Local inter bank market rates for US\$ were: Spot US\$ 1 = Rs 42.70 / 42.85

Calculate cover rate and ascertain the profit or loss in the transaction. Ignore brokerage.

Solution:

The bank (Dealer) covers itself by buying from the market at market selling rate.

Rupee - Dollar selling rate = 42.85

Dollar - Hong Kong Dollar = HK \$ 7.5880

Rupee - Hong Kong cross rate = 42.85 / 7.5880

= 5.6471

Profit / Loss to the Bank

Amount received from customer (1 crore × 5.70) 5,70,00,000

Amount paid on cover deal (1 crore × 5.6471) 5,64,71,000

Profit to Bank 5,29,000

Question 17

You, a foreign exchange dealer of your bank, are informed that your bank has sold a T.T. on Copenhagen for Danish Kroner 10,00,000 at the rate of Danish Kroner 1 = Rs 6.5150. You are required to cover the transaction either in London or New York market. The rates on that date are as under:

Mumbai-London	Rs 74.3000	Rs 74.3200
Mumbai-New York	Rs 49.2500	Rs 49.2625
London-Copenhagen	DKK 11.4200	DKK 11.4350
New York-Copenhagen	DKK 07.5670	DKK 07.5840

In which market will you cover the transaction, London or New York, and what will be the exchange profit or loss on the transaction? Ignore brokerages.

Solution:

Amount realized on selling Danish Kroner 10,00,000 at Rs 6.5150 per Kroner = Rs 65,15,000.

Cover at London:

Bank buys Danish Kroner at London at the market selling rate.

Pound sterling required for the purchase (DKK 10,00,000 ÷ DKK 11.4200) = GBP 87,565.67

Bank buys locally GBP 87,565.67 for the above purchase at the market selling rate of 74.3200.

The rupee cost will be = 65,07,881

Profit (65,15,000 - 65,07,881) = 7,119

Cover at New York:

Bank buys Kroners at New York at the market selling rate.

Dollars required for the purchase of Danish Kroner (DKK 10,00,000 ÷ 7.5670) = USD 1,32,152.77

Bank buys locally USD 1,32,152.77 for the above purchase at the market selling rate of 49.2625.

The rupee cost will be = 65,10,176.

Profit (65,15,000 - 65,10,176) = 4,824

The transaction would be covered through London which gets the maximum profit of 7,119 or lower cover cost at London Market by (65,10,176 - 65,07,881) = 2,295

Question 18

On January 28, 2013 an importer customer requested a Bank to remit Singapore Dollar (SGD) 2,500,000 under an irrevocable Letter of Credit (LC). However, due to unavoidable factors, the Bank could effect the remittances only on February 4, 2013. The inter-bank 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?

(Note: Calculate the rate in multiples of 0.0001)

Solution:

On January 28, 2013 the importer customer requested to remit SGD 25 lakhs.

To consider sell rate for the bank:

US \$	=	45.90
Pound 1	=	US\$ 1.7850
Pound 1	=	SGD 3.1575
Therefore, SGD 1	=	$\frac{45.90 \times 1.7850}{\text{SGD 3.1575}}$

SGD 1 =	25.9482
Add: Exchange margin (0.125%)	<u>0.0324</u>
	<u>25.9806</u>

On February 4, 2013 the rates are

US \$	=	45.97
Pound 1	=	US\$ 1.7775
Pound 1	=	SGD 3.1380
Therefore, SGD 1	=	$\frac{45.97 \times 1.7775}{\text{SGD 3.1380}}$

SGD 1 =	26.0394
Add: Exchange margin (0.125%)	<u>0.0325</u>
	<u>26.0719</u>

Hence, loss to the importer = SGD 25,00,000 (26.0719 - 25.9806) = 2,28,250

Question 19

Following are the details of cash inflows and outflows in foreign currency denominations of MNP Co. an Indian export firm, which have no foreign subsidiaries:

Currency	Inflow	Outflow	Spot rate	Forward rate
US \$	4,00,00,000	2,00,00,000	48.01	48.82
French Franc (FFr)	2,00,00,000	80,00,000	7.45	8.12
U.K. £	3,00,00,000	2,00,00,000	75.57	75.98
Japanese Yen	1,50,00,000	2,50,00,000	3.20	2.40

- Determine the net exposure of each foreign currency in terms of Rupees.
- Are any of the exposure positions offsetting to some extent?

Solution:

(i) Net exposure of each foreign currency in Rupees

	Inflow	Outflow	Net Inflow	Spread	Net Exposure
	(Millions)	(Millions)	(Millions)		(Millions)
US\$	40	20	20	0.81	16.20
FFr	20	8	12	0.67	8.04
UK£	30	20	10	0.41	4.10
Japan Yen	15	25	-10	-0.80	8.00

(ii) In Japanese Yen, the net exposure is payable, and the forward rate is quoted at a discount, effectively offsetting the position. Likewise, in the remaining currencies, the net exposures are in receivables, and the related currencies are at a premium, offsetting the positions in their respective currencies.

Question 20

The following 2-way quotes appear in the foreign exchange market:

	Spot	2-months forward
Rs/US \$	46.00/ 46.25	47.00/ 47.50

Required:

- 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:

(i) US \$ required to get 25 lakhs after 2 months at the Rate of 47/\$

$$\therefore 25\,00\,000/47 = \text{US \$ } 53191.489$$

(ii) required to get US\$ 2,00,000 now at the rate of 46.25/\$

$$\therefore \text{US \$ } 200,000 \times 46.25 = 92,50,000$$

(iii) Encashing US \$ 69,000 Now Vs 2 month later

Proceed if we can encash in open mkt \$ 69,000 $\times$ 46 = 31,74,000

Opportunity gain

$$= 31,74,000 \times 10/100 \times 2/12$$

Likely sum at end of 2 months

$$\underline{52,900}$$

$$\underline{32,26,900}$$

Proceeds if we can encash by forward rate :

$$\text{\$ } 69,000 \times 47.00 \quad 32,43,000$$

It is better to encash the proceeds after 2 months and get opportunity gain.

Question 21

Z Ltd. importing goods worth USD 2 million, requires 90 days to make the payment. The overseas supplier has offered a 60 days interest free credit period and for additional credit for 30 days an interest of 8% per annum.

The bankers of Z Ltd offer a 30 days loan at 10% per annum and their quote for foreign exchange is as follows:

Spot 1 USD	56.50
60 days forward for 1 USD	57.10
90 days forward for 1 USD	57.50

You are required to evaluate the following options:

- (i) Pay the supplier in 60 days, or (ii) Avail the supplier's offer of 90 days credit.

Solution:**(i) Pay the supplier in 60 days**

If the payment is made to supplier in 60 days the applicable forward rate for 1 USD	57.10
Payment Due	USD 2,000,000
Outflow in Rupees ($\text{USD } 2,000,000 \times 57.10$)	114,200,000
Add: Interest on loan for 30 days @10% p.a.	9,51,667
Total Outflow in	11,51,51,667

(ii) Availing supplier's offer of 90 days credit

Amount Payable	USD 2,000,000
Add: Interest on credit period for 30 days @8% p.a.	USD 13,333
Total Outflow in USD	USD 2,013,333
Applicable forward rate for 1 USD	57.50
Total Outflow in ($\text{USD } 2,013,333 \times 57.50$)	115,766,648

Alternative 1 is better as it entails lower cash outflow.

Question 22

Followings are the spot exchange rates quoted at three different forex markets:

USD/INR 48.30 in Mumbai

GBP/INR 77.52 in London

GBP/USD 1.6231 in New York

The arbitrageur has USD1,00,00,000. Assuming that there are no transaction costs, explain whether there is any arbitrage gain possible from the quoted spot exchange rates.

Solution:

The arbitrageur can proceed as stated below to realize arbitrage gains.

(i) Buy from USD 10,000,000 At Mumbai $48.30 \times 10,000,000$

(ii) Convert these to GBP at London ($483,000,000/77.52$) GBP 6,230,650.155

(iii) Convert GBP to USD at New York $\text{GBP } 6,230,650.155 \times 1.6231$ USD 10,112,968.26

There is net gain of USD 10,112,968.26 less USD 10,000,000 i.e. USD 112,968.26

Question 23

The US dollar is selling in India at Rs 55.50. If the interest rate for 6 months borrowing in India is 10% per annum and the corresponding rate in USA is 4%.

(i) Do you expect that US dollar will be at a premium or at discount in the Indian Forex Market?

(ii) What will be the expected 6-months forward rate for US dollar in India? and

(iii) What will be the rate of forward premium or discount?

Solution:

(i) Under the given circumstances, the USD is expected to quote at a premium in India as the interest rate is higher in India.

$$(ii) \text{Calculation of the forward rate: } \frac{1+(0.10/2)}{1+(0.04/2)} = \frac{F_1}{55.50}$$

Therefore Forward rate is $F_1 = 57.13$

$$(iii) \text{ Rate of premium: } \frac{57.13 - 55.50}{55.50} \times \frac{12}{6} \times 100 = 5.87\%$$

Question 24

In March, 2009, the Multinational Industries make the following assessment of dollar rates per British pound to prevail as on 1.9.2009:

\$/Pound	Probability
1.60	0.15
1.70	0.20
1.80	0.25
1.90	0.20
2.00	0.20

(i)What is the expected spot rate for 1.9.2009?

(ii)If, as of March, 2009, the 6-month forward rate is \$ 1.80, should the firm sell forward its pound receivables due in September, 2009?

Solution:

(i)Calculation of expected spot rate for September, 2009:

\$ for £	Probability	Expected \$/£
(1)	(2)	(1) × (2) = (3)
1.60	0.15	0.24
1.70	0.20	0.34
1.80	0.25	0.45
1.90	0.20	0.38
2.00	<u>0.20</u>	<u>0.40</u>
	<u>1.00</u>	EV = <u>1.81</u>

Therefore, the expected spot value of \$ for £ for September, 2009 would be \$ 1.81.

(ii)If the six-month forward rate is \$ 1.80, the expected profits of the firm can be maximised by retaining its pounds receivable.

Question 25

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/Rs 49.3700/3800 and USD/SGD 1.7058/68. The swap points are:

USD / Rs		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:

USD/ on 3 rd September	49.3800
Swap Point for October	0.1300
USD/ SGD on 3 rd September	49.5100
Swap Point for 2 nd month Forward	1.7058
	0.0096
	1.7154
SGD/Rs (49.5100/ 1.7154)	28.8621
Add: Exchange Margin	0.0500
	28.9121

Thus, Cross Rate for SGD/Rs of 30th October shall be 28.9121.

Question 26

A company operating in Japan has today affected sales to an Indian company, the payment being due 3 months from the date of invoice. The invoice amount is 108 lakhs yen. At today's spot rate, it is equivalent to Rs 30 lakhs. It is anticipated that 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:

Spot rate of Rs 1 against yen = 108 lakhs yen/ 30 lakhs = 3.6 yen

3 months forward rate of Re. 1 against yen = 3.3 yen

Anticipated decline in Exchange rate = 10%.

Expected spot rate after 3 months = 3.6 yen - 10% of 3.6 = 3.6 yen - 0.36 yen = 3.24 yen per rupee
(in lakhs)

Present cost of 108 lakhs yen 30.00

Cost after 3 months: 108 lakhs yen/ 3.24 yen 33.33

Expected exchange loss 3.33

If the expected exchange rate risk is hedged by a Forward contract:

Present cost	30.00
Cost after 3 months if forward contract is taken 108 lakhs yen/ 3.3 yen	<u>32.73</u>
Expected loss	<u>2.73</u>

Suggestion: If the exchange rate risk is not covered with forward contract, the expected exchange loss is 3.33 lakhs. This could be reduced to 2.73 lakhs if it is covered with Forward contract. Hence, taking forward contract is suggested.

Question 27

ABC Co. have taken a 6 month loan from their foreign collaborators for US Dollars 2 millions. Interest payable on maturity is at SOFR plus 1.0%. Current 6-month SOFR is 2%.

Enquiries regarding exchange rates with their bank elicits the following information:

Spot USD 1	48.5275
6 months forward	48.4575

- (i) What would be their total commitment in Rupees, if they enter into a forward contract?
(ii) Will you advise them to do so? Explain giving reasons.

Solution:

Firstly, the interest is calculated at 3% p.a. for 6 months. That is:

$$\text{USD } 20,00,000 \times 3/100 \times 6/12 = \text{USD } 30,000$$

From the forward points quoted, it is seen that the second figure is less than the first, this means that the currency is quoted at a discount.

- (i) The value of the total commitment in Indian rupees is calculated as below:

Principal Amount of loan	USD 20,00,000
Add: Interest	<u>USD 30,000</u>
Amount due	<u>USD 20,30,000</u>
Spot rate	48.5275
Forward Points (6 months)	(-) 0.0700
Forward Rate	48.4575
Value of Commitment	9,83,68,725

- (ii) It is seen from the forward rates that the market expectation is that the dollar will depreciate. If the firm's own expectation is that the dollar will depreciate more than what the bank has quoted, it may be worthwhile not to cover forward and keep the exposure open. If the firm has no specific view regarding future dollar price movements, it would be better to cover the exposure. This would freeze the total commitment and insulate the firm from undue market fluctuations. In other words, it will be advisable to cut the losses at this point of time. Given the interest rate differentials and inflation rates between India and USA, it would be unwise to expect continuous depreciation of the dollar. The US Dollar is a stronger currency than the Indian Rupee based on past trends and it would be advisable to cover the exposure.

Question 28

Excel Exporters are holding an Export bill in United States Dollar (USD) 1,00,000 due 60 days hence. They are worried about the falling USD value which is currently at Rs 45.60 per USD. The concerned Export Consignment has been priced on an Exchange rate of Rs 45.50 per USD. The Firm's Bankers have quoted a 60-day forward rate of Rs 45.20.

Calculate: (i) Rate of discount quoted by the Bank (ii) The probable loss of operating profit if the forward sale is agreed to.

Solution:

$$(i) \text{ Rate of discount quoted by the bank} = \frac{(45.20 - 45.60) \times 365 \times 100}{45.60 \times 60} = 5.33\%$$

$$(ii) \text{ Probable loss of operating profit: } (45.20 - 45.50) \times 1,00,000 = 30,000$$

Question 29

In International Monetary Market international forward bid for December, 15 on pound sterling is \$ 1.2816 at same time that price of IMM sterling future for delivery on December, 15 is \$ 1.2806. The contract size of pound sterling is £ 62,500. How could the dealer use arbitrage in profit from this situation and how much profit is earned?

Solution:

Buy £ 62500 × 1.2806	= \$ 80037.50
Sell £ 62500 × 1.2816	= <u>\$ 80100.00</u>
Profit	<u>\$ 62.50</u>

Question 30

An Indian importer has to settle an import bill for \$ 1,30,000. The exporter has given the Indian exporter two options:

- (i) Pay immediately without any interest charges.
- (ii) Pay after three months with interest at 5 percent per annum.

The importer's bank charges 15 percent per annum on overdrafts. The exchange rates in the market are as follows:

Spot rate (Rs/\$): 48.35 / 48.36
 3-Months forward rate (Rs/\$) : 48.81 / 48.83

The importer seeks your advice. Give your advice.

Solution:

If importer pays now, he will have to buy US\$ in Spot Market by availing overdraft facility. Accordingly, the outflow under this option will be

Amount required to purchase \$130000[\$130000 × 48.36]	6286800
Add: Overdraft Interest for 3 months @15% p.a.	235755
	6522555

If importer makes payment after 3 months then, he will have to pay interest for 3 months @ 5% p.a. for 3 month along with the sum of import bill. Accordingly, he will have to buy \$ in forward market. The outflow under this option will be as follows:

	\$
Amount of Bill	130000
Add: Interest for 3 months @5% p.a.	1625
	131625

Amount to be paid in Indian Rupee after 3 month under the forward purchase contract Rs 6427249 (US\$ 131625 X Rs 48.83)

Since outflow of cash is least in (ii) option, it should be opted for.

Question 31

DEF Ltd. has imported goods to the extent of US\$ 1 crore. The payment terms are 60 days interest-free credit. For additional credit of 30 days, interest at the rate of 7.75% p.a. will be charged.

The banker of DEF Ltd. has offered a 30 days loan at the rate of 9.5% p.a. Their quote for the foreign exchange is as follows:

Spot rate INR/US\$	62.50
60 days forward rate INR/US\$	63.15
90 days forward rate INR/US\$	63.45

Which one of the following options would be better?

- (i) Pay the supplier on 60th day and avail bank loan for 30 days.
- (ii) Avail the supplier's offer of 90 days credit.

Solution:

(i) Pay the supplier in 60 days

If the payment is made to supplier in 60 days the applicable forward rate for 1 USD	63.15
Payment Due	USD 1 crore
Outflow in Rupees (USD 1 crore × 63.15)	63.15 crore
Add: Interest on loan for 30 days @ 9.5% p.a.	0.50 crore
Total Outflow in	63.65 crore

(ii) Availing supplier's offer of 90 days credit

Amount Payable	USD 1.00000 crore
Add: Interest on credit period for 30 days @7.75% p.a.	USD 0.00646 crore
Total Outflow in USD	USD 1.00646 crore
Applicable forward rate for 1 USD	63.45
Total Outflow in (USD 1.00646 crore × 63.45)	63.86 crore

Alternative 1 is better as it entails lower cash outflow.

Question 32

A company is considering hedging its foreign exchange risk. It has made a purchase on 1st July, 2016 for which it has to make a payment of US\$ 60,000 on December 31, 2016. The present exchange rate is 1 US \$ = Rs 65. It can purchase forward 1 \$ at Rs 64. The company will have to make an upfront premium @ 2% of the forward amount purchased. The cost of funds to the company is 12% per annum.

In the following situations, compute the profit/loss the company will make if it hedges its foreign exchange risk with the exchange rate on 31st December, 2016 as:

(i) 68 per US \$. (ii) 62 per US \$. (iii) 70 per US \$. (iv) 65 per US \$.

Solution:

	0
Present Exchange Rate 65 = 1 US\$	
If company purchases US\$ 60,000 forward premium is $60000 \times 64 \times 2\%$	76,800
Interest on 76,800 for 6 months at 12%	<u>4,608</u>
Total hedging cost	<u>81,408</u>
If exchange rate is 68	
Then gain (68 - 64) for US\$ 60,000	2,40,000
Less: Hedging cost	<u>81,408</u>
Net gain	<u>1,58,592</u>
If US\$ = 62	
Then loss (64 - 62) for US\$ 60,000	1,20,000
Add: Hedging Cost	<u>81,408</u>
Total Loss	<u>2,01,408</u>
If US\$ = 70	
Then Gain (70 - 64) for US\$ 60,000	3,60,000
Less: Hedging Cost	<u>81,408</u>
Total Gain	<u>2,78,592</u>
If US\$ = 65	
Then Gain (65 - 64) for US\$ 60,000	60,000
Less: Hedging Cost	<u>81,408</u>
Net Loss	<u>21,408</u>

Question 33

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/Rs	US\$/Rs	Euro/Rs
Spot market	2.417-2.437	0.0214-0.0217	0.0177-0.0180
3 months forward	2.397-2.427	0.0213-0.0216	0.0176-0.0178
3 months spot	2.423-2.459	0.02144-0.02156	0.0177-0.0179

Advise AKC Ltd. by calculating average contribution to sales ratio whether it should hedge its foreign currency risk or not.

Solution:

If foreign exchange risk is hedged

				Total (₹)
Sum due	Yen 78,00,000	US\$1,02,300	Euro 95,920	
Unit input price	Yen 650	US\$10.23	Euro 11.99	
Unit sold	12000	10000	8000	
Variable cost per unit	225/-	395/-	510/-	
Variable cost	27,00,000	39,50,000	40,80,000	1,07,30,000
Three months forward rate for selling	2.427	0.0216	0.0178	
Rupee value of receipts	32,13,844	47,36,111	53,88,764	1,33,38,719
Contribution	5,13,844	7,86,111	13,08,764	26,08,719
Average contribution to sale ratio				19.56%

If risk is not hedged

Rupee value of receipt	31,72,021	47,44,898	53,58,659	1,32,75,578
Total contribution				25,45,578
Average contribution to sale ratio				19.17%

AKC Ltd. Is advised to hedge its foreign currency exchange risk.

Question 34

EFD Ltd. is an Indian export business house. The company prepares invoice in customers' currency. Its debtors of US\$ 10,000,000 is due to be received 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:	Rs 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	Rs 17,500	6.5%
3-Months	Rs 22,500	7%

On April 1, 2015 the spot rate US\$/INR is 0.016136 and Currency Futures rate is 0.016134. Which of the following methods would be most advantageous to EFD Ltd?

(i) Using forward contract (ii) Using currency futures (iii) Not hedging the currency risk

Solution:

Receipts using a forward contract = $\$10,000,000 / 0.016129$ = 620,001,240

Receipts using currency futures

The number of contracts needed is $(\$10,000,000 / 0.016118) / 24,816,975 = 25$

Initial margin payable is 25 contracts $\times$ 22,500 = 5,62,500

On April 1, 2015 Futures Contracts close at 0.016134

Receipts = $\text{US\$}10,000,000 / 0.016136$ = 619,732,276

Variation Margin =

$[(0.016134 - 0.016118) \times 25 \times 24,816,975] / 0.016136$ = 615,195

Less: Interest Cost $5,62,500 \times 0.07 \times 3/12$ = 9,844

Net Receipts 620,337,627

Receipts under different methods of hedging

Forward contract 620,001,240

Futures 620,337,627

No hedge (US\$ 10,000,000 / 0.016136) 619,732,276

The most advantageous option would have been to hedge with Futures.

Question 35

Spot rate 1 US \$ = Rs 48.0123

180 days Forward rate for 1 US \$ = Rs 48.8190

Annualised interest rate for 6 months - Rupee = 12%

Annualised interest rate for 6 months - US \$ = 8%

Is there any arbitrage possibility? If yes how an arbitrageur can take advantage of the situation, if he is willing to borrow 40,00,000 or US \$83,312.

Solution:

Forward Premium on US\$ = $[(48.8190 - 48.0123)/48.0123] \times 12/6 \times 100 = 3.36\%$

Interest rate differential = $12\% - 8\% = 4\%$

Since the negative Interest rate differential is greater than forward premium there is a possibility of arbitrage inflow into India.

The advantage of this situation can be taken in the following manner:

1. Borrow US\$ 83,312 for 6 months
Amount to be repaid after 6 months = $\text{US \$ } 83,312 (1 + 0.08 \times 6/12) = \text{US \$ } 86,644.48$
2. Convert US\$ 83,312 into Rupee and get the principal i.e. 40,00,000
Interest on Investments for 6 months = $40,00,000/- \times 0.06 = 2,40,000/-$
Total amount at the end of 6 months = $(40,00,000 + 2,40,000) = 42,40,000/-$
Converting the same at the forward rate = $42,40,000 / 48.8190 = \text{US \$ } 86,851.43$

Hence the gain is $\text{US \$ } (86,851.43 - 86,644.48) = \text{US \$ } 206.95$ OR 10,103 i.e., $(\$206.95 \times 48.8190)$

Question 36

Given the following information:

Exchange rate - Canadian dollar 0.665 per DM (spot)

Canadian dollar 0.670 per DM (3 months)

Interest rates - DM 7% p.a.

Canadian Dollar - 9% p.a.

What operations would be carried out to take the possible arbitrage gains?

Solution:

Premium = $[(0.67 - 0.665) / 0.665] \times (12/3) \times 100 = 3.01 \text{ per cent}$

Interest rate differential = $9\% - 7\% = 2 \text{ per cent}$.

Since the interest rate differential is smaller than the premium, it will be profitable to place money in Deutschmarks the currency whose 3-months interest is lower.

The following operations are carried out:

- (i) Borrow Can\$ 1000 at 9 per cent for 3- months;
- (ii) Change this sum into DM at the spot rate to obtain DM = $(1000/0.665) = 1503.76$
- (iii) Place DM 1503.76 in the money market for 3 months to obtain a sum of DM

Principal:	1503.76
Add: Interest @ 7% for 3 months =	<u>26.32</u>
Total	<u>1530.08</u>

- (iv) Sell DM at 3-months forward to obtain Can\$ = $(1530.08 \times 0.67) = 1025.15$

- (v) Refund the debt taken in Can\$ with the interest due on it, i.e.,

	Can\$
Principal	1000.00
Add: Interest @9% for 3 months	<u>22.50</u>
Total	<u>1022.50</u>

Net arbitrage gain = $1025.15 - 1022.50 = \text{Can\$ } 2.65$

Question 37

An Indian exporting firm, Rohit and Bros., would be covering itself against a likely depreciation of pound sterling. The following data is given:

Receivables of Rohit and Bros	:	£500,000
Spot rate	:	Rs 56.00/£
Payment date	:	3-months
3 months interest rate	:	India : 12 per cent per annum
	:	UK : 5 per cent per annum

What should the exporter do?

Solution:

The only thing lefts Rohit and Bros to cover the risk in the money market. The following steps are required to be taken:

(i) Borrow pound sterling for 3- months. The borrowing has to be such that at the end of three months, the amount becomes £ 500,000. Say, the amount borrowed is £ x.

Therefore $x [1+0.05 \times 3/12] = 500,000$ or $x = £493,827$

(ii) Convert the borrowed sum into rupees at the spot rate. This gives: $£493,827 \times 56 = 27,654,312$

(iii) The sum thus obtained is placed in the money market at 12 per cent to obtain at the end of 3-months: $S=27,654,312 \times [1+0.12 \times 3/12] = 28,483,941$

(iv) The sum of £500,000 received from the client at the end of 3- months is used to refund the loan taken earlier.

From the calculations. It is clear that the money market operation has resulted into a net gain of 483,941 (28,483,941 - 500,000 × 56).

If pound sterling has depreciated in the meantime. The gain would be even bigger.

Question 38

An exporter is a UK based company. Invoice amount is \$3,50,000. Credit period is three months. Exchange rates in London are :

Spot Rate	(\$/£) 1.5865 - 1.5905
3-month Forward Rate	(\$/£) 1.6100 - 1.6140

Rates of interest in Money Market :

	Deposit	Loan
\$	7%	9%
£	5%	8%

Compute and show how a money market hedge can be put in place. Compare and contrast the outcome with a forward contract.

Solution:

Identify: Foreign currency is an asset. Amount \$ 3,50,000.

Create: \$ Liability.

Borrow: In \$. The borrowing rate is 9% per annum or 2.25% per quarter.

Amount to be borrowed: $3,50,000 / 1.0225 = \$ 3,42,298.29$

Convert: Sell \$ and buy £. The relevant rate is the Ask rate, namely, 1.5905 per £,

(Note: This is an indirect quote). Amount of £s received on conversion is 2,15,214.27 (3,42,298.29/1.5905).

Invest: £ 2,15,214.27 will be invested at 5% for 3 months and get £ 2,17,904.45

Settle: The liability of \$3,42,298.29 at interest of 2.25 per cent quarter matures to \$3,50,000 receivable from customer.

Using forward rate, amount receivable is = $3,50,000 / 1.6140 = \text{£}2,16,852.54$

Amount received through money market hedge = $\text{£}2,17,904.45$

Gain = $2,17,904.45 - 2,16,852.54 = \text{£}1,051.91$

So, money market hedge is beneficial for the exporter.

Question 39

The rate of inflation in India is 8% per annum and in the U.S.A. it is 4%. The current spot rate for USD in India is 46. What will be the expected rate after 1 year and after 4 years applying the Purchasing Power Parity Theory.

Solution:

End of Year		Rs/USD
1	$46.00 \times \frac{(1+0.08)}{(1+0.04)}$	47.77
2	$47.77 \times \frac{(1+0.08)}{(1+0.04)}$	49.61
3	$49.61 \times \frac{(1+0.08)}{(1+0.04)}$	51.52
4	$51.52 \times \frac{(1+0.08)}{(1+0.04)}$	53.50

Question 40

On April 1, 3 months interest rate in UK £ and US \$ are 7.5% and 3.5% per annum respectively. The UK £/US \$ spot rate is 0.7570. What would be the forward rate for US \$ for delivery on 30th June?

Solution:

As per interest rate parity

$$S_1 = \text{£}0.7570 \frac{1 + (0.075) \times \frac{3}{12}}{1 + (0.035) \times \frac{3}{12}}$$

$$= \text{£}0.7570 \frac{1.01875}{1.00875}$$

$$= \text{£}0.7570 \times 1.0099 = \text{£}0.7645$$

$$= \text{UK £}0.7645 / \text{US\$}$$

Question 41

An importer requests his bank to extend the forward contract for US\$ 20,000 which is due for maturity on 30th October, 2010, for a further period of 3 months. He agrees to pay the required margin money for such extension of the contract.

Contracted Rate - US\$ 1= 42.32

The US Dollar quoted on 30-10-2010:-

Spot - 41.5000/41.5200

3 months' Premium - 0.87% /0.93%

Margin money for buying and selling rate is 0.075% and 0.20% respectively.

Compute:

- (i) The cost to the importer in respect of the extension of the forward contract, and
- (ii) The rate of new forward contract.

Solution:

(i)	The contract is to be cancelled on 30-10-2010 at the spot buying rate of US\$ 1	= 41.5000
	Less: Margin Money 0.075%	= <u>0.0311</u>
		= <u>41.4689</u> or 41.47
	US\$ 20,000 @ 41.47	= 8,29,400
	US\$ 20,000 @ 42.32	= <u>8,46,400</u>
	The difference in favour of the Bank/Cost to the importer	<u>17,000</u>
(ii)	The Rate of New Forward Contract	
	Spot Selling Rate US\$ 1	= 41.5200
	Add: Premium @ 0.93%	= <u>0.3861</u>
		= 41.9061
	Add: Margin Money 0.20%	= <u>0.0838</u>
		= <u>41.9899</u> or 41.99

Question 42

XYZ Ltd., an Indian firm, will need to pay JAPANESE YEN (JY) 5,00,000 on 30th June. In order to hedge the risk involved in foreign currency transaction, the firm is considering two alternative methods i.e. forward market cover and currency option contract.

On 1st April, following quotations (JY/INR) are made available:

Spot	3 months forward
1.9516/1.9711.	1.9726./1.9923

The prices for forex currency option on purchase are as follows:

Strike Price	JY 2.125
Call option (June)	JY 0.047
Put option (June)	JY 0.098

For excess or balance of JY covered, the firm would use forward rate as future spot rate. You are required to recommend cheaper hedging alternative for XYZ LTD.

Solution:

(i) Forward Cover

3-month Forward Rate = $1/1.9726 = 0.5070/\text{JY}$

Accordingly, INR required for JY 5,00,000 ($5,00,000 \times 0.5070$) 2,53,500

(ii) Option Cover

To purchase JY 5,00,000, XYZ LTD shall enter into a Put Option @ JY 2.125/INR

Accordingly, outflow in INR($\text{JY } 5,00,000/2.125$) 2,35,294

Premium [$(\text{INR } 2,35,294 \times 0.098)/1.9516$] 11,815

2,47,109

Since outflow of cash is least in case of Option same should be opted for. Further if price of INR goes above JY 2.125/INR the outflow shall further be reduced.

Question 43

ABC Technologic is expecting to receive a sum of US\$ 4,00,000 after 3 months. Company decided to go for future contract to hedge against the risk. The standard size of future contract available in the market is \$1000. As on date spot and futures \$ contract are quoting at Rs 44.00 & Rs 45.00 respectively. Suppose after 3 months company closes out its position futures are quoting at Rs 44.50 and spot rate is also quoting at 44.50. You are required to calculate effective realization for company while selling receivable. Also calculate how company has been benefitted by using the future option.

Solution:

The company can hedge position by selling future contracts as it will receive amount from outside.

$$\text{Number of Contracts} = \frac{\$4,00,000}{\$1,000} = 400 \text{ contracts}$$

$$\text{Gain by trading in futures} = (45 - 44.50) 4,00,000 = 2,00,000$$

$$\text{Net Inflow after after 3 months} = 44.50 \times 4,00,000 + 2,00,000 = 1,80,00,000$$

$$\text{Effective Price realization} = \frac{\$1,80,00,000}{\$4,00,000} = 45 \text{ Per US\$}$$

Question 44

Gibraltar Limited has imported 5000 bottles of shampoo at landed cost in Mumbai, of US \$ 20 each. The company has the choice for paying for the goods immediately or in 3 months' time. It has a clean overdraft limit where 14% p.a. rate of interest is charged.

Calculate which of the following method would be cheaper to Gibraltar Limited.

- (i) Pay in 3 months' time with interest @ 10% p.a. and cover risk forward for 3 months.
- (ii) Settle now at a current spot rate and pay interest of the overdraft for 3 months.

The rates are as follows:

Mumbai /\$ spot	:	Rs 60.25-60.55
3 months swap points	:	35/25

Solution:**Option-I**

$$\$20 \times 5000 = \$ 1,00,000$$

$$\text{Repayment in 3 months time} = \$1,00,000 \times (1 + 0.10/4) = \$ 1,02,500$$

$$\text{3-months outright forward rate} = \text{Rs } 59.90/ \text{ } 60.30$$

$$\text{Repayment obligation in } (\$1,02,500 \times 60.30) = 61,80,750$$

Option - II

$$\text{Overdraft } (\$1,00,000 \times 60.55) \quad 60,55,000$$

$$\text{Interest on Overdraft } (60,55,000 \times 0.14/4) \quad \underline{2,11,925}$$

$$\underline{62,66,925}$$

Option I should be preferred as it has lower outflow.

Question 45

An American firm is under obligation to pay interests of Can\$ 1010000 and Can\$ 705000 on 31st July and 30th September respectively. The Firm is risk averse and its policy is to hedge the risks involved in all foreign currency transactions. The Finance Manager of the firm is thinking of hedging the risk considering two methods i.e. fixed forward or option contracts.

It is now June 30. Following quotations regarding rates of exchange, US\$ per Can\$, from the firm's bank were obtained:

Spot	1 Month Forward	3 Months Forward
0.9284-0.9288	0.9501	0.9556

Price for a Can\$ option on a U.S. stock exchange (cents per Can\$, payable on purchase of the option, contract size Can\$ 50000) are as follows:

Strike Price (US\$/Can\$)	Calls		Puts	
	July	Sept.	July	Sept.
0.93	1.56	2.56	0.88	1.75
0.94	1.02	NA	NA	NA
0.95	0.65	1.64	1.92	2.34

According to the suggestion of finance manager if options are to be used, one month option should be bought at a strike price of 94 cents and three month option at a strike price of 95 cents and for the remainder uncovered by the options the firm would bear the risk itself. For this, it would use forward rate as the best estimate of spot. Transaction costs are ignored.

Recommend, which of the above two methods would be appropriate for the American firm to hedge its foreign exchange risk on the two interest payments.

Solution:

Forward Market Cover

Hedge the risk by buying Can\$ in 1 and 3 months time will be:

July -	1010000 X 0.9501 = US \$ 959601
Sept. -	705000 X 0.9556 = US \$ 673698

Option Contracts

July Payment	= 1010000/ 50,000 = 20.20
September Payment	= 705000/ 50,000 = 14.10

Company would like to take out 20 contracts for July and 14 contracts for September respectively. Therefore costs, if the options were exercised, will be:

	July		Sept.	
	Can \$	US \$	Can \$	US \$
Covered by Contracts	1000000	940000	700000	665000
Balance bought at spot rate	10000	9501	5000	4778
<u>Option Costs:</u> Can \$ 50000 x 20 x 0.0102		10200	---	
Can \$ 50000 x 14 x 0.0164	---			11480
Total cost in US \$ of using Option Contract		959701		681258

Decision: As the firm is stated as risk averse and the money due to be paid is certain, a fixed forward contract, being the cheapest alternative in the both the cases, would be recommended.

Question 46

Zaz plc, a UK Company is in the process of negotiating an order amounting €2.8 million with a large German retailer on 6 month's credit. If successful, this will be first time for Zaz has exported goods into the highly competitive German Market. The Zaz is considering following 3 alternatives for managing the transaction risk before the order is finalized.

- (a) Mr. Peter the Marketing head has suggested that in order to remove transaction risk completely Zaz should invoice the German firm in Sterling using the current €/£ average spot rate to calculate the invoice amount.
- (b) Mr. Wilson, CE is doubtful about Mr. Peter's proposal and suggested an alternative of invoicing the German firm in € and using a forward exchange contract to hedge the transaction risk.
- (c) Ms. Karen, CFO is agreed with the proposal of Mr. Wilson to invoice the German first in €, but she is of opinion that Zaz should use sufficient 6-month Sterling Future contracts (to the nearest whole number) to hedge the transaction risk.

Following data is available

Spot Rate	€ 1.1960 - €1.1970/£
6-months forward points	0.60 - 0.55 Euro Cents.
6-month Future contract is currently trading at	€ 1.1943/£
6-month Future contract size is	£62,500
After 6-month Spot rate and future rate	€ 1.1873/£

You are required to

- (a) Calculate (to the nearest £) the £ receipt for Zaz plc, under each of 3 above proposals.
- (b) In your opinion which alternative you consider to be most appropriate.

Solution:

(i) Receipt under three proposals

(a) Proposal of Mr. Peter

$$\text{Invoicing in £ will produce} = \frac{\text{£ 2.8million}}{1.1965} = \text{£ 2.340 million}$$

(b) Proposal of Mr. Wilson

$$\text{Forward Rate} = \text{€ 1.1970} - 0.0055 = 1.1915$$

$$\text{Using Forward Market hedge Sterling receipt would be } \frac{\text{£ 2.8million}}{1.1915} = \text{£ 2.35 million}$$

(c) Proposal of Ms. Karen

The equivalent sterling of the order placed based on future price (€1.1943)

$$= \frac{\text{£ 2.8million}}{1.1943} = \text{£ 2,344,470 (rounded off)}$$

$$\text{Number of Contracts} = \frac{\text{£ 2,344,470}}{62,500} = 37 \text{ Contracts (to the nearest whole number)}$$

Thus, € amount hedged by future contract will be = $37 \times \text{£ 62,500} = \text{£ 23,12,500}$

Buy Future at € 1.1943

Sell Future at € 1.1873

€ 0.0070

Total loss on Future Contracts = $37 \times \text{£ 62,500} \times \text{€ 0.0070} = \text{€ 16,188}$

After 6 months	
Amount Received	€ 28,00,000
Less: Loss on Future Contracts	€ 16,188
	<u>€ 27,83,812</u>

Sterling Receipts

On sale of € at spot = $\frac{£ 27,83,812}{1.1873} = £ 2.3446 \text{ million}$

- (ii) Proposal of option (b) is preferable because the option (a) & (c) produces least receipts. Further, in case of proposal (a) there must be a doubt as to whether this would be acceptable to German firm as it is described as a competitive market and Zaz is moving into it first time.

Question 47

Columbus Surgicals Inc. is based in US, has recently imported surgical raw materials from 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

Three 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

£ Exposure

Since Columbus has a £ receipt (£ 138,000) and payment of (£ 480,000) maturing at the same time i.e. 3 months, it can match them against each other leaving a net liability of £ 342,000 to be hedged.

- (i) Forward market hedge

Buy 3 months' forward contract accordingly, amount payable after 3 months will be
 $£ 342,000 / 0.9520 = US\$ 359,244$

- (ii) Money market hedge

To pay £ after 3 months' Columbus shall requires to borrow in US\$ and translate to £ and then deposit in £.

For payment of £ 342,000 in 3 months (@2.5% interest) amount required to be deposited now
 $(£ 342,000 \div 1.025) = £ 333,658$

With spot rate of 0.9830 the US\$ loan needed will be = US\$ 339,429
 Loan repayable after 3 months (@3.25% interest) will be = US\$ 350,460

In this case the money market hedge is a cheaper option.

€ Receipt

Amount to be hedged = € 590,000

- (i) Forward market hedge
 Sell 4 months' forward contract accordingly, amount receivable after 4 months will be (€ 590,000 x 1.9510)
 = US\$ 1,151,090
- (ii) Money market hedge
 For money market hedge Columbus shall borrow in € and then translate to US\$ and deposit in US\$
 For receipt of € 590,000 in 4 months (@ 5.33% interest) amount required to be borrowed now (€590,000 ÷ 1.0533)
 = € 560,144
 With spot rate of 1.8890 the US\$ deposit will be = US\$ 1,058,113
 Deposit amount will increase over 4 months (@3.83% interest) will be = US\$ 1,098,639

In this case, more will be received in US\$ under the forward hedge.

Question 48

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	4.5%	5%
180 days borrowing rate	5%	5.5%

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.?

(a) A forward contract; (b) A money market hedge; (c) An option contract; (d) No hedging.

Show calculations in each case

Solution:

(a) Forward contract: Dollar needed in 180 days = £3,00,000 × \$ 1.96 = \$5,88,000/-

(b) Money market hedge: Borrow \$, convert to £, invest £, repay \$ loan in 180 days

Amount in £ to be invested = 3,00,000/1.045 = £ 2,87,081

Amount of \$ needed to convert into £ = 2,87,081 × 2 = \$ 5,74,162

Interest and principal on \$ loan after 180 days = \$5,74,162 × 1.055 = \$ 6,05,741

(c) Call option:

Expected Spot rate in 180 days	Prem./ unit	Exercise Option	Total price per unit	Total price for £3,00,000 x i	Prob. Pi	pixi
1.91	0.04	No	1.95	5,85,000	0.25	1,46,250
1.95	0.04	No	1.99	5,97,000	0.60	3,58,200
2.05	0.04	Yes	2.01*	6,03,000	0.15	90,450
						5,94,900
Add: Interest on Premium @ 5.5% (12,000 x 5.5%)						660
						5,95,560

* (\$1.97 + \$0.04)

(d) No hedge option:

Expected Future spot rate	Dollar needed Xi	Prob. Pi	Pi xi
1.91	5,73,000	0.25	1,43,250
1.95	5,85,000	0.60	3,51,000
2.05	6,15,000	0.15	92,250
			5,86,500

The probability distribution of outcomes for no hedge strategy appears to be most preferable because least number of \$ are needed under this option to arrange £3,00,000.

Question 49

A Ltd. of U.K. has imported some chemical worth of USD 3,64,897 from one of the U.S. suppliers. The amount is payable in six months time. The relevant spot and forward rates are:

Spot rate USD 1.5617-1.5673

6 months' forward rate USD 1.5455 -1.5609

Borrowing rates in U.K. and U.S. are 7% and 6% respectively and 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: (i) Forward cover (ii) Money market cover, and (iii) Currency option
Which of the alternatives is preferable by the company?

Solution:

In the given case, the exchange rates are indirect. These can be converted into direct rates as follows:

Spot rate

$$\text{GBP} = \frac{1}{\text{USD } 1.5617} \text{ to } \frac{1}{\text{USD } 1.5673}$$

$$\text{USD} = \text{GBP } 0.64033 - \text{GBP } 0.63804$$

6 months' forward rate

$$\text{GBP} = \frac{1}{\text{USD } 1.5455} \text{ to } \frac{1}{\text{USD } 1.5609}$$

$$\text{USD} = \text{GBP } 0.64704 - \text{GBP } 0.64066$$

Payoff in 3 alternatives**i. Forward Cover**

Amount payable USD 3,64,897

Forward rate GBP 0.64704

Payable in GBP GBP 2,36,103

ii. Money market Cover

Amount payable USD 3,64,897

PV @ 4.5% for 6 months i.e. $1/1.0225 = 0.9779951$ USD 3,56,867

Spot rate purchase GBP 0.64033

Borrow GBP $3,56,867 \times 0.64033$ GBP 2,28,512

Interest for 6 months @ 7 % 7,998

-

Payable after 6 months GBP 2,36,510

iii. Currency options

Amount payable USD 3,64,897

Unit in Options contract GBP 12,500

Value in USD at strike rate of 1.70 (GBP 12,500 $\times$ 1.70) USD 21,250

Number of contracts USD 3,64,897 / USD 21,250 17.17

Exposure covered USD 21,250 $\times$ 17 USD 3,61,250

Exposure to be covered by Forward (USD 3,64,897 - USD 3,61,250) USD 3,647

Options premium 17 $\times$ GBP 12,500 $\times$ 0.096 USD 20,400

Premium in GBP (USD 20,400 $\times$ 0.64033) GBP 13,063

Total payment in currency option

Payment under option (17 $\times$ 12,500) GBP 2,12,500

Premium payable GBP 13,063

Payment for forward cover (USD 3,647 $\times$ 0.64704) GBP 2,360

GBP 2,27,923

Thus total payment in:

(i) Forward Cover	2,36,103 GBP
(ii) Money Market	2,36,510 GBP
(iii) Currency Option	2,27,923 GBP

The company should take currency option for hedging the risk.

Note: Even interest on Option Premium can also be considered in the above solution.

Question 50

Nitrogen Ltd, a UK company is in the process of negotiating an order amounting to €4 million with a large German retailer on 6 months credit. If successful, this will be the first time that Nitrogen Ltd has exported goods into the highly competitive German market. The following three alternatives are being considered for managing the transaction risk before the order is finalized.

- Invoice the German firm in Sterling using the current exchange rate to calculate the invoice amount.
- Alternative of invoicing the German firm in € and using a forward foreign exchange contract to hedge the transaction risk.
- Invoice the German first in € and use sufficient 6 months sterling future contracts (to the nearly whole number) to hedge the transaction risk.

Following data is available:

Spot Rate	€ 1.1750 - €1.1770/£
6 months forward premium	0.55-0.60 Euro Cents
6 months future contract is currently trading at	€ 1.1760/£
6 months future contract size is	£ 62500
Spot rate and 6 months future rate	€ 1.1785/£

Required:

- Calculate to the nearest £ the receipt for Nitrogen Ltd, under each of the three proposals.
- In your opinion, which alternative would you consider to be the most appropriate and the reason thereof.

Solution:

(i) Receipt under three proposals

- Invoicing in Sterling
Invoicing in £ will produce = € 4 million = £3398471
- Use of Forward Contract
Forward Rate = €1.1770 + 0.0060 = 1.1830
Using Forward Market hedge Sterling receipt would be € 4 million/1.1830 = £ 3381234
- Use of Future Contract
The equivalent sterling of the order placed based on future price (€1.1760)
= € 4.00 million/1.1760 = £ 3401360

Number of Contracts = £3401360/62,500 = 54 Contracts (to the nearest whole number)

Thus, € amount hedged by future contract will be = 54£62,500 = £3375000 ×

Buy Future at	€1.1760
Sell Future at	<u>€1.1785</u>
	<u>€0.0025</u>

Total profit on Future Contracts = $54 \times \text{£}62,500 \times \text{€}0.0025 = \text{€}8438$

After 6 months

Amount Received € 4000000

Add: Profit on Future Contracts € 8438

€ 4008438

Sterling Receipts

On sale of € at spot = $\text{€}4008438 / 1.1785 = \text{€}3401305$

(ii) Proposal of option (c) is preferable because the option (a) & (b) produces least receipts.

Question 51

Sun Ltd. is planning to import equipment from Japan at a cost of 3,400 lakh yen. The company may avail loans at 18 percent per annum with quarterly rests with which it can import the equipment. The company has also an offer from Osaka branch of an India based bank extending credit of 180 days at 2 percent per annum against opening of an irrecoverable letter of credit.

Additional information:

Present exchange rate 100 = 340 yen

180 day's forward rate 100 = 345 yen

Commission charges for letter of credit at 2 per cent per 12 months.

Advice the company whether the offer from the foreign branch should be accepted.

Solution:

Option I (To finance the purchases by availing loan at 18% per annum):

Cost of equipment	in lakhs
3400 lakh yen at 100 = 340 yen	1,000.00
Add: Interest at 4.5% I Quarter	45.00
Add: Interest at 4.5% II Quarter (on 1045 lakhs)	<u>47.03</u>
Total outflow in Rupees	<u>1,092.03</u>
Alternatively, interest may also be calculated on compounded basis, i.e., $1000 \times [1.045]^2$	1092.03

Option II (To accept the offer from foreign branch):

Cost of letter of credit	
At 1 % on 3400 lakhs yen at 100 = 340 yen	10.00 lakhs
Add: Interest for 2 Quarters	0.90 lakhs
(A)	10.90 lakhs
Payment at the end of 180 days: Cost	3400.00 lakhs yen
Interest at 2% p.a. $[3400 \times 2/100 \times 180/365]$	33.53 lakhs yen
	3433.53 lakhs yen
Conversion at 100 = 345 yen $[3433.53 / 345 \times 100]$ (B)	995.23 lakhs
Total Cost: (A) + (B)	1006.13 lakhs

Advise: Option 2 is cheaper by $(1092.03 - 1006.13)$ lakh = 85.90 lakh. Hence, the offer may be accepted.

Question 52

NP and Co. has imported goods for US \$ 7,00,000. The amount is payable after three months. The company has also exported goods for US \$ 4,50,000 and this amount is receivable in two months. For receivable amount a forward contract is already taken at Rs 48.90.

The market rates for Rupee and Dollar are as under:

Spot	48.50/70
Two months	48.25/30
Three months	48.40/45

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) To cover payable and receivable in forward Market

Amount payable after 3 months	\$7,00,000
Forward Rate	₹48.45
Thus Payable Amount (₹) (A)	₹ 3,39,15,000
Amount receivable after 2 months	\$ 4,50,000
Forward Rate	₹ 48.90
Thus Receivable Amount (₹) (B)	₹ 2,20,05,000
Interest @ 12% p.a. for 1 month (C)	<u>₹ 2,20,050</u>
Ne Amount Payable in(₹) (A)-(B)-(C)	<u>₹ 1,16,89,950</u>

(B) Assuming that since the forward contract for receivable was already booked it shall be cancelled if we lag the receivables. Accordingly, any profit/ loss on cancellation of contract shall also be calculated and shall be adjusted as follows:

Amount Payable (\$)	\$7,00,000
Amount receivable after 3 months	\$ 4,50,000
Net Amount payable	\$2,50,000
Applicable Rate	48.45
Amount payable in () (A)	1,21,12,500
Profit on cancellation of Forward cost	
(48.90 - 48.30) × 4,50,000 (B)	2,70,000
Thus, net amount payable in () (A) + (B)	1,18,42,500

Since net payable amount is least in case of first option, hence the company should cover payable and receivables in forward market.

Note: Alternatively, students can also consider the interest element on the Profit earned due cancellation of Forward Contract.

Question 53

A customer with whom the Bank had entered into 3 months' forward purchase contract for Swiss Francs 10,000 at the rate of Rs 27.25 comes to the bank after 2 months and requests cancellation of the contract. On this date, the rates, prevailing, are:

Spot	CHF 1 =	27.30	27.35
One month forward		27.45	27.52

What is the loss/gain to the customer on cancellation?

Solution:

The contract would be cancelled at the one-month forward sale rate of 27.52.

Francs bought from customer under original forward contract at:	27.25
It is sold to him on cancellation at:	<u>27.52</u>
Net amount payable by customer per Franc	<u>0.27</u>

At Rs 0.27 per Franc, exchange difference for CHF 10,000 is 2,700.

Loss to the Customer:

Exchange difference (Loss)	2,700

Note: The exchange commission and other service charges are ignored.

Question 54

A bank enters into a forward purchase TT covering an export bill for Swiss Francs 1,00,000 at 32.4000 due 25th April and covered itself for same delivery in the local interbank market at 32.4200. However, on 25th March, exporter sought for cancellation of the contract as the tenor of the bill is changed.

In Singapore market, Swiss Francs were quoted against dollars as under:

Spot	USD 1 = Sw. Fcs. 1.5076/1.5120
One month forward	1.5150/ 1.5160
Two months forward	1.5250 / 1.5270
Three months forward	1.5415/ 1.5445

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:

First the contract will be cancelled at TT Selling Rate

USD/ Rupee Spot Selling Rate	49.4455

Add: Premium for April	<u>0.4200</u>

49.8655

Add: Exchange Margin @ 0.10%	<u>0.04987</u>

49.91537 Or 49.9154

USD/ Sw. Fcs One Month Buying Rate	Sw. Fcs. 1.5150
Sw. Fcs. Spot Selling Rate (49.91537/1.5150)	32.9474
Rounded Off	32.9475
Bank buys Sw. Fcs. Under original contract	32.4000
Bank Sells under Cancellation	<u>32.9475</u>
Difference payable by customer	<u>00.5475</u>
Exchange difference of Sw. Fcs. 1,00,000 payable by customer	54,750 (Sw. Fcs. 1,00,000 x 0.5475)

Question 55

Your forex dealer had entered into a cross currency deal and had sold US \$ 10,00,000 against EURO at US \$ 1 = EURO 1.4400 for spot delivery.

However, later during the day, the market became volatile and the dealer in compliance with his management's guidelines had to square - up the position when the quotations were:

Spot US \$ 1	INR 31.4300/4500
1 month margin	25/20
2 months margin	45/35

Spot US \$ 1	EURO 1.4400/4450
1 month forward	1.4425/4490
2 months forward	1.4460/4530

What will be the gain or loss in the transaction?

Solution:

The amount of EURO bought by selling US\$

US\$ 10,00,000 * EURO 1.4400 = EURO 14,40,000

The amount of EURO sold for buying USD 10,00,000 * 1.4450 = EURO 14,45,000

Net Loss in the Transaction = EURO 5,000

To acquire EURO 5,000 from the market @

(a) USD 1 = EURO 1.4400 &

(b) USD1 = INR 31.4500

Cross Currency buying rate of EUR/INR is 31.4500 / 1.440 i.e. 21.8403

Loss in the Transaction 21.8403 * 5000 = 1,09,201.50

Alternatively, if delivery to be affected then computation of loss shall be as follows:

EURO to be surrendered to acquire \$ 10,00,000 = EURO 14,45,000

EURO to be received after selling \$ 10,00,000 = EURO 14,40,000

Loss = EURO 5,000

To acquire EURO 5,000 from market @

US \$ 1 = EURO 1.4400

US \$ 1 = INR 31.45

Cross Currency = 31.45/1.440 = 21.8403

Loss in Transaction (21.8403 x EURO 5,000) = 1,09,201.50

Question 56

You have following quotes from Bank A and Bank B:

	Bank A	Bank B
SPOT	USD/CHF 1.4650/55	USD/CHF 1.4653/60
3 months	5/10	
6 months	10/15	
SPOT	GBP/USD 1.7645/60	GBP/USD 1.7640/50
3 months	25/20	
6 months	35/25	

Calculate :

- (i) How much minimum CHF amount you have to pay for 1 Million GBP spot?
- (ii) Considering the quotes from Bank A only, for GBP/CHF what are the Implied Swap points for Spot over 3 months?

Solution:

- (i) To Buy 1 Million GBP Spot against CHF

1. First to Buy USD against CHF at the cheaper rate i.e. from Bank A. 1 USD = CHF 1.4655
2. Then to Buy GBP against USD at a cheaper rate i.e. from Bank B 1 GBP = USD 1.7650

By applying chain rule Buying rate would be

$$1 \text{ GBP} = 1.7650 * 1.4655 \text{ CHF}$$

$$1 \text{ GBP} = \text{CHF } 2.5866$$

Amount payable CHF 2.5866 Million or CHF 25,86,600

- (ii) Spot rate Bid rate GBP 1 = CHF 1.4650 * 1.7645 = CHF 2.5850
Offer rate GBP 1 = CHF 1.4655 * 1.7660 = CHF 2.5881

GBP / USD 3 months swap points are at discount

Outright 3 Months forward rate GBP 1 = USD 1.7620 / 1.7640

USD / CHF 3 months swap points are at premium

Outright 3 Months forward rate USD 1 = CHF 1.4655 / 1.4665

Hence

Outright 3 Months forward rate GBP 1 = CHF 2.5822 / 2.5869

Spot rate GBP 1 = CHF 2.5850 / 2.5881

Therefore 3-month swap points are at discount of 28/12.

Question 57

M/s Omega Electronics Ltd. exports air conditioners to Germany by importing all the components from Singapore. The company is exporting 2,400 units at a price of Euro 500 per unit. The cost of imported components is S\$ 800 per unit. The fixed cost and other variables cost per unit are Rs 1,000 and Rs 1,500 respectively. The cash flows in Foreign currencies are due in six months. The current exchange rates are as follows:

Rs /Euro	51.50/55
Rs /S\$	27.20/25

After six months the exchange rates turn out as follows:

Rs /Euro	52.00/05
Rs /S\$	27.70/75

(A) You are required to calculate loss/gain due to transaction exposure.

(B) Based on the following additional information calculate the loss/gain due to transaction and operating exposure if the contracted price of air conditioners is 25,000 :

(i) the current exchange rate changes to

Rs/Euro	51.75/80
Rs/S\$	27.10/15

(ii) Price elasticity of demand is estimated to be 1.5

(iii) Payments and receipts are to be settled at the end of six months.

Solution:

(i) **Profit at current exchange rates**

$$2400 [€ 500 \times 51.50 - (\text{S\$ } 800 \times 27.25 + 1,000 + 1,500)]$$

$$2400 [25,750 - 24,300] = 34,80,000$$

Profit after change in exchange rates

$$2400 [€ 500 \times 52 - (\text{S\$ } 800 \times 27.75 + 1000 + 1500)]$$

$$2400 [26,000 - 24,700] = 31,20,000$$

LOSS DUE TO TRANSACTION EXPOSURE

$$34,80,000 - 31,20,000 = \text{Rs } 3,60,000$$

(ii) **Profit based on new exchange rates**

$$2400 [25,000 - (800 \times 27.15 + 1,000 + 1,500)]$$

$$2400 [25,000 - 24,220] = 18,72,000$$

Profit after change in exchange rates at the end of six months

$$2400 [25,000 - (800 \times 27.75 + 1,000 + 1,500)]$$

$$2400 [25,000 - 24,700] = 7,20,000$$

Decline in profit due to transaction exposure

$$18,72,000 - 7,20,000 = 11,52,000$$

Current price of each unit in = ₹ 25,000/₹51.50 = €485.44

Price after change in Exch. Rate = ₹25,000/₹51.75 = € 483.09

Change in Price due to change in Exch. Rate

€ 485.44 - € 483.09 = € 2.35 or (-) 0.48%

Price elasticity of demand = 1.5

Increase in demand due to fall in price $0.48 \times 1.5 = 0.72\%$

Size of increased order = $2400 \times 1.0072 = 2417$ units

Profit = $2417 [25,000 - (800 \times 27.75 + 1,000 + 1,500)]$

= $2417 [25,000 - 24,700] = 7,25,100$

Therefore, decrease in profit due to operating exposure

$18,72,000 - 7,25,100 = 11,46,900$

Alternatively, if it is assumed that Fixed Cost shall not be changed with change in units then answer will be as follows:

Fixed Cost = $2400 [1,000] = 24,00,000$

Profit = $2417 [25,000 - (800 \times 27.75 + 1,500)] - 24,00,000$

= $2417 (1,300) - 24,00,000 = 7,42,100$

Therefore, decrease in profit due to operating exposure $18,72,000 - 7,42,100 = 11,29,900$

Question 58

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
1month	15/18
2months	30/35
3months	80/85

London on Frankfurt

Spot	1.8260/90
1 month	60/55
2 months	95/90
3 months	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:**(i) If investment is made at London**

Convert US\$ 5,00,000 at Spot Rate (5,00,000/1.5390) = £ 3,24,886
 Add: £ Interest for 3 months on £ 324,886 @ 5% = £ 4,061
 = £ 3,28,947

Less: Amount Invested \$ 5,00,000
 Interest accrued thereon \$ 5,000
 = \$ 5,05,000

Equivalent amount of £ required to pay the above sum (\$ 5,05,000/1.5430*) = £ 3,27,285
 Arbitrage Profit = £ 1,662

(ii) If investment is made at New York

Gain \$ 5,00,000 (8% - 4%) × 3/12 = \$ 5,000
 Equivalent amount in £ 3 months (\$ 5,000/ 1.5475) = £ 3,231

(iii) If investment is made at Frankfurt

Convert US\$ 500,000 at Spot Rate (Cross Rate) 1.8260/1.5390 = € 1.1865
 Euro equivalent US\$ 500,000 = € 5,93,250
 Add: Interest for 3 months @ 3% = € 4,449
 = € 5,97,699
 3 month Forward Rate of selling € (1/1.8150) = £ 0.5510
 Sell € in Forward Market € 5,97,699 × £ 0.5510 = £ 3,29,332
 Less: Amount invested and interest thereon = £ 3,27,285
 Arbitrage Profit = £ 2,047

Since out of three options the maximum profit is in case investment is made in New York. Hence it should be opted. * Due to conservative outlook.

Question 59

Drilldip Inc. a US based company has won a contract in India for drilling oil field. The project will require an initial investment of 500 crore. The oil field along with equipments will be sold to Indian Government for 740 crore in one year time. Since the Indian Government will pay for the amount in Indian Rupee (₹) the company is worried about exposure due exchange rate volatility.

You are required to:

- Construct a swap that will help the Drilldip to reduce the exchange rate risk.
- Assuming that Indian Government offers a swap at spot rate which is 1US\$ = ₹ 50 in one year, then should the company should opt for this option or should it just do nothing. The spot rate after one year is expected to be 1US\$ = ₹ 54. Further you may also assume that the Drilldip can also take a US\$ loan at 8% p.a.

Solution:

(a) The following swap arrangement can be entered by Drilldip.

- Swap a US\$ loan today at an agreed rate with any party to obtain Indian Rupees (₹) to make initial investment.
- 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.

(b) With the swap

	Year 0 (Million US\$)	Year 1 (Million US\$)
Buy 500 crore at spot rate of 1US\$ = 50	(100.00)	----
Swap 500 crore back at agreed rate of 50	----	100.00
Sell 240 crore at 1US\$ = 54	----	44.44
Interest on US\$ loan @8% for one year	----	(8.00)
	(100.00)	136.44

Net result is a net receipt of US\$ 36.44 million.

Without the swap

	Year 0 (Million US\$)	Year 1 (Million US\$)
Buy 500 crore at spot rate of 1US\$ = 50	(100.00)	----
Sell 740 crore at 1US\$ = 54	----	137.04
Interest on US\$ loan @8% for one year	----	(8.00)
	(100.00)	129.04

Net result is a net receipt of US\$ 29.04 million.

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

Question 60

You as a dealer in foreign exchange have the following position in Swiss Francs on 31st October, 2009:

	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:

Exchange Position:

<i>Particulars</i>	<i>Purchase Sw. Fcs.</i>	<i>Sale Sw. Fcs.</i>
Opening Balance Overbought	50,000	
Bill on Zurich	80,000	
Forward Sales - TT		60,000
Cancellation of Forward Contract		30,000
TT Sales		75,000
Draft on Zurich cancelled	30,000	—
	1,60,000	1,65,000
Closing Balance Oversold	5,000	—
	1,65,000	1,65,000

Cash Position (Nostro A/c)

	Credit	Debit
Opening balance credit	1,00,000	—
TT sales	—	<u>75,000</u>
	1,00,000	75,000
Closing balance (credit)	—	<u>25,000</u>
	<u>1,00,000</u>	<u>1,00,000</u>

The Bank has to buy spot TT Sw. Fcs. 5,000 to increase the balance in Nostro account to Sw. Fcs. 30,000.

This would bring down the oversold position on Sw. Fcs. as Nil.

Since the bank requires an overbought position of Sw. Fcs. 10,000, it has to buy forward Sw. Fcs. 10,000.

Question 61

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	0.0150

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.

- (i) 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.
- (ii) Which method do you think is preferable from the parent company's point of view?

Solution:

Cash Balances:

(‘000)

Acting independently

	Capital	Interest	₹ in 30 days
India	-5,00,000	-2,666.67	-5,02,667
U.S.	12,500	15.63	5,76,757
U.K.	6,000	18.50	4,01,233
			4,75,323

Cash Balances:-

Immediate Cash pooling

India	-	- 5,00,000
U.S. =	$\frac{12,500}{0.0215}$	5,81,395
U.K.	$\frac{6,000}{0.0149}$	<u>4,02,685</u>
		<u>4,84,080</u>

Immediate cash pooling is preferable as it maximizes interest earnings

Note: If the company decides to invest pooled amount of ₹ 4,84,080/- @ 6.2% p.a. for 30 days an interest of ₹ 2,501/- will accrue.

Question 62

Suppose you are a treasurer of XYZ plc in the UK. XYZ have two overseas subsidiaries, one based in Amsterdam and one in Switzerland.

The Dutch subsidiary has surplus Euros in the amount of 725,000 which it does not need for the next three months but which will be needed at the end of that period (91 days).

Swiss subsidiary has surplus of Swiss Francs in amount of 998,077 that, again, it will need on day 91.

XYZ plc in UK has a net balance of £ 75,000 that is not needed for the foreseeable future.

Given the rates below, what is the advantage of swapping Euros and Swiss Francs into Sterling?

Spot Rate (€)	£0.6858- 0.6869
91 day Pts	0.0037 0.0040
Spot Rate(£)	CHF 2.3295- 2.3326
91 day Pts	0.0242 0.0228

Interest rates for the Deposits

Amount of Currency	91 day Interest Rate % pa		
	£	€	CHF
0 - 100,000	1	$\frac{1}{4}$	0
100,001 - 500,000	2	$1\frac{1}{2}$	$\frac{1}{4}$
500,001 - 1,000,000	4	2	$\frac{1}{2}$
Over 1,000,000	5.375	3	1

Solution:

Individual Basis

	Interest	Amt. after 91 days	Conversion in £
Holland $€ 725,000 \times 0.02 \times 91/360 =$	€ 3,665.28	€ 728,665.28	£502,414.71 (728,665.28 $\times$ 0.6895)
Switzerland $CHF 998,077 \times 0.005 \times 91/360 =$	CHF 1,261.46	CHF 999,338.46	£432,651.51 (999,338.46 $\div$ 2.3098)
UK $£ 75,000 \times 0.01 \times 91/360 =$	£ 189.58	£ 75,189.58	£ 75,189.58
Total GBP at 91 days			£ 1,010,255.80

Swap to Sterling

Sell € 7,25,000 (Spot at 0.6858) buy £	£ 4,97,205.00
Sell CHF 9,98,077(Spot at 2.3326) buy £	£ 4,27,881.76
Independent GBP amount	£ 75,000.00
	£ 1,000,086.76
Interest (£ 1,000,086.76 $\times$ 0.05375 $\times$ 91/360)	£ 13,587.98
Total GBP at 91 days	£ 1,013,674.74
Less: Total GBP at 91 days as per individual basis	£ 1,010,255.80
Net Gain	£ 3,418.94

Question 63**[RTP NOV 20]**

Citi Bank quotes JPY/ USD 105.00 -106.50 and Honk Kong Bank quotes USD / JPY 0.0090- 0.0093.

- Are these quotes identical if not then how they are different?
- Is there a possibility of arbitrage?
- If there is an arbitrage opportunity, then show how would you make profit from the given quotation in both cases if you are having JPY 1,00,000 or US\$ 1,000.

Solution:

a) No, while Citi Bank's quote is a Direct Quote for JPY (i.e. for Japan) the Hong Kong Bank quote is a Direct Quote for USD (i.e. for USA).

b) Since Citi Bank quote imply USD/ JPY 0.0094 - 0.0095 and both rates exceed those offered by Hong Kong Bank, there is an arbitrage opportunity. Alternatively, it can also be said that Hong Kong Bank quote imply JPY / USD 107.53 - 111.11 and both rates exceed quote by Citi Bank, there is an arbitrage opportunity.

c) Let us how arbitrage profit can be made.

(i)	Covert US \$ 1,000 into JPY by buying from Hong Kong Bank Sell these JPY to Citi Bank at JPY / USD 106.50	JPY 1,07,530
	and convert in US \$	US \$ 1009.67
	Thus, arbitrage gain (US \$ 1009.67 - US \$ 1000.00)	US \$ 9.67
(ii)	Covert JPY 1,00,000 into USD by buying from Citi Bank at JPY/ USD 106.50	JPY 1,07,530
	Sell these US \$ to Hong Kong Bank at	US \$ 938.97
	JPY/ USD 107.53 and convert in US \$	JPY 100967.44
	Thus, arbitrage gain (JPY 1,00,967.44 - JPY 1,00,000)	JPY 967.44

Question 64**[MTP APRIL 21]**

On 1st February 2020, XYZ Ltd. a laptop manufacturer imported a particular type of Memory Chips from SKH Semiconductor of South Korea. The payment is due in one month from the date of Invoice, amounting to 1190 Million South Korean Won (SKW). Following Spot Exchange Rates (1st February) are quoted in two different markets:

USD/ INR	75.00/ 75.50	in Mumbai
USD/ SKW	1190.00/ 1190.75	in New York

Since hedging of Foreign Exchange Risk was part of company's strategic policy and no contract for hedging in SKW was available at any in - shore market, it approached an off - shore Non - Deliverable Forward (NDF) Market for hedging the same risk.

In NDF Market a dealer quoted one - month USD/ SKW at 1190.00/1190.50 for notional amount of USD 100,000 to be settled at reference rate declared by Bank of Korea.

After 1 month (1st March 2020) the dealer agreed for SKW 1185 / USD as rate for settlement and on the same day the Spot Rates in the above markets were as follows:

USD/ INR	75.50/ 75.75	in Mumbai
USD/ SKW	1188.00/ 1188.50	in New York

Analyze the position of company under each of the following cases, comparing with Spot Position of 1st February (i) Do Nothing. (ii) Opting for NDF Contract.

Note: Both Rs. / SKW Rate and final payment (to be computed in Rs. Lakh) to be rounded off upto 4 decimal points.

Solution:

(i) Do Nothing

We shall compute the cross rates in Spot Market on both days and shall compare the amount payable in INR on these two days.

On 1st February 2020

Rupee - Dollar selling rate = Rs. 75.50

Dollar - SKW = SKW 1190.00

Rupee - SKW cross rate = Rs. 75.50 / 1190.00 = Rs. 0.0634

Amount payable to Importer as per above rate (1190 Million x Rs. 0.0634) Rs. 754.4600 Lakh

On 1st March 2020

Rupee - Dollar selling rate = Rs. 75.75

Dollar - SKW = SKW 1188.00

Rupee - SKW cross rate = Rs. 75.75 / 1188.00 = Rs. 0.0638

Amount payable to Importer as per above rate (1190 Million x Rs. 0.0638) Rs. 759.2200 Lakh

Thus, Exchange Rate Loss = (Rs. 759.2200 Lakh - Rs. 754.4600 Lakh) Rs. 4.7600 Lakh

(ii) Hedging in NDF

Since company needs SKW after one month it will take long position in SKW at quoted rate of SKW 1190 / USD and after one-month it will reverse its position at fixing rate of SKW 1187 / USD. The profit / loss position will be as follows:

Buy SKW 1190 Million and sell USD (1190 Million / 1190)	USD 1,000,000
Sell SKW 1190 Million and buy USD at Fixing Rate (1190 Million / 1185)	USD 1,004,219
Profit	USD 4,219

Final Position

Amount Payable in Spot Market (as computed earlier)	Rs. 759.2200 Lakh
Less: Profit form NDF Market USD 4219 x 75.50	Rs. 3.1853 Lakh
	Rs. 756.0347 Lakh

Thus, Exchange Rate Loss = (Rs. 756.0347 Lakh - Rs. 754.4600 Lakh) Rs. 1.5747 Lakh

Decision: Since Exchange Loss is less in case of NDF same can be opted for.

Question 65**[NOV 18/MTP MARCH 21]**

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%

Note: For the purpose of calculation you can take the units of dollar and rupee as 100 each.

Solution:

(i) If company borrows in \$ then outflow would be as follows:

Let company borrows \$ 100	\$ 100.00
Add: Interest for 6 months @ 5.5%	\$ 2.75
Amount Repayable after 6 months	<u>\$ 102.75</u>

Applicable 6 month forward rate	36.40
Amount of Cash outflow in Indian Rupees	₹ 3,740.10

If company borrows equivalent amount in Indian Rupee, then outflow would be as follows:

Equivalent ₹ amount ₹ 36.10 × 100	₹ 3,610.00
Add: Interest @11.50%	₹ 207.58
	<u>₹ 3817.58</u>

Since cash outflow is more in ₹ borrowing then borrowing should be made in \$.

Question 66**[NOV 20]**

ZX Ltd. has made purchases worth USD 80,000 on 1st May 2020 for which it has to make a payment on 1st November 2020. The present exchange rate is INR / USD 75. The company can purchase forward dollars at INR / USD 74. The company will have to make an upfront premium @ 1 per cent of the forward amount purchased. The cost of funds to ZX Ltd. is 10 per cent per annum.

The company can hedge its position with the following expected rate of USD in foreign exchange market on 1st May 2020:

	Exchange Rate	Probability
(i)	INR/USD 77	0.15
(ii)	INR/USD 71	0.25
(iii)	INR/USD 79	0.20
(iv)	INR/USD 74	0.40

You are required to advise the company for a suitable cover for risk.

Solution:

(i) If ZX Ltd. does not take forward (Unhedged Position):

$$\begin{aligned}\text{Expected Rate} &= ₹ 77 \times 0.15 + ₹ 71 \times 0.25 + ₹ 79 \times 0.20 + ₹ 74 \times 0.40 \\ &= ₹ 11.55 + ₹ 17.75 + ₹ 15.80 + ₹ 29.60 = ₹ 74.70\end{aligned}$$

$$\text{Expected Amount Payable} = \text{USD } 80,000 \times ₹ 74.70 = ₹ 59,76,000$$

(ii) If the ZX Ltd. hedge its position in the forward market:

Particulars	Amount (₹)
If company purchases US \$ 80,000 forward premium is $(80000 \times 74 \times 1\%)$	59,200
Interest on ₹ 59,200 for 6 months at 10%	2,960
Total hedging cost (a)	62,160
Amount to be paid for US \$ 80,000 @ ₹ 74.00 (b)	59,20,000
Total Cost (a) + (b)	59,82,160

Advise: Since cashflow is less in case of unhedged position company should opt for the same.

Question 67

[NOV 20]

ZX Ltd. has made purchases worth USD 80,000 on 1st May 2020 for which it has to make a payment 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:

The arbitrageur can proceed as stated below to realize arbitrage gains.

- (i) Buy € from US \$ 10,000 from Dealer A $(10,000 / 1.1539)$ € 8,666.26
- (ii) Convert these € to £ by selling to Dealer B $(€ 8,666.26 \times 0.9094)$ £ 7,881.09
- (iii) Convert £ to US\$ by selling to Dealer C $(£ 7,881.09 \times 1.2752)$ US\$ 10,049.97

There is net gain of US \$ 10,049.97 less US \$ 10,000 i.e. US \$ 49.97 or US \$ 50.00.

Question 68

[JAN 21]

M/s. Sky products Ltd., of Mumbai, an exporter of sea foods has submitted a 60 days bill for EUR 5,00,000 drawn under an irrevocable Letter of Credit for negotiation. The company has desired to keep 50% of the bill amount under the Exchange Earners Foreign Currency Account (EEFC). The rates for ₹ / USD and USD/EUR in inter-bank market are quoted as follows:

	₹ / USD	USD / EUR
Spot	67.8000 - 67.8100	1.0775 - 1.8000
1 month forward	10 / 11 Paise	0.20 / 0.25 Cents
2 months forward	21 / 22 Paise	0.40 / 0.45 Cents
3 months forward	32 / 33 Paise	0.70 / 0.75 Cents

Transit Period is 20 days. Interest on post shipment credit is 8 % p.a. Exchange Margin is 0.1%. Assume 365 days in a year.

You are required to calculate: (i) Exchange rate quoted to the company (ii) Cash inflow to the company (iii) Interest amount to be paid to bank by the company.

Solution:

(i) Transit and usance period is 80 days. It will be rounded off to the lower of months and @ months forward bid rate is to be taken

₹ / USD	₹ 67.8000
Add: Premium for 2 months	₹ 0.2100
	₹ 68.0100
Less: Exchange margin @ 0.1%	₹ 0.0680
Bid rate for USD	₹ 67.9420
USD / EUR	USD 1.0775
Add: Premium	USD 0.0040
	USD 1.0815
₹ / EUR Rate (67.942 × 1.0815)	₹ 73.4793
Amount of Export Bill	EUR 5,00,000
Less: EEFC	EUR 2,50,000
	EUR 2,50,000
Exchange Rate	₹ 73.4793

(ii) Cash Inflow	₹ 1,83,69,825
(iii) Interest for 80 days @ 8%	₹ 3,22,101

Question 69**[JULY 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	Annualised 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:

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 3months
\$	₹ 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

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 imports should be in £.

Question 70**[RTP MAY 22]**

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:

(i) Nominal rate of return to the US investor

Size of investment (\$)	20,00,000
Size of investment (₹) (\$ 20,00,000 × 42.50)	8,50,00,000
Sensex at To	3,256
No. of units of Sensex that can be purchased at To (₹ 8,50,00,000/3,256)	26,105
Sensex at T1	3,765
Sale of Sensex (26,105 × 3,765)	9,82,85,325
US\$ at T1	43.90
Equivalent Amount in US\$	22,38,846
Gain in US\$ [22,38,846 - 20,00,000]	2,38,846
Nominal rate to US investor	11.94%

(ii) Real Appreciation/Depreciation of Rupee

$$\text{Real exchange rate (Buying)} = \frac{43.85(1+0.05)}{(1+0.09)} = 42.24$$

$$\text{Real appreciation of ₹} = \frac{(42.5 - 42.24) \times 100}{42.5} = 0.61\%$$

(iii) Exchange rate if relevant purchasing power parity holds

$$\text{Buying rate} = \frac{42.5(1+0.09)}{(1+0.05)} = 44.12$$

$$\text{Selling rate} = \frac{42.60(1+0.09)}{(1+0.05)} = 44.22$$

$$\text{Exchange rate} = 44.12 / 44.22$$

(iv) Real return to Indian investor in Sensex:

$$\text{Nominal return} = \frac{(3,765 - 3,256) \times 100}{3,256} = 15.63\%$$

$$\text{Real return} = \frac{(1.1563) - 1}{(1.09)} = 0.0608 \text{ or } 6.08\%$$

Question 71**[RTP MAY 22/MTP OCT 22]**

Mr. Mammen, an Indian investor invests in a listed bond in USA. If the price of the bond at the beginning of the year is USD 100 and it is USD 103 at the end of the year. The coupon rate is 3% payable annually. CALCULATE the return on investment in terms of home country currency if:

(i) USD is Flat.

(ii) USD appreciates during the year by 3%.

(iii) USD depreciates during the year by 3%.

(iv) Indian Rupee appreciates during the year by 5%.

(v) Will your answer differ if Mr. Mammen invests in the bond just before the interest payable?

Solution:**(i) If USD is flat**

$$\text{Return} = \frac{(\text{Price at end} - \text{Price at beginning}) + \text{Interest}}{\text{Price at beginning}} = \frac{(103 - 100) + 3}{100} = 6\%$$

(ii) If USD appreciates by 3%

$$(1 + 0.06)(1 + 0.03) - 1 = 1.06 \times 1.03 - 1 = 0.0918 \text{ i.e. } 9.18\%$$

(iii) If USD depreciates by 3%

$$(1 + 0.06)(1 - 0.03) - 1 = 1.06 \times 0.97 - 1 = 0.0282 \text{ i.e. } 2.82\%$$

(iv) If Indian Rupee is appreciated by 5%

$$(1 + 0.06)(1 - 0.05) - 1 = 1.06 \times 0.95 - 1 = 0.007 \text{ i.e. } 0.7\%.$$

(v) No, our answer will not differ even if Mr. Mammen invests in bond just before interest is payable.

Question 72

On 19th April following are the spot rates

Spot	EURO/USD 1.20000	USD/INR 44.8000

Following are the quotes of European Options:

Currency Pair	Call / Put	Strike Price	Premium	Expiry date
EUR / USD	Call	1.2000	\$ 0.035	July 19
EUR / USD	Put	1.2000	\$ 0.04	July 19
USD / INR	Call	44.8000	₹ 0.12	Sep. 19
USD / INR	Put	44.8000	₹ 0.04	Sep. 19

- A trader sells an at - the - money spot straddle expiring at three months (July 19). Calculate gain or loss if three months later the spot rate is EUR / USD 1.2900.
- Which strategy gives a profit to the dealer if five months later (Sep. 19) expected spot rate is USD / INR 45.00. Also calculate profit for a transaction USD 1.5 million.

Solution:

(i) Straddle is a portfolio of a CALL & a PUT option with identical Strike Price. A trader will be selling a Call option & a Put option with Strike Price of USD per EURO.

He will receive premium of \$ 0.035 + \$ 0.040 = \$ 0.075

At the expiry of three months Spot rate is 1.2900 i.e. higher than Strike Price. Hence, buyer of the Call option will exercise the option, but buyer of Put option will allow the option to lapse.

Profit or Loss to a trader is

Premium received	\$ 0.075
Loss on call option exercised 1.2900 - 1.2000	\$ 0.090
Net Loss of	\$ 0.015 per EURO

(ii) Strategy i.e. either Call or Put

Price is expected to go up then buy call option is beneficial.

On 19th April to pay Premium US \$ 15,00,000 @ ₹ 0.12 i.e.	INR 1,80,000
On 19th September exercise call option to gain US \$15,00,000 @ ₹ 0.20	INR 3,00,000
Net Gain or Profit	INR 1,20,000

Or Sell of Put option will be beneficial.

On 19th April to receive Premium US\$ 15,00,000 @ ₹ 0.04 i.e.	INR 60,000
On 19th September option buyer shall not exercise the option hence no loss	INR -
Net Gain or Profit	INR 60,000

Question 73 (Nov 24 Exam)

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. 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.

- (i) Construct a swap that will help the True Life Inc. to reduce the exchange rate risk.
- (ii) 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

- (i) The following swap arrangement can be entered by True Life Inc.
 - (1) 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 US\$ 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 US\$ 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.

Fate of Forward Contract

Question 74

A customer entered into a two month forward contract for Buying 10,000 \$ on 1.01.2022 with a Bank. The exchange rates in the interbank market on following dates were:

1.01.2022	Spot 1	1\$= 50/50.50
	2 Month Forward	0.50/0.60
1.02.2022	Spot	1\$= 50.10/50.65
	1 Month Forward	0.45/0.75
	2 Month Forward Spot	0.65/0.80
1.03.2022	Spot	1\$= 50.80/50.95
	1 Month Forward	0.25/0.50
3.03.2022	Spot	1\$= 50.85/51.00
	1 Month Forward	0.30/0.40
4.03.2022	Spot	1\$=50.90/51.05

Exchange Margin is 0.10%.

Interest Rate on Deposit (Inflow of Funds) is 8% and on Advance (Outflow of Funds) is 12%.

Rates rounded to 4 decimals in multiples of 0.0025. Assume 365 days in a year.

Calculate the consequence if:

- i. Customer wants the delivery on due date
- ii. Customer wants delivery on 1.02.2022
- iii. Customer cancels the contract on Due Date
- iv. Customer cancels the contract on 1.02.2022
- v. Customer cancels the contract on 3.03.2022
- vi. Customer does not approach the bank
- vii. Customer wants delivery on 3.03.2022
- viii. Customer extends the contract for one month on due date
- ix. Customer extends the contract for two months on 1.02.2022
- x. Customer extends the contract for one month on 3.03.2022

Solution:

- (i) Customer wants delivery on due date (i.e. 1.03.2022)

Contract with Customer			Contract with Inter-Bank Market		
Date	Transaction		Date	Transaction	
1.1.22	2 Month Forward Sale		1.1.22	2 Month Forward Buy	
	Spot(High)	1\$=50.50		Spot(High)	1\$=50.50
	(+) Prm. (High)	0.60		(+) Prm. (High)	0.60
		1\$= 51.10			1\$= 51.10
	(+) E.M. @0.10%	0.0511			
		1\$ 51.1511			
	Rounding Off	1\$51.1500			

Customer will take delivery by paying @ 1\$ = 51.15

(ii) Customer wants delivery on 1.02.2022(i.e. Early Delivery)

Dealer (Local Bank)

Contract with Customer			Contract with Inter-Bank Market		
Date	Transaction		Date	Transaction	
1.1.22	2 Month Forward Sale		1.1.22	2 Month Forward Buy	
	Spot(High)	1\$=50.50		Spot(High)	1\$=50.50
	(+) Prm. (High)	0.60		(+) Prm. (High)	0.60
		1\$= 51.10			1\$= 51.10
	(+) E.M. @0.10%	0.0511			
		1\$ 51.1511			
	Rounding Off	1\$51.1500			
1.2.22	Request for delivery		1.2.22	Spot Buy(High)	1\$=50.65
				1 Month Forward Sale	
				Spot (Low)	1\$=50.10
				(+)Prm.(Low)	0.45
					1\$=50.55

Calculation of Profit/loss

- Swap Loss

Spot Buy@ 1\$=50.65

1Month Forward Sale @ 1\$=50.55

Swap Loss@ 1\$=0.10

Total Swap Loss=0.10 × 10,000\$=1,000
- Interest

Inflow 1\$=51.15

Outflow 1\$=50.65

Net Inflow @ 1\$=0.5

Total Inflow=0.5 × 10,000\$=5,000

Interest Inflow=5,000 × 8% × 28/365=30.68
- Net Loss=1,000 - 30.68 = 969.32

After paying 969.32 customer can take delivery @1\$=51.15

(iii) Customer cancels the contract on Due Date (i.e 1.03.2022)

Dealer (Local Bank)

Contract with Customer			Contract with Inter-Bank Market		
Date	Transaction		Date	Transaction	
1.1.22	2 Month Forward Sale		1.1.22	2 Month Forward Buy	
	Spot(High)	1\$=50.50		Spot(High)	1\$=50.50
	(+) Prm. (High)	0.60		(+) Prm. (High)	0.60
		1\$= 51.10			1\$= 51.10
	(+) E.M. @0.10%	0.0511			
		1\$ 51.1511			
	Rounding Off	1\$51.1500			
1.3.22	Request for cancellation		1.3.22	Cancellation	
				Spot Sale(Low)@	1\$=50.80
				(-)E.M @ 0.10%	0.0508
					1\$=50.7492
				Rounding Off	1\$=50.7500

Calculation of Profit/Loss:

- Exchange Difference(Cancellation Loss)

2 Month Forward Sale @	1\$= 51.15
Spot Sale@	1\$= 50.75
Exchange Difference (Cancellation Loss) @	1\$=0.4

Total Exchange Difference(Cancellation Loss)=0.4 × 10,000\$= 4,000

- Net Loss =4,000
Customer have to pay 4,000 for Cancellation charges

(iv) Customer cancels the contract on 1.02.2022 (i.e Early Cancellation)

Dealer (Local Bank)

Contract with Customer			Contract with Inter-Bank Market		
Date	Transaction		Date	Transaction	
1.1.22	2 Month Forward Sale		1.1.22	2 Month Forward Buy	
	Spot(High)	1\$=50.50			
	(+) Prm. (High)	0.60		Spot(High)	1\$=50.50
		1\$= 51.10		(+) Prm. (High)	0.60
	(+) E.M. @0.10%	0.0511			1\$= 51.10
		1\$ 51.1511			
	Rounding Off	1\$51.1500			
1.2.22	Request for cancellation		1.2.22	Cancellation (1 Month Forward Sale)	
				Spot (Low)@	1\$=50.10
				(+)Prm.(Low)	0.45
					1\$=50.55
				(-)E.M @ 0.10%	0.0506
					1\$=50.4994
				Rounding Off	1\$=50.5000

Calculation of Profit/Loss:

- Exchange Difference (Cancellation Loss)

2 Month Forward Sale @	1\$=51.15
Spot Sale	1\$=50.50
Exchange Difference (Cancellation Loss) @	1\$=0.65

Total Exchange Difference (Cancellation Loss)=0.65 × \$10,000=6,500
- Net Loss =6,500
Customer have to pay 6,500 for Cancellation charges

(v) Customer cancels the contract on 3.03.2022 (i.e. Late Cancellation)

Dealer (Local Bank)

Contract with Customer			Contract with Inter-Bank Market		
Date	Transaction		Date	Transaction	
1.1.22	2 Month Forward Sale		1.1.22	2 Month Forward Buy	
	Spot(High)	1\$=50.50		Spot(High)	1\$=50.50
	(+) Prm. (High)	0.60		(+) Prm. (High)	0.60
		1\$= 51.10			1\$= 51.10
	(+) E.M. @0.10%	0.0511			
		1\$ 51.1511			
	Rounding Off	1\$51.1500			
1.3.22	Does not approach		1.3.22	Spot Sale (Low)	1\$=50.80
			1.3.22	Nearest Forward(1 Month)Open Buy	
				(+)Spot (High)	1\$=50.95
				(+)Prm.(High)	.50
					1\$=51.45
3.3.22	Request for Cancellation		3.3.22	Cancellation	
				Spot Sale(Low)@	1\$=50.85
				(-)E.M @ 0.10%	0.0509
					1\$=50.7991
				Rounding Off	1\$=50.8000

Calculation of Profit/loss

- Swap Loss**

Swap Sale@	1\$=50.80
Nearest Forward(1 Month) Open Buy@	1\$=51.45
Swap Loss@	1\$=0.65
Total Swap Loss=0.65x 10,000\$	=6,500
- Interest**

Inflow	1\$=50.80
Outflow	1\$=51.10
Net Inflow @	1\$=0.30
Total Inflow=0.30x 10,000\$	=3,000
Interest Inflow=3,000 x 12% x 2/365	=2
- Exchange Difference(Cancellation Loss)**

2 Month Forward Sale @	1\$=51.15
Spot Sale@	1\$=50.80
Exchange Difference (Cancellation Loss) @	1\$=0.35

Total Exchange Difference(Cancellation Loss)=0.35 x 10,000=3,500
- Net Loss=6,500 + 2 + 3,500 =10,002**

Customer have to pay 10,002 for Cancellation charges

(vi) Customer does not approach the bank (i.e Automatic Cancellation)

Dealer (Local Bank)

Contract with Customer			Contract with Inter-Bank Market		
Date	Transaction		Date	Transaction	
1.1.22	2 Month Forward Sale		1.1.22	2 Month Forward Buy	
	Spot(High)	1\$=50.50		Spot(High)	1\$=50.50
	(+) Prm. (High)	0.60		(+) Prm. (High)	0.60
		1\$= 51.10			1\$= 51.10
	(+) E.M. @0.10%	0.0511			
		1\$ 51.1511			
	Rounding Off	1\$51.1500			
1.3.22	Does not approach		1.3.22	Spot (Low)@	1\$=50.80
			1.3.22	Nearest Forward(1 Month)Open Buy	
				(+)Spot (High)	1\$=50.95
				(+)Prm.(High)	.50
					1\$=51.45
			4.3.22	Cancellation	
4.3.22	Does not approach			Spot Sale(Low)@	1\$=50.90
				(-)E.M @ 0.10%	0.0509
					1\$=50.8491
				Rounding Off	1\$=50.8500

Calculation of Profit/loss

- Swap Loss**

Swap Sale@	1\$=50.80
Nearest Forward(1 Month) Open Buy@	1\$=51.45
Swap Loss@	1\$=0.65
Total Swap Loss=0.65x 10,000\$	=6,500
- Interest**

Inflow	1\$=50.80
Outflow	1\$=51.10
Net Inflow @	1\$=0.30
Total Inflow=0.30x 10,000\$	=3,000
Interest Inflow=3,000 x 12% x 3/365	=3
- Exchange Difference(Cancellation Loss)**

2 Month Forward Sale @	1\$=51.15
Spot Sale@	1\$=50.85
Exchange Difference (Cancellation Loss) @	1\$=0.3
Total Exchange Difference(Cancellation Loss)= 0.3 x 10,000\$	=3000
- Net Loss = 6,500 + 3 + 3,000 =9,503**

Customer have to pay 9,503 for Cancellation charges

(vii) Customer wants delivery on 3.03.2022(i.e. Late Delivery)

Dealer (Local Bank)

Contract with Customer			Contract with Inter-Bank Market		
Date	Transaction		Date	Transaction	
1.1.22	2 Month Forward Sale		1.1.22	2 Month Forward Buy	
	Spot(High)	1\$=50.50		Spot(High)	1\$=50.50
	(+) Prm. (High)	0.60		(+) Prm. (High)	0.60
		1\$= 51.10			1\$= 51.10
	(+) E.M. @0.10%	0.0511			
		1\$ 51.1511			
	Rounding Off	1\$51.1500			
1.3.22	Does not approach		1.3.22	Spot (Low)@	1\$=50.80
			1.3.22	Nearest Forward(1 Month)Open Buy	
				(+)Spot (High)	1\$=50.95
				(+)Prm.(High)	.50
					1\$=51.45
3.3.22	Request for Cancellation		3.3.22	Cancellation	
3.3.22	New Contract for Spot Sale			Spot Sale(Low)@	1\$=50.85
	Spot(High)	1\$=51		(-)E.M @ 0.10%	0.0509
	(+) E.M @ 0.10%	0.0510			1\$=50.7991
		1\$=51.0510		Rounding Off	1\$=50.8000
	Rounding Off	1\$=51.0500			

Calculation of Profit/loss

- Swap Loss**

Swap Sale@	1\$=50.80
Nearest Forward (1 Month) Open Buy@	1\$=51.45
Swap Loss@	1\$=0.65
Total Swap Loss=0.65x 10,000\$	=6,500
- Interest**

Inflow	1\$=50.80
Outflow	1\$=51.10
Net Inflow @	1\$=0.30
Total Inflow=0.30x 10,000\$	=3,000
Interest Inflow=3,000 x 12% x 2/365	=2
- Exchange Difference(Cancellation Loss)**

2 Month Forward Sale @	1\$=51.15
Spot Sale@	1\$=50.80
Exchange Difference (Cancellation Loss) @	1\$=0.35
Total Exchange Difference(Cancellation Loss)=0.35 x 10,000	=3,500
- Net Loss = 6,500 + 2 + 3,500 = 10,002**

After paying 10,002 customer can take delivery@1\$ = 51.05

(viii) Customer extends the contract for one month on due date (i.e. 1.03.22)

Dealer (Local Bank)

Contract with Customer			Contract with Inter-Bank Market		
Date	Transaction		Date	Transaction	
1.1.22	2 Month Forward Sale		1.1.22	2 Month Forward Buy	
	Spot(High)	1\$=50.50		Spot(High)	1\$=50.50
	(+) Prm. (High)	0.60		(+) Prm. (High)	0.60
		1\$= 51.10			1\$= 51.10
	(+) E.M. @0.10%	0.0511			
		1\$ 51.1511			
	Rounding Off	1\$51.1500			
1.3.22	Request for Extension				
1.3.22	New Contract for 1 M Forward Sale		1.3.22	Cancellation	
	Spot(High)	1\$=50.95		Spot Sale(Low)@	1\$=50.80
	(+)Prm(High)	0.50		(-)E.M @ 0.10%	0.0508
		1\$=51.45			1\$=50.7492
	(+) E.M @ 0.10%	0.0514		Rounding Off	1\$=50.7500
		1\$=51.5014			
	Rounding Off	1\$=51.5025			

Calculation of Profit/loss

- Exchange Difference(Cancellation Loss)

2 Month Forward Sale @ 1\$=51.15

Spot Sale@ 1\$=50.75

Exchange Difference (Cancellation Loss) @ 1\$=0.4

Total Exchange Difference(Cancellation Loss)=0.4 x 10,000\$ =4,000
- Net Loss =4,000

Customer have to pay 4000 for extension @1\$=51.5025

(ix) Customer extends the contract for two months on 1.02.2022 (i.e. Early Extension)

Dealer (Local Bank)

Contract with Customer			Contract with Inter-Bank Market		
Date	Transaction		Date	Transaction	
1.1.22	2 Month Forward Sale		1.1.22	2 Month Forward Buy	
	Spot(High)	1\$=50.50		Spot(High)	1\$=50.50
	(+) Prm. (High)	0.60		(+) Prm. (High)	0.60
		1\$= 51.10			1\$= 51.10
	(+) E.M. @0.10%	0.0511			
		1\$ 51.1511			
	Rounding Off	1\$51.1500			
1.2.22	Request for Extension				
1.2.22	New Contract for 2 M Forward Sale		1.2.22	Cancellation (1 Month Forward Sale)	
	Spot(High)	1\$=50.65		Spot Sale(Low)@	1\$=50.10
	(+)Prm(High)	0.80		(+)Prm.(Low)	0.45
		1\$=51.45			1\$=50.55
	(+) E.M @ 0.10%	0.05145		(-)E.M @ 0.10%	0.0506
		1\$=51.5015			1\$=50.4994
	Rounding Off	1\$=51.5025		Rounding Off	1\$=50.5000

Calculation of Profit/loss

- Exchange Difference(Cancellation Loss)

2 Month Forward Sale @	1\$=51.15
Spot Sale@	1\$=50.50
Exchange Difference (Cancellation Loss) @	1\$=0.65
Total Exchange Difference(Cancellation Loss)=0.65 × 10,000\$	=6,500
- Net Loss =6,500
 Customer have to pay 6,500 for extension @1\$=51.5025

(x) Customer extends the contract for one month on 3.03.2022(i.e Late Extension)

Dealer (Local Bank)

Contract with Customer			Contract with Inter-Bank Market		
Date	Transaction		Date	Transaction	
1.1.22	2 Month Forward Sale		1.1.22	2 Month Forward Buy	
	Spot(High)	1\$=50.50		Spot(High)	1\$=50.50
	(+) Prm. (High)	0.60		(+) Prm. (High)	0.60
		1\$= 51.10			1\$= 51.10
	(+) E.M. @0.10%	0.0511			
		1\$ 51.1511			
	Rounding Off	1\$51.1500			
1.3.22	Does not approach		1.3.22	Spot Sale(Low)@	1\$=50.80
			1.3.22	Nearest Forward (1 Month) Open Buy	
				Spot(High)	1\$=50.95
				(+)Prm.(High)	.50
					1\$=51.45
3.3.22	Request for Extension		3.3.22	Cancellation (1 Month Forward Sale)	
3.3.22	New Contract for 1 M Forward Sale			Spot Sale(Low)@	1\$=50.85
	Spot(High)	1\$=51		(-)E.M @ 0.10%	0.0509
	(+)Prm(High)	0.40			1\$=50.7991
		1\$=51.40		Rounding Off	1\$=50.8000
	(+) E.M @ 0.10%	0.0514			
		1\$=51.4514			
	Rounding Off	1\$=51.4525			

Calculation of Profit/loss

- Swap Loss**

Swap Sale@	1\$=50.80
Nearest Forward(1 Month) Open Buy@	1\$=51.45
Swap Loss@	1\$=0.65
Total Swap Loss=0.65x 10,000\$	=6,500
- Interest**

Inflow	1\$=50.80
Outflow	1\$=51.10
Net Inflow @	1\$=0.30
Total Inflow=0.30x 10,000\$	=3,000
Interest Inflow=3,000 x 12% x 2/365	=2
- Exchange Difference(Cancellation Loss)**

2 Month Forward Sale @	1\$=51.15
Spot Sale@	1\$=50.80
Exchange Difference (Cancellation Loss) @	1\$=0.35
Total Exchange Difference (Cancellation Loss)= 0.35 x 10,000\$	=3,500
- Net Loss=6,500 + 2 + 3,500**

Customer have to pay 10,002 for extension @1\$=51.4525

=10,002



International Financial Management

Question 1

Perfect Inc., a U.S. based Pharmaceutical Company has received an offer from Aidscore Ltd., a company engaged in manufacturing of drugs to cure Dengue, to set up a manufacturing unit in Baddi(H.P.), India in a joint venture.

As per the Joint Venture agreement, Perfect Inc. will receive 55% share of revenues plus a royalty @ US \$0.01 per bottle. The initial investment will be 200 crores for machinery and factory. The scrap value of machinery and factory is estimated at the end of five (5) year to be 5 crores. The machinery is depreciable @ 20% on the value net of salvage value using Straight Line Method. An initial working capital to the tune of 50 crores shall be required and thereafter 5 crores each year.

As per GOI directions, it is estimated that the price per bottle will be 7.50 and production will be 24 crores bottles per year. The price in addition to inflation of respective years shall be increased by 1 each year. The production cost shall be 40% of the revenues.

The applicable tax rate in India is 30% and 35% in US and there is Double Taxation Avoidance Agreement between India and US. According to the agreement tax credit shall be given in US for the tax paid in India. In both the countries, taxes shall be paid in the following year in which profit have arisen/ remittance received.

The Spot rate of \$ is 57. The inflation in India is 6% (expected to decrease by 0.50% every year) and 5% in US.

As per the policy of GOI, only 50% of the share can be remitted in the year in which they are realised and remaining in the following year.

Though WACC of Perfect Inc. is 13% but due to risky nature of the project it expects a return of 15%. Determine whether Perfect Inc. should invest in the project or not (from subsidiary point of view).

Solution:

Working Notes:

1. Estimated Exchange Rates (Using PPP Theory)

Year	0	1	2	3	4	5	6
Exchange rate *	57	57.54	57.82	57.82	57.54	56.99	56.18

2. Share in sales

Year	1	2	3	4	5
Annual Units in crores	24	24	24	24	24
Price per bottle (₹)	7.50	8.50	9.50	10.50	11.50
Price fluctuating Inflation Rate	6.00%	5.50%	5.00%	4.50%	4.00%
Inflated Price (₹)	7.95	8.97	9.98	10.97	11.96
Inflated Sales Revenue (Crores)	190.80	215.28	239.52	263.28	287.04
Sales share @55%	104.94	118.40	131.74	144.80	157.87

3. Royalty Payment

Year	1	2	3	4	5
Annual Units in crores	24	24	24	24	24
Royalty in \$	0.01	0.01	0.01	0.01	0.01
Total Royalty (\$ Crore)	0.24	0.24	0.24	0.24	0.24
Exchange Rate	57.54	57.82	57.82	57.54	56.99
Total Royalty (Crore)	13.81	13.88	13.88	13.81	13.68

4. Tax Liability

(Crore)

Year	1	2	3	4	5
Sales Share	104.94	118.40	131.74	144.80	157.87
Total Royalty	13.81	13.88	13.88	13.81	13.68
Total Income	118.75	132.28	145.61	158.61	171.55
Less: Expenses					
Production Cost (Sales share x 40%)	41.98	47.36	52.69	57.92	63.15
Depreciation (195 x 20%)	39.00	39.00	39.00	39.00	39.00
PBT	37.77	45.92	53.92	61.69	69.40
Tax on Profit @30%	11.33	13.78	16.18	18.51	20.82
Net Profit	26.44	32.14	37.74	43.18	48.58

5. Cash Flow

(Crore)

Year	0	1	2	3	4	5	6
Sales Share	0.00	104.94	118.40	131.74	144.80	157.87	0.00
Total Royalty	0.00	13.81	13.88	13.88	13.81	13.68	0.00
Production Cost	0.00	-41.98	-47.36	-52.69	-57.92	-63.15	0.00
Initial Outlay	-200.00	0.00	0.00	0.00	0.00	0.00	0.00
Working Capital	-50.00	-5.00	-5.00	-5.00	-5.00	70.00	0.00
Scrap Value	0.00	0.00	0.00	0.00	0.00	5.00	0.00
Tax on Profit	0.00	0.00	-11.33	-13.78	-16.18	-18.51	-20.82
Free Cash Flow	-250.00	71.77	68.59	74.15	79.51	164.89	-20.82

6. Remittance of Cash Flows

(Crore)

Year	0	1	2	3	4	5	6
Free Cash Flow	-250.00	71.77	68.59	74.15	79.51	164.89	-20.82
50% of Current Year Cash Flow	0.00	35.89	34.29	37.07	39.76	82.45	0.00
Previous year remaining cash flow	0.00	0.00	35.88	34.30	37.08	39.75	82.44
Total Remittance	-250.00	35.88	70.17	71.37	76.84	122.20	61.62

NPV of Project under Appraisal

Year	0	1	2	3	4	5	6	7
Total Remittance (Crore)	-250.00	35.88	70.17	71.37	76.84	122.20	61.62	-
Exchange Rate	57.00	57.54	57.82	57.82	57.54	56.99	56.18	-
Remittance (\$ mn)	-43.86	6.24	12.14	12.34	13.35	21.44	10.97	-
US Tax @35% (\$ mn)	0.00	0.00	2.18	4.25	4.32	4.67	7.50	3.84
Indian Tax (\$ mn)	0.00	0.00	1.96	2.38	2.82	3.25	3.71	-
Net Tax (\$ mn)	0.00	0.00	0.22	1.87	1.51	1.42	3.79	3.84
Net Cash Flow (\$ mn)	-43.86	6.24	11.92	10.47	11.84	20.02	7.18	-3.84
PVF @ 15%	1.000	0.870	0.756	0.658	0.572	0.497	0.432	0.376
Present Value (\$ mn)	-43.86	5.43	9.01	6.89	6.77	9.95	3.10	-1.44
Net Present Value (\$ mn)	= -4.15							

Decision: Since NPV of the project is negative, Perfect inc. should not invest in the project.

Question 2

Its Entertainment Ltd., an Indian Amusement Company is happy with the success of its Water Park in India. The company wants to repeat its success in Nepal also where it is planning to establish a Grand Water Park with world class amenities. The company is also encouraged by a marketing research report on which it has just spent 20,00,000.

The estimated cost of construction would be Nepali Rupee (NPR) 450 crores and it would be completed in one years time. Half of the construction cost will be paid in the beginning and rest at the end of year. In addition, working capital requirement would be NPR 65 crores from the year end one. The after tax realizable value of fixed assets after four years of operation is expected to be NPR 250 crores. Under the Foreign Capital Encouragement Policy of Nepal, company is allowed to claim 20% depreciation allowance per year on reducing balance basis subject to maximum capital limit of NPR 200 crore. The company can raise loan for theme park in Nepal @ 9%.

The water park will have a maximum capacity of 20,000 visitors per day. On an average, it is expected to achieve 70% capacity for first operational four years. The entry ticket is expected to be NPR 220 per person. In addition to entry tickets revenue, the company could earn revenue from sale of food and beverages and fancy gift items. The average sales expected to be NPR 150 per visitor for food and beverages and NPR 50 per visitor for fancy gift items. The sales margin on food and beverages and fancy gift items is 20% and 50% respectively. The park would open for 360 days a year.

The annual staffing cost would be NPR 65 crores per annum. The annual insurance cost would be NPR 5 crores. The other running and maintenance costs are expected to be NPR 25 crores in the first year of operation which is expected to increase NPR 4 crores every year. The company would apportion existing overheads to the tune of NPR 5 crores to the park.

All costs and receipts (excluding construction costs, assets realizable value and other running and maintenance costs) mentioned above are at current prices (i.e. 0 point of time) which are expected to increase by 5% per year.

The current spot rate is NPR 1.60 per rupee. The tax rate in India is 30% and in Nepal it is 20%.

The average market return is 11% and interest rate on treasury bond is 8%. The company's current equity beta is 0.45. The company's funding ratio for the Water Park would be 55% equity and 45% debt.

Being a tourist Place, the amusement industry in Nepal is competitive and very different from its Indian counterpart. The company has gathered the relevant information about its nearest competitor in Nepal. The competitor's market value of the equity is NPR 1850 crores and the debt is NPR 510 crores and the equity beta is 1.35.

State whether Its Entertainment Ltd. should undertake Water Park project in Nepal or not.

Solution:

Working Notes:

1. Calculation of Cost of Funds/ Discount Rate

Competing Company's Information	
Equity Market Value	1850.00
Debt Market Value	510.00
Equity Beta	1.35

Assuming debt to be risk free i.e. beta is zero, the beta of competitor is un-gearred as follows:

$$\text{Asset Beta} = \text{Equity Beta} \times \frac{E}{E+D(1+t)} = 1.35 \times \frac{1850}{1850+510(1-0.20)} = 1.106$$

Equity beta for Its Entertainment Ltd. in Nepal

Assets beta in Nepal	1.106
Ratio of funding in Nepal	
Equity	55.00%
Debt	45.00%

$$1.106 = \text{Equity Beta} \times \frac{55}{55+45(1-0.20)}$$

Equity Beta = 1.83

Cost of Equity as per CAPM Market Return 11.00% Risk free return 8.00%

Cost of Equity = Risk free return + β (Market Return - Risk free return)

$$= 8.00\% + 1.83(11.00\% - 8.00\%) = 13.49\%$$

$$\text{WACC} = 13.49\% \times 0.55 + 9\%(1-0.20) \times 0.45 = 10.66\%$$

2. Present Value Factors at the discount rate of 10.66%

Year	0	1	2	3	4	5
PVAF	1.000	0.904	0.817	0.738	0.667	0.603

3. Calculation of Capital Allowances

Year	1	2	3	4
Opening Balance (NPR Crore)	200.00	160.00	128.00	102.40
Less: Depreciation (NPR Crore)	40.00	32.00	25.60	20.48
Closing Balance (NPR Crore)	160.00	128.00	102.40	81.92

Calculation of Present of Free Cash Flow

Year	0	1	2	3	4	5
Expected Annual visitors			5040000	5040000	5040000	5040000
Entry ticket price per visitor (NPR)			242.55	254.68	267.41	280.78
Profit from sale of Food and Beverages per visitor (NPR)			33.08	34.73	36.47	38.29
Profit from sale of Fancy Gift Items per visitor (NPR)			27.56	28.94	30.39	31.91
Revenue per visitor (NPR)			303.19	318.35	334.27	350.98
Total Revenue (NPR crores)			152.81	160.45	168.47	176.89
Less:						
Annual Staffing Cost (NPR crores)			71.66	75.25	79.01	82.96
Annual Insurance Costs (NPR crores)			5.51	5.79	6.08	6.38
Other running and maintenance costs (NPR crores)			25.00	29.00	33.00	37.00
Depreciation Allowances (NPR crores)			40.00	32.00	25.60	20.48
Total Expenses (NPR crores)			142.17	142.04	143.69	146.82
PBT (NPR crores)			10.64	18.41	24.78	30.07
Tax on Profit (NPR crores)			2.13	3.68	4.96	6.01
Net Profit (NPR crores)			8.51	14.73	19.82	24.06
Add: Depreciation Allowances (NPR crores)			40	32	25.6	20.48
Park Construction Cost (NPR crores)	-225	-225				
After tax assets realisation value (NPR crores)						250
Working capital (NPR crores)		-65.00	-3.25	-3.41	-3.58	75.25
Net cash Flow (NPR crores)	-225.00	-290.00	45.26	43.32	41.84	369.79
PVF at discount rate	1.00	0.904	0.817	0.738	0.667	0.603
Present Values (NPR crores)	225.00	-262.16	36.98	31.97	27.91	222.98

Net Present Value (NPR crores)

-167.32

Decision: Since NPV of the project is negative the Entertainment Ltd. should not undertake Water Park project in Nepal.

Question 3

Opus Technologies Ltd., an Indian IT company is planning to make an investment through a wholly owned subsidiary in a software project in China with a shelf life of two years. The inflation in China is estimated as 8 percent. Operating cash flows are received at the year end.

For the project an initial investment of Chinese Yuan (CN¥) 30,00,000 will be in land. The land will be sold after the completion of project at estimated value of CN¥ 35,00,000. The project also requires an office complex at cost of CN¥ 15,00,000 payable at the beginning of project. The complex will be depreciated on straight-line basis over two years to a zero salvage value. This complex is expected to fetch CN¥ 5,00,000 at the end of project.

The company is planning to raise the required funds through GDR issue in Mauritius. Each GDR will have 5 common equity shares of the company as underlying security which are currently trading at 200 per share (Face Value =Rs 10) in the domestic market. The company has currently paid the dividend of 25% which is expected to grow at 10% p.a. The total issue cost is estimated to be 1 percent of issue size.

The annual sales is expected to be 10,000 units at the rate of CN¥ 500 per unit. The price of unit is expected to rise at the rate of inflation. Variable operating costs are 40 percent of sales. Fixed operating costs will be CN¥ 22,00,000 per year and expected to rise at the rate of inflation.

The tax rate applicable in China for income and capital gain is 25 percent and as per GOI Policy no further tax shall be payable in India. The current spot rate of CN¥ 1 is 9.50. The nominal interest rate in India and China is 12% and 10% respectively and the international parity conditions hold

You are required to

- Identify expected future cash flows in China and determine NPV of the project in CN¥.
- Determine whether Opus Technologies should go for the project or not assuming that there neither there is restriction on the transfer of funds from China to India nor any charges/taxes payable on the transfer of funds.

Solution:

Working Notes:

1. Calculation of Cost of Capital (GDR)

Current Dividend (D ₀)	2.50
Expected Dividend (D ₁)	2.75
Net Proceeds (Rs 200 per share - 1%)	198.00
Growth Rate	10.00%

$$K_e = \frac{2.75}{198} + 0.10 = 0.1139 \text{ i.e. } 11.39\%$$

2. Calculation of Expected Exchange Rate as per Interest Rate Parity

Year	Expected Rate
1	$= 9.50 \times \frac{(1+0.12)}{(1+0.10)} = 9.67$
2	$= 9.50 \times \frac{(1+0.12)^2}{(1+0.10)^2} = 9.85$

3. Realization on the disposal of Land net of Tax

	CN¥
Sale value at the end of project	3500000.00
Cost of Land	3000000.00
Capital Gain	500000.00
Tax paid	125000.00
Amount realized net of tax	3375000.00

4. Realization on the disposal of Office Complex

	(CN¥)
Sale value at the end of project	500000.00
WDV	0.00
Capital Gain	500000.00
Tax paid	125000.00
Amount realized net of tax (A)	375000.00

5. Computation of Annual Cash Inflows

Year	1	2
Annual Units	10000	10000
Price per bottle (CN¥)	540.00	583.20
Annual Revenue (CN¥)	5400000.00	5832000.00
Less: Expenses		
Variable operating cost (CN¥)	2160000.00	2332800.00
Depreciation (CN¥)	750000.00	750000.00
Fixed Cost per annum (CN¥)	2376000.00	2566080.00
PBT (CN¥)	114000.00	183120.00
Tax on Profit (CN¥)	28500.00	45780.00
Net Profit (CN¥)	85500.00	137340.00
Add: Depreciation (CN¥)	750000.00	750000.00
Cash Flow	835500.00	887340.00

(a) Computation of NPV of the project in CN¥

(CN¥)

Year	0	1	2
Initial Investment	-4500000.00		
Annual Cash Inflows		835500.00	887340.00
Realization on the disposal of Land net of Tax			3375000.00
Realization on the disposal of Office Complex			375000.00
Total	-4500000.00	835500.00	4637340.00
PVF @11.39%	1.000	0.898	0.806
PV of Cash Flows	-4500000.00	750279.00	3737696.00
NPV		-12,025	

(b) Evaluation of Project from Opus Point of View

(i) Assuming that inflow funds are transferred in the year in which same are generated i.e. first year and second year.

Year	0	1	2
Cash Flows (CN¥)	-4500000.00	835500.00	4637340.00
Exchange Rate (Rs/ CN¥)	9.50	9.67	9.85
Cash Flows (Rs)	-42750000.00	8079285.00	45677799.00
PVF @ 12%	1.00	0.893	0.797
	-42750000.00	7214802.00	36405206.00
NPV			870008.00

(ii) Assuming that inflows are transferred at end of project i.e. second year

Year	0	2
Cash Flows (CN¥)	-4500000.00	5472840
Exchange Rate (Rs/ CN¥)	9.50	9.85
Cash Flows (Rs)	-42750000.00	53907474
PVF	1.00	0.797
	-42750000.00	42964257.00
NPV		214257.00

Though in terms of CN¥ the NPV of the project is negative but in Rs it has positive NPV due to weakening of Rs in comparison of CN¥. Thus, Opus can accept the project.

Question 4

X Ltd. is interested in expanding its operation and planning to install manufacturing plant at US. For the proposed project it requires a fund of \$ 10 million (net of issue expenses/ floatation cost). The estimated floatation cost is 2%. To finance this project it proposes to issue GDRs.

You as financial consultant is required to compute the number of GDRs to be issued and cost of the GDR with the help of following additional information.

- (i) Expected market price of share at the time of issue of GDR is 250 (Face Value 100)
- (ii) 2 Shares shall underly each GDR and shall be priced at 10% discount to market price.
- (iii) Expected exchange rate 60/\$.
- (iv) Dividend expected to be paid is 20% with growth rate 12%.

Solution:

Net Issue Size = \$10 million

$$\text{Gross Issue} = \frac{\$10 \text{ million}}{0.98} = \$10.204 \text{ million}$$

Issue Price per GDR in (250 × 2 × 90%)	450
Issue Price per GDR in \$ (450/ 60)	\$ 7.50
Dividend Per GDR (D1) (20 × 2)	40
Net Proceeds Per GDR (450 × 0.98)	441.00

$$(a) \quad \text{Number of GDR to be issued} = \frac{\$10.204 \text{ million}}{\$7.50} = 1.3605 \text{ million}$$

$$(b) \quad \text{Cost of GDR to X Ltd. } K_e = \frac{40.00}{441.00} + 0.12 = 21.07\%$$

Question 5

ABC Ltd. is considering a project in US, which will involve an initial investment of US \$ 1,10,00,000. The project will have 5 years of life. Current spot exchange rate is Rs 48 per US \$. The risk free rate in US is 8% and the same in India is 12%. Cash inflow from the project is as follows:

Year	Cash inflow
1	US \$ 20,00,000
2	US \$ 25,00,000
3	US \$ 30,00,000
4	US \$ 40,00,000
5	US \$ 50,00,000

Calculate the NPV of the project using foreign currency approach. Required rate of return on this project is 14%.

Solution:

$$(1 + 0.12) (1 + \text{Risk Premium}) = (1 + 0.14)$$

$$\text{Or, } 1 + \text{Risk Premium} = 1.14/1.12 = 1.0179$$

$$\text{Therefore, Risk adjusted dollar rate is} = 1.0179 \times 1.08 = 1.099 - 1 = 0.099$$

Calculation of NPV

Year	Cash flow (Million) US\$	PV Factor at 9.9%	P.V.
1	2.00	0.910	1.820
2	2.50	0.828	2.070
3	3.00	0.753	2.259
4	4.00	0.686	2.744
5	5.00	0.624	3.120
			12.013
		Less: Investment	11.000
		NPV	1.013

Therefore, Rupee NPV of the project is = (48 × 1.013) Million = 48.624 Million

Question 6

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 millions. 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 millions. Other estimates are as follows:

Rent for fully furnished unit with necessary hardware in India	Rs 15,00,000
Man power cost (80 software professional will be working for 10 hours each day)	Rs 400 per man hour
Administrative and other costs	Rs 12,00,000

Advise the US Company on the financial viability of the project. The rupee-dollar rate is 48/\$.

Note: Assume 365 days a year.

Solution:

Proforma profit and loss account of the Indian software development unit

	Rs	Rs
Revenue		48,00,00,000
Less: Costs:		
Rent	15,00,000	
Manpower (400 × 80 × 10 × 365)	11,68,00,000	
Administrative and other costs	12,00,000	11,95,00,000
Earnings before tax		36,05,00,000
Less: Tax		10,81,50,000
Earnings after tax		25,23,50,000
Less: Withholding tax(TDS)		2,52,35,000
Repatriation amount (in rupees)		22,71,15,000
Repatriation amount (in dollars)		\$ 4.7 million

Advise: The cost of development software in India for the US based company is \$5.268 million. As the USA based Company is expected to sell the software in the US at \$12.0 million, it is advised to develop the software in India.

Alternatively, if it is assumed that since foreign subsidiary has paid taxes it will not pay withholding taxes then solution will be as under:

	Rs	Rs
Revenue		48,00,00,000
Less: Costs:		
Rent	15,00,000	
Manpower (400 x 80 x 10 x 365)	11,68,00,000	
Administrative and other costs	12,00,000	11,95,00,000
Earnings before tax		36,05,00,000
Less: Tax		10,81,50,000
Earnings after tax		25,23,50,000
Repatriation amount (in rupees)		25,23,50,000
Repatriation amount (in dollars)		\$ 5,257,292

Advise: The cost of development software in India for the US based company is \$4.743 million. As the USA based Company is expected to sell the software in the US at \$12.0 million, it is advised to develop the software in India.

Alternatively, if it is assumed that first the withholding tax @ 10% is being paid and then its credit is taken in the payment of corporate tax then solution will be as follows:

	Rs	Rs
Revenue		48,00,00,000
Less: Costs:		
Rent	15,00,000	
Manpower (400 x 80 x 10 x 365)	11,68,00,000	
Administrative and other costs	12,00,000	11,95,00,000
Earnings before tax		36,05,00,000
Less: Withholding Tax		3,60,50,000
Earnings after Withholding tax @ 10%		32,44,50,000
Less: Corporation Tax net of Withholding Tax		7,21,00,000
Repatriation amount (in rupees)		25,23,50,000
Repatriation amount (in dollars)		\$ 5,257,292

Advise: The cost of development software in India for the US based company is \$4.743 million. As the USA based Company is expected to sell the software in the US at \$12.0 million, it is advised to develop the software in India.

Question 7

XY Limited is engaged in large retail business in India. It is contemplating for expansion into a country of Africa by acquiring a group of stores having the same line of operation as that of India.

The exchange rate for the currency of the proposed African country is extremely volatile. Rate of inflation is presently 40% a year. Inflation in India is currently 10% a year. Management of XY Limited expects these rates likely to continue for the foreseeable future.

Estimated projected cash flows, in real terms, in India as well as African country for the first three years of the project are as follows:

	Year - 0	Year - 1	Year - 2	Year - 3
Cash flows in Indian Rs (000)	-50,000	-1,500	-2,000	-2,500
Cash flows in African Rands (000)	-2,00,000	+50,000	+70,000	+90,000

XY Ltd. assumes the year 3 nominal cash flows will continue to be earned each year indefinitely. It evaluates all investments using nominal cash flows and a nominal discounting rate. The present exchange rate is African Rand 6 to Rs 1.

You are required to calculate the net present value of the proposed investment considering the following:

- African Rand cash flows are converted into rupees and discounted at a risk adjusted rate.
- All cash flows for these projects will be discounted at a rate of 20% to reflect it's high risk.
- Ignore taxation.

	Year - 1	Year - 2	Year - 3
PVIF @ 20%	0.833	0.694	0.579

Solution:

Calculation of NPV

Year	0	1	2	3
Inflation factor in India	1.00	1.10	1.21	1.331
Inflation factor in Africa	1.00	1.40	1.96	2.744
Exchange Rate (as per IRP)	6.00	7.6364	9.7190	12.3696
Cash Flows in Rs '000				
Real	-50000	-1500	-2000	-2500
Nominal (1)	-50000	-1650	-2420	-3327.50
Cash Flows in African Rand '000				
Real	-200000	50000	70000	90000
Nominal	-200000	70000	137200	246960
In Indian Rs '000 (2)	-33333	9167	14117	19965
Net Cash Flow in Rs '000 (1)+(2)	-83333	7517	11697	16637
PVF@20%	1	0.833	0.694	0.579
PV	-83333	6262	8118	9633

NPV of 3 years = -59320 ('000)

NPV of Terminal Value = $\frac{16637}{0.20} \times 0.579 = 48164$ ('000)

Total NPV of the Project = -59320 ('000) + 48164 ('000) = -11156 ('000)

Question 8

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:

- (i) Variable operating cost will be US \$ 20 per unit of production;
- (ii) 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;
- (iii) Production capacity of the proposed project in India will be 5 million units;
- (iv) Expected useful life of the proposed plant is five years with no salvage value;
- (v) Existing working capital investment for production & sale of two million units through exports was US \$ 15 million;
- (vi) 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;
- (vii) Applicable Corporate Income Tax rate is 35%, and
- (viii) Required rate of return for such project is 12%.

Assuming that there will be no variation in the exchange rate of two currencies and all profits will be repatriated, as there will be no withholding tax, estimate Net Present Value (NPV) of the proposed project in India.

Present Value Interest Factors (PVIF) @ 12% for five years are as below:

Year	1	2	3	4	5
PVIF	0.8929	0.7972	0.7118	0.6355	0.5674

Solution:

Financial Analysis whether to set up the manufacturing units in India or not may be carried using NPV technique as follows:

I. Incremental Cash Outflows

	\$ Million
Cost of Plant and Machinery	500.00
Working Capital	50.00
Release of existing Working Capital	(15.00)
	535.00

II. Incremental Cash Inflow after Tax (CFAT)**(a) Generated by investment in India for 5 years**

	\$ Million
Sales Revenue (5 Million x \$80)	400.00
Less: Costs	
Variable Cost (5 Million x \$20)	100.00
Fixed Cost	30.00
Depreciation (\$500Million/5)	100.00
EBIT	170.00
Taxes@35%	59.50
EAT	110.50
Add: Depreciation	100.00
CFAT (1-5 years)	210.50

(b) Cash flow at the end of the 5 years (Release of Working Capital) 35.00

(c) Cash generation by exports (Opportunity Cost)

	\$ Million
Sales Revenue (1.5 Million x \$80)	120.00
Less: Variable Cost (1.5 Million x \$40)	60.00
Contribution before tax	60.00
Tax@35%	21.00
CFAT (1-5 years)	39.00

(d) Additional CFAT attributable to Foreign Investment

	\$ Million
Through setting up subsidiary in India	210.50
Through Exports in India	39.00
CFAT (1-5 years)	171.50

III. Determination of NPV

Year	CFAT (\$ Million)	PVF@12%	PV (\$ Million)
1-5	171.50	3.6048	618.2232
5	35	0.5674	19.8590
			638.0822
Less: Initial Outflow			535.0000
			103.0822

Question 9

XYZ Ltd., a company based in India, manufactures very high quality modern furniture and sells to a small number of retail outlets in India and Nepal. It is facing tough competition. Recent studies on marketability of products have clearly indicated that the customers are now more interested in variety and choice rather than exclusivity and exceptional quality. Since the cost of quality wood in India is very high, the company is reviewing the proposal for import of woods in bulk from Nepalese supplier.

The estimate of net Indian (Rs) and Nepalese Currency (NC) cash flows in Nominal terms for this proposal is shown below:

	Net Cash Flow (in millions)			
Year	0	1	2	3
NC	-25.000	2.600	3.800	4.100
Indian (Rs)	0	2.869	4.200	4.600

The following information is relevant:

- XYZ Ltd. evaluates all investments by using a discount rate of 9% p.a. All Nepalese customers are invoiced in NC. NC cash flows are converted to Indian (Rs) at the forward rate and discounted at the Indian rate.
- Inflation rates in Nepal and India are expected to be 9% and 8% p.a. respectively. The current exchange rate is Rs 1= NC 1.6

Assuming that you are the finance manager of XYZ Ltd., calculate the net present value (NPV) and modified internal rate of return (MIRR) of the proposal.

You may use following values with respect to discount factor for Rs 1 @9%.

	Present Value	Future Value
Year 1	0.917	1.188
Year 2	0.842	1.090
Year 3	0.772	1

Solution:

Working Notes:

- Computation of Forward Rates

End of Year	NC	NC/ Rs
1	$NC1.60 \times \frac{(1+0.09)}{(1+0.08)}$	1.615
2	$NC1.615 \times \frac{(1+0.09)}{(1+0.08)}$	1.630
3	$NC1.630 \times \frac{(1+0.09)}{(1+0.08)}$	1.645

(ii) NC Cash Flows converted in Indian Rupees

Year	NC (Million)	Conversion Rate	Rs (Million)
0	-25.00	1.600	-15.625
1	2.60	1.615	1.61
2	3.80	1.630	2.33
3	4.10	1.645	2.49

Net Present Value

(Rs Million)

Year	Cash Flow in India	Cash Flow in Nepal	Total	PVF @ 9%	PV
0	---	-15.625	-15.625	1.000	-15.625
1	2.869	1.61	4.479	0.917	4.107
2	4.200	2.33	6.53	0.842	5.498
3	4.600	2.49	7.09	0.772	5.473
					-0.547

Modified Internal Rate of Return

	Year			
	0	1	2	3
Cash Flow (Rs Million)	-15.625	4.479	6.53	7.09
Year 1 Cash Inflow reinvested for 2 years (1.188 × 4.479)				5.32
Year 2 Cash Inflow reinvested for 1 years (1.090 × 6.53)				7.12
				19.53

$$MIRR = \sqrt[n]{\frac{\text{Terminal Cash Flow}}{\text{Initial Outlay}}} - 1 = \sqrt[3]{\frac{19.53}{15.625}} - 1 = 0.0772 \text{ say } 7.72\%$$

Question 10**[JAN 21/MTP MAY 23]**

A proposed foreign investment involves creation of a plant with an annual output of 1 million units. The entire production will be exported at a selling price of USD 10 per unit. At the current rate of exchange dollar cost of local production equals to USD 6 per unit. Dollar is expected to decline by 10% or 15%. The change in local cost of production and probability from the expected current level will be as follows:

Decline in value of USD (%)	Reduction in local cost of production (USD/unit)	Probability
0	-	0.4
10	0.30	0.4
15	0.15 Additional reduction	0.2

The plant at the current rate of exchange will have a depreciation of USD 1 million annually. Assume local Tax rate as 30%.

You are required to find out:

- Annual Cash Flow After Tax (CFAT) under all the different scenarios of exchange rate.
- Expected value of CFAT assuming no repatriation of profits.
- Viability of the investment proposal assuming an initial investment of USD 25 million on plant and working capital with a required rate of return of 11% on investment and on the basis of CFAT arrived under option (ii). The CFAT will grow @ 3% per annum in perpetuity.

Solution**(i) Calculation of Annual CFAT**

	Scenario 1	Scenario 2	Scenario 3
Annual Sales (in units) (A)	10,00,000	10,00,000	10,00,000
	US \$	US \$	US \$
Selling price p.u.	10.00	10.00	10.00
Cost p.u.	6.00	5.70	5.55
Profit p.u. (B)	4.00	4.30	4.45
Total Profit (A × B)	40,00,000	43,00,000	44,50,000
Less: Depreciation	10,00,000	9,00,000	8,50,000
PBT	30,00,000	34,00,000	36,00,000
Less: Tax @ 30%	9,00,000	10,20,000	10,80,000
PAT	21,00,000	23,80,000	25,20,000
Add: Depreciation	10,00,000	9,00,000	8,50,000
Expected CFAT (US \$)	31,00,000	32,80,000	33,70,000

(ii) Expected Value of CFAT

$$= \text{US \$ } 31,00,000 \times 0.4 + \text{US \$ } 32,80,000 \times 0.4 + \text{US \$ } 33,70,000 \times 0.2 = \text{US \$ } 32,26,000$$

(iii) Viability of proposal:

Expected CFAT

= US \$ 32,26,000

Expected Growth Rate

= 3%

Expected Value of inflow in perpetuity = $\frac{\text{US\$}32,26,000(1.03)}{0.11 - 0.03} = \frac{33,22,780}{0.08} = \text{US\$ } 4,15,34,750$

	US \$
Value of Inflows	4,15,34,750
Less: Initial Outlay	2,50,00,000
NPV of project	1,65,34,750

Question 11**[JAN 21]**

X Ltd., an Indian company, is considering a proposal to make an investment of USD 1,65,00,000 in Latin America. The project will have a life of 5 years. The current spot exchange rate is INR / USD 72. All investments and revenues will occur in USD. The USD and INR risk free rates are 8% and 12% respectively. The following cash flow is expected from the project.

Year	Cash inflow (USD)
1	30,00,000
2	37,50,000
3	45,00,000
4	60,00,000
5	75,00,000

Assume required rate of return on the project as 14%.

You are required to calculate:

- The viability of the project using foreign currency approach.
- What will be the impact if there is a withholding tax of 10% applicable on the project.

Solution:

- Viability of the Project

$$(1 + 0.12)(1 + \text{Risk Premium}) = (1 + 0.14)$$

$$\text{Or, } 1 + \text{Risk Premium} = 1.14 / 1.12 = 1.0179$$

$$\text{Therefore, Risk adjusted dollar rate is } = 1.0179 \times 1.08 = 1.099 - 1 = 0.099$$

Calculation of NPV

Year	Cash flow (Million) US\$	PV Factor at 9.9%	P.V.
1	3.00	0.910	2.730
2	3.75	0.828	3.105
3	4.50	0.753	3.389
4	6.00	0.686	4.116
5	7.50	0.624	4.680
			18.02
Less: Investment			16.50
NPV			1.52

Therefore, Rupee NPV of the project is = ₹ 72 × US \$ 1.52 Million = ₹ 109.44 Million

Project is viable as the NPV is positive.

(ii) If there is a withholding tax of 10%

Total PV of Cash Inflows	US\$ 18.02 Million
Less: Withholding Tax @ 10%	US\$ 1.802 Million
PV of Cash Inflow after Withholding Tax	US\$ 16.218 Million
Less: Initial Investment	<u>US\$ 16.50 Million</u>
NPV	<u>(US\$ 0.282 Million)</u>

Therefore, Rupee NPV of the project is = ₹ 72 × (US \$ 0.282 Million) = - ₹ 20.304 Million

Thus, if there is a withholding tax of 10% then the project will not be viable.

Question 12

[DEC 21]

A US company wants to set up a manufacturing plant in India which requires an initial outlay of ₹ 8 Million. It is expected to have a useful life of 5 years with a salvage of ₹ 2 Million. The company follows straight line method of depreciation. To support additional level of activity, investment would require one time additional working capital of ₹ 1 Million.

Since the cost of production lower in India, the variable cost of production would be ₹ 30 per unit. Additional fixed cost per annum is estimated at ₹ 0.5 Million. The company is projecting its annual sales to 80000 units at the price of ₹ 100 per unit. Applicable tax rate to the company is 34% and its cost of capital is 8%.

Inflation rates in US and India are expected to be 8% and 9% respectively. The current exchange rate is ₹ 72 per US Dollar.

Assuming that all profit will be repatriated every year and there will be no withholding taxes, estimate the net present value of the proposed project in India and evaluate its feasibility.

PVF @ 8% for the five years are as under:

Rate	1 Year	2 Year	3 Year	4 Year	5 Year
8%	0.926	0.857	0.794	0.735	0.681

Solution:

Working Notes:

(i) Initial Investment in US \$

Particulars	Amount
Initial Outlay	₹ 80,00,000
Additional Working Capital	<u>₹ 10,00,000</u>
Total	₹ 90,00,000
Exchange Rate	₹ 72 / US \$
Initial Investment in US \$	US \$ 1,25,000

(ii) Expected Exchange Rates

Year		₹ / USD
1	$72.00 \times \frac{(1+0.09)}{(1+0.08)}$	72.67
2	$72.67 \times \frac{(1+0.09)}{(1+0.08)}$	73.34
3	$73.34 \times \frac{(1+0.09)}{(1+0.08)}$	74.02
4	$74.02 \times \frac{(1+0.09)}{(1+0.08)}$	74.71
5	$74.71 \times \frac{(1+0.09)}{(1+0.08)}$	75.40

(iii) Annual Cash Inflows

Particulars	Amount (₹)
Sales (80000 X ₹ 100)	80,00,000
Less: Variable Cost (80000 x ₹ 30)	<u>24,00,000</u>
Additional Fixed Cost	5,00,000
Depreciation (₹ 80,00,000 - ₹ 20,00,000)/5	<u>12,00,000</u>
Profit Before Tax (PBT)	39,00,000
Less: Tax @ 34%	13,26,000
	25,74,000
Add: Depreciation	12,00,000
	37,74,000

(iv) Amount repatriated each year in US \$

Year	in ₹	Expected Exchange Rate (₹ / US \$)	in US \$
1	37,74,000	72.67	51,933.40
2	37,74,000	73.34	51,458.96
3	37,74,000	74.02	50,986.22
4	37,74,000	74.71	50,513.33
5	37,74,000	75.40	50,053.05

(v) Release of Working Capital in US \$ at the end (₹ 10,00,000 / ₹ 75.40) = US \$ 13,262.60

(vi) Salvage Value of Project in US \$ (₹ 20,00,000 / ₹ 75.40) = US \$ 26,525.20

NPV of the proposed project

Particulars	Period	Cash Flows (\$)	PVF @ 8%	PV (\$)
Initial Outlay	0	(1,25,000.00)	1.000	(1,25,000.00)
Annual Cash Flow	1	51,933.40	0.926	48,090.33
Annual Cash Flow	2	51,458.96	0.857	44,100.33
Annual Cash Flow	3	50,986.22	0.794	40,483.06
Annual Cash Flow	4	50,513.33	0.735	37,127.30
Annual Cash Flow	5	50,053.05	0.681	34,086.13
Release of Working Capital	5	13,262.60	0.681	9,031.83
Salvage Value of the Project	5	26,525.20	0.681	18,063.66
				1,05,982.64

Since the NPV of the project is positive, it is feasible.

Question 13 (Nov 24 Exam)

PQ Ltd. expects sales of ₹ 100 lakhs in the year 1. The same will increase by ₹ 20 lakhs per year over the next four years. At the end of 5 years the project would be wound up. The Depreciation will be charged at 20% p.a. on straight line method. The expenses excluding the depreciation will be 40% of the sales. There will be no salvage value of the plant. PQ Ltd. proposes to invest in the plant an amount where the Net Present Value will be Zero.

Corporate Tax rate is 30%. You are required to calculate investment which can be made in the plant.

Solution Working Notes:

(1) Expected Sales

Year	Expected Sales
1	₹ 100 lakhs
2	₹ 120 lakhs
3	₹ 140 lakhs
4	₹ 160 lakhs
5	₹ 180 lakhs

(2) Expected Expenses excluding Depreciation

Year	Exp.
1	₹ 40 lakhs
2	₹ 48 lakhs
3	₹ 56 lakhs
4	₹ 64 lakhs
5	₹ 72 lakhs

(3) Cash Inflow from the Project

Let P be the cost of the plant then chargeable depreciation for each year shall be $0.20P$. Accordingly, annual cash flow from the project shall be computed as follows:

Year	Expected Sales ₹ lakhs	Exp. ₹ lakhs	Dep. (3)	Profit Before Tax	Tax @30%	Profit After Tax
1	100	40	0.20P	60 - 0.20P	18 - 0.06P	42 - 0.14P
2	120	48	0.20P	72 - 0.20P	21.6 - 0.06P	50.4 - 0.14P
3	140	56	0.20P	84 - 0.20P	25.2 - 0.06P	58.8 - 0.14P
4	160	64	0.20P	96 - 0.20P	28.8 - 0.06P	67.2 - 0.14P
5	180	72	0.20P	108 - 0.20P	32.4 - 0.06P	75.6 - 0.14P

Year	Profit After Tax	Dep. Added Back	Cash Inflow
1	42 - 0.14P	0.20P	42 + 0.06P
2	50.40 - 0.14P	0.20P	50.40 + 0.06P
3	58.80 - 0.14P	0.20P	58.80 + 0.06P
4	67.20 - 0.14P	0.20P	67.20 + 0.06P
5	75.60 - 0.14P	0.20P	75.60 + 0.06P
Total			294 + 0.30P

Since NPV will be Zero the required comes as follows: Sum of Cash Inflows - Plant Cost = 0
 $294 + 0.30P - P = 0$ $P = 420$

Thus, the required investment to be made in plant shall be ₹ 420 lakhs.

Alternative solution if a discount rate of 10% is applied, though students may solve the question using a rate other than 10%.

Working Notes:

(1) Expected Sales

Year	Expected Sales
1	₹ 100 lakhs
2	₹ 120 lakhs
3	₹ 140 lakhs
4	₹ 160 lakhs
5	₹ 180 lakhs

(2) Expected Expenses excluding Depreciation

Year	Exp.
1	₹ 40 lakhs
2	₹ 48 lakhs
3	₹ 56 lakhs
4	₹ 64 lakhs
5	₹ 72 lakhs

(3) Cash Inflow from the Project

Let P be the cost of the plant then chargeable depreciation for each year shall be 0.20P. Accordingly, annual cash flow from the project shall be computed as follows:

Year	Expected Sales ₹ lakhs	Exp. ₹ lakhs	Dep. (3)	Profit Before Tax	Tax	Profit After Tax
1	100	40	0.20P	60 - 0.20P	18 - 0.06P	42 - 0.14P
2	120	48	0.20P	72 - 0.20P	21.6 - 0.06P	50.4 - 0.14P
3	140	56	0.20P	84 - 0.20P	25.2 - 0.06P	58.8 - 0.14P
4	160	64	0.20P	96 - 0.20P	28.8 - 0.06P	67.2 - 0.14P
5	180	72	0.20P	108 - 0.20P	32.4 - 0.06P	75.6 - 0.14P

Year	Profit After Tax	Dep. Added Back	Cash Inflow	PVF @ 10%	PV of Cash Inflow
1	42 - 0.14P	0.20P	42 + 0.06P	0.909	38.178 + 0.05454P
2	50.40 - 0.14P	0.20P	50.40 + 0.06P	0.826	41.6304 + 0.04956P
3	58.80 - 0.14P	0.20P	58.80 + 0.06P	0.751	44.1588 + 0.04506P
4	67.20 - 0.14P	0.20P	67.20 + 0.06P	0.683	45.8976 + 0.04098P
5	75.60 - 0.14P	0.20P	75.60 + 0.06P	0.621	46.9476 + 0.03726P
Total					216.8124 + 0.2274P

Since NPV will be Zero the required comes as follows: Sum of Cash Inflows - Plant Cost = 0

$$216.8124 + 0.2274P - P = 0 \quad P = 280.63$$

Thus, the required investment to be made in plant shall be ₹ 280.63 lakhs.

Question 14 (Nov 24 Exam)

PQR Ltd. is considering a project in US, which involve an initial investment of ₹ 124.50 Crore. The project will have useful life of 5 years Current spot exchange rate is INR/USD is 83. The risk free rate in US is 4.186% and the same in India is 6.9768%. Cash inflows in USD from the project are as follows:

Year	1	2	3	4	5
Cash inflow	30,00,000	40,00,000	50,00,000	60,00,000	70,00,000

PQR Ltd. is expecting net surplus of ₹ 1858.08 lakh to be received after closure of the project. There is no salvage value. PQR Ltd. want to take a forward cover to protect itself from exchange rate fluctuations.

N	1	2	3	4	5
PVIF (6.976%, n)	0.935	0.874	0.817	0.764	0.714
PVIF (4.186%, n)	0.959	0.921	0.884	0.849	0.815
PVIF (12%, n)	0.893	0.797	0.712	0.636	0.567
PVIF (15%, n)	0.870	0.756	0.658	0.572	0.497

You are required to recommend the INR/USD rate for the forward cover?

Solution

Let F be the recommended INR/USD rate for the forward cover. Accordingly, year-wise equivalent cash inflows in Indian Rupees shall be as follows:

Year	Cash Inflow in USD Lakh	Cash Inflow in ₹ Lakh
1	30.00	30.00F
2	40.00	40.00F
3	50.00	50.00F
4	60.00	60.00F
5	70.00	70.00F

Now let us compute Net Present Value of project assuming a discount rate of 12% as follows:

Year	PVF@12%	Cash flow in ₹ Lakh	PV in ₹ Lakh
0	1.00	- 12450.00	- 12450.00
1	0.893	30.00F	26.79F
2	0.797	40.00F	31.88F
3	0.712	50.00F	35.60F
4	0.636	60.00F	38.16F
5	0.567	70.00F	39.69F
			172.12F - 12450

Since expected surplus after closure of the project is ₹ 1858.08 Lakh, we can compute the value of F as follows: $1858.08 = 172.12F - 12450$

$$F = 83.13$$

Thus, for forward cover the rate of ₹ 83.13/ USD is recommended.

Alternatively, if students have assumed discounting rate as 15% then answer will be as follows:

Let F be the recommended INR/USD rate for the forward cover. Accordingly, year-wise equivalent cash inflows in Indian Rupees shall be as follows:

Year	Cash Inflow in USD Lakh	Cash Inflow in ₹ Lakh
1	30.00	30.00F
2	40.00	40.00F
3	50.00	50.00F
4	60.00	60.00F
5	70.00	70.00F

Now let us compute Net Present Value of project assuming a discount rate of 15% as follows:

Year	PVF@15%	Cash flow in ₹ Lakh	PV in ₹ Lakh
0	1.00	- 12450.00	- 12450.00
1	0.870	30.00F	26.10F
2	0.756	40.00F	30.24F
3	0.658	50.00F	32.90F
4	0.572	60.00F	34.32F
5	0.497	70.00F	34.79F
			158.35F - 12450

Since expected surplus after closure of the project is ₹ 1858.08 Lakh, we can compute the value of F as follows: $1858.08 = 158.35F - 12450$

$$F = 90.36$$

Thus, for forward cover the rate of ₹ 90.36/ USD is recommended.

Alternative Solution if students have assumed that the discounting rate 15% for the given cash inflows then applicable discounting rates for the project is -

$$(1 + 0.06978) / (1 + \text{Risk Premium}) = (1 + 0.15)$$

$$\text{Or, } 1 + \text{Risk Premium} = 1.15 / 1.06978 = 1.0750$$

$$\text{Therefore, Risk adjusted dollar rate is } = (1.0750 \times 1.04186) - 1 = 1.1199 - 1 = 0.12$$

Calculation of NPV

Year	Cash flow US\$ lakh	PV Factor at 12%	PV (US\$ lakh)
1	30.00	0.893	26.79
2	40.00	0.797	31.88
3	50.00	0.712	35.60
4	60.00	0.636	38.16
5	70.00	0.567	<u>39.69</u>
			172.12
		Less: Investment	<u>150.00</u>
		NPV	<u>22.12</u>

Since PQR Ltd. is expecting a net surplus of ₹ 1858.08 lakh after the closure of the project the recommended rate of INR/ USD is (₹ 1858.08 lakh/ USD 22.12 lakh) ₹ 84.00.



Interest Rate Risk Management

Question 1

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 the 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

Final settlement amount shall be computed by using formula:

$$\frac{(N)(RR-FR)(dtm/DY)}{[1+RR(dt m/DY)]}$$

Where,

N = the notional principal amount of the agreement;

RR = Reference Rate for the maturity specified by the contract prevailing on the contract settlement date;

FR = Agreed-upon Forward Rate; and

dtm = maturity of the forward rate, specified in days (FRA Days)

DY = Day count basis applicable to money market transactions which could be 360 or 365 days.

Accordingly,

If actual rate of interest after 6 months happens to be 9.60%

$$= \frac{(60 \text{ crore})(0.096 - 0.093)(3/12)}{[1 + 0.096(3/12)]} = \frac{(60 \text{ crore})(0.00075)}{1.024} = 4,39,453.13$$

Thus banker will pay Parker & Co. a sum of 4,39,453.13 or 4,39,453.

If actual rate of interest after 6 months happens to be 8.80%

$$= \frac{(60 \text{ crore})(0.088 - 0.093)(3/12)}{[1 + 0.088(3/12)]} = \frac{(60 \text{ crore})(-0.00125)}{1.022} = -7,33,855.19$$

Thus Parker & Co. will pay banker a sum of 7,33,855.19 or 7,33,855.

Note: Alternatively, students may solve the question on basis of different days count conventions instead of months (as considered in above calculations) i.e. 90 days/360 days, 90 days/ 365 days, 91 days/360 days or 91 days/365 days.

Question 2

TM Fincorp has bought a 6 x 9 Rs. 100 crore Forward Rate Agreement (FRA) at 5.25%. On fixing date reference rate i.e. MIBOR turns out be as follows:

Period	Rate (%)
3 months	5.50
6 months	5.70
9 months	5.85

You are required to determine:

- (a) Profit/Loss to TM Fincorp. in terms of basis points. (b) The settlement amount.
(Assume 360 days in a year)

Solution

(a) TM will make a profit of 25 basis points since a 6X9 FRA is a contract on 3-month interest rate in 6 months, which turns out to be 5.50% (higher than FRA price).

(b) The settlement amount shall be calculated by using the following formula:

$$\frac{(N)(RR - FR)(dtm/360)}{[1 + RR(dt\text{m}/360)]}$$

Where

N = Notional Principal Amount

RR = Reference Rate

FR = Agreed upon Forward Rate

Dtm = FRA period specified in days.

Accordingly:

$$= \frac{100 \text{ crore}(5.50\% - 5.25\%)(90/360)}{[1 + 0.055(90/360)]} = 6,16,523$$

Hence there is profit of 6,16,523 to TM Fincorp.

Question 3

XYZ Limited borrows £ 15 Million of six months SONIA + 10.00% for a period of 24 months. The company anticipates a rise in SONIA, hence it proposes to buy a Cap Option from its Bankers at the strike rate of 8.00%. The lump sum premium is 1.00% for the entire reset periods and the fixed rate of interest is 7.00% per annum. The actual position of SONIA during the forthcoming reset period is as under:

Rate Period	SONIA
1	9.00%
2	9.50%
3	10.00%

You are required to show how far interest rate risk is hedged through Cap Option.

For calculation, work out figures at each stage up to three decimal points and amount nearest to £. It should be part of working notes.

Solution

First of all we shall calculate premium payable to bank as follows:

$$P = \frac{rp}{[(1+i) - \frac{1}{i \times (1+i)^t}]} \times A \quad \text{or} \quad \frac{rp}{PVA(3.5\%, 4)} \times A$$

Where

P = Premium

A = Principal Amount

rp = Rate of Premium

i = Fixed Rate of Interest

t = Time

$$= \frac{0.01}{(1/0.035) - \frac{1}{0.035 \times 1.035^4}} \times £15,000,000 \quad \text{or} \quad \frac{0.01}{(0.966 + 0.933 + 0.901 + 0.871)} \times £15,000,000$$

$$= \frac{0.01}{[(28.571) - \frac{1}{0.0402}]} \times £15,000,000 = £40,595 \text{ or } \frac{£150,000}{3.671} = £40,861$$

Now we see the net payment received from bank

Reset Period	Additional interest due to rise in interest rate	Amount received from bank	Premium paid to bank*	Net Amt. received from bank
1	£ 75,000	£ 75,000	£ 40,861	£34,139
2	£ 112,500	£ 112,500	£ 40,861	£71,639
3	£ 150,000	£ 150,000	£ 40,861	£109,139
TOTAL	£ 337,500	£ 337,500	£122,583	£ 214,917

Thus, from above it can be seen that interest rate risk amount of £ 337,500 reduced by £ 214,917 by using of Cap option.

* Alternatively, if premium paid is considered as £ 40,595, then above figure of £ 214,917 shall be changed to £ 215,715.

Question 4

Suppose a dealer quotes 'All-in-cost' for a generic swap at 8% against six month SOFR flat.

If the notional principal amount of swap is US\$ 5,00,000.

- Calculate semi-annual fixed payment.
- Find the first floating rate payment for (i) above if the six month period from the effective date of swap to the settlement date comprises 181 days and that the corresponding SOFR was 6% on the effective date of swap.

In (ii) above, if the settlement is on 'Net' basis, how much the fixed rate payer would pay to the floating rate payer?

Generic swap is based on 30/360 days basis.

Solution

(i) Semi-annual fixed payment

= (N) (AIC) (Period)

Where N = Notional Principal amount = US\$ 5,00,000

AIC = All-in-cost = 8% = 0.08

= 5,00,000 × 0.08 (180/360) = 5,00,000 × 0.08 (0.5) = 5,00,000 × 0.04 = 20,000/-

(ii) Floating Rate Payment

= N (SOFR) (dt/360) = 5,00,000 × 0.06 × 181/360

= 5,00,000 × 0.06 (0.503) or 5,00,000 × 0.06 (0.502777)

= 5,00,000 × 0.03018 or 5,00,000 × 0.030166 = US\$ 15,090 or 15,083

(iii) Net Amount

= (i) - (ii)

= US\$ 20,000 - US\$ 15,090 = US\$ 4,910

or = US\$ 20,000 - US\$ 15,083 = US\$ 4,917

Question 5

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,

- What is the nature of this Swap arrangement.
- Calculate Fixed rate and interest under both legs.

Notes: (i) Sunday is Holiday. (ii) Work in rounded rupees and avoid decimal working.

Solution

The given swap arrangement is Plain Vanilla Overnight Index Swap (OIS)

Day	Principal ()	MIBOR (%)	Interest ()
Tuesday	10,00,00,000	7.75	21,233
Wednesday	10,00,21,233	8.15	22,334
Thursday	10,00,43,567	8.12	22,256
Friday	10,00,65,823	7.95	21,795
Saturday & Sunday (*)	10,00,87,618	7.98	43,764
Monday	10,01,31,382	8.15	<u>22,358</u>
Total Interest @ Floating			1,53,740
Less: Net Received			<u>317</u>
Expected Interest @ fixed			<u>1,53,423</u>
Thus Fixed Rate of Interest			0.07999914
Approx.			8%

(*) i.e. interest for two days.

Note: Alternatively, answer can also be calculated on the basis of 360 days in a year.

Question 6

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

Opportunity gain of A Inc under currency swap	Receipt	Payment	Net
Interest to be remitted to B. Inc in \$ 2,00,000 × 9% = \$18,000 Converted into (\$18,000 × ¥120)		¥21,60,000	
Interest to be received from B. Inc in \$ converted into ¥ (6% × \$2,00,000 × ¥120)	¥14,40,000	-	
Interest payable on ¥ loan	=	<u>¥12,00,000</u>	
	¥14,40,000	¥33,60,000	
Net Payment	<u>¥19,20,000</u>	=	
	<u>¥33,60,000</u>	<u>¥33,60,000</u>	
\$ equivalent paid ¥19,20,000 × (1/¥120)			\$16,000
Interest payable without swap in \$			<u>\$18,000</u>
Opportunity gain in \$			<u>\$ 2,000</u>

Opportunity gain of B inc under currency swap	Receipt	Payment	Net
Interest to be remitted to A. Inc in (\$ 2,00,000 × 6%)		\$12,000	
Interest to be received from A. Inc in ¥ converted into \$ = ¥21,60,000/¥120	\$18,000		
Interest payable on \$ loan@10%	=	<u>\$20,000</u>	
	\$18,000	\$32,000	
Net Payment	<u>\$14,000</u> <u>\$32,000</u>	= <u>\$32,000</u>	
¥ equivalent paid \$14,000 × ¥120			¥16,80,000
Interest payable without swap in ¥ (\$2,00,000 × ¥ 120 × 8%)			<u>¥19,20,000</u>
Opportunity gain in ¥			<u>¥ 2,40,000</u>

Alternative Solution

Cash Flows of A Inc

(i) At the time of exchange of principal amount

Transactions		Cash Flows
Borrowings	\$2,00,000 × ¥120	+ ¥240,00,000
Swap		- ¥240,00,000
Swap		<u>+\$2,00,000</u>
Net Amount		<u>+\$2,00,000</u>

(ii) At the time of exchange of interest amount

Transactions		Cash Flows
Interest to the lender	¥240,00,000X5%	¥12,00,000
Interest Receipt from B Inc.	¥2,00,000X120X6%	¥14,40,000
Net Saving (in \$)	¥2,40,000/¥120	\$2,000
Interest to B Inc.	\$2,00,000X9%	<u>-\$18,000</u>
Net Interest Cost		<u>-\$16,000</u>

A Inc. used \$2,00,000 at the net cost of borrowing of \$16,000 i.e. 8%. If it had not opted for swap agreement the borrowing cost would have been 9%. Thus there is saving of 1%.

Cash Flows of B Inc

(i) At the time of exchange of principal amount

Transactions		Cash Flows
Borrowings		+ \$2,00,000
Swap		- \$2,00,000
Swap	\$2,00,000X¥120	<u>+¥240,00,000</u>
Net Amount		<u>+¥240,00,000</u>

(ii) At the time of exchange of interest amount

Transactions		Cash Flows
Interest to the lender	\$2,00,000X10%	- \$20,000
Interest Receipt from A Inc.		+\$18,000
Net Saving (in ¥)	-\$2,000X¥120	- ¥2,40,000
Interest to A Inc.	\$2,00,000X6%X¥120	- ¥14,40,000
Net Interest Cost		- ¥16,80,000

B Inc. used ¥240,00,000 at the net cost of borrowing of ¥16,80,000 i.e. 7%. If it had not opted for swap agreement the borrowing cost would have been 8%. Thus there is saving of 1%.

Question 7

A textile manufacturer has taken floating interest rate loan of 40,00,000 on 1st April, 2012. The rate of interest at the inception of loan is 8.5% p.a. interest is to be paid every year on 31st March. In the month of October 2012, the Central bank of the country releases following projections about the interest rates likely to prevail in future.

- On 31st March, 2013, at 8.75%; on 31st March, 2014 at 10% on 31st March, 2015 at 10.5% and on 31st March, 2016 at 7.75%. Show how the borrower can hedge the risk using Option Cap arising out of expected rise in the rate of interest when he wants to peg his interest cost at 8.50% p.a.
- Assume that the premium negotiated by both the parties is 0.75% to be paid at once on 1st October, 2012 and the actual rate of interest on the respective due dates happens to be as: on 31st March, 2013 at 10.2%; on 31st March, 2014 at 11.5%; on 31st March, 2015 at 9.25%; on 31st March, 2016 at 8.25%. Show how the settlement will be executed on the perspective interest due dates.

Solution

As borrower does not want to pay more than 8.5% p.a., on this loan where the rate of interest is likely to rise beyond this, hence, he has hedge the risk by entering into an agreement to buy interest rate caps with the following parameters:

- Notional Principal: 40,00,000/-
- Strike rate: 8.5% p.a.
- Reference rate: the rate of interest applicable to this loan
- Calculation and settlement date: 31st March every year
- Duration of the caps: till 31st March 2016
- Premium for caps: negotiable between both the parties

To purchase the caps this borrower is required to pay the premium upfront at the time of buying caps. The payment of such premium will entitle him with right to receive the compensation from the seller of the caps as soon as the rate of interest on this loan rises above 8.5%. The compensation will be at the rate of the difference between the rate of none of the cases the cost of this loan will rise above 8.5% calculated on 40,00,000/-. This implies that in none of the cases the cost of this loan will rise above 8.5%. This hedging benefit is received at the respective interest due dates at the cost of premium to be paid only once.

The premium to be paid on 1st October 2012 is 30,000/- ($40,00,000 \times 0.75/100$). The payment of this premium will entitle the buyer of the caps to receive the compensation from the seller of the caps whereas the buyer will not have obligation. The compensation received by the buyer of caps will be as follows:

On 31st March 2013

The buyer of the caps will receive the compensation at the rate of 1.70% ($10.20 - 8.50$) to be calculated on 40,00,000, the amount of compensation will be 68000/- ($40,00,000 \times 1.70/100$).

On 31st March 2014

The buyer of the caps will receive the compensation at the rate of 3.00% ($11.50 - 8.50$) to be calculated on 40,00,000/-, the amount of compensation will be 120000/- ($40,00,000 \times 3.00/100$).

On 31st March 2015

The buyer of the caps will receive the compensation at the rate of 0.75% ($9.25 - 8.50$) to be calculated on 40,00,000/-, the amount of compensation will be 30,000 ($40,00,000 \times 0.75/100$).

On 31st March 2016

The buyer of the caps will not receive the compensation as the actual rate of interest is 8.25% whereas strike rate of caps is 8.5%. Hence, his interest liability shall not exceed 8.50%.

Thus, by paying once the premium upfront buyer of the caps gets the compensation on the respective interest due dates without any obligations.

Question 8**[OLD PM]**

Electra space 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

- By entering into an FRA, firm shall effectively lock in interest rate for a specified future in the given it is 6 months. Since, the period of 6 months is starting in 3 months, the firm shall opt for 3 × 9 FRA locking borrowing rate at 5.94%. In the given scenarios, the net outcome shall be as follows:

	If the rate turns out to be 4.50%	If the rate turns out to be 6.50%
FRA Rate	5.94%	5.94%
Actual Interest Rate	4.50%	6.50%
Loss/ (Gain)	1.44%	(0.56%)
FRA Payment / (Receipts)	€ 50 m × 1.44% × $\frac{1}{2}$ = € 360,000	€ 50m × 0.56% × $\frac{1}{2}$ = (€ 140,000)
Interest after 6 months on €50 Million at actual rates	= € 50m × 4.5% × $\frac{1}{2}$ = €1,125,000	= € 50m × 6.5% × $\frac{1}{2}$ = € 1,625,000
Net Out Flow	€ 1,485,000	€ 1,485,000

Thus, by entering into FRA, the firm has committed itself to a rate of 5.94% as follows:

$$\frac{€1,485,000}{€50,000,000} \times 100 \times \frac{6}{12} = 5.94\%$$

- Since firm is a borrower, it will like to off - set interest cost by profit on Future Contract. Accordingly, if interest rate rises it will gain hence it should sell interest rate futures.

The final outcome in the given two scenarios shall be as follows:

	If the interest rate turns out to be 4.5%	If the interest rate turns out to be 6.5%
Future Course Action:		
Sell to open	94.15	94.15
Buy to close	95.50 (100 - 4.5)	93.50 (100 - 6.5)
Loss / (Gain)	1.35%	(0.65%)
Cash Payment (Receipt) for Future Settlement	€ 50,000 × 2000 × 1.35% × 3/12 = €337,500	€ 50,000 × 2000 × 0.65% × 3/12 = (€ 162,500)
Interest for 6 months on € 50 million at actual rates	€ 50 million × 4.5% × $\frac{1}{2}$ = € 11,25,000	€ 50 million × 6.5% × $\frac{1}{2}$ = € 16,25,000
	€ 1,462,500	€ 1,462,500

Thus, the firm locked itself in interest rate $\frac{€1,462,500}{€50,000,000} \times 100 \times \frac{12}{6} = 5.85\%$

Question 9

[MTP OCT 21]

Two companies ABC Ltd. and XYZ Ltd. approach the DEF Bank for FRA (Forward Rate Agreement). They want to borrow a sum of ₹ 100 crores after 2 years for a period of 1 year. Bank has calculated Yield Curve of both companies as follows:

Year	XYZ Ltd.	ABC Ltd.*
1	3.86	4.12
2	4.20	5.48
3	4.48	5.78

*The difference in yield curve is due to the lower credit rating of ABC Ltd. compared to XYZ Ltd.

- You are required to calculate the rate of interest DEF Bank would quote under 2V3 FRA, using the company's yield information as quoted above.
- Suppose bank offers Interest Rate Guarantee for a premium of 0.1% of the amount of loan, you are required to calculate the interest payable by XYZ Ltd. if interest rate in 2 years turns out to be:
 - 4.50%
 - 5.50%

Solution

- DEF Bank will fix interest rate for 2V3 FRA after 2 years as follows:

$$\begin{aligned}
 (1+r) (1+0.0420)^2 &= \text{XYZ Ltd. } (1+0.0448)^3 \\
 (1+r) (1.0420)^2 &= (1.0448)^3 \\
 r &= 5.04\%
 \end{aligned}$$

Bank will quote 5.04% for a 2V3 FRA.

ABC Ltd.		
$(1+r) (1+0.0548)^2$	=	$(1+0.0578)^3$
$(1+r) (1.0548)^2$	=	$(1.0578)^3$
r	=	6.38%

Bank will quote 6.38% for a 2V3 FRA

(ii)

		4.50% - Allow to Lapse	5.50% - Exercise
Interest	₹ 100 crores X 4.50%	₹ 4.50 crores	
	₹100 crores X 5.04%	-	₹ 5.04 crores
Premium(Cost of Option)	₹ 100 crores X 0.1%	<u>₹ 0.10 crores</u>	<u>₹ 0.10 crores</u>
		<u>₹ 4.50 crores</u>	<u>₹ 5.14 crores</u>

Question 10**[OLD PM]**

MPD Inc. issues a ₹ 10 million floating rate loan on July 1, 2018 with resetting of coupon rate every 6 months equal to LIBOR + 50 bp. MPD is interested in an Interest Rate collar strategy by 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	₹ 10 million
Reference Rate	6 months LIBOR
Strike Rate	4% for Floor and 7% for Cap
Premium	Nil, Since Premium paid for Cap = Premium received for Floor

Using the following data you are required to determine:

- Effective interest paid out at each six reset dates, (Round off to the nearest rupee)
- The average overall effective rate of interest p.a. (Round off to 2 decimals)

Reset Date	LIBOR (%)
31-12-2018	6.00
30-06-2019	7.50
31-12-2019	5.00
30-06-2020	4.00
31-12-2020	3.75
30-06-2021	4.25

Solution

- a) The pay-off of each leg shall be computed as follows:

Cap Receipt

$$\text{Max} \frac{\{0, [\text{Notional principal} \times (\text{LIBOR on Reset date} - \text{Cap Strike Rate}) \times \text{Number of days in the settlement period}]\}}{365}$$

Floor Pay-Off

$$\text{Max} \frac{\{0, [\text{Notional principal} \times (\text{Floor Strike Rate} - \text{LIBOR on Reset date}) \times \text{Number of days in the settlement period}]\}}{365}$$

Statement showing effective interest on each re-set date

Reset Date	LIBOR (%)	Days	Interest Payment (₹) LIBOR+ 0.50%	Cap Receipts (₹)	Floor Pay-off (₹)	Effective Interest
31-12-2018	6.00	184	3,27,671	0	0	3,27,671
30-06-2019	7.50	181	3,96,712	24795	0	3,71,917
31-12-2019	5.00	184	2,77,260	0	0	2,77,260
30-06-2020	4.00	182	2,23,770	0	0	2,23,770
31-12-2020	3.75	184	2,13,661	0	12,568	2,26,229
30-06-2021	4.25	181	2,35,548	0	0	2,35,548
Total		1096				16,62,395

b) Average Annual Effective Interest Rate shall be computed as follows:

$$\frac{16,62,395}{1,00,00,000} \times \frac{365}{1096} \times 100 = 5.54\%$$

Question 11

[RTP MAY 18]

The following market data is available: Spot USD/JPY 116.00

Deposit rates p.a.	USD	JPY
3 months	4.50%	0.25%
6 months	5.00%	0.25%

Forward Rate Agreement (FRA) for Yen is Nil.

- 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

- 3 Months Interest rate is 4.50% & 6-Months Interest rate is 5% p.a.**
 Future Value 6 Months from now is a product of Future Value 3 Months now & 3 Months Future Value from after 3 Months.
 $(1+0.05*6/12) = (1+0.045*3/12) \times (1+ R*3/12)$
 i.e. 5.44% p.a.
- 6 Months Interest rate is 5% p.a & 12 Month interest rate is 6.5% p.a.**
 Future value 12 month from now is a product of Future value 6 Months from now and 6 Months Future value from after 6 Months.
 $(1+0.065) = (1+0.05*6/12) \times (1+ R*6/12)$
 6 Months forward 6 month rate is 7.80% p.a.

The Bank is quoting 6/12 USD FRA at 6.50 - 6.75%

Therefore, there is an arbitrage Opportunity of earning interest @ 7.80% p.a. & paying @ 6.75%

Borrow for 6 months, buy an FRA & invest for 12 months

To get \$ 1.065 at the end of 12 months for \$ 1 invested today

To pay \$ 1.060 at the end of 12 months for every \$ 1 Borrowed today

Net gain \$ 0.005 i.e. risk less profit for every \$ borrowed

Question 12

From the following data for government securities, calculate the forward rates:

Face value (₹)	Interest rate	Maturity (Year)	Current price (₹)
1,00,000	0%	1	91,500
1,00,000	10%	2	98,500
1,00,000	10.5%	3	99,000

Solution Consider one - year Treasury bill. $91,500 = \frac{1,00,000}{(1+r_1)}$

$$r_1 = 0.0929 \text{ or } 0.093$$

Consider two-year Government Security $98,500 = \frac{10,000}{1.093} + \frac{1,10,000}{1.093(1+r_2)}$ $98,500 = 9149.131 + \frac{1,10,000}{1.093(1+r_2)}$ $89,350.87 = \frac{100640.4}{1+r_2}$ $1+r_2 = 1.126351$ $r_2 = 0.126325$ $r_2 = 0.1263$	Consider three - year Government Securities: $99,000 = \frac{10,500}{1.093} + \frac{10,500}{1.093 \times 1.1263} + \frac{1,10,500}{1.093 \times 1.1263(1+r_3)}$ $99,000 = 9,606.587 + 8,529.65 + 89,761.07/1+r_3$ $1+r_3 = 1.1100284$ $r_3 = 0.1100284 \text{ say } 11.003\%$

Question 13

[MTP MARCH 21/MTP OCT 21]

IM is an American firm having its subsidiary in Japan and JI is a Japanese firm having its subsidiary in USA: They face the following interest rates

	IM	JI
USD Floating rate	LIBOR+0.5%	LIBOR+2.5%
JPY Fixed rate	4%	4.25%

IM wishes to borrow JPY at fixed rate and JI wished to borrow USD. The amount required by both the companies is same at the current Exchange Rate. A financial institution requires 75 basis points as commission for arranging Swap. The companies agree to share the benefit/ loss equally.

Advise:

- How a beneficial swap can be arranged?
- The effective interest cost for both IM and JI if swap arrangement is entered into.

Solution

IM has overall strong position and hence is in a comparative advantageous position in both rates. However, it has a comparative advantage in floating-rate market.

The differential between the U.S. dollar floating rates is 2.00% per annum, and the differential between the JPY fixed rates is 0.25% per annum. The difference between the differentials is 1.75% per annum. The total potential gain to all parties from the swap is therefore 1.75% per annum, or 175 basis points. If the financial intermediary requires 75 basis points, each of IM and JI can be made 50 basis points better off.

Since the Net Benefit of 100 Basis Points to be shared equally among IM and JI interest rate for them shall be as follows:

J

Borrowing from Market	LIBOR + 2.5%
Less: Benefit from Swap	0.5%
Net Interest	LIBOR + 2%

I

Borrowing from Market	4%
Less: Benefit from Swap	0.5%
Net Interest	3.5%

Question 14

[MTP APRIL 21]

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	1037.40	1.0370
6.55 GOI 2025	926.40	0.9060
6.80 GOI 2029	877.50	0.9195
6.85 GOI 2026	972.30	0.9643
8.44 GOI 2027	1146.30	1.1734
8.85 GOI 2028	1201.70	1.2428

Recommend the Security that should be delivered by the XYZ Bank if Future Settlement Price is 1000.

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 x Conversion Factor - Quoted Spot Price of Deliverable Bond

Security (1)	Future Settlement Price (2)	Conversion Factor (3)	(4) = (2) x (3)	Quoted Price of Bonds (5)	Profit (6)
7.96 GOI 2023	1000	1.0370	1037.00	1037.40	- 0.40
6.55 GOI 2025	1000	0.9060	906.00	926.40	- 20.40
6.80 GOI 2029	1000	0.9195	919.50	877.50	42.00
6.85 GOI 2026	1000	0.9643	964.30	972.30	- 8.00
8.44 GOI 2027	1000	1.1734	1173.40	1146.30	27.10
8.85 GOI 2028	1000	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 15**[NOV 20]**

IB an Indian firm has its subsidiary in Japan and Zaki a Japanese firm has its subsidiary in India and face the following interest rates:

Company	IB	Zaki
INR floating rate	BPLR + 0.50%	BPLR + 2.50%
JPY (Fixed rate)	2%	2.25%

Zaki wishes to borrow Rupee Loan at a floating rate and IB wishes to borrow JPY at a fixed rate. The amount of loan required by both the firms is same at the current exchange rate. A financial institution may arrange a swap and requires 25 basis points as its commission. Gain, if any, is to be shared by the firms equally.

You are required to find out:

- Whether a swap can be arranged which may be beneficial to both the firms?
- What rate of interest will the firms end up paying?

Solution

Though Company IB has an advantage in both the markets but it has comparative more advantage in the INR floating-rate market. Company Zaki has a comparative advantage in the JPY fixed interest rate market.

However, company IB wants to borrow in the JPY fixed interest rate market and company Zaki wants to borrow in the INR floating-rate market. This gives rise to the swap opportunity.

IB raises INR floating rate at BPLR + 0.50% and Zaki raises JPY at 2.25%

Total Potential Gain = (INR interest differential) - (Yen rate differential) = (BPLR + 2.50% - BPLR + 0.50%) + (2% - 2.25%)	1.75%
Less: Banker's Commission(to be shared equally)	0.25%
Net Gain (To be shared equally: 0.75% each)	1.50%

Yes, a beneficial swap can be arranged

Since net benefit of 1.5% is to be shared equally, effective cost will be

IB

Borrowing from Market	2%
Less: Benefit from swap	(0.75%)
Net Interest	1.25%

Zaki

Borrowing from Market	BPLR + 2.5%
Less: Benefit from swap	(0.75%)
Net Interest	BPLR + 1.75%



Business Valuation

Question 1

There is a privately held company X Pvt. Ltd that is operating into the retail space, and is now scouting for angel investors. The details pertinent to valuing X Pvt. Ltd are as follows -

The company has achieved break even this year and has an EBITDA of 90. The unleveraged beta based on the industry in which it operates is 1.8, and the average debt to equity ratio is hovering at 40:60. The rate of return provided by risk free liquid bonds is 5%. The EV is to be taken at a multiple of 5 on EBITDA. The accountant has informed that the EBITDA of 90 includes an extraordinary gain of 10 for the year, and a potential write off of preliminary sales promotion costs of 20 are still pending. The internal assessment of rate of market return for the industry is 11%. The FCFs for the next 3 years are as follows:

	Y1	Y2	Y3
Future Cash flows	100	120	150

The pre-tax cost of debt is 12%. Assume a tax regime of 30%. What is the potential value to be placed on X Pvt. Ltd?

Solution

The levered beta of the company will be $1.8[1+(1-0.3)*40/60]] = 2.64$

The adjusted EBITDA would be $90 - 10 - 20 = 60$

The EV will be multiple of 5 on the 60 obtained above = 300

The Cost of equity in accordance with CAPM = $r(f) + \beta (R_m - R_f)$
 $= 5\% + 2.64 (11\% - 5\%) = 20.84\%$

The WACC = Cost of Equity + Cost of Debt
 $= 20.84 (60/100) + 12.0 (1-0.3) (40/100) = 15.864$

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

	Y1	Y2	Y3
Future Cash flows	100	120	150
Discount factor	0.863	0.745	0.643
PVs of cash flows	86.30	89.40	96.45
VALUE OF THE FIRM			272.15

Question 2

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

Risk Free Rate of Return	4.5%
Market Rate of Return	12%
β of the Company	0.9

Determine: (a) Per Share Earning Value of the Company. (b) Equity Value of the company if applicable EBITDA multiple is 5.

Solution

(a) Capitalization Rate using CAPM $4.5\% + 0.9(12\% - 4.5\%) = 11.25\%$

Calculation of Earning Value Per Share

	(000)
Gross Profit	1000
Less: Indirect Expenses	(400)
EBITDA	600
Earning Value of Company (600/ 0.1125)	5333.33
Number of Shares	1,00,000
Earning Value Per Share	53.33

(b) Equity Value of Company

	(000)
EBITDA	600
EBITDA Multiple	5
Capitalized Value	3000
Less: Debt	(300)
Add: Surplus Funds	500
Equity Value	3200

Question 3 The balance sheet of H K Ltd. is as follows:

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

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

Solution

Shares outstanding	70,000
CMP	12
Market Capitalization	8,40,000
Add: Debt	2,00,000
Less: Cash & Cash equivalents	(5,00,000)
Enterprise Value (EV)	5,40,000

Question 4

Using the chop-shop approach (or Break-up value approach), assign a value for Cornett GMBH. whose stock is currently trading at a total market price of €4 million. For Cornett, the accounting data set forth in three business segments: consumer wholesaling, specialty services, and assorted centers. Data for the firm's three segments are as follows:

Business segment	Segment sales	Segment assets	Segment income
Consumer wholesaling	€1,500,000	€ 750,000	€100,000
Specialty services	€800,000	€700,000	€150,000
Assorted centers	€2,000,000	€3,000,000	€600,000

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

Business segment	Capitalization/sales	Capitalization/assets	Capitalization/operating income
Consumer wholesaling	0.75	0.60	10.00
Specialty services	1.10	0.90	7.00
Assorted centers	1.00	0.60	6.00

Solution Cornett, GMBH. - Break-up valuation

Business Segment	Capital-to-Sales	Segment Sales	Theoretical Values
Consumer wholesaling	0.75	€1,500,000	€1,125,000
Specialty services	1.10	€800,000	€880,000
Assorted centers	1.00	€2,000,000	€2,000,000
Total value			€4,005,000

Business Segment	Capital-to-Assets	Segment Assets	Theoretical Values
Consumer wholesaling	0.60	€750,000	€450,000
Specialty services	0.90	€700,000	€630,000
Assorted centers	0.60	€3,000,000	€1,800,000
Total value			€2,880,000

Business Segment	Capital-to-Income	Segment Income	Theoretical Values
Consumer wholesaling	10.00	€100,000	€1,000,000
Specialty services	7.00	€150,000	€1,050,000
Assorted centers	6.00	€600,000	€3,600,000
Total value			€5,650,000

Average theoretical value = $4,005,000 + 2,880,000 + 5,650,000 / 3 = 4,178,333.33$ say 4,178,000

Average theoretical value of Cornett GMBH. = €4,178,000

Question 5

Compute EVA of A Ltd. with the following information:

All Figure are in Lac

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

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

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

Solution Step I: Computation of NOPAT

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

Step II: Finding out the Invested Capital:

Invested Capital	
Total Assets	1300
Less: Non Interest bearing liabilities	-400
	900
Add: Non Cash adjustment	20
	920

Note: It is assumed that the current liabilities also include the 100 of tax liability.

Step III: Compute the WACC: $WACC = \text{Cost of equity} + \text{Cost of debt}$

In this case, $WACC = (800/900 \times 8.45\%) + [100/900 \times 12\% (1 - 0.30)] = 8.44\%$

Step IV: Find out the Capital Charge

Capital Charge = Invested Capital * WACC = $920 \times 8.44\% = 77.65$

Step V: EVA = Adjusted NOPAT - Capital Charge = $307 - 77.65 = 229.35$

Question 6

ABC Company is considering acquisition of XYZ Ltd. which has 1.5 crores shares outstanding and issued. The market price per share is 400 at present. ABC's average cost of capital is 12%. Available information from XYZ indicates its expected cash accruals for the next 3 years as follows:

Year	Cr.
1	250
2	300
3	400

Calculate the range of valuation that ABC has to consider. (PV factors at 12% for years 1 to 3 respectively: 0.893, 0.797 and 0.712).

Solution

VALUATION BASED ON MARKET PRICE

Market Price per share	400
Thus value of total business is (400 x 1.5 Cr.)	600 Cr.

VALUATION BASED ON DISCOUNTED CASH FLOW

Present Value of cash flows (250 cr x 0.893) + (300 cr. X 0.797) + (400 cr. X 0.712) = 747.15 Cr.

Value of per share (747.15 Cr. / 1.5 Cr) = 498.10 per share

RANGE OF VALUATION

	Per Share	Total Cr.
Minimum	400.00	600.00
Maximum	498.10	747.15

Question 7

Eagle Ltd. reported a profit of 77 lakhs after 30% tax for the financial year 2011-12. An analysis of the accounts revealed that the income included extraordinary items of 8 lakhs and an extraordinary loss of 10 lakhs. The existing operations, except for the extraordinary items, are expected to continue in the future. In addition, the results of the launch of a new product are expected to be as follows:

	In lakhs
Sales	70
Material costs	20
Labour costs	12
Fixed costs	10

You are required to:

- Calculate the value of the business, given that the capitalization rate is 14%.
- Determine the market price per equity share, with Eagle Ltd.'s share capital being comprised of 1,00,000 13% preference shares of 100 each and 50,00,000 equity shares of 10 each and the P/E ratio being 10 times.

Solution**(i) Computation of Business Value**

		(Lakhs)
Profit before tax 77/(1 -0.30)		110
Less: Extraordinary income		(8)
Add: Extraordinary losses		10
		112
Profit from new product	(Lakhs)	
Sales	70	
Less: Material costs 20		
Labour costs 12		28
Fixed costs 10	(42)	
		140.00
Less: Taxes @30%		42.00
Future Maintainable Profit after taxes		98.00
Relevant Capitalisation Factor		0.14
Value of Business (98/0.14)		700

(ii) Determination of Market Price of Equity Share

Future maintainable profits (After Tax)	98,00,000
Less: Preference share dividends 1,00,000 shares of 100 @ 13%	13,00,000
Earnings available for Equity Shareholders	85,00,000
No. of Equity Shares	50,00,000
Earning per share = $\frac{85,00,000}{50,00,000}$	<u>1.70</u>
PE ratio	10
Market price per share	17

Question 8 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

Projected Balance Sheet

	Year 1	Year 2	Year 3	Year 4
Fixed Assets (40% of Sales)	9,600	11,520	13,824	13,824
Current Assets (20% of Sales)	4,800	5,760	6,912	6,912
Total Assets	14,400	17,280	20,736	20,736
Equity	14,400	17,280	20,736	20,736

Projected Cash Flows:-

	Year 1	Year 2	Year 3	Year 4
Sales	24,000	28,800	34,560	34,560
PBT (10% of sale)	2,400	2,880	3,456	3,456
PAT (70%)	1,680	2,016	2,419.20	2,419.20
Depreciation	800	960	1,152	1,382
Addition to Fixed Assets	(2,400)	(2,880)	(3,456)	(1,382)
Increase in Current Assets	(800)	(960)	(1,152)	-
Operating cash flow (FCFF)	(720)	(864)	(1,036.80)	2,419.20

Projected Cash Flows:-

Present value of Projected Cash Flows:-

Cash Flows	PVF at 15%	PV
-720	0.870	-626.40
-864	0.756	-653.18
-1,036.80	0.658	-682.21
		-1,961.79

Residual Value= $2419.20/0.15 = 16,128$

Present value of Residual value	=	$16128/(1.15)^3$	
	=	$16128/1.521 = 10603.55$	
Total shareholders' value	=	10,603.55 - 1,961.79 =	8,641.76
Pre strategy value	=	$1,400 / 0.15 = 9,333.33$	
Incremental Value of strategy	=	8,641.76 - 9,333.33 =	- 691.57

Conclusion: The strategy is not financially viable

Question 9

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

Balance sheet as at 31st March, 2012 (In Crores of Rupees)

Liabilities:	H. Ltd	B. Ltd.
Paid up Share Capital		
-Equity Shares of 100 each	350.00	--
-Equity Shares of 10 each	--	6.50
Reserve & Surplus	950.00	25.00
Total	1,300.00	31.50
Assets:		
Net Fixed Assets	220.00	0.50
Net Current Assets	1,020.00	29.00
Deferred Tax Assets	60.00	2.00
Total	1,300.00	31.50

H Ltd. proposes to buy out B Ltd. and the following information is provided to you as part of the scheme of buying:

- (1) The weighted average post tax maintainable profits of H Ltd. and B Ltd. for the last 4 years are 300 crores and 10 crores respectively.
- (2) Both the companies envisage a capitalization rate of 8%.
- (3) H Ltd. has a contingent liability of 300 crores as on 31st March, 2012.
- (4) H Ltd. to issue shares of 100 each to the shareholders of B Ltd. in terms of the exchange ratio as arrived on a Fair Value basis. (Please consider weights of 1 and 3 for the value of shares arrived on Net Asset basis and Earnings capitalization method respectively for both H Ltd. and B Ltd.)

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

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

Solution

- (i) Net asset value

H Ltd.	$\frac{1300 \text{ Crores} - 300 \text{ Crores}}{3.50 \text{ Crores}} = 285.71$
B Ltd.	$\frac{31.50 \text{ Crores}}{0.65 \text{ Crores}} = 48.46$

- (ii) Earning capitalization value

H Ltd.	$\frac{300 \text{ Crores} / 0.08}{3.50 \text{ Crores}} = 1071.43$
B Ltd.	$\frac{10 \text{ Crores} / 0.08}{0.65 \text{ Crores}} = 192.31$

- (iii) Fair value

H Ltd.	$\frac{285.71 \times 1 + 1071.43 \times 3}{4} = 875$
B Ltd.	$\frac{48.46 \times 1 + 192.31 \times 3}{4} = 156.3475$
Exchange ratio	$156.3475 / 875 = 0.1787$

H Ltd should issue its 0.1787 share for each share of B Ltd.

Note: In above solution it has been assumed that contingent liability will materialize at its full amount.

Question 10

AB Ltd., is planning to acquire and absorb the running business of XY Ltd. The valuation is to be based on the recommendation of merchant bankers and the consideration is to be discharged in the form of equity shares to be issued by AB Ltd. As on 31.3.2006, the paid up capital of AB Ltd. consists of 80 lakhs shares of 10 each. The highest and the lowest market quotation during the last 6 months were 570 and 430. For the purpose of the exchange, the price per share is to be reckoned as the average of the highest and lowest market price during the last 6 months ended on 31.3.06.

XY Ltd.'s Balance Sheet as at 31.3.2006 is summarised below:

	lakhs
Sources	
Share Capital	
20 lakhs equity shares of 10 each fully paid	200
10 lakhs equity shares of 10 each, 5 paid	50
Loans	100
Total	350

Uses	
Fixed Assets (Net)	150
Net Current Assets	<u>200</u>
	<u>350</u>

An independent firm of merchant bankers engaged for the negotiation, have produced the following estimates of cash flows from the business of XY Ltd.:

Year ended	By way of	lakhs
31.3.07	after tax earnings for equity	105
31.3.08	do	120
31.3.09	Do	125
31.3.10	Do	120
31.3.11	Do	100
	Terminal Value estimate	200

It is the recommendation of the merchant banker that the business of XY Ltd. may be valued on the basis of the average of (i) Aggregate of discounted cash flows at 8% and (ii) Net assets value. Present value factors at 8% for years

1-5:	0.93	0.86	0.79	0.74	0.68

You are required to:

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

Solution

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

Value of XY Ltd based on future cash flow capitalization $(105 \times 0.93) + (120 \times 0.86) + (125 \times 0.79) + (120 \times 0.74) + (300 \times 0.68)$	lakhs	592.40
Value of XY Ltd based on net assets	lakhs	250.00
Average value $(592.40+250)/2$		421.20
No. of shares in AB Ltd to be issued $4,21,20,000/500$	Nos.	84240
Basis of allocation of shares		
Fully paid equivalent shares in XY Ltd. $(20+5)$ lakhs		2500000
Distribution to fully paid shareholders $84240 \times 20/25$		67392
Distribution to partly paid shareholders $84240 - 67392$		16848

Question 11

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 Cost of capital by applying Free Cash Flow to Firm (FCFF) Model is as follows:-

$$\text{Value of Firm} = V_0 = \frac{\text{FCFF}_1}{K_c - g_n}$$

Where -

FCFF_1 = Expected FCFF in the year 1

K_c = Cost of capital

g_n = Growth rate forever

Thus, 1800 lakhs = 54 lakhs / ($K_c - g$)

Since $g = 9\%$, then $K_c = 12\%$

Now, let X be weight of debt and given cost of equity = 20% and cost of debt = 10%, then $20\% (1 - X) + 10\% X = 12\%$

Hence, $X = 0.80$, so book value weight for debt was 80%

∴ Correct weight should be 60 of equity and 40 of debt.

∴ Cost of capital = $K_c = 20\% (60/132) + 10\% (72/132) = 14.5455\%$ and correct firm's value = 54 lakhs / ($0.1454 - 0.09$) = 974.73 lakhs.

Question 12

Following information are 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

High growth phase	Stable growth phase
$k_e = 0.10 + 1.15 \times 0.06 = 0.169$ or 16.9%.	$k_e = 0.09 + 1.0 \times 0.05 = 0.14$ or 14%.
$k_d = 0.13 \times (1 - 0.3) = 0.091$ or 9.1%.	$k_d = 0.1286 \times (1 - 0.3) = 0.09$ or 9%.
Cost of capital = $0.5 \times 0.169 + 0.5 \times 0.091 = 13\%$.	Cost of capital = $0.6 \times 0.14 + 0.4 \times 0.09 = 12\%$.

Determination of forecasted Free Cash Flow of the Firm (FCFF) (in crores)

	Yr. 1	Yr. 2	Yr. 3	Yr. 4	Terminal Year
Revenue	2,400	2,880	3,456	4,147.20	4,561.92
EBIT	360	432	518.40	622.08	684.29
EAT	252	302.40	362.88	435.46	479.00
Capital Expenditure	96	115.20	138.24	165.89	-
Less Depreciation					
Δ Working Capital	100.00	120.00	144.00	172.80	103.68
Free Cash Flow (FCF)	56.00	67.20	80.64	96.77	375.32

Alternatively, it can also be computed as follows: (in crores)

	Yr. 1	Yr. 2	Yr. 3	Yr. 4	Terminal Year
Revenue	2,400	2,880	3,456	4,147.20	4,561.92
EBIT	360	432	518.40	622.08	684.29
EAT	252	302.40	362.88	435.46	479.00
Add: Depreciation	240	288	345.60	414.72	456.19
	492	590.40	708.48	850.18	935.19
Less: Capital Exp.	336	403.20	483.84	580.61	456.19
□ WC	100.00	120.00	144.00	172.80	103.68
	56.00	67.20	80.64	96.77	375.32

Present Value (PV) of FCFF during the explicit forecast period is:

FCFF (in crores)	PVF @ 13%	PV (in crores)
56.00	0.885	49.56
67.20	0.783	52.62
80.64	0.693	55.88
96.77	0.613	59.32
		217.38

Terminal Value of Cash Flow $375.32 / 0.12 - 0.10 = 18,766.00$ Crores

PV of the terminal, value is = $18,766.00 \text{ Crores} \times 1/(1.13)^4 = 18,766.00 \text{ Crores} \times 0.613$
 = ₹ 11,503.56 Crores

The value of the firm is : $217.38 \text{ Crores} + 11,503.56 \text{ Crores} = 11,720.94 \text{ Crores}$

Question 13

Following information is given in respect of WXY Ltd., which is expected to grow at a rate of 20% p.a. for next three years, after which the growth rate will stabilize at 8% p.a. normal level, in perpetuity.

	For the year ended March 31, 2014
Revenues	7,500 Crores
Cost of Goods Sold (COGS)	3,000 Crores
Operating Expenses	2,250 Crores
Capital Expenditure	750 Crores
Depreciation (included in Operating Expenses)	600 Crores

During high growth period, revenues & Earnings before Interest & Tax (EBIT) will grow at 20% p.a. and capital expenditure net of depreciation will grow at 15% p.a. From year 4 onwards, i.e. normal growth period revenues and EBIT will grow at 8% p.a. and incremental capital expenditure will be offset by the depreciation. During both high growth & normal growth period, net working capital requirement will be 25% of revenues.

The Weighted Average Cost of Capital (WACC) of WXY Ltd. is 15%.

Corporate Income Tax rate will be 30%.

Required: Estimate the value of WXY Ltd. using Free Cash Flows to Firm (FCFF) & WACC methodology.

The PVIF @ 15 % for the three years are as below:

Year	t_1	t_2	t_3
PVIF	0.8696	0.7561	0.6575

Solution Determination of forecasted Free Cash Flow of the Firm (FCFF)

(in crores)

	Yr. 1	Yr. 2	Yr. 3	Terminal Year
Revenue	9000.00	10800.00	12960.00	13996.80
COGS	3600.00	4320.00	5184.00	5598.72
Operating Expenses	1980.00*	2376.00	2851.20	3079.30
Depreciation	720.00	864.00	1036.80	1119.74
EBIT	2700.00	3240.00	3888.00	4199.04
Tax @30%	810.00	972.00	1166.40	1259.71
EAT	1890.00	2268.00	2721.60	2939.33
Capital Exp. - Dep.	172.50	198.38	228.13	-
Δ Working Capital	375.00	450.00	540.00	259.20
Free Cash Flow (FCF)	1342.50	1619.62	1953.47	2680.13

* Excluding Depreciation.

Present Value (PV) of FCFF during the explicit forecast period is:

FCFF (in crores)	PVF @ 15%	PV (in crores)
1342.50	0.8696	1167.44
1619.62	0.7561	1224.59
1953.47	0.6575	1284.41
		3676.44

PV of the terminal, value is:

$$\frac{2680.13}{0.15 - 0.08} \times \frac{1}{(1.15)^3} = 38287.57 \text{ Crore} \times 0.6575 = 25174.08 \text{ Crore}$$

The value of the firm is :

$$3676.44 \text{ Crores} + 25174.08 \text{ Crores} = 28,850.52 \text{ Crores}$$

Question 14 With help of 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

$$\text{Financial Leverage} = \text{PBIT} / \text{PBT}$$

$$1.5 = \text{PBIT} / (\text{PBIT} - \text{Interest})$$

$$1.5 = \text{PBIT} / (\text{PBIT} - 40)$$

$$1.5 (\text{PBIT} - 40) = \text{PBIT}$$

$$1.5 \text{ PBIT} - 60 = \text{PBIT}$$

$$1.5 \text{ PBIT} - \text{PBIT} = 60$$

$$0.5 \text{ PBIT} = 60$$

$$\text{or PBIT} = 60 / 0.5 = 120 \text{ lakhs}$$

$$\text{NOPAT} = \text{PBIT} - \text{Tax} = 120 \text{ lakhs} (1 - 0.30) = 84 \text{ lakhs.}$$

Weighted Average Cost of Capital (WACC)

$$= 14\% \times (300 / 700) + (1 - 0.30) \times (10\%) \times (400 / 700) = 10\%$$

$$\text{EVA} = \text{NOPAT} - (\text{WACC} \times \text{Total Capital})$$

$$\text{EVA} = 84 \text{ lakhs} - 0.10 \times 700 \text{ lakhs} = 14 \text{ lakhs}$$

Question 15

RST Ltd.'s current financial year's income statement reported its net income after tax as 25,00,000.

The applicable corporate income tax rate is 30%.

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

Debt (Coupon rate = 11%)	40 lakhs
Equity (Share Capital + Reserves & Surplus)	125 lakhs
Invested Capital	165 lakhs

Following data is given to estimate cost of equity capital:

Equity Beta of RST Ltd.	1.36
Risk-free rate i.e. current yield on Govt. bonds	8.5%
Average market risk premium (i.e. Excess of return on market portfolio over risk-free rate)	9%

Required:

- (i) Estimate Weighted Average Cost of Capital (WACC) of RST Ltd.; and
- (ii) Estimate Economic Value Added (EVA) of RST Ltd.

Solution

Cost of Equity as per CAPM $k_e = R_f + \beta \times \text{Market Risk Premium} = 8.5\% + 1.36 \times 9\%$
 $= 8.5\% + 12.24\% = 20.74\%$

Cost of Debt $k_d = 11\%(1 - 0.30) = 7.70\%$

$$WACC(K_0) = K_e \times \frac{E}{E+D} + K_d \times \frac{D}{E+D} = 20.74 \times \frac{125}{165} + 7.70 \times \frac{40}{165} = 15.71 + 1.87 = 17.58\%$$

Taxable Income = $25,00,000 / (1 - 0.30) = 35,71,429$ or 35.71 lakhs

Operating Income = Taxable Income + Interest = $35,71,429 + 4,40,000 = 40,11,429$ or 40.11 lacs

EVA = EBIT (1-Tax Rate) - WACC $\times$ Invested Capital = $40,11,429 (1 - 0.30) - 17.58\% \times 1,65,00,000$
 $= 28,08,000 - 29,00,700 = - 92,700$

Question 16

Tender Ltd has earned a net profit of 15 lacs after tax at 30%. Interest cost charged by financial institutions was 10 lacs. The invested capital is 95 lacs of which 55% is debt. The company maintains a weighted average cost of capital of 13%. Required,

- (a) Compute the operating income.
- (b) Compute the Economic Value Added (EVA).
- (c) Tender Ltd. has 6 lac equity shares outstanding. How much dividend can the company pay before the value of the entity starts declining?

Solution

Taxable Income = $15 \text{ lac} / (1 - 0.30) = 21.43 \text{ lacs}$ or 21,42,857

Operating Income = Taxable Income + Interest = $21,42,857 + 10,00,000 = 31,42,857$ or 31.43 lacs

EVA = EBIT (1-Tax Rate) - WACC $\times$ Invested Capital = $31,42,857 (1 - 0.30) - 13\% \times 95,00,000$
 $= 22,00,000 - 12,35,000 = 9,65,000$

EVA Dividend = $9,65,000 / 6,00,000 = 1.6083$

Question 17

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

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

The tax rate is uniform 35% in all cases.

- (i) Compute the Weighted average cost of capital for each company.
- (ii) Compute the Economic Valued Added (EVA) for each company.
- (iii) Based on the EVA, which company would be considered for best investment? Give reasons.
- (iv) If the industry PE ratio is 11x, estimate the price for the share of each company.
- (v) Calculate the estimated market capitalisation for each of the Companies.

Solution

(i) Working for calculation of WACC

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

WACC			
Orange:	$(10.4 \times 0.8) + (26 \times 0.2)$	=	13.52%
Grape:	$(8.45 \times 0.5) + (22 \times 0.5)$	=	15.225%
Apple:	$(9.75 \times 0.2) + (20 \times 0.8)$	=	17.95%

(ii)

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

- (iii) Orange would be considered as the best investment since the EVA of the company is highest and its weighted average cost of capital is the lowest

(iv) Estimated Price of each company shares

	Orange	Grape	Apple
EBIT ()	25,000	25,000	25,000
Interest ()	12,800	6,500	3,000
Taxable Income ()	12,200	18,500	22,000
Tax 35% ()	4,270	6,475	7,700
Net Income ()	7,930	12,025	14,300
Shares	6,100	8,300	10,000
EPS ()	1.30	1.45	1.43
Stock Price (EPS x PE Ratio) ()	14.30	15.95	15.73

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

(v) Market Capitalisation

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

Question 18

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%.

- (i) Compute the operating income or EBIT earned by Delta Ltd. in the current year.
- (ii) What is Delta Ltd.'s Economic Value Added (EVA) for the current year?
- (iii) 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

- (i) Taxable income = Net Income / (1 - 0.40)
or, Taxable income = 15,00,000 / (1 - 0.40) = 25,00,000
Again, taxable income = EBIT - Interest
or, EBIT = Taxable Income + Interest
= 25,00,000 + 15,00,000 = 40,00,000
- (ii) EVA = EBIT (1 - T) - (WACC × Invested capital)
= 40,00,000 (1 - 0.40) - (0.126 × 1,00,00,000)
= 24,00,000 - 12,60,000 = 11,40,000
- (iii) EVA Dividend = 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 19 Following data pertains to XYZ Inc. engaged in software consultancy business as on 31 December 2010. (\$ Million)

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

Balance Sheet (\$ Million)

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

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

(a) Economic Value Added® (b) Market Value Added.

Assuming that: (i)WACC is 12%. (ii)The share of company currently quoted at \$ 50 each

Solution

(a) Determination of Economic Value Added (EVA)

	\$ Million
EBIT	180.00
Less: Taxes @ 35%	63.00
Net Operating Profit after Tax	117.00
Less: Cost of Capital Employed [W. No.1]	72.60
Economic Value Added	44.40

(b) Determination of Market Value Added (MVA)

	\$ Million
Market value of Equity Stock [W. No. 2]	500
Equity Fund [W. No. 3]	425
Market Value Added	75

Working Notes:

(1)	Total Capital Employed	
	Equity Stock	\$ 100 Million
	Reserve and Surplus	\$ 325 Million
	Loan	\$ 180 Million
		\$ 605 Million
	WACC	12%
	Cost of Capital employed \$ 605 Million x 12%	\$ 72.60 Million
(2)	Market Price per equity share (A)	\$ 50
	No. of equity share outstanding (B)	10 Million
	Market value of equity stock (A) x (B)	\$ 500 Million
(3)	Equity Fund	
	Equity Stock	\$ 100 Million
	Reserves & Surplus	\$ 325 Million
		\$ 425 Million

Question 20

Herbal Gyan is a small but profitable producer of beauty cosmetics using the plant Aloe Vera. This is not a high-tech business, but Herbal's earnings have averaged around 12 lakh after tax, largely on the strength of its patented beauty cream for removing the pimples.

The patent has eight years to run, and Herbal has been offered 40 lakhs for the patent rights. Herbal's assets include 20 lakhs of working capital and 80 lakhs of property, plant, and equipment. The patent is not shown on Herbal's books. Suppose Herbal's cost of capital is 15 percent. What is its Economic Value Added (EVA)?

Solution EVA = Income earned - (Cost of capital x Total Investment)

Total Investments

Particulars	Amount
Working capital	20 lakhs
Property, plant, and equipment	80 lakhs
Patent rights	40 lakhs
Total	140 lakhs

Cost of Capital 15%

EVA = 12 lakh - (0.15 x 140 lakhs) = 12 lakh - 21 lakh = - 9 lakh

Thus, Herbal Gyan has a negative EVA of 9 lakhs.

Question 21

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 EVA = Income Earned - (Cost of Capital x Total Investment)

Total Investments

	Amount (Crore)
Net Worth	200.00
Long Term Debts	400.00
Patent Rights	100.00
Total	700.00

$$WACC(K_0) = K_e \times \frac{E}{E+D} + K_d \times \frac{D}{E+D} = 12 \times \frac{300}{700} + 10 \times \frac{400}{700} = 5.14\% + 5.71\% = 10.85\%$$

EVA = Profit Earned - WACC x Invested Capital

= 84 crore - 10.85% x 700 crore = 8.05 crore

Question 22

[OLD PM]

ABC (India) Ltd., a market leader in printing industry, is planning to diversify into defense equipment businesses that have recently been partially opened up by the GOI for private sector. In the meanwhile, the CEO of the company wants to get his company valued by a leading consultant, as he is not satisfied with the current market price of his scrip.

He approached consultant with a request to take up valuation of his company with the following data for the year ended 2009:

Share Price	₹ 66 per share
Outstanding debt	1934 lakh
Number of outstanding shares	75 lakh
Net income (PAT)	17.2 lakh

EBIT	245 lakh
Interest expenses	218.125 lakh
Capital expenditure	234.4 lakh
Depreciation	234.4 lakh
Working capital	44 lakh
Growth rate 8% (from 2010 to 2014)	
Growth rate 6% (beyond 2014)	
Free cash flow	240.336 lakh (year 2014 onwards)

The capital expenditure is expected to be equally offset by depreciation in future and the debt is expected to decline by 30% in 2014.

Required:

Estimate the value of the company and ascertain whether the ruling market price is undervalued as felt by the CEO based on the foregoing data. Assume that the cost of equity is 16%, and 30% of debt repayment is made in the year 2014.

Solution

(i) Computation of Tax rate

EBIT	=	₹ 245 lakh
Interest	=	₹ 218.125 lakh
PBT	=	₹ 26.875 lakh
PAT	=	₹ 17.2 lakh
Tax Paid	=	₹ 9.675 lakh
Tax Rate	=	₹ 9.675/26.875 = 0.36 = 36%

(ii) Computation for increase in working capital

Working capital (2009)	=	₹ 44 lakh
Increase in 2010	=	₹ 44 × 0.08 = ₹ 3.52 lakh

It will continue to increase @ 8% per annum.

(iii) Weighted average Cost of capital

Present debt =	₹ 1934 lakh
Interest cost =	₹ 218.125 lakh/ ₹ 1934 = 11.28%

$$K_c = \frac{4950}{1934 + 4950} \times 16\% + \frac{1934}{1934 + 4950} \times 11.28(1 - 0.36) = 11.51 + 2.028 = 13.54$$

(iv) As capital expenditure and depreciation are equal, they will not influence the free cash flows of the company.

(v) Computation of free cash flows upto 2012

Year	2010	2011	2012	2013	2014
	₹	₹	₹	₹	₹
EBIT (1 - t)	169.344 lakh	182.89 lakh	197.52 lakh	213.32 lakh	230.39 lakh
Increase in working capital	(3.52 lakh)	(3.80 lakh)	(4.10 lakh)	(4.43 lakh)	(4.78 lakh)
Debt repayment	-	-	-	-	$1934 \times 0.30 =$ (580.2 lakh)
Free cash flows	165.824 lakh	179.09 lakh	193.41 lakh	208.89 lakh	-354.59 lakh
PVF @ 13.54%	0.8807	0.7757	0.6832	0.6017	0.53
PV of free cash flow @ 13.54%	146.04 lakh	138.92 lakh	132.14 lakh	125.69 lakh	-187.93 lakh

Present value of free cash flows upto 2014 = ₹ 354.86 lakh

(vi) Cost of capital (2014 Onwards) Debt = $0.7 \times ₹ 1934 = ₹ 1353.80$ lakh

Equity = ₹ 4950 lakh

$$K_c = \frac{4950}{4950 + 1353.80} \times 16\% + \frac{1353.80}{4950 + 1353.80} \times 11.28(1 - 0.36)$$

$$= 12.56 + 1.55\% = 14.11\%$$

(vii) Continuing value = $240.336 / 0.1411 - 0.06 \times (1/1.1354)^5$

a) Value of Firm = PV of free cash flows upto 2014 + continuing value

= ₹ 354.86 lakh + ₹ 1570.556 lakh

= ₹ 1925.416 lakh

b) Value per share = (Value of Firm - Value of Debt) / Number of Shares

= (₹ 1925.416 lakh - ₹ 1353.80 lakh) / 75 lakh

= ₹ 7.622 < ₹ 66 (present market price)

Alternatively, following value can also be considered

= (Value of Firm - Value of Debt) / No. of Shares

= (₹ 1925.416 lakh - ₹ 1934) / 75 lakh

= - ₹ 0.1145 or ₹ 0

Thus, share has zero value, and hence overvalued.

Answer as per Equity Cash Approach

(i) Computation of tax rate

EBIT	=	₹ 245 lakh
Interest	=	₹ 218.125 lakh
PBT	=	₹ 26.875 lakh
PAT	=	₹ 17.2 lakh
Tax Paid	=	₹ 9.675 lakh
Tax Rate	=	₹ 9.675 / 26.875 = 0.36 = 36%

(ii) Computation for increase in working capital

Working capital (2009)	=	₹ 44 lakh
Increase in 2010	=	₹ 44 × 0.08 = ₹ 3.52 lakh

(iii) As capital exp and depreciation are equal, they will not influence free cash flows of company.

(iv) Computation of free cash flows upto 2014

Year	2010	2011	2012	2013	2014
	₹	₹	₹	₹	₹
EBIT	245.000	264.600	285.768	308.629	333.319
Less : Interest	218.125	218.125	218.125	218.125	218.125
EBT	26.875	46.475	67.643	90.504	180.531
Less: Tax	9.675	16.266	24.351	32.581	65.027
EAT	17.200	30.209	43.292	57.923	115.604
Increase in working capital	3.52	3.80	4.10	4.43	4.78
Debt Repayment	-	-	-	-	1934 × 0.30 = 580.20
Free cash flows	13.68	26.409	39.192	53.493	-469.376
PVF @ 16%	0.8621	0.7632	0.6407	0.5523	0.4761
PV of free cash flow	11.794	19.627	25.110	29.544	-233.470

Present value of free cash flows upto 2014 = - ₹ 137.395 lakh

(v) Continuing value = $\frac{117.473^*}{0.16 - 0.06} \times \frac{1}{(1.16)^5}$

(i) Value of Firm = PV of free cash flows upto 2014 + continuing value

= - ₹ 137.395 lakh + ₹ 559.304 lakh = ₹ 421.909 lakh

(ii) Value per share = Value of Equity / Number of Shares

= ₹ 421.909 lakh / 75 lakh

= ₹ 5.62 < ₹ 66 (present market value)

Question 23**[OLD PM]**

Personal Computer Division of Distress Ltd., a computer hardware manufacturing company has started facing financial difficulties for the last 2 to 3 years. The management of the division headed by Mr. Smith is interested in a buy - out on 1 April 2013. However, to make this buy - out successful there is an urgent need to attract substantial funds from venture capitalists. Ven Cap, a European venture capitalist firm has shown its interest to finance the proposed buy-out. Distress Ltd. is interested to sell the division for ₹ 180 crore and Mr. Smith is of opinion that an additional amount of ₹ 85 crore shall be required to make this division viable. The expected financing pattern shall be as follows:

Source	Mode	Amount (₹ Crore)
Management	Equity Shares of ₹ 10 each	60.00
Ven Cap VC	Equity Shares of ₹ 10 each	22.50
	9% Debentures with attached warrant of ₹ 100 each	22.50
	8% Loan	160.00
Total		265.00

The warrants can be exercised any time after 4 years from now for 10 equity shares @ ₹ 120 per share. The loan is repayable in one go at the end of 8th year. The debentures are repayable in equal annual installment consisting of both principal and interest amount over a period of 6 years.

Mr. Smith is of view that the proposed dividend shall not be kept more than 12.5% of distributable profit for the first 4 years. The forecasted EBIT after the proposed buyout is as follows:

Year	2013-14	2014-15	2015-16	2016-17
EBIT (₹ crore)	48	57	68	82

Applicable tax rate is 35% and it is expected that it shall remain unchanged at least for 5 - 6 years. In order to attract Ven Cap, Mr. Smith stated that book value of equity shall increase by 20% during above 4 years. Although, Ven Cap has shown their interest in investment but are doubtful about the projections of growth in the value as per projections of Mr. Smith. Further Ven Cap also demanded that warrants should be convertible in 18 shares instead of 10 as proposed by Mr. Smith.

You are required to determine whether or not the book value of equity is expected to grow by 20% per year. Further if you have been appointed by Mr. Smith as advisor then whether you would suggest to accept the demand of Ven Cap of 18 shares instead of 10 or not.

Solution Working Notes

Calculation of Interest Payment on 9% Debentures

PVAF (9%,6) = 4.486

Annual Installment = 22,50 crore / 4.486 = 5.0156 crore

Year	Balance Outstanding (₹ Crore)	Interest (₹Crore)	Installment (₹ Crore)	Principal Repayment (₹ Crore)	Balance (₹ Crore)
1	22.5000	2.025	5.0156	2.9906	19.5094
2	19.5094	1.756	5.0156	3.2596	16.2498
3	16.2498	1.462	5.0156	3.5536	12.6962
4	12.6962	1.143	5.0156	3.8726	8.8236

Statement showing Value of Equity

Particulars	2013-14 (₹ Crore)	2014-15 (₹ Crore)	2015-16 (₹ Crore)	2016-17 (₹ Crore)
EBIT	48.0000	57.0000	68.0000	82.0000
Interest on 9% Debentures	2.0250	1.7560	1.4620	1.1430
Interest on 8% Loan	12.8000	12.8000	12.8000	12.8000
EBT	33.1750	42.4440	53.7380	68.0570
Tax* @35%	11.6110	14.8550	18.8080	23.8200
EAT	21.5640	27.5890	34.9300	44.2370
Dividend @12.5% of EAT*	2.6955	3.4490	4.3660	5.5300
	18.8685	24.1400	30.5640	38.7070
Balance b/f	Nil	18.8685	43.0085	73.5725
Balance c/f	18.8685	43.0085	73.5725	112.2795
Share Capital	82.5000	82.5000	82.5000	82.5000
	101.3685	125.5085	156.0725	194.7795

*Figures have been rounded off.

In the beginning of 2013 - 14 equity was ₹ 82.5000 crore which has been grown to ₹ 194.7795 over a period of 4 years. In such case the compounded growth rate shall be as follows: $(194.7795 / 82.5000)^{1/4} - 1 = 23.96\%$

This growth rate is slightly higher than 20% as projected by Mr. Smith.

If condition of Ven Cap for 18 shares is accepted expected shareholding after 4 years shall be as follows:

No. of shares held by Management	6.00 crore
No. of shares held by Ven Cap at the starting stage	2.25 crore
No. of shares held by Ven Cap after 4 years	4.05 crore
Total holding	6.30 crore

Thus, it is likely that Mr. Smith may not accept this condition of Ven Cap as this may result in losing their majority ownership and control to Ven Cap. Mr. Smith may accept their condition if management has further opportunity to increase their ownership through other forms.

Question 24

[DEC 21]

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

Particulars	
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-

- (i) Calculate Weighted Average Cost of Capital of DY Ltd.
- (ii) Calculate Economic Value Added
- (iii) Calculate Market Value Added

Solution

(i) Weighted Average Cost of Capital of DY Ltd.

Cost of Equity as per CAPM $K_e = R_f + \beta \times \text{Market Risk Premium}$
 $= 7\% + 1.4 \times [12\% - 7\%] = 7\% + 7\% = 14\%$

Cost of Debt $k_d = 8\% (1 - 0.30) = 5.60\%$

$$WACC(K_0) = K_e \times \frac{E}{E+D} + K_d \times \frac{D}{E+D} = 14\% \times \frac{500}{750} + 5.60\% \times \frac{250}{750}$$

$$= 9.33\% + 1.87\% = 11.20\%$$

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

		₹ Lakhs
Sales		1000
Operating Expenses (excluding interest)	₹ 620	
	(₹ 20)	(₹ 600)
		₹ 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	<u>250</u>
Total Capital Employed	<u>750</u>

EVA = NOPAT – (WACC × Total Capital)

EVA = ₹ 280 Lakh – 0.1120 × ₹ 750 lakhs

EVA = 196.00 lakhs

(iii) Determination of Market Value Added (MVA)

	₹ Lakh
Market value of Equity Stock [₹ 900 Lakh - ₹ 250 Lakh]	650
Equity Fund [₹ 250 Lakh + ₹ 250 Lakh]	500
Market Value Added	150

Alternatively, it can also be computed as follows:

	₹ Lakh
Market value of DY Ltd.	900

Capital employed [₹ 250 Lakh + ₹ 250 Lakh + ₹ 250 Lakh]	750
Market Value Added	150

Question 25

[MAY 22]

Calculate the value of share from the following Information:

Profit of the company (After tax)	₹ 560 crores
Equity share capital of the Company	₹ 1900 crores
Par value of share	₹ 50 each
Debt ratio (Debt/Debt + Equity)	43%
Long run growth rate of the company	7%
Beta 0.1 (Risk free Interest rate)	9.5%
Market return	12.6%
Capital expenditure per share	₹ 53
Depreciation per share	₹ 45
Increase in working capital	₹ 4.62 per share

Solution

Number of Shares = $1900 \text{ crores} / 50 = 38 \text{ crores}$

EPS = PAT/No. of Share = 38 crores

EPS = $560 \text{ crores} / 38 \text{ crores} = 14.737$

Cost of Equity = $R_f + \beta (R_m - R_f) = 9.5 + 0.1 (12.6 - 9.5) = 9.81\%$

FCFE = Net income – [(1-b) (capex – dep) + (1-b) (ΔWC)]

FCFE

= $14.737 - [(1-0.43) (53-45) + (1-0.43) (4.62)]$

= $14.737 - [4.56 + 2.6334] = 7.5436$

$P = \frac{FCFE(1+g)}{K_e - g} = \frac{7.5436(1.07)}{0.0981 - 0.07} = \frac{8.0716}{0.0281} = 287.25$

Question 26

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

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

Summarized financial position as on 31st March 2012 as follows: \$ Million

Liabilities	Amount (\$ Million)	Assets	Amount (\$ Million)
Equity Stocks	12	Fixed Assets (Net)	17
12% Bonds	8	Current Assets	3
	20		20

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

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

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

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

Fixed assets are subject to depreciation at 15% as per WDV method.

The company has planned additional capital expenditures (in the beginning of each year) for the coming 8 years as follows:

Period	Amount (\$ Million)
1	0.50
2	0.80
3	2.00
4	2.50
5	3.50
6	2.50
7	1.50
8	1.00

(a) Investment in Working Capital is estimated to be 20% of Revenue.

(b) Applicable tax rate for the company is 30%

(c) Cost of Equity is estimated to be 16%

(d) The Free Cash Flow of the firm is expected to grow at 5% per annum after 8 years. With above information you are required to determine the: (i) Value of Firm & (ii) Value of Equity

Solution Working Notes

(a) Determination of Weighted Average Cost of Capital

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

(b) Schedule of Depreciation

\$ Million

Year	Opening Balance of Fixed Assets	Additional during the year	Total	Depreciation @ 15%
1	17.00	0.50	17.50	2.63
2	14.87	0.80	15.67	2.35
3	13.32	2.00	15.32	2.30
4	13.02	2.50	15.52	2.33
5	13.19	3.50	16.69	2.50
6	14.19	2.50	16.69	2.50
7	14.19	1.50	15.69	2.35
8	13.34	1.00	14.34	2.15

(c) Determination of Investment

\$ Million

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

*Balance of CA in Year 1 (\$ 3 Million) - Capital Expenditure in Year 1 (\$ 0.50 Million) ** Similarly balance of CA in Year 2 (\$2.80) - Capital Expenditure in Year 2 (\$ 0.80 Million)

(d) Determination of Present Value of Cash Inflows

\$ Million

Particulars				Years				
	1	2	3	4	5	6	7	8
Revenue(A)	8.00	10.00	15.00	22.00	30.00	26.00	23.00	20.00
Less:								
Expenses								
-Variable Cost	3.20	4.00	6.00	8.80	12.00	10.40	9.20	8.00
-Fixed Cash Operating Cost	1.60	1.60	1.60	1.60	2.00	2.00	2.00	2.00
Advertisement Cost	0.50	1.50	1.50	3.00	3.00	3.00	1.00	1.00
Depreciation	<u>2.63</u>	<u>2.35</u>	<u>2.30</u>	<u>2.33</u>	<u>2.50</u>	<u>2.50</u>	<u>2.35</u>	<u>2.15</u>
Total Expenses(B)	<u>7.93</u>	<u>9.45</u>	<u>11.40</u>	<u>15.73</u>	<u>19.50</u>	<u>17.90</u>	<u>14.55</u>	<u>13.15</u>
EBIT C = A-B	0.07	0.55	3.60	6.27	10.50	8.10	8.45	6.85
Less: Taxes @ 30% (D)	<u>0.02</u>	<u>0.16</u>	<u>1.08</u>	<u>1.88</u>	<u>3.15</u>	<u>2.43</u>	<u>2.53</u>	<u>2.06</u>
NOPAT (E) = (C) - (D)	0.05	0.39	2.52	4.39	7.35	5.67	5.92	4.79
Gross Cash Flow (F) = (E) + Dep	2.68	2.74	4.82	6.72	9.85	8.17	8.27	6.97
Free Cash Flow (H) = (F) -(G)	2.68	2.44	1.82	2.82	4.75	6.47	7.37	6.54
PVF @ 13% (I)	0.885	0.783	0.693	0.613	0.543	0.480	0.425	0.376
PV (H)(I)	2.371	1.911	1.261	1.729	2.579	3.106	3.132	2.46

Total present value = \$ 18.549 million

(e) **Determination of Present Value of Continuing Value (CV)**

$$CV = \frac{FCF_9}{K-g} = \frac{\$6.54\text{million}(1.05)}{0.13-0.05} = \frac{\$6.867\text{million}}{0.08} = \$ 85.8375 \text{ million}$$

Present Value of Continuing Value (CV) = \$ 85.8376 million × PVF13%,8 = \$ 85.96875 million × 0.376 = \$ 32.2749

(i) Value of Firm

\$ Million

Present Value of cash flow during explicit period	18.5490
Present value of Continuing Value	<u>32.2749</u>
Total Value	<u>50.8239</u>

(ii) Value Of Equity

\$ Million

Total value of Firm	50.8239
Less: Value of Debt	<u>8.0000</u>
Value of Equity	<u>42.8239</u>

Question 27 (Nov 24 Exam)

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.	0.90
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

To compute Profit after Tax (PAT) of ABC Ltd. first we shall compute Cost of Equity, Cost of Debt and WACC as follows: Cost of Equity (ke) as per CAPM

$$k_e = 8\% + 0.90 \times 10\% = 17\%$$

$$\text{Post Tax Cost of Debt (kd)} = 10\% (1 - 0.30) = 7.00\%$$

$$WACC = 17\% \times 170/250 + 7\% \times (80/250) = 11.56\% + 2.24\% = 13.80\%$$

$$EVA = \text{Net Operating Profit after Tax (NOPAT)} - (\text{Invested Capital} \times WACC)$$

$$₹ 31,10,000 = \text{NOPAT} - (₹ 2,50,00,000 \times 0.1380) \text{ NOPAT} = ₹ 65,60,000$$

$$\text{Operating Profit} = 65,60,000 / 0.70 = ₹ 93,71,429$$

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 28 (RTP May 25)

ABC, a large business house is planning to sell its wholly owned subsidiary KLM. Another large business entity XYZ has expressed its interest in making a bid for KLM. XYZ expects that after acquisition the annual earning of KLM will increase by 10%.

Following information, ignoring any potential synergistic benefits arising out of possible acquisitions, are available:

- Profit after tax for KLM for the financial year which has just ended is estimated to be ` 10 crore.
- KLM's after-tax profit has an increasing trend of 7% each year and the same is expected to continue.
- Estimated post tax market return is 10% and risk-free rate is 4%. These rates are expected to continue.
- Corporate tax rate is 30%.

	XYZ	ABC	Proxy entity for KLM in the same line of business
No. of shares	100 lakhs	80 lakhs	--
Current share price	287	` 375	--
Dividend pay out	40%	50%	50%
Debt: Equity at market values	1 : 2	1 : 3	1 : 4
P/E ratio	10	13	12
Equity beta	1	1.1	1.1

Assume that gearing level of KLM to be the same as for ABC and a debt beta is zero.

You are required :

- To calculate appropriate cost of equity for KLM based on the data available for the proxy entity.
- A range of values for KLM both before and after any potential synergistic benefits to XYZ of the acquisition.
- Compute the market value of KLM as a part of ABC.

Note: Round off calculation up to 2 decimal and compute figure in ` crores.

Solution

- (a) To calculate cost of equity for KLM first we shall calculate β of KLM as follows:

$$\beta \text{ (equity ungeared for the proxy company)} = 1.1 \times 4 / [4 + (1 - 0.3)] = 0.94$$

$$0.94 = \beta \text{ equity geared} \times 3 / [3 + (1 - 0.3)]$$

$$\beta \text{ equity geared} = 1.16$$

$$\text{Cost of equity} = 0.04 + 1.16 \times (0.10 - 0.04) = 10.96\%$$

- (b) Based on the data available range of valuation can be computed using P/E and dividend-based valuation approach.

P/E valuation (Based on earning of ` 10 Crore)

	Using proxy entity's P/E	Using XYZ's P/E
Pre synergistic value	= 12 X 10 Crore	= 10 X 10 Crore
	= 120 Crore	= 100 Crore
Post synergistic value	= 12 X 10 Crore X 1.1	= 10 X 10 Crore X 1.1
	= 132 Crore	= 110 Crore

Divided valuation model

	Based on 50% pay-out	Based on 40% pay-out
Pre synergistic value	$= \frac{0.5 \times 10 \times 1.07}{0.1096 - 0.07}$ = 135.10 Crore	$= \frac{0.4 \times 10 \times 1.07}{0.1096 - 0.07}$ = 108.08 Crore
Post synergistic value	$= \frac{0.5 \times 10 \times 1.1 \times 1.07}{0.1096 - 0.07}$ = 148.61 Crore	$= \frac{0.4 \times 10 \times 1.1 \times 1.07}{0.1096 - 0.07}$ = 118.89 Crore

Range of valuation

	P/E Based	Dividend Based
Pre synergistic	` 100 Crore	` 135.10
Post synergistic	` 110 Crore	` 148.61

- (c) **Market Price**

Although no information is available about the value of KLM, it may be possible to calculate a market value based on proportion of earnings of ABC that is generated by KLM.

$$\text{Market value of ABC} = 80 \text{ Lakh Shares} \times 375 = 300 \text{ Crore}$$

$$\text{Post-tax earnings of ABC} = 300 \text{ crore} / 13 = 23.08 \text{ Crore}$$

If market value of ABC is allocated to KLM in the proportion of relative earning of KLM to that of ABC, KLM would have a market value of 300 crore X [10/23.08] = 129.98 Crore.

KLM's Post Tax earning = 10 Crore.

If ABC's P/E ratio is applied to it, the market value of KLM becomes 10 Crore X 13 = 130 Crore.



Mergers, Acquisitions & Corporate Restructuring

Question 1

The following is the Balance-sheet of XYZ Ltd. as on March 31st, 2013.

(₹ in lakh)

Liabilities	Amount	Assets	Amount
6 lakh Equity Shares of ₹100/- each	600	Land & Building	200
2 Lakh 14% Preference shares of ₹100/- each	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
	1,400		1,400

The 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 Dividend 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 per cent 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 Restructuring

(i) Benefits to XYZ Ltd.

		₹ in lakhs
(a)	Reduction of liabilities payable	
	Reduction in Equity Share capital (6 lakh shares x ₹75 per share)	450
	Reduction in Preference Share capital (2 lakh shares x ₹50 per share)	100
	Waiver of outstanding Debenture Interest	26
	Waiver from Trade Creditors (₹300 lakhs x 0.25)	75
		651
(b)	Revaluation of Assets	
	Appreciation of Land and Building (₹250 lakhs - ₹200 lakhs)	50
		701

(ii) Amount of ₹ 701 lakhs utilized to write off losses, fictitious assets and over-valued assets.

	₹ in lakhs
Writing off Profit and Loss account	485
Cost of issue of debentures	5
Preliminary expenses	10
Provision for bad and doubtful debts	5
Revaluation of Plant and Machinery (₹300 lakhs - ₹104 lakhs)	196
	701

Balance sheet of XYZ Ltd as at _____ (after re-construction) (₹ in lakhs)

Liabilities	Amount	Assets	Amount
21 lakhs Equity Shares of ₹25/- each	525	Land & Building	250
2 lakhs 10% Preference shares of ₹50/- each	100	Plant & Machinery	104
9% Debentures	200	Furnitures & Fixtures	50
		Inventory	150
		Sundry debtor	70
		-5	65
		Cash-at-Bank (Balancing figure)*	206
	825		825

*Opening Balance of ₹ 130/- lakhs + Sale proceeds from issue of new equity shares ₹ 150/- lakhs - Payment of bank loan of ₹ 74/- lakhs = ₹ 206 lakhs.

Question 2

Company X is contemplating the purchase of Company Y, Company X has 3,00,000 shares having a market price of ₹ 30 per share, while Company Y has 2,00,000 shares selling at ₹ 20 per share. The EPS are ₹ 4.00 and ₹ 2.25 for Company X and Y respectively. Managements of both companies are discussing two alternative proposals for exchange of shares as indicated below:

- (i) in proportion to the relative earnings per share of two companies.
- (ii) 0.5 share of Company X for one share of Company Y (0.5:1).

You are required:

- (i) to calculate the Earnings Per share (EPS) after merger under two alternatives; and
- (ii) to show the impact of EPS for the shareholders of two companies under both the alternatives.

Solution

Working Notes: Calculation of total earnings after merger

Particulars	Company X	Company Y	Total
Outstanding shares	3,00,000	2,00,000	
EPS (₹)	4	2.25	
Total earnings (₹)	12,00,000	4,50,000	16,50,000

(i)

(a) Calculation of EPS when exchange ratio is in proportion to relative EPS of two companies

Company X	3,00,000
Company Y ($2,00,000 \times 2.25/4$)	1,12,500
Total number of shares after merger	4,12,500

Company X

EPS before merger	=	₹ 4
EPS after merger = $\text{₹ } 16,50,000 / 4,12,500 \text{ shares}$	=	₹ 4
Company Y		
EPS before merger	=	₹ 2.25
EPS after merger		
= EPS of Merged Entity after merger $\times$ Share Exchange ratio on EPS basis $= 4 \times 2.25/4$	=	₹ 2.25

(b) Calculation of EPS when share exchange ratio is 0.5 : 1

Total earnings after merger = ₹ 16,50,000

Total number of shares after merger = $3,00,000 + (2,00,000 \times 0.5) = 4,00,000 \text{ shares}$

EPS after merger = $\text{₹ } 16,50,000 / 4,00,000 = \text{₹ } 4.125$

(ii) Impact of merger on EPS for shareholders of Company X and Company Y

(a) Impact on Shareholders of Company X

	(₹)
EPS before merger	4.000
EPS after merger	4.125
Increase in EPS	0.125

(b) Impact on Shareholders of Company Y

	(₹)
Equivalent EPS before merger	2.2500
Equivalent EPS after merger	2.0625
Decrease in EPS	0.1875

Question 3

A Ltd. is studying the possible acquisition of B Ltd. by way of merger. The following data are available:

Firm	After-tax earnings	No. of equity shares	Market price per share
A Ltd.	₹ 10,00,000	2,00,000	₹ 75
B Ltd.	₹ 3,00,000	50,000	₹ 60

- If the merger goes through by exchange of equity shares and the exchange ratio is set according to the current market prices, what is the new earnings per share for A Ltd.
- B Ltd. wants to be sure that its earning per share is not diminished by the merger. What exchange ratio is relevant to achieve the objective?

Solution

- The current market price is the basis of exchange of equity shares, in the proposed merger, shareholders of B Ltd. will get only 40,000 shares in all or 4 shares of A Ltd. for every 5 shares held by them, i.e.,

$$40 = \frac{50,000 \times 60}{75} = 40,000$$

The total number of shares in A Ltd. will then be 2,40,000 and, ignoring any synergistic effect, the profit will be ₹ 13,00,000. The new earning per share (EPS) of A Ltd. will be ₹ 5.42, i.e., ₹ 13,00,000/2,40,000.

- The present earnings per share of B Ltd. is ₹6/- (₹ 3,00,000 ÷ 50,000) and that of A Ltd. is ₹5/-, i.e., ₹ 10,00,000 ÷ 2,00,000. If B Ltd. wants to ensure that, even after merger, the earning per share of its shareholders should remain unaffected, then the exchange ratio will be 6 shares for every 5 shares.

Total number of shares of A Ltd. that will produce ₹ 3,00,000 profit is 60,000, (3,00,000 ÷ 5), to be distributed among, shareholders of B Ltd., giving ratio of 6 shares in A for 5 shares in B.

Proof: The shareholders of B Ltd. will get in all 60,000 share for 50,000 shares. It means after merger, their earning per share will be ₹ 5/-, i.e. ₹13,00,000/2,60,000

In all they will get ₹ 3,00,000, i.e., 60,000 × 5, as before.

Question 4

Simpson Ltd. is considering a merger with Wilson Ltd. The data below are in the hands of both Board of Directors. The issue at hand is how many shares of Simpson should be exchanged for Wilson Ltd. Both boards are considering three possibilities 20,000, 25,000 and 30,000 shares. You are required to construct a table demonstrating the potential impact of each scheme on each set of shareholders:

		Simpson Ltd.	Wilson Ltd.	Combined Post merger Firm 'A'
1.	Current earnings per year	2,00,000	1,00,000	3,50,000
2.	Shares outstanding	50,000	10,000	?
3.	Earnings per share (₹) ($1 \div 2$)	4	10	?
4.	Price per share (₹)	40	100	?
5.	Price-earning ratio [$4 \div 3$]	10	10	10
6.	Value of firm (₹)	20,00,000	10,00,000	35,00,000
7.	Expected Annual growth rate in earnings in foreseeable future	0	0	0

Solution The following table demonstrates the potential impact of the three possible schemes, on each set of shareholders:-

Number of Simpson Ltd.'s shares issued to shareholders of Wilson Ltd.	Exchange ratio [(1)/10,000 shares of Wilson Ltd]	Number of Simpson Ltd.'s shares outstanding after merger [50,000+(1)]	Fraction of Simpson Ltd. (Post merger) owned by Wilson Ltd.'s shareholders [(1)/(3)]	Value of shares owned by Wilson Ltd.'s shareholders [(4) × 35,00,000]	Fraction of Simpson Ltd. (combined Post-merger owned by Simpson Ltd.'s shareholders [50,000/(3)]	Value of shares owned by Simpson Ltd.'s shareholders [(6) × 35,00,000]
(1)	(2)	(3)	(4)	(5)	(6)	(7)
20,000	2	70,000	2/7	10,00,000	5/7	25,00,000
25,000	2.5	75,000	1/3	11,66,667	2/3	23,33,333
30,000	3	80,000	3/8	13,12,500	5/8	21,87,500

Question 5

B Ltd. is a highly successful company and wishes to expand by acquiring other firms. Its expected high growth in earnings and dividends is reflected in its PE ratio of 17. The Board of Directors of B Ltd. has been advised that if it were to take over firms with a lower PE ratio than its own, using a share-for-share exchange, then it could increase its reported earnings per share. C Ltd. has been suggested as a possible target for a takeover, which has a PE ratio of 10 and 1,00,000 shares in issue with a share price of ₹ 15. B Ltd. has 5,00,000 shares in issue with a share price of ₹ 12.

Calculate the change in earnings per share of B Ltd. if it acquires the whole of C Ltd. by issuing shares at its market price of ₹12. Assume the price of B Ltd. shares remains constant.

Solution

Total market value of C Ltd is = $1,00,000 \times ₹ 15$ = ₹ 15,00,000
PE ratio (given) = 10
Therefore, earnings = ₹ 15,00,000 / 10
= ₹ 1,50,000
Total market value of B Ltd. is = $5,00,000 \times ₹ 12$ = ₹ 60,00,000
PE ratio (given) = 17
Therefore, earnings = ₹ 60,00,000 / 17
= ₹ 3,52,941
The number of shares to be issued by B Ltd.
 $₹ 15,00,000 \div 12$ = 1,25,000
Total number of shares of B Ltd = $5,00,000 + 1,25,000 = 6,25,000$
The EPS of the new firm is = $(₹ 3,52,941 + ₹ 1,50,000) / 6,25,000$
= ₹ 0.80
The present EPS of B Ltd is = $₹ 3,52,941 / 5,00,000$ = ₹ 0.71
So the EPS of B will increase from Re. 0.71 to ₹ 0.80 as a result of merger

Question 6

Elrond Limited plans to acquire Doom Limited. The relevant financial details of the two firms prior to the merger announcement are:

	Elrond Limited	Doom Limited
Market price per share	₹ 50	₹ 25
Number of outstanding shares	20 lakhs	10 Lakhs

The merger is expected to generate gains, which have a present value of ₹200 lakhs. The exchange ratio agreed to is 0.5.

What is the true cost of the merger from the point of view of Elrond Limited?

Solution

Shareholders of Doom Ltd. will get 5 lakh share of Elrond Limited, so they will get:
= $5\text{lakh} / 20\text{lakh} \times 5\text{lakh} = 20\%$ of shares Elrond Limited

The value of Elrond Ltd. after merger will be:
= $₹ 50 \times 20\text{lakh} + ₹ 25 \times 10\text{lakh} + ₹ 200\text{lakh}$
= $₹ 1000\text{lakh} + ₹ 250\text{lakh} + ₹ 200\text{lakh} = ₹ 1450\text{lakh}$

True Cost of Merger will be: $(₹ 1450 \times 20\%) ₹ 290\text{lakhs} - ₹ 250\text{lakhs} = ₹ 40\text{lakhs}$

Question 7

MK Ltd. is considering acquiring NN Ltd. The following information is available:

Company	Earning after Tax (₹)	No. of Equity Shares	Market Value Per Share (₹)
MK Ltd.	60,00,000	12,00,000	200.00
NN Ltd.	18,00,000	3,00,000	160.00

Exchange of equity shares for acquisition is based on current market value as above. There is no synergy advantage available.

- Find the earning per share for company MK Ltd. after merger, and
- Find the exchange ratio so that shareholders of NN Ltd. would not be at a loss.

Solution

- (i) Earning per share of company MK Ltd after merger:-

Exchange ratio $160 : 200 = 4 : 5$.

that is 4 shares of MK Ltd. for every 5 shares of NN Ltd.

∴ Total number of shares to be issued = $\frac{4}{5} \times 3,00,000 = 2,40,000$ Shares.

∴ Total number of shares of MK Ltd. and NN Ltd. = $12,00,000$ (MK Ltd.) + $2,40,000$ (NN Ltd.)
= $14,40,000$ Shares

Total profit after tax = ₹ 60,00,000 MK Ltd.

= ₹ 18,00,000 NN Ltd.

= ₹ 78,00,000

∴ EPS. (Earning Per Share) of MK Ltd. after merger

₹ 78,00,000 / $14,40,000 = ₹ 5.42$ per share

- (ii) To find the exchange ratio so that shareholders of NN Ltd. would not be at a Loss:

Present earning per share for company MK Ltd.

= ₹ 60,00,000 / $12,00,000 = ₹ 5.00$

Present earning per share for company NN Ltd.

= ₹ 18,00,000 / $3,00,000 = ₹ 6.00$

∴ Exchange ratio should be 6 shares of MK Ltd. for every 5 shares of NN Ltd.

∴ Shares to be issued to NN Ltd. = $3,00,000 \times \frac{6}{5} = 3,60,000$ shares

Now, total No. of shares of MK Ltd. and NN Ltd. = $12,00,000$ (MK Ltd.) + $3,60,000$ (NN Ltd.)
= $15,60,000$ shares

∴ EPS after merger = ₹ 78,00,000 / $15,60,000 = ₹ 5.00$ per share

Total earnings available to shareholders of NN Ltd. after merger

= $3,60,000$ shares $\times ₹ 5.00 = ₹ 18,00,000$.

This is equal to earnings prior merger for NN Ltd.

∴ Exchange ratio on the basis of earnings per share is recommended.

Question 8

ABC Ltd. is intending to acquire XYZ Ltd. by merger and the following information is available in respect of the companies:

	ABC Ltd.	XYZ Ltd.
Number of equity shares	10,00,000	6,00,000
Earnings after tax (₹)	50,00,000	18,00,000
Market value per share (₹)	42	28

Required:

- What is the present EPS of both the companies?
- If the proposed merger takes place, what would be the new earning per share for ABC Ltd.? Assume that the merger takes place by exchange of equity shares and the exchange ratio is based on the current market price.
- What should be exchange ratio, if XYZ Ltd. wants to ensure the earnings to members are same as before the merger takes place?

Solution

- Earnings per share = Earnings after tax / No. of equity shares
ABC Ltd. = ₹ 50,00,000 / 10,00,000 = ₹ 5
XYZ Ltd. = ₹ 18,00,000 / 6,00,000 = ₹ 3
- Number of Shares XYZ Limited's shareholders will get in ABC Ltd. based on market value per share = ₹ 28 / 42 × 6,00,000 = 4,00,000 shares
Total equity shares of ABC Ltd. after merger = 10,00,000 + 4,00,000 = 14 Lakh shares
Earnings per share after merger = ₹ 50,00,000 + 18,00,000 / 14,00,000 = ₹ 4.86
- Calculation of exchange ratio to ensure shareholders of XYZ Ltd. to earn the same as was before merger:
Shares to be exchanged based on EPS = (₹ 3 / ₹ 5) × 6,00,000 = 3,60,000 shares
EPS after merger = (₹ 50,00,000 + 18,00,000) / 13,60,000 = ₹ 5
Total earnings in ABC Ltd. available to shareholders of XYZ Ltd. = 3,60,000 × ₹ 5 = ₹ 18,00,000.
Thus, to ensure that Earning to members are same as before, the ratio of exchange should be 0.6 share for 1 share.

Question 9

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 (i)

	Acquirer Company	Target Company
Net Profit	₹ 80 lakhs	₹ 15.75 lakhs
PE Multiple	10.50	10.00
Market Capitalization	₹ 840 lakhs	₹ 157.50 lakhs
Market Price	₹ 42	₹ 105
No. of Shares	20 lakhs	1.50 lakhs
EPS	₹ 4	₹ 10.50

Maximum Exchange Ratio 4 : 10.50 or 1 : 2.625

Thus, for every one share of Target Company 2.625 shares of Acquirer Company.

- (ii) Let x lakhs be the amount paid by Acquirer company to Target Company. Then to maintain same EPS i.e. ₹ 4 the number of shares to be issued will be:

$$\frac{(80\text{ lakhs} + 15.75\text{ lakhs}) - 0.70 \times 15\% \times x}{20\text{ lakhs}} = 4$$

$$\frac{95.75 - 0.105x}{20} = 4$$

$$x = ₹ 150 \text{ lakhs}$$

Thus, ₹ 150 lakhs shall be offered in cash to Target Company to maintain same EPS.

Question 10

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:

	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
Market price per share	₹30	₹14

Required:

- 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.
- What is the expected market price per share of A Ltd. after the acquisition, assuming its PE multiple remains unchanged?
- Determine the market value of the merged firm.

Solution

- (i) The number of shares to be issued by A Ltd.:

The Exchange ratio is 0.5

So, new Shares = 1,80,000 × 0.5 = 90,000 shares.

(ii) **EPS of A Ltd. After a acquisition:**

Total Earnings	(₹ 18,00,000 + ₹ 3,60,000)	₹ 21,60,000
No. of Shares	(6,00,000 + 90,000)	6,90,000
EPS	(₹ 21,60,000)/6,90,000)	₹ 3.13

(iii) **Equivalent EPS of T Ltd.:**

No. of new Shares	0.5
EPS	₹ 3.13
Equivalent EPS (₹ 3.13 × 0.5)	₹ 1.57

(iv) **New Market Price of A Ltd. (P/E remaining unchanged):**

Present P/E Ratio of A Ltd.	10 times
Expected EPS after merger	₹ 3.13
Expected Market Price (₹3.13 × 10)	₹ 31.30

(v) **Market Value of merged firm:**

Total number of Shares	6,90,000
Expected Market Price	₹ 31.30
Total value (6,90,000 × 31.30)	₹ 2,15,97,000

Question 11

The following info is provided related to acquiring Firm Mark Limited and target Firm Mask Limited:

	Firm Mark Limited	Firm Mask Limited
Earning after tax (₹)	2,000 lakhs	400 lakhs
Number of shares outstanding	200 lakhs	100 lakhs
P/E ratio (times)	10	5

Required:

- What is the Swap Ratio based on current market prices?
- What is the EPS of Mark Limited after acquisition?
- What is the expected market price per share of Mark Limited after acquisition, assuming P/E ratio of Mark Limited remains unchanged?
- Determine the market value of the merged firm.
- Calculate gain/loss for shareholders of the two independent companies after acquisition.

Solution

Particulars	Mark Ltd.	Mask Ltd.
EPS	₹ 2,000 Lakhs/ 200 lakhs = ₹ 10	₹ 400 lakhs / 100 lakhs = ₹ 4
Market Price	₹ 10 × 10 = ₹ 100	₹ 4 × 5 = ₹ 20

- The Swap ratio based on current market price is
 $\text{₹ } 20 / \text{₹ } 100 = 0.2$ or 1 share of Mark Ltd. for 5 shares of Mask Ltd.
No. of shares to be issued = 100 lakh × 0.2 = 20 lakhs.
- EPS after merger = $\frac{2,000 \text{ lakhs} + 400 \text{ lakhs}}{200 \text{ lakhs} + 20 \text{ lakhs}} = ₹ 10.91$

- (iii) Expected market price after merger assuming P/E 10 times. = ₹ 10.91 × 10 = ₹ 109.10
- (iv) Market value of merged firm = ₹ 109.10 market price × 220 lakhs shares = 240.02 crores
- (v) Gain from the merger

Post merger market value of the merged firm ₹ 240.02 crores

Less: Pre-merger market value

Mark Ltd. 200 Lakhs × ₹ 100 = 200 crores

Mask Ltd. 100 Lakhs × ₹ 20 = 20 crores ₹ 220.00 crores

Gain from merger **₹ 20.02 crores**

Appropriation of gains from the merger among shareholders:

	Mark Ltd.	Mask Ltd.
Post merger value	218.20 crores	21.82 crores
Less: Pre-merger market value	200.00 crores	20.00 crores
Gain to Shareholders	18.20 crores	1.82 crores

Question 12 XYZ Ltd. wants to purchase ABC Ltd. by exchanging 0.7 of its shares for each share of ABC Ltd. Relevant financial data are as follows:

Equity shares outstanding	10,00,000	4,00,000
EPS (₹)	40	28
Market price per share (₹)	250	160

- (i) Illustrate the impact of merger on EPS of both the companies.
- (ii) The management of ABC Ltd. has quoted a share exchange ratio of 1:1 for the merger. Assuming that P/E ratio of XYZ Ltd. will remain unchanged after the merger, what will be the gain from merger for ABC Ltd.?
- (iii) What will be the gain/loss to shareholders of XYZ Ltd.?
- (iv) Determine the maximum exchange ratio acceptable to shareholders of XYZ Ltd.

Solution

Working Notes (a)

	XYZ Ltd.	ABC Ltd.
Equity shares outstanding (Nos.)	10,00,000	4,00,000
EPS	₹ 40	₹ 28
Profit	₹ 400,00,000	₹ 112,00,000
PE Ratio	6.25	5.71
Market price per share	₹ 250	₹ 160

(b) EPS after merger

No. of shares to be issued ($4,00,000 \times 0.70$)	2,80,000
Exiting Equity shares outstanding	10,00,000
Equity shares outstanding after merger	12,80,000
Total Profit (₹ 400,00,000 + ₹ 112,00,000)	₹ 512,00,000
EPS	₹ 40

(i) Impact of merger on EPS of both the companies

	XYZ Ltd.	ABC Ltd.
EPS after Merger	₹ 40	₹ 28
EPS before Merger	₹ 40	₹ 28*
	Nil	Nil

* ₹ 40 × 0.70

(ii) Gain from the Merger if exchange ratio is 1: 1

No. of shares to be issued	4,00,000
Exiting Equity shares outstanding	10,00,000
Equity shares outstanding after merger	14,00,000
Total Profit (₹ 400,00,000 + ₹ 112,00,000)	₹ 512,00,000
EPS	₹ 36.57
Market Price of Share (₹ 36.57 × 6.25)	₹ 228.56
Market Price of Share before Merger	₹ 160.00
Impact (Increase/ Gain)	₹ 68.56

(iii) Gain/ loss from the Merger to the shareholders of XYZ Ltd.

Market Price of Share	₹ 228.56
Market Price of Share before Merger	₹ 250.00
Loss from the merger (per share)	₹ 21.44

(iv) Maximum Exchange Ratio acceptable to XYZ Ltd. shareholders

	₹ Lakhs
Market Value of Merged Entity (₹ 228.57 × 1400000)	3199.98
Less: Value acceptable to shareholders of XYZ Ltd.	2500.00
Value of merged entity available to shareholders of ABC Ltd.	699.98
Market Price Per Share	250
No. of shares to be issued to the shareholders of ABC Ltd. (lakhs)	2.80

Thus maximum ratio of issue shall be 2.80 : 4.00 or 0.70 share of XYZ Ltd. for one share of ABC Ltd.

Alternatively, it can also be computed as follows:

Earning after Merger ($40 \times 1000000 + 28 \times 400000$)	₹ 512 lakhs
PE Ratio of XYZ Ltd.	6.25
Market Value of Firm after Merger (512×6.25)	₹ 3200 lakhs
Existing Value of Shareholders of XYZ Ltd.	₹ 2500 lakhs
Value of Merged entity available to Shareholders of ABC Ltd.	₹ 700 lakhs
Market Price per Share	₹ 250
Total No. of shares to be issued	2.8 lakh

Thus, maximum acceptable ratio shall be 2.80:4.00 i.e. 0.70 share of XYZ Ltd. for 1 share of ABC Ltd.

Question 13

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 effected by means of a stock swap (exchange). ABC Ltd., has agreed to a plan under which XYZ Ltd., will offer the current market value of ABC Ltd.'s shares:

- 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?
- What should be the exchange ratio; if XYZ Ltd.'s pre-merger and post-merger EPS are to be the same?

Solution

- Pre-merger EPS and P/E ratios of XYZ Ltd. and ABC Ltd.

Particulars	XYZ Ltd.	ABC Ltd.
Earnings after taxes	5,00,000	1,25,000
Number of shares outstanding	2,50,000	1,25,000
EPS	2	1
Market Price per share	20	10
P/E Ratio (times)	10	10

- Current Market Price of ABC Ltd. if P/E ratio is 6.4 = ₹ 1 × 6.4 = ₹ 6.40

Exchange ratio = ₹20/₹6.40 = 3.125 or ₹6.40/₹20 = 0.32

Post-merger EPS of XYZ Ltd.

$= (\text{₹}5,00,000 + \text{₹}1,25,000) / [2,50,000 + (1,25,000 / 3.125)] = 6,25,000 / 2,90,000 = 2.16$

(iii) Desired Exchange Ratio

Total number of shares in post-merged company

$$= \text{Post-merger earnings} / \text{Pre-merger EPS of XYZ Ltd} = ₹6,25,000 / 2 = 3,12,500$$

$$\text{Number of shares required to be issued} = 3,12,500 - 2,50,000 = 62,500$$

Therefore, the exchange ratio is $62,500 : 1,25,000 = 0.50$

Question 14

Following information is provided relating to the acquiring company Mani Ltd. and the target company Ratnam Ltd:

	Mani Ltd.	Ratnam Ltd.
Earnings after tax (₹ lakhs)	2,000	4,000
No. of shares outstanding (lakhs)	200	1,000
P/E ratio (No. of times)	10	5

Required:

- What is the swap ratio based on current market prices?
- What is the EPS of Mani Ltd. after the acquisition?
- What is the expected market price per share of Mani Ltd. after the acquisition, assuming its P/E ratio is adversely affected by 10%?
- Determine the market value of the merged Co.
- Calculate gain/loss for the shareholders of the two independent entities, due to the merger.

Solution

(i) **SWAP ratio based on current market prices:**

EPS before acquisition:

$$\text{Mani Ltd. : } ₹2,000 \text{ lakhs} / 200 \text{ lakhs:} \quad 10$$

$$\text{Ratnam Ltd.: } ₹4,000 \text{ lakhs} / 1,000 \text{ lakhs:} \quad ₹ 4$$

Market price before acquisition:

$$\text{Mani Ltd.: } ₹10 \times 10 \quad ₹100$$

$$\text{Ratnam Ltd.: } ₹4 \times 5 \quad ₹ 20$$

$$\text{SWAP ratio: } 20/100 \text{ or } 1/5 \text{ i.e.} \quad 0.20$$

(ii) **EPS after acquisition:**

$$\frac{2,000 \text{ lakhs} + 4,000 \text{ lakhs}}{200 \text{ lakhs} + 200 \text{ lakhs}} = ₹15.00$$

(iii) **Market Price after acquisition:**

$$\text{EPS after acquisition :} \quad ₹15.00$$

$$\text{P/E ratio after acquisition } 10 \times 0.9 \quad 9$$

$$\text{Market price of share (₹ 15 X 9)} \quad ₹135.00$$

(iv) **Market value of the merged Co.:**

$$\begin{aligned} ₹135 \times 400 \text{ lakhs shares} & \quad ₹ 540.00 \text{ Crores} \\ & \quad \text{or ₹ 54,000 Lakhs} \end{aligned}$$

(v) Gain/loss per share:

₹ Crore

	Mani Ltd.	Ratnam Ltd.
Total value before Acquisition	200	200
Value after acquisition	270	270
Gain (Total)	70	70
No. of shares (pre-merger) (lakhs)	200	1,000
Gain per share (₹)	35	7

Question 15

You have been provided the following Financial data of two companies:

	Krishna Ltd.	Rama Ltd.
Earnings after taxes	₹ 7,00,000	₹ 10,00,000
No. of Equity shares (outstanding)	2,00,000	4,00,000
EPS	3.5	2.5
P/E ratio	10 times	14 times
Market price per share	₹ 35	₹ 35

Company Rama Ltd. is acquiring the company Krishna Ltd., exchanging its shares on a one-to-one basis for company Krishna Ltd. The exchange ratio is based on the market prices of the shares of the two companies. Required:

- What will be the EPS subsequent to merger?
- What is the change in EPS for the shareholders of companies Rama Ltd. and Krishna Ltd.?
- Determine the market value of the post-merger firm. PE ratio is likely to remain the same.
- Ascertain the profits accruing to shareholders of both the companies.

Solution

Exchange Ratio	1:1
New Shares to be issued	2,00,000
Total shares of Rama Ltd. (4,00,000+2,00,000)	6,00,000
Total earnings (₹ 10,00,000 + ₹ 7,00,000)	₹ 17,00,000
New EPS (₹ 17,00,000/6,00,000)	₹ 2.83
(ii) Existing EPS of Rama Ltd	₹ 2.50
Increase in EPS of Rama Ltd (₹ 2.83 - ₹ 2.50)	₹ 0.33
Existing EPS of Krishna Ltd.	₹ 3.50
Decrease in EPS of Krishna Ltd. (₹ 3.50 - ₹ 2.83)	₹ 0.67
(iii) P/E ratio of new firm (expected to remain same)	14 times
New market price (14 × ₹ 2.83)	₹ 39.62
Total No. of Shares	6,00,000
Total market Capitalization (6,00,000 × ₹ 39.62)	₹ 2,37,72,000
Existing market capitalization (₹ 70,00,000 + ₹ 1,40,00,000)	₹ 2,10,00,000
Total gain	₹ 27,72,000

(iv)

	Rama Ltd.	Krishna Ltd	Total
No. of shares after merger	4,00,000	2,00,000	6,00,000
Market price	₹ 39.62	₹ 39.62	₹ 39.62
Total Mkt. Values	₹ 1,58,48,000	₹ 79,24,000	₹ 2,37,72,000
Existing Mkt. values	₹ 1,40,00,000	₹ 70,00,000	₹ 2,10,00,000
Gain to share holders	₹ 18,48,000	₹ 9,24,000	₹ 27,72,000

or ₹ 27,72,000 ÷ 3 = ₹ 9,24,000 to Krishna Ltd. and ₹ 18,48,000 to Rama Ltd. (in 2:1 ratio)

Question 16

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	M Co. Ltd.	N Co. Ltd.
Earnings after tax (₹)	80,00,000	24,00,000
No. of equity shares	16,00,000	4,00,000
Market value per share (₹)	200	160

- (i) If the merger goes through by exchange of equity and the exchange ratio is based on the current market price, what is the new earning per share for M Co. Ltd.?
- (ii) 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?

Solution

- (i) Calculation of new EPS of M Co. Ltd.

No. of equity shares to be issued by M Co. Ltd. to N Co. Ltd.

= 4,00,000 shares × ₹ 160/₹ 200 = 3,20,000 shares

Total no. of shares in M Co. Ltd. after acquisition of N Co. Ltd. = 16,00,000 + 3,20,000 = 19,20,000

Total earnings after tax [after acquisition] = 80,00,000 + 24,00,000 = 1,04,00,000

EPS = ₹1,04,00,000/19,20,000 equity shares = ₹5.42

- (ii) Calculation of exchange ratio which would not diminish the EPS of N Co. Ltd. after its merger with M Co. Ltd.

Current EPS:

M Co. Ltd. = ₹80,00,000/16,00,000 equity shares = ₹5

N Co. Ltd. = ₹24,00,000/4,00,000 equity shares = ₹6

Exchange ratio = 6/5 = 1.20

No. of new shares to be issued by M Co. Ltd. to N Co. Ltd. = 4,00,000 × 1.20 = 4,80,000 shares

Total shares of M Co. Ltd. after acquisition = 16,00,000 + 4,80,000 = 20,80,000 shares

EPS [after merger] = ₹1,04,00,000/20,80,000 shares = ₹5

Total earnings in M Co. Ltd. available to new shareholders of N Co. Ltd.

= 4,80,000 × ₹ 5 = ₹ 24,00,000

Recommendation: The exchange ratio (6 for 5) based on market shares is beneficial to shareholders of 'N' Co. Ltd.

Question 17 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
Earning per Share (EPS)	₹	8	5
Price Earnings Ratio (P/E Ratio) (Ignore Synergy)		15	10

You are required to determine:

- (i) Pre-merger Market Value per Share, and
- (ii) The maximum exchange ratio Longitude Limited can offer without the dilution of
 - (1) EPS and
 - (2) Market Value per Share

Calculate Ratio/s up to four decimal points and amounts and number of shares up to 2 decimal points.

Solution

- (i) Pre Merger Market Value of Per Share

P/E Ratio X EPS

Longitude Ltd. ₹ 8 X 15 = ₹ 120.00

Latitude Ltd. ₹ 5 X 10 = ₹ 50.00

- (ii) (1) **Maximum exchange ratio without dilution of EPS**

Pre Merger PAT of Longitude Ltd.	₹ 120 Lakhs
Pre Merger PAT of Latitude Ltd.	₹ 80 Lakhs
Combined PAT	₹ 200 Lakhs
Longitude Ltd. 's EPS	₹ 8
Maximum number of shares of Longitude after merger (₹ 200 lakhs/₹ 8)	25 Lakhs
Existing number of shares	15 Lakhs
Maximum number of shares to be exchanged	10 Lakhs

Maximum share exchange ratio 10:16 or 5:8

- (2) **Maximum exchange ratio without dilution of Market Price Per Share**

Pre Merger Market Capitalization of Longitude Ltd. (₹ 120 × 15 Lakhs)	₹ 1800 Lakhs
Pre Merger Market Capitalization of Latitude Ltd. (₹ 50 × 16 Lakhs)	₹ 800 Lakhs
Combined Market Capitalization	₹ 2600 Lakhs
Current Market Price of share of Longitude Ltd.	₹ 120
Maximum number of shares to be exchanged of Longitude (surviving company) (₹ 2600 Lakhs/₹ 120)	21.67 Lakhs
Current Number of Shares of Longitude Ltd.	15.00 Lakhs
Maximum number of shares to be exchanged (Lakhs)	6.67 Lakhs

Maximum share exchange ratio 6.67:16 or 0.4169:1

Question 18

P Ltd. is considering take-over of R Ltd. by the exchange of four new shares in P Ltd. for every five shares in R Ltd. The relevant financial details of the two companies prior to merger announcement are as follows:

	P Ltd	R Ltd
Profit before Tax (₹ Crore)	15	13.50
No. of Shares (Crore)	25	15
P/E Ratio	12	9
Corporate Tax Rate	30%	

You are required to determine:

- Market value of both the company.
- Value of original shareholders.
- Price per share after merger.
- Effect on share price of both the company if the Directors of P Ltd. expect their own pre-merger P/E ratio to be applied to the combined earnings.

Solution

	P Ltd.	R Ltd.
Profit before Tax (₹ in crore)	15	13.50
Tax 30% (₹ in crore)	<u>4.50</u>	<u>4.05</u>
Profit after Tax (₹ in crore)	<u>10.50</u>	<u>9.45</u>
Earning per Share (₹)	$\frac{10.50}{25} = ₹ 0.42$	$\frac{9.45}{15} = 0.63$
Price of Share before Merger (EPS × P/E Ratio)	$₹ 0.42 \times 12 = ₹ 5.04$	$₹ 0.63 \times 9 = ₹ 5.67$

- (i) ∴ Market Value of company
P Ltd. = ₹ 5.04 × 25 Crore = ₹ 126 crore
R Ltd. = ₹ 5.67 × 15 Crore = ₹ 85.05 crore
Combined = ₹ 126 + ₹ 85.05 = ₹ 211.05 Crores
After Merger

	P Ltd.	R Ltd.
No. of Shares	25 crores	15 × 4/5 = 12 crores
Combined		37 crores
% of Combined Equity Owned	25/37 × 100 = 67.57%	12/37 × 100 = 32.43%

- (ii) ∴ Value of Original Shareholders

P Ltd.	R Ltd.
₹ 211.05 crore × 67.57%	₹ 211.05 crore × 32.43%
= ₹ 142.61	= ₹ 68.44

Alternatively, it can also be computed as follows:

Combined Value of Entity	211.05 crore
No. of shares after Merger	37 crore
Value of Per Share	₹ 5.70405
Value of P Ltd. Shareholders (25 crores × ₹ 5.70405)	₹ 142.60 crore
Value of R Ltd. Shareholders (12 crores × ₹ 5.70405)	₹ 68.45 crore

(iii) Price per Share after Merger

EPS = ₹19.95 crore/37crore= ₹ 0.539 per share

Market Value Per Share = ₹ 0.539 × 12 = ₹ 6.47

Total Market Value = ₹ 6.47 × 37 crore = ₹ 239.39 crore

Price of Share = Market Value/Number of Shares = 239.39crore/37crore=₹6.47

(iv) Effect on Share Price

P Ltd.

Gain/loss (-) per share = ₹ 6.47 - ₹ 5.04 = ₹ 1.43

i.e. $6.47 - 5.04/5.04 \times 100 = 0.284$ or 28.4%

∴ Share price would rise by 28.4%

R Ltd.

$6.47 \times 4/5 = ₹5.18$

Gain/loss (-) per share = ₹ 5.18 - ₹ 5.67 = (-₹ 0.49)

i.e. $5.18-5.67/5.67 \times 100 (-) 0.0864$ or (-) 8.64%

∴ Share Price would decrease by 8.64%.

Question 19

Simple Ltd. and Dimple Ltd. are planning to merge. The total value of the companies are dependent on the fluctuating business conditions. The following information is given for the total value (debt + equity) structure of each of the two companies.

Business Condition	Probability	Simple Ltd. ₹ Lacs	Dimple Ltd. ₹ Lacs
High Growth	0.20	820	1050
Medium Growth	0.60	550	825
Slow Growth	0.20	410	590

The current debt of Dimple Ltd. is ₹ 65 lacs and of Simple Ltd. is ₹ 460 lacs.

Calculate the expected value of debt and equity separately for the merged entity.

Solution

Compute Value of Equity

Simple Ltd. (₹ in Lacs)

	High Growth	Medium Growth	Slow Growth
Debt + Equity	820	550	410
Less: Debt	460	460	460
Equity	360	90	-50

Since the Company has limited liability the value of equity cannot be negative therefore the value of equity under slow growth will be taken as zero because of insolvency risk and the value of debt is taken at 410 lacs. The expected value of debt and equity can then be calculated as:

Simple Ltd. (₹ in Lacs)

	High Growth		Medium Growth		Slow Growth		Expected Value
	Prob.	Value	Prob.	Value	Prob.	Value	
Debt	0.20	460	0.60	460	0.20	410	450
Equity	0.20	360	0.60	90	0.20	0	126
		820		550		410	576

Dimple Ltd. (₹ in Lacs)

	High Growth		Medium Growth		Slow Growth		Expected Value
	Prob.	Value	Prob.	Value	Prob.	Value	
Equity	0.20	985	0.60	760	0.20	525	758
Debt	0.20	65	0.60	65	0.20	65	65
		1050		825		590	823

Expected Values (₹ in Lacs)

Equity		Debt	
Simple Ltd.	126	Simple Ltd.	450
Dimple Ltd.	758	Dimple Ltd.	65
	884		515

Question 20 Yes Ltd. wants to acquire No Ltd. and the cash flows of Yes Ltd. and the merged entity are given below: (₹ In lakhs)

Year	1	2	3	4	5
Yes Ltd.	175	200	320	340	350
Merged Entity	400	450	525	590	620

Earnings would have witnessed 5% constant growth rate without merger and 6% with merger on account of economies of operations after 5 years in each case. The cost of capital is 15%.

The number of shares outstanding in both the companies before the merger is the same and the companies agree to an exchange ratio of 0.5 shares of Yes Ltd. for each share of No Ltd.

PV factor at 15% for years 1-5 are 0.870, 0.756; 0.658, 0.572, 0.497 respectively.

You are required to:

Compute the Value of Yes Ltd. before and after merger.

(i) Value of Acquisition and

(ii) Gain to shareholders of Yes Ltd.

Solution (i)**Working Notes:**

Present Value of Cash Flows (CF) upto 5 years

Year End	CF of Yes Ltd. (₹ lakhs)	PVF @15%	PV of CF (₹ lakhs)	CF of Merged Entity (₹ lakhs)	PV of CF of Merged Entity (₹ lakhs)
1	175	0.870	152.25	400	348.00
2	200	0.756	151.20	450	340.20
3	320	0.658	210.56	525	345.45
4	340	0.572	194.48	590	337.48
5	350	0.497	<u>173.95</u>	620	<u>308.14</u>
			<u>882.44</u>		<u>1679.27</u>

PV of Cash Flows of Yes Ltd. after the forecast period

$$TV_5 = \frac{CF_5(1+g)}{K_e - g} = \frac{350(1+0.05)}{0.15 - 0.05} = \frac{367.50}{0.10} = ₹ 3675 \text{ lakhs}$$

PV of TV5 = ₹3675 lakhs × 0.497 = ₹ 1826.475 lakhs

PV of Cash Flows of Merged Entity after the forecast period

$$TV_5 = \frac{CF_5(1+g)}{K_e - g} = \frac{626(1+0.05)}{0.15 - 0.06} = \frac{657.20}{0.09} = ₹ 7302.22 \text{ lakhs}$$

PV of TV5 = ₹ 7302.22 lakhs × 0.497 = ₹ 3629.20 lakhs

Value of Yes Ltd.

	Before merger (₹ lakhs)	After merger (₹ lakhs)
PV of CF (1-5 years)	882.440	1679.27
Add: PV of TV ₅	<u>1826.475</u>	<u>3629.20</u>
	<u>2708.915</u>	<u>5308.47</u>

(ii) Value of Acquisition = Value of Merged Entity - Value of Yes Ltd.

= ₹ 5308.47 lakhs - ₹ 2708.915 lakhs = ₹ 2599.555 lakhs

(iii) Gain to Shareholders of Yes Ltd.

Share of Yes Ltd. in merged entity = ₹ 5308.47 lakhs × 1/1.5 = ₹ 3538.98 lakhs

Gain to shareholder = Share of Yes Ltd. in merged entity - Value of Yes Ltd. Before merger

= ₹ 3538.98 lakhs - ₹ 2708.915 = ₹ 830.065 lakhs

Question 21 The following information is provided relating to the acquiring company Efficient Ltd. and the target Company Healthy Ltd.

	Efficient Ltd.	Healthy Ltd.
No. of shares (F.V. ₹ 10 each)	10.00 lakhs	7.5 lakhs
Market capitalization	500.00 lakhs	750.00 lakhs
P/E ratio (times)	10.00	5.00
Reserves and Surplus	300.00 lakhs	165.00 lakhs
Promoter's Holding (No. of shares)	4.75 lakhs	5.00 lakhs

Board of Directors of both the Companies have decided to give a fair deal to the shareholders and accordingly for swap ratio the weights are decided as 40%, 25% and 35% respectively for Earning, Book Value and Market Price of share of each company:

- Calculate the swap ratio and also calculate Promoter's holding % after acquisition.
- What is the EPS of Efficient Ltd. after acquisition of Healthy Ltd.?
- What is the expected market price per share and market capitalization of Efficient Ltd. after acquisition, assuming P/E ratio of Firm Efficient Ltd. remains unchanged.
- Calculate free float market capitalization of the merged firm.

Solution

Swap Ratio

	Efficient Ltd.	Healthy Ltd.
Market capitalization	500 lakhs	750 lakhs
No. of shares	10 lakhs	7.5 lakhs
Market Price per share	₹ 50	₹ 100
P/E ratio	10	5
EPS	₹ 5	₹ 20
Profit	₹ 50 lakh	₹ 150 lakh
Share capital	₹ 100 lakh	₹ 75 lakh
Reserves and surplus	₹ 300 lakh	₹ 165 lakh
Total	₹ 400 lakh	₹ 240 lakh
Book Value per share	₹ 40	₹ 32

- Calculation of Swap Ratio

EPS	1 : 4 i.e.	4.0 × 40%	1.6
Book value	1 : 0.8 i.e.	0.8 × 25%	0.2
Market price	1 : 2 i.e.	2.0 × 35%	0.7
		Total	2.5

Swap ratio is for every one share of Healthy Ltd., to issue 2.5 shares of Efficient Ltd.

Hence, total no. of shares to be issued 7.5 lakh × 2.5 = 18.75 lakh shares.

Promoter's holding = 4.75 lakh shares + (5 × 2.5 = 12.5 lakh shares) = 17.25 lakh i.e.

Promoter's holding % is (17.25 lakh/28.75 lakh) × 100 = 60%.

Calculation of EPS, Market price, Market capitalization and free float market capitalization.

- (ii) **Total No. of shares** 10 lakh + 18.75 lakh = 28.75 lakh
 Total capital 100 lakh + 187.5 lakh = ₹ 287.5 lakh
 $EPS = \text{Total Profit} / \text{No. of Shares} = 50\text{Lakh} + 150\text{Lakh} / 28.75 \text{ Lakh} = 200 / 28.75 = ₹ 6.956$
- (iii) **Expected market price** $EPS 6.956 \times P/E 10 = ₹ 69.56$
 Market capitalization = ₹ 69.56 per share $\times 28.75 \text{ lakh shares} = ₹ 1,999.85 \text{ lakh}$
- (iv) **Free float of market capitalization** = ₹ 69.56 per share $\times (28.75 \text{ lakh} \times 40\%) = ₹ 799.94 \text{ lakh}$

Question 22 Abhiman Ltd. is a subsidiary of Janam Ltd. and is acquiring Swabhiman Ltd. which is also a subsidiary of Janam Ltd. The following information is given :

	Abhiman Ltd.	Swabhiman Ltd.
% Shareholding of promoter	50%	60%
Share capital	₹ 200 lacs	100 lacs
Free Reserves and surplus	₹ 900 lacs	600 lacs
Paid up value per share	₹ 100	10
Free float market capitalization	₹ 500 lacs	156 lacs
P/E Ratio (times)	10	4

Janam Ltd., is interested in doing justice to both companies. The following parameters have been assigned by the Board of Janam Ltd., for determining the swap ratio:

Book value	25%
Earning per share	50%
Market price	25%

You are required to compute

- (i) The swap ratio.
 (ii) Book Value, EPS and Expected Market Price of Swabhiman Ltd., (assuming P/E Ratio of Abhiman remains the same and all assets and liabilities of Swabhiman Ltd. are taken over at book value.)

Solution

SWAP RATIO

	Abhiman Ltd.	Swabhiman Ltd.
	(₹)	(₹)
Share capital	200 lacs	100 lacs
Free reserves & surplus	900 lacs	600 lacs
Total	1100 lacs	700 lacs
No. of shares	2 lacs	10 lacs
Book value for share	₹ 550	₹ 70
Promoters Holding	50%	60%
Non promoters holding	50%	40%
Free float market capitalization (Public)	500 lacs	₹ 156 lacs
Total Market Cap	1000 lacs	390 lacs
No. of shares	2 lacs	10 lacs
Market Price	₹ 500	₹ 39
P/E ratio	10	4
EPS	₹ 50.00	₹ 9.75

Calculation of SWAP Ratio

Book Value	1:0.1273	$0.1273 \times 25\%$	0.031825
EPS	1:0.195	$0.195 \times 50\%$	0.097500
Market Price	1:0.078	$0.078 \times 25\%$	<u>0.019500</u>
Total			<u>0.148825</u>

(i) SWAP Ratio is 0.148825 shares of Abhiman Ltd. for every share of Swabhimman Ltd.

Total No. of shares to be issued = 10 lakh $0.148825 = 148825$ shares $\times$

(ii) Book value, EPS & Market Price.

Total No. shares = 200000 + 148825 = 348825

Total capital = ₹200 lakh + ₹148.825 lac = ₹ 348.825 lac

Reserves = ₹ 900 lac + ₹ 551.175 lac = ₹ 1451.175 lac

Book value Per Share = ₹348.825 lac + ₹1451.175 lac / 3.48825lac = ₹ 516.02

or ₹ 516.02 $\times 0.148825 = ₹ 76.80$

$$\text{Or} = \frac{\text{Total Capital}}{\text{No. of Shares}} = \frac{1100\text{lac} + 700\text{lac}}{348825}$$

$$\text{EPS} = \frac{\text{Total Profit}}{\text{No. of Shares}} = \frac{100\text{lac} + 97.50\text{lac}}{3.48825\text{lac}} \quad \text{or} \quad ₹ 56.62 \times 0.148825 = ₹ 8.43$$

Expected market price = ₹ 56.62 $\times$ PE Ratio = ₹ 56.62 $\times 10 = ₹ 566.20$

or ₹ 566.20 $\times 0.148825 = ₹ 84.26$

Question 23

Following info is provided relating to the acquiring company E Ltd., and the target company H Ltd:

Particulars	E Ltd. (₹)	H Ltd. (₹)
Number of shares (Face value ₹ 10 each)	20 Lakhs	15 Lakhs
Market Capitalization	1000 Lakhs	1500 Lakhs
P/E Ratio (times)	10.00	5.00
Reserves and surplus in ₹	600.00 Lakhs	330.00 Lakhs
Promoter's Holding (No. of shares)	9.50 Lakhs	10.00 Lakhs

The Board of Directors of both the companies have decided to give a fair deal to the shareholders. Accordingly, the weights are decided as 40%, 25% and 35% respectively for earnings (EPS), book value and market price of share of each company for swap ratio.

Calculate the following:

- Market price per share, earnings per share and Book Value per share;
- Swap ratio;
- Promoter's holding percentage after acquisition;
- EPS of E Ltd. after acquisitions of H Ltd;
- Expected market price per share and market capitalization of E Ltd.; after acquisition, assuming P/E ratio of E Ltd. remains unchanged; and
- Free float market capitalization of the merged firm.

Solution (i)

	E Ltd.	H Ltd.
Market capitalisation	1000 lakhs	1500 lakhs
No. of shares	20 lakhs	15 lakhs
Market Price per share	₹ 50	₹ 100
P/E ratio	10	5
EPS	₹ 5	₹ 20
Profit	₹ 100 lakh	₹ 300 lakh
Share capital	₹ 200 lakh	₹ 150 lakh
Reserves and surplus	<u>₹ 600 lakh</u>	<u>₹ 330 lakh</u>
Total	<u>₹ 800 lakh</u>	<u>₹ 480 lakh</u>
Book Value per share	₹ 40	₹ 32

(ii) Calculation of Swap Ratio

EPS	1 : 4 i.e.	4.0 × 40%	1.6
Book value	1 : 0.8 i.e.	0.8 × 25%	0.2
Market price	1 : 2 i.e.	2.0 × 35%	<u>0.7</u>
		Total	<u>2.5</u>

Swap ratio is for every one share of H Ltd., to issue 2.5 shares of E Ltd. Hence, total no. of shares to be issued 15 lakh × 2.5 = 37.50 lakh shares

(iii) Promoter's holding = 9.50 lakh shares + (10 × 2.5 = 25 lakh shares) = 34.50 lakh i.e. Promoter's holding % is (34.50 lakh/57.50 lakh) × 100 = 60%.

(iv) Calculation of EPS after merger

Total No. of shares 20 lakh + 37.50 lakh = 57.50 lakh

$$\text{EPS} = \frac{\text{Total Profit}}{\text{No. of Shares}} = \frac{100\text{lac} + 300\text{lac}}{57.50\text{lac}} = 400/57.50 = ₹ 6.956$$

(v) Calculation of Market price and Market capitalization after merger

Expected market price EPS 6.956 × P/E 10 = ₹ 69.56

Market capitalization = ₹ 69.56 per share × 57.50 lakh shares = ₹ 3,999.70 lakh or ₹ 4,000 lakh

(vi) Free float of market capitalization = ₹ 69.56 per share × (57.50 lakh × 40%) = ₹ 1599.88 lakh

Question 24 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 lakh	128 lakh
P/E Ratio (times)	10	4

Trident Ltd. is interested to do justice to the shareholders of both the Companies. For the swap ratio weights are assigned to different parameters by the Board of Directors as follows:

Book Value	25%
EPS (Earning per share)	50%
Market Price	25%

- (a)
- (b) What is the swap ratio based on above weights?
- (c) 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).
- (d) Calculate:
 - (i) Promoter's revised holding in the Abhiman Ltd.
 - (ii) Free float market capitalization.
 - (iii) Also calculate No. of Shares, Earning per Share (EPS) and Book Value (B.V.), if after acquisition of Abhishek Ltd., Abhiman Ltd. decided to :
 - (1) Issue Bonus shares in the ratio of 1 : 2; and
 - (2) Split the stock (share) as ₹ 5 each fully paid.

Solution

(a) Swap Ratio

	Abhiman Ltd.	Abhishek Ltd.
Share Capital	200 Lakh	100 Lakh
Free Reserves	<u>800 Lakh</u>	<u>500 Lakh</u>
Total	<u>1000 Lakh</u>	<u>600 Lakh</u>
No. of Shares	2 Lakh	10 Lakh
Book Value per share	₹ 500	₹ 60
Promoter's holding	50%	60%
Non promoter's holding	50%	40%
Free Float Market Cap. i.e.	400 Lakh	128 Lakh
relating to Public's holding Hence Total market Cap.	800 Lakh	320 Lakh
No. of Shares	2 Lakh	10 Lakh
Market Price	₹ 400	₹ 32
P/E Ratio	10	4
EPS	40	8
Profits (₹ 2 X 40 lakh)	₹ 80 lakh	-
(₹ 8 X 10 lakh)	-	₹ 80 lakh

Calculation of Swap Ratio

Book Value	1 : 0.12 i.e.	$0.12 \times 25\%$	0.03
EPS	1 : 0.2	$0.20 \times 50\%$	0.10
Market Price	1 : 0.08	$0.08 \times 25\%$	<u>0.02</u>
		Total	<u>0.15</u>

Swap ratio is for every one share of Abhishek Ltd., to issue 0.15 shares of Abhiman Ltd. Hence total no. of shares to be issued, $10 \text{ Lakh} \times 0.15 = 1.50 \text{ lakh shares}$

(b) Book Value, EPS & Market Price

Total No of Shares	$2 \text{ Lakh} + 1.5 \text{ Lakh} = 3.5 \text{ Lakh}$
Total Capital	$\text{₹ } 200 \text{ Lakh} + \text{₹ } 150 \text{ Lakh} = \text{₹ } 350 \text{ Lakh}$
Reserves	$\text{₹ } 800 \text{ Lakh} + \text{₹ } 450 \text{ Lakh} = \text{₹ } 1,250 \text{ Lakh}$
Book Value	$\frac{\text{₹ } 350 \text{ Lakh} + \text{₹ } 1,250 \text{ Lakh}}{3.5 \text{ Lakh}} = \text{₹ } 457.14 \text{ per share}$

EPS = Total Profit/ No. of Shares = $\frac{\text{₹ } 80 \text{ lakh} + \text{₹ } 80 \text{ lakh}}{3.5 \text{ lakh}} = \frac{\text{₹ } 160 \text{ lakh}}{3.5} = \text{₹ } 45.71$

Expected Market Price EPS ($\text{₹ } 45.71$) $\times$ P/E Ratio (10) = $\text{₹ } 457.10$

(c) (i) Promoter's holding

Promoter's Revised Holding	Abhiman 50% i.e.	1.00 Lakh shares
	Abhishek 60% i.e.	<u>0.90 Lakh shares</u>
	Total	<u>1.90 Lakh shares</u>

Promoter's % = $1.90/3.50 \times 100 = 54.29\%$

(ii) Free Float Market Capitalisation

Free Float Market Capitalisation	$= (3.5 \text{ Lakh} - 1.9 \text{ Lakh}) \times \text{₹ } 457.10$
	$= \text{₹ } 731.36 \text{ Lakh}$

(iii) (a) & (b)

Revised Capital	$\text{₹ } 350 \text{ Lakh} + \text{₹ } 175 \text{ Lakh} = \text{₹ } 525 \text{ Lakh}$
No. of shares before Split (F.V ₹ 100)	5.25 Lakh
No. of Shares after Split (F.V. ₹ 5)	$5.25 \times 20 = 105 \text{ Lakh}$
EPS	$160 \text{ Lakh} / 105 \text{ Lakh} = 1.523$
Book Value	$\text{Cap. ₹ } 525 \text{ Lakh} + \text{₹ } 1075 \text{ Lakh}$
	No. of Shares = 105 Lakh
	$= \text{₹ } 15.238 \text{ per share}$

Question 25 T Ltd. and E Ltd. are in same industry. Former is in negotiation for acquisition of latter. Important information about the two companies as per their latest financial statements is given below:

	T Ltd.	E Ltd.
₹ 10 Equity shares outstanding	12 Lakhs	6 Lakhs
Debt:		
10% Debentures (₹ Lakhs)	580	--
12.5% Institutional Loan (₹ Lakhs)	--	240
Earning before interest, depreciation and tax (EBIDAT) (₹ Lakhs)	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:

- (i) Net consideration payable.
- (ii) No. of shares to be issued by T Ltd.
- (iii) EPS of T Ltd. after acquisition.
- (iv) Expected market price per share of T Ltd. after acquisition.
- (v) State briefly the advantages to T Ltd. from the acquisition.

Note: Calculations (except EPS) may be rounded off to 2 decimals in lakhs.

Solution **As per T Ltd.'s Offer**

	₹ in lakhs
(i) Net Consideration Payable	
7 times EBIDAT, i.e. $7 \times ₹ 115.71$ lakh	809.97
Less: Debt	<u>240.00</u>
	<u>569.97</u>
(ii) No. of shares to be issued by T Ltd ₹ 569.97 lakh/₹ 220 (rounded off) (Nos.)	2,59,000
(iii) EPS of T Ltd after acquisition	
Total EBIDT (₹ 400.86 lakh + ₹ 115.71 lakh)	516.57
Less: Interest (₹ 58 lakh + ₹ 30 lakh)	<u>88.00</u>
	428.57
Less: 30% Tax	<u>128.57</u>
Total earnings (NPAT)	<u>300.00</u>
Total no. of shares outstanding (12 lakh + 2.59 lakh)	14.59 lakh
EPS (₹ 300 lakh/ 14.59 lakh)	₹ 20.56
(iv) Expected Market Price: Pre-acquisition P/E multiple:	
EBIDAT (₹ in lakhs)	400.86
Less: Interest ($580 \times \frac{10}{100}$)(₹ in lakhs)	<u>58.00</u>
	342.86
Less: 30% Tax (₹ in lakhs)	<u>102.86</u>
EAT (₹ in lakhs)	<u>240.00</u>
No. of shares (lakhs)	12.00
EPS	₹ 20.00
Hence, PE multiple $\frac{220}{20}$	11
Expected market price after acquisition (₹ 20.56 × 11)	₹ 226.16

As per E Ltd's Plan

		₹ in lakhs
(i)	Net consideration payable 6 lakhs shares × ₹ 110	660
(ii)	No. of shares to be issued by T Ltd ₹ 660 lakhs ÷ ₹ 220	3 lakh
(iii)	EPS of T Ltd after Acquisition NPAT (as per earlier calculations)	300.00
	Total no. of shares outstanding (12 lakhs + 3 lakhs)	15 lakh
	Earning Per Share (EPS) ₹ 300 lakh/15 lakh	₹ 20.00
(iv)	Expected Market Price (₹ 20 × 11)	₹ 220.00

(v) 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 26

The following information is relating to Fortune India Ltd. having two division, viz. Pharma Division and Fast Moving Consumer Goods Division (FMCG Division). Paid up share capital of Fortune India Ltd. is consisting of 3,000 Lakhs equity shares of Re. 1 each. Fortune India Ltd. decided to de-merge Pharma Division as Fortune Pharma Ltd. w.e.f. 1.4.2009. Details of Fortune India Ltd. as on 31.3.2009 and of Fortune Pharma Ltd. as on 1.4.2009 are given below:

Particulars	Fortune Pharma Ltd.	Fortune India Ltd.
	₹	₹
Outside Liabilities		
Secured Loans	400 lakh	3,000 lakh
Unsecured Loans	2,400 lakh	800 lakh
Current Liabilities & Provisions	1,300 lakh	21,200 lakh
Assets		
Fixed Assets	7,740 lakh	20,400 lakh
Investments	7,600 lakh	12,300 lakh
Current Assets	8,800 lakh	30,200 lakh
Loans & Advances	900 lakh	7,300 lakh
Deferred tax/Misc. Expenses	60 lakh	(200) lakh

Board of Directors of the Company have decided to issue necessary equity shares of Fortune Pharma Ltd. of Re. 1 each, without any consideration to the shareholders of Fortune India Ltd. For that purpose following points are to be considered:

- Transfer of Liabilities & Assets at Book value.
- Estimated Profit for the year 2009-10 is ₹ 11,400 Lakh for Fortune India Ltd. & ₹ 1,470 lakhs for Fortune Pharma Ltd.
- Estimated Market Price of Fortune Pharma Ltd. is ₹ 24.50 per share.
- Average P/E Ratio of FMCG sector is 42 & Pharma sector is 25, which is to be expected for both the companies.

Calculate:

- The Ratio in which shares of Fortune Pharma are to be issued to the shareholders of Fortune India Ltd.
- Expected Market price of Fortune India (FMCG) Ltd.
- Book Value per share of both the Companies immediately after Demerger.

Solution

Share holders' funds

(₹ Lakhs)

Particulars	Fortune India Ltd.	Fortune Pharma Ltd.	Fortune India (FMCG) Ltd.
Assets	70,000	25,100	44,900
Outside liabilities	<u>25,000</u>	<u>4,100</u>	<u>20,900</u>
Net worth	<u>45,000</u>	<u>21,000</u>	<u>24,000</u>

1. Calculation of Shares of Fortune Pharma Ltd. to be issued to shareholders of Fortune India Ltd.

	Fortune Pharma Ltd.
Estimated Profit (₹ in lakhs)	1,470
Estimated market price (₹)	24.5
Estimated P/E	25
Estimated EPS (₹)	0.98
No. of shares lakhs	1,500

Hence, Ratio is 1 share of Fortune Pharma Ltd. for 2 shares of Fortune India Ltd.

OR for 0.50 share of Fortune Pharma Ltd. for 1 share of Fortune India Ltd.

2. Expected market price of Fortune India (FMCG) Ltd.

	Fortune India (FMCG) Ltd.
Estimated Profit (₹ in lakhs)	11,400
No. of equity shares (₹ in lakhs)	3,000
Estimated EPS (₹)	3.8
Estimated P/E	42
Estimated market price (₹)	159.60

3. Book value per share

	Fortune Pharma Ltd.	Fortune India (FMCG) Ltd.
Net worth (₹ in lakhs)	21,000	24,000
No. of shares (₹ in lakhs)	1,500	3,000
Book value of shares	₹ 14	₹ 8

Question 27 H Ltd. agrees to buy over the business of B Ltd. effective 1st April, 2012. The summarized Balance Sheets of H Ltd. and B Ltd. as on 31st March 2012 are as follows:

Balance sheet as at 31st March, 2012 (In Crores of Rupees)

Liabilities:	H. Ltd	B. Ltd.
Paid up Share Capital		
-Equity Shares of ₹100 each	350.00	
-Equity Shares of ₹10 each		6.50
Reserve & Surplus	950.00	25.00
Total	1,300.00	31.50
Assets:		
Net Fixed Assets	220.00	0.50
Net Current Assets	1,020.00	29.00
Deferred Tax Assets	60.00	2.00
Total	1,300.00	31.50

H Ltd. proposes to buy out B Ltd. and the following information is provided to you as part of the scheme of buying:

- The weighted average post tax maintainable profits of H Ltd. and B Ltd. for the last 4 years are ₹ 300 crores and ₹ 10 crores respectively.
- Both the companies envisage a capitalization rate of 8%.
- H Ltd. has a contingent liability of ₹ 300 crores as on 31st March, 2012.
- H Ltd. to issue shares of ₹ 100 each to the shareholders of B Ltd. in terms of exchange ratio as arrived on a Fair Value basis. (Please consider weights of 1 and 3 for the value of shares arrived on Net Asset basis and Earnings capitalization method respectively for both H Ltd. and B Ltd.)

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

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

Solution

(i) Net asset value

H Ltd.	$\text{₹ } 1300 \text{ Crores} - \text{₹ } 300 \text{ Crores} / 3.50 \text{ Crores} = \text{₹ } 285.71$
B Ltd.	$\text{₹ } 31.50 \text{ Crores} / 0.65 \text{ Crores} = \text{₹ } 48.46$

(ii) Earning capitalization value

H Ltd.	$(\text{₹ } 300 \text{ Crores} \div 0.08) / 3.50 \text{ Crores} = \text{₹ } 1071.43^*$
B Ltd.	$(\text{₹ } 10 \text{ Crores} \div 0.08) / 0.65 \text{ Crores} = \text{₹ } 192.31$

* Alternatively, Contingent Liability can also be deducted from this Valuation.

(iii) Fair value

H Ltd.	$(\text{₹ } 285.71 \times 1 + \text{₹ } 1071.43 \times 3) / 4 = \text{₹ } 875$
B Ltd.	$(\text{₹ } 48.46 \times 1 + \text{₹ } 192.31 \times 3) / 4 = \text{₹ } 156.3475$

Exchange ratio $\text{₹ } 156.3475 / \text{₹ } 875 = 0.1787$

H Ltd should issue its 0.1787 share for each share of B Ltd.

Note: In above solution it has been assumed that contingent liability will materialize at its full amount.

Question 28 Reliable Industries Ltd. (RIL) is considering a takeover of Sunflower Industries Ltd. (SIL). The particulars of 2 companies are given below:

Particulars	Reliable Industries Ltd	Sunflower Industries Ltd.
Earnings After Tax (EAT)	₹ 20,00,000	₹ 10,00,000
Equity shares O/s	10,00,000	10,00,000
Earnings per share (EPS)	2	1
PE Ratio (Times)	10	5

Required:

- What is the market value of each Company before merger?
- Assume that the management of RIL estimates that the shareholders of SIL will accept an offer of one share of RIL for four shares of SIL. If there are no synergic effects, what is the market value of the Post-merger RIL? What is the new price per share?
- Are the shareholders of RIL better or worse off than they were before the merger?
- Due to synergic effects, the management of RIL estimates that the earnings will increase by 20%. What are the new post-merger EPS and Price per share? Will the shareholders be better off or worse off than before the merger?

Solution**(i) Market value of Companies before Merger**

<i>Particulars</i>	<i>RIL</i>	<i>SIL</i>
EPS	₹ 2	Re.1
P/E Ratio	10	5
Market Price Per Share	₹ 20	₹ 5
Equity Shares	10,00,000	10,00,000
Total Market Value	2,00,00,000	50,00,000

(ii) Post Merger Effects on RIL

	₹
Post-merger earnings	30,00,000
Exchange Ratio (1:4)	
No. of equity shares o/s (10,00,000 + 2,50,000)	12,50,000
EPS: 30,00,000/12,50,000	2.4
PE Ratio	10
Market Value 10 × 2.4	24
Total Value (12,50,000 × 24)	3,00,00,000

Gains From Merger:	₹
Post-Merger Market Value of the Firm	3,00,00,000
Less: Pre-Merger Market Value	
RIL 2,00,00,000	
SIL <u>50,00,000</u>	<u>2,50,00,000</u>
Total gains from Merger	<u>50,00,000</u>

Apportionment of Gains between the Shareholders:

Particulars	RIL (₹)	SIL (₹)
Post-Merger Market Value:		
10,00,000 × 24	2,40,00,000	--
2,50,000 × 24	-	60,00,000
Less: Pre-Merger Market Value	2,00,00,000	50,00,000
Gains from Merger:	40,00,000	10,00,000

Thus, the shareholders of both the companies (RIL + SIL) are better off than before

- (iii) **Post-Merger Earnings:**
 Increase in Earnings by 20%
 New Earnings: ₹ 30,00,000 × (1+0.20) ₹ 36,00,000
 No. of equity shares outstanding: 12,50,000
 EPS (₹ 36,00,000/12,50,000) ₹ 2.88
 PE Ratio 10
 Market Price Per Share: = ₹2.88 × 10 ₹ 28.80
 ∴ Shareholders will be better-off than before the merger situation.

Question 29 AFC Ltd. wishes to acquire BCD Ltd. The shares issued by the two companies are 10,00,000 and 5,00,000 respectively:

- (i) **Calculate the increase in the total value of BCD Ltd. resulting from the acquisition on the basis of the following conditions:**

Current expected growth rate of BCD Ltd.	7%
Expected growth rate under control of AFC Ltd., (without any additional capital investment and without any change in risk of operations)	8%
Current Market price per share of AFC Ltd.	₹ 100
Current Market price per share of BCD Ltd.	₹ 20
Expected Dividend per share of BCD Ltd.	₹ 0.60

- (ii) 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.
 (iii) 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

- (i) For BCD Ltd., before acquisition
 The cost of capital of BCD Ltd. may be calculated by using the following formula:
 (Dividend/Price) + Growth%
 Cost of Capital i.e., $K_e = (0.60/20) + 0.07 = 0.10$
 After acquisition g (i.e. growth) becomes 0.08
 Therefore, price per share after acquisition = $0.60/(0.10-0.08) = ₹ 30$
 The increase in value therefore is = $₹(30-20) \times 5,00,000 = ₹ 50,00,000$
- (ii) To shareholders of BCD Ltd. the immediate gain is ₹ 100 - ₹ 20 × 4 = ₹ 20 per share
 The gain can be higher if price of shares of AFC Ltd. rise following merger which they should undertake.

To AFC Ltd. shareholders	(In ₹ lakhs)
Value of Company now	1,000
Value of BCD Ltd.	<u>150</u>
	<u>1,150</u>
No. of shares	11.25
∴ Value per share	1150/11.25 = ₹ 102.22

Gain to shareholders of BCD Ltd. = ₹ 102.22 - ₹(4 × 20) = ₹ 22.22

Gain to shareholders of AFC Ltd. = ₹ 102.22 - ₹ 100.00 = ₹ 2.22

(iii) Gain to shareholders of AFC Ltd:-

Earnings of BCD Ltd. (5,00,000 × 2.50) ₹ 12,50,000/-

Less: Loss of earning in cash (5,00,000 × ₹ 22 × 0.10) ₹ 11,00,000/-

Net Earning ₹ 1,50,000/-

Number of shares 10,00,000

Net increase in earning per share 0.15

P/E ratio of AFC Ltd. = 100/8 = 12.50

Therefore, Gain per share of shareholders of AFC Ltd. = 0.15 × 12.50 = ₹ 1.88

Gain to the shareholders of BCD Ltd. ₹ (22-20) = ₹ 2/- per share

Alternatively, it can also be computed as follows:

Post-Merger Earnings (10,00,000 × ₹ 8 + 5,00,000 × ₹ 2.5 - 11,00,000)	₹ 81,50,000
EPS after Merger (81,50,000/10,00,000)	₹8.15
PE Ratio	12.50
Post Merger Price of Share (₹ 8.15 × 12.50)	₹ 101.875
Less: Price before merger	₹100
	₹1.875
Say	₹1.88

Question 30

AB Ltd., is planning to acquire and absorb the running business of XY Ltd. The valuation is to be based on the recommendation of merchant bankers and the consideration is to be discharged in the form of equity shares to be issued by AB Ltd. As on 31.3.2006, the paid up capital of AB Ltd. consists of 80 lakhs shares of ₹10 each. The highest and the lowest market quotation during the last 6 months were ₹570 and ₹430. For the purpose of the exchange, the price per share is to be reckoned as the average of the highest and lowest market price during the last 6 months ended on 31.3.06.

XY Ltd.'s Balance Sheet as at 31.3.2006 is summarised below:

	₹ lakhs
Sources	
Share Capital	
20 lakhs equity shares of ₹10 each fully paid	200
10 lakhs equity shares of ₹10 each, ₹5 paid	50
Loans	<u>100</u>
Total	<u>350</u>
Uses	
Fixed Assets (Net)	150
Net Current Assets	<u>200</u>
	<u>350</u>

An independent firm of merchant bankers engaged for the negotiation, have produced the following estimates of cash flows from the business of XY Ltd.:

Year ended	By way of	₹ lakhs
31.3.07	after tax earnings for equity	105
31.3.08	do	120
31.3.09	Do	125
31.3.10	Do	120
31.3.11	Do	100
	Terminal Value estimate	200

It is the recommendation of the merchant banker that the business of XY Ltd. may be valued on the basis of the average of (i) Aggregate of discounted cash flows at 8% and (ii) Net assets value. Present value factors at 8% for years 1-5: 0.93 0.86 0.79 0.74 0.68

You are required to:

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

Solution

Price/share of AB Ltd. for determination of number of shares to be issued

$$= (\text{₹ } 570 + \text{₹ } 430) / 2 = \text{₹ } 500$$

Value of XY Ltd based on future cash flow capitalization (105x0.93) + (120x0.86) + (125x0.79) + (120x0.74) + (300x0.68)	₹ lakhs	592.40
Value of XY Ltd based on net assets	₹ lakhs	250.00
Average value (592.40+250)/2		421.20
No. of shares in AB Ltd to be issued ₹ 4,21,20,000/500	Nos.	84240
Basis of allocation of shares		
Fully paid equivalent shares in XY Ltd. (20+5) lakhs		2500000
Distribution to fully paid shareholders 84240x20/25		67392
Distribution to partly paid shareholders 84240-67392		16848

Question 31 R Ltd. and S Ltd. are companies that operate in the same industry. The financial statements of both the companies for the current financial year are as follows:

Balance Sheet

Particulars	R. Ltd. (₹)	S. Ltd (₹)
Equity & Liabilities		
Shareholders Fund		
Equity Capital (₹ 10 each)	20,00,000	16,00,000
Retained earnings	4,00,000	-
Non-current Liabilities		
16% Long term Debt	10,00,000	6,00,000
Current Liabilities	<u>14,00,000</u>	<u>8,00,000</u>
Total	<u>48,00,000</u>	<u>30,00,000</u>
Assets		
Non-current Assets	20,00,000	10,00,000
Current Assets	<u>28,00,000</u>	<u>20,00,000</u>
Total	<u>48,00,000</u>	<u>30,00,000</u>

Income Statement

	Particulars	R. Ltd. (₹)	S. Ltd. (₹)
A.	Net Sales	69,00,000	34,00,000
B.	Cost of Goods sold	<u>55,20,000</u>	<u>27,20,000</u>
C.	Gross Profit (A-B)	13,80,000	6,80,00
D.	Operating Expenses	4,00,000	2,00,000
E.	Interest	<u>1,60,000</u>	<u>96,000</u>
F.	Earnings before taxes [C-(D+E)]	8,20,000	3,84,000
G.	Taxes @ 35%	2,87,000	1,34,400
H.	Earnings After Tax (EAT)	5,33,000	2,49,600

Additional Information:

No. of equity shares	2,00,000	1,60,000
Dividend payment Ratio (D/P)	20%	30%
Market price per share	₹ 50	₹ 20

Assume that both companies are in process of negotiating a merger through exchange of Equity shares:

You are required to:

- (i) Decompose the share price of both the companies into EPS & P/E components. Also segregate their EPS figures into Return On Equity (ROE) and Book Value/Intrinsic Value per share components.
- (ii) Estimate future EPS growth rates for both the companies.
- (iii) Based on expected operating synergies, R Ltd. estimated that the intrinsic value of S Ltd. Equity share would be ₹ 25 per share on its acquisition. You are required to develop a range of justifiable Equity Share Exchange ratios that can be offered by R Ltd. to the shareholders of S Ltd. Based on your analysis on parts (i) and (ii), would you expect the negotiated terms to be closer to the upper or the lower exchange ratio limits and why?

Solution

(i) Determination of EPS, P/E Ratio, ROE and BVPS of R Ltd. & S Ltd.

	R Ltd.	S Ltd.
EAT (₹)	5,33,000	2,49,600
N	200000	160000
EPS (EAT÷N)	2.665	1.56
Market Price Per Share	50	20
PE Ratio (MPS/EPS)	18.76	12.82
Equity Fund (Equity Value)	2400000	1600000
BVPS (Equity Value ÷ N)	12	10
ROE (EAT ÷ EF) or	0.2221	0.156
ROE (EAT ÷ EF) × 100	22.21%	15.60%

(ii) Determination of Growth Rate of EPS of R Ltd. & S Ltd.

	R Ltd.	S Ltd.
Retention Ratio (1-D/P Ratio)	0.80	0.70
Growth Rate (ROE × Retention Ratio) or	0.1777	0.1092
Growth Rate (ROE × Retention Ratio) × 100	17.77%	10.92%

(iii) Justifiable equity share exchange ratio

(a) Market Price Based = MPSS/MPSR = ₹ 20/ ₹ 50 = 0.40:1 (lower limit)

(b) Intrinsic Value Based = ₹ 25/ ₹ 50 = 0.50:1 (max. limit)

Since R Ltd. has higher EPS, PE, ROE and higher growth expectations the negotiated term would be expected to be closer to the lower limit, based on existing share price.

Question 32 BA Ltd. and DA Ltd. both the companies operate in the same industry. The Financial statements of both the companies for the current financial year are as follows:

Balance Sheet

Particulars		BA Ltd. (₹)	DA Ltd. (₹)
Current Assets		14,00,000	10,00,000
Fixed Assets (Net)		<u>10,00,000</u>	<u>5,00,000</u>
	Total (₹)	<u>24,00,000</u>	<u>15,00,000</u>
Equity capital (₹10 each)		10,00,000	8,00,000
Retained earnings		2,00,000	--
14% long-term debt		5,00,000	3,00,00
Current liabilities		<u>7,00,000</u>	<u>4,00,000</u>
	Total (₹)	<u>24,00,000</u>	<u>15,00,000</u>

Income Statement

	BA Ltd. (₹)	DA Ltd. (₹)
Net Sales	34,50,000	17,00,000
Cost of Goods sold	<u>27,60,000</u>	<u>13,60,000</u>
Gross profit	6,90,000	3,40,000
Operating expenses	2,00,000	1,00,000
Interest	70,000	42,000
Earnings before taxes	4,20,000	1,98,00
Taxes @ 50%	<u>2,10,000</u>	<u>99,000</u>
Earnings after taxes (EAT)	<u>2,10,000</u>	<u>99,000</u>
Additional Information :		
No. of Equity shares	1,00,000	80,000
Dividend payment ratio (D/P)	40%	60%
Market price per share	₹40	₹15

Assume that both companies are in the process of negotiating a merger through an exchange of equity shares. You have been asked to assist in establishing equitable exchange terms and are required to:

- (i) Decompose the share price of both the companies into EPS and P/E components; and also segregate their EPS figures into Return on Equity (ROE) and book value/intrinsic value per share components.
- (ii) Estimate future EPS growth rates for each company.
- (iii) Based on expected operating synergies BA Ltd. estimates that the intrinsic value of DA's equity share would be ₹20 per share on its acquisition. You are required to develop a range of justifiable equity share exchange ratios that can be offered by BA Ltd. to the shareholders of DA Ltd. Based on your analysis in part (i) and (ii), would you expect the negotiated terms to be closer to the upper, or the lower exchange ratio limits and why?
- (iv) Calculate the post-merger EPS based on an exchange ratio of 0.4: 1 being offered by BA Ltd. and indicate the immediate EPS accretion or dilution, if any, that will occur for each group of shareholders.
- (v) Based on a 0.4: 1 exchange ratio and assuming that BA Ltd.'s pre-merger P/E ratio will continue after the merger, estimate the post-merger market price. Also show the resulting accretion or dilution in pre-merger market prices.

Solution

Market price per share (MPS) = EPS X P/E ratio or P/E ratio = MPS/EPS

(i) Determination of EPS, P/E ratio, ROE and BVPS of BA Ltd. and DA Ltd.

		BA Ltd.	DA Ltd.
Earnings After Tax	(EAT)	₹ 2,10,000	₹ 99,000
No. of Shares	(N)	100000	80000
EPS	(EAT/N)	₹ 2.10	₹ 1.2375
Market price per share	(MPS)	40	15
P/E Ratio	(MPS/EPS)	19.05	12.12
Equity Funds	(EF)	₹ 12,00,000	₹ 8,00,000
BVPS	(EF/N)	12	10
ROE	(EAT/EF) × 100	17.50%	12.37%

(ii) Estimation of growth rates in EPS for BA Ltd. and DA Ltd.

Retention Ratio	(1-D/P ratio)	0.6	0.4
Growth Rate	(ROE × Retention Ratio)	10.50%	4.95%

(iii) Justifiable equity shares exchange ratio

(a) Intrinsic value based = ₹20 / ₹40 = 0.5:1 (upper limit)

(b) Market price based = MPSDA/MPSBA = ₹15 / ₹40 = 0.375:1 (lower limit)

Since, BA Ltd. has a higher EPS, ROE, P/E ratio and even higher EPS growth expectations, negotiable terms would be expected to be closer to lower limit, based on existing share prices.

(iv) Calculation of Post merger EPS and its effects

Particulars			BA Ltd.	DA Ltd.	Combined
EAT	(₹)	(i)	2,10,000	99,000	3,09,000
Share outstanding		(ii)	100000	80000	132000*
EPS	(₹)	(i) / (ii)	2.1	1.2375	2.341
EPS Accretion (Dilution)	(Re.)		0.241	(0.301***)	

* Shares outstanding (combined) = 100000 shares + (0.40 × 80000) = 132000 shares

** EPS claim per old share = ₹ 2.34 × 0.4 = ₹ 0.936

EPS dilution = ₹ 1.2375 - ₹ 0.936 = ₹ 0.3015

***S claim per old share (₹ 44.60 × 0.4) = ₹ 17.84

Less: MPS per old share = ₹ 15.00

₹ 2.84

Question 33

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	<u>890</u>	<u>2,500</u>
Total Liabilities	<u>5,120</u>	<u>52,500</u>
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	<u>50</u>	=
Total Assets	<u>5,120</u>	<u>52,500</u>

You are required to

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

Solution**(a) Swap Ratio**

Gross NPA	5:40	$5/40 \times 30\%$	0.0375
CAR	5:16	$5/16 \times 28\%$	0.0875
Market Price	12:96	$12/96 \times 32\%$	0.0400
Book Value Per Share	12:120	$12/120 \times 10\%$	0.0100
			0.1750

Thus, for every share of Weak Bank, 0.1750 share of Strong Bank shall be issued.

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

(b) No. of equity shares to be issued: $(150/10) \times 0.1750 = 2.625$ lakh shares

(c) Balance Sheet after Merger

Calculation of Capital Reserve

Book Value of Shares	₹ 180.00 lac
Less: Value of Shares issued	₹ 26.25 lac
Capital Reserve	₹ 153.75 lac

Balance Sheet

	₹ lac		₹ lac
Paid up Share Capital	526.25	Cash in Hand & RBI	2900.00
Reserves & Surplus	5500.00	Balance with other banks	2000.00
Capital Reserve	153.75	Investment	20100.00
Deposits	48000.00	Advances	30500.00
Other Liabilities	3390.00	Other Assets	2070.00
	57570.00		57570.00

(d) Calculation CAR & Gross NPA % of Bank 'S' after merger

CAR / CRWAR = Total Capital / Risky Weighted Assets

	Weak Bank	Strong Bank	Merged
Capital Adequacy Ratio (CAR)	5%	16%	
Total Capital	₹ 180 lac	₹ 6000 lac	₹ 6180 lac
Risky Weighted Assets	₹ 3600 lac	₹ 37500 lac	₹ 41100 lac

$$CAR = (6180/41100) \times 100 = 15.04\%$$

GNPA Ratio = (Gross NPA / Gross Advances) $\times$ 100

	Weak Bank	Strong Bank	Merged
GNPA (Given)	0.40	0.05	
	$0.40 = \text{GNPA}_R / ₹3500 \text{ lac}$	$0.05 = \text{GNPA}_S / ₹27000 \text{ lac}$	
Gross NPA	₹ 1400 lac	₹ 1350 lac	₹ 2750 lac

$$2750/30500 \times 100 = 9.02\%$$

Question 34

M/s Tiger Ltd. wants to acquire M/s. Leopard Ltd. The balance sheet of Leopard Ltd. as on 31st March, 2012 is as follows:

Liabilities	₹	Assets	₹
Equity Capital (70,000 shares)	7,00,000	Cash	50,000
Retained earnings	3,00,000	Debtors	70,000
12% Debentures	3,00,000	Inventories	2,00,000
Creditors and other liabilities	3,20,000	Plants & Eqpt.	13,00,000
	16,20,000		16,20,000

Additional Information:

- Shareholders of Leopard Ltd. will get one share in Tiger Ltd. for every two shares. External liabilities are expected to be settled at ₹ 5,00,000. Shares of Tiger Ltd. would be issued at its current price of ₹ 15 per share. Debenture holders will get 13% convertible debentures in the purchasing company for the same amount. Debtors and inventories are expected to realize ₹ 2,00,000.
- Tiger Ltd. has decided to operate the business of Leopard Ltd. as a separate division. The division is likely to give cash flows (after tax) to the extent of ₹ 5,00,000 per year for 6 years. Tiger Ltd. has planned that, after 6 years, this division would be demerged and disposed of for ₹ 2,00,000.
- The company's cost of capital is 16%.

Make a report to the Board of the company advising them about the financial feasibility of this acquisition. Net present values for 16% for ₹ 1 are as follows:

Years	1	2	3	4	5	6
PV	0.862	0.743	0.641	0.552	0.476	0.410

Solution**Calculation of Purchase Consideration**

	₹
Issue of Share 35000 x ₹15	5,25,000
External Liabilities settled	5,00,000
13% Debentures	3,00,000
	13,25,000
Less: Realization of Debtors and Inventories	2,00,000
Cash	50,000
	10,75,000

Net Present Value = PV of Cash Inflow + PV of Demerger of Leopard Ltd. - Cash Outflow

$$= ₹ 5,00,000 \text{ PVA}(16\%, 6) + ₹ 2,00,000 \text{ PVF}(16\%, 6) - ₹ 10,75,000$$

$$= ₹ 5,00,000 \times 3.684 + ₹ 2,00,000 \times 0.410 - ₹ 10,75,000$$

$$= ₹ 18,42,000 + ₹ 82,000 - ₹ 10,75,000 = ₹ 8,49,000$$

Since NPV of the decision is positive it is advantageous to acquire Leopard Ltd.

Question 35

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

Required:

- What is the maximum price per equity share which PQR Ltd. can offer to pay for XYZ Ltd.?
- What is the minimum price per equity share at which the management of XYZ Ltd. will be willing to offer their controlling interest?

Solution

- Calculation of maximum price per share at which PQR Ltd. can offer to pay for XYZ Ltd.'s share

Market Value (10,00,000 × ₹ 24)	₹ 2,40,00,000
Synergy Gain	₹ 80,00,000
Saving of Overpayment	₹ 30,00,000
	₹ 3,50,00,000
Maximum Price (₹ 3,50,00,000/10,00,000)	₹ 35

Alternatively, it can also be computed as follows: Let ER be the swap ratio then,

$$40 = \frac{24 \times 10,00,000 + 40 \times 15,00,000 + 80,00,000 + 30,00,000}{15,00,000 + 10,00,000 \times ER}$$

$$ER = 0.875$$

$$MP = PE \times EPS \times ER = (40/4) \times ₹ 4 \times 0.875 = ₹ 35$$

- Calculation of minimum price per share at which the management of XYZ Ltd.'s will be willing to offer their controlling interest

Value of XYZ Ltd.'s Management 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 (₹ 1,26,00,000/4,00,000)	₹ 31.50

Question 36**[OLD PM]**

K. Ltd. is considering acquiring N. Ltd., the following information is available:

Company	Profit after Tax	Number of Equity shares	Market value per share
K. Ltd.	50,00,000	10,00,000	200.00
N. Ltd.	15,00,000	2,50,000	160.00

Exchange of equity shares for acquisition is based on current market value as above. There is no synergy advantage available:

- Find the earning per share for company K. Ltd. after merger.
- Find the exchange ratio so that shareholders of N. Ltd. would not be at a loss.

Solution

- Earning per share for company K. Ltd. after Merger:

Exchange Ratio 160 : 200 = 4: 5

That is 4 shares of K. Ltd. for every 5 shares of N. Ltd.

Therefore, Total number of shares to be issued =

Therefore, Total number of shares of K. Ltd. and N. Ltd.	=10,00,000	K. Ltd.
	+ 2,00,000	N. Ltd
	12,00,000	
Total profit after Tax =	₹ 50,00,000	K. Ltd.
	₹ 15,00,000	N Ltd.
	₹ 65,00,000	

Therefore, E.P.S. (Earning per share) of K. Ltd. after Merger

= ₹65,00,000/12,00,000 = ₹ 5.42 Per share

- To find the Exchange Ratio so that shareholders of N. Ltd. would not be at a Loss:

Present Earnings per share for company K. Ltd.

= ₹50,00,000/₹10,00,000=₹5.00

Present Earnings Per share for company N. Ltd.

= ₹15,00,000/₹2,50,000=₹6.00

Therefore, Exchange Ratio should be 6 shares of K. Ltd. for every 5 shares of N Ltd.

Therefore, Shares to be issued to N. Ltd. $2,50,000 \times 6 / 5 = 3,00,000$ shares

Therefore, Total No. of Shares of K. Ltd. and N. Ltd.

=	10,00,000	K. Ltd.
	+ 3,00,000	N. Ltd
	<u>13,00,000</u>	

Therefore, E.P.S. After Merger = ₹65,00,000/13,00,000 = ₹ 5.00 Per share

Total Earnings Available to Shareholders of N. Ltd. after Merger = ₹ 3,00,000 × ₹ 5.00

= ₹15,00,000

This is equal to Earnings prior Merger for N. Ltd.

Therefore, Exchange Ratio on the Basis of Earnings per share is recommended.

Question 37**[OLD PM]**

Cauliflower Limited is contemplating acquisition of Cabbage Limited. Cauliflower Limited has 5 lakh shares having market value of ₹ 40 per share while Cabbage Limited has 3 lakh shares having market value of ₹ 25 per share. The EPS for Cabbage Limited and Cauliflower Limited are ₹ 3 per share and ₹ 5 per share respectively. The managements of both the companies are discussing two alternatives for exchange of shares as follows:

- (i) In proportion to relative earnings per share of the two companies.
- (ii) 1 share of Cauliflower Limited for two shares of Cabbage Limited.

Required:

- (i) Calculate the EPS after merger under both the alternatives.
- (ii) Show the impact on EPS for the shareholders of the two companies under both the alternatives.

Solution

- (i) Exchange ratio in proportion to relative EPS

Company	Existing No. of shares	EPS	Total earnings
Cauliflower Ltd.	5,00,000	5.00	25,00,000
Cabbage Ltd.	3,00,000	3.00	9,00,000
Total earnings			34,00,000

No. of shares after merger $5,00,000 + 1,80,000 = 6,80,000$

Note: 1,80,000 may be calculated as $=(3,00,000 \times 3.00/5.00)$

EPS for Cauliflower Ltd. after merger $=34,00,000/6,80,000=\text{₹}5.00$

Impact on EPS

	₹
Cauliflower Ltd. shareholders	
EPS before merger	5.00
EPS after merger	5.00
Increase/ Decrease in EPS	0.00
Cabbage Ltd.' Shareholders	
EPS before merger	3.00
EPS after the merger $5.00 \times 3 / 5$	3.00
Increase / Decrease in EPS	0.00

- (ii) Merger effect on EPS with share exchange ratio of 1 : 2

Total earnings after merger	₹ 34,00,000
No. of shares post - merger $5,00,000 + 1,50,000$ (i.e., $0.5 \times 3,00,000$)	6,50,000
EPS $(34,00,000 \div 6,50,000)$	5.23

Impact on EPS

	₹
Cauliflower Ltd. shareholders	
EPS before merger	5.00
EPS after merger	5.23
Increase in EPS	0.23
Cabbage Ltd. shareholders	
EPS before merger	3.000
EPS after the merger 5.23×0.5	2.615
Decrease in EPS	0.385

Question 38

[OLD PM]

Bank 'R' was established in 2005 and doing banking in India. The bank is facing DO OR DIE situation. There are problems of Gross NPA (Non – Performing Assets) at 40% & CAR / CRAR (Capital Adequacy Ratio / Capital Risk Weight Asset Ratio) at 4%. The net worth of the bank is not good. Shares are not traded regularly. Last week, it was traded @ ₹ 8 per share.

RBI Audit suggested that bank has either to liquidate or to merge with other bank.

Bank 'P' is professionally managed bank with low gross NPA of 5%. It has Net NPA as 0% and CAR at 16%. Its share is quoted in the market @ ₹ 128 per share. The board of directors of bank 'P' has submitted a proposal to RBI for takeover of bank 'R' on the basis of share exchange ratio.

The Balance Sheet details of both the banks are as follows:

	Bank 'R' Amt. in ₹ lacs	Bank 'P' Amt. In ₹ lacs
Paid up share capital (F.V. ₹ 10 each)	140	500
Reserves & Surplus	70	5,500
Deposits	4,000	40,000
Other liabilities	890	2,500
Total Liabilities	<u>5,100</u>	<u>48,500</u>
Cash in hand & with RBI	400	2,500
Balance with other banks	-	2,000
Investments	1,100	15,000
Advances	3,500	27,000
Other Assets	100	2,000
Total Assets	<u>5,100</u>	<u>48,500</u>

It was decided to issue shares at Book Value of Bank 'P' to the shareholders of Bank 'R'. All assets and liabilities are to be taken over at Book Value.

For the swap ratio, weights assigned to different parameters are as follows:

Gross NPA	30%
CAR	20%
Market price	40%
Book value	10%

- What is the swap ratio based on above weights?
- How many shares are to be issued?
- Prepare Balance Sheet after merger.
- Calculate CAR & Gross NPA % of Bank 'P' after merger.

Solution

a) Swap Ratio

Gross NPA	5 :	40	i.e.	$5 / 40 \times 30\% =$	0.0375
CAR	4 :	16	i.e.	$4 / 16 \times 20\% =$	0.0500
Market Price	8 :	128	i.e.	$8 / 128 \times 40\% =$	0.025
Book Value Per Share	15 :	120	i.e.	$15 / 120 \times 10\% =$	0.0125
					0.125

Thus, for every 1 share of Bank 'R' 0.125 share of Bank 'P' shall be issued.

b) No. of equity shares to be issued: ₹140lac / ₹10 × 0.125 = 1.75 lac shares

c) Balance Sheet after Merger

Calculation of Capital Reserve

Book Value of Shares	₹ 210.00 lac
Less: Value of Shares issued	<u>₹ 17.50 lac</u>
Capital Reserve	<u>₹ 192.50 lac</u>

Balance Sheet

	₹ lac		₹ lac
Paid up Share Capital	517.50	Cash in Hand & RBI	2900.00
Reserves & Surplus	5500.00	Balance with other banks	2000.00
Capital Reserve	192.50	Investment	16100.00
Deposits	44000.00	Advances	30500.00
Other Liabilities	<u>3390.00</u>	Other Assets	<u>2100.00</u>
	<u>53600.00</u>		<u>53600.00</u>

d) Calculation CAR & Gross NPA % of Bank 'P' after merger $CAR/CRWAR = \frac{\text{Total Capital}}{\text{Risky Weighted Assets}}$

	Bank 'R'	Bank 'P'	Merged
CAR (Given)	4%	16%	
Total Capital	₹ 210 lac	₹ 6000 lac	₹ 6210 lac
Risky Weighted Assets	₹ 5250 lac	₹ 37500 lac	₹ 42750 lac

CAR = ₹6210 lac / ₹42750 lac = 14.53%

$$\text{GNPA Ratio} = \frac{\text{Gross NPA}}{\text{Gross Deposits}} \times 100$$

	Bank 'R'	Bank 'P'	Merged
GNPA (Given)	0.40	0.05	
	$0.40 = \frac{\text{GNPA}_R}{33500 \text{ lac}}$	$0.05 = \frac{\text{GNPA}_S}{327000 \text{ lac}}$	
Gross NPA	₹ 1400 lac	₹ 1350 lac	₹ 2750 lac

Question 39

[MTP Aug 18/RTP Nov 20]

The following is the Balance-sheet of Grape Fruit Company Ltd as at March 31st 2019.

Liabilities	(₹ in lakhs)	Assets	(₹ in lakhs)
Equity shares of ₹ 100 each	600	Land and Building	200
14% preference shares of ₹ 100/- each	200	Plant and Machinery	300
13% Debentures	200	Furniture and Fixtures	50
Debenture interest accrued and payable	26	Inventory	150
Loan from bank	74	Sundry debtors	70
Trade creditors	340	Cash at bank	130
		Preliminary expenses	10
		Cost of issue of debentures	5
		Profit and Loss account	525
	1440		1440

The Company did not perform well and has suffered sizable losses during the last few years. However, it is felt that the company could be nursed back to health by proper financial restructuring. Consequently the following scheme of reconstruction has been drawn up :

- 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 forgo the accrued interest due to them. In the future, the rate of interest on debentures is to be reduced to 9 percent.
- Trade creditors will forego 25 percent of the amount due to them.
- The company issues 6 lakh of equity shares at ₹ 25 each and the entire sum was to be paid on application. The entire amount was fully subscribed by promoters.
- Land and Building was to be revalued at ₹ 450 lakhs, Plant and Machinery was to be written down by ₹ 120 lakhs and a provision of ₹ 15 lakhs had to be made for bad and doubtful debts.

Required:

- Show the impact of financial restructuring on the company's activities.
- Prepare the fresh balance sheet after the reconstruction is completed on the basis of the above proposals.

Solution

a) Impact of Financial Restructuring

(i) Benefits to Grape Fruit Ltd.

	(₹ in lakhs)
Reduction in equity share capital (6 lakh shares x ₹ 75 per share)	450
Reduction in preference share capital (2 lakh shares x ₹ 50 per share)	100
Waiver of outstanding debenture Interest	26
Waiver from trade creditors (₹ 340 lakhs x 0.25)	85
Revaluation of Assets	661
Appreciation of Land and Building (₹ 450 lakhs - ₹ 200 lakhs)	250
Total (A)	911

(ii) Amount of ₹ 911 lakhs utilized to write off losses, fictitious assets and over - valued assets.

Writing off profit and loss account	525
Cost of issue of debentures	5
Preliminary expenses	10
Provision for bad and doubtful debts	15
Revaluation of Plant and Machinery (₹ 300 lakhs - ₹ 180 lakhs)	120
Total (B)	675
Capital Reserve (A) - (B)	236

b) Balance sheet of Grape Fruit Ltd as at 31st March 2019 (after re-construction)

(₹ in lakhs)

Liabilities	Amount	Assets	Amount
12 lakhs equity shares of ₹ 25/- each	300	Land & Building	450
10% Preference shares of ₹50/- each	100	Plant & Machinery	180
Capital Reserve	236	Furnitures & Fixtures	50
9% Debentures	200	Inventory	150
Loan from Bank	74	Sundry debtors	70
Trade Creditors	255	Prov. for Doubtful Debts	<u>-15</u>
		Cash-at-Bank (Balancing figure) *	<u>280</u>
	1165		1165

*Opening Balance of ₹ 130/- lakhs + Sale proceeds from issue of new equity shares ₹ 150/- lakhs

Question 40**[RTP MAY 21]**

ABC Ltd. is intending to acquire XYZ Ltd. by way of merger and the following information is available in respect of these companies:

	ABC Ltd.	XYZ Ltd.
Total Earnings (E) (in lakh)	₹ 1200	₹ 400
Number of outstanding shares (S) (in lakh)	400	200
Price earnings ratio (P/E)	8	7

- a) Determine the maximum exchange ratio acceptable to the shareholders of ABC Ltd., if the P / E ratio of the combined firm is expected to be 8?
- b) Determine the minimum exchange ratio acceptable to the shareholders XYZ Ltd., if the P / E ratio of the combined firm is expected to be 10?

Note: Make calculation in lakh multiples and compute ratio upto 4 decimal points.

Solution

- a) Maximum exchange ratio acceptable to the shareholders of ABC Ltd.

Market Price of share of ABC Ltd. (₹ 3 × 8)	₹ 24
No. of Equity Shares	400 lakh
Market Capitalisation of ABC Ltd. (₹ 24 × 400 lakh)	₹ 9600 lakh
Combined Earnings (₹ 1200 + ₹ 400) lakh	₹ 1600 lakh
Combined Market Capitalisation (₹ 1600 lakh × 8)	₹ 12800 lakh
Market Capitalisation of ABC Ltd. (₹ 24 × 400 lakh)	₹ 9600 lakh
Balance for XYZ Ltd.	₹ 3200 lakh

Let D be the no. of equity shares to be issued to XYZ Ltd. then, $\frac{3200 \text{ Lakh}}{\left(\frac{1600 \text{ Lakh}}{D + 400}\right) \times 8} \times 100$

D = 133.333 lakh Shares

Exchange Ratio = 133.333 / 200 = 0.6666:1

- b) Minimum exchange ratio acceptable to the shareholders of XYZ Ltd.

Market Price of share of XYZ Ltd.	₹ 14.00
No. of Equity Shares	200 lakh
Market Capitalisation of XYZ Ltd. (₹ 14.00 × 200 lakh)	₹ 2800 lakh
Combined Earnings (₹ 1200 + ₹ 400) lakh	₹ 1600 lakh
Combined Market Capitalisation (₹ 1600 lakh × 10)	₹ 16000 lakh
Balance for ABC Ltd.	₹ 13200 lakh

Let D be the no. of equity shares to be issued to XYZ Ltd. then, $\frac{2800 \text{ Lakh}}{\left(\frac{1600 \text{ Lakh}}{D + 400}\right) \times 10} \times 100$

D = 84.8485 lakh Shares

Exchange Ratio = 84.8485 / 200 = 0.4242 : 1

Question 41**[MTP MARCH 21]**

The Nishan Ltd. has 35000 shares of equity stock outstanding with a book value of ₹ 20 per share. It owes debt Rs. 15,00,000 at an interest rate of 12%. Selected financial results are as follows.

Income and Cash Flow			
	₹		₹
EBIT	80,000	Capital Structure	
Interest	1,80,000	Debt	15,00,000
EBT	(1,00,000)	Equity	7,00,000
Tax	-		22,00,000
EAT	(1,00,000)		
Depreciation	50,000		
Principal Repayment	(75,000)		
Cash Flow	(1,25,000)		

Evaluate and Restructure the financial line items shown assuming a composition in which creditors agree to convert two thirds of their debt into equity at book value. Assume Nishan will pay tax at a rate of 15% on income after the restructuring, and that principal repayments are reduced proportionately with debt. Demonstrate as to who will control the company and by how big a margin after the restructuring?

Solution

Creditors would convert ₹ 10,00,000 in debt to equity by accepting $\frac{₹ 1,00,00,000}{₹ 20} = 50,000$ shares of stock. The remaining ₹ 5,00,000 of debt would generate interest of $₹ 5,00,000 \times 0.12 = ₹ 60,000$. Repayment of principal would be reduced by two thirds to ₹ 25000 per year.

The result is as follows

Income and Cash Flow			
	₹		₹
EBIT	80,000	Capital Structure	
Interest	60,000	Debt	5,00,000
EBT	20,000	Equity	17,00,000
Tax	3000		22,00,000
EAT	17,000		
Depreciation	50,000		
Principal Repayment	(25,000)		
Cash Flow	42,000		

After the restructuring there will be a total of $(35000 + 50000)$ 85000 shares of equity stock outstanding. The original shareholders will still own 35000 shares (approximately 41%), while the creditors will own 50,000 shares (59%). Hence the creditors will control the company by a substantial majority.

Question 42**[MTP MAY 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 (₹)	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 (₹)	10,00,000	-
10% Debenture (₹)	-	14,40,000
No. of Equity Shares	1,00,000	60,000
Operating Expenses	86%	78%
Corporate Tax Rate	30%	30%
Closing Stock (₹)	15,00,000	5,00,000
Debtors (₹)	10,00,000	8,00,000

You are required to calculate:

- Swap ratio based on EPS & MPS respectively as weightage of 40% and 60%.
- Post Merger EPS
- Post Merger market price assuming same PE Ratio of X Ltd.
- Post Merger gain or loss in EPS

Solution

Working Notes:

- Inventory Turnover Ratio = $\text{COGS} / \text{Closing Stock}$

X Ltd	Y Ltd
$5 = \frac{\text{COGS}}{15,00,000}$	$4 = \frac{\text{COGS}}{5,00,000}$
$\text{COGS} = ₹ 75,00,000$	$\text{COGS} = ₹ 20,00,000$
Gross Profit Ratio = 20% means COGS is 80% of Sales, then	
$\text{Sales} = \frac{75,00,000 \times 100}{80} = ₹ 93,75,000$	$\text{Sales} = \frac{20,00,000 \times 100}{80} = ₹ 25,00,000$

Statement of Profit

	X Ltd.	Y Ltd.
Sales	93,75,000	25,00,000
Less: Operating Exp.	<u>80,62,500</u>	<u>19,50,000</u>
EBIT	13,12,500	5,50,000
Less: Interest	<u>1,20,000</u>	<u>1,44,000</u>
EBT	11,92,500	4,06,000
Less: Tax @ 30%	<u>3,57,750</u>	<u>1,21,800</u>
EAT	<u>8,34,750</u>	<u>2,84,200</u>

	X Ltd.	Y Ltd.
No. of Shares	1,00,000	60,000
EPS (EAT / No. of Shares)	8,34,750/1,00,000 = ₹ 8.34	2,84,200 / 60,000 = ₹ 4.74
Market Price Share (Market Capitalisation /No. Shares)	75,00,000 / 1,00,000 = ₹ 75	90,00,000 / 60,000 = ₹ 150
PE Ratio (MPS/ EPS)	75 / 8.34= 8.99	150 / 4.74= 31.65

(i) $\text{Swap Ratio} = \frac{\text{Target Co.}}{\text{Acquirer Co.}}$

	Acquirer Co	Target Co.	Weight
	X Ltd	Y Ltd	
EPS	8.34	4.74	0.40
MPS	75	150	0.60

(ii) $\text{Post-Merger EPS} = \frac{\text{EAT}_x + \text{EAT}_y}{\text{No. of Shares of Both Cos.}} \times 100$

$$= \frac{8,34,750 + 2,84,200}{1,00,000 + (60,000 \times 1.427)} = \frac{11,18,950}{1,85,620} = 6.03$$

(iii) Post-Merger market price assuming same PE of X Ltd.

$$\text{MPS} = \text{PE} \times \text{EPS} = 8.99 \times 6.03 = ₹ 54.21$$

(iv) Gain or Loss to the shareholders

	Pre - Merger EPS	Post - Merger EPS
X Ltd.	₹ 8.34	₹ 6.03
Y Ltd.	₹ 4.74	6.03 × 1.427 = 8.60

While Shareholders of X Ltd. will lose EPS of ₹ 2.31 (₹ 8.34 - ₹ 6.03) per share the shareholders of Y Ltd. stands to gain EPS of ₹ 3.86 (₹ 8.60 - 4.74) per share.

Question 43**[MTP MARCH 21]**

Eager Ltd. has a market capitalization of Rs. 1,500 crores and the current market price of its share is Rs. 1,500. It made a PAT of Rs. 200 crores and the Board is considering a proposal to buy back 20% of the shares at a premium of 10% to the current market price. It plans to fund this through a 16% bank loan. The company's corporate tax rate is 30%. Calculate the post buy back Earnings Per Share (EPS).

Solution

Existing No. of Equity Shares = ₹1500 crore / ₹1500 = 1 crore

No. of shares to be bought back = 1 Crore × 0.20 = 20 Lakh

Price at which share to be bought back = Rs. 1,500 + 10% of Rs. 1,500 = Rs. 1,650

Amount required for Buyback of Shares = Rs. 1,650 × 20 Lakh = Rs. 330 Crore

Amount of Loan @ 16% = Rs. 330 Crore

Statement showing Post Buyback EPS

Profit before tax (Rs. 200 crore / 0.70)	Rs. 285.7143 crore
Less: Interest on Loan (Rs. 330 Crore × 16%)	<u>Rs. 52.8000 crore</u>
Profit before Tax	Rs. 232.9143 crore
Tax	<u>Rs. 69.8743 crore</u>
Profit after Tax (PAT)	<u>Rs. 163.0400 crore</u>
No. of Shares Post buyback	80 Lakh
EPS (Post Buyback) (Rs. 163.0400 Crore / 80.00 Lakh)	Rs. 203.80

Question 44**[MTP APRIL 21]**

C Ltd. and P Ltd. both companies operating in the same industry decided to merge and form a new entity S Ltd. The relevant financial details of the two companies prior to merger announcement are as follows:

	C Ltd.	P Ltd.
Annual Earnings after Tax (Rs. lakh)	10000	5800
No. Shares Outstanding (lakh)	4000	1000
PE Ratio (No. of Times)	8	10

The merger will be affected by means of stock swap (exchange) of 3 shares of C Ltd. for 1 share of P Ltd.

After the merger it is expected that due to synergy effects, Annual Earnings (Post Tax) are expected to be 8% higher than sum of the earnings of the two companies individually. Further, it is expected that P/E Ratio of S Ltd. shall be average of P/E Ratios of two companies before the merger.

Evaluate the extent to which shareholders of P Ltd. will be benefitted per share from the proposed merger.

Solution Working Notes:

(i) The Earnings of S Ltd.

	Rs. lakh
Earnings of C Ltd.	10000
Earnings of D Ltd.	<u>5800</u>
	<u>15800</u>
Growth	0.08
Earnings of S Ltd. (15800 × 1.08)	17064

(ii) Market Value of S Ltd.

	Rs. lakh
Earnings of S Ltd.	17064
P/E Ratio (10 + 8) / 2	9
Market Value of S Ltd.	153576

(iii) No of Shares in S Ltd.

No. of shares of C Ltd.	4000
No. of shares issued to P Ltd.	3000
No. of shares of C Ltd.	7000

Gain to Shareholders of P Ltd

Share of Shareholders of P Ltd. in S Ltd. (3000 / 7000) × 153576	Rs. 65818.29 lakh
Market Value of P Ltd. before merger (5800 × 10)	<u>Rs. 58000.00 lakh</u>
Gains to Shareholders	<u>Rs. 7818.29 lakh</u>
No. of Shares (before merger)	1000 lakh
Gain Per Share	Rs. 7.82

Question 45**[MTP OCT 21]**

Intel Ltd., promoted by a Trans National Company, is listed on the stock exchange holding 80%. The value of the floating stock is ₹ 45 crores. The Market Price per Share (MPS) is ₹ 150.

The capitalisation rate is 20%.

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

You are required to calculate:

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

Solution

(i) No. of Bonus Shares to be issued:

Free Float Capitalization = ₹ 45 crore

Market Price Per Share = ₹ 150

Shares of Minority = ₹45 crore/₹150=30lacs

Minority Share Holding (100% - 80%) = 20%

Hence Total shares = 30 lacs/0.20=150 lacs

Promoters holding 80%, = 120 lacs shares

Shares remains the same, but holding % to be taken as 75%

Hence Total shares = 120 lacs/0.75=160 lacs

Shares of Minority = 160 lacs – 120 lacs = 40 lacs

Bonus 10 lacs for 30 lacs i.e. 1 shares for 3 shares held.

(ii) Market price after Bonus issue:

Let us compute PE with given k_e as follows:

$PE = 1/K_e = 1/0.20 = 5$

Market Price Given = ₹ 150

Hence EPS will be (₹ 150 / 5) = ₹ 30

Total No. of shares before bonus issue = 150 lacs

Accordingly, Total PAT shall be (₹ 30 × 150 lacs) = ₹ 4500 lacs

Total No. of shares after bonus issue = 150 lacs + 10 lacs = 160 lacs

EPS after Bonus Issue = ₹ 4500 lacs / 160 lacs = ₹ 28.13

Market Price After Bonus Issue = ₹ 28.13 × 5 = ₹ 140.65

(iii) Free Float Capitalization after Bonus Issue

₹ 140.65 × 40 lacs = ₹ 5,626 lacs i.e. ₹ 56.26 crore

Question 46

[MTP OCT 21]

XY Ltd., a Cement manufacturing Company has hired you as a financial consultant of the company. The Cement Industry has been very stable for some time and the cement companies SK Ltd. & AS Ltd. are similar in size and have similar product market mix characteristic. Use comparable method to value the equity of XY Ltd. In performing analysis, use the following ratios:

(i) Market to book value (ii) Market to replacement cost (iii) Market to sales (iv) Market to Net Income

The following data are available for your analysis:

(Amount in ₹)

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

Solution

Estimation of Ratios

Sl. No.	Particulars	SK Ltd.	AS Ltd.	Average
(i)	Market to Book Value	$450/400=1.125$	$400/300=1.33$	1.2290
(ii)	Market to Replacement Cost	$450/600=0.750$	$400/550=0.727$	0.7385
(iii)	Market to Sales	$450/550=0.818$	$400/450=0.889$	0.8535
(iv)	Market to Net Income	$450/18=25$	$400/16=25$	25

Application of Ratios to XY Ltd.

Sl. No.	Particulars	XY Ltd. (₹)	Average	Indicative Value of XY Ltd. (₹)
(i)	Book Value	250	1.2290	$250 \times 1.2290 = 307.25$
(ii)	Replacement Cost	500	0.7385	$500 \times 0.7385 = 369.25$
(iii)	Sales	500	0.8535	$500 \times 0.8535 = 426.75$
(iv)	Net Income	14	25	$14 \times 25 = 350.00$
Average				₹ 363.31

Value of XY Ltd. according to the comparable method is ₹ 363.31.

Question 47

[MTP NOV 21]

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

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

Solution

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

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

Question 48

[NOV 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

	ICL		SVL	
Fixed Assets				
Land & Building (Net)	720		190	
Plant & Machinery (Net)	900		350	
Furniture & Fixtures (Net)	30	1,650	10	550
Current Assets		775		580
Less: Current Liabilities				
Creditors	230		130	
Overdrafts	35		10	
Provision for Tax	145		50	
Provision for dividends	60	470	50	240
Net Assets		1,955		890
Paid up Share Capital (₹ 10 per share)	250		125	
Reserves and Surplus	1050	1,300	660	785
Borrowing		655		105
Capital Employed		1,955		890
Market Price Per Share		52		75

ICL's Land & Buildings are stated at current prices. SVL's Land & Buildings are revalued three years ago. There has been an increase of 30 per cent per year in the value of Land & Buildings.

SVL is expected to grow @ 18 per cent each year, after merger.

ICL's Management wants to determine the premium on the shares over the current market price which can be paid on the acquisition of SVL. You are required to determine the premium using:

- Net Worth adjusted for the current value of Land & Buildings plus the estimated average profit after tax (PAT) for the next five years.
- The dividend growth formula.
- ICL will push forward which method during the course of negotiations?

Period (t)	1	2	3	4	5
FVIF (30%, t)	1.300	1.690	2.197	2.856	3.713
FVIF (15%, t)	1.15	2.4725	3.9938	5.7424	7.7537

Solution**(i) Computation of Premium (Net Worth Formula):****Amount ₹ in Crores**

Total Assets (Fixed assets + Current Assets) = (550 + 580)	1130
Less: Liabilities (Current Liabilities + Borrowings) = (240 + 105)	345
Net Assets Value	785
Current Value of Land after growing for three years @ 30% = 190×2.197	417.43
Less: Book Value	190.00
Increase in the Value of land	227.43
Adjusted NAV (785 + 227.43)	1012.43
Current Profit after Tax (@15 % for 5 years i.e. 250×7.7537)	1938.43
Average Profit for 1 year = $1938.43 / 5$	387.69
Total Value of Firm (1012.43 + 387.69)	1400.12
Total Market Value = No of shares $\times$ MPS = 12.50×75	937.50
Premium (Total Value - Market Value)	462.62
Premium (%) = $462.62 / 937.50 \times 100$	49.35%

(ii) Computation of Premium (Dividend Growth Formula):

Existing Growth Rate	0.15
DPS = $125 / 12.50$	10
MPS	75
Cost of Equity ($D_1 / MP + g$) = $[(10 \times 1.15 / 75) + 0.15]$	0.3033
Expected growth rate after merger	0.18
Expected Market Price = $10 \times [1.18 / (0.3033 - 0.18)]$	95.70
Premium over current market price $(95.70 - 75) / 75 \times 100$	27.60%

Alternatively, if given figure of dividend is considered as D_1 then Premium over Current Market Price shall be computed as follows:

Cost of Equity ($D_1 / P + g$)	$10/75+0.15$	0.2833
Expected Growth Rate after Merger		0.18
Expected Market Price	$10.00 / (0.2833 - 0.18)$	96.81
Premium over Current Market Price $(96.81 - 75) / 75 \times 100$		29.08%

(iii) During the course of negotiations, ICL will push forward valuation based on Growth Rate Method as it will lead to least cash outflow.

Question 49**[JULY 21]**

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

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

Cash Paid for the shares of Tall Ltd. (₹ 60 × 18,00,000)	₹ 10,80,00,000
Less: Value of Tall Ltd., as a separate entity (18,00,000 × ₹ 50)	₹ 9,00,00,000
Net Cost of acquisition of Tall Ltd.	₹ 1,80,00,000

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

Exchange ratio = 1 share of long Ltd for every 3 shares of Tall Ltd.

Number of shares to be issued in Long Ltd. (18,00,000 / 3)	= 6,00,000 shares
Total no. of shares in Long Ltd. after merger (30,00,000 + 6,00,000)	= 36,00,000

Calculation of cost of Equity of Tall Ltd.

Growth rate under new management after acquisition	= $D_1 / P_0 + g = ₹ 3 / 50 + 0.06 = 12\%$
Value of Merged company assuming perpetual growth	= 8%
Value of merged company (₹ 180 × 30,00,000) + (₹ 3 / (0.12 - 0.08) × 18,00,000 = 54,00,00,000 + (75 × 18,00,000)	= ₹ 67,50,00,000
Value per share of merged company (67,50,00,000 / 36,00,000)	= ₹ 187.50 per share

Calculation of net cost of acquisition

Gross cost of acquisition (6,00,000 × 187.50)	11,25,00,000
Less: CMP (18,00,000 × 50)	<u>9,00,00,000</u>
Net Cost of acquisition	<u>2,25,00,000</u>

Alternatively, Net Cost of Acquisition can also be computed as follows:

No. of shares issued to shareholders of Tall Ltd. in the ratio of 1:3	6,00,000
Existing price of one share of Long Ltd.	₹ 180
Value of consideration paid for acquisition of Tall Ltd.	₹ 10,80,00,000
Less: Existing Value of Tall Ltd., as a separate entity	<u>₹ 9,00,00,000</u>
Net Cost of acquisition of Tall Ltd.	<u>₹ 1,80,00,000</u>

(iii) Calculation of gain from acquisition:

Total Earnings of Long Ltd. (₹ 12 × 30,00,000)	₹3,60,00,000
Total Earnings of Tall Ltd. (₹ 5 × 18,00,000)	<u>₹ 90,00,000</u>
Combined Earnings	<u>₹ 4,50,00,000</u>
PE Ratio of Long Ltd. (180 / 12)	15
Value of Long Ltd. after acquisition	₹67,50,00,000
Less: Value of two companies separately	
Long Ltd. (₹ 180 × 30,00,000)	₹ 54,00,00,000
Tall Ltd. (₹ 50 × 18,00,000)	<u>₹ 9,00,00,000</u>
Gain from Acquisition	<u>₹ 63,00,00,000</u>
	₹4,50,00,000



Additional Questions

Advanced Capital Budgeting

Question 1 (RTP Jan 26)

SS Company is considering the replacement of its existing machine with a new machine. The Purchase price of the new machine is Rs 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:

- (i) Installation Charges Rs 9,000
- (ii) Fees paid to the consultant for his advice to buy New Machine Rs 6,000.
- (iii) Additional Working Capital required Rs 17,000. (will be released after 8 years)

The written down value of the existing machine is Rs 76,000, and its Cash Salvage Value is Rs 12,500. The dismantling of this machine would cost Rs 4,500.

The Annual Earnings (before tax but after depreciation) from the New Machine would amount to Rs 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.

$$PVIF (13\%, 8) = 0.376$$

$$PVIFA (13\%, 8) = 4.800$$

Solution:

Working Notes:

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	26,15,000
Useful Life	8 Years
Annual Depreciation (Total Cost / No. of Years)	3,26,875

Computation of Annual Cash Savings

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

Tax Effect on Sale of Old Machine

Particulars	₹
Proceeds of Sale	12,500
Less: Cost of Removal	4,500
Net Proceeds	8,000
Less: WDV	76,000
Net Loss due to Sale	68,000
Tax savings due to Loss on Sale @35%	23,800
Total Cash Inflow due to Sale (₹8,000 + ₹23,800)	31,800

Computation of Net Present Value

Particulars	Period	Cash Flow (₹)	PVF @13%	PV (₹)
(a) Annual Cash Inflow after Tax	1-8	5,31,625	4.800	25,51,800
(b) Net Salvage Value of Existing Machine	0	31,800	1.000	31,800
(c) Working Capital Realized	8	17,000	0.376	6,392
Present Value of Cash Inflows				25,89,992
Less: 1. Initial Investment	0	26,15,000	1.000	26,15,000
2. Initial Working Capital	0	17,000	1.000	17,000
NPV of the Proposal				(42,008)

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

Question 2 (May 25)

BC Ltd. is contemplating on buying a new machine at Rs 70,00,000 with an additional working capital requirement of Rs 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 Rs 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 place. PV Factor at 10% & 6% are as under -

PV factor	1	2	3	4	5
At 10%	0.909	0.826	0.751	0.683	0.621
At 6%	0.943	0.890	0.840	0.792	0.747

Note: This is main exam's Question where ICAI has adjusted inflation in depreciation amount, which is logically incorrect.

Solution

Working Notes:

1. Cash Outflow (Initial Outlay) = Rs 70,00,000 + Rs 10,00,000 = Rs 80,00,000

2. Cash Flow After Tax and Present Value

Particulars	(Rs)
Incremental cash operating income	25,00,000
Less: Taxes (0.35)	8,75,000
CFAT	16,25,000
Cum. PV Factor for 5 years at 10%	3.790
Present value	61,58,750

3. 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 (Rs)
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

4. PV of Release of Working Capital

	(Rs)
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 (Rs)
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 (Nov 24)

PQ Ltd. expects sales of ₹ 100 lakhs in the year 1. The same will increase by ₹ 20 lakhs per year over the next four years. At the end of 5 years the project would be wound up. The Depreciation will be charged at 20% p.a. on straight line method. The expenses excluding the depreciation will be 40% of the sales. There will be no salvage value of the plant. PQ Ltd. proposes to invest in the plant an amount where the Net Present Value will be Zero. Corporate Tax rate is 30%. You are required to calculate the investment which can be made in the plant.

Solution Note: Question is solved by using a discount rate of 10%. Students may solve the question using a rate other than 10%.

Working Notes:

(1) Expected Sales

Year	Expected Sales
1	₹ 100 lakhs
2	₹ 120 lakhs
3	₹ 140 lakhs
4	₹ 160 lakhs
5	₹ 180 lakhs

(2) Expected Expenses excluding Depreciation

Year	Exp.
1	₹ 40 lakhs
2	₹ 48 lakhs
3	₹ 56 lakhs
4	₹ 64 lakhs
5	₹ 72 lakhs

(3) Cash Inflow from the Project

Let P be the cost of the plant then chargeable depreciation for each year shall be 0.20P. Accordingly, annual cash flow from the project shall be computed as follows:

Year	Expected Sales ₹ lakhs	Exp. ₹ lakhs	Dep. (3)	Profit Before Tax	Tax @30%	Profit After Tax
1	100	40	0.20P	60 - 0.20P	18 - 0.06P	42 - 0.14P
2	120	48	0.20P	72 - 0.20P	21.6 - 0.06P	50.4 - 0.14P
3	140	56	0.20P	84 - 0.20P	25.2 - 0.06P	58.8 - 0.14P
4	160	64	0.20P	96 - 0.20P	28.8 - 0.06P	67.2 - 0.14P
5	180	72	0.20P	108 - 0.20P	32.4 - 0.06P	75.6 - 0.14P

Year	Profit After Tax	Dep. Added Back	Cash Inflow	PVF @ 10%	PV of Cash Inflow
1	42 - 0.14P	0.20P	42 + 0.06P	0.909	38.178 + 0.05454P
2	50.40 - 0.14P	0.20P	50.40 + 0.06P	0.826	41.6304 + 0.04956P
3	58.80 - 0.14P	0.20P	58.80 + 0.06P	0.751	44.1588 + 0.04506P
4	67.20 - 0.14P	0.20P	67.20 + 0.06P	0.683	45.8976 + 0.04098P
5	75.60 - 0.14P	0.20P	75.60 + 0.06P	0.621	46.9476 + 0.03726P
Total					216.8124 + 0.2274P

Since NPV will be Zero the required comes as follows:

Sum of Cash Inflows - Plant Cost = 0

$$216.8124 + 0.2274P - P = 0$$

$$P = 280.63$$

Thus, the required investment to be made in plant shall be ₹ 280.63 lakhs.

Mutual Funds

Question 1 (May 24)

Mr. Kar has invested in three mutual fund schemes as per details below:

	MFX	MFY	MFZ
Amount of investment (Rs)	5,50,000	4,20,000	1,00,000
Dividend received up to 31.03.2023 (Rs)	10,000	6,000	Nil
NAV as on 31.03.2023 (Rs)	11.50	11.00	9.50
Effective yield p.a. as on 31.03.2023	19.345%	22.59%	-36.50%
Holding period	120 days	100 days	50 days

You are required to calculate Net Asset Value (NAV) at the time of purchase assuming 365 days in a year.

Solution

	MFX	MFY	MFZ
A. Amt. of Investment	550,000	420,000	1,00,000
B. Effective Yield p.a.	19.345%	22.59%	-36.50%
C. Period of Holding	120 Days	100 Days	50 days
D. Return for Holding Period	34,980	25,993.97	- 5000
E. Dividend Received	10,000	6,000	-
F. Total Gain in NAV(D - E)	24,980	19993.97	-5,000
G. Total NAV at End of Holding Period (A + F)	5,74,980	4,39,993.97	95,000
H. NAV (p.u.) as on 31.3.23	11.50	11.00	9.50
I. No. of Units (G/H)	49,998.26	39,999.45	10,000
J. NAV (p.u.) at the time of Purchase (A/I)	11.00	10.50	10.00

Question 2 (Sep 25)

In 2024, Mr. Raj, an investor made a lump sum investment in an equity mutual fund that had an entry load of Rs 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 Rs 5.00 per unit, which were reinvested at a year-end NAV of Rs 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 to required to

- (i) Calculate the number of units purchased by Mr. Raj at the beginning of the investment.
- (ii) Calculate the NAV per unit and the total investment amount made by Mr. Raj at the beginning of the year.
- (iii) 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

$$X + \frac{5X}{25} = 15000$$

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

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

$$N \times 1.1360 = 25, N = \text{Rs } 22.01$$

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

$$\text{Raj is: } = (\text{Rs } 22.01 + \text{Rs } 0.05) \times 12,500 = \text{Rs } 2,75,750$$

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

NAV at the end	Rs 25
No. of Units	15000
Amount Redeemable	Rs 3,75,000
Less: Exit Load	Rs 3,750
Amount Received on Redemption of Units	Rs 3,71,250
Total Amount Realized	Rs 3,71,250
Less: Initial Investment	Rs 2,75,750
Return	Rs 95,500
Less: Tax @ 20%	Rs 19,100
Net Return	Rs 76,400
Return in Percentage Terms (Rs 76,400/ Rs 2,75,750)	27.71%
Real Return in Percentage Terms (27.71%/1.045)	26.52%
Or Real Return $\frac{1+0.2771}{1+.045} - 1 =$	22.21%

Question 3 (Nov 24)

Mr. X invested ₹ 1,00,000 at a face value of ₹ 10 per unit in a dividend reinvestment plan in a mutual fund during its initial public offering on

1st July, 2022. On 31st March, 2023, the mutual fund declared a dividend of 10%. At that time Mr. X calculated his holding period return to be 115%

On 31 March, 2024 the mutual fund declared a dividend of 20% and Mr. X redeemed all his investment and calculated his holding period return to be 193.134%.

You are required to calculate

- The NAVs as on 31.03.2023 and 31.03.2024.
- Calculate the total units redeemed.

Solution

- (i) Yield for 9 months = 115%

Market value of Investments as on 31.03.2023

$$= 1,00,000 + (1,00,000 \times 115\%)$$

$$= ₹ 2,15,000/-$$

Therefore, NAV as on 31.03.2023 = $(2,15,000 - 10,000) / 10,000 = ₹ 20.50$

(NAV would stand reduced to the extent of dividend payout, being $(₹ 1,00,000 \times 10\%) = ₹ 10,000$)

Since dividend was reinvested by Mr. X, additional units acquired:

$$= ₹ 10,000 / ₹ 20.50 = 487.80 \text{ units}$$

Therefore, total units as on 31.03.2023 = $10,000 + 487.80 = 10,487.80$

Alternately, total units as on 31.03.2023 = $(2,15,000 / 20.50) = 10,487.80$

Dividend as on 31.03.2024 = $10,487.80 \times 10 \times 0.2 = ₹ 20,975.60$

Market Value of Investment as on 31.03.2024

$$= ₹ 1,00,000 + ₹ 1,00,000(193.134\%)$$

$$= ₹ 2,93,134$$

Thus, NAV per Unit as on 31.03.2024 = $₹ (2,93,134 - 20,975.60) / 10,487.80 = ₹ 25.95$

- (ii) Calculation of total numbers of Units redeemed

No. of Units issued on 31.03.2024 = $20,975.60 / 25.95 = 808.31 \text{ units}$

Thus, total number of units redeemed = $10,487.80 + 808.31 = 11,296.11 \text{ units}$

Portfolio Management

Question 1 (May 25)

Security	Standard Deviation (σ)	Weights (w)
R	20%	0.8
S	50%	0.2

Calculation up to two decimal places.

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

- (i) Securities returns are **independent**.
- (ii) Securities returns are **perfectly negatively correlated**.
- (iii) Securities returns are **perfectly positively correlated**.

Solution

(i) Portfolio Variance and Standard Deviation of Portfolio if securities returns are independent

$$\text{Variance of Portfolio} = \sigma_A^2 \times w_A^2 + \sigma_B^2 \times w_B^2$$

$$\text{Variance } (\sigma_p^2) = (0.80)^2 (20)^2 + (0.20)^2 (50)^2$$

$$\text{Variance } (\sigma_p^2) = 256 + 100 = 356$$

$$\text{Standard Deviation } (\sigma_p) = \sqrt{356} = 18.87\%$$

(ii) Portfolio Variance and Standard Deviation if securities returns are perfectly negatively correlated

$$\text{Portfolio Variance: } \sigma_p^2 = (w_1\sigma_1 - w_2\sigma_2)^2$$

$$\text{Portfolio Standard Deviation: } \sigma_p = w_1\sigma_1 - w_2\sigma_2$$

Accordingly

$$\text{Variance } (\sigma_p^2) = (0.80 \times 20 - 0.20 \times 50)^2$$

$$\text{Variance } (\sigma_p^2) = (6)^2 = 36$$

$$\text{Standard Deviation } (\sigma_p) = \sqrt{36} = 6\%$$

(iii) Portfolio Variance and Standard Deviation if securities returns are perfectly positively correlated

$$\text{Portfolio Variance: } \sigma_p^2 = (w_1\sigma_1 + w_2\sigma_2)^2$$

$$\text{Portfolio Standard Deviation: } \sigma_p = w_1\sigma_1 + w_2\sigma_2$$

Accordingly

$$\text{Variance } (\sigma_p^2) = (0.80 \times 20 + 0.20 \times 50)^2$$

$$\text{Variance } (\sigma_p^2) = (26)^2 = 676$$

$$\text{Standard Deviation } (\sigma_p) = \sqrt{676} = 26\%$$

Question 2 (Sep 25)

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

Particulars	TC Limited	PC Limited	Nifty Index
Average return	0.12	0.18	0.06
Variance of return	5.8	4.8	2.10
Beta (β)	0.8	0.7	—
Proportion of allocated fund	50%	50%	—

You are required to:

- (i) Calculate the **systematic and unsystematic risk** for the companies' stocks.
- (ii) Calculate **portfolio risk**.
- (iii) If the proportion 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

(a) (i) Calculation of Systematic Risk and Unsystematic Risk

TC Ltd.

$$\text{Systematic Risk} = \beta^2 \sigma_m^2 = (0.8)^2 (2.10) = \mathbf{1.344}$$

$$\text{Unsystematic Risk} = \text{Total Risk} - \text{Systematic Risk} = 5.80 - 1.344 = \mathbf{4.456}$$

PC Ltd.

$$\text{Systematic Risk} = \beta^2 \sigma_m^2 = (0.7)^2 (2.10) = \mathbf{1.029}$$

$$\text{Unsystematic Risk} = \text{Total Risk} - \text{Systematic Risk} = 4.80 - 1.029 = \mathbf{3.771}$$

(ii) Portfolio Risk

$$\text{Covariance of returns between any two stocks} = \beta_1 \beta_2 \sigma_m^2$$

Accordingly, Covariance of returns between TC Ltd. and PC Ltd. is:

$$0.8 \times 0.7 \times 2.10 = \mathbf{1.176}$$

Portfolio Variance:

$$\sigma_p^2 = (0.50)^2 (5.80) + (0.50)^2 (4.80) + 2 \times 1.176 \times 0.50 \times 0.50$$

$$\sigma_p^2 = 1.45 + 1.20 + 0.588 = \mathbf{3.238}$$

Portfolio Standard Deviation:

$$\sigma_p = \sqrt{3.238} = \mathbf{1.80}$$

(iii) Fund allocation changed to 60% and 40%

$$\sigma_p^2 = (0.60)^2(5.80) + (0.40)^2(4.80) + 2 \times 1.176 \times 0.60 \times 0.40$$

$$\sigma_p^2 = 2.088 + 0.768 + 0.565 = 3.421$$

$$\sigma_p = \sqrt{3.421} = 1.85$$

Expected Returns

Existing Return (50:50):

$$0.50 \times 0.12 + 0.50 \times 0.18 = 0.06 + 0.09 = 0.15 \text{ or } 15\%$$

New Proportion Return (60:40):

$$0.60 \times 0.12 + 0.40 \times 0.18 = 0.072 + 0.072 = 0.144 \text{ or } 14.40\%$$

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 3.238 (or 1.80) to 3.421 or 3.420 (or 1.85).

Question 3 (Nov 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

- (i) Variance of the Funds
- (ii) Coefficient of Determination of the Funds

Solution

- (i) Variance of different Funds can be calculated by using Sharpe Ratio as follows:

(a) Growth Fund

Let σ_G be the Standard Deviation of Growth Fund. Accordingly

$$-0.15 = \frac{7.50 - 9.00}{\sigma_G}$$

$$\sigma_G = 10$$

Hence the variance of Growth Fund $(\sigma_G)^2 = 100$

(b) Balanced Fund

Let σ_B be the Standard Deviation of Balanced Fund. Accordingly

$$- 0.36 = \frac{6.30 - 9.00}{\sigma_B}$$

$$\sigma_B = 7.50$$

Hence the variance of Growth Fund $(\sigma_B)^2 = 56.25$

(c) Regular Fund

Let σ_R be the Standard Deviation of Regular Fund. Accordingly

$$- 0.48 = \frac{5.40 - 9.00}{\sigma_R}$$

$$\sigma_R = 7.50$$

Hence the variance of Growth Fund $(\sigma_R)^2 = 56.25$

(ii) To determine the Coefficient of Determination we need the Coefficient of Correlation which can be determined by computing β using the Treynor Ratio as follows:

(a) Growth Fund

Let β_G be the Beta of Growth Fund. Accordingly

$$- 2 = \frac{7.50 - 9.00}{\beta_G}$$

$$\beta_G = 0.75$$

$$\text{Since Beta} = \frac{\sigma_G \text{Corr}_{G,M}}{\sigma_M}$$

$$\text{and } \sigma_G = 10 \text{ and } \sigma_M = \sqrt{50.41} = 7.1$$

$$\text{Hence } 0.75 = \frac{10 \text{Corr}_{G,M}}{7.10}$$

$$\text{Corr}_{G,M} = 0.5325 \text{ or } 0.53 \text{ and}$$

$$\text{Coefficient of Determination of Growth Fund} = (0.5325)^2 = 0.2836 \text{ or } (0.53)^2 = 0.28$$

(b) Balanced Fund

Let β_B be the Beta of Balanced Fund. Accordingly

$$-3 = \frac{6.30 - 9.00}{\beta_B}$$

$$\beta_B = 0.90$$

$$\text{Since Beta} = \frac{\sigma_B \text{Corr}_{B,M}}{\sigma_M}$$

$$\text{and } \sigma_B = 7.50 \text{ and } \sigma_M = \sqrt{50.41} = 7.1$$

$$\text{Hence } 0.90 = \frac{7.50 \text{Corr}_{B,M}}{7.10}$$

$$\text{Corr}_{B,M} = 0.852 \text{ or } 0.85 \text{ and}$$

$$\text{Coefficient of Determination of Balanced Fund} = (0.852)^2 = 0.7259 \text{ or } (0.85)^2 = 0.73$$

(c) Regular Fund

Let β_R be the Beta of Regular Fund. Accordingly

$$-4.80 = \frac{5.40 - 9.00}{\beta_R}$$

$$\beta_R = 0.75$$

$$\text{Since Beta} = \frac{\sigma_R \text{Corr}_{R,M}}{\sigma_M}$$

$$\text{and } \sigma_R = 7.50 \text{ and } \sigma_R = \sqrt{50.41} = 7.1$$

$$\text{Hence } 0.75 = \frac{7.50 \text{Corr}_{R,M}}{7.10}$$

$$\text{Corr}_{R,M} = 0.71 \text{ and}$$

$$\text{Coefficient of Determination of Regular Fund} = (0.71)^2 = 0.5041 \text{ or } 0.50$$

Forex

Question 1 (RTP Jan 26)

On 1st October, 2024 Mr. G, an exporter, enters into a forward contract with a Bank to sell USD 1,00,000 on 31st December 2024 at INR/USD 85.40. However, at the request of the importer, Mr. G received the amount on 30th November, 2024. Mr. G requested the bank take delivery of the remittance on 30th November, 2024 i.e. before due date.

The inter-bank rate on 30th November 2024 was as follows:

Spot INR/USD	85.22/85.27
One Month Premium	10/15

- If bank agrees to take early delivery then what will be net inflow to Mr. G.
- If Mr. G can deploy these funds in USD and earn a return of 3% per annum, then advise which option will be better: delivery to the bank or investment in USD?

Note:

- Assume 365 days in a year.
- Assume the prevailing prime lending rate is 18% p.a. and term deposit rate is 12% p.a.
- Round off calculations upto two decimal points.

(i) If Bank agrees to take early delivery -
Working Notes:

(1) Swap Difference

Particulars	₹
Bank Sells at Spot Rate on 30th November 2024	85.22
Bank Buys at Forward Rate of 31st December 2024 (85.27 + 0.15)	85.42
Swap Loss per US\$	- 0.20
Swap Loss for US\$ 1,00,000 (1,00,000 × ₹0.20)	₹ 20,000

(2) Interest on Outlay Funds

Particulars	₹
On 30th November, Bank sells at	85.22
It buys from customer at	85.40
Outlay of Funds per US\$	₹ 0.18
Interest on Outlay Fund for US\$ 1,00,000 for 31 days (US\$1,00,000 × ₹0.18 × 31/365 × 18%)	₹ 275.18

(3) Charges for Early Delivery

Particulars	₹
Swap Loss	20,000.00
Interest on Outlay Fund for US\$ 1,00,000 for 31 days	275.18
Total Charges for Early Delivery	₹ 20,275.18

Net Inflow to Mr. G

Particulars	₹
Amount received on sale ($₹ 85.40 \times 1,00,000$)	85,40,000.00
Less: Charges for early delivery payable to bank	20,275.18
Net Inflow to Mr. G as on 30th November 2024	₹ 85,19,724.82

(ii) If Mr. G deploys these funds in US\$, then inflow will be -

Particulars	US\$
Receipt of US\$ on 30th November 2024	1,00,000
Add: Interest for 31 Days ($1,00,000 \times 3\% \times 31/365$)	254.79
US\$ available on 31st December 2024 for sale	1,00,254.79

Particulars	₹
Sale of US\$ 1,00,000 to bank as per agreed rate ($₹ 85.40$)	85,40,000.00
Sale of US\$ 254.79 @ $₹ 85.32$ i.e., Forward Rate	21,738.68
Amount of Inflows	₹ 85,61,738.68

If Mr. G deploys funds received in INR from bank in term deposit, then amount of inflows on 31st December 2024 will be -

Particulars	₹
Net Inflow to Mr. G as on 30th November 2024	85,19,724.82
Add: Opportunity Interest for 31 Days ($₹ 85,19,724.82 \times 12\% \times 31/365$)	86,831.17
Amount on 31st December 2024 for sale	₹ 86,06,555.99

Advice: In case if opportunity to invest funds in INR is available at term deposit rate then Mr. G should deliver the USD to the Bank 30th November and invest the INR funds.

Question 2 (RTP Jan 26)

XP Pharma Ltd., has acquired an export order for Rs 10 million for formulations from a European company. The Company has also planned to import bulk drugs worth Rs 5 million from a company in UK. The proceeds of exports will be realized in 3 months from now and the payments for imports will be due after 6 months from now. The invoicing of these exports and imports can be done in any currency i.e. Dollar, Euro or Pounds sterling at company's choice.

The following market quotes are available.

	Spot Rate	Annualised Premium
Rs/\$	87.10/87.20	\$ - 7%
Rs /Euro	101.15/101.20	Euro - 6%
Rs /Pound	116.65/116.75	Pound - 5%

Advise XP Pharma Ltd. in which currency invoicing for both import and export should be opted for. (Exchange Rate including calculations should be upto two decimal places).

Solution

Proceeds of Exports in INR = Rs 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
\$	Rs 100,00,000/Rs 87.10 = \$ 1,14,810.56	Rs 87.10 (1 + 0.07/4) = Rs 88.62	Rs 88.62 × \$ 1,14,810.56 = Rs 1,01,74,511.83
€	Rs 100,00,000/Rs 101.15 = € 98,863.07	Rs 101.15 (1 + 0.06/4) = Rs 102.67	Rs 102.67 × € 98,863.07 = Rs 1,01,50,271.40
£	Rs 100,00,000/ Rs 116.65 = £ 85,726.53	Rs 116.65 (1 + 0.05/4) = Rs 118.11	Rs 118.11 × £ 85,726.53 = Rs 1,01,25,160.46

Payment of Import in INR = Rs 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
\$	Rs 50,00,000/ Rs 87.20 = \$ 57,339.45	Rs 87.20 (1 + 0.07/2) = Rs 90.25	Rs 90.25 × \$ 57,339.45 = Rs 51,74,885.36
€	Rs 50,00,000/ Rs 101.20 = € 49,407.11	Rs 101.20 (1 + 0.06/2) = Rs 104.24	Rs 104.24 × € 49,407.11 = Rs 51,50,197.15
£	Rs 50,00,000/ Rs 116.75 = £ 42,826.55	Rs 116.75 (1 + 0.05/2) = Rs 119.67	Rs 119.67 × £ 42,826.55 = Rs 51,25,053.24

Advice: Since cash inflow is highest (Rs 1,01,74,511.83) in case of \$ hence invoicing for Export should be in \$. However, cash outflow is least (Rs 51,25,053.24) in case of £ the invoicing for import should be in £.

Question 3 (RTP Sep 25)

The Treasury desk of a global bank incorporated in UK wants to invest GBP 200 million on 1st January, 2019 for a period of 6 months and has the following options:

- (1) The Equity Trading desk in Japan wants to invest the entire GBP 200 million in high dividend yielding Japanese securities that would earn a dividend income of JPY 1,182 million. The dividends are declared and paid on 29th June. Post dividend, the securities are expected to quote at a 2% discount. The desk also plans to earn JPY 10 million on a stock borrow lending activity because of this investment. The securities are to be sold on June 29 with a T+1 settlement and the amount remitted back to the Treasury in London.
- (2) The Fixed Income desk of US proposed to invest the amount in 6 month G-Secs that provides a return of 5% p.a.

The exchange rates are as follows:

Currency Pair	1 Jan 2019 (Spot)	30 Jun 2019 (Forward)
GBP - JPY	148.0002	150.0000
GBP- USD	1.28000	1.30331

As a treasurer, advise the bank on the best investment option. What would be your decision from a risk perspective? You may ignore taxation.

Note: Calculate all figures in millions and round off them upto 4 decimal points.

Solution

1. Yield from Investment in Equity Trading Index in Japan

Conversion of GBP 200 million in JPY (148.0002)	JPY 29600.04 Million
Dividend Income	JPY 1182.00 Million
Stock Lending	JPY 10.00 Million
Investment Value at End	JPY 29008.0392 Million
Amount available at End	JPY 30200.0392 Million
Forward Rate of 30.06.2019	JPY 150/ GBP
Amount to be Remitted back to London Gain = 201.3336 - 200	GBP 201.3336 Million GBP 1.3336 Million

2. Fixed Income Desk of US

Conversion of GBP 200 million in USD (1.28000)	USD 256.00 Million
Add: Interest @ 5% p.a. for 6 months	USD 6.40 Million
Amount available at End	USD 262.40 Million
Forward Rate of 30.06.2019	USD 1.30331/ GBP
Amount to be Remitted back to London Gain = 201.3335 - 200	GBP 201.3335 Million GBP 1.3335 Million

Decision: Investment in Japanese Yen is preferred over the investment in USD G- Sec as there is a marginal gain. From a risk perspective, the company should go for Option-2 Investment in G- Secs as they are risk free.

Question 4 (RTP Nov 24)

PKR Ltd. has made purchases worth USD 8,00,000 on 1st May 2020 for which it has to make a payment on 1st November 2020. The present exchange rate is INR/USD 75. The company can purchase forward dollars at INR/USD 74. The company will have to make an upfront premium @ 1 per cent of the forward amount purchased.

The company can hedge its position with the following expected rate of USD in foreign exchange market on 1st May 2020:

PKR Ltd. has made purchases worth USD 8,00,000 on 1st May 2020 for which it has to make a payment on 1st November 2020. The present exchange rate is INR/USD 75. The company can purchase forward dollars at INR/USD 74. The company will have to make an upfront premium @ 1 per cent of the forward amount purchased.

The company can hedge its position with the following expected rate of USD in foreign exchange market on 1st May 2020:

Exchange Rate	Probability
(i) INR/USD 77	0.15
(ii) INR/USD 71	0.25
(iii) INR/USD 79	0.20
(iv) INR/USD 74	0.40

You are required to advise the company for a suitable cover for risk assuming that the cost of funds to PKR Ltd. is 10 per cent per annum.

Solution

1. If PKR Ltd. does not take forward cover (Unhedged Position): Expected Rate
= Rs 77 × 0.15 + Rs 71 × 0.25 + Rs 79 × 0.20 + Rs 74 × 0.40
= Rs 11.55 + Rs 17.75 + Rs 15.80 + Rs 29.60 = Rs 74.70
Expected Amount Payable = USD 8,00,000 × Rs 74.70 = Rs 5,97,60,000

2. If the PKR Ltd. hedge its position in the forward market:

Particulars	Amount (Rs)
If company purchases US\$ 8,00,000 forward premium is (800000 × 74 × 1%)	5,92,000
Interest on Rs 5,92,000 for 6 months at 10%	29,600
Total hedging cost (a)	6,21,600
Amount to be paid for US\$ 8,00,000 @ Rs 74.00 (b)	5,92,00,000
Total Cost (a) + (b)	5,98,21,600

Advice: Since cash outflow is lesser in case of unhedged position company should opt for the same.

Derivatives

Question 1 (RTP Jan 26)

On 1 April 2015, Sunidhi was holding a portfolio of 10 securities whose value was Rs 9,94,450, the weighted average of beta of 9 securities of the portfolio was 1.10.

Since she was expecting a fall in the prices of the shares in near future to hedge her portfolio, she sold 5 contract of NIFTY Futures (Multiplier of 25) expiring in May 2015, which was trading at 8767.07 on 1 April.

Required:

1. Calculate the beta of the 10th security.
2. Reconcile the reasons in spite of 2% fall in the market as per Sunidhi's apprehension if she would have earned some profit on her cash position.

Solution

1. To compute the beta of 10th security first we shall compute overall weighted beta as follows:

$$5 = \frac{994450}{8767.07 \times 25} \times w$$

$$w = 1.102 \text{ approximately}$$

$$\text{Let beta of 10th security is } \beta \text{ then, } 1.102 = 0.90 \times 1.10 + 0.10 \times \beta$$

$$\beta = 1.12$$

2. The main reason for the profit in cash position might be due to reason that contrary to her expectation fall in the value of cash position there may be increase in value of cash position or decrease in the stock price may be lesser than 2%.

Question 2 (RTP Jan 26)

A Futures contract is available on R Ltd. that pays annual dividend of Rs 4 and whose stock is currently priced at Rs 125. Each Futures contract calls for delivery of 1,000 shares to stock in one year, daily marking to market. The treasury bill rate is 8%.

Required:

1. Given the above information, assess the price of one Futures contract.
2. If the company stock price decreases by 6%, then what will be the price of one Futures contract?
3. Suppose the company stock price decreases, then evaluate realizes gain or loss for an investor that has a long position in one Futures contract of R Ltd. (Ignore margin and taxation, if any)

Solution

1. Future Price = Spot + Cost of Carry - Dividend = Rs 125 + (Rs 125 × 0.08) - Rs 4 = Rs 131

$$\text{Price of one future contract} = 1000 \text{ share} \times \text{Rs } 131 = \text{Rs } 1,31,000$$

2. Price decrease by 6%

$$\text{Market Price} = \text{Rs } 125 \times 94\% = \text{Rs } 117.50 \text{ Then, price of one future contract}$$

$$= \text{Rs } 117.50 + (\text{Rs } 117.50 \times 0.08) - \text{Rs } 4 = \text{Rs } 122.90$$

$$= \text{Rs } 122.90 \times 1000 = \text{Rs } 1,22,900$$

3. If the investor has taken a long position, decrease in price will result in loss for the investor. Amount of loss will be: Rs 1,31,000 - Rs 1,22,900 = Rs 8,100

Question 3 (RTP May 25)

Mr. X, is a Senior Portfolio Manager at ABC Asset Management Company. He expects to purchase a portfolio of shares in 90 days. However, he is worried about the expected price increase in shares in coming day and to hedge against this potential price increase he decides to take a position on a 90-day forward contract on the Index. The index is currently trading at 2290. Assuming that the continuously compounded dividend yield on the same index is 1.75% and risk-free rate of interest is 4.16%, you are required to determine:

- (a) The justified forward price on this contract.
- (b) The position Mr X should take in forward contract on the Index.
- (c) Gain/ loss on the position taken if after 28 days of the purchase of the contract the Index value stands at 2450.
- (d) Gain/ loss on position taken if at expiration of 90 days the Index Value is 2470.

Note: Take 365 days in a year and value of $e^{0.005942} = 1.005960$

Solution

(a) The Forward Price shall be = Spot $\times e^{rt}$

$$\begin{aligned}\text{Forward Price} &= 2290 e^{90/365(0.0416 - 0.0175)} \\ &= 2290 e^{0.005942} \\ &= 2290(1.005960) \\ &= 2303.65\end{aligned}$$

(b) Mr. X shall take long position in the Forward Contract on Index.

$$\begin{aligned}\text{(c) Gain/loss on Long Position after 28 days} &= 2450 e^{(0.0416 - 0.0175)62/365} - 2303.65 \\ &= 2460.05 - 2303.65 \\ &= 156.4\end{aligned}$$

$$\begin{aligned}\text{(d) Gain/loss on Long Position at maturity} &= 2470.00 - 2303.65 \\ &= 166.35\end{aligned}$$

Question 4 (Nov 24)

On January 1, 2023 an investor has a portfolio of 5 securities as given below:

Security	Price (Rs.)	No. of shares	Beta
A	612.65	3000	?
B	334.20	5000	1.15
C	454.45	6000	0.40
D	775.10	10000	0.95
E	781.05	3000	0.85

Portfolio beta is 0.859

The cost of capital to the investor is 10.5% p.a.

You are required to calculate:

- The beta of Security A.
- The theoretical value of the Nifty futures for February, 2023. Current value of Nifty 6500.
- The number of contract of Nifty the investor needs to sell to get a full hedge until February, for his portfolio, if the current value of Nifty is 6500 and Nifty futures have a minimum trade lot requirement of 200 units. Assume that the Futures are trading at their fair value.
- What will be new beta if 4 Future contracts are sold to the investors?

No. of days in a year be traded as 365 days

Given: $\ln(1.105) = 0.0998$, $e^{0.015858} = 1.01598$ and $e^{0.01668} = 1.01682$

Solution

- Calculation of beta of Security A

Let beta of Security A is β_A

Security	Price of the Stock	No. of shares	Value	Weightage w_i	Beta B_i	Weighted Beta
A	612.65	3,000	18,37,950	0.113	β_A	$0.113 \beta_A$
B	334.20	5,000	16,71,000	0.102	1.15	0.117
C	454.45	6,000	27,26,700	0.167	0.40	0.067
D	775.10	10,000	77,51,000	0.475	0.95	0.451
E	781.05	3,000	23,43,150	0.143	0.85	0.122
			1,63,29,800			$0.757 + 0.113 \beta_A$

Since the Portfolio beta is 0.859, the beta of Security A shall be:

$$0.757 + 0.113 \beta_A = 0.859 \quad \beta_A = 0.903 \text{ or } 0.90$$

- Calculation of Theoretical Value of Future Contract

Cost of Capital = 10.5% p.a. Accordingly, the Continuously

Compounded Rate of Interest $\ln(1.105) = 0.0998$

For February 2023 contract, $t = 58/365 = 0.1589$

Further $F = Se^{rt}$

$$F = ₹ 6,500e^{(0.0998)(0.1589)}$$

$$F = ₹ 6,500e^{0.015858}$$

$$F = ₹ 6,500 \times 1.01598 = ₹ 6,603.87$$

Alternatively, it can also be taken as follows:

$$= ₹ 6500 e^{0.105 \times 58 / 365}$$

$$= ₹ 6500 e^{0.01668}$$

$$= ₹ 6500 \times 1.01682 = ₹ 6,609.33$$

(iii) When total portfolio is to be hedged:

$$\begin{aligned} & \text{Value of Spot Position requiring hedging} \\ &= \frac{\text{Value of Future Contract}}{\text{Value of Future Contract}} \times \text{Portfolio Beta} \end{aligned}$$

$$= \frac{16329800}{6603.87 \times 200} \times 0.859$$

$$= 10.62 \text{ contracts say 11 contracts}$$

Or

$$= \frac{16329800}{6609.33 \times 200} \times 0.859$$

$$= 10.61 \text{ contracts say 11 contracts}$$

(iv) Revised Portfolio Beta if 4 Future contracts are sold to investor:

$$4 = (\beta_{P\text{₹}} - 0.859) \times \frac{16329800}{6603.87 \times 200}$$

$$\beta_{P\text{₹}} = 1.18$$

Or

$$4 = (\beta_{P\text{₹}} - 0.859) \times \frac{16329800}{6609.33 \times 200}$$

$$\beta_{P\text{₹}} = 1.18$$

IRRM

Question 1 (Nov 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:

- (i) The actual interest rate if the Banker pays to XY Ltd. an amount of ₹ 9,78,952.52
- (ii) The actual interest rate if XY Ltd. will pay to the Banker a sum of ₹ 9,80,872.98

Solution

Final settlement amount shall be computed by using formula:

$$\frac{(N)(RR - FR)(dtm/DY)}{[1 + RR(dt m/DY)]}$$

Where,

N = the notional principal amount of the agreement;

RR = Actual Reference Rate for the maturity specified by the contract prevailing on the contract settlement date; FR = Agreed-upon Forward Rate; and

dtm = maturity period in days or months of the forward rate agreement

DY = Total number of days or month in a year as per convention

Accordingly,

- (i) If Banker pays to XY Ltd. an amount of ₹ 9,78,952.52 then actual interest shall be computed as follows:

$$\text{₹ } 9,78,952.52 = \frac{(\text{₹ } 100 \text{ crore})(RR - 0.082)(3/12)}{[1 + RR(3/12)]}$$

$$RR = 0.086$$

Thus, the actual interest rate happens to be 8.60% on the settlement date.

- (ii) If XY Ltd. pays to Banker an amount of ₹ 9,80,872.98 then actual interest shall be computed as follows:

$$-\text{₹ } 9,80,872.98 = \frac{(\text{₹ } 100 \text{ crore})(RR - 0.082)(3/12)}{[1 + RR(3/12)]}$$

$$RR = 0.078$$

Thus, the actual interest rate happens to be 7.80% on the settlement date.

Business Valuation

Question 1 (Nov 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.	0.90
Risk-free rate (i.e., current yield on Govt. Bonds)	8%
Average market risk premium	10%

The applicable corporate income tax rate is 30%.

You are required to calculate the Profit After Tax of ABC Ltd.

Solution

To compute Profit after Tax (PAT) of ABC Ltd. first we shall compute Cost of Equity, Cost of Debt and WACC as follows: Cost of Equity (k_e) as per CAPM $k_e = 8\% + 0.90 \times 10\% = 17\%$

Post Tax Cost of Debt (k_d) = $10\% (1 - 0.30) = 7.00\%$

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

$$= 11.56\% + 2.24\% = 13.80\%$$

EVA = Net Operating Profit after Tax (NOPAT) - (Invested Capital $\times$ WACC)

$$₹ 31,10,000 = NOPAT - (₹ 2,50,00,000 \times 0.1380)$$

$$NOPAT = ₹ 65,60,000$$

$$\text{Operating Profit} = \frac{65,60,000}{0.70} = ₹ 93,71,429$$

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 2 (Sep 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 preferred stock is 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**.

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 the same value of equity as calculated in (i) for using the **FCFE approach**, calculate **free cash flow to 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

(I) Calculation of WACC

$$\begin{aligned} &= 8.60\% \times (1 - 0.30) \times 20\% + 11\% \times 30\% + 13\% \times 50\% \\ &= 1.20\% + 3.30\% + 6.50\% \\ &= 11\% \end{aligned}$$

$$(II) \text{ Value of Firm based on FCFF} = \frac{125M(1.08)}{0.11 - 0.08} = 4500 \text{ Million}$$

(i) To decide whether the value of share is justified, compute value per share based on FCFF:

Particulars	Amount
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 the share at this price as it is underpriced.

(ii) Computation of Free Cash Flow to Equity (FCFE)

Value of one Equity Share as per FCFF: ₹ 205.25

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

$$205.25 = \frac{FCFE (1.085)}{0.13 - 0.085} = 8.51$$

No. of Equity Shares outstanding: 20 million

FCFE of ABC Ltd = ₹8.51 × 20 million = ₹170.20 million

Question 3 (May 25)

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: Rs 110 Lakh, including an extraordinary gain of Rs 16 Lakh.
- Pending Adjustments: Rs 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:

	Year 1	Year 2	Year 3
Future cash flows (Rs in Lakh)	150	200	220

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

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

	1	2	3
PV Factor at 15%	0.870	0.756	0.658
PV Factor at 14%	0.877	0.769	0.675

Calculation upto 2 decimal places.

You are required to calculate potential value to be placed on ZIO Company.

Solution

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

The adjusted EBITDA would be Rs 110 Lakh - Rs 16 Lakh - Rs 38 Lakh = Rs 56 Lakh

The EV will be multiple of 8 on the Rs 56 Lakh obtained above = Rs 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 4 (RTP Sep 25)

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) of KGFL.
- Ascertain Equity Beta (β_E) of KGF Ltd., if it 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.
- Evaluate whether the new Equity Beta (β_E) justifies increase in the value of equity on account of leverage?

Solution

i. Equity Beta

To calculate Equity Beta first we shall calculate Weighted Average of Asset Beta as follows:

$$= 1.45 \times 0.74 + 1.20 \times 0.26$$

$$= 1.073 + 0.312 = 1.385$$

Now we shall compute Equity Beta using the following formula:

$$\beta_{Asset} = \beta_{Equity} \left(\frac{E}{E + D(1 - T)} \right) + \beta_{Debt} \left(\frac{D(1 - T)}{E + D(1 - T)} \right)$$

Accordingly,

$$1.385 = \beta_{Equity} \left(\frac{410}{410 + 170} \right) + \beta_{Debt} \left(\frac{170}{410 + 170} \right)$$

$$\beta_{Equity} = 1.860$$

ii. Equity Beta on change in Capital Structure

Amount of Debt to be raised:

Particulars	Value
Total Value of Firm (Equity Rs 410 cr + Debt Rs 170 cr)	Rs580 Cr
Desired Debt Equity Ratio	1.90 : 1.00
Desired Debt Level = $\frac{\text{Total Value} \times \text{Debt Ratio}}{\text{Debt Ratio} + \text{Equity Ratio}}$	Rs 380 Cr
Less : Value of Existing Debt	(Rs 170 Cr)
Value of Debt to be Raised	Rs 210 Cr

Equity after Repurchase = Total value of Firm - Desired Debt Value

$$= \text{Rs } 580 \text{ Cr} - \text{Rs } 380 \text{ Cr}$$

$$= \text{Rs } 200 \text{ Cr}$$

Weighted Average Beta of KGFL:

Source of Finance	Investment (Rs Cr)	Weight	Beta	Weighted Beta
Equity	200	0.345	$\beta_{(E = x)}$	$0.345x$
Debt - 1	170	0.293	0.35	0.103
Debt - 2	210	0.362	0.40	0.145
	580	Weighted Average Beta		$0.248 + (0.345x)$

$$\beta_{KGFL} = 0.248 + 0.345x$$

$$1.385 = 0.248 + 0.345x$$

$$0.345x = 1.385 - 0.248$$

$$x = 1.137/0.345 = 3.296$$

$$\beta_{KGFL} = 3.296$$

- iii. Since there is no increase in the value of equity after buyback, it does not justify the increase in the equity beta.

International Financial Management

Question 1 (RTP May 24)

Mr. Vishwas, a friend of Mr. Pramod who is one of the Directors of Ashirwad Limited, is a citizen of Mauritius. His immediate family members including his parents, born in India are residing in India. He has many friends in different parts of India, due to which he happens to visit India on frequent basis. He along with Mr. Pramod evince interest in setting up business in India and formally incorporate a company to commence their operations. Accordingly, a company is called "Aerious Private Ltd." got incorporated in Mumbai.

To start with he received a business proposal from one of his friends Nimish a consultant. It is estimated that in equivalent terms the business shall require an initial investment of MUR 100 Million and thereafter MUR 2 Million each year will be needed as working capital fund.

He wished to evaluate whether the business proposal is viable or not. The information related to exchange rate and inflation rate is as follows:

Spot Rate for 1 Mauritian Dollar (MUR) = 1.88 Indian Rupee (INR) The inflation in India is 6% and in Mauritius is 5%. It is expected that this inflation rate will remain unchanged for the next 4 years.

INR 8 Crore out of initial investment shall be required for setting up a plant. The useful life of the plant is 4 years. At the end of 4th year estimated salvage value of this plant shall be INR 80 lakhs. Depreciation of the plant shall be charged on the basis of straight-line method.

40 % of the investment shall be through debt funds from Mauritius at the cost of 10% (post tax) while remaining funds shall be arranged by him and his friends. They expect a rate of return of 12% on their funds.

Expected revenues & costs (excluding depreciation) in real term are as under:

Year	1	2	3	4
Revenues (Rs Crore)	6.00	7.00	8.00	8.00
Costs (Rs Crore)	3.00	4.00	4.00	4.00

Assume that applicable tax rate in India is 30%. Since there is Double tax avoidance agreement between India and Mauritius, the company is not required to pay tax in Mauritius if tax has been paid in India.

The applicable inflation rates for revenues & costs are as follows:

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

He wants an expert opinion for the same investment proposal. Demonstrate whether investment in this project is viable option or not.

Note:

1. Round off calculations upto 4 decimal points.
2. Show INR calculations in Crore and MUR calculations in Million.

To evaluate whether investment in same project is a viable option or not, we shall compute the NPV of the project.

Working Note:

(1) Expected Exchange Rates

End of Year	INR	INR/MUR
1	$(1.88 \times 1.06) / 1.05$	1.8979
2	$(1.8979 \times 1.06) / 1.05$	1.9160
3	$(1.9160 \times 1.06) / 1.05$	1.9342
4	$(1.9342 \times 1.06) / 1.05$	1.9526

- (2) Initial Investment = MUR 100 Million $\times$ INR 1.88 = INR 18.80 crore
 Working Capital (Year 1) = MUR 2 Million $\times$ 1.8979 = INR 0.3796 crore
 Working Capital (Year 2) = MUR 2 Million $\times$ 1.9160 = INR 0.3832 crore
 Working Capital (Year 3) = MUR 2 Million $\times$ 1.9342 = INR 0.3868 crore
 Working Capital (Year 4) = MUR 2 Million $\times$ 1.9526 = INR 0.3905 crore

- (3) WACC = $40\% \times 10\% + 60\% \times 12\% = 11.20\%$

(4) Inflation adjusted Revenue

Year	Revenue (Rs)	Revenue (Inflation Adjusted) (Rs)
1	6.00 crore	$6.00 \text{ crore} \times 1.10 = 6.60 \text{ crore}$
2	7.00 crore	$7.00 \text{ crore} \times 1.10 \times 1.09 = 8.393 \text{ crore}$
3	8.00 crore	$8.00 \text{ crore} \times 1.10 \times 1.09 \times 1.08 = 10.3594 \text{ crore}$
4	8.00 crore	$8.00 \text{ crore} \times 1.10 \times 1.09 \times 1.08 \times 1.07 = 11.0845 \text{ crore}$

(5) Inflation adjusted Cost

Year	Cost (Rs)	Cost (Inflation Adjusted) (Rs)
1	3.00 crore	$3.00 \text{ crore} \times 1.12 = 3.3600 \text{ crore}$
2	4.00 crore	$4.00 \text{ crore} \times 1.12 \times 1.10 = 4.9280 \text{ crore}$
3	4.00 crore	$4.00 \text{ crore} \times 1.12 \times 1.10 \times 1.09 = 5.3715 \text{ crore}$
4	4.00 crore	$4.00 \text{ crore} \times 1.12 \times 1.10 \times 1.09 \times 1.08 = 5.8012 \text{ crore}$

(6) Annual cash flows (Crore)

Year	1	2	3	4
Revenue	6.600	8.393	10.3594	11.0845
Less: Cost	3.360	4.928	5.3715	5.8012
Less: Depreciation	1.800	1.800	1.800	1.800
Profit before Tax (PBT)	1.440	1.665	3.1879	3.4833
Tax @ 30%	0.432	0.4995	0.9564	1.0450
Profit after Tax	1.008	1.1655	2.2315	2.4383
Add: Depreciation	1.800	1.800	1.800	1.800
Cash Flows	2.808	2.9655	4.0315	4.2383

(7) NPV of the Project

Year	0	1	2	3	4
Initial Investment (Rs Crore)	(18.80)				
Working Capital (Rs Crore)	-	(0.3796)	(0.3832)	(0.3868)	(0.3905)
Scrap Value (Rs Crore)					0.8000
W.C Recovered (Rs Crore)					1.5401
Annual Cash flows		2.8080	2.9655	4.0315	4.2383
Net Cash Flow	(18.80)	2.4284	2.5823	3.6447	6.1879
Exchange Rate	1.88	1.8979	1.9160	1.9342	1.9526
Cash Flows (in Million MUR)	(100)	12.7952	13.4776	18.8434	31.6906
PVF@11.20%	1	0.8993	0.8087	0.7273	0.6540
Present value (in Million MUR)	(100)	11.5067	10.8993	13.7048	20.7257

(8) Net Present Value = - MUR 43.1635 Million

(9) Advise: Since NPV of the project is negative the proposal is not a viable option for investment.

Question 2 (Nov 24)

PQR Ltd. is considering a project in US, which involve an initial investment of ₹ 124.50 Crore. The project will have useful life of 5 years Current spot exchange rate is INR/USD is 83. The risk free rate in US is 4.186% and the same in India is 6.9768%. Cash inflows in USD from the project are as follows:

Year	1	2	3	4	5
Cash inflow	30,00,000	40,00,000	50,00,000	60,00,000	70,00,000

PQR Ltd. is expecting net surplus of ₹ 1858.08 lakh to be received after closure of the project. There is no salvage value. PQR Ltd. want to take a forward cover to protect itself from exchange rate fluctuations.

N	1	2	3	4	5
PVIF (6.976%, n)	0.935	0.874	0.817	0.764	0.714
PVIF (4.186%, n)	0.959	0.921	0.884	0.849	0.815
PVIF (12%, n)	0.893	0.797	0.712	0.636	0.567
PVIF (15%, n)	0.870	0.756	0.658	0.572	0.497

You are required to recommend the INR/USD rate for the forward cover?

Solution

Let F be the recommended INR/USD rate for the forward cover. Accordingly, year-wise equivalent cash inflows in Indian Rupees shall be as follows:

Year	Cash Inflow in USD Lakh	Cash Inflow in ₹ Lakh
1	30.00	30.00F
2	40.00	40.00F
3	50.00	50.00F
4	60.00	60.00F
5	70.00	70.00F

Now let us compute Net Present Value of project assuming a discount rate of 12% as follows:

Year	PVF@12%	Cash flow in ₹ Lakh	PV in ₹ Lakh
0	1.00	- 12450.00	- 12450.00
1	0.893	30.00F	26.79F
2	0.797	40.00F	31.88F
3	0.712	50.00F	35.60F
4	0.636	60.00F	38.16F
5	0.567	70.00F	39.69F
			172.12F - 12450

Since expected surplus after closure of the project is ₹ 1858.08 Lakh, we can compute the value of F as follows:

$$1858.08 = 172.12F - 12450$$

$$F = 83.13$$

Thus, for forward cover the rate of ₹ 83.13/ USD is recommended.

Alternatively, if students have assumed discounting rate as 15% then answer will be as follows:

Let F be the recommended INR/USD rate for the forward cover. Accordingly, year-wise equivalent cash inflows in Indian Rupees shall be as follows:

Year	Cash Inflow in USD Lakh	Cash Inflow in ₹ Lakh
1	30.00	30.00F
2	40.00	40.00F
3	50.00	50.00F
4	60.00	60.00F
5	70.00	70.00F

Now let us compute Net Present Value of project assuming a discount rate of 15% as follows:

Year	PVF@15%	Cash flow in ₹ Lakh	PV in ₹ Lakh
0	1.00	- 12450.00	- 12450.00
1	0.870	30.00F	26.10F
2	0.756	40.00F	30.24F
3	0.658	50.00F	32.90F
4	0.572	60.00F	34.32F
5	0.497	70.00F	34.79F
			158.35F - 12450

Since expected surplus after closure of the project is ₹ 1858.08 Lakh, we can compute the value of F as follows:

$$1858.08 = 158.35F - 12450$$

$$F = 90.36$$

Thus, for forward cover the rate of ₹ 90.36/ USD is recommended.

Security Valuation

Question 1 (May 25)

Following details are available for PQR Ltd.:

Current Dividend	= Rs 3.50
Cost of Equity	= 12.50%
Growth Rate	= 2%

You required to -

- (i) Calculate Price of Share of PQR Ltd.
- (ii) Is PQR Ltd.'s Share over-valued if the Share Price = Rs 45, ROE = 8% and EPS = Rs 2.75? Show your calculations using both the P/E Multiple Approach and Earnings Growth Model.

Solution

- i. Present Value of the stock of PQR Ltd. is:- $V_0 = 3.50(1.02)/0.125 - 0.02 = \text{Rs } 34.00$

ii.

A. Value of stock under the PE Multiple Approach

Particulars	
Actual Stock Price	Rs 45.00
Return on equity	8%
EPS	Rs 2.75
PE Multiple (1/Return on Equity) = $1/8\%$	12.50
Market Price per Share	Rs 34.38

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

B. Value of the Stock under the Earnings Growth Model

Particulars	
Actual Stock Price	Rs 45.00
Return on equity	8%
EPS	Rs 2.75
Growth Rate	2%
Market Price per Share $[EPS \times (1+g)] / (K_e - g)$ = $\text{Rs } 2.75 \times 1.02 / 0.06$	Rs 46.75

Since, Actual Stock Price is lower, hence it is undervalued.

Question 2 (Sep 25)

TK Ltd. has Rs 600 Lakh 12% Debenture outstanding with 5 years remaining to redemption. Since interest rates are decreasing, company is planning to redeem these debentures with a Rs 600 Lakh issue of 5 years 10% Debenture at par. Issue cost of 10% Debenture will be Rs 10 Lakh. Premium paid on redemption of 12% Debenture is 5%. Tax rate applicable to company is 20%. You are required to advise on the 12% Debenture Redemption Decision.

PVF @ 10% & 8% are as under -

Rate	1	2	3	4	5
8%	0.93	0.86	0.79	0.74	0.68
10%	0.91	0.83	0.75	0.68	0.62

Calculation up to 2 decimal points

Solution

NPV of Bond Refunding Decision =

PV of Annual Cash flow savings calculated as per Step 2 Below = 10 Lakhs x PVIFA (8%, 5 Years) = 10 lakhs x 4	40 Lakhs
Less: Initial Investment calculated as per Step 1 Below	34 Lakhs
NPV of Bond Refunding Decisions	6 Lakhs

Since NPV is positive, Refunding decision should be taken

Step 1: Calculate Initial Investment

1. [Call Premium - (Tax saving on Call Premium i.e. Call Premium x Tax Rate)] (600 Lakh x 5%) - (30L x 20%)	24 Lakhs
2. Floatation cost on issue of new bonds	10 Lakhs
TOTAL	34 Lakhs

Step 2: Annual Cash Flow savings = Annual cost on old bonds (A) - Annual cost on new bonds (B)
= 57.6 Lakhs - 47.6 Lakhs = 10 Lakhs

Calculate Annual cost on old bonds (A)

1. Interest cost on old bonds - Tax savings on interest on old bonds (600 Lakh x 12%) - 20% Tax Saving	57.6 Lakhs
TOTAL	57.6 Lakhs

Calculate Annual cost on New bonds (B)

1. Interest cost on new bonds - Tax savings on interest on new bonds (600 Lakh x 10%) - 20% Tax Saving	48 Lakhs
2. Tax savings on amortization of floatation cost on issue of new bonds (10 Lakhs / 5 Years) x 20% Tax saving	(0.4 Lakhs)
TOTAL	47.6 Lakhs

Question 3 (Nov 24)

Following is the data regarding Three Securities.

Stock	Expected Return (%)	Std. deviation	Correlation with the Market return
A	19%	2.50	0.840
B	13.50%	2.00	0.540
C	11.00%	0.80	0.975
Market risk	-	1.20	-
Market rate of return	14.00%	-	-
Risk free* rate	9.00%	-	-

* In the Question Paper mistakenly it got typed as tree.

- (i) Advise which of the above stocks are over, under or correctly valued in the market?
- (ii) What will be strategy you would like to recommend?

Solution

- (i) To decide which of this security is over, under or correctly valued we need to compute the Required Rate of Return of each Stock using CAPM for which Beta shall be calculated as follows:
Beta of Stock A (β_A) = $(0.840 \times 2.50) / 1.20 = 1.75$

$$\text{Beta of Stock B } (\beta_B) = (0.540 \times 2.00) / 1.20 = 0.90$$

$$\text{Beta of Stock C } (\beta_C) = (0.975 \times 0.80) / 1.20 = 0.65$$

Required rate of return is given by CAPM

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

$$\text{For Stock A } R_A = 9\% + 1.75 (14\% - 9\%) = 17.75\%$$

$$\text{Stock B } R_B = 9\% + 0.90 (14\% - 9\%) = 13.50\%$$

$$\text{Stock C } R_C = 9\% + 0.65 (14\% - 9\%) = 12.25\%$$

Stock	Required rate of return %	Expected rate of return %	Valuation
A	17.75%	19.00%	Under Valued
B	13.50%	13.50%	Correctly Valued
C	12.25%	11.00%	Over Valued

- (ii) Strategy

Stock	Decision
A	Buy
B	Hold
C	Sell

Mergers and Acquisition

Question 1 (May 24)

The equity shares of XYZ Ltd., are currently being traded at Rs 34 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 30%. ABC Ltd., wishes to acquire XYZ Ltd., because of likely synergies. The estimated present value of these synergies is Rs 1,00,00,000.

Further ABC Ltd., feels that management of XYZ Ltd., has been overpaid. With better motivation, lower salaries and fewer perks for the top management, will lead to savings of Rs 5,00,000 per annum. Top management with their families are promoters of XYZ Ltd., Present value of these savings would add Rs 25,00,000 in value to the acquisition.

Following additional information is available regarding ABC Ltd.,

Earnings per share	Rs 5
Total number of shares outstanding	15,00,000
Market price of equity share	Rs 30

You are required to:

1. Calculate the maximum price per equity share which ABC Ltd., can offer to pay for XYZ Ltd.
2. Calculate the minimum price per equity share at which the management of XYZ Ltd., will be willing to offer their controlling interest.

Solution

- (a) **Calculation of maximum price per share at which ABC Ltd. can offer to pay for XYZ Ltd.'s share**

Market Value (10,00,000 × Rs 34)	Rs 3,40,00,000
Synergy Gain	Rs 1,00,00,000
Saving of Overpayment	Rs 25,00,000
	Rs 4,65,00,000
Maximum Price (Rs 4,65,00,000/10,00,000)	Rs 46.50

- (b) **Calculation of minimum price per share at which the management of XYZ Ltd.'s will be willing to offer for their controlling interest**

Value of XYZ Ltd.'s Management Holding (30% of 10,00,000 × Rs 34)	Rs 1,02,00,000
Add: PV of loss of remuneration to top management	Rs 25,00,000
	Rs 1,27,00,000
No. of Shares	3,00,000
Minimum Price (Rs 1,27,00,000/3,00,000)	Rs 42.33

Question 2 (May 25)

GL Ltd. is having a Price Earnings Ratio (P/E Ratio) of 16 times and Earnings per Share (EPS) of Rs 5. The total numbers of outstanding shares are 2,80,000.

FL Ltd. another company is also in the same industry. The GL Ltd. is in negotiation for acquisition of the FL Ltd. by issuing shares in the ratio of 4:5, i.e., for 5-shares of FL Ltd., 4 shares of GL Ltd. will be issued. Outstanding shares of FL Ltd. are 50,000. The EPS of the merged entity will be Rs 5.4.

You are required to calculate-

- (i) Pre-merger EPS of FL Ltd.
- (ii) Number of shares of GL Ltd. to be issued to FL Ltd. if pre-merger EPS of GL Ltd. is to be maintained.

Solution

(a) Pre Merger EPS

No. of shares to be issued by GL to FL ($50,000 \times 4/5$)	40,000
Existing number of shares of GL	2,80,000
Total no. of shares Post Merger	3,20,000
EPS (Post Merger)	Rs 5.40
Post-Merger (Total Earning)	Rs 17,28,000
Less: Pre-Merger Earning of GL ($2,80,000 \times 5$)	Rs 14,00,000
Pre-Merger Earning of FL	Rs 3,28,000
Number of shares of FL (Existing)	50,000
EPS ($Rs\ 3,20,000/50,000$)	Rs 6.56

(b) Number of shares to be issued to FL to maintain Pre-Merger EPS

$$5.00 = 17,28,000 / (2,80,000 + X)$$

$$14,00,000 + 5X = 17,28,000$$

$$X = 65,600$$

Thus, 65,600 shares to be issued by GL to FL to maintain pre-merger EPS.

Alternatively, it can also be computed as follows: Swap Ratio if EPS before merger is maintained by GL Then, Swap Ratio = $6.56 / 5 = 1.312$

Number of shares of GL is to be issued to FL is $50000 \text{ shares} \times 1.312 = 65,600 \text{ shares}$

