

CA
FINAL

AFM - 263

IMPORTANT QUESTIONS

NOV 2024 EXAMS

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PREFACE

Dear Students,

As you prepare for your **CA Final Group 1** exams in **November 2024**, specifically for **Paper 2, Advanced Financial Management (AFM)**, it's crucial to have a strategic approach to your studies. To assist you in this endeavor, I have meticulously prepared a list of **263 important practical questions**, spread over 300 pages, to help you streamline your revision process.

While this compilation may seem extensive, please keep in mind that it has been carefully curated from a much larger pool of **701 practical** questions covered in the **AFM Compiler 5.0 and the ICAI Study Material**. This means that every question in this list has been selected with purpose and precision, covering approximately **99% of the topics from the syllabus** on which practical questions are likely to be asked.

It is important to emphasize that this list is meant to help you reinforce and brush up on your concepts rather than serve as a predictor of the exact questions you will face in the exam. The primary aim here is to ensure you can cover the syllabus comprehensively in the shortest possible time.

In addition to this list, remember to thoroughly prepare for the **theoretical part** of the syllabus, which typically accounts for 12-20 marks in the exam. This can be effectively done by reviewing the ICAI Study Material and the third volume of the Compiler.

I hope this guide aids you in your preparation and contributes to your success in the exams. All the best!

Warm regards,

CA Mayank Kothari

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For any assistance contact me on Telegram or Instagram "**CA Mayank Kothari**"

Q	Concept Name
1. Financial Policy & Corporate Strategy	
1	Sustainable Growth
2. Risk Management	
1	Z Score Probability
2	VAR-Reverse Calculation
3	Portfolio VAR
4	Z Score Probability
3. Advanced Capital Budgeting	
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CHAPTER 1

FINANCIAL POLICY & CORPORATE STRATEGY

Question 1

- What is sustainable growth rate?
- What makes an Organization Sustainable?
- Mr. X has submitted the following data:

Particulars	(₹) in Lakhs
Total Assets	250
Total Liabilities	220
Net Income	12
Dividend Paid	4.5
Sales	100

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

Answer:

- The sustainable growth rate is a measure of how much a firm can grow without borrowing more money. After the firm has passed this rate, it must borrow funds from another source to facilitate growth.
- In order to be sustainable, an organisation must:
 - have a clear strategic direction;
 - be able to scan its environment or context to identify opportunities for its work;
 - be able to attract, manage and retain competent staff ;
 - have an adequate administrative and financial infrastructure;
 - be able to demonstrate its effectiveness and impact in order to leverage further resources; and
 - Get community support for, and involvement in its work.

(iii)

No	Particulars	Amount in ₹Lakhs
(a)	Total Assets	250.00
(b)	Total Liabilities	220.00
(c)	Net Income	12.00
(d)	Dividend Paid	4.50
(e)	Sales	100.00
(f)	Equity (a) – (b)	30.00
(g)	Return on Equity (ROE) (c) /(f)	40.00%
(h)	Dividend pay-out Ratio (d) /(c)	37.50%
(i)	SGR [$g \times (1-h)$]	25.00%*
(j)	Additional Sales can be achieved without further borrowings (e) $\times$ (i)	25.00
(k)	Maximum sales can be achieved without further borrowings (e) + (j)	125.00

* Alternatively, it can also be computed as follow

$SGR = \frac{g(1-h)}{1-[g(1-h)]} = 33.33\%$ and then Additional Sales shall be ₹33.33 Lakhs and Maximum Sales can be achieved without further borrowings shall be ₹133.33 Lakhs

CHAPTER 2 RISK MANAGEMENT

Question 1

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

In case ABC Ltd. loses on any project more than ₹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

MTP April 21 (4 Marks)

Answer:

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 Value of financial difficulty):

$$z = \frac{x - \mu}{\sigma} = \frac{-1.00 \text{ crore} - 2.00 \text{ crore}}{1.60 \text{ crore}} = -1.875$$

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 $= 0.005 \times \frac{0.0006}{0.01} = 0.0003$

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

And the value of -1.875 shall be $= 0.50 - 0.4696 = 0.0304$

Thus the probability the company shall be in financial difficulty is 3.04%.

Question 2

Neel holds ₹1 Crore shares of XY Ltd. Whose market price standard deviation is 2% per day. Assuming 252 trading days in a year, determine maximum loss level over the period of 1 trading day and 10 trading days with 99% confidence level. Assuming share prices are normally distributed for level of 99%, the equivalent Z score from Normal table of Cumulative Area shall be 2.33.

May 18 (4 Marks)

Answer:

Assuming share prices are normally distributed, for level of 99%, the equivalent Z score from Normal table of Cumulative Area is 2.33.

Volatility in terms of Rupee is

2% of ₹1 Crore = ₹2 Lakh

The maximum loss for 1 day at 99% Confidence level is

₹2 Lakh × 2.33 = **₹4.66 Lakhs,**

and expected maximum loss for 10 trading days shall be:

$\sqrt{10} \times ₹4.66 \text{ lakh} = \textbf{14.74 Lakhs or 14.73 Lakhs.}$

Question 3

Following is the information about Mr. J's portfolio:

Investment in shares of ABC Ltd.	₹200 lakh
Investment in shares of XYZ Ltd.	₹200 lakh
Daily standard deviation of both shares	1%
Co-efficient of correlation between both shares	0.3

Required:

Determine the 10 days 99% Value At Risk (VAR) for Mr. J's portfolio. Given: The Z score from the Normal Table at 99% confidence level is 2.33. (Show your calculations up to four decimal points).

Nov 19 (4 Marks)

Answer:

$$\begin{aligned} \text{VAR}_{\text{Portfolio}} &= \text{SD}_{\text{Portfolio}} \times \text{Z Score} \times \sqrt{t} \\ &= 3.22 \times 2.33 \times \sqrt{10} \end{aligned}$$

VAR_{Portfolio} = ₹23.73 Lakhs --- 10 Days

$$\text{SD} = \sqrt{\text{Variance of Portfolio}}$$

$$\text{Variance}_P(\%) = (\sigma_{XYZ} W_{XYZ})^2 + (\sigma_{ABC} W_{ABC})^2 + 2\sigma_{XYZ} \times W_{XYZ} \sigma_{ABC} W_{ABC} r_{XA}$$

$$\text{Variance}_P(\%) = \sigma_{XYZ}^2 + \sigma_{ABX}^2 + 2\sigma_{XYZ} \sigma_{ABC} r_{XA}$$

$$\begin{aligned} \text{Variance}_P &= \sigma_{XYZ}^2 + \sigma_{ABX}^2 + 2\sigma_{XYZ} \sigma_{ABC} r_{XA} \\ &= 2^2 + 2^2 + 2 \times 2 \times 2 \times 0.3 \\ &= 4 + 4 + 2.4 \end{aligned}$$

$$\text{Variance}_P = 10.4$$

$$\text{SD}_P = \sqrt{10.4} = 3.22$$

Question 4

Mr. Bull is a rational risk taker. He takes his position in a single stock for 4 days in a week. He does not take a position on Friday to avoid weekend effect and takes position only for four days in a week i.e. Monday to Thursday. He transfers the amount on Monday morning and withdraws the balance on Friday morning. He desires to make a maximum investment where Value At Risk (VAR) should not exceed the balance lying in his bank account. The position by his manager, as per standing instructions, is taken on the free balance lying in the bank account in the morning on each Monday.

On Monday morning (before opening of the capital market) he has transferred an amount of ₹11 Crore to his bank account. A fixed deposit also matured on this Monday. The maturity amount of ₹63,42,560 was also credited to his account by the bank in the morning of the Monday. However, Mr. Bull received the intimation of the same in the evening. The bank needs a minimum balance of ₹1,000 all the time. The value of Z score, at the required confidence level of 99 percent is 2.33.

The other information with respect to stocks X and Y, which are under consideration for this week, is as under:

X		Y	
Return	Probability	Return	Probability
6	0.10	4	0.10
7	0.25	6	0.20
8	0.30	8	0.40
9	0.25	10	0.20
10	0.10	12	0.10

You are required to recommend a single stock, where maximum investment can be made. May 23 (8 Marks)

Answer:

(a) Working Notes:

(1) Security X

Return (1)	Prob. (2)	(1) × (2)	Dev.	Dev. ²	Dev. ² × Prob.
6	0.10	0.60	-2	4	0.40
7	0.25	1.75	1	1	0.25
8	0.30	2.40	0	0	0
9	0.25	2.25	1	1	0.25
10	0.10	1.00	2	4	0.40
		8.00			1.30

Expected Return (R_x) = 8.00%

Variance (σ_X^2) = 1.30

Standard Deviation (σ_X) = $\sqrt{1.30} = 1.14$

(2) Security Y

Return (1)	Prob. (2)	(1) × (2)	Dev.	Dev. ²	Dev. ² × Prob.
4	0.10	0.40	-4	16	1.60
6	0.20	1.20	-2	4	0.80
8	0.40	3.20	0	0	0
10	0.20	2.00	2	4	0.80
12	0.10	1.20	4	16	1.60
		8.00			4.80

Expected Return (R_Y) = 8.00%

Variance (σ_Y^2) = 4.80

Standard Deviation (σ_Y) = $\sqrt{4.80} = 2.19$

	No. of days	X	Y
Amount Transferred		₹110000000	₹110000000
Maturity Proceeds of Fixed Deposit		₹6342560	₹6342560
Amount available in bank account		₹116342560	₹116342560
Minimum balance to be kept		₹1000	₹1000
Available amount which can be used for potential investment for 4 days		₹116341560	₹116341560
Maximum loss for 4 days at 99% Level	4	₹116341560	₹116341560
Maximum loss for 1 day at 99% level			
= Maximum loss for 4 days / $\sqrt{\text{No. of days}} = 116341560 / \sqrt{4}$	1	₹58170780	₹58170780
Z Score at 99% level		2.33	2.33
Volatility in terms of ₹		₹24966000	₹24966000
(Maximum Loss/Z Score at 99% Level)			
Standard Deviation		0.0114	0.0219
Maximum Investment (Volatility in terms of ₹ / SD)		₹2190000000	₹1140000000

Recommendation: Position should be taken in X.

CHAPTER 3

ADVANCED CAPITAL BUDGETING

Question 1

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?

StudyMat

Answer:

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

(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,

$$\sigma_{ENPV} = \sqrt{0.3(-8580 + 39,813)^2 + 0.5(47950 - 39,813)^2 + 0.2(92,060 - 39,813)^2}$$

$$= ₹35,800/-$$

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

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

Year	Expected net cash flow	PV @ 9%	Present Value
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 2

Aeroflot airlines is planning to procure a light commercial aircraft for flying class clients at an investment of ₹50 lakhs. The expected cash flow after tax for next three years is as follows:

Year 1		Year 2		Year 3	
CFAT	Prob	CFAT	Prob	CFAT	Prob
15	0.1	15	0.1	18	0.2
18	0.2	20	0.3	22	0.5
22	0.4	30	0.4	35	0.2
35	0.3	45	0.2	50	0.1

The company wishes to consider all possible risk factors relating to an airline.

The company wants to know-

- The expected NPV of this proposal assuming independent probability distribution with 6 per cent risk free rate of interest, and
- The possible deviation on expected values.

Answer:

(i) Determination of expected CFAT

Year-1				Year-2				Year - 3			
CFAT	P ₁	Cash flow		CFAT	P ₂	Cash flow		CFAT	P ₃	Cash flow	
15	0.1		1.5	15	0.1		1.5	18	0.2		3.6
18	0.2		3.6	20	0.3		6	22	0.5		11
22	0.4		8.8	30	0.4		12	35	0.2		7
35	0.3		10.5	45	0.2		9	50	0.1		5
		CF₁	22.4			CF₂	22.4			CF₃	22.4

CFAT (₹ in lakh)	PV factor @ 6%	Total PV (₹ in lakh)
24.4	0.943	23.009
28.5	0.89	25.365
26.6	0.84	22.344
	Total Cash Inflow	70.718
	Total Cash Outflow	50
	NPV	20.718

(ii) Determination of Standard deviation for each year

Year 1

$(CF_1 - \overline{CF}_1)^2$	$(CF_1 - \overline{CF}_1)^2$	P_1	
$(15-24.4)^2$	88.36	0.1	8.836
$(18-24.4)^2$	40.96	0.2	8.192
$(22-24.4)^2$	5.76	0.4	2.304
$(35-24.4)^2$	112.36	0.3	33.708
			???

$$\sigma = \sqrt{53.04} = 7.282$$

Year 2

$(CF_2 - \overline{CF}_2)^2$	$(CF_2 - \overline{CF}_2)^2$	P_2	
$(15-28.5)^2$	182.25	0.1	18.225
$(20-28.5)^2$	72.25	0.3	21.675
$(30-28.5)^2$	2.25	0.4	0.9
$(45-28.5)^2$	272.25	0.2	54.45
			???

$$\sigma = \sqrt{95.25} = 9.76$$

Year 3

$(CF_3 - \overline{CF}_3)^2$	$(CF_3 - \overline{CF}_3)^2$	P_3	
$(18-26.6)^2$	73.96	0.2	14.792
$(22-26.6)^2$	21.16	0.5	10.58
$(35-26.6)^2$	70.56	0.2	14.112
$(50-26.6)^2$	547.56	0.1	54.756
			???

$$\sigma = \sqrt{94.24} = 9.70$$

Standard deviation of the expected Values

$$\sigma = \sqrt{\sum_{t=1}^n \frac{\sigma_t^2}{(1+i)^{2t}}}$$

$$\sigma = \sqrt{\frac{53.04}{(1+0.06)^2} + \frac{95.25}{(1+0.06)^4} + \frac{94.24}{(1+0.06)^6}}$$

$$\sigma = \sqrt{47.21 + 75.45 + 66.44} = \sqrt{189.10} = 13.75$$

Question 3

KLM Ltd. requires ₹15,00,000 for a new project.

Useful life of project is 3 years.

Salvage value - NIL.

Depreciation is ₹5,00,000 p.a.

Given below are projected revenues and costs (excluding depreciation) ignoring inflation:

Year →	1	2	3
Revenues in ₹	10,00,000	13,00,000	14,00,000

Costs in ₹	5,00,000	6,00,000	6,50,000

Applicable tax rate is 35%. Assume cost of capital to be 14% (after tax). The inflation rates for revenues and costs are as under:

Year	Revenues %	Costs %
1	9	10
2	8	9
3	6	7

PVF at 14%, for 3 years = 0.877, 0.769 and 0.675

Show amount to the nearest rupee in calculations.

You are required to calculate net present value of the project.

StudyMat

Answer:

(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	Revenues (₹)	Revenues (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) (₹)	Costs (Inflation Adjusted) (₹)	Net Profit (₹)	Tax (₹)	Profit after Tax (₹)
	(1)	(2)	(3) = (1) - (2)	(4) = 35% of (3)	(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 4

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?

StudyMat

Answer:

- (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:

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

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

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

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	1,14,400
Total Present Value			12,67,800
Less: Cost of Investment			11,00,000
Net Present Value			1,67,800

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	7,35,600

Total Present Value		21,13,800
Less: Cost of Investment		19,00,000
Net Present Value		2,13,800

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

Question 5

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?

StudyMat

Answer:

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

Year end	Cash Flow (₹)	C.E.	Adjusted Cash flow (₹)	Present value factor at 6%	Total Present value (₹)
	(a)	(b)	(c) = (a) × (b)	(d)	(e) = (c) × (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	2,10,000
					8,60,980
Less: Initial Investment					8,50,000
Net Present Value					10,980

Statement Showing the Net Present Value of Project N

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

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

Question 6

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:

- Tabulate the NPV of the project. Does it represent the actual outcome? Comment.
- Examine the impact of 2.5 percent adverse variance in each of the variables on the project's NPV. Decide which variable is having maximum effect?
- Critically analyse the Sensitivity analysis as method of incorporating risk in capital budgeting decisions.

Consider Life of the project as 3 years.

RTP May 2024

Answer:

i. 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.

ii. **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	97.50	100	100	100
B	Variable cost per unit	50	50	50	51.25	50	50
C	Contribution per unit (A - B)	50	50	47.50	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	237.50	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	187.50	193.75	198.75	193.75
H	PV of Net cash Inflow per year (G × 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%.

Advantages of Sensitivity Analysis:

Following are the main advantages of Sensitivity Analysis:

- (1) **Critical Issues:** This analysis identifies critical factors that impinge on a project's success or failure.
- (2) **Simplicity:** It is a simple technique.

Disadvantage of Sensitivity Analysis

Following are the main disadvantages of Sensitivity Analysis:

- (1) **Assumption of Independence:** This analysis assumes that all variables are independent i.e. they are not related to each other, which is unlikely in real life.
- (2) **Ignore probability:** This analysis does not look to the probability of changes in the variables

Question 7

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

- Initial Investment of the Project
- Net Present Value of the Project
- Annual Fixed Cost
- Estimated annual unit of sales
- Break Even Units

Cumulative Discounting Factor for 5 years

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

StudyMat

Answer:

(i) Initial Investment

IRR = 16% (Given)

At IRR, NPV shall be zero, therefore

$$\begin{aligned}\text{Initial Cost of Investment} &= \text{PVAF (16\%, 5)} \times \text{Cash Flow (Annual)} \\ &= 3.274 \times ₹57,500 \\ &= ₹1,88,255\end{aligned}$$

(ii) Net Present Value (NPV)

$$\text{Let Cost of Capital be X, then } \frac{16 - X}{X} = 60\% \quad X = 10\%$$

Thus NPV of the project

$$\begin{aligned}&= \text{Annual Cash Flow} \times \text{PVAF (10\%, 5)} - \text{Initial Investment} \\ &= ₹57,500 \times 3.791 - ₹1,88,255 \\ &= ₹2,17,982.50 - ₹1,88,255 \\ &= ₹29,727.50\end{aligned}$$

(iii) Annual Fixed Cost

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

$$₹29,727.50 - 3.791X = 0$$

$$\text{Thus } X = ₹7,841.60$$

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

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

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

$$\frac{\text{₹57,500} + \text{₹1,00,000}}{0.70} = \text{₹2,25,000}$$

$$\text{Sales in Units} = \frac{\text{₹2,25,000}}{\text{₹200}} = 1,125 \text{ units}$$

(v) Break Even Units

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

Question 8

A company in India is evaluating a project using **Simulation Analysis** to account for uncertainties in the project's annual cash flow and project life. The following data is provided:

Annual Cash Flow		Project Life	
Value (₹)	Probability	Value (Year)	Probability
10,000	0.02	3	0.05
15,000	0.03	4	0.10
20,000	0.15	5	0.30
25,000	0.15	6	0.25
30,000	0.30	7	0.15
35,000	0.20	8	0.10
40,000	0.15	9	0.03
		10	0.02

Random Numbers for 10 Simulation Runs:

Run	Random No. (Cash Flow)	Random No. (Project Life)
1	53	97
2	66	99
3	30	81
4	19	09
5	31	67
6	81	70
7	38	75
8	48	83
9	90	33
10	58	52

Calculate the NPV for each Simulation run, Take 10% as the Discount Rate

Study Mat

Answer:

Correspondence between Values of Exogenous Variables and two Digit Random Numbers:

Value (₹)	Probability	Cumulative Probability	Two Digit Random No.	Value (Year)	Probability	Cumulative Probability	Two Digit Random No.
10,000	0.02	0.02	00-01	3	0.05	0.05	00-04
15,000	0.03	0.05	02-04	4	0.10	0.15	05-14
20,000	0.15	0.20	05-19	5	0.30	0.45	15-44
25,000	0.15	0.35	20-34	6	0.25	0.70	45-69
30,000	0.30	0.65	35-64	7	0.15	0.85	70-84
35,000	0.20	0.85	65-84	8	0.10	0.95	85-94
40,000	0.15	1.00	85-99	9	0.03	0.98	95-97
				10	0.02	1.00	98-99

$$NPV = (\text{Annual Cash Flow} \times PVAF) - \text{Initial Investment}$$

Run	Random No. (Cash Flow)	Corresponding Cash Flow (₹)	Random No. (Project Life)	Corresponding Project Life (Years)	PVAF @ 10%	PV of CIF	PV of COF	NPV (₹)
1	53	30,000	97	9	5.759	172770	130000	42,770
2	66	35,000	99	10	6.145	215075	130000	85,075
3	30	25,000	81	7	4.868	121700	130000	-8,300
4	19	20,000	9	4	3.17	63400	130000	-66,600
5	31	25,000	67	6	4.355	108875	130000	-21,125
6	81	35,000	70	7	4.868	170380	130000	40,380
7	38	30,000	75	7	4.868	146040	130000	16,040
8	48	30,000	83	7	4.868	146040	130000	16,040
9	90	40,000	33	5	3.791	151640	130000	21,640
10	58	30,000	52	6	4.355	130650	130000	650

Question 9

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:

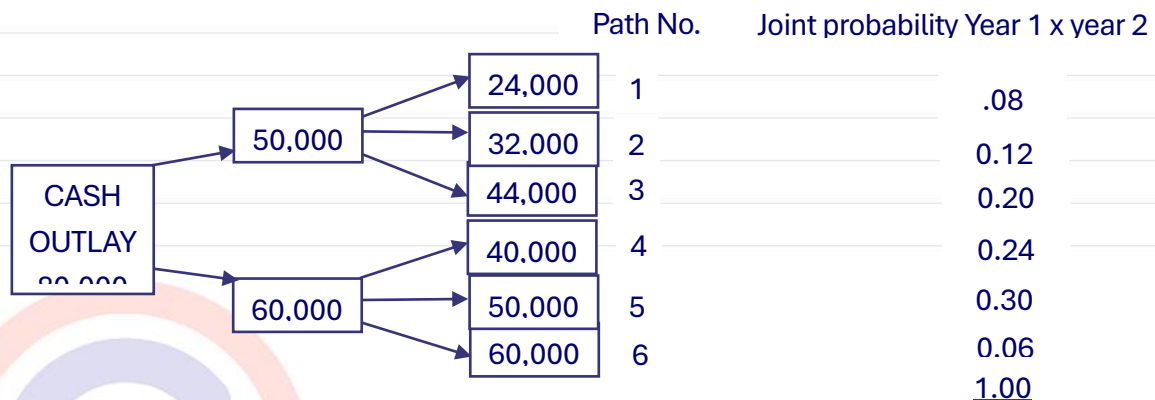
- ii. Construct a decision tree for the proposed investment project and calculate the expected net present value (NPV).
- iii. What net present value will the project yield, if worst outcome is realized? What is the probability of occurrence of this NPV?
- iv. What will be the best outcome and the probability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

(Note: 10% discount factor 1 year 0.909; 2 year 0.826)

StudyMat

Answer:

- (i) 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	$50,000 \times .909 = 45,450$	$24,000 \times .826 = 19,824$	65,274	80,000	(—) 14,726
2	45,450	$32,000 \times .826 = 26,432$	71,882	80,000	(—) 8,118
3	45,450	$44,000 \times .826 = 36,344$	81,794	80,000	1,794
4	$60,000 \times .909 = 54,540$	$40,000 \times .826 = 33,040$	87,580	80,000	7,580
5	54,540	$50,000 \times .826 = 41,300$	95,840	80,000	15,840
6	54,540	$60,000 \times .826 = 49,560$	1,04,100	80,000	24,100

Statement showing Expected Net Present Value ₹

z	NPV (₹)	Joint Probability	Expected NPV
1	—14,726	0.08	—1,178.08
2	—8,118	0.12	—974.16
3	1,794	0.20	358.80
4	7,580	0.24	1,819.20
5	15,840	0.30	4,752.00
6	24,100	0.06	1,446.00
			6,223.76

- (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 10

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:

	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:

	Plant A	Plant B
Running hours per annum	2500	2500
Costs		
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 Cost	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

May 2015 (7 Marks)

Answer:

Calculation of Equivalent Annual Cost

	Machine A	Machine B
Cash Outlay	₹24,00,000	₹40,00,000
Less: PV of Salvage Value		
$4,00,000 \times 0.1486$	₹59,440	
$4,00,000 \times 0.2394$		₹95,760
Annuity Factor	0.1175	0.1315
	₹2,75,016	₹5,13,408

Computation of Cost Per Unit

	Machine A	Machine B
Annual Output (a)	$2500 \times 60 \times 200$ = 3,00,00,000	$2500 \times 60 \times 400$ = 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	2,75,016	5,13,408
Total	12,35,016	17,13,408
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 11

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).

StudyMat

Answer:

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)	44,873
	1,34,873
Less: PV of salvage value at the end of 8 years (₹20,000 × 0.3269)	6,538
	1,28,335
Equivalent annual cost (EAC) (₹1,28,335/4.4873)	28,600

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	40,000
				11,400
Replace in one year	1	(28,600)	0.870	(24,882)
	1	(10,000)	0.870	(8,700)
	1	25,000	0.870	21,750

				(11,832)
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	11,340
				(34,102)
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	6,580
				(55,799)
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	(22,880)
				(82,799)

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	Cash Flow	PV @ 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 12

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.

May 24 (8 Marks), May 2012 (10 Marks), StudyMat

Answer:**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

Year	PVF@ 15%	1 Year		2 Years		3 Years		4 Years	
		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	$\frac{46,086}{0.8696}$	52,997
2 Years	$\frac{72,402}{1.6257}$	44,536
3 Years	$\frac{98,438}{2.2832}$	43,114
4 Years	$\frac{1,24,968}{2.855}$	43,772

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

Note: Alternatively, Answer can also be computed by excluding initial outflow as there will be no change in final decision

CHAPTER 4

SECURITY ANALYSIS

Question 1

The Closing values of NSE Nifty from 2nd January, 2024 to 11th January, 2024 were as follows:

Days	Date	Day	Nifty
1	2	TUE	21,742
2	3	WED	21,665
3	4	THU	21,517
4	5	FRI	21,462
5	6	SAT	No Trading
6	7	SUN	No Trading
7	8	MON	21,238
8	9	TUE	21,182
9	10	WED	20,997
10	11	THU	20,926
11	12	FRI	20,901

You are required to:

- Calculate Exponential Moving Average (EMA) of Nifty during the above period. The previous day exponential moving average of Nifty can be assumed as 21,500. The value of exponent for 31 days EMA is 0.062.
- Give brief analysis on the basis of your calculations.

May 24 (8 Marks)

Answer:

$$\text{EMA} = \text{Previous EMA} + [(\text{CP} - \text{Previous EMA}) \times e] \text{ or}$$

$$\text{EMA} = [\text{CP} \times e] + [\text{Previous EMA} \times (1 - e)]$$

	1	2	3	4	5
	Sensex	EMA for Previous Day	(1 – 2)	(3) × 0.062	EMA (2 + 4)
02/01/2024	21742	21500.00	242.00	15.00	21515.00
03/01/2024	21665	21515.00	150.00	9.30	21524.30
04/01/2024	21517	21524.30	-7.30	-0.45	21523.85
05/01/2024	21462	21523.85	-61.85	-3.83	21520.02
08/01/2024	21238	21520.02	-282.02	-17.49	21502.53
09/01/2024	21182	21502.53	-320.53	-19.87	21482.66
10/01/2024	20997	21482.66	-485.66	-30.11	21452.55
11/01/2024	20926	21452.55	-526.55	-32.65	21419.90
12/01/2024	20901	21419.90	-518.90	-32.17	21387.73

Question 2

The closing value of Sensex for the month of October, 2017 is given below:

Date	Closing Sensex Value
1.10.17	2800
3.10.17	2780
4.10.17	2795
5.10.17	2830
8.10.17	2760
9.10.17	2790
10.10.17	2880
11.10.17	2960
12.10.17	2990
15.10.17	3200
16.10.17	3300
17.10.17	3450
19.10.17	3360
22.10.17	3290
23.10.17	3360
24.10.17	3340
25.10.17	3290
29.10.17	3240
30.10.17	3140
31.10.17	3260

ANALYZE the weak form of efficient market hypothesis by applying the run test at 5% and 10% level of significance using 18 Degrees of Freedom.

Note: 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

MTP April 21 (12 Marks), Nov 08 (8 Marks), RTP Nov 23, RTP May 12, MTP Mar 16 (8 Marks), MTP Oct 18 (10 Marks), StudyMat

Answer:

Date	Closing Sensex	Sign of Price Charge
1.10.11	2800	
3.10.11	2780	-
4.10.11	2795	+
5.10.11	2830	+

7.10.11	2760	-
10.10.11	2790	+
11.10.11	2880	+
12.10.11	2960	+
13.10.11	2990	+
14.10.11	3200	+
17.10.11	3300	+
18.10.11	3450	+
19.10.11	3360	-
20.10.11	3290	-
21.10.11	3360	+
24.10.11	3340	-
25.10.11	3290	-
27.10.11	3240	-
28.10.11	3140	-
31.10.11	3260	+

Total of price changes (r) = 8

No. of Positive changes = $n_1 = 11$

No. of Negative changes = $n_2 = 08$

$$\begin{aligned}\mu_r &= \frac{2n_1n_2}{n_1+n_2} + 1 \\ &= \frac{2 \times 11 \times 8}{11+8} + 1 \\ &= 176/19 + 1 \\ &= 10.26\end{aligned}$$

$$\begin{aligned}\hat{\sigma}_r &= \sqrt{\frac{2n_1n_2(2n_1n_2-n_1-n_2)}{(n_1+n_2)^2(n_1+n_2-1)}} \hat{\sigma}_r \\ &= \sqrt{\frac{(2 \times 11 \times 8)(2 \times 11 \times 8 - 11 - 8)}{(11+8)^2(11+8-1)}} \\ &= \sqrt{\frac{176 \times 157}{(19)^2(18)}} \\ &= \sqrt{4.252} \\ &= 2.06\end{aligned}$$

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 the t-table.

The lower limit = $\mu - t \times \sigma_r = 10.26 - 2.101 \times 2.06 = 5.932$

Upper limit = $\mu + t \times \sigma_r = 10.26 + 2.101 \times 2.06 = 14.588$

At 10% level of significance at 18 degrees of freedom

Lower limit = $10.26 - 1.734 \times 2.06 = 6.688$

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

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.

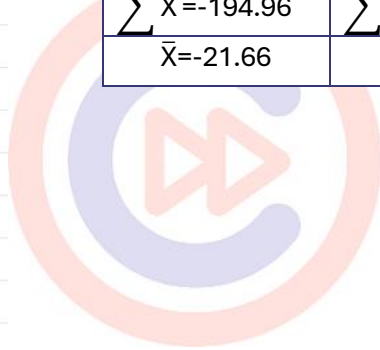
Jan 21 (8 Marks)

Answer:

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
$\sum X = -194.96$	$\sum Y = 68.08$	$\sum X^2 = 6848.66$	$\sum Y^2 = 6745.74$	$\sum XY = 164.68$
$\bar{X} = -21.66$	$\bar{Y} = 7.56$			



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

$$\begin{aligned} a &= \bar{Y} - b\bar{X} \\ &= 7.56 - 0.624(-21.66) \\ &= 21.08 \end{aligned}$$

$$\begin{aligned} r^2 &= \frac{a \sum Y + b \sum XY - n(\bar{Y})^2}{\sum Y^2 - n(\bar{Y})^2} \\ &= \frac{21.08(68.08) + 0.624(164.68) - 9(7.56)^2}{6745.74 - 9(7.56)^2} \\ r^2 &= 0.164 \end{aligned}$$

$$r = 0.405$$

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.

CHAPTER 5

SECURITY VALUATION

Question 1

The following information pertains to M/s XY Ltd.

Earnings of the Company	₹5,00,000
Dividend Payout ratio	60%
No. of shares outstanding	1,00,000
Equity capitalization rate	12%
Rate of return on investment	15%

- What would be the market value per share as per Walter's model?
- What is the optimum dividend payout ratio according to Walter's model and the market value of Company's share at that payout ratio?

RTP May 16

Answer:

(a) M/s XY Ltd.

(i) **Walter's model is given by**

$$P = \frac{D + (E - D)(r/k_e)}{k_e}$$

Where,

P = Market price per share

E = Earnings per share = ₹5

D = Dividend per share = ₹3

r = Return earned on investment = 15%

k_e Cost of equity capital = 12%

$$P = \frac{3 + (5-3) \times \frac{0.15}{0.12}}{0.12} = \frac{3 + 2 \times \frac{0.15}{0.12}}{0.12} = ₹45.83$$

- (ii) According to Walter's model when the return on investment is more than the cost of equity capital, the price per share increases as the dividend pay-out ratio decreases. Hence, the **optimum dividend pay-out ratio in this case is nil.**

So, at a pay-out ratio of zero, the market value of the company's share will be:

$$P = \frac{0 + (5-0) \times \frac{0.15}{0.12}}{0.12} = ₹52.08$$

Question 2

Given the following information:

Current Dividend (Do)	₹5.00
Discount Rate (k)	10.5%
Growth rate (g)	4%

- (i) Calculate the present value of the stock of ABC Ltd.
 (ii) Evaluate whether the stock is overvalued if stock price is ₹70, ROE = 18% and EPS (E0) = ₹4.50 applying:
 a. PE Multiple approach and
 b. Earnings Growth model. (using discount rate of 10.5%).

Jan 21 (8 Marks), Nov 12 (8 Marks), MTP Mar 24 (8 Marks), MTP March 15 (5 Marks), Study Mat

Answer:

(i) **Present Value of the stock:-** $V_0 = \frac{5.00(1.04)}{0.105-0.04} = ₹80$

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

Particulars	
Actual Stock Price	₹70.00
Return on equity	18%
EPS	₹4.50
PE Multiple (1/Return on Equity) = 1/18%	5.56
Market Price per Share	₹25.02

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

Value of the Stock under the Earnings Growth Model

Particulars	
Actual Stock Price	₹70.00
Return on equity	18%

EPS	₹4.50
Growth Rate	4%
Market Price per Share $[EPS \times (1+g)] / (K_e - g)$ = $₹4.50 \times 1.04 / (0.105 - 0.04)$	₹72.00

Since, Actual Stock Price is lower, hence it is **undervalued**.

Question 3

Following financial information's are available of XP Ltd. for the year 2018:

Equity Share Capital (₹10 each)	₹200 Lakh
Reserves and Surplus	₹600 Lakh
10% Debentures (₹100 each)	₹350 Lakh
Total Assets	₹1200 Lakh
Assets Turnover Ratio	2 times
Tax Rate	30%
Operating Margin	10%
Dividend Payout Ratio	20%
Current Market Price per Equity Share	₹28
Required Rate of Return of Investors	18%

You are required to:

- Prepare Income Statement for the year 2018.
- Determine its Sustainable Growth Rate.
- Determine the fair price of the company's share using Dividend Discount Model.
- Give your opinion on investment in the company's share at current price.

July 21 (8 Marks), June 09 (6 Marks), Nov 12 (8 Marks), May 19 (8 Marks), RTP May 16, RTP Nov 11, RTP May 20, MTP March 16 (8 Marks), MTP Feb 16 (8 Marks)

Answer:

Workings:

Asset turnover ratio	= 2 times
Total Assets	= ₹1200 lakh
Turnover ₹1200 lakhs × 2	= ₹2400 lakhs
Interest on Debentures	= 350 lakh × 10% = 35 lakhs
Operating Margin	= 10%
Hence operating cost	= (1 - 0.10) 2400 lakhs = ₹2160 lakhs
Dividend Payout	= 20%
Tax rate	= 30%

(i) Income statement

	(₹Lakhs)
Sale	2400
Operating Exp	2160
EBIT	240
Interest	35
EBT	205
Tax @ 30%	61.5
EAT	143.5
Dividend @ 20%	28.7
Retained Earnings	114.8

(ii)

Net Worth	= ₹200 lakh + ₹600 lakhs = ₹800 lakhs
ROE	$= \frac{PAT}{NW} = \frac{₹143.5 \text{ lakhs}}{₹800 \text{ lakhs}} \times 100 = 17.94\%$
SGR	$= ROE (1 - b)$ = Return on Equity (1 - Dividend Pay-out Ratio) $= 0.1794(1 - 0.20) = 14.35\%$

(iii) Calculation of fair price of share using dividend discount model

Dividend	$= \frac{₹28.7 \text{ lakhs}}{20 \text{ lakhs}} = ₹1.435$
Growth Rate	= 14.35%
Hence P_0	$P_0 = \frac{D_0(1+g)}{k_e - g} = \frac{₹1.435(1+0.1435)}{0.18-0.1435} = \frac{₹1.64}{0.0365} = ₹44.93$

(iv) Since the current market price of share is ₹28, the share is **undervalued**. Hence, the investor should invest in the company.

Question 4

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.

Nov 20 (8 Marks)

Answer:

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
Equity Multiplier	$\frac{\text{Equity}}{\text{Equity} + \text{Debt}} = \frac{12 \text{ Lakhs}}{12 \text{ Lakhs} + 8 \text{ Lakhs}}$	0.6
ROE	$\frac{1.20 \text{ Lakhs}}{19.50 \text{ Lakhs}} \times 0.60 \times 100$	3.69%

Sustainable Growth Rate = ROE × Retention Ratio = 3.69% × 0.75 = **2.77%**

Sustainable Growth Rate under Proposal 2

New Equity = ₹12 Lakhs + ₹1 Lakh = ₹13 Lakhs

New Debt = ₹13 Lakhs × 4 = ₹52 Lakhs

Total Assets = ₹13 Lakhs + ₹52 Lakhs = ₹65 Lakhs

Target Assets to Sales Ratio (Given)		0.62
Sales	₹65 Lakhs / 0.62	₹104.84 Lakhs
Net Profit	₹104.84 Lakhs × 5%	₹5.242 Lakhs
Equity Multiplier	$\frac{\text{Equity}}{\text{Equity} + \text{Debt}} = \frac{13 \text{ Lakhs}}{13 \text{ Lakhs} + 52 \text{ Lakhs}}$	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

Sustainable Growth Rate = ROE × Retention Ratio = 1.613% × 0.943 = **1.52%**

Question 5

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

X Ltd. has hired Swastika consultants to analyse the future earnings. The report of Swastika consultants states as follows:

- The earnings and dividend will grow at 25% for the next two years.
- Earnings are likely to grow at the rate of 10% from 3rd year and onwards.
- Further, if there is reduction in earnings growth, dividend payout ratio will increase to 50%.

The other data related to the company are as follows:

Year	EPS (₹)	Net Dividend per share (₹)	Share Price (₹)
2010	6.30	2.52	63.00
2011	7.00	2.80	46.00
2012	7.70	3.08	63.75
2013	8.40	3.36	68.75
2014	9.60	3.84	93.00

You may assume that the tax rate is 30% (not expected to change in future) and post-tax cost of capital is 15%.

By using the Dividend Valuation Model, calculate

- Expected Market Price per share
- P/E Ratio.

Nov 15 (6 Marks), MTP Mar 17 (8 Marks), MTP Oct 19 (8 Marks), RTP May 19, RTP May 20

Answer:

- The formula for the **Dividend valuation Model** is $P_0 = \frac{D_1}{K_e - g}$

K_e = Cost of Capital

g = Growth rate

D_1 = Dividend at the end of year 1

On the basis of the information given, the following projection can be made:

Year	EPS (₹)	DPS (₹)	PVF @15%	PV of DPS (₹)
2015	12 (9.60 × 125%)	4.8 (3.84 × 125%)	0.870	4.176
2016	15 (12.00 × 125%)	6 (4.80 × 125%)	0.756	4.536
2017	16.5 (15.00 × 110%)	8.25* (50% of ₹ 16.50)	0.658	5.429
				14.141

*Payout Ratio changed to 50%.

After 2017, the perpetuity value assuming 10% constant annual growth is:

$$D_1 = ₹8.25 \times 110\% = ₹9.075$$

$$\text{Therefore, } P_0 \text{ from the end of 2017} = \frac{₹9.075}{0.15 - 0.10} = ₹181.50$$

This must be discounted back to the present value, using the 3 year discount factor after 15%.

Present Value of P_0 (₹181.50 × 0.658)	119.43
Add: PV of Dividends 2015 to 2017	14.14
Expected Market Price of Share	133.57

(b) P/E Ratio

$$\text{P/E Ratio} = \frac{\text{Expected Market Price of Share}(P_1)}{\text{EPS}} = \frac{₹133.57}{₹9.60} = 13.91$$

Question 6

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

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

You are required:

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

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

May 23 (8 Marks)

Answer:**(i) Working Notes:**

$$D_1 = ₹6$$

$$D_2 = 6 (1.20) = ₹7.20$$

$$D_3 = 6 (1.20)^2 = ₹8.64$$

$$D_4 = 6 (1.20)^3 = ₹10.37$$

$$D_5 = 10.37(1.19) = ₹12.34$$

$$D_6 = 10.37 (1.19) (1.18) = ₹14.56$$

$$D_7 = 10.37 (1.19) (1.18) (1.17) = ₹17.04$$

Price at the end of 7th year

Year	Dividend (₹)	PVF@20%	PV (₹)
1	6.00	0.8333	5.00
2	7.20	0.6944	5.00
3	8.64	0.5787	5.00
4	10.37	0.4823	5.00
5	12.34	0.4019	4.96
6	14.56	0.3349	4.88
7	17.04	0.2791	4.76
Total			34.60

Current Market Price	₹172.45
Less: PV of Dividends upto the year ending 7 th year	₹34.60
PV of Expected Market Price at the end of 7 th year	₹137.85

$$\text{Let } g \text{ be growth rate then: } 137.85 = \frac{17.04 (1 + g)}{0.20 - g} \times 0.2791$$

$$g = 0.16 \text{ i.e. } 16\%$$

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

(ii) Since growth rate is more than target growth rate it is worth to purchase the share.

Question 7

The current EPS of M/s VEE Ltd. is ₹4. The company has shown an extraordinary growth of 40% in its earnings in the last few year. This high growth rate is likely to continue for the next 5 years after which growth rate in earnings will decline from 40% to 10% during the next 5 years and remain stable at 10% thereafter. The decline in the growth rate during the five year transition period will be equal and linear. Currently, the company's pay-out ratio is 10%. It is likely to remain the same for the next five years and from the beginning of the sixth year till the end of the 10th year, the pay-out will linearly increase and stabilize at 50% at the end of the 10th year. The post tax cost of capital is 17% and the PV factors are given below:

Years	1	2	3	4	5	6	7	8	9	10
PVIF @17%	0.855	0.731	0.625	0.534	0.456	0.390	0.333	0.285	0.244	0.209

You are required to calculate the intrinsic value of the company's stock based on expected dividend. If the current market price of the stock is ₹125, suggest if it is advisable for the investor to invest in the company's stock or not.

Nov 19 (8 Marks)

Answer: Working Notes:

(i) Computation of Growth Rate in Earning and EPS

Years	1	2	3	4	5	6	7	8	9	10
Growth in Earning	40%	40%	40%	40%	40%	34%	28%	22%	16%	10%
EPS (₹)	5.60	7.84	10.98	15.37	21.51	28.82	36.89	45.00	52.20	57.42

(ii) Computation of Payout Ratio and Dividend

Years	1	2	3	4	5	6	7	8	9	10
Payout Ratio	10%	10%	10%	10%	10%	18%	26%	34%	42%	50%
Dividend (₹)	0.56	0.78	1.10	1.54	2.15	5.19	9.59	15.30	21.92	28.71

(iii) Calculation of PV of Dividend

Year	Dividend (₹)	PVF	PV of Dividend (₹)
1	0.56	0.855	0.48
2	0.78	0.731	0.57
3	1.10	0.625	0.69
4	1.54	0.534	0.82
5	2.15	0.456	0.98
6	5.19	0.390	2.02
7	9.59	0.333	3.19
8	15.30	0.285	4.36

9	21.92	0.244	5.35
10	28.71	0.209	6.00
			24.46

$$TV = \frac{28.71(1.10)}{0.17-0.10} \times 0.209 = ₹94.29 \text{ Intrinsic Value} = ₹24.46 + ₹94.29 = ₹118.75$$

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

Question 8

SAM Ltd. has just paid a dividend of ₹2 per share and it is expected to grow @ 6% p.a. After paying dividend, the Board declared to take up a project by retaining the next three annual dividends. It is expected that this project is of same risk as the existing projects. The results of this project will start coming from the 4th year onward from now. The dividends will then be ₹2.50 per share and will grow @ 7% p.a.

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

Required:

- EVALUATE whether the market value of the share is affected by the decision of the Board.
- RECOMMEND how the investor can maintain his target receipt from the investment for first 3 years and improved income thereafter, given that the cost of capital of the firm is 8%.

RTP May 18, MTP March 22 (6 Marks), MTP Mar 18 (7 Marks), MTP Oct 20 (8 Marks), StudyMat

Answer:

(i)

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

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

(ii) In order to maintain his receipt at ₹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.

Thus, 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 9

Mr. X wants to buy shares of A Ltd. (having a Beta of 2) at the current market price of ₹500 each, with a face value of ₹100. He is expecting a bonus at the ratio of 1:4 during the fifth year. The annual expected dividend is 20%, and the same rate is expected to be maintained throughout the holding period. He intends to sell the shares at the end of the 7th year and expects that the market price shall be doubled during this holding period. Incidental expenses for the purchase of shares are estimated to be 5% of the market price. The risk-free rate of return and market rate of return are 5% and 7.50%, respectively.

Objective: Advise Mr. X on whether he should buy this share or not. If so, then recommend the maximum price he should pay for each share.

Note: Assume no tax on dividend income and capital gains. MTP Nov 22 (8 Marks), MTP Apr 19 (6 Marks)

Answer:

1. Calculate the Required Rate of Return using CAPM:

Required Rate of Return(R)

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

$$=0.05 + 2 \times (0.075 - 0.05)$$

$$=0.10 \text{ or } 10\%$$

2. Calculate the Present Value of Expected Cash Flows:

Year	Cash Flow (₹)	Present Value Factor (10%)	Present Value (₹)
1	20	0.909	18.18
2	20	0.826	16.52
3	20	0.751	15.02
4	20	0.683	13.66
5	25	0.621	15.53
6	25	0.564	14.10
7	25	0.513	12.83
7	1000 x 1.25 = 1250	0.513	641.25
Total Present Value (₹)			747.09
Less: Cost of shares 500 x 1.05			525
Net Gain			222.09

3. Compare the Present Value to the Current Market Price:

Parameter	Value (₹)
Present Value of Expected Cash Flows	619.05
Current Market Price	500
Incidental Expenses (5%)	25
Maximum Price to Pay	594.05

Since Mr. X is gaining ₹222.09 per share, he should buy the share.

Maximum price Mr. A should be ready to pay is ₹747.09.

Question 10

Lockheed Martin (LM) the aerospace and defense conglomerate, has a stellar dividend history, with steadily increasing quarterly payments since 1995. In recent years, however, the rate of dividend growth has declined from a solid 15.6% in 2014 to 10% in 2016. Of course, the 2016 fiscal year has just begun as of this writing, but the total dividend can be extrapolated from the first quarter dividend of \$1.65 per share and the company's history of consistent quarterly payments.

Based on this steady rate of decline, it can be assumed that dividend growth will again decrease by 2.8% in 2017 and then stabilize at a healthy 7.2% thereafter. This example will use LMT's actual dividend performance for 2013 through 2016, along with a projected decline and stabilization in 2017, to produce a value estimate for the stock in 2013 using the H model dividend discount calculation. For the purposes of this example, a 10% expected rate of return is used. The number of years over which the growth rate will transition is four. Calculate the value estimate using the 2013 dividend payment of \$4.60.

Answer:

Value of stock using H Model

$$\begin{aligned}
 MP &= \frac{D_0(1+g_n)}{K_e - g_n} + \frac{D_0 \times H \times (g_c - g_n)}{K_e - g_n} \\
 &= \frac{4.6(1.072)}{0.10 - 0.072} + \frac{4.60 \times 2 \times (0.1560 - 0.072)}{0.10 - 0.072} \\
 &= 176.11 + 27.60 \\
 &= \text{\$203.71}
 \end{aligned}$$

Question 11

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

- CALCULATE the firm's expected or required return on equity using a dividend- discount model approach if this dividend were expected to grow at a rate of 12% per annum forever.
- CALCULATE the firm's expected, or required, return on equity if 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.

RTP Nov 18 StudyMat

Answer:

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

According to Dividend discount model approach the firm's expected or required return on equity is computed as follows:

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

Where,

K_e = Cost of equity share capital or (Firm's expected or required return on equity share capital)

D_1 = Expected dividend at the end of year 1

P_0 = Current market price of the share.

g = Expected growth rate of dividend.

Now, $D_1 = D_0 (1 + g)$ or ₹1 (1 + 0.12) or ₹1.12, $P_0 = ₹20$ and $g = 12\%$ per annum

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

$$\text{Or, } K_e = ₹17.6\%$$

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

(If dividends were expected to grow at a rate of 20% per annum for 5 years and 10% per year thereafter)

Since in this situation if dividends are expected to grow at a super normal growth rate g_s , for n years and thereafter, at a normal, perpetual growth rate of g_n beginning in the year $n + 1$, then the cost of equity can be determined by using the following formula:

$$P_0 = \sum_{t=1}^n \frac{\text{Div}_0(1+g_s)^t}{(1+K_e)^t} + \frac{\text{Div}_{n+1}}{K_e - g_n} \times \frac{1}{(1+K_e)^n}$$

Where,

g_s = Rate of growth in earlier years.

g_n = Rate of constant growth in later years.

P_0 = Discounted value of dividend stream.

K_e = Firm's expected, required return on equity (cost of equity capital).

Now,

$g_s = 20\%$ for 5 years, $g_n = 10\%$

Therefore,

$$P_0 = \sum_{t=1}^n \frac{D_0(1+0.20)^t}{(1+K_e)^t} + \frac{\text{Div}_{5+1}}{K_e - 0.10} \times \frac{1}{(1+K_e)^n}$$

$$0 = \frac{1.20}{(1+K_e)^1} + \frac{1.44}{(1+K_e)^2} + \frac{1.73}{(1+K_e)^3} + \frac{2.07}{(1+K_e)^4} + \frac{2.49}{(1+K_e)^5} + \frac{2.49(1+0.10)}{-0.10} \times \frac{1}{(1+K_e)^5}$$

Or

$$P_0 = ₹1.20 (\text{PVF}_1, K_e) + ₹1.44 (\text{PVF}_2, K_e) + ₹1.73 (\text{PVF}_3, K_e) + ₹2.07 (\text{PVF}_4, K_e) + ₹2.49 (\text{PVF}_5, K_e) + \frac{₹2.74 (\text{PVF}_5, K_e)}{K_e - 0.10}$$

By trial and error, we are required to find out K_e

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

$$P_0 = ₹1.20(0.8475) + ₹1.44(0.7182) + ₹1.73(0.6086) + ₹2.07(0.5158) + ₹2.49(0.4371) + ₹2.74(0.4371) \times \frac{1}{0.18 - 0.10}$$

$$= ₹1.017 + ₹1.034 + ₹1.053 + ₹1.068 + ₹1.09 + ₹14.97$$

$$= ₹20.23$$

Since the 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

$$P_0 = ₹1.20(0.8403) + ₹1.44(0.7061) + ₹1.73(0.5934) + ₹2.07(0.4986)$$

$$+ ₹2.49(0.4190) + ₹2.74(0.4190) \times \frac{1}{0.19-0.10}$$

$$= ₹1.008 + ₹1.017 + ₹1.026 + ₹1.032 + ₹1.043 + ₹12.76$$

$$= ₹17.89$$

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:

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

Where,

LR = Lower Rate

NPV at LR = Present value of share at LR

NPV at HR = Present value of share at Higher Rate

Δr = Difference in rates

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

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 12

Consider the data given below and calculate the FCFE and FCFF.

Balance Sheet		
Assets	2016	2015
Cash	30	15
Accounts Receivables	90	45
Inventory	120	90
Current Assets	240	150
Gross PPE	1200	900
Accumulated Depreciation	570	420
Total Assets	870	630
Liabilities	2016	2015
Accounts Payable	60	60
Short Term Debt	60	30
Current Liabilities	120	90

Long term Debt	342	300
Common Stock	150	150
Retained Earnings	258	90
Total Liabilities and Equities	870	630

Income Statement		
	2016	2015
Sales	900	750
COGS	360	300
Gross Profit	540	450
Selling and Admin. Exp.	105	90
EBITDA	435	360
Depreciation	150	120
EBIT	285	240
Interest Expense	45	30
EBT	240	210
Tax (30%)	72	63
Net Income	168	147

Answer:

a) FCFE

$$\begin{aligned}
 \text{FCFE} &= \text{PAT} + \text{Depreciation} - \Delta \text{CAPEX} - \Delta \text{WC} - \text{Repayment of Debt} + \text{New debt issued} \\
 &= 168 + 150 - 300 - 75 - 0 + 72 \\
 &= ₹15 \text{ Lakhs}
 \end{aligned}$$

1. CAPEX = 300

Fixed Assets			
Opening	900		
CAPEX	300		
		Closing	1200
	1200		1200

Accumulated Depreciation			
		Opening	420
		P & L	150
Closing	570		
	570		570

2. ΔWC

$$\begin{aligned}\text{Non Cash WC (2016)} &= \text{Non Cash CA} - \text{Non Cash CL} \\ &= (240 - 30) - (120 - 60) \\ &= 210 - 60 = 150\end{aligned}$$

$$\begin{aligned}\text{Non Cash WC (2015)} &= (150 - 15) - (90 - 30) \\ &= 135 - 60 \\ &= 75\end{aligned}$$

$$\Delta WC = 150 - 75 = 75$$

3. New Fund Issued

Short Term Debt	60 - 30	= 30
Long Term Debt	342 - 300	= 42
	New Debt	= 72

a) FCFF

$$\begin{aligned}\text{FCFF} &= \text{EBIT} (1 - \text{tax}) + \text{Depreciation} - \Delta \text{CAPEX} - \Delta \text{WC} \\ &= 285 (1 - 0.30) + 150 - 300 - 75 + 30 \\ &= 199.50 + 150 - 300 - 75 + 30 \\ &= -25.50 + 30 \\ &= 4.50\end{aligned}$$

Question 13

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

You being an expert is required to evaluate the market value of the share of the company.

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

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

June 09 (6 Marks), RTP May 24, MTP Feb 15 (6 Marks), MTP Oct 15 (5 Marks), MTP April 19 (5 Marks), MTP Aug 18 (4 Marks), RTP Nov 13, RTP Nov 14, RTP May 20 RTP Nov 19, StudyMat

Answer:

No. of Shares = (₹1300 crores)/(₹40) = 32.5 crores

$$\text{EPS} = \frac{\text{PAT}}{\text{No. of Shares}} = \frac{₹290 \text{ crores}}{32.5 \text{ crores}} = ₹8.923$$

FCFE = Net income – [(1-b) (capex – dep) + (1-b) (ΔWC)]

$$= 8.923 - [(1-0.27) (47-39) + (1-0.27) (3.45)]$$

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

$$= 0.5645$$

Cost of Equity = $R_f + \beta (R_m - R_f)$ = 8.7 + 0.1 (10.3 – 8.7) = 8.86%

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

Calculation of value per share using dividend discount model:

$$P_o = \frac{D_o (1+g)}{K_e - g} = \frac{2(1.08)}{0.0886 - 0.08} = \frac{2.16}{0.0086} = ₹251.16$$

- From the above we can see that the value per share on the basis of the dividend discount model is more than the value per share on the basis of the free cash flow to equity model.
- In the dividend discount model, the analyst considers the stream of expected dividends to value the company's stock. It is assumed that the company follows a consistent dividend payout ratio, which can be less than the actual cash available with the firm.
- A stock's intrinsic value based on the dividend discount model may not represent the fair value for the shareholders because dividends are distributed in the form of cash from profits. In case the company is maintaining healthy cash in its balance sheet, it means that the dividend payout is low, which could result in undervaluation of the stock.
- In the case of the free cash flow to equity model, a stock is valued on the cash flow available for distribution after all the reinvestment needs of capex and incremental working capital are met. Thus, using the free cash flow to equity model provides a better measure for valuations in comparison to the dividend discount model.
- Thus, the view of Mr. Amit that the dividend discount model represents the fair value is incorrect. The share is not undervalued; rather, it is overvalued if we take the "free cash flow to equity model" into consideration.

Question 14

Jorge Zaldys, CFA, is researching the relative valuation of two companies in the aerospace/defense industry, NCI Heavy Industries (NCI) and Relay Group International (RGI). He has gathered relevant information on the companies in the following table

Company	RGI	NCI
Price per share	150	100
Shares Outstanding	5 Million	2 Million

Market Value of the debt	50	100
Book Value of debt	52	112
Cash and Investment	5	2
Net Income	49.5	12
Net Income from continuing operations	49.5	8
Interest Expense	3	5
Depreciation and Amortization	8	4
Taxes	2	3

Using the information in the table, answer the following questions:

- Calculate P/EBITDA for NCI and RGI.
- Calculate EV/EBITDA for NCI and RGI.
- Which company should Zaldys recommend as relatively undervalued? Justify the selection

Answer:

Enterprise Value = Market Value of Equity + Market Value of Debt – Cash & Cash Equivalents

$$EV_{NCI} = 100 \times 2 + 100 - 2 = 298$$

$$EV_{RGI} = 150 \times 5 + 50 - 5 = 795$$

EBITDA = Net Income from continuing operations + Tax + Interest + D & A

$$EBITDA_{NCI} = 8 + 3 + 5 + 4 = 20$$

$$EBITDA_{RGI} = 49.50 + 2 + 3 + 8 = 62.50$$

	RGI	NCI
a) Price / EBITDA per share (It means it costs 12 & 10 respectively for ₹1 income)	$= \frac{150}{\frac{62.50}{5}}$	$= \frac{100}{\frac{20}{2}}$
	$= \frac{150}{12.50}$	$= \frac{100}{10}$
	= 12	= 10
b) EV/EBITDA (it means it costs 12.72 & 14.90 respectively for ₹1 income)	$= \frac{795}{62.50}$	$= \frac{298}{20}$
	= 12.72	= 14.90

- a) Whether the multiple is P/EBITDA or EV/EBITDA, a low multiple is always preferred over high multiple.

According to P/EBITDA, NCI is recommended

But According to EV/EBITDA, RGI is recommended

When there is a conflict in decision due to different multiple, EV/EBITDA multiple should be preferred as it gives proper picture of fair value of company, whereas P/EBITDA ignores Debt & Cash balance with company.

∴ RGI is undervalued & Recommended for investment purpose

Question 15

Pragya Limited has issued 75,000 equity shares of ₹10 each. The current market price per share is ₹24. The company has a plan to make a rights issue of one new equity share at a price of ₹16 for every four share held.

You are required to:

- Calculate the theoretical post-rights price per share;
- Calculate the theoretical value of the right alone;
- Show the effect of the rights issue on the wealth of a shareholder, who has 1,000 shares assuming he sells the entire rights; and
- Show the effect, if the same shareholder does not take any action and ignores the issue.

Nov 23 (8 Marks), RTP May 13, RTP Nov 14, RTP Nov 18, MTP April 14 (5 Marks)

Answer:

- (i) **Calculation of theoretical Post-rights (ex-right) price per share:**

$$\text{Ex-right value} = \left[\frac{MN+SR}{N+R} \right]$$

Where,

M = Market price, N = Number of old shares for a right share

S = Subscription price, R = Right share offer

$$= \left[\frac{(\text{₹}24 \times 4) + (\text{₹}16 \times 1)}{4+1} \right] = \text{₹}22.40$$

- (ii) **Calculation of theoretical value of the rights alone:**

= Ex-right price – Cost of rights share

$$= \text{₹}22.40 - \text{₹}16 = \text{₹}6.40$$

Or

$$= \frac{\text{₹}22.40 - \text{₹}16}{4} = \text{₹}1.60$$

- (iii) **Calculation of effect of the rights issue on the wealth of a shareholder who has 1,000 shares assuming he sells the entire rights:**

		₹
(a)	Value of shares before right issue (1,000 shares × ₹24)	24,000
(b)	Value of shares after right issue (1,000 shares × ₹22.40)	22,400
	Add: Sale proceeds of rights renunciation (250 shares × ₹6.40)	1,600
		24,000

There is **no change** in the wealth of the shareholder even if he sells his right.

(iv) Calculation of effect if the shareholder does not take any action and ignores the issue:

	₹
Value of shares before right issue (1,000 shares × ₹24)	24,000
Less: Value of shares after right issue (1,000 shares × ₹22.40)	22,400
Loss of wealth to shareholders, if rights ignored	1,600

Question 16

The stock of the Soni plc is selling for £50 per common stock. The company then issues rights to subscribe to one new share at £40 for each five rights held.

- What is the theoretical value of a right when the stock is selling rights-on?
- What is the theoretical value of one share of stock when it goes ex-rights?
- What is the theoretical value of a right when the stock sells ex-rights at £50?
- John Speculator has £1,000 at the time Soni plc goes ex-rights at £50 per common stock. He feels that the price of the stock will rise to £60 by the time the rights expire. Compute his return on his £1,000 if he (1) buys Soni plc stock at £50, or (2) buys the rights at the price computed in part c, assuming his price expectations are valid.

Answer:

a) Value of Right = $P_0 - P_1 = 50 - 48.33 = \text{£}1.67$

b)

$$\text{Ex Right Price } (P_1) = \frac{nP_0 + n_1s}{n + n_1} = \frac{250 + 40}{5 + 1} = \text{£}48.33$$

c)

$$V = \frac{P_0 - S}{N} = \frac{50 - 40}{5} = \text{£}2$$

d)

$$\text{Buy Stock @£50} = \frac{\text{£}1000}{50} = 20 \text{ Stock}$$

$$\text{Sell Stock @£60} \times 20 = \text{£}1200 \text{ Stock}$$

$$\text{Profit } (1200 - 1000) = \text{£}200$$

$$\text{No. of rights purchased} = \frac{\text{£}1000}{2} = 500 \text{ Rights}$$

When the stock is £50 one could purchase the same at £40 if he has rights, the value of which is £2. This will give the benefit of £10 pounds in the price of the stock. But when the price of the share goes to £60. The rights becomes more attractive because one can still purchase the share under right at £40 which is worth £60 and save £20; this will result into higher demand of rights and accordingly the value of rights will increase.

$$V = \frac{P_0 - S}{N} = \frac{60 - 40}{5} = \frac{20}{5} = 4$$

John will sell rights purchased at £2 for £4 when the share price goes 60. Hence he makes profit of £2 on each right. Thus total profit = $500 \times 2 = \text{£}1000$

Question 17

Following information is available in respect of a bond

Face value	₹1000
Coupon Rate	8%
Time to Maturity	10 years
Market Price	₹1140
Callable in 6 years	₹1100

Find out the YTM and YTC of the bond?

Answer:

a)

$$YTM = \frac{C + \frac{R_u - M_p}{n}}{\frac{R_u + M_p}{2}}$$

$$= \frac{80 + \frac{1000 - 1140}{10}}{\frac{1000 + 1140}{2}}$$

$$= \frac{80 - 14}{1070}$$

$$YTM = 6.17\% \text{ p.a.}$$

MP (1140) > FU (1000), YTM (6.17%) < CR (8%)

b)

$$YTC = \frac{C + \frac{R_u - M_p}{n}}{\frac{R_u + M_p}{2}}$$

$$= \frac{80 + \frac{1100 - 1140}{6}}{\frac{1100 + 1140}{2}}$$

$$= \frac{80 - 6.667}{1120}$$

$$YTC = 6.55\% \text{ p.a.}$$

Question 18

Mr. X wants to invest ₹1,00,000 in the 7 years 8% bonds in the market (Face Value ₹100) which were issued 2 years ago.

- i. You are requested to advise him what is the maximum price for bonds to be paid in the following scenarios:
- (1) If Mr. X is expecting minimum 9% return on the bonds
 - (2) If Mr. X is expecting minimum 7% return on the bonds

- (3) If the present rate of similar bonds issued is 8.25%
- (4) If the present rate of similar bonds issued is 7.75%
- ii. If the bonds are available at par and 1% is the transaction cost, what is the effective yield?
- iii. Find the number of days required to breakeven transaction cost if the bonds are available at par and 2% is the transaction cost.

Nov 22 (8 Marks)

Answer:

- i. The maximum price to be paid for Bond

(1) To have a return of 9% return on Bond.

$$₹100 \times \frac{8}{9} = ₹88.89$$

Alternative Answer

$$= \frac{8}{(1.09)^1} + \frac{8}{(1.09)^2} + \frac{8}{(1.09)^3} + \frac{8}{(1.09)^4} + \frac{8}{(1.09)^5}$$

$$= ₹7.34 + ₹6.73 + ₹6.18 + ₹5.67 + ₹70.19 = ₹96.11$$

(2) To have a return of 7% return on Bond.

$$₹100 \times \frac{8}{7} = ₹114.29$$

Alternative Answer

$$= \frac{8}{(1.07)^1} + \frac{8}{(1.07)^2} + \frac{8}{(1.07)^3} + \frac{8}{(1.07)^4} + \frac{8}{(1.07)^5}$$

$$= ₹7.48 + ₹6.99 + ₹6.53 + ₹6.10 + ₹77.00 = ₹104.10$$

(3) If present rate of similar bond issued is 8.25%

$$= \frac{8}{(1.0825)^1} + \frac{8}{(1.0825)^2} + \frac{8}{(1.0825)^3} + \frac{8}{(1.0825)^4} + \frac{8}{(1.0825)^5}$$

$$= ₹7.39 + ₹6.83 + ₹6.31 + ₹5.83 + ₹72.66 = ₹99.02$$

Alternative Answer

$$₹100 \times \frac{8}{8.25} = ₹96.97$$

(4) If present rate of similar bond issued is 7.75%

$$= \frac{8}{(1.0775)^1} + \frac{8}{(1.0775)^2} + \frac{8}{(1.0775)^3} + \frac{8}{(1.0775)^4} + \frac{8}{(1.0775)^5}$$

$$= ₹7.42 + ₹6.89 + ₹6.39 + ₹5.94 + ₹74.36 = ₹101.00$$

Alternative Answer

$$₹100 \times \frac{8}{7.75} = ₹103.23$$

- ii. Effective yield if transaction cost is 1% = $\frac{8}{101} \times 100 = 7.92$

- iii. No. of Days required for break even

$$= \frac{2\% \times 1,00,000}{1,00,000 \times \frac{8\%}{360}} = \frac{2,000}{22.22} = 90 \text{ days}$$

Alternatively, if 365 days used in Calculation then answer will be as follows:

$$= \frac{2\% \times 1,00,000}{1,00,000 \times \frac{8\%}{360}} = \frac{2,000}{21.92} = 91.24 \text{ days say 91 days}$$

Question 19

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.

Nov 13 (5 Marks), Nov 18 (5 Marks), MTP Apr 18 (5 Marks), MTP May 20 (8 Marks)

Answer:**(i) Intrinsic value of Bond**

PV of Interest + PV of Maturity Value of Bond

Forward rate of interests

1 st Year	12%
2 nd Year	11.25%
3 rd Year	10.75%

$$\text{PV of interest} = \frac{₹90}{(1+0.12)} + \frac{₹90}{(1+0.12)(1+0.1125)} + \frac{₹90}{(1+0.12)(1+0.1125)(1+0.1075)} = ₹217.81$$

$$\text{PV of Maturity Value of Bond} = \frac{₹1000}{(1+0.12)(1+0.1125)(1+0.1075)} = ₹724.67$$

$$\text{Intrinsic value of Bond} = ₹217.81 + ₹724.67 = ₹942.48$$

$$\text{(ii) Expected Price} = \text{Intrinsic Value} \times \text{Beta Value} = ₹942.48 \times 1.02 = ₹961.33$$

Question 20

ABC Ltd. wants to issue 9% Bonds redeemable in 5 years at its face value of ₹1,000 each. The annual spot yield curve for similar risk class of Bond is as follows:

Year	Interest Rate
1	12%
2	11.62%
3	11.33%
4	11.06%
5	10.80%

- (i) Evaluate the expected market price of the Bond if it has a Beta value of 1.10 due to its popularity because of lesser risk.

(ii) Interpret the nature of the above yield curve and reasons for the same.

Note: Use PV Factors upto 4 decimal points and value in Rs. upto 2 decimal points.

MTP April 21 (8 Marks)

Answer:

i. For finding expected market price first we shall calculate Value of Bond as follows:

PV of Interest + PV of Maturity Value of Bond

PV of Interest

$$\begin{aligned}
 &= \frac{₹90}{(1+0.12)} + \frac{₹90}{(1+0.1162)^2} + \frac{₹90}{(1+0.1133)^3} + \frac{₹90}{(1+0.1106)^4} + \frac{₹90}{(1+0.1080)^5} \\
 &= ₹90 \times 0.8929 + ₹90 \times 0.8026 + ₹90 \times 0.7247 + ₹90 \times 0.6573 + ₹90 \times 0.5988 \\
 &= ₹80.36 + ₹72.23 + ₹65.22 + ₹59.16 + ₹53.89 \\
 &= ₹330.86
 \end{aligned}$$

$$\text{PV of Maturity of Bonds} = \frac{₹1000}{(1+0.1080)^5} = 1000 \times 0.5988 = ₹598.80$$

$$\text{Intrinsic value of Bond} = ₹330.86 + ₹598.80 = ₹929.66$$

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

ii. The given yield curve is inverted yield curve.

The main reason for this shape of curve is expectation for forthcoming recession when investors are more interested in Short-term rates over the long term.

Question 21

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%.

- (e) If an investor expects that interest will be 8%, six years from now then how much he should pay for this bond now.
- (f) 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 company extends the life of bond by another 6 years.

RTP Nov 18

Answer:

- (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:

$$\begin{aligned}
 &= £1,000 \text{ PVIAF } (8\%, 6) + £10,000 \text{ PVIF } (8\%, 6) \\
 &= £1,000 \times 4.623 + £10,000 \times 0.630 \\
 &= £4,623 + £ 6,300 \\
 &= £10,923
 \end{aligned}$$

- (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**

$$\begin{aligned}
 &= \text{£}1,000 \text{ PVIAF } (12\%, 6) + \text{£}10,000 \text{ PVIF } (12\%, 6) \\
 &= \text{£}1,000 \times 4.111 + \text{£}10,000 \times 0.507 \\
 &= \text{£}4,111 + \text{£}5,070 \\
 &= \text{£}9,181
 \end{aligned}$$

Thus, potential loss will be $\text{£}9,181 - \text{£}10,923 = \text{£}1,742$

Question 22

Today being 1st January 2019, Ram is considering to purchase an outstanding Corporate Bond having a face value of ₹1,000 that was issued on 1st January 2017 which has 9.5% Annual Coupon and 11 years of original maturity (i.e. maturing on 31st December 2027). Since the bond was issued, the interest rates have been on downside and it is now selling at a premium of ₹1125.75 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

RTP Nov 20

Answer:

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:

$$M = ₹1000, \text{ Interest} = ₹95 (0.095 \times ₹1000), n = 9 \text{ years}$$

$$V_0 = ₹1125.75 (₹1,000 + ₹125.75)$$

YTM can be determined from the following equation

$$₹95 \times \text{PVIFA} (\text{YTM}, 9) + ₹1000 \times \text{PVIF} (\text{YTM}, 9) = ₹1125.75$$

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	648.24	0.500	547.50
			112.37		-32.36

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 23

The following data are available for a bond:

Face Value	₹10,000 to be redeemed at par on maturity
Coupon rate	8.5 per cent per annum
Years to Maturity	5 years
Yield to Maturity (YTM)	10 per cent

You are required to calculate:

- Current market price of the Bond,
- Macaulay's Duration,
- Volatility of the Bond,
- Convexity of the Bond,
- Expected market price, if there is a decrease in the YTM by 200 basis points
 - By Macaulay's Duration based estimate
 - 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

RTP May 23, MTP April 22 (8 Marks), Nov 20 (7 Marks)

Answer:

(i) Current Market Price of Bond

$$= ₹850 (\text{PVIFA } 10\%, 5) + ₹10,000 (\text{PVIF } 10\%, 5)$$

$$= ₹850 (3.79) + ₹10,000 (0.621) = ₹3,221.50 + ₹6,210 = ₹9,431.5$$

(ii) Macaulay's Duration

Year	Cash flow	P.V. @ 10%		Proportion of bond value	Proportion of bond value × 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

$$\text{Volatility of Bonds} = \frac{\text{Duration}}{(1+YTM)} = \frac{4.252}{1.10} = 3.865$$

(iv) Convexity of Bond

$$C = \frac{V_+ + V_- - 2V_0}{2 \times V_0 \times \Delta y^2}$$

Year	Cash flow	P.V. @ 8%	P.V @12%
1	850	0.926	0.892
2	850	0.857	0.797
3	850	0.794	0.712
4	850	0.735	0.636
5	10,850	0.681	0.567
		10204.05	8,733.40

$$C^* = \frac{10,204.05 + 8,733.40 - 2 \times 9,431.50}{2 \times 9,431.50 \times (0.02)^2} = \frac{74.45}{7.5452} = 9.867$$

$$\text{Convexity of Bond} = 9.867 \times (0.02)^2 \times 100 = 0.395\%$$

(v) The expected market price if decrease in YTM by 200 basis points.

(a) By Macaulay's duration-based estimate

$$= ₹9431.50 \times 2 (3.865/100) = ₹729.05$$

$$\text{Hence expected market price is } ₹9431.50 + ₹729.05 = ₹10,160.55$$

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

$$\text{Hence, expected market price is } ₹10,204.05$$

Question 24

An investor, in the beginning of 2022, has purchased substantial number of 8 year 7.50%, ₹1000 bond with 5% premium on maturity at a required Yield to Maturity (YTM) of 8.50 %. However, due to the continuing war in Europe, the inflation is running very high in the economies of the countries. The yield on the bonds is decreasing. The risk averse investor wants to protect himself from further loss and decides to sell the bonds in 2023. He has got a proposal from another investor who is willing to purchase these bonds by shelling out a maximum amount of ₹797.50 per bond.

Investor follows intrinsic value method for valuation of the Bonds.

You are required to determine

- (i) The Market price, Duration and Volatility of the bond.
(ii) Will it be a right decision of the new investor if he is looking for Required Yield to Maturity (YTM) as 12% p.a.?

Period	1	2	3	4	5	6	7
PVIF (8.50%,n)	0.9217	0.8495	0.7829	0.7216	0.6650	0.6129	0.5649

May 23 (9 Marks)

Answer:**(A) Market Price of Bond**

$$\begin{aligned}
 &= 1,000 \times 7.50\% \times (\text{PVIAF } 8.50\%, 7) + 1,050 \times (\text{PVIF } 8.5\%, 7) \\
 &= 75 \times 5.1185 + 1050 \times 0.5649 \\
 &= 383.89 + 593.15 = ₹977.04
 \end{aligned}$$

(B) Duration of Bond

Year	Cash flow	P.V. @ 8.5%		Proportion of bond value	Proportion of bond value x time (years)
1	75	0.9217	69.128	0.071	0.071
2	75	0.8495	63.713	0.065	0.130
3	75	0.7829	58.718	0.060	0.180
4	75	0.7216	54.120	0.055	0.220
5	75	0.6650	49.875	0.051	0.255
6	75	0.6129	45.968	0.047	0.282
7	1125	0.5649	635.513	0.651	4.557
			977.035		5.695

Duration of the Bond is 5.695 years.

Alternatively, it can also be calculated as follows:

Year (1)	Cash flow (2)	PVF (3)	PV (4)	(1) × (4)
1	75	0.9217	69.13	69.13
2	75	0.8495	63.71	127.42
3	75	0.7829	58.72	176.16
4	75	0.7216	54.12	216.48
5	75	0.6650	49.88	249.40
6	75	0.6129	45.97	275.82
7	1125	0.5649	635.51	4448.57
			977.04	5562.98

$$\text{Duration of the Bond} = \frac{5562.98}{977.04} = 5.69 \text{ years}$$

(C) Volatility of Bond

$$\text{Volatility} = \text{Duration} / (1 + \text{YTM}) = 5.695 / (1 + 0.085) = 5.249$$

$$\text{Or} = 5.69 / (1 + 0.085) = 5.24$$

$$\text{PV of Bond @ 12\% YTM} = ₹75 \text{ PVIAF } (12\%, 7) + ₹1050 \times \text{PVIF } (12\%, 7)$$

$$= ₹75 \times 4.5637 + ₹1050 \times 0.4523$$

$$= ₹342.28 + ₹474.92$$

$$= ₹817.20$$

Since, Intrinsic Value of Bond is ₹817.20 the decision of new investor is right at purchase price of ₹797.50.

Alternatively, it can also be solved as follows:

Price Difference between Current Selling Price & Intrinsic Value

₹179.54

Increase in Yield justified $\left[\frac{\text{Price Difference} \times 100}{\text{Volatility} \times P_0} \right]$	3.50%
Justified YTM (8.50% + 3.50%)	12%
Increase in Yield justified	

Question 25

Find the current market price of a bond having face value ₹1,00,000 redeemable after 6 year maturity with YTM at 16% payable annually and duration 4.3202 years. Given $1.16^6 = 2.4364$.

Answer:

The formula for the duration of a coupon bond is as follows:

$$D = \frac{1+YTM}{YTM} - \frac{(1+YTM)+t(c-YTM)}{c[(1+YTM)^t-1]+YTM}$$

Where YTM = Yield to Maturity

c = Coupon Rate

t = Years to Maturity

Accordingly, since YTM = 0.16 and t = 6

$$4.3202 = \frac{1.16}{0.16} - \frac{1.16+6(c-0.16)}{c[(1.16)^6-1]+0.16}$$

$$4.3202 = 7.25 - \frac{1.16+(6c-0.96)}{1.4364c+0.16}$$

$$\frac{1.16+6c-0.96}{1.4364c+0.16} = 2.9298$$

$$0.2 + 6c = 4.20836472c + 0.468768$$

$$1.79163528c = 0.268768$$

$$c = 0.150012674$$

$$c = 0.15$$

Where c = Coupon rate, Therefore, current price

$$= ₹(1,00,000/- \times 0.15 \times 3.685 + 1,00,000/- \times 0.410) = ₹96,275/-$$

Alternatively, it can also be calculated as follows:

Let x be annual coupon payment. Accordingly, the duration (D) of the Bond shall be

Year	CF	PVIF 16% PV (CF)	PV (CF)	PV(CF) x year
1	X	0.862	0.862x	0.862x
2	X	0.743	0.743x	1.486x
3	X	0.641	0.641x	1.923x
4	X	0.552	0.552x	2.208x
5	X	0.476	0.476x	2.38x
6	X + 100000	0.410	0.410x + 41000	2.46x + 246000
			3.684x + 41000	11.319x + 246000

$$4.3202 = \frac{11.319x + 246000}{3.684x + 41000}$$

$$x = ₹14,983 \text{ i.e. } 14.98\% \text{ say } 15\%$$

Accordingly, current price of the Bond shall be:

$$= 1,00,000 \times 0.15 \times \text{PVAF}(16\%, 6) + 1,00,000 \times \text{PVF}(16\%, 6)$$

$$= 15,000 \times 3.685 + 1,00,000 \times 0.410$$

$$= ₹96,275$$

Question 26

A bond is currently trading for 98.722 per 100 of par value. If the bond's yield-to-maturity (YTM) rises by 10 basis points, the bond's full price is expected to fall to 98.669. If the bond's YTM decreases by 10 basis points, the bond's full price is expected to increase to 98.782. Calculate the bond's approximate convexity.

Answer:

$$P_0 = 98.722, P_+ = 98.669, P_- = 98.782$$

$$\Delta y = 10\text{bp} (0.001)$$

$$\begin{aligned} \text{Convexity} &= \frac{P_+ + P_- - 2P_0}{2P_0 \times \Delta y^2} \\ &= \frac{98.669 + 98.782 - 2(98.722)}{2 \times 98.722 \times (0.001)^2} \\ &= \frac{0.007}{0.0001974} \\ \text{Convexity} &= 35.46 \end{aligned}$$

Question 27

A bond has an annual modified duration of 7.020 and annual convexity of 65.180. If the bond's yield-to-maturity decreases by 25 basis points, what is the expected percentage price change

Answer:

$$\begin{aligned} \% \Delta MP &= -[\text{AnnModDur} \times \Delta y] + [\text{Convexity} \times \Delta y^2] \\ &= -[7.020 \times (-0.0025)] + [65.180 \times (0.0025)^2] \\ &= 0.01755 + 0.00041 \\ &= 0.01796 \end{aligned}$$

$$\% \Delta MP = 1.796\% \uparrow$$

Question 28

The following data are available for three bonds A, B and C. These bonds are used by a bond portfolio manager to fund an outflow scheduled in 6 years. Current yield is 9%. All bonds have face value of ₹100 each and will be redeemed at par. Interest is payable annually.

Bond	Maturity (Years)	Coupon rate
A	10	10%
B	8	11%

C	5	9%

- (i) Calculate the duration of each bond.
- (i) The bond portfolio manager has been asked to keep 45% of the portfolio money in Bond A. Calculate the percentage amount to be invested in bonds B and C that need to be purchased to immunize the portfolio.
- (ii) After the portfolio has been formulated, an interest rate change occurs, increasing the yield to 11%. The new duration of these bonds are: Bond A = 7.15 Years, Bond B = 6.03 Years and Bond C = 4.27 years. Is the portfolio still immunized? Why or why not?
- (iv) Determine 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	t_1	t_2	t_3	t_4	t_5
$PVIF_{0.09,t}$	0.917	0.842	0.772	0.708	0.650

Present Values	t_6	t_7	t_8	t_9	t_{10}
$PVIF_{0.09,t}$	0.596	0.547	0.502	0.460	0.4224

Nov 18 (12 Marks), MTP May 20 (12 Marks), MTP March 21 (12 Marks)

Answer:

- (i) **Calculation of Bond Duration**
Bond A

Year	Cash flow	P.V. @ 9%		Proportion of bond value	Proportion of bond value 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 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 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

$$b + c = 0.55$$

$$6.03b + 4.27c = 2.7825$$

$$b = 0.2466$$

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 29

Firm XYZ is required to make a \$5M payment in 1 year and a \$4M payment in 3 years. The yield curve is flat at 10% APR with semiannual compounding. Firm XYZ wants to form a portfolio using 1-year and 4-year U.S. strips to fund the payments. How much of each strip must the portfolio contain for it to still be able to fund the payments after a shift in the yield curve?

Answer:

$$1 \text{ year} = \frac{\$5\text{M}}{(1.05)^2} = \$4.535\text{M}$$

$$3 \text{ year} = \frac{\$4\text{M}}{(1.05)^6} = \$2.985\text{M}$$

$$\therefore \text{PV of Liabilities} = \$7.52 \text{ M}$$

$$\therefore \text{PV of Assets} = \$7.52 \text{ M}$$

$$\text{Average Investors Horizon} = 1 \times \left[\frac{4.535}{7.52} \right] + 3 \times \left[\frac{2.985}{7.52} \right] = 0.6031 + 1.1908 = 1.7939 \text{ years}$$

For Immunised Portfolio,

Duration = Investors Horizon

$$\therefore \text{Duration} = 1.7939 \text{ Year}$$

$$\sum W_i D_i = 1.7939$$

$$W_A D_A + W_B D_B = 1.7939$$

$$W_A \times 1 + [1 - W_A] \times 4 = 1.7939$$

$$W_A + 4 - 4W_A = 1.7939$$

$$3W_A = 2.2061$$

$$W_A = 0.7354 \text{ (73.54\%)}$$

$$W_B = 1 - 0.7354$$

$$W_B = 0.2646 \text{ (26.46\%)}$$

$\therefore$ Immunized Bond Portfolio Investment

1 year Bond	$7.52 \times 73.54\%$	= \$5.53M
4 year Bond	$7.52 \times 26.46\%$	= \$1.99M
		\$7.52M

Question 30

The following data is related to 8.5% Fully Convertible (into Equity shares) Debentures issued by JAC Ltd. at ₹1000.

Market Price of Debenture	₹900
Conversion Ratio	30
Straight Value of Debenture	₹700
Market Price of Equity share on the date of Conversion	₹25
Expected Dividend Per Share	₹1

You are required to calculate:

- (e) Conversion Value of Debenture
- (f) Market Conversion Price
- (g) Conversion Premium per share
- (h) Ratio of Conversion Premium
- (i) Premium over Straight Value of Debenture
- (j) Favorable income differential per share
- (k) Premium pay back period

MTP April 22 (10 Marks), RTP Nov 21, May 18 (8 Marks), RTP Nov 12, RTP May 13, RTP May 15, RTP Nov 16, MTP Aug 18 (8 Marks)

Answer:

(a) Conversion Value of Debenture

$$= \text{Market Price of One Share} \times \text{Conversion Ratio} = ₹25 \times 30 = ₹750$$

(b) Market Conversion Price

$$= \frac{\text{Market Price of Convertible Debenture}}{\text{Conversion Ratio}} = \frac{900}{30} = ₹30$$

(c) Conversion Premium per share

$$= \text{Market Conversion Price} - \text{Market Price of Equity Share} = ₹30 - 25 = ₹5$$

(d) Ratio of Conversion Premium

$$= \frac{\text{Conversion premium per share}}{\text{Market Price of Equity Share}} = \frac{₹5}{₹25} = 20\%$$

(e) Premium over Straight Value of Debenture

$$= \frac{\text{Market Price of Convertible Bond}}{\text{Straight Value of Bond}} - 1 = \frac{900}{700} - 1 = 28.6\%$$

(f) Favorable income differential per share

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

$$= \frac{85 - 30 \times 1}{30}$$

$$= ₹1.833$$

(g) Premium pay back period

$$= \frac{\text{Conversion Premium per share}}{\text{Favorable Income Differential per share}}$$

$$= \frac{₹5}{₹1.833}$$

$$= 2.73 \text{ years}$$

Question 31

GHI Ltd., AAA rated company has issued, fully convertible bonds on the following terms, a year ago:

Face value of bond	₹1000
Coupon (interest rate)	8.5%
Time to Maturity (remaining)	3 years
Interest Payment	Annual, at the end of year
Principal Repayment	At the end of bond maturity
Conversion ratio (Number of shares per bond)	25
Current market price per share	₹45
Market price of convertible bond	₹1175

AAA rated company can issue plain vanilla bonds without conversion option at an interest rate of 9.5%.

Required: Calculate as of today:

- Straight Value of bond.
- Conversion Value of the bond.
- Conversion Premium.
- Percentage of downside risk.
- Conversion Parity Price.

T	1	2	3
PVIF _{0.095, t}	0.9132	0.8340	0.7617

Nov 22 (8 Marks), May 14 (8 Marks), RTP May 17, MTP Aug 18 (8 Marks)

Answer:**(i) Straight Value of Bond**

$$= ₹85 \times 0.9132 + ₹85 \times 0.8340 + ₹1085 \times 0.7617 = ₹974.96$$

(ii) Conversion Value

$$\text{Conversion Ratio} \times \text{Market Price of Equity Share} = ₹45 \times 25 = ₹1,125$$

(iii) Conversion Premium

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

$$= \frac{₹1,175}{25} - ₹45 = ₹2$$

$$\text{or} = ₹1,175 - ₹45 \times 25 = ₹50$$

$$\text{or } \frac{₹1,175 - ₹1,125}{₹1,125} = 4.47\%$$

(iv) **Percentage of Downside Risk**

$$= \frac{₹1,175 - ₹974.96}{₹974.96} \times 100 = 20.52\%$$

$$\text{or } \frac{₹1,175 - ₹974.96}{₹1,175} = 17.02\%$$

(v) **Conversion Parity Price**

$$\frac{\text{Bond Price}}{\text{No. of Share on conversion}} = \frac{₹1175}{25} = ₹47$$

Question 32

B International Ltd. (BIL) has purchased 5 years 15.28% convertible debentures on 1.04.2021. The convertible debentures will mature on 31.03.2026. Each debenture can be converted into 20 equity shares of face value of ₹1 at any point of time but before maturity. Debentures will be redeemed at ₹100 on maturity. The required rate of return of BIL is 10% per annum on a 5-year security.

The Reputed, a consultant has projected the following behavior of the shares:

Period		Price Range		
From	To	Passive	Most likely	Optimistic
1.04.2021	31.12.2022	4	4.5	5
1.01.2023	30.06.2025	4.5	6.5	7
1.07.2025	31.03.2026	3.5	5	5.5

BIL, as a matter of policy, rounds up the amount.

You are required to calculate:

- The break-even price at which the debentures can be converted
- The ideal period in which BIL shall convert and dispose of the shares.

Given:

PVIF (10%, 5) 0.6209

PVIFA (10%, 5) 3.7908

Dec 21 (5 Marks)

Answer:

- (i) **The Break-even price** at which Debenture can be converted shall be equivalent to Present Value of stream of cash flows from holding debenture till maturity and it shall be computed as follows:

$$PV = ₹15.28 \times PVIFA (10\%, 5) + ₹100 \times PVIF (10\%, 5)$$

$$= ₹15.28 \times 3.7908 + ₹100 \times 0.6209$$

$$= ₹57.92 + ₹62.09 = ₹120.01 \text{ say } ₹120$$

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

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

Question 33

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 debentures. 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	t_1	t_2	t_3	t_4	t_5	t_6	t_7	t_8	t_9	t_{10}
$PVIF_{0.11,t}$	0.901	0.812	0.731	0.659	0.593	0.535	0.482	0.434	0.391	0.352
$PVIF_{0.13,t}$	0.885	0.783	0.693	0.613	0.543	0.480	0.425	0.376	0.333	0.295

RTP Nov 19, MTP March 18 (5 Marks), MTP Apr 19 (8 Marks), MTP March 19 (7 Marks)

Answer:

Conversion Price = ₹50 × 17 = ₹850

Intrinsic Value = ₹850

Accordingly, the yield (r) on the bond shall be:

$$₹850 = ₹100 \text{ PVA}F(r, 10) + ₹1000 \text{ PV}F(r, 10)$$

Let us discount the cash flows by 11%

$$850 = 100 \text{ PVA}F(11\%, 10) + 1000 \text{ PV}F(11\%, 10)$$

$$850 = 100 \times 5.890 + 1000 \times 0.352 = 91$$

Now let us discount the cash flows by 13%

$$850 = 100 \text{ PVA}F(13\%, 10) + 1000 \text{ PV}F(13\%, 10)$$

$$850 = 100 \times 5.426 + 1000 \times 0.295 = -12.40$$

Accordingly, IRR

$$11\% + \frac{91}{91 - (-12.40)} \times (13\% - 11\%)$$

$$= 11\% + \frac{91}{103.40} \times (13\% - 11\%)$$

$$= 12.76\%$$

$$\text{The spread from comparable bond} = 12.76\% - 11.80\% = 0.96\%$$

Question 34

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?

Dec 21 (12 Marks), MTP Nov 21 10 Marks, RTP Nov 14, RTP Nov 16

Answer:

NPV for bond refunding

	₹
PV of annual cash flow savings (W.N. 2)	
$(3,49,600 \times PVIFA\ 8\%,25)$ 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%	16,80,000	
After tax cost of call prem.		25,20,000
(b) Floatation cost		4,00,000
(c) Overlapping interest		
Before tax $(0.14 \times 2/12 \times 3 \text{ crores})$	7,00,000	
Less: tax @ 40%	2,80,000	
After tax cost of Overlapping interest		4,20,000
(d) Tax saving on unamortized discount on old bond $25/30 \times 9,00,000 \times 0.4$		(3,00,000)
(e) Tax savings from unamortized floatation Cost of old bond $25/10 \times 3,60,000 \times 0.4$		(1,20,000)
		29,20,000

(2) Annual Cash Flow Savings:

(a) Old bond

Interest cost $(0.14 \times 3 \text{ crore})$	42,00,000	
Less Tax @ 40%	16,80,000	25,20,000
Tax savings from amortization of discount $9,00,000/30 \times 0.4$		(12,000)
Tax savings from amortization of floatation cost $3,60,000/30 \times 0.4$		(4,800)
Annual after tax payment under old bond (A)		25,03,200

(b) New bond

Interest cost before tax (0.12×3 crore)	36,00,000	
Less Tax @ 40%	14,40,000	21,60,000
Tax savings from amortization of flotation cost ($0.4 \times 4,00,000/25$)		(6,400)
Annual after tax payment under new bond (B)		21,53,600
Annual cash flow savings [(A) - (B)]		3,49,600

Question 35

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 semiannually on June 30th and December 31st each year. Assume that you purchased an outstanding MP Ltd. bond on 1st March, 2018 when the going interest rate was 12%.

Required:

- What was the YTM of MP Ltd. bonds as on January 1, 2010?
- What amount you should pay to complete the transaction? Of that amount how much should be accrued interest and how much would represent bonds basic value.

Answer:

- Since the bonds were sold at par, the original YTM was 10%.

$$\text{YTM} = \frac{\text{Interest}}{\text{Principal}} = \frac{₹100}{₹1,000} = 10\%$$

- Price of the bond as on 1st July, 2018

$$= ₹50 \times 9.712 + ₹1,000 \times 0.417$$

$$= ₹485.60 + ₹417$$

$$= ₹902.60$$

Total value of the bond on the next

$$= ₹902.60 + ₹50$$

interest date 30/06/18

$$= ₹952.60$$

Value of bond at purchase date

$$= ₹952.60 \times \frac{1}{(1+0.06)^{2/3}}$$

$$= ₹952.60 \times 0.9620 \text{ (by using excel)}$$

$$= ₹916.40†$$

The amount to be paid to complete the transaction is ₹916.40. Out of this amount ₹48.10 represent accrued interest* and ₹868.30 represent the bond basic value.

† Alternatively, it can also be calculated as follows:

$$= ₹952.60 \times \frac{1}{\left(1+0.06 \times \frac{2}{3}\right)}$$

$$= ₹952.60 \times \frac{1}{(1+0.04)}$$

$$= ₹915.96$$

The amount to be paid to complete the transaction is ₹915.96. Out of this amount ₹48.08 represent accrued interest* and ₹867.88 represent the bond basic value.

*Alternatively, Accrued Interest can also be calculated as follows:

$$\text{Accrued Interest on Bonds} = 1,000 \times \frac{10}{100} \times \frac{2}{12} = 16.67$$

Question 36

Suppose Mr. X purchase Treasury Bill for ₹9,940 maturing in 91 days for ₹10,000. Then what would be annualized investment rate for Mr. X and annualized discount rate for the Govt. Investment. RTP Nov 11

Answer:

$$\text{Investment Rate} = \frac{₹10,000 - ₹9,940}{₹9,940} \times \frac{365}{91} = 0.02421 \text{ i.e. } 2.42\%$$

$$\text{Discount Rate} = \frac{₹10,000 - ₹9,940}{₹10,000} \times \frac{360}{91} = 0.02374 \text{ i.e. } 2.374\%$$

Question 37

From the following information, compute the effective rate of interest per annum as well as the 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

Nov 20 (6 Marks)

Answer:

$$\text{Nominal Interest or Bond Equivalent Yield} = \left[\frac{F-P}{P} \right] \times \frac{12}{M} \times 100$$

Where, F = Face Value, P = Issue Price

$$= \frac{5,00,000 - 4,87,750}{4,87,750} \times \frac{12}{3} \times 100 = 0.025115 \times 4 \times 100 = 10.046 = 10.05\% \text{ p.a.}$$

$$\text{Effective interest rate} = \left[1 + \frac{0.1005}{4} \right]^4 - 1 = 10.435\% \text{ p.a.}$$

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)	0.80%
	12.385%

Question 38

Consider the following for Certificate of Deposit (CD):

Amount of Issue	– ₹100
Period	- 6 months
Rate of discount	– 20%

Calculate the effective yield.

StudyMat

Answer:

$$\text{Discount} = 100 \times \frac{20}{100} \times \frac{6}{12} = ₹10.00$$

Hence CD will be issued for ₹100 – 10 = ₹90.00.

The effective rate to the bank will, however, be calculated on the basis of the following formula:

$$E = \frac{FV-SV}{SV} \times \frac{\text{Days or months in a year}}{M} \times 100$$

Where, E = Effective Yield, FV = Face Value, SV = Sale Value, M = Period of Discount

Accordingly, the Yield as per the data given in the example will be:

$$\frac{100-90}{90} \times \frac{12}{6} \times 100 = 22.22\%$$

Question 39

A money market instrument with face value of ₹100 and discount yield of 6% will mature in 45 days. You are required to calculate:

- Current price of the instrument.
- Bond equivalent yield
- Effective annual return.

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MTP March 15 (6 Marks)

Answer:

- (i) **Current price of the Bond** = $100 \times [1 - \{45/360\} \times 0.06] = ₹99.25$

Alternatively, the current price of bond may also be calculated as follows:

$$\frac{D}{100-D} \times \frac{360}{45} = 0.06$$

$$\frac{D}{100-D} = 0.06 \times \frac{45}{360}$$

$$\frac{D}{100-D} = 0.06 \times \frac{1}{8}$$

$$8D = 6 - 0.06D$$

$$8.06D = 6$$

$$D = \frac{6}{8.06} = 0.7444$$

$$\text{Current price of the bond} = \text{Face value} - D$$

$$= ₹100 - 0.7444$$

$$= ₹99.2556$$

- (ii)

$$\text{Bond equivalent yield} = \frac{100-99.25}{99.25} \times \frac{360}{45} = 6.045\% \text{ p.a.}$$

(iii) Effective annual return = $[1 + (0.06045/8)]^8 - 1 = 6.207\% \text{ p.a.}$

Note: If a year of 365 days is considered the Bond equivalent yield and Effective annual return works out to 6.296% p.a.

Question 40

On 30th June 2015, PNB Bank proposes to borrow a sum of ₹400 crore from CB Bank via Repo @ 11.65% using 10.00% GOI Securities 2025 (face value ₹10,000) for a period of 14 days with a 3.00% haircut. The current price of the securities is ₹9,872. The coupon dates are 30 April and 30 September. You are required to determine:

- Nominal Amount as well as No. of Securities to be delivered in the beginning of the Repo.
- The cash amount to be repaid at the end of the Repo.

MTP April 19 (5 Marks)

Answer:

- The GOI Security has semi-annual coupon of 30 April hence the accrual period is 1 May 2015 to 30 June 2015 i.e. 61 days. Therefore,

$$\text{Accrued Interest on Security} = 10000 \times \frac{10}{100} \times \frac{61}{365} = ₹167.12$$

$$\text{Dirty Price} = ₹9,872 + ₹167.12 = ₹10,039.12$$

$$\text{Dirty Price Adjusted for 3\% haircut} = \frac{10039.12}{1.03} = ₹9,746.72$$

$$\text{Nominal Amount of Securities Required} = 400 \times \frac{10000}{9746.72} = ₹410.39447 \text{ crore}$$

$$\text{No. of securities required} = \frac{410.39447}{9746.72} = 4,21,059 \text{ (Approx.)}$$

- The original cash amount to be repaid at the end

$$₹400 \text{ crore} \times \left(1 + 0.1165 \times \frac{14}{365}\right) = ₹401.7874 \text{ crore}$$

Question 41

The Bank BK enters into a Repo for 9 days with Bank NE in 6% Government bonds 2022 for an amount of ₹2 crore. The other relevant details are as follows:

First Leg Payment (Start Proceed)	₹2,00,06,750
Second Leg Payment (Repayment Proceed)	₹2,00,31,759
Initial Margin	1.25%
Days of accrued interest	240

Assume 360 days in a year.

You are required to calculate:

- Repo Rate
- Dirty Price and
- Clean Price

July 21 (5 Marks), MTP Oct 22 (8 Marks)

Answer:

(i)

$$\text{Second Leg} = \text{Start Proceed} \times \left(1 + \text{Repo Rate} \times \frac{\text{No. of Days}}{360} \right)$$

$$₹2,00,31,759 = ₹2,00,06,750 \times \left(1 + \text{Repo Rate} \times \frac{9}{360} \right)$$

$$\text{Repo Rate} = 0.05 = 5\%$$

(ii)

$$\text{First Leg (Start Proceed)} = \text{Nominal Value} \times \frac{\text{Dirty Price}}{100} \times \frac{100 - \text{Initial Margin}}{100}$$

$$₹2,00,06,750 = ₹2,00,00,000 \times \frac{\text{Dirty Price}}{100} \times \frac{100 - 1.25}{100}$$

$$10003.375 = 98.75 \times \text{Dirty Price}$$

$$\text{Dirty Price} = ₹101.30$$

(iii) Dirty Price = Clean Price + Interest Accrued

$$101.30 = \text{Clean Price} + 100 \times \frac{240}{360} \times 6\%$$

$$\text{Clean Price} = ₹97.30$$

CHAPTER 6 PORTFOLIO MANAGEMENT

Question 1

Standard deviation of security A = 40

Standard deviation of security B = 20

Proportion of investment in A = 0.4 and in B = 0.6

Calculate the standard deviation of portfolio when correlation coefficient is

(i) 1

(ii) -1

(iii) 0

StudyMat

Answer:

$$\sigma_p = \sqrt{(W_a \sigma_a)^2 + (W_b \sigma_b)^2 + 2W_a W_b \sigma_a \sigma_b r_{ab}}$$

(i) When $r = 1$

$$\sigma_p = \sqrt{(0.40 \times 40)^2 + (0.60 \times 20)^2 + 2 \times 0.40 \times 0.60 \times 40 \times 20 \times 1}$$

$$\sigma_p = \sqrt{256 + 144 + 384}$$

$$\sigma_p = \sqrt{784}$$

$$\sigma_p = 28$$

Alternatively,

$$\sigma_p = \sqrt{(W_a\sigma_a)^2 + (W_b\sigma_b)^2 + 2W_a\sigma_aW_b\sigma_b}$$

$$\sigma_p = \sqrt{a^2 + b^2 + 2ab\sigma_p} = \sqrt{(a+b)^2}$$

$$\sigma_p = a + b$$

$$\sigma_p = W_a\sigma_a + W_b\sigma_b$$

$$\sigma_p = 0.40 \times 40 + 0.60 \times 20$$

$$\sigma_p = 16 + 12$$

$$\sigma_p = 28\%$$

When $r = 1$, No risk reduction is possible through diversification & hence portfolio risk is simply the weighted average risk.

(ii) When $r = -1$

$$\sigma_p = \sqrt{(W_a\sigma_a)^2 + (W_b\sigma_b)^2 - 2W_a\sigma_aW_b\sigma_b}$$

$$\sigma_p = \sqrt{a^2 + b^2 - 2ab\sigma_p} = \sqrt{(a-b)^2}$$

$$\sigma_p = a - b$$

$$\sigma_p = W_a\sigma_a - W_b\sigma_b$$

$$\sigma_p = 0.40 \times 40 - 0.60 \times 20$$

$$\sigma_p = 16 - 12$$

$$\sigma_p = 4\%$$

(iii) When $r = 0$

$$\sigma_p = \sqrt{(W_a\sigma_a)^2 + (W_b\sigma_b)^2}$$

$$\sigma_p = \sqrt{(0.40 \times 40)^2 + (0.60 \times 20)^2}$$

$$\sigma_p = \sqrt{256 + 144}$$

$$\sigma_p = \sqrt{400}$$

$$\sigma_p = 20\%$$

Question 2

Calculate the risk of the following multiple asset portfolio

Security	X_i	σ_i	Correlation coefficient
X	0.25	16	X and Y = 0.7
Y	0.35	7	X and Z = 0.3
Z	0.40	9	Y and Z = 0.4

It may be noted that the correlation coefficient between X and X, Y and Y, Z and Z is 1.

StudyMat

Answer:

$$\begin{aligned}
 \sigma_p^2 &= (a + b + c)^2 \\
 &= a^2 + b^2 + c^2 + 2ab + 2bc + 2ca \\
 &= (W_x \sigma_x)^2 + (W_y \sigma_y)^2 + (W_z \sigma_z)^2 + 2W_x \sigma_x W_y \sigma_y r_{xy} + 2W_y \sigma_y W_z \sigma_z r_{yz} + 2W_z \sigma_z W_x \sigma_x r_{zx} \\
 &= (0.25 \times 16)^2 + (0.35 \times 7)^2 + (0.40 \times 9)^2 + 2 \times 0.25 \times 16 \times 0.35 \times 7 \times 0.7 + 2 \times 0.35 \times 7 \times 0.40 \times 9 \times 0.4 + \\
 &\quad 2 \times 0.40 \times 9 \times 0.25 \times 16 \times 0.3 \\
 &= 16 + 6 + 12.96 + 13.72 + 7.06 + 8.64 \\
 \text{Variance} &= 64.38 \\
 \text{SD} &= \sqrt{64.38} \\
 \sigma_p^2 &= 8.02\%
 \end{aligned}$$

Question 3

Mayuri is interested to construct a Portfolio of Securities X and Y. She has collected the following information:

	X	Y
Expected Return (ER)	19%	23%
Risk (σ)	14%	18%

Mayuri has 5 Portfolio options of X and Y as follows:

- 50% of funds in each X and Y
- 75% of funds in X and 25% in Y
- 25% of funds in X and 75% in Y
- 60% of funds in X and 40% in Y
- 35% of funds in X and 65% in Y

Co-efficient of correlation (r) between X and Y is 0.16. You are required to calculate:

- Expected Return under different Portfolio Options.
- Risk Factor associated with these Portfolio Options.
- Which Portfolio is best from the point of view of Risk?
- Which Portfolio is best from the point of view of Return?

MTP Oct 21 (10 Marks), Nov 20 (8 Marks), RTP May 22

Answer:

We have $E_p = W_1 E_1 + W_2 E_2 + \dots + W_n E_n$

and for standard deviation $\sigma_p^2 = \sum_{i=1}^n \sum_{j=1}^n w_i w_j \sigma_{ij}$

Two asset portfolio

$$\sigma_p^2 = w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2w_1 w_2 \sigma_1 \sigma_2 \rho_{12}$$

Or

$$\sigma_p^2 = \sqrt{w_1 \sigma_1 + w_2 \sigma_2 + 2w_1 w_2 \sigma_1 \sigma_2 \rho_{12}}$$

Substituting the respective values we get,

- 50% of funds in each of X and Y**

$$E_p = 0.50 \times 19\% + 0.50 \times 23\% = 21\%$$

$$\sigma_p^2 = (0.50)^2 (14\%)^2 + (0.50)^2 (18\%)^2 + 2(0.50)(0.50)(0.16)(14\%)(18\%)$$

$$\sigma_p^2 = 49 + 81 + 20.16 = 150.16$$

$$\sigma_p = 12.25\%$$

(ii) 75% in X and 25% in Y

$$E_p = 0.75 \times 19\% + 0.25 \times 23\% = 20\%$$

$$\sigma_p^2 = (0.75)^2 (14\%)^2 + (0.25)^2 (18\%)^2 + 2(0.75)(0.25)(0.16)(14\%)(18\%)$$

$$\sigma_p^2 = 110.25 + 20.25 + 15.12 = 145.62$$

$$\sigma_p = 12.07\%$$

(iii) 25% in X and 75% in Y

$$E_p = 0.25 \times 19\% + 0.75 \times 23\% = 22\%$$

$$\sigma_p^2 = (0.25)^2 (14\%)^2 + (0.75)^2 (18\%)^2 + 2(0.25)(0.75)(0.16)(14\%)(18\%)$$

$$\sigma_p^2 = 12.25 + 182.25 + 15.12 = 209.62$$

$$\sigma_p = 14.48\%$$

(iv) 60% in X and 40% in Y

$$E_p = 0.60 \times 19\% + 0.40 \times 23\% = 20.6\%$$

$$\sigma_p^2 = (0.60)^2 (14\%)^2 + (0.40)^2 (18\%)^2 + 2(0.60)(0.40)(0.16)(14\%)(18\%)$$

$$\sigma_p^2 = 70.56 + 51.84 + 19.35 = 141.75$$

$$\sigma_p = 11.91\%$$

(v) 35% in X and 65% in Y

$$E_p = 0.35 \times 19\% + 0.65 \times 23\% = 21.6\%$$

$$\sigma_p^2 = (0.35)^2 (14\%)^2 + (0.65)^2 (18\%)^2 + 2(0.35)(0.65)(0.16)(14\%)(18\%)$$

$$\sigma_p^2 = 24.01 + 136.89 + 18.35 = 179.25$$

$$\sigma_p = 13.39\%$$

Portfolio	(i)	(ii)	(iii)	(iv)	(v)
Return	21	20	22	20.6	21.6
σ	12.25	12.07	14.48	11.91	13.39

In the terms of return, we see that portfolio (iii) is the best portfolio.

In terms of risk we see that portfolio (iv) is the best portfolio.

Question 4

Consider the following asset class returns for calendar year 2016:

Asset Class	Portfolio Weight (%)	Benchmark Weight (%)	Portfolio Return (%)	Benchmark Return (%)
Domestic Equities	55	40	10	8
International Equities	20	30	10	9
Bonds	25	30	5	6

What is the value added (or active return) for the managed portfolio?

Answer:

$$\begin{aligned}\text{Portfolio Return} &= \sum W_i R_i \\ &= 0.55 \times 10 + 0.20 \times 10 + 0.25 \times 5 \\ &= 5.5 + 2 + 1.25 \\ &= 8.75 \%\end{aligned}$$

$$\begin{aligned}\text{Market Return} &= \sum W_i R_i \\ &= 0.40 \times 8 + 0.30 \times 9 + 0.30 \times 6 \\ &= 3.20 + 2.7 + 1.8 \\ &= 7.71 \%\end{aligned}$$

$$\text{Active Return [Value Added]} = 8.75 - 7.7 = 1.05\%$$

Question 5

Mr. Gupta is considering investment in the shares of R. Ltd. He has the following expectations of return on the stock and the market:

Return (%)		
Probability	R. Ltd.	Market
0.35	30	25
0.30	25	20
0.15	40	30
0.20	20	10

You are required to:

- Calculate the expected return, variance and standard deviation for R. Ltd.
- Calculate the expected return variance and standard deviation for the market.
- Find out the beta co-efficient for R. Ltd. shares.

Nov 18 (8 Marks)

Answer:

- (i) **Calculation of Expected Return, Variance and Standard Deviation for R Ltd.**

Prob.(P)	R	P × R	(R - R̄)	(R - R̄) ²	(R - R̄) ² P
0.35	30	10.50	2	4	1.40
0.30	25	7.50	-3	9	2.70
0.15	40	6.00	12	144	21.60
0.20	20	4.00	-8	64	12.80
		28.00			38.50

$$\sigma = \sqrt{38.50} = 6.20$$

(ii) Calculation of Expected Return, Variance and Standard Deviation for Market

Prob.(P)	M	P × M	(M - M̄)	(M - M̄) ²	P(M - M̄) ²	(R - R̄)(M - M̄)	(R - R̄)(M - M̄) × P
0.35	25	8.75	3.75	14.063	4.922	7.50	2.625
0.30	20	6.00	-1.25	1.563	0.469	3.75	1.125
0.15	30	4.50	8.75	76.563	11.484	105.00	15.75
0.20	10	2.00	-11.25	126.563	25.313	90.00	18.00
		21.25			42.188		37.50

$$\sigma = \sqrt{42.188} = \mathbf{6.495}$$

(iii) Beta Co-efficient for R Ltd. Shares

$$\beta = \frac{\text{Cov}(R, M)}{\sigma_M^2} = \frac{37.50}{42.188} = \mathbf{0.888}$$

Question 6

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.

RTP May 20 StudyMat

Answer:

Security F

Prob (P)	R _f	P × R _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

$$\text{STDEV}\sigma_f = \sqrt{141} = \mathbf{11.87\%}$$

Market Portfolio, P

$R_M \%$	P_M	Exp. Return $R_M \times P_M$	Dev. of P $(R_M - ER_M)$	$(\text{Dev. of P})^2$	$(\text{Dev.})^2 P_M$	$(\text{Dev. of F}) \times (\text{Dev. of P})$	$(\text{Dev. of F}) \times (\text{Dev. of P}) \times P$
-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
		$ER_M = 14$		$Var_M = 264$ $SD(M) = 16.25$			$COV_{pm} = -168$

$$\text{Beta} = \frac{Cov_{PM}}{\sigma_M^2} = \frac{-168}{264} = -0.636$$

Question 7

The returns and beta of 3 stocks are given below

Stock	A	B	C
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?

MTP Mar 24 (4 Marks), StudyMat

Answer:

Beta	A = 1.7	B = 0.6	C = 1.2
CAPM $[R_f + \beta(R_m - R_f)]$	$9 + 1.7(5) = 17.5\%$	$9 + 0.6(5) = 12\%$	$9 + 1.2(5) = 15\%$
Actual Return	= 18%	= 11%	= 15%
Valuation	Undervalued	Overvalued	Correctly Valued
Action	Buy	Sell	Hold

Question 8

The following information is available in respect of Security A:

Equilibrium Return	12%
Market Return	12%
6% Treasury Bond trading at	₹120
Co-variance of Market Return and Security Return	196%
Coefficient of Correlation	0.80

You are required to determine the Standard Deviation of:

(i) Market Return and

(ii) Security Return

Nov 16 (5 Marks)

Answer:

$$(i) R_f = \frac{6}{120} \times 100 = 5\%$$

Applying CAPM

$$12\% = 5\% + \beta (12\% - 5\%)$$

$$7\% = \beta (7\%)$$

$$\beta = 1$$

$$\beta = \frac{\text{Cov}(r, m)}{\sigma_m^2}$$

$$1 = \frac{196}{\sigma_m^2}$$

$$\sigma_m^2 = 196$$

$$\sigma_m = \sqrt{196} = 14$$

Standard Deviation of Market Return = 14

(ii)

$$r_{sm} = \frac{\text{Cov}(r, m)}{\sigma_m \sigma_r}$$

$$0.80 = \frac{196}{14\sigma_r}$$

$$\sigma_r = 17.50\%$$

Standard Deviation of Security Return = 17.50%

Question 9

Mr. X is having 1 lakh shares of M/s. Kannyaka Ltd. The beta of the company is 1.40.

Mr. Y a financial advisor has suggested having the following portfolio:

Security	Beta	% holding
S	1.20	10
K	0.75	10
P	0.40	30
D	1.40	50
		100

Market Return is 12%, Risk free rate is 8%

You are required to calculate the following for the present investment and suggested portfolio:

(i) What is the expected return based on CAPM and also

(1) If the market goes up by 2.5%

(2) If the market goes down by 2.5%

(3) If the market gives Negative Returns of 2.5%

(ii) If the probability of market giving negative return is more, please advise Mr. X whether to continue the holdings of M/s. Kannyaka Ltd. or to buy the portfolio as per the suggestion of Mr. Y. If so why?

July 21 (10 Marks), RTP May 22, MTP Oct 22 (8 Marks)

Answer:

(a) Working Notes –

Calculation of Portfolio Beta suggested by Mr. Y

Security	Beta	Wt. of Holding	Beta × Wt. of Holding
S	1.20	0.1	0.120
K	0.75	0.1	0.075
P	0.40	0.3	0.120
D	1.40	0.5	0.700
Total		1.0	1.015

Portfolio Beta is 1.015

Calculation of Expected Return based on CAPM at present situation-

Particulars	Risk Free Rate (R_f)	Beta	Market Return	Risk Premium = $R_m - R_f$	Beta × Risk Premium	Expected Return
a	b	c	d	e = d - b	f = c × e	g = b + f
Kannyaka 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 at present situation -

Particulars	Risk Free Rate (R_f)	Beta	Market Return	Risk Premium = $R_m - R_f$	Beta × Risk Premium	Expected Return
a	b	c	d	e = d - b	f = c × e	g = b + f
Kannyaka Ltd.	8	1.400	14.5	6.5	9.100	17.10
Portfolio	8	1.015	14.5	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 (R_f)	Beta	Market Return	Risk Premium = $R_m - R_f$	Beta × Risk Premium	Expected Return
a	b	c	d	e = d - b	f = c × e	g = b + f
Kannyaka Ltd.	8	1.400	9.5	1.5	2.100	10.10
Portfolio	8	1.015	9.5	1.5	1.523	9.52

(3) Calculation of Expected Return based on CAPM if market gives negative returns of 2.5%

Particulars	Risk Free Rate (R_f)	Beta	Market Return	Risk Premium = $R_m - R_f$	Beta × Risk Premium	Expected Return
a	b	c	d	e = d - b	f = c × e	G = b + f
Kannyaka Ltd.	8	1.400	-2.5	-10.5	-14.700	-6.70
Portfolio	8	1.015	-2.5	-10.5	-10.658	-2.66

- (ii) If the probability of market giving negative return is more, It is advisable to Mr.X to buy the portfolio suggested by Mr.Y because Beta of portfolio is less than of Kannyaka Ltd.

Question 10

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

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

Other Information:

Risk Free Rate of Return	7%
Market Rate of Return	14%

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

Dec 21 (8 Marks), RTP Nov 15, MTP Feb 15 (8 Marks)

Answer:

(i) Calculation of Prices of shares of both companies

	X Ltd.	Y Ltd.
Beta	0.9	1.20
Cost of Equity using CAPM	$7\% + 0.9 [14\% - 7\%]$ = 13.30%	$7\% + 1.20 [14\% - 7\%]$ = 15.40%
Growth Rate	10%	10%
Price of Share	$\frac{4 \times 1.10}{0.133 - 0.10} = \frac{4.40}{0.033}$ = ₹133.33	$\frac{4 \times 1.10}{0.154 - 0.10} = \frac{4.40}{0.054}$ = ₹81.48

(ii) and (iii)

Name of Company	Current Market Price	Value of the Share	Valuation	Action of the Investor
X Ltd.	₹150.00	₹133.33	Overvalued/ overpriced	Not to Invest/ to be sold
Y Ltd.	₹70.00	₹81.48	Undervalued/ under-priced	Invest/ to be purchased

Alternatively, if the given figure of Dividend is considered as Dividend Expected (D1) then solution will be as follows:

	X Ltd.	Y Ltd.
Beta	0.9	1.20
Cost of Equity using CAPM	$7\% + 0.9 [14\% - 7\%]$ = 13.30%	$7\% + 1.20 [14\% - 7\%]$ = 15.40%

Growth Rate	10%	10%
Price of Share	$\frac{4.00}{0.133-0.10} = \frac{4.00}{0.033} = ₹121.21$	$\frac{4.00}{0.154-0.10} = \frac{4.00}{0.054} = ₹74.07$

(ii) and (iii)

Name of Company	Current Market Price	Value of the Share	Valuation	Action of the Investor
X Ltd.	₹150.00	₹121.21	Overvalued / overpriced	Not to Invest/to be sold
Y Ltd.	₹70.00	₹74.07	Undervalued / under-priced	Invest/to be purchased

Question 11

SRK Ltd. is a listed company and it has just announced annual dividend for the year ending 2013-14. Earning Per Share (EPS) and Dividend Per Share (DPS) for 5 years is as follows:

	2013-14	2012-13	2011-12	2010-11	2009-10
EPS (₹)	14.00	13.60	13.10	12.70	12.20
DPS (₹)	8.20	8.10	7.90	7.80	7.70

In the opinion of MD of SRK Ltd., if current dividend policy is maintained annual growth in Earning and Dividends will be no better than the annual growth in earnings over the past years. Since the Board of SRK Ltd. is reluctant to take debt to finance growth it is considering changing its dividend policy by retaining 50% of its earnings for investment in various projects having a post-tax rate of return of 15%. The beta of SRK Ltd. is 1.5, market risk premium is 4% and Risk Free Rate of Return is 6%.

You are required to calculate expected market price of share, if

1. SRK Ltd. does not announce a change in its Dividend Policy.
2. SRK Ltd. does announce a change in its Dividend Policy by retaining 50% of its earnings.

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

MTP March 15 (10 Marks)

Answer:

Working Notes:

Required Rate of Return using CAPM $6\% + 1.5(10\% - 6\%) = 12\%$

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

Payout Ratio

$$= \left(\frac{8.20+8.10+7.90+7.80+7.70}{5} \right) \div \left(\frac{14.00+13.60+13.10+12.70+12.20}{5} \right)$$

$$= \frac{7.94}{13.12} = 0.605 \text{ or } 60\%$$

1. Market Price of Share using Dividend Valuation Model if there is no change in Dividend Policy and assuming constant growth rate,

$$P = \frac{D_1}{K_e - g} = \frac{8.20 \times 1.035}{0.12 - 0.035} = \frac{8.487}{0.085} = ₹99.85$$

2. Market Price of Share using Earning Growth Model assuming retention ratio inconstant and return on investment perpetual:

$$P = \frac{E(1-b)(1+br)}{k_e-br} = \frac{14.00(1-0.50)(1+0.50 \times 15\%)}{0.12-(0.50 \times 15\%)} = \frac{7.525}{0.12-0.075} = ₹167.22$$

Question 12

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?

Nov 14 (8 Marks), May 18 (4 Marks), MTP Sep 23 (8 Marks), MTP March 19 (8 Marks), StudyMat

Answer:

- (i) **Equilibrium price of Equity using CAPM**

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

$$= 9\% + 4.8\% = 13.8\%$$

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

- (ii) **New Equilibrium price of Equity using CAPM**

$$= 9.18\% + 1.3(13\% - 9.18\%)$$

$$= 9.18\% + 4.966\% = 14.146\%$$

$$= \frac{D_1}{k_e - g} = \frac{2.00(1.10)}{0.14146 - 0.10} = \frac{2.20}{0.04146} = ₹53.06$$

Alternatively, it can also be computed as follows:

$$= 11\% + 1.3(15\% - 8\%)$$

$$= 11\% + 5.2\% = 16.20\%$$

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

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:**

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

- (i) **Expected Growth rate increases by 3%. Hence, revised growth rate stands at 10%:**

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

- (ii) **Beta rises to 1.3. Hence, revised cost of equity shall be:**

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

$$= 9\% + 5.2\% = 14.2\%$$

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 13

K Ltd. has invested in a portfolio of short-term equity investments. You are required to calculate the risk of K Ltd.'s short-term investment portfolio relative to that of the market from the information given below:

Investment	A	B	C	D
No. of shares	1,20,000	1,60,000	2,00,000	2,50,000
Market price per share (₹)	8.58	5.84	4.34	6.28
Beta	2.32	4.56	1.80	3.00
Expected Dividend Yield	9.50%	14.00%	7.50%	16.00%

The current market return is 20% and the risk free return is 10%.

Advise whether K Ltd. should change the composition of its portfolio. If yes, then how.

Note: Make calculations upto 4 decimal points.

RTP May 21

Answer:

- (i) To determine whether K Ltd. should change composition of its portfolio first we should determine the Beta of the Portfolio and compare it with implicit Beta as justified by the Return on Portfolio.

Calculation of Beta of Portfolio

Investment	No. of shares	Market Price (₹)	Market Value	Dividend Yield	Dividend	Composition	β	Weighted β
A	1,20,000	8.58	10,29,600	9.50%	97,812	0.2339	2.32	0.5426
B	1,60,000	5.84	9,34,400	14.00%	1,30,816	0.2123	4.56	0.9681
C	2,00,000	4.34	8,68,000	7.50%	65,100	0.1972	1.80	0.3550
D	2,50,000	6.28	15,70,000	16.00%	2,51,200	0.3566	3.00	1.0698
			44,02,000		5,44,928	1.0000		2.9355

$$\text{Return of the Portfolio} = \frac{5,44,928}{44,02,000} = 0.1238$$

$$\text{Beta of Portfolio} = 2.9355$$

Market Risk implicit

$$0.1238 = 0.10 + \beta \times (0.20 - 0.10)$$

$$\text{Or, } 0.10\beta + 0.10 = 0.1238$$

$$\beta = \frac{0.1238 - 0.10}{0.10} = 0.238$$

Market β implicit is 0.238 while the portfolio β is 2.93. Thus, the portfolio is marginally risky compared to the market.

- (ii) To decide whether K Ltd. should change the composition of its portfolio the dividend yield (given) should be compared with the Expected Return as per CAPM as follows:

$$\text{Expected return as per CAPM is } R_f + (R_M - R_f) \beta$$

Accordingly,

Expected Return for investment A	$= 0.10 + (0.20 - 0.10) 2.32 = 33.20\%$
Expected Return for investment B	$= 0.10 + (0.20 - 0.10) 4.56 = 55.60\%$
Expected Return for investment C	$= 0.10 + (0.20 - 0.10) 1.80 = 28\%$
For investment D,	$= 0.10 + (0.20 - 0.10) 3 = 40\%$

Comparing dividend yields with the expected returns of investment as per CAPM it can be observed that all investments are over-priced and they should be sold by the K Ltd. and acquire new securities.

Question 14

On the basis of the given information, Mr. XLY wants to create a portfolio that is equally as risky as the market and has ₹20,00,000 to invest. The details of the assets are as follows:

Asset	Investment (₹)	Beta
Stock A	4,00,000	0.70
Stock B	5,00,000	1.10
Stock C	?	1.60
Debenture (D)	?	0

How do you recommend and interpret the risk scenario and investment in all the securities?

MTP Apr 24 (6 Marks), MTP Apr 23 (8 Marks)

Answer:

Let W_A , W_B , W_C and W_D be the weights of Stock A, B, C and Debenture respectively.

$$W_A = 4,00,000 \div 20,00,000 = 0.20$$

$$W_B = 5,00,000 \div 20,00,000 = 0.25$$

$$\text{Now } W_C + W_D = 1 - W_A - W_B = \mathbf{0.55}$$

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,

$$W_A (0.7) + W_B (1.1) + W_C (1.6) + W_D (0) = 1$$

$$0.2 \times 0.7 + 0.25 \times 1.1 + 1.6W_C + W_D \times 0 = 1$$

$$0.14 + 0.275 + 1.6W_C + 0 = 1$$

$$1.6W_C = 1 - 0.415$$

$$1.6W_C = 0.585$$

$$W_C = 0.585 / 1.6 = \mathbf{0.3656}$$

$$\text{Weight of Debenture (WD)} = 1 - 0.2 - 0.25 - 0.3656 = \mathbf{0.1844}$$

$$\text{Hence, Amount invested in Stock C} = 0.3656 \times 20,00,000 = ₹7,31,200$$

$$\text{Amount invested in Debenture D} = 0.1844 \times 20,00,000 = ₹3,68,800$$

Thus, amount to be invested in Stock (C) is ₹ 7,31,200 and in Debenture is ₹3,68,800.

Question 15

M/s. Siri Ltd. Has a surplus amount of ₹3 crores to invest and has shortlisted the following equity shares:

Company	Beta
S Ltd.	1.6
K Ltd.	1
P Ltd.	-0.3
D Ltd.	2
C Ltd.	0.6

Required:

- If M/s. Siri Ltd. invests an equal amount in all securities, what is the beta of the portfolio?
- If M/s. Siri Ltd. invests 15% of its investment in S Ltd., 15% in P Ltd., 10% in C Ltd. and the balance in equal amount in the other two securities, what is the beta of the portfolio?
- If the expected return of market portfolio is 12% at a beta factor of 1.0, what will be the portfolios expected return in both the situations given above?
- If the Company changes its policy to invest in any 3 securities with a minimum of 20% in each of these 3 securities to diversify risk, you are requested to advise the company to have a right mix of securities to maximize the return in the following two scenarios and also calculate the expected return:
 - Bull Phase: Expected Market returns 10%
 - Bear Phase: Expected Market returns — 5%

Nov 22 (8 Marks)

Answer:

i. Beta of the Portfolio

Investment	Beta (β)	Investment (₹Lakhs)	Weighted Investment
S Ltd.	1.6	60	96
K Ltd.	1.0	60	60
P Ltd.	-0.3	60	-18
D Ltd.	2.0	60	120
C Ltd.	0.6	60	36
		300	294

$$\beta_p = \frac{294 \text{ lakh}}{300 \text{ lakh}} = 0.98$$

Alternatively, it can also be computed as follows:

$$1.6 \times \frac{1}{5} + 1.0 \times \frac{1}{5} + (-0.30) \times \frac{1}{5} + 2 \times \frac{1}{5} + 0.6 \times \frac{1}{5} = 0.98$$

ii. With varied percentages of investments portfolio beta is calculated as follows:

Investment	Beta (β)	Investment (₹Lakhs)	Weighted Investment
S Ltd.	1.6	45	72
K Ltd.	1.0	90	90
P Ltd.	-0.3	45	-13.50
D Ltd.	2.0	90	180
C Ltd.	0.6	30	18
		300	346.50

$$\text{Beta} = \frac{346.50}{300} = 1.155$$

- iii. Expected return of the portfolio with pattern of investment as in case (i) = $12\% \times 0.98$ i.e. 11.76%
 Expected Return with pattern of investment as in case (ii) = $12\% \times 1.155$ i.e., 13.86%.

iv.

1. Securities to be selected during Bull Phase Expected Market returns 10%

As it is bull Market Higher Beta stocks should be selected.

Shares	% to be invested	Beta (β)	Investment	Weighted Investment
S Ltd.	20	1.6	60,00,000	96,00,000
K Ltd.	20	1	60,00,000	60,00,000
P Ltd.	0	-0.3	-	-
D Ltd.	60	2	1,80,00,000	3,60,00,000
C Ltd.	0	0.6	-	-
	100		3,00,00,000	5,16,00,000

Portfolio or Weighted Beta (β) (5,16,00,000/ 3,00,00,000)	1.72
Portfolio Beta (β)	1.72
Market Return	10%
Expected Return	17.20%

2. Securities to be selected During Bear Phase Expected Market returns – 5%

As it is bear market Lower Beta stocks should be selected

Shares	% to be invested	Beta (β)	Investment	Weighted Investment
S Ltd.	0	1.6	-	-
K Ltd.	20	1	60,00,000	60,00,000
P Ltd.	60	-0.3	1,80,00,000	-54,00,000
D Ltd.	0	2	-	-
C Ltd.	20	0.6	60,00,000	36,00,000
	100		3,00,00,000	42,00,000

Portfolio or Weighted Beta (β) (42,00,000/ 3,00,00,000)	0.14
Portfolio Beta (β)	0.14
Market Return	-5%
Expected Return	-0.70%

Question 16

Following is the information related to return on shares of three different companies:

Years	A Ltd.	B Ltd.	C Ltd.
2018	2%	3%	5%
2019	6%	8%	7%
2020	13%	14%	15%
2021	7%	9%	11%

Required:

- (i) Construct maximum number of portfolio and its return, if each portfolio consists of any two Company's shares in proportion of 65% and 35% and suggest which portfolio provides highest return.

- (ii) Calculate portfolio return and beta (β), if Mr. X invests ₹65,000 in A Ltd. Having beta (β) of 0.45; ₹20,000 in B Ltd. having beta (β) of 1.15 and ₹15,000 in C Ltd. having beta (β) of 1.8.

Nov 22 (8 Marks)

Answer:**(a) Calculation of Average Return**

Year	A Ltd.	B Ltd.	C Ltd.
2018	2%	3%	5%
2019	6%	8%	7%
2020	13%	14%	15%
2021	2021	9%	11%
Sum	28%	34%	38%
Average	7%	8.50%	9.50%

i.

- (1) Combination 1 - 65% in A Ltd. & 35% B Ltd.

$$\text{Return} = 7\% \times 0.65 + 8.50\% \times 0.35 = 4.55\% + 2.975\% = 7.525\% \text{ or } 7.53\%$$

- (2) Combination 2 - 65% in B Ltd. & 35% in C Ltd.

$$\text{Return} = 8.50\% \times 0.65 + 9.50\% \times 0.35 = 5.525\% + 3.325\% = 8.85\%$$

- (3) Combination 3 - 65% in C Ltd. & 35% in A Ltd.

$$\text{Return} = 0.65 \times 9.50\% + 0.35 \times 7.00\% = 6.175\% + 2.45\% = 8.625\% \text{ or } 8.63\%$$

- (4) Combination 4 - 65% in A Ltd. & 35% in C Ltd.

$$\text{Return} = 0.65 \times 7\% + 0.35 \times 9.50\% = 4.55\% + 3.325\% = 7.875\% \text{ or } 7.88\%$$

- (5) Combination 5 - 35% in A Ltd. & 65% in B Ltd.

$$\text{Return} = 0.35 \times 7\% + 0.65 \times 8.50\% = 2.45\% + 5.525\% = 7.975\% \text{ or } 7.98\%$$

- (6) Combination 6 - 35% in B Ltd. & 65% in C Ltd.

$$\text{Return} = 0.35 \times 8.50\% + 0.65 \times 9.50\% = 2.975\% + 6.175\% = \mathbf{9.15\%}$$

ii. Calculation of Return and Beta of Portfolio

$$\begin{aligned} \text{Return of Portfolio} &= 7\% \times \frac{65,000}{1,00,000} + 8.50\% \times \frac{20,000}{1,00,000} + 9.50\% \times \frac{15,000}{1,00,000} \\ &= \mathbf{7.675\%} \end{aligned}$$

$$\begin{aligned} \text{Beta of Portfolio} &= 0.45 \times \frac{65,000}{1,00,000} + 1.15 \times \frac{20,000}{1,00,000} + 1.80 \times \frac{15,000}{1,00,000} \\ &= \mathbf{0.7925 \text{ or } 0.79} \end{aligned}$$

Question 17

You are presented with the following information concerning the returns on the shares of C Ltd. and on the market portfolio, according to the various conditions of the economy.

Condition of economy	Prob. of condition	Returns on C Ltd.	Returns on Market
1	0.2	15%	10%
2	0.4	14%	16%
3	0.4	26%	24%

The current risk free interest rate is 9%

Required:

- Calculate the coefficient of correlation between the returns on C Ltd. and the market portfolio.
- Calculate the total risk (i.e. standard deviation) of C Ltd. and discuss why this is not the most appropriate measure of risk to be used in making investment decisions.
- Calculate the beta factor for C Ltd. and briefly discuss its significance. Is C Ltd. efficiently priced according to the CAPM and the information given above?

Answer:

Prob.	C	M	C × P	M × P	(C-C)	(M-M)	[(C-C)(M-M)] P	$(\bar{C}-C)^2 P$	$(\bar{M}-M)^2 P$
0.20	15	10	3	2	-4	-8	6.4	3.20	12.80
0.40	14	16	5.6	6.4	-5	-2	4	10.00	1.60
0.40	26	24	10.40	9.6	7	6	16.80	19.60	14.40
			$\bar{C} = 19$	$\bar{M} = 18$			27.20	$\sigma_c^2 = 32.80$	$\sigma_m^2 = 28.80$
								$\sigma_c = 5.73$	$\sigma_m = 5.37$

a.

$$R_{CM} = \frac{\text{Cov}_{CM}}{\sigma_C \sigma_M} = \frac{27.20}{5.73 \times 5.37} = 0.88$$

b. Total Risk C Ltd = 5.73%

This is not the best measure for taking investment decisions because it contains unsystematic Risk which can be diversified & reduced to a greater extent & thus market will not give any premium for this Risk.

The best measure is β [Systematic Risk]

c.

$$\begin{aligned} \text{Beta} &= \frac{\text{Cov}_{CM}}{\sigma_M^2} \text{ or } \frac{R_{CM} \times \sigma_C}{\sigma_M} \\ &= \frac{27.20}{5.37^2} \text{ or } \frac{0.88 \times 5.73}{5.37} \\ \beta_C &= 0.94 \text{ or } 0.94 \end{aligned}$$

In order to calculate if the stock is efficiently priced. We need to compare Theoretical Return [CAPM] & Expected Return [Incomplete in book]

$$\begin{aligned} \therefore \text{CAPM } R_C &= R_f + \beta [R_m - R_f] \\ &= 9 + 0.94 [18 - 9] \\ &= 17.46 \end{aligned}$$

Expected [19%] > CAPM [17.46]

$\therefore$ Shares are undervalued & its worth buying now.

Question 18

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%.

MTP Nov 21 (8 Marks)

Answer:

(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

$$\frac{\text{Dividend Earned} + \text{Capital appreciation}}{\text{Initial investment}} \times 100 = \frac{₹66,75,000}{₹7,50,00,000} \times 100 = 8.90\%$$

Weighted Average Beta of the Portfolio

$$\frac{3,00,00,000}{7,50,00,000} = 0.40$$

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 the present risk appetite, the client would expect at least a return of 6.37% on Bonds.

(2) The expected return on the Portfolio using CAPM:

$$= 7\% + 0.40[12.7 - 7\%] = 9.28\%$$

Since the actual return is 8.90% which is quite lower than expected return considering the systematic risk borne by the investor and hence portfolio has not outperformed the market rather has underperformed.

Question 19

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?

RTP Nov 21, RTP Nov 16, Nov 11 (8 Marks), RTP May 20 MTP Mar 17 (8 Marks), StudyMat

Answer:

(i)

Security	No. of shares (1)	Market Price of Per Share (2)	(1) × (2)	% to total (w)	$\beta(x)$	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)	$\beta (x)$	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		10	462500	0.2780	0	0
			1662050	1		0.80

Revised Portfolio beta 0.80

(iii)

To increase Beta to	1.2
Required Beta	1.2
It should become $(1.2 / 1.108)$	108.30 % of present beta
If ₹12,00,000 is 108.30%, the total portfolio should be ₹12,00,000 × 100/108.30 or	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)	$\beta (x)$	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
			1662050	1		1.20

Portfolio Beta 1.20

Alternative Approach

(i) Let x be the amount of Risk-Free Asset to be acquired, then

Security	(1) × (2)	$B(x)$	wx
VSL	500000	0.9	450000
CSL	100000	1	100000
SML	200000	1.5	300000
APL	400000	1.2	480000
Risk free asset	x	0	0
	120000 + x		1330000

Accordingly,

$$\frac{13,30,000}{12,00,000+x} = 0.8$$

$x = 462500$ i.e. value of Risk Free Asset to be purchased to decrease beta of portfolio to 0.8.

(ii) Similarly let y the amount of Risk Free Assets to be divest, then

$$\frac{13,30,000}{12,00,000+y} = 1.20$$

$y = -91,667$ i.e. value of Risk Free Asset to be divested to increase beta of portfolio to 1.20.

Question 20

The returns of a portfolio A and market portfolio for the last 12 months are indicated as follows:

Month	Portfolio A	Market Portfolio
January	- 0.52	0.82
February	2.20	0.04
March	2.17	2.80
April	4.17	1.72
May	2.04	0.27
June	3.00	0.39
July	1.99	1.95
August	4.00	0.64
September	-1.38	1.53
October	2.67	2.70
November	3.99	2.52
December	1.86	2.09
Standard Deviation (σ)	1.6223	0.9498

- (i) You are required to find out the monthly returns attributable to the sheer skill of the Portfolio Manager.
(ii) What part of the monthly return is attributable to the higher risk assumed by the Portfolio Manager?

Assume that the risk-free rate of return is 12% per annum and the portfolio is fully diversified.

Nov 19 (8 Marks)

Answer:

(i) The monthly risk free rate of return = $(12\%/12) = 1\%$

Month	R_A	R_M
January	-0.52	0.82
February	2.20	0.04
March	2.17	2.80
April	4.17	1.72
May	2.04	0.27
June	3.00	0.39
July	1.99	1.95

August	4.00	0.64
September	-1.38	1.53
October	2.67	2.70
November	3.99	2.52
December	1.86	2.09
	26.19	17.47
Average Returns	2.1825	1.4558

(ii) Average Portfolio Return (R_p) = 2.1825

Average Market Return (R_m) = 1.4558

Portfolio Risk (σ_p) = 1.6223

Market Risk (σ_m) = 0.9498

Since portfolio A is fully diversified then it can be compared with a portfolio whose beta (β) can be found as follows:

$$\sigma_m^2 \times \beta^2 = \sigma_p^2$$

$$\beta = \frac{\sigma_p}{\sigma_m} = \frac{1.6223}{0.9498} = 1.708$$

Therefore, portfolio A is comparable to a portfolio whose Beta is 1.708.

Expected monthly returns on such portfolio can be calculated as follows:

$$R'_p = R_f + \beta (R_m - R_f)$$

$$= 1\% + 1.708 (1.4558\% - 1.0000\%)$$

$$= 1.7785\%$$

Return due to the net selectivity = $R_p - R'_p$

$$= 2.1825\% - 1.7785\% = 0.404\% \text{ per month}$$

(ii) **The returns due to higher risk assumed by the portfolio manager**

$$= 1.7785\% - 1.4558\% = 0.3227\% \text{ per month}$$

Question 21

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

It is supposed that there are no restrictions on short sales.

- What would be the weight for each stock for a portfolio constructed by investing ₹5,000 in portfolio X and ₹3,000 in portfolio Y?
- Suppose the investor invests ₹4,000 out of ₹8,000 in security A. How he will allocate the balance between security B and C to ensure that his portfolio is on minimum variance set?

May 23 (8 Marks), June 09 (6 Marks), StudyMat

Answer:

- (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:-

$$W_B = a + bW_A$$

Substituting the values of W_A & W_B from portfolio X and Y in above equation, we get

$$0.40 = a + 0.30b, \text{ and}$$

$$0.50 = a + 0.20b$$

Solving above equation we obtain the slope and intercept, $a = 0.70$ and $b = -1$ and thus, the critical line is

$$W_B = 0.70 - W_A$$

If half of the funds is invested in security A then,

$$W_B = 0.70 - 0.50 = 0.20$$

$$\text{Since } W_A + W_B + W_C = 1$$

$$W_C = 1 - 0.50 - 0.20 = 0.30$$

Allocation of funds to

$$\text{Security B} = 0.20 \times 8,000 = ₹1,600, \text{ and}$$

$$\text{Security C} = 0.30 \times 8,000 = ₹2,400$$

Question 22

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 the weights of the above categories of stocks in the market index. Further, the sensitivity of returns on these categories of stocks to the three important factors 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:

- Using Arbitrage Pricing Theory, determine the expected return on the market index.
- Using Capital Asset Pricing Model (CAPM), determine the expected return on the market index.
- Mr. Nirmal Kumar wants to construct a portfolio constituting only the 'small cap value' and 'large cap growth' stocks. If the target beta for the desired portfolio is 1, determine the composition of his portfolio.

MTP April 22 (8 Marks), RTP Nov 19, StudyMat

Answer:

Method I

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

$$0.25 \times 5.9925 + 0.10 \times 8.8525 + 0.50 \times 8.478 + 0.15 \times 7.535 = 7.7526\%$$

Method II

Expected return on the market index

$$\begin{aligned} &= 4.5\% + [0.1 \times 0.9 + 0.25 \times 0.8 + 0.15 \times 0.85 + 0.50 \times 1.165] \times 6.85 + [(0.75 \times 0.10 + 1.39 \times 0.25 \\ &+ 2.05 \times 0.15 + 2.75 \times 0.5)] \times (-3.5) + [(1.25 \times 0.10 + 1.35 \times 0.25 + 6.75 \times 0.15 + 8.65 \times 0.50)] \times 0.65 \\ &= 4.5 + 6.85 + (-7.3675) + 3.77 \\ &= 7.7525\% \end{aligned}$$

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

$$= 0.25 \times 9.98 + 0.10 \times 10.665 + 0.50 \times 12.48 + 0.15 \times 10.3225$$

$$= 11.33\%$$

Let us assume that Mr. Nirmal will invest $X_1\%$ in small cap value stock and $X_2\%$ in large cap growth stock

$$X_1 + X_2 = 1$$

$$0.90 X_1 + 1.165 X_2 = 1$$

$$0.90 X_1 + 1.165(1 - X_1) = 1$$

$$0.90 X_1 + 1.165 - 1.165 X_1 = 1$$

$$0.165 = 0.265 X_1$$

$$\frac{0.165}{0.265} = X_1$$

$$0.623 = X_1, X_2 = 0.377$$

$$62.3\% \text{ in small cap value}$$

$$37.7\% \text{ in large cap growth.}$$

Question 23

An investor has categorized all the available stock in the market into the following types and the estimated weights of the categories of stocks in the market index are given below. Further, the sensitivity of returns of these categories of stocks to two factors Inflation and Stock market are also given below:

Category	Weight in Market Index	Factor 1 (Inflation)			Factor 2 (Stock Market)		
		Beta 1	Expected Value in %	Actual Value in %	Beta 2	Expected Value in %	Actual Value in %
Small Cap	20%	1.20	6.70	6.70	0.80	10.00	10.50
Medium Cap	30%	1.75	4.50	6.00	0.90	7.00	8.00
Large Cap	15%	1.30	6.75	8.00	1.165	9.00	10.00
Flexi Cap	35%	1.70	7.00	6.50	0.85	8.85	9.75

Risk Free Rate of Interest is 7.50%., Round of to 2 decimal.

You are required to calculate:

- Expected return on the market index for both the factors.
- Expected return on the market index under Arbitrage Pricing Theory (Existing Scenario).
- Expected return on the market index under Arbitrage Pricing Theory if the composition of the Portfolio is changed to 25% equally in all four categories.
- Which alternative (Existing or Changed) will be more prof table?

Nov 23 (8 Marks)

Answer:**i. Expected Return on Market Index for Both factors****Factor 1**

$$= 0.20 \times 6.70\% + 0.30 \times 4.50\% + 0.15 \times 6.75\% + 0.35 \times 7.00\%$$

$$= 1.34\% + 1.35\% + 1.01\% + 2.45\% = \mathbf{6.15\%}$$

Factor 2

$$= 0.20 \times 10\% + 0.30 \times 7\% + 0.15 \times 9\% + 0.35 \times 8.85\%$$

$$= 2\% + 2.10\% + 1.35\% + 3.10\% = \mathbf{8.55\%}$$

ii. Calculation of expected Return on the Market index under Arbitrage Pricing Theory (Existing Scenario):

Category	Factor 1 (Inflation)				
	Beta	Actual value	Expected value	Difference	Beta x Diff.
	(a)	(b) (%)	(c) (%)	(b) - (c) = (d) (%)	(e)
Small Cap	1.20	6.70	6.70	0.00	0.00
Medium Cap	1.75	6.00	4.50	1.50	2.63
Large Cap	1.30	8.00	6.75	1.25	1.63
Flexi cap	1.70	6.50	7.00	(0.50)	(0.85)

Category	Factor 2 (Stock Market)					
	Beta	Actual value	Expected value	Difference	Beta x Diff.	Total
	(f)	(g) (%)	(h) (%)	(g) - (h) = (i) (%)	(j)	(e) + (j) = (k)
Small Cap	0.80	10.50	10.00	0.50	0.40	0.40
Medium Cap	0.90	8.00	7.00	1.00	0.90	3.53
Large Cap	1.165	10.00	9.00	1.00	1.17	2.80
Flexi cap	0.85	9.75	8.85	0.90	0.77	(0.08)

Category	Weight in market index (1)	Total Beta x Diff (2)	Expected Return (2 × 1 = 3)
Small Cap	20%	0.40	0.08
Medium Cap	30%	3.53	1.06
Large Cap	15%	2.80	0.42
Flexi cap	35%	(0.08)	(0.03)
Total			1.53
Add: Risk Free Rate of Interest			7.50
Expected Return (%)			9.03

iii. **Expected Return on the Market Index under Arbitrage Pricing Theory under changed scenario:**

Category	Weight in market index (1)	Total Beta x Diff (2)	Expected Return (2 × 1 = 3)
Small Cap	25%	0.40	0.10
Medium Cap	25%	3.53	0.88
Large Cap	25%	2.80	0.70
Flexi cap	25%	(0.08)	(0.02)
Total			1.66
Add: Risk Free Rate of Interest			7.50
Expected Return (%)			9.16

- iv. As per the above calculation, the investors by investing 25% equally in all four categories, is prof table compared to the existing composition. As the proposed composition gives rate of return of 9.16% per annual when compared to the existing return of the present portfolio which is 9.03%.

Question 24

A study by a Mutual fund has revealed the following data in respect of three securities:

Security	$\sigma(\%)$	Correlation with Index, P_m
A	20	0.60
B	18	0.95
C	12	0.75

The standard deviation of market portfolio (BSE Sensex) is observed to be 15%.

- What is the sensitivity of returns of each stock with respect to the market?
- What are the co-variances 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)?

Nov 09 (8 Marks), RTP Nov 15, MTP March 19 (8 Marks), RTP Nov 20, StudyMat

Answer:

☐☐ **Sensitivity of each stock with market is given by its beta.**

Standard deviation of market Index = 15%

Variance of market Index = 0.0225

Beta of stocks = $\sigma_i r / \sigma_m$

$$A = 20 \times 0.60/15 = 0.80$$

$$B = 18 \times 0.95/15 = 1.14$$

$$C = 12 \times 0.75/15 = 0.60$$

iii) 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	108.00	153.900	144.000

iii) Total risk of the equally weighted portfolio (Variance)

$$= 400(1/3)^2 + 324(1/3)^2 + 144(1/3)^2 + 2(205.20)(1/3)^2 + 2(108.0)(1/3)^2 + 2(153.900)(1/3)^2$$

$$= 200.244$$

iii) β of equally weighted portfolio

$$\beta_p = \frac{\sum \beta_i}{N} = \frac{0.80+1.14+0.60}{3} = 0.8467$$

iii) Systematic Risk $\beta_p^2\sigma_m^2 = (0.8467)^2(15)^2 = 161.302$

iii) Unsystematic Risk = Total Risk – Systematic Risk
 $= 200.244 - 161.302$
 $= 38.942$

Question 25

Following are the details of a portfolio consisting of three shares:

Share	Portfolio weight	Beta	Expected return in %	Total Variance
DGS	0.35	0.30	12%	0.010
DV	0.25	1.20	18%	0.030
BP	0.40	0.50	10%	0.015

Standard Deviation of Market Portfolio Returns = 14%

Covariance (DGS, DV) = 0.020,

Covariance (DV, BP) = 0.050,

Covariance (BP, DGS) = 0.030

You are required to calculate:

- 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).

Jan 21 (8 Marks), May 15 (8 Marks), MTP Oct 17 (10 Marks), MTP April 18 (8 Marks), MTP Aug 18 (10 Marks), MTP Nov 21 8 Marks, RTP May 18, StudyMat

Answer:

(i) **Portfolio Beta**

$$0.35 \times 0.30 + 0.25 \times 1.20 + 0.40 \times 0.50 = 0.605$$

(ii) Residual Variance

To determine Residual Variance first of all we shall compute the Systematic Risk as follows:

$$\beta_A^2 \times \sigma_M^2 = (0.30)^2(0.14)^2 = \mathbf{0.001764}$$

$$\beta_B^2 \times \sigma_M^2 = (1.20)^2(0.14)^2 = \mathbf{0.028224}$$

$$\beta_C^2 \times \sigma_M^2 = (0.50)^2(0.14)^2 = \mathbf{0.0049}$$

Residual Variance

$$\text{DGS} \quad 0.010 - 0.001764 \quad = \mathbf{0.008236}$$

$$\text{DV} \quad 0.030 - 0.028224 \quad = \mathbf{0.001776}$$

$$\text{BP} \quad 0.015 - 0.0049 \quad = \mathbf{0.0101}$$

(iii) Portfolio variance using Sharpe Index Model

$$\text{Systematic Variance of Portfolio} = (0.14)^2 \times (0.605)^2 = \mathbf{0.007174 \text{ or } 0.0072}$$

$$\text{Unsystematic Variance of Portfolio} = 0.008236 \times (0.35)^2 + 0.001776 \times (0.25)^2 + 0.0101 \times (0.40)^2 \\ = \mathbf{0.002736 \text{ or } 0.0027}$$

$$\text{Total Variance} = 0.007174 + 0.002736 = \mathbf{0.00991 \text{ or } 0.0099}$$

(iv) Portfolio variance on the basis of Markowitz Theory

$$= (W_A \times W_A \times \sigma_A^2) + (W_A \times W_B \times \text{COV}_{AB}) + (W_A \times W_C \times \text{COV}_{AC}) + (W_B \times W_A \times \text{COV}_{AB}) + (W_B \times W_B \times \sigma_B^2) + \\ (W_B \times W_C \times \text{COV}_{BC}) + (W_C \times W_A \times \text{COV}_{CA}) + (W_C \times W_B \times \text{COV}_{CB}) + (W_C \times W_C \times \sigma_C^2) \\ = (0.35 \times 0.35 \times 0.010) + (0.35 \times 0.25 \times 0.020) + (0.25 \times 0.40 \times 0.050) + (0.40 \times 0.35 \times 0.030) + \\ (0.25 \times 0.35 \times 0.020) + (0.40 \times 0.25 \times 0.050) + (0.35 \times 0.40 \times 0.030) + (0.25 \times 0.25 \times 0.030) \\ + (0.40 \times 0.40 \times 0.015) \\ = 0.001225 + 0.00175 + 0.005 + 0.0042 + 0.00175 + 0.005 + 0.0042 + 0.001875 + 0.0024 \\ = \mathbf{0.0274}$$

Question 26

The expected return of the market portfolio is 14% and the risk free rate is 10%. The standard deviation of the market portfolio is 28% whereas the standard deviation of the portfolio of an investor is 37%. Find out the expected return of the investor as per CML

Answer:

$$\text{CML} = R_i = R_f + \frac{\sigma_i}{\sigma_m} [R_m - R_f] \\ = 10 + \frac{37}{28} [14 - 10] \\ = \mathbf{15.29\%}$$

Question 27

Expected returns on two stocks against BSE SENSEX returns are given in the following table under two scenarios-bullish and bearish:

Market return	Scenario -1: Bullish Case	Scenario -2: Bearish Case
BSE Sensex	25%	-5%
Stock R	32%	-4%
Stock Z	18%	-3%

You are required to calculate:

- The Betas of two stocks R and Z.
- Expected return on each stock, if the likelihood of market achieving Scenario-1 is thrice the likelihood of the market achieving Scenario-2.
- The Security Market Line (SML), if the risk free rate is 8% and likelihood of the market return achieving the bullish base returns of 25% is thrice that of achieving -5% returns.
- The Alphas of the two stocks based on Sharpe Index Model.

Nov 23 (8 Marks), RTP May 14, RTP May 18, RTP May 19, MTP Aug 18 (8 Marks), MTP Sep 23 (8 Marks), MTP March 15 (8 Marks), MTP Oct 19 (8 Marks), MTP May 20 (5 Marks), StudyMat

Answer:

i. The Betas of two stocks:

Stock R - $(32\% + 4\%)/(25\% + 5\%) = 1.2$
 Stock Z - $(18\% + 3\%)/(25\% + 5\%) = 0.70$

Alternatively, it can also be solved by using the Characteristic Line Relationship as follows:

$$R_s = \alpha + \beta R_m$$

Where

α = Alpha

β = Beta

R_m = Market Return

For Stock R

$$32\% = \alpha + \beta(25\%)$$

$$-4\% = \alpha + \beta(-5\%)$$

$$36\% = \beta(30\%)$$

$$\beta = 1.2$$

For Stock Z

$$18\% = \alpha + \beta(25\%)$$

$$-3\% = \alpha + \beta(-5\%)$$

$$21\% = \beta(30\%)$$

$$\beta = 0.70$$

Alternatively, Beta can also be calculated as follows:

Basic Calculation for stock R

(R_R)	$\bar{R}_R$	$R_R - \bar{R}_R$	$(R_R - \bar{R}_R)^2$	(R_m)	$\bar{R}_M$	$R_m - \bar{R}_M$	$(R_m - \bar{R}_M)^2$	$(R_R - \bar{R}_R)(R_m - \bar{R}_M)$
32%	14%	18%	324	25%	10%	15%	225	270
-4%	14%	-18%	324	-5%	10%	-15%	225	270
Total			648				450	540

Basic Calculation for stock Z

(R_R)	$\bar{R}_R$	$R_R - \bar{R}_R$	$(R_R - \bar{R}_R)^2$	(R_m)	$\bar{R}_M$	$R_m - \bar{R}_M$	$(R_m - \bar{R}_M)^2$	$(R_R - \bar{R}_R)(R_m - \bar{R}_M)$
18%	7.5%	10.5%	110.25	25%	10%	15%	225	157.50
-3%	7.5%	-10.5%	110.25	-5%	10%	-15%	225	157.50
Total			220.50				450	315

Co- Variance (R, M) = $540/2 = 270$

Co- Variance (Z, M) = $315/2 = 157.50$

$(\sigma_M)^2 = 450/2 = 225$

Beta of stocks R & Z

$$\text{Beta}(R) = \frac{\text{Cov. (R, M)}}{\sigma_M^2} = 270/255 = 1.2$$

$$\text{Beta}(Z) = \frac{\text{Cov. (R, Z)}}{\sigma_M^2} = 157.5/255 = 0.7$$

ii. Expected returns of the two stocks:

Stock R - $0.75 \times 32\% - 0.25 \times 4\% = 23\%$

Stock Z - $0.75 \times 18\% - 0.25 \times 3\% = 12.75\%$

iii.

Expected return of market portfolio

$$= 0.75 \times 25\% + 0.25\% \times (-5\%) = 17.50\%$$

$\therefore$ Market risk prem.

$$= 17.50\% - 8.00\% = 9.5\%$$

$\therefore$ SML is, required return

$$= 8.00\% + \beta i 9.5\%$$

iv. Alpha for two stocks

Required Return for Stock R

$$E(R) = \alpha_R + \beta R_M$$

Accordingly

$$23\% = \alpha_R + 1.20 \times 17.50\%$$

$$\alpha_R = 2\%$$

Required Return for Stock Z

$$E(Z) = \alpha_Z + \beta R_M$$

Accordingly

$$12.75\% = \alpha_Z + 0.70 \times 17.50\%$$

$$\alpha_Z = 0.5\%$$

Question 28

Following are the security returns and market returns for last 10 months

	Security Return (X)	Market Return (Y)
1	4.6	3.2
2	-0.5	0.3
3	3.3	3.8
4	3.9	3.5
5	-2.3	-1.6
6	4.5	4.1
7	4.6	4.0
8	4.3	4.4
9	4.1	6.0
10	-3.6	-2.7

Estimate the values of α & β for the security

Answer:

X	Y	XY	Y ²
4.6	3.3	15.18	10.89
-0.5	0.3	-0.15	0.09
3.3	3.8	12.54	14.44
3.9	3.5	13.65	12.25
-2.3	-1.6	3.68	2.56
4.5	4.1	18.45	16.81
4.6	4.0	18.40	16.00
4.3	4.4	18.92	19.36
4.1	6.0	24.60	36
-3.6	-2.7	9.72	7.29
X = 2.29	Y = 2.51	135.00	135.69

According to Regression Analysis:

$$\beta_i = \frac{\sum xy - n\bar{x}\bar{y}}{\sum y^2 - n\bar{y}^2} = \frac{135 - 10 \times 2.29 \times 2.51}{135.69 - 10 \times (2.51)^2} = \frac{77.52}{72.69} = 1.066$$

According to SIM/SCL

$$R_i = \alpha_i + \beta_i R_m$$

$$R_x = \alpha_x + \beta_x R_m$$

$$2.29 = \alpha_x + 1.066 \times 2.51$$

$$\alpha_x = -0.39$$

Question 29

The returns and market portfolio for a period of four years are as under:

Year	% Return of Stock B	% Return on Market Portfolio
1	10	8
2	12	10
3	9	9
4	3	-1

For stock B, you are required to determine:

- (i) Characteristic line; and
- (ii) The Systematic and Unsystematic risk.

June 09 (6 Marks), Nov 16 (8 Marks)

Answer:

Characteristic line is given by

$$\alpha_i + \beta_i R_m$$

$$\beta_i = \frac{\sum xy - n\bar{x}\bar{y}}{\sum x^2 - n(\bar{x})^2}$$

$$\alpha_i = \bar{y} - \beta\bar{x}$$

Return on B(Y)	Return on Market (X)	XY	X ²	(x-x̄)	(x-x̄) ²	(y-ȳ)	(y-ȳ) ²
10	8	80	64	1.50	2.25	1.50	2.25
12	10	120	100	3.50	12.25	3.50	12.25
9	9	81	81	2.50	6.25	0.50	0.25
3	-1	-3	1	-7.50	56.25	-5.50	30.25
34	26	278	246		77.00		45.00

$$\bar{y} = \frac{34}{4} = 8.50, \bar{x} = \frac{26}{4} = 6.50$$

$$\beta = \frac{\sum xy - n\bar{x}\bar{y}}{\sum x^2 - n(\bar{x})^2} = \frac{278 - 4(6.50)(8.50)}{246 - 4(6.50)^2} = \frac{278 - 221}{246 - 169} = \frac{57}{77} = 0.74$$

$$\alpha = \bar{y} - \beta\bar{x} = 8.50 - 0.74(6.50) = 3.69$$

Hence the characteristic line is **3.69 + 0.74 (R_m)**

$$\text{Total Risk of Market} = \sigma_m^2 = \frac{\sum (x - \bar{x})^2}{n} = \frac{77}{4} = 19.25(\%)$$

$$\text{Total Risk of Stock} = \frac{45}{4} = 11.25(\%)$$

$$\text{Systematic Risk} = \beta_i^2 \sigma_m^2 = (0.74)^2 \times 19.25 = 10.54(\%)$$

$$\text{Unsystematic Risk is} = \text{Total Risk} - \text{Systematic Risk} = 11.25 - 10.54 = 0.71(\%)$$

Question 30

Five portfolios experienced the following results during a 7- year period:

Portfolio	Average Annual Return (R _p) (%)	Standard Deviation (S _p)	Correlation with the market returns (r)
A	19.0	2.5	0.840
B	15.0	2.0	0.540
C	15.0	0.8	0.975
D	17.5	2.0	0.750
E	17.1	1.8	0.600
Market Risk (σ _m)		1.2	
Market rate of Return (R _m)	14.0		
Risk-free Rate (R _f)	9.0		

Rank the portfolios using (a) Sharpe's method, (b) Treynor's method and (c) Jensen's Alpha

RTP Nov 21, MTP Oct 19 (8 Marks), StudyMat

Answer:Let portfolio standard deviation be σ_p

Market Standard Deviation	=	σ_m
Coefficient of correlation	=	r
Portfolio beta (β_p)	=	$\frac{\sigma_p r}{\sigma_m}$

Required portfolio return (R_p) = $R_f + \beta_p (R_m - R_f)$

Portfolio	Beta	Return from the portfolio (R_p)(%)
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 31

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
M	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

Nov 16 (8 Marks), MTP Mar 24 (8 Marks), MTP Mar 19 (12 Marks), RTP Nov 20, StudyMat

Answer:

(i) Variance of Returns

$$\text{Cor}_{i,j} = \frac{\text{Cov}(i,j)}{\sigma_i \sigma_j}$$

Accordingly, for MFX

$$1 = \frac{\text{Cov}(X,X)}{\sigma_X \sigma_X}$$

$$\sigma_X^2 = 4.800$$

Accordingly, for MFY

$$1 = \frac{\text{Cov}(Y,Y)}{\sigma_Y \sigma_Y}$$

$$\sigma_Y^2 = 4.250$$

Accordingly, for Market Return

$$1 = \frac{\text{Cov}(M,M)}{\sigma_M \sigma_M}$$

$$\sigma_M^2 = 3.100$$

Alternatively, by referring diagonally the given Table these values can identified as follows:

Variance_X = 4.800

Variance_Y = 4.250

Variance_X = 3.100

(ii) Portfolio return, beta, variance and standard deviation

$$\text{Weight of MFX in portfolio} = \frac{1,20,000}{2,00,000} = 0.60$$

$$\text{Weight of MFY in portfolio} = \frac{80,000}{2,00,000} = 0.40$$

Accordingly, **Portfolio Return**

$$0.60 \times 15\% + 0.40 \times 14\% = 14.60\%$$

Beta of each Fund

$$\beta = \frac{\text{Cov (Fund, Market)}}{\text{Variance of Market}}$$

$$\beta_X = \frac{3.370}{3.100} = 1.087$$

$$\beta_Y = \frac{2.800}{3.100} = 0.903$$

Portfolio Beta

$$0.60 \times 1.087 + 0.40 \times 0.903 = 1.013$$

Portfolio Variance

$$\begin{aligned}\sigma_{XY}^2 &= W_X^2\sigma_X^2 + W_Y^2\sigma_Y^2 + 2W_XW_Y\text{Cov}_{X,Y} \\ &= (0.60)^2(4.800) + (0.40)^2(4.250) + 2(0.60)(0.40)(4.300) = 4.472\%\end{aligned}$$

Or **Portfolio Standard Deviation**

$$\sigma_{XY} = \sqrt{4.472} = 2.115\%$$

(iii) Expected Return, Systematic and Unsystematic Risk of Portfolio

$$\text{Portfolio Return} = 10\% + 1.0134(12\% - 10\%) = 12.03\%$$

$$\text{MF X Return} = 10\% + 1.087(12\% - 10\%) = 12.17\%$$

$$\text{MF Y Return} = 10\% + 0.903(12\% - 10\%) = 11.81\%$$

Systematic Risk = $\beta^2\sigma^2$

$$\text{Systematic Risk of MFX} = (1.087)^2 \times 3.10 = 3.663$$

$$\text{Systematic Risk of MFY} = (0.903)^2 \times 3.10 = 2.528$$

$$\text{Systematic Risk of Portfolio} = (1.013)^2 \times 3.10 = 3.181$$

Unsystematic Risk = Total Risk – Systematic Risk

$$\text{Unsystematic Risk of MFX} = 4.80 - 3.663 = 1.137$$

$$\text{Unsystematic Risk of MFY} = 4.250 - 2.528 = 1.722$$

$$\text{Unsystematic Risk of Portfolio} = 4.472 - 3.181 = 1.291$$

(iv) Sharpe and Treynor Ratios and Alpha

Sharpe Ratio

$$\text{MFX} = \frac{15\% - 10\%}{\sqrt{4.800}} = 2.282$$

$$\text{MFY} = \frac{14\% - 10\%}{\sqrt{4.250}} = 1.94$$

$$\text{Portfolio} = \frac{14.6\% - 10\%}{2.115} = 2.175$$

Treynor Ratio

$$\text{MFX} = \frac{15\% - 10\%}{1.087} = 4.60$$

$$\text{MFY} = \frac{14\% - 10\%}{0.903} = 4.43$$

$$\text{Portfolio} = \frac{14.6\% - 10\%}{1.0134} = 4.54$$

Alpha

$$\text{MFX} = 15\% - 12.17\% = 2.83\%$$

$$\text{MFY} = 14\% - 11.81\% = 2.19\%$$

$$\text{Portfolio} = 14.6\% - 12.03\% = 2.57\%$$

Question 32

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?

MTP Mar 16 (6 Marks), StudyMat

Answer:

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	$R_i - R_f$	β_i	σ^2_{ei}	$\frac{(R_i - R_f)\beta_i}{\sigma^2_{ei}}$	$\sum_{e=i}^N \frac{(R_i - R_f)\beta_i}{\sigma^2_{ei}}$	$\frac{\beta_i^2}{\sigma^2_{ei}}$	$\sum_{e=i}^N \frac{\beta_i^2}{\sigma^2_{ei}}$	C_i
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

$$C_A = 10 \times 0.30 / [1 + (10 \times 0.056)] = 1.923$$

$$C_F = 10 \times 0.65 / [1 + (10 \times 0.131)] = 2.814$$

$$C_B = 10 \times 1.15 / [1 + (10 \times 0.331)] = 2.668$$

$$C_D = 10 \times 1.35 / [1 + (10 \times 0.431)] = 2.542$$

$$C_C = 10 \times 1.60 / [1 + (10 \times 0.639)] = 2.165$$

$$C_E = 10 \times 1.66 / [1 + (10 \times 0.711)] = 2.047$$

Cut off point is 2.814

$$Z_i = \frac{\beta_i}{\sigma_{ei}^2} \left[\left(\frac{(R_i - R_f)}{\beta_i} - C \right) \right]$$

$$Z_A = \frac{1.5}{40} (5.33 - 2.814) = 0.09435$$

$$Z_F = \frac{1.5}{30} (4.67 - 2.814) = 0.0928$$

$$X_A = 0.09435 / [0.09435 + 0.0928] = 50.41\%$$

$$X_F = 0.0928 / [0.09435 + 0.0928] = 49.59\%$$

Funds to be invested in security A & F are 50.41% and 49.59% respectively.

Question 33

Indira has a fund of ₹3 lacs which she wants to invest in share market with rebalancing target after every 10 days to start with for a period of one month from now. The present NIFTY is 5326. The minimum NIFTY within a month can at most be 4793.4. She wants to know as to how she should rebalance her portfolio under the following situations, according to the theory of Constant Proportion Portfolio Insurance Policy, using "2" as the multiplier:

- (1) Immediately to start with.
- (2) 10 days later-being the 1st day of rebalancing if NIFTY falls to 5122.96.
- (3) 10 days further from the above date if the NIFTY touches 5539.04.

For the sake of simplicity, assume that the value of her equity component will change in tandem with that of the NIFTY and the risk free securities in which she is going to invest will have no Beta.

May 12 (8 Marks), RTP Nov 23, RTP May 19 MTP Apr 24 (8 Marks), MTP Apr 23 (8 Marks)

Answer:

$$\text{Maximum decline in one month} = \frac{5326 - 4793.40}{5326} \times 100 = 10\%$$

(1) Immediately to start with

$$\begin{aligned} \text{Investment in equity} &= \text{Multiplier} \times (\text{Portfolio value} - \text{Floor value}) \\ &= 2 (3,00,000 - 2,70,000) \\ &= ₹60,000 \end{aligned}$$

Indira may invest ₹60,000 in equity and balance in risk free securities.

(2) After 10 days

Value of equity = 60,000 × 5122.96/5326	=	₹57,713
Value of risk free investment	=	₹2,40,000
Total value of portfolio	=	₹2,97,713
Investment in equity = Multiplier × (Portfolio value – Floor value) = 2 (2,97,713 – 2,70,000) = ₹55,426		
Revised Portfolio:		

Equity	=	₹55,426
Risk free Securities = ₹2,97,713 – ₹55,426	=	2,42,287
The investor should invest ₹2287 in risk free securities and divert from Equity.		

(3) After another 10 days

Value of equity = $55,426 \times 5539.04/5122.96$	=	₹59,928
Value of risk free investment	=	₹2,42,287
Total value of portfolio	=	₹3,02,215
Investment in equity = Multiplier $\times$ (Portfolio value – Floor value) = 2 (3,02,215 – 2,70,000) = ₹64,430		
Revised Portfolio:		
Equity	=	₹64,430
Risk Free Securities = ₹3,02,215 – ₹64,430	=	₹2,37,785
The investor should off-load ₹4502 of risk free securities and divert to Equity.		

Question 34

Ms. Sreenidhi is learning the portfolio management techniques and wants to test one of the techniques she has developed on KIFS Equity Fund and compare the gains and losses from the technique with those from a passive buy and hold strategy.

The KIFS Equity Fund consists of equities only and the ending NAVs of the fund she constructed for the last 10 months are given below:

Month Ending	NAV (₹/unit)
Jan-22	100
Feb-22	78
Mar-22	92
Apr-22	86
May-22	102
Jun-22	98
Jul-22	100
Aug-22	102
Sep-22	118
Oct-22	120

Assume

- Sreenidhi had invested a notional amount of ₹5 lakhs equally in the equity fund and a conservative portfolio (of bonds) in the beginning of January 2022 and the total portfolio was being rebalanced each time the NAV of the fund increased or decreased by 15% compared to the NAV of previous month.
- There is no income earned from the conservative portfolio during the period

(iii) There is no taxation and entry/exit loads.

You are required to determine:

- Value of the portfolio for each level of NAV following the Constant Ratio Plan.
- Whether there are any errors in the technique developed by Sreenidhi? If so brief y explain.

Answer:

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
100	2,50,000.00	2,50,000.00	5,00,000.00	-	2500
78	2,50,000.00	1,95,000.00	4,45,000.00	-	2500
	2,22,500.00	2,22,500.00	4,45,000.00	Buy 352.56 Units	2852.56
92	2,22,500.00	2,62,435.52	4,84,935.52	-	2852.56
	2,42,467.76	2,42,467.76	4,84,935.52	Sell 217.04 Units	2635.52
86	2,42,467.76	2,26,654.72	4,69,122.48	-	2635.52
102	2,42,467.76	2,68,823.04	5,11,290.80	-	2635.52
	2,55,645.40	2,55,646.40	5,11,290.80	Sell 129.19 Units	2506.33
98	2,55,645.40	2,45,620.34	5,01,265.74	-	2506.33
100	2,55,645.40	2,50,633.00	5,06,278.40	-	2506.33
102	2,55,645.40	2,55,645.66	5,11,291.06	-	2506.33
118	2,55,645.40	2,95,746.94	5,51,392.34	-	2506.33
	2,75,696.17	2,75,696.17	5,51,392.34	Sell 169.92 Units	2336.41
120	2,75,696.17	2,80,369.20	5,56,065.37	-	2336.41

Hence, the ending value of the mechanical strategy is ₹5,56,065.37 and buy & hold strategy is (₹2,50,000+ 2,500 × ₹120 = ₹5,50,000)

- Though the value of portfolio as per technique is lesser than Buy & Hold Strategy but there is no error as if market has been bearish then the value of much lesser under Buy & Hold Strategy.

Question 35

Ms. Kiran had a surplus fund of ₹2,00,000 on 31.03.2016. She is interested in constructing a portfolio of shares of the core sectors to be weighted equally in rupee value terms. Her friend Shaila based on her research advised her to purchase following shares:

Company	No. of Shares	Price Per Share
O Ltd.	100	400
H Ltd.	1000	40
A Ltd.	320	125
R Ltd.	400	100
T Ltd.	200	200

On April 1, 2016, the prices of these stocks were as follows:

Company	Price Per Share
O Ltd.	300

H Ltd.	60
A Ltd.	120
R Ltd.	150
T Ltd.	125

You are required to exhibit how Kiran can rebalance her portfolio on 1.4.2016 so that her exposure to individual stock is maintained at original level in terms of rupee value. MTP Mar 18 (5 Marks)

Answer:

Rebalancing Action:

Company	New Price Per Share	Original No. of Shares	Revised Value of Portfolio	No. of Shares to held as per Revised Price	No. of Shares Buy (+)/Sell (-)
O Ltd.	300	100	30,000	142.27*	+42.27
H Ltd.	60	1000	60,000	711.33	-288.67
A Ltd.	120	320	38,400	355.67	+35.67
R Ltd.	150	400	60,000	284.53	-115.47
T Ltd.	125	200	25,000	341.44	+141.44
Total			2,13,400		

$$* = \frac{\text{Prop. investment in each security}}{\text{Price of security}} = \frac{\text{₹}213400/5}{\text{₹}300} = 142.27$$

Question 36

An investor has decided to invest Rs.1,00,000 in the shares of X Ltd. and Y Ltd. The desired returns from the shares of the two companies along with their probabilities are as follows:

Probability	X Ltd(%)	Y Ltd(%)
0.20	—5	15
0.50	10	25
0.30	15	—10

You are required to:

- Calculate the risk and return 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. May 24 (8 Marks)

Answer:

(i)

Probability	X Ltd (%)	Y Ltd (%)	1 × 2 (%)	1 × 3 (%)
(1)	(2)	(3)	(4)	(5)
0.20	-5	15	-1.00	3.0
0.50	10	25	5.00	12.5
0.30	15	-10	4.50	-3
Average return			8.5	12.5

Hence the expected return from X Ltd = 8.5% and Y Ltd is 12.5%

Probability	$(X - \bar{X})$	$(X - \bar{Y})^2$	1×3	$(Y - \bar{Y})$	$(Y - \bar{Y})^2$	$(1) \times (6)$
(1)	(2)	(3)	(4)	(5)	(6)	
0.20	-13.5	182.25	36.45	2.5	6.25	1.25
0.50	1.50	2.25	1.125	12.5	156.25	78.125
0.30	5.5	42.25	12.675	-22.5	506.25	151.875
			50.25			231.25

$\sigma^2_X = 50.25(\%)^2$	; $\sigma_X = 7.09\%$
$\sigma^2_Y = 231.25(\%)^2$	; $\sigma_Y = 15.20\%$

(ii) In order to find risk of portfolio of two shares, the covariance between the two is necessary here.

Probability	$(X - \bar{X})$	$(Y - \bar{Y})$	$1 \times 2 \times 3$
(1)	(2)	(3)	(4)
0.20	-13.5	2.5	-6.75
0.50	1.50	12.5	9.375
0.30	5.5	-22.5	-43.875
			-41.25

$$\sigma^2_P = (0.5^2 \times 50.25) + (0.5^2 \times 231.25) + 2 \times (-41.25) \times 0.5 \times 0.5$$

$$\sigma^2_P = 12.5625 + 57.8125 - 20.625$$

$$\sigma^2_P = 49.75$$

$$\sigma_P = \sqrt{49.75} = 7.05\%$$

$$E(R_p) = (0.5 \times 8.5) + (0.5 \times 12.5) = 10.5\%$$

Hence, the return is 10.5% with the risk of 7.05% 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

$$W_X = \frac{\sigma_Y^2 - r_{XY}\sigma_X\sigma_Y}{\sigma_X^2 + \sigma_Y^2 - 2r_{XY}\sigma_X\sigma_Y} \text{ or } = \frac{\sigma_Y^2 - \text{Cov}_{XY}}{\sigma_X^2 + \sigma_Y^2 - 2\text{Cov}_{XY}}$$

σ_X = Std. Deviation of X Ltd

σ_Y = Std. Deviation of Y Ltd

r_{XY} = Coefficient of Correlation between X Ltd and Y Ltd

Cov_{XY} = Covariance between X Ltd and Y Ltd.

Therefore,

$$\% \text{ X Ltd} = \frac{231.25 - (-41.25)}{50.25 + 231.25 - [2 \times (-41.25)]} = \frac{272.50}{364} = 0.7486 \text{ or } 74.86\%$$

% X Ltd = 74.86%, XYZ = 25.14%

The portfolio with equal proportions offers a balanced risk-return profile, and the minimum risk portfolio significantly reduces risk by allocating a higher proportion to the less volatile stock, X Ltd.

Question 37

Mr. A is holding 1000 shares of face value of ₹100 each of M/s. ABC Ltd. He wants to hold these shares for long term and have no intention to sell.

On 1st January 2020, M/s XYZ Ltd. has made short sales of M/s. ABC Ltd.'s shares and approached Mr. A to lend his shares under Stock Lending Scheme with following terms:

- Shares to be borrowed for 3 months from 01-01-2020 to 31-03-2020,
- Lending Charges/Fees of 1% to be paid every month on the closing price of the stock quoted in Stock Exchange and
- Bank Guarantee will be provided as collateral for the value as on 01 -01-2020.

Other Information:

- Cost of Bank Guarantee is 8% per annum,
- On 29-02-2020 M/s. ABC Ltd.'s share quoted in Stock Exchange on various dates are as follows:

Date	Share Price in Scenario -1 Bullish	Share Price in Scenario -2 Bullish
01-01-2020	1000	1000
31-01-2020	1020	980
29-02-2020	1040	960
31-03-2020	1050	940

You are required to find out:

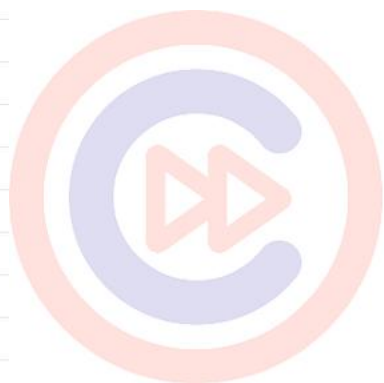
- Earning of Mr. A through Stock Lending Scheme in both the scenarios,
- Total Earnings of Mr. A during 01-01-2020 to 31-03-2020 in both the scenarios,
- What is the Profit or loss to M/s. XYZ by shorting the shares using through Stock Lending Scheme in both the scenarios?

Jan 21 (8 Marks), RTP May 22, MTP Apr 24 (8 Marks)

Answer:

		Scenario 1	Scenario 2
(i)	Earnings of Mr. A through stock lending scheme		
	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)	Total Earnings of Mr. A during 01-01-2020 to 31-01-2020		
	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	56,100	53,800
(iii)	Profit or loss to M/s. XYZ		
	Gain on shortening the shares		
	(1,000 – 1,050) 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	(101.10)	11.20
	Total No. of Shares	1000	1000
	Total Gain on shortening the shares	(1,01,100)	11,200



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CHAPTER 8

MUTUAL FUNDS

Question 1

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 to the investors:

- Get dividend of ₹0.75 per unit and capital gain of ₹0.60 per unit, or
- These distributions are to be reinvested at an average NAV of ₹8.65 per unit.

What difference would it make in terms of returns available and which option is preferable by the investors?

RTP May 14, MTP Sep 23 (8 Marks), MTP Sep 22 (8 Marks), MTP Oct 14 (6 Marks), MTP Mar 18 (8 Marks), Nov 18 (8 Marks), Nov 17 (5 Marks), RTP May 12, StudyMat

Answer:

Option 1: When Dividend and Capital Gain are paid:

Calculation of monthly return on the mutual funds:

$$r = \frac{(\text{NAV}_t - \text{NAV}_{t-1}) + I_t + G_t}{\text{NAV}_{t-1}}$$

$$r = \frac{(\text{₹}9.45 - \text{₹}8.75) + (\text{₹}0.75 + \text{₹}0.60)}{8.75} = \frac{0.70 + 1.35}{8.75} = 23.43\%$$

Option 2: When Dividend and Capital Gain are reinvested:

If all dividends and capital gain are reinvested into additional units at ₹8.65 per unit the position would be.

Total amount reinvested = ₹1.35 × 300 = ₹405

Additional units added = $\frac{\text{₹}405}{8.65} = 46.82$ units or 47 units

Value of units at the end = 346.82 units × ₹9.45 = ₹ 3277.45

Or = 347 units × ₹9.45 = ₹ 3279.15

Price paid for 300 units as at the beginning = (300 × ₹8.75) = ₹2,625

Return = $(\text{₹}3277.45 - \text{₹}2625) / \text{₹}2625 = 24.86\%$

Or Return = $\frac{\text{₹}3279.15 - \text{₹}2625}{\text{₹}2625} = \frac{\text{₹}654.15}{\text{₹}2625} = 24.92\%$

From the above, it can be said that reinvestment option is better.

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:

- Front end Load
- Back end Load

May 18 (5 Marks), StudyMat

Answer:

Public Offer Price = NAV / (1 – Front end Load)

Public Offer Price: ₹10.204 and NAV: ₹10

Accordingly,

10.204 = 10 / (1 – F)

F = 0.0199 say 2%

$$\text{POP} = \frac{\text{NAV}}{1 - \text{FEL}}$$

Redemption Price = NAV/ (1 + Back end Load)

$$₹9.80 = 10 / (1 + \text{Back end Load})$$

$$B = 0.0204 \text{ i.e. } 2.04\%$$

Alternatively,

$$(i) \text{ Front End Load} = \frac{10.204 - 10}{10.00} = 0.0204 \text{ or } 2.04\%$$

$$(ii) \text{ Exit Load} = \frac{10.00 - 9.80}{10.00} = 0.020 \text{ or } 2.00\%$$

$$RP = \frac{NAV}{1 + BEL}$$

Question 3

During the year 2017 an investor invested in a mutual fund. The capital gain and dividend for the year was ₹3.00 per unit, which were re-invested at the yearend NAV of ₹23.75. The investor had total units of 26,750 as at the end of the year. The NAV had appreciated by 18.75% during the year and there was an entry load of ₹0.05 at the time when the investment was made. The investor lost his records and wants to find out the amount of investment made and the entry load in the mutual fund.

Nov 18 (5 Marks)

Answer:

$$\text{NAV in the Beginning of year} = \frac{₹23.75}{118.75} \times 100 = ₹20$$

$$\text{No. of Units after Bonus issue} = 26,750$$

Let x be the No. of Units acquired then

$$26,750 = x + \frac{x \times 3}{23.75}$$

$$x = 23,750 \text{ units}$$

$$\text{Investment Amount} = 23,750 \text{ units } (₹20 + ₹0.05) = ₹4,76,187.50$$

$$\text{Entry load} = ₹1,187.50 \text{ i.e. } (23750 \times ₹0.05)$$

Question 4

Mr. Alex, a practicing Chartered Accountant, can earn a return of 15 percent by investing in equity shares on his own. He is considering a recently announced equity based mutual fund scheme in which initial expenses are 6 percent and annual recurring expenses are 2 percent.

- (i) How much should the mutual fund earn to provide Mr. Alex a return of 15 percent per annum?
- (ii) Mr. Alex's current Annual Professional Income is ₹40 Lakhs. His portfolio value is ₹50 Lakhs and now he is spending 10% of his time to manage his portfolio. If he spends this time on profession, his professional income will go up in same proportion. He is thinking to invest his entire portfolio into a Multicap Fund, assuming the fund's NAV will grow at 13% per annum (including dividend).

You are requested to advise Mr. Alex, whether he can invest the portfolio into Multicap Funds? If so, what is the net financial benefit?

Nov 19 (8 Marks)

Answer:

$$(i) \text{ Personal earnings of Mr. Alex} = R_1 = 15\%$$

$$\text{Mutual Fund earnings} = R_2$$

$$R_2 = \frac{1}{1 - \text{Initial expense}(\%)} R_1 + \text{Recurring expenses}(\%)$$

$$= \frac{1}{1-0.06} \times 15\% + 2\%$$

$$= 17.96\%$$

Mutual Fund earnings = 17.96%

- (ii) Net financial benefit to Mr. Alex if he invests his portfolio in Fund:

Present Income of Mr. Alex

	₹ Lakhs
Annual Professional Income (A)	40.00
Portfolio Value	50.00
Income on his Portfolio @ 15% (B)	7.50
Total Income (A) + (B)	47.50

Expected Income of Mr. Alex after investing the Portfolio in Multi-cap Fund:

	₹ Lakhs
Annual Professional Income (A)	40.00
Additional Professional Income (B)	4.00
Portfolio Value	50.00
Income on his Portfolio @ 13% (C)	6.50
Total Income (A) + (B) + (C)	50.50

It is advisable to invest in Multi-cap Mutual Funds and devote the time on profession. He will get net benefit of ₹3 Lakhs (₹50.50 - ₹47.50)

Question 5

Mr. Suhail has invested in three Mutual Fund Schemes as given below:

Particulars	Scheme A	Scheme B	Scheme C
Date of investment	1-4-2011	1-5-2011	1-7-2011
Amount of Investment (₹)	12,00,000	4,00,000	2,50,000
Net Asset Value (NAV) at entry date (₹)	10.25	10.15	10.00
Dividend received up to 31-7-2011 (₹)	23,000	6,000	Nil
NAV as at 31-7-2011 (₹)	10.20	10.25	9.90

You are required to calculate the effective yield on per annum basis in respect of each of the three Schemes to Mr. Suhail up to 31-7-2011.

Take one year = 365 days.

Show calculations up to two decimal points.

May 13 (10 Marks)

Answer:

Scheme	Investment ₹	Unit Nos. (Investment/NAV at entry date)	Unit NAV 31.7.2011 ₹	Total NAV 31.7.2011 (Unit Nos. × Unit NAV as on 31.7.2011) ₹
MF A	12,00,000	1,17,073.17	10.20	11,94,146.33
MF B	4,00,000	39,408.87	10.25	4,03,940.92
MF C	2,50,000	25,000	9.90	2,47,500.00

Scheme	NAV (+) / (-) (NAV as on 31.7.2011 – Investment) (₹)	Dividend Received (₹)	Total Yield Change in NAV + Dividend (₹)	Number of days	Effective Yield (% p.a.) (Total Yield/ Investment) × (365/No. of days) × 100
MF A	(-)5,853.67	23,000	17,146.33	122	4,275%
MF B	(+)3,940.92	6,000	9,940.92	92	9.86%
MF C	(-) 2,500	Nil	(-) 2,500	31	(-) 11.77 %

Question 6

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:

- Number of units in each scheme;
- Total NAV;
- Total Yield; and
- Number of days investment held.

May 18 (8 Marks), MTP Apr 19 (8 Marks), MTP Oct 20 (8 Marks), MTP Oct 20 (8 Marks)

Answer:

(i) Number of Units in each Scheme

MF 'X'	$\frac{2,00,000}{10.30}$	= 19,417.48
MF 'Y'	$\frac{4,00,000}{10.10}$	= 39,603.96

MF 'Z'	$\frac{2,00,000}{10.00}$	= 20,000.00

(ii) Total NAV on 31.03.2018

MF 'X'	= 19,417.48 × ₹ 10.25	₹1,99,029.17
MF 'Y'	= 39,603.96 × ₹ 10.00	₹3,96,039.60
MF 'Z'	= 20,000.00 × ₹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

$$\text{Total Yield} = \frac{10,068.77}{8,00,000} \times 100 = 1.2586\%$$

(iv) No. of Days Investment Held

	MF 'X'	MF 'Y'	MF 'Z'
Let No. of days be	X	Y	Z
Initial Investment (₹)	2,00,000	4,00,000	2,00,000
Yield (₹)	5,029.17	-3,960.40	9,000.00
Yield (%)	2.5146	- 0.9901	4.5
Period of Holding (Days)	$\frac{2.5146}{9.66} \times 365$ = 95 Days	$\frac{-0.9901}{-11.66} \times 365$ = 31 Days	$\frac{4.5}{24.15} \times 365$ = 68 Days
Date of Original Investment	26.12.17	28.02.18	22.01.18

Question 7

Mr. Kar has invested in three mutual fund schemes as per details below:

	MFY	MFZ	MFZ
Amount of investment (₹)	5,50,000	4,20,000	1,00,000
Dividend received up to 31.03.2023 (₹)	10,000	6,000	Nil
NAV as on 31.03.2023 (₹)	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.

May 24 (4 Marks)

Answer:

The formula to calculate the NAV at the time of purchase is derived from the effective yield formula:

$$\text{Effective Yield} = \left(\frac{\text{Closing NAV} + \text{Dividend Received} - \text{Opening NAV}}{\text{Opening NAV}} \right) \times \left(\frac{365}{\text{Holding Period}} \right) \times 100$$

Rearranging this formula to solve for the Opening NAV gives:

$$\text{Opening NAV} = \frac{\text{Closing NAV} + \text{Dividends Received}}{1 + \left(\frac{\text{Effective Yield}}{100} \times \frac{\text{Holding Period}}{365} \right)}$$

1. Mutual Fund MFX

- Amount of Investment: ₹5,50,000
- Dividends Received: ₹10,000
- NAV on 31.03.2023: ₹11.50
- Effective Yield: 19.345%
- Holding Period: 120 days

$$\text{Opening NAV} = \frac{11.50 + \frac{10000}{550000/11.50}}{1 + \left(\frac{19.345}{100} \times \frac{120}{365} \right)}$$

Calculating the dividends per unit:

$$\text{Dividends per Unit} = 10,000 / (5,50,000 / 11.50) = 0.209$$

$$\text{NAV at Purchase for MFX} = (11.50 + 0.209) / (1 + 0.0635) = 11.01$$

2. Mutual Fund MFY

- Amount of Investment: ₹4,20,000
- Dividends Received: ₹6,000
- NAV on 31.03.2023: ₹11.00
- Effective Yield: 22.59%
- Holding Period: 100 days

Using the formula:

$$\text{Opening NAV} = \frac{11.00 + \frac{6000}{420000/11.00}}{1 + \left(\frac{22.59}{100} \times \frac{100}{365} \right)}$$

Calculating the dividends per unit:

$$\text{Dividends per Unit} = 6,000 / (4,20,000 / 11.00) = 0.157$$

Plug in the values:

$$\text{NAV at Purchase for MFY} = (11.00 + 0.157) / (1 + 0.0619) = 10.51$$

3. Mutual Fund MFZ

- Amount of Investment: ₹1,00,000
- Dividends Received: Nil
- NAV on 31.03.2023: ₹9.50
- Effective Yield: -36.50%
- Holding Period: 50 days

$$\text{Opening NAV} = \frac{9.50}{1 + \left(\frac{-36.50}{100} \times \frac{50}{365} \right)}$$

NAV at Purchase for MFZ = 9.50 / 0.95 = 10.00

Summary

- NAV at Purchase for MFX: ₹11.01
- NAV at Purchase for MFY: ₹10.51
- NAV at Purchase for MFZ: ₹10.00

Question 8

Cinderella Mutual Fund, an approved mutual fund, sponsored open-ended equity oriented scheme "Rudolf Opportunity Fund". There are three plans under the scheme viz. 'A' - Dividend Re-investment plan, 'B' - Bonus plan and 'C' - Growth plan.

At the time of initial public offer on 1-4-2009, Mr. Amit, Mr. Ashish and Mr. Arun, three investors invested ₹2,00,000 each at face value of ₹10 per unit and chosen plan 'B', 'C' and 'A' respectively.

The particulars of the fund over the period are as follows:

Date	Dividend %	Bonus Ratio	Net Asset Value per unit (₹)		
			Plan A	Plan B	Plan C
31.07.2013	10	-	30.70	31.20	35.40
31.03.2014	35	5:4	58.42	31.05	58.25
30.10.2017	20	-	42.18	26.45	56.45
15.03.2018	12.50	-	46.45	27.72	62.78
31.03.2018	-	1:3	45.20	20.05	67.12
25.03.2019	20	1:4	48.10	19.95	71.42
31.07.2019	-	-	53.75	22.98	82.07

On 31st July, 2019, all the three investors redeemed all the balance units.

1. Consider the following:
 - (a) Long-term capital gain is exempt from Income-tax.
 - (b) Short-term capital gain is subject to 10% Income-tax.
 - (c) Security Transaction Tax is 0.2% only on sale/ redemption of units.
 - (d) Ignore Education Cess.
2. You are required:
 - (i) To calculate the Effective Yield per annum (annual rate of return) of each of the investors.
 - (ii) To suggest the name of investor with the highest Effective Yield per annum with the difference to his nearest investor.

(Show your calculations up to two decimal points)

Nov 19 (10 Marks), RTP May 18 StudyMat

Answer:

- (i) **Calculation of effective yield per annum of each of the investors**

Mr. Arun Plan A Dividend Reinvestment

(Amount in ₹)

Date	Investment	Dividend payout (%)	Dividend Re-invested (Closing Units × Face value of ‘10 × Dividend Payout %)	NAV	Units	Closing Unit Balance
01.04.2009	2,00,000.00			10.00		20,000.00
31.07.2013		10	20,000.00	30.70	651.47	20,651.47
31.03.2014		35	72,280.15	58.42	1,237.25	21,888.72
30.10.2017		20	43,777.44	42.18	1,037.87	22,926.59
15.03.2018		12.5	28,658.24	46.45	616.97	23,543.56
25.03.2019		20	47,087.12	48.10	978.94	24,522.50
Redemption value 24522.5×53.75					13,18,084.38	
Less: Security Transaction Tax (STT) is 0.2%					2636.17	
Net amount received					13,15,448.21	
Less: Short term capital gain tax @ 10% on 978.94 ($53.64^* - 48.10^{\approx}$) = 5423.33					542.33	
Net of tax					13,14,905.88	
Less: Investment					2,00,000.00	
					11,14,905.88	

*(53.75 – STT @ 0.2%) ≈ This value can also be taken as zero

$$\text{Annual average return(\%)} = \frac{11,14,905.88}{2,00,000} \times \frac{12}{124} \times 100 = 53.95\%$$

Mr. Amit Plan B – Bonus

(Amount in ₹)

Date	Units	Bonus units	Total Balance	NAV per unit
01.04.2009	20,000		20,000	10
31.03.2014		25,000	45,000	31.05
31.03.2018		15,000	60,000	20.05
25.03.2019		15,000	75,000	19.95
Redemption value 75,000 × 22.98			17,23,500	
Less: Security Transaction Tax (STT) is 0.2%			3447	
Net amount received			17,20,053	
Less: Short term capital gain tax @ 10%				

$15,000 \times (22.93^{\dagger} - 19.95) = 44,700$	4470
Net of tax	17,15,583
Less: Investment	2,00,000
Net gain	15,15,583

$\dagger(22.98 - \text{STT @ } 0.2\%)$

$$\text{Annual average return}(\%) = \frac{15,15,583}{2,00,000} \times \frac{12}{124} \times 100 = 73.33\%$$

Mr. Ashish Plan C – Growth

Particulars	(Amount in ₹)
Redemption value $20,000 \times 82.07$	16,41,400.00
Less: Security Transaction Tax (S.T.T) is 0.2%	3282.80
Net amount received	16,38,117.20
Less: Short term capital gain tax @ 10%	0.00
Net of tax	16,38,117.20
Less: Investment	2,00,000.00
Net gain	14,38,117.20

$$\text{Annual average return}(\%) = \frac{14,38,117.20}{2,00,000} \times \frac{12}{124} \times 100 = 69.59\%$$

- (ii) **Mr. Amit (Bonus Plan)** earns the highest effective yield per annum of 73.33% and the difference to his nearest investor Mr. Ashish is 3.74 (73.33 – 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.

In such case:

Mr. Arun Plan A – Short term capital gains tax would be ₹553.10. Accordingly Net of tax will be ₹13,14,895.10 and the net gain would be ₹11,14,895.10.

Mr. Amit Plan B – Bonus Plan – Short term capital gains tax would be ₹4,545. Accordingly Net of tax will be ₹17,15,508 and the net gain would be ₹15,15,508.

Question 9

M/S. Promising, an AMC, on 01.04.2018 has floated two schemes viz. Dividend Reinvestment Plan and Bonus Plan. Mr. X, an investor has invested in both the schemes. Mr. X, while submitting the tax papers, returned a capital loss on both the plans. Tax officials, suspicious on the claim of Mr. X, decided to launch an investigation and were able to collect the following details (except the issue price):

Date	Dividend (%)	Bonus Ratio	NAV (₹)	
			Dividend Reinvestment Plan	Bonus Plan
01.04.2018			?	?
31.12.2019		1:5	58	70
31.03.2020	12		60	72
31.03.2021	10		68	75
31.03.2022	15		75	66
31.12.2022*		1:3	70	60
31.03.2023			80	71

* In question paper this row got typed before the row of values of 31.03.2022.

Additional details	Dividend Reinvestment Plan	Bonus Plan
Investment (₹)	₹10,80,000	₹10,00,000
Average Profit (₹)	₹1,21,824	
Average Yield (%)		8.40%

Assume face value of unit as ₹10.

You are required to assist the tax officials to calculate the issue price of both the schemes as on 01.04.2018.

May 23 (8 Marks), Nov 20 (10 Marks), RTP May 23

Answer:

i. Dividend Plan

(a) Average Annual gain over a period of 5 Years	₹1,21,824
(b) Total gain over a period of 5 years (a*5)	₹6,09,120
(c) Initial Investment	₹10,80,000
(d) Total value of investment (b+c)	₹16,89,120
(e) NAV as on 31.3.2023	₹80
(f) Number of units at the end of the period as on 31.03.2022 (d/e)	21114

	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
31.03.2022	21114	0.15	10	1.50	75	414	20700
31.03.2021	20700	0.10	10	1.00	68	300	20400
31.03.2020	20400	0.12	10	1.20	60	400	20000

Issue Price as on 01.04.2018

Investment 1080000/ Units purchased 20000 (c/i) = ₹54

* Let the units issued be X

$$X = (\text{Closing Units}/\text{NAV} + \text{Dividend}) \times \text{Dividend}$$

Alternatively, it can also be computed as follows: Dividend Plan

Average Profit = ₹121,824

Total Gain = ₹121,824 × 5 = ₹6,09,120

Cost of Acquisition = ₹10,80,000

Maturity Value = ₹16,89,120 (₹6,09,120 + ₹10,80,000)

On 31.03.23 since the NAV of the Fund is ₹80 the units redeemed are:

$$\frac{16,89,120}{80} = 21114$$

Let X be the NAV on 01.04.18

$$\text{Thus, units acquired on 01.04.18} = \frac{1080000}{X}$$

$$\text{Units added on 31.03.2020} = \left[\frac{\frac{1080000}{X} \times 1.2}{60} \right] = \left[\frac{21600}{X} \right]$$

$$\text{Units added on 31.03.2021} = \left[\frac{\frac{1080000}{X} + \frac{21600}{X}}{68} \right] = \frac{16200}{X}$$

$$\text{Units added on 31.03.2022} = \left[\frac{1080000}{X} + \frac{21600}{X} + \frac{16200}{X} \right] \times \frac{1.5}{75} = \frac{22356}{X}$$

Thus, total units can be shown as follows:

$$\left[\frac{1080000}{X} + \frac{21600}{X} + \frac{16200}{X} + \frac{22356}{X} \right] = 21114$$

$$X = 54$$

Thus, the issue Price of units under Dividend Plan shall be ₹54

ii. Bonus Plan

(a) Average Yield	0.084
(b) Investment	₹10,00,000
(c) Gain over a period of 5 years (a*b*5)	₹4,20,000
(d) Market Value as on 31.03.2023 (b + c)	₹14,20,000
(e) NAV as on 31.03.2023	71
(f) Total units as on 31.03.2023 (d/e)	20000
(g) No of units as on 31.03.2022 Pre bonus = 20000*3/ (3 + 1)	15000
(h) No of units as on 31.12.2019 Pre bonus = 15000*5/ (5 + 1)	12500
(i) Issue Price as on 01.04.2019	
Investment ₹10,00,000/ Units purchased 12500 (b/h)	₹80

Alternatively, it can also be computed as follows:

Units on 01.04.2018	X
Units after bonus on 31.12.2019 (1:5)	1.20X
Units after bonus on 31.12.2022 (1:3)	1.60X
Average yield	0.084
Investment	₹10,00,000
Gain for 5 years (10,00,000 × 0.084 × 5)	₹4,20,000
Total Value (₹10,00,000 + ₹4,20,000)	₹14,20,000

$$\text{Where, } 1.6X \times ₹71 = ₹14,20,000$$

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

$$\text{Issue Price on 01.04.2018} = ₹10,00,000 / 12,500 \text{ units} = ₹80$$

Alternatively, it can also be computed as follows:

$$\text{Average Yield} = 8.40\%$$

$$\text{Investment} = ₹10,00,000$$

$$\text{Gain over a period of 5 years} = ₹10,00,000 \times 0.084 \times 5 = ₹4,20,000$$

$$\text{Thus, Maturity Value on 31.03.23 shall be ₹14,20,000}$$

$$\text{No. of units} = \frac{14,20,000}{71} = 20,000$$

Now let B be the NAV on 01.04.18 then

$$\text{Units acquired on 01.04.18} = \frac{10,00,000}{B}$$

$$\text{Units added on 31.12.19} = \frac{10,00,000}{B} \times \frac{1}{5} = \frac{2,00,000}{B}$$

$$\text{Units added on 31.12.21} = \frac{12,00,000}{B} \times \frac{1}{3} = \frac{4,00,000}{B}$$

Thus, total units can be shown as follows:

$$\left[\frac{1000000}{B} + \frac{200000}{B} + \frac{400000}{B} \right] = 20000$$

$$B = ₹80$$

Thus, the issue Price of units under Bonus Plan shall be ₹80

Question 10

A mutual fund raised ₹150 lakhs on April 1, 2018 by issue of 15 lakh units at ₹10 per unit. The fund invested in several capital market instruments to build a portfolio of ₹140 lakhs, Initial expenses amounted to ₹8 lakhs. During the month of April, the fund sold certain instruments costing ₹44.75 lakhs for ₹47 lakhs and used the proceeds to purchase certain other securities for ₹41.6 lakhs. The fund management expenses for the month amounted to ₹6 lakhs of which ₹50,000 was in arrears. The fund earned dividends amounting to ₹1.5 lakhs and it distributed 80% of the realized earnings. The market value of the portfolio on 30th April 2018 was ₹147.85 lakhs.

An investor subscribed to 1000 units on April 1 and disposed it off at closing NAV on 30th April. Determine his annual rate of earnings.

Nov 18 (8 Marks), MTP May 20 (8 Marks), MTP March 21 (8 Marks)

Answer:

	Amount in ₹ lakhs	Amount in ₹ lakhs
Opening Bank (150 - 140 - 8)	2.00	
Add: Proceeds from sale of securities	47.00	
Add: Dividend received	1.50	50.50
Deduct:		
Cost of securities purchased	41.60	
Fund management expenses paid	5.50	
Capital gains distributed = 80% of (47 - 44.75)	1.80	
Dividend distributed = 80% of 1.50	1.20	50.10
Closing Bank		0.40
Closing market value of portfolio		147.85
		148.25
Less: Arrears of expenses		0.50
Closing Net Assets		147.75

Number of units (Lakhs)		15
Closing NAV per unit (147.75/15)		9.85

Rate of Earning (Per Unit)

	Amount
Income received ($\text{₹}1.20 + \text{₹}1.80$)/15	₹0.20
Loss: Loss on disposal ($\text{₹}150 - \text{₹}147.75$)/15	₹0.15
Net earning	₹0.05
Initial investment	₹10.00
Rate of earning (Monthly)	0.5%
Rate of earning (Annual)	6.00%

Question 11

Based on the following information, determine the NAV of a regular income scheme on 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	106.5
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.

May 16 (6 Marks), May 2010 (6 Marks), MTP April 22 (8 Marks), RTP Nov 2018

Answer:

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 12

The following particulars relating to S Fund Schemes:

Particulars	Value ₹ in Crores
1. Investment in Shares (at cost)	
a. Pharmaceuticals companies	158
b. Construction Industries	62
c. Service Sector Companies	112
d. IT Companies	68
e. Real Estate Companies	20
2. Investment in Bonds (Fixed Income)	
a. Listed Bonds (8000, 14% Bonds of ₹15,000 each)	24
b. Unlisted Bonds	14
3. No. of Units outstanding (crores)	8.4
4. Expenses Payable	7
5. Cash and Cash equivalents	3
6. Market expectations on listed bonds	8.842%

The fund has incurred the following expenses:

Consultancy and Management fees	₹520 Lakhs
Office Expenses	₹180 Lakhs
Advertisement Expenses	₹48 Lakhs

Particulars relating to each sector are as follows:

Sector	Index on Purchase date	Index on Valuation date
Pharmaceutical companies	300	500
Construction Industries	275	490
Service Sector Companies	285	500
IT Companies	270	515
Real Estate Companies	265	440

Required:

- Calculate the Net Asset Value of the fund
- Calculate the Net Asset Value per unit
- Determine the Net return (Annualized), if the period of consideration is 4 years, and the fund has distributed ₹2 per unit per year as cash dividend during the same period.

Note: Calculate figure in ₹Crore upto 3 decimal points.

RTP May 21

Answer:

(i) Calculation of NAV of the Fund

		(in ₹ Crore)
1.	Value of Shares	
	a. Pharmaceutical Companies	$158 \times \frac{500}{300}$ 263.333
	b. Construction Companies	$62 \times \frac{490}{275}$ 110.473
	c. Service Sector Companies	$112 \times \frac{500}{285}$ 196.491
	d. IT Companies	$68 \times \frac{515}{270}$ 129.704
	e. Real Estate Companies	$20 \times \frac{440}{265}$ 33.208
2.	Investment in Bonds	
	a. Listed Bonds	$\frac{14}{8.842} \times 24$ 38.00
	b. Unlisted Bonds	14.000
3.	Cash and Cash Equivalent	3.00
		788.209
	Less: Expense Payable	7.000
	NAV of the Fund	781.209

(ii) NAV of the Fund per Unit

NAV of the Fund	₹781.209 crore
Number of Units	8.40 crore
NAV Per Unit (₹781.209 crore/ 8.40 crore)	₹93.00

(iii) Net Return

Initial Cost Per Unit		
Investment in Shares	₹420 crore	
Bonds	₹38 crore	₹458 crore
Number of Units		8.40 crore
Cost Per Unit		₹54.52
Return		
Capital Gain	(₹93.00 - ₹54.52)	₹38.48
Dividend	₹4 × 2	₹8.00
		₹46.48
Annualised Return	$\frac{46.48}{54.52} \times \frac{1}{4}$	21.31%

Question 13

Based on the following data, estimate the Net Asset Value (NAV) 1st July 2016 on per unit basis of a Debt Fund:

Name of Security	Face Value ₹	Purchase Price	Maturity Date	No. of Securities	Coupon Date(s)	Duration of Bonds
10.71% GOI 2028	100	104.78	31 st March, 2028	100000	31 st March	7.3494
10% GOI 2023	100	100.00	31 st March, 2023	50000	31 st March & 30 th September	5.086
9.5% GOI 2021	100	97.93	31 st December, 2021	40000	30 th June & 31 st December	4.3949
8.5% SGL 2025	100	91.36	30 th June, 2025	20000	30 th June	6.5205

Number of Units (₹10 face value each): 100000

All securities were purchased at a time when applicable Yield to Maturity (YTM) was 10%. On NAV date, the required yield increased by 75 basis point and Cash in hand and accrued expenses were ₹6,72,800 and ₹2,37,400 respectively.

MTP Oct 17, RTP Nov 17

Answer:

Working Note:

 **Calculation of Interest Accrued**

Name of Security	Maturity Date	Amount (₹)
10.71% GOI 2028	$100 \times 100000 \times 10.71\% \times \frac{3}{12}$	2,67,750
10% GOI 2023	$100 \times 50000 \times 10.00\% \times \frac{3}{12}$	1,25,000
Total		3,92,750

Note: Interests on two remaining securities shall not be considered as last interest was paid on 30.06.2016

Valuation of Securities

Name of Security	Purchase Amount ₹	Duration of Bonds	Volatility (%)	(+)/(-)	Total Amount
10.71% GOI 2028	1,04,78,000	7.3494	$\frac{7.3494}{1.10} \times 0.75 = 5.0110$	-5,25,053	99,52,947
10% GOI 2023	50,00,000	5.086	$\frac{5.086}{1.05} \times 0.75 = 3.6329$	-1,81,645	48,18,355
9.5% GOI 2021	39,17,200	4.3949	$\frac{4.3949}{1.05} \times 0.75 = 3.1392$	-1,22,969	37,94,231
8.5% SGL 2025	18,27,200	6.5205	$\frac{6.5205}{1.10} \times 0.75 = 4.4456$	-81,230	17,45,970
					2,03,11,503

(iii) Calculation of NAV

Particulars	₹ crores
Value of Securities as computed above	2,03,11,503
Cash in hand	6,72,800
Interest accrued	3,92,750
Sub total assets (A)	2,13,77,053
Less: Liabilities Expenditure accrued	2,37,400
Sub total Liabilities (B)	2,37,400
Net Asset Value (A) – (B)	2,11,39,653
No. of units	1,00,000
Net Assets Value per unit (₹2,11,39,653/1,00,000)	₹211.40

Question 14

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 ₹15 lakhs in the plan before the declaration of the first bonus and remain invested thereafter.

The following information is also available:

Period (t)	01.04.2016	30.09.2017	30.09.2019	31.03.2021
NAV (₹)	?	85	92	100

You are required to advise to Mr. Optimistic the opening NAV, which is required by him to calculate the capital appreciation.

July 21 (4 Marks), MTP Oct 22 (4 Marks)

Answer:

Particulars	
(a) Amount invested by Mr. Optimistic as on 01/04/2016	₹15,00,000
(b) Gain during 5 years (15,00,000 × 17.5% × 5 years)	₹13,12,500
(c) Value of investment as on 31/03/2021 (a + b)	₹28,12,500
(d) NAV as on 31/03/2021	₹100 per Unit
(e) Total number of units as on 31/03/2021 (c/d)	28125 Units
Total units before second bonus = 28125 × 4/5	22500 Units
Total units before first bonus = 22500 × 5/6	18750 Units
NAV as on 01/04/2016 = 15,00,000/18750	₹80 per Unit

Question 15

Mr. X on 1.7.2015, during the initial offer of some Mutual Fund invested in 10,000 units having face value of ₹10 for each unit. On 31.3.2016, the dividend paid by the M.F. was 10% and Mr. X found that his annualized yield was 153.33%. On 31.3.2017, 20% dividend was given. On 31.3.2018, Mr. X redeemed all his balance of 11,296.11 units when his annualized yield was 73.52%. What are the NAVs as on 31.3.2016, 31.3.2017 and 31.3.2018?

MTP Mar 17 (8 Marks), RTP May 19

Answer:

Yield for 9 months = (153.33 × 9/12)	= 115%
Market value of Investments as on 31.03.2016	= 1,00,000/- + (1,00,000 × 115%) = ₹2,15,000/-
Therefore, NAV as on 31.03.2016	= (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 = $\frac{₹10,000}{₹20.50} = 487.80$ units	
Therefore, units as on 31.03.2016	= 10,000 + 487.80 = 10,487.80
[Alternately, units as on 31.03.2016	= (2,15,000/20.50) = 10,487.80]
Dividend as on 31.03.2017	= 10,487.80 × 10 × 0.2 = ₹20,975.60

Let X be the NAV on 31.03.2017, 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 31.03.2016). Thus, by way of equation it can be shown as follows:

$$11296.11 = \frac{20975.60}{X} + 10487.80$$

$$\begin{aligned}\text{Therefore, NAV as on 31.03.2017} &= 20,975.60 / (11,296.11 - 10,487.80) \\ &= ₹25.95\end{aligned}$$

$$\begin{aligned}\text{NAV as on 31.03.2018} &= ₹1,00,000 (1 + 0.7352 \times 33/12) / 11296.11 \\ &= ₹26.75\end{aligned}$$

Question 16

Following are the details of closely ended schemes of two mutual funds as on 31/08/2021:

Particular	AJ Mutual Fund	RP Mutual Fund
NAV (p.u.)	₹80 (Consisting 95% equity & remaining cash balance)	₹61 (Consisting ₹60 equity & remaining cash balance)
Sharpe Ratio	1.5	3
Treynor Ratio	12	10
Standard deviation	10	6

There is no change in portfolios during the September month.

Monthly cost is ₹0.50 per unit for each mutual fund scheme.

Share market rose by 2% in the month of September.

You are required to calculate expected NAV p.u. as on 30/09/2021 for both schemes.

Dec 21 (8 Marks), MTP Nov 21 10 Marks, RTP May 19, MTP Mar 18 (8 Marks), RTP Nov 20

Answer:

(i) Decomposition of Funds in Equity and Cash Components

	AJ Mutual Fund	RP Mutual Fund
NAV on 31.08.21	₹80.00	₹61.00
% of Equity	95%	98.36%
Equity element in NAV	₹76.00	₹60.00
Cash element in NAV	₹4.00	₹1.00

(ii) Calculation of Beta

(a) AJ Mutual Fund

$$\text{Sharpe Ratio} = 1.5 = \frac{E(R) - R_f}{\sigma_{A,J}} = \frac{E(R) - R_f}{10}$$

$$E(R) - R_f = 15$$

$$\text{Treynor Ratio} = 12 = \frac{E(R) - R_f}{\beta_{A,J}} = \frac{15}{\beta_{A,J}}$$

$$\beta_{A,J} = 15.00 / 12 = 1.25$$

(b) RP Mutual Fund

$$\text{Sharpe Ratio} = 3 = \frac{E(R) - R_f}{\sigma_{R,P}} = \frac{E(R) - R_f}{6}$$

$$E(R) - R_f = 18$$

$$\text{Treynor Ratio} = 10 = \frac{E(R) - R_f}{\beta_{R,P}} = \frac{18}{\beta_{R,P}}$$

$$B_K = 18/10 = 1.80$$

(iii) Increase in the Value of Equity

	AJ Mutual Fund	RP Mutual Fund
Market rose by	2.00%	2.00%
Beta	1.25	1.80
Equity component goes up	2.50%	3.60%

(iv) Balance of Cash after 1 month

	AJ Mutual Fund	RP Mutual Fund
Cash in Hand on 30.09.21	₹4.00	₹1.00
Less: Exp. Per month	₹0.50	₹0.50
Balance after 1 month	₹3.50	₹0.50

NAV after 1 month

	AJ Mutual Fund	RP Mutual Fund
Value of Equity after 1 month		
$76 \times (1 + 0.025)$	₹77.90	-
$60 \times (1 + 0.036)$	-	₹62.16
Cash Balance	₹3.50	₹0.50
NAV	₹81.40	₹62.66

Question 17

ANP Plan, a hedge fund currently has assets of ₹20 crore. CA. X, the manager of fund charges fee of 0.10% of portfolio asset. In addition to it he charges incentive fee of 2%. The incentive will be linked to gross return each year in excess of the portfolio maximum value since the inception of fund. The maximum value the fund achieved so far since inception of fund about one and half year ago was ₹21 crores.

You are required to compute the fee payable to CA. X, if return on the fund this year turns out to be

- (a) 29%
- (b) 4.5%
- (c) -1.8%

RTP Nov 19, StudyMat

Answer:

Qa? 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

Qb? If return is 4.5%

	₹
Fixed (A) 0.10% of ₹20 crore	2,00,000
New Fund Value ($1.045 \times ₹20$ 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

Qc? If return is (-1.8%)

No incentive only fixed fee of ₹2,00,000 will be paid

Question 18

Blue Tooth Mutual Fund is planning to float a fixed income fund of ₹100 crores on 1 January 2015 with a term of 7 years. If the target duration of fund is $5\frac{1}{2}$ years and has expected rate of return of 8.00%, then determine the amount of interest it has to earn annually on its investment after defraying management expenses of 10% of amount income earned.

MTP March 15 (5 Marks)

Answer:

Let annual inflow after defraying management expenses be x. Then

Period	Inflow	PVF @ 8%	Year	PVF X Inf ow	PV × Years
2015	x	0.926	1	0.926x	0.926x
2016	x	0.857	2	0.857x	1.714x
2017	x	0.794	3	0.794x	2.382x
2018	x	0.735	4	0.735x	2.94x
2019	x	0.681	5	0.681x	3.405x
2020	x	0.630	6	0.630x	3.78x
2021	x	0.583	7	0.583x	4.081x
2021	100	0.583	7	58.3	408.10
				5.206x + 58.3	19.228x + 408.10

$$\frac{19.228x + 408.10}{5.206x + 58.30} = 5.5$$

$$19.228x + 408.10 = 28.633x + 320.65$$

$$9.405x = 87.45$$

$$x = 9.31 \text{ i.e. } 9.31\% \text{ (Post Management Expenses)}$$

$$\text{Return before management expenses} = \frac{9.31}{0.90} = 10.34\%$$

Question 19

On 1st January, 2020 an open ended scheme of mutual fund had outstanding units of 300 lakhs with a NAV of ₹20.25. At the end of January 2020, it had issued 5 lakhs units at an opening NAV plus a load of 2%, adjusted for dividend equalization. At the end of February 2020, it had repurchased 2.5 lakhs units at an opening NAV less 2% exit load adjusted for dividend equalization. At the end of March 2020, it had distributed 70 per cent of its available income. In respect of January – March quarter, the following additional information is available:

Value appreciation of the portfolio	₹460 lakhs
Income for January	₹24 lakhs
Income for February	₹36 lakhs
Income for March	₹47 lakhs

You are required to calculate:

- Income available for distribution
- Issue price at the end of January
- Repurchase price at the end of February
- Closing value of Net Assets at the end of March

Answer:

(i) Calculation of Income Available for Distribution

	Units (Lakh)	Per Unit (₹)	Total (₹ In lakh)
Income from January	300	0.0800	24.0000
Add: Dividend equalization collected on issue	5	0.0800	0.4000
	305	0.0800	24.4000
Add: Income from February		0.1180	36.0000
	305	0.1980	60.4000
Less: Dividend equalization paid on repurchase	2.50	0.1980	(0.4950)
	302.50	0.1980	59.9050
Add: Income from March		0.1554	47.0000
	302.50	0.3534	106.9050
Less: Dividend Paid		0.2474	(74.8335)
	302.50	0.1060	32.0715

(ii) Calculation of Issue Price at the end of January

	₹
Opening NAV	20.250
Add: Entry Load 2% of ₹20.25	0.405
	20.655
Add: Dividend Equalization collected on Issue Price	0.080
	20.735

(iii) Calculation of Repurchase Price at the end of February

	₹
Opening NAV	20.250
Less: Exit Load 2% of ₹20.250	(0.405)
	19.845
Add: Dividend Equalization paid on Issue Price	0.198
	20.043

(iv) Closing NAV at the end of March

		₹ (lakh)
Opening Net Asset Value (₹20.25 × 300)		6075.000
Portfolio Value Appreciation		460.000
Issue of Fresh Units (5 × 20.735)		103.675
Income Received (24 + 36 + 47)		107.000
Less: Units repurchased (2.5 × 20.043)	- 50.1075	6745.675
Income Distributed	-74.8335	(-124.941)
Closing Net Asset Value		6620.734
Closing Units (300 + 5 – 2.5) lakh		302.50 lakh
Closing NAV as on 31st March		₹21.8867

Question 20

The Asset Management Company of the mutual fund (MF) has declared a dividend of 9.98% on the units under the dividend reinvestment plan for the year ended 31st March, 2021. The investors are issued additional units for the dividend at the rate of closing Net Asset Value (NAV) for the year as per the conditions of the scheme. The closing NAV was ₹24.95 as on 31st March, 2021. An investor Mr. X who is having 20,800 units at the year-end has made an investment in the units before the declaration of the dividend and at the rate of opening NAV plus an entry load of ₹0.04. The NAV has appreciated by 25% during the year.

Assume the face value of the unit as ₹10.00.

You are required to calculate:

- Opening NAV,
- Number of the units purchased,
- Original amount of the investment.

July 21 (5 Marks), MTP Oct 22 (4 Marks)

Answer

(i) Let N be the opening NAV, then

$$N(1 + 0.25) = ₹24.95$$

$$N = ₹19.96$$

i.e., beginning NAV = ₹19.96

(ii) Let X be the number of units purchased

Then ending units = 20,800

Accordingly,

$$20800 = X + \frac{0.998X}{24.95}$$

$$20800 = \frac{24.05X + 0.998X}{24.95}$$

$$X = 20000$$

Thus, number of units to be purchased = 20,000

(iii) Original amount of investment

Initial NAV	₹19.96
Entry Load	₹0.04
	₹20.00
Number of funds purchased	20,000
Amount of Investment	₹4,00,000

CHAPTER 9 DERIVATIVES ANALYSIS & VALUATION

Question 1

Suppose that there is a future contract on a share presently trading at ₹1000. The life of future contract is 90 days and during this time the company will pay dividends of ₹7.50 in 30 days, ₹8.50 in 60 days and ₹9.00 in 90 days.

Assuming that the Compounded Continuously Risk-Free Rate of Interest (CCRRI) is 12% p.a. you are required to find out:

- Fair Value of the contract if no arbitrage opportunity exists.
- Value of Cost to Carry.

[Given $e^{-0.01} = 0.9905$, $e^{-0.02} = 0.9802$, $e^{-0.03} = 0.97045$ and $e^{0.03} = 1.03045$]

RTP Nov 12

Answer:

(a) First of all, we shall calculate the Dividend Proceed which is as follows:

$$= ₹7.50e^{-0.12 \times 30/360} + ₹8.50e^{-0.12 \times 60/360} + ₹9.00e^{-0.12 \times 90/360}$$

$$= ₹7.50e^{-0.01} + ₹8.50e^{-0.02} + ₹9.00e^{-0.03}$$

$$= ₹7.50 \times 0.9905 + ₹8.50 \times 0.9802 + ₹9.00 \times 0.97045$$

$$= ₹7.43 + ₹8.33 + ₹8.73$$

$$= ₹24.49$$

Fair Value of Future Contract

$$= ₹1000 e^{0.12 \times 90/360} - \text{Dividend Proceeds}$$

$$= ₹1000 \times 1.03045 - ₹24.49$$

$$= ₹1005.96$$

(b) Since Value of Future Contract

$$= \text{Spot Price} + \text{Cost to Carry}$$

$$= ₹1005.96 = ₹1000 + \text{Cost to Carry}$$

$$\text{Cost to Carry} = ₹5.96$$

Question 2

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 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.

RTP Nov 20

Answer:

(i) **The price of one Future Contract**

Let X be the Price of Future Contract. Accordingly,

No. of Contracts = Contract Value / Price of one Future Contract

$$5 = \frac{₹9,00,000}{X}$$

$$X (\text{Price of One Future Contract}) = ₹1,80,000$$

(ii)

$$\text{Current Future price of the index} = \frac{₹1,80,000}{75} = 2400$$

Let Y be the current Nifty Index (on 1st February 2020) then

$$\text{Accordingly, } Y + Y(0.09 - 0.06) \frac{4}{12} = 2400$$

$$\text{and } Y = \frac{2400}{1.01} = 2376.24$$

∴ Nifty Index on 1st February 2020 shall be approximately 2376.24

(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 2376 and Nifty Futures is 2400, 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 3

Mr. X is a Senior Portfolio Manager at ABC Asset Management Company. He expects to purchase a portfolio of shares in 90 days. However, he is worried about the expected price increase in shares in coming day and to hedge against this potential price increase he decides to take a position on a 90-day forward contract on the Index. The index is currently trading at 2290. Assuming that the continuously compounded dividend yield is 1.75% and risk-free rate of interest is 4.16%, you are required to determine:

- Calculate the justified forward price on this contract.
- Suppose after 28 days of the purchase of the contract the index value stands at 2450 then determine gain/ loss on the above long position.
- If at expiration of 90 days, the Index Value is 2470 then what will be gain on long position.

Note: Take 365 days in a year and value of $e^{0.005942} = 1.005960$, $e^{0.001849} = 1.001851$. RTP May 15

Answer:

The Forward Price shall be

$$F = S_0 e^{n(r-y)}$$

Where,

S_0 = Spot Price,

n = period,

r = risk free rate of interest,

y = dividend yield

$$\begin{aligned} \text{Forward Price} &= 2290 e^{90/365(0.0416 - 0.0175)} \\ &= 2290 e^{0.005942} \\ &= 2290(1.005960) \\ &= 2303.65 \end{aligned}$$

Gain/loss on Long Position after 28 days

$$\begin{aligned} F &= S e^{(r-y)t} \\ &= 2450 \times e^{(0.0410-0.0175)62/365} \\ &= 2450 \times e^{0.00409} \\ &= 2450 \times 1.0041 \\ &= 2460.05 \end{aligned}$$

$$\text{Gain/(loss)} = 2460.05 - 2303.65 = ₹156.40$$

Gain/Loss on Long Position at maturityFutures Price on Maturity, $F = S$ $F = 2470$

$$\begin{aligned}\text{Gain or Loss} &= S_n - S_0 e^{n(r-y)} \\ &= 2470.00 - 2303.65 \\ &= ₹166.35\end{aligned}$$

Question 4

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
12-2-09	3315.00	3286.30	3292.00
14-2-09	3315.00	3257.10	3309.30
17-2-09	3278.00	3249.50	3257.80
18-2-09	3118.00	3091.40	3102.60

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.

MTP April 22 (6 Marks), RTP May 13, RTP May 15, RTP Nov 18, StudyMat

Answer:**Initial Margin** $\mu \sigma$ 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 × (3294.40 - 3296.50) = -105	15895	-
6/2/09	50 × (3230.40 - 3294.40) = -3200	12695	-
7/2/09	50 × (3212.30 - 3230.40) = -905	16000	4210
10/2/09	50 × (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 5

On 31/08/2021 Mr. R has taken a Long position of two lots of Nifty Futures at 17300.

One lot of Nifty future is 50 units.

Initial Margin required is 10% of Contract Value.

Maintenance Margin required is 80% of Initial Margin.

The closing price of 5 days are given below-

Date	Closing Price of Nifty Futures
01/09/2021	17340
02/09/2021	17180
03/09/2021	16990
06/09/2021	16900
07/09/2021	17120

You are required to-

- Prepare a statement showing the daily balances in the margin account & payment on margin calls, if any.
- Compute the Gain or Loss of Mr. R, if contract squared off on 07/09/2021.
- What would be the Gain or Loss if Mr. R, had taken the short position? Dec 21 (8 Marks)

Answer:

Contract Size ($\text{₹}17,300 \times 50 \times 2$)	= ₹17,30,000
Initial Margin (10% of 17,30,000)	= ₹1,73,000
Maintenance Margin (80% of 1,73,000)	= ₹1,38,400

Statement showing the daily balances in Margin Account and margin call if any,

Day	Change in Future value (₹)	Margin Account (₹)	Call Money (₹)
31/08/21	-----	₹17,30,000	₹1,73,000
01/09/21	$(\text{₹}17,340 - \text{₹}17,300) \times 50 \times 2 = 4,000$	₹17,34,000	₹1,73,000
02/09/21	$(\text{₹}17,180 - \text{₹}17,340) \times 50 \times 2 = -16,000$	₹17,22,000	₹1,73,000
03/09/21	$(\text{₹}16,990 - \text{₹}17,180) \times 50 \times 2 = -19,000$	₹17,03,000	₹1,73,000
06/09/21	$(\text{₹}16,900 - \text{₹}16,990) \times 50 \times 2 = -9,000$	₹16,94,000	₹1,73,000
07/09/21	$(\text{₹}17,120 - \text{₹}16,900) \times 50 \times 2 = 22,000$	₹17,16,000	₹1,73,000

Gain or Loss of Mr. R squared off position on 07/09/2021

	(₹)
Ending margin	1,95,000
Less: Initial Margin	1,73,000

Profit	22,000
Less: Margin Call	40,000
Net Loss	18,000

iii) Gain/Loss if Mr. R has taken Short Position

Day	Change in Future value (₹)	Margin A/c (₹)	Call Money (₹)
31/08/21	-----	2,22,000	0
01/09/21	$(₹17,300 - ₹17,340) \times 50 \times 2 = -4,000$	2,22,000	0
02/09/21	$(₹17,340 - ₹17,180) \times 50 \times 2 = 16,000$	2,22,000	0
03/09/21	$(₹17,180 - ₹16,990) \times 50 \times 2 = 19,000$	2,22,000	0
06/09/21	$(₹16,990 - ₹16,900) \times 50 \times 2 = 9,000$	2,22,000	0
07/09/21	$(₹16,900 - ₹17,120) \times 50 \times 2 = -22,000$	2,22,000	0

Profit or Loss on Short Position

	(₹)
Ending margin	1,91,000
Less: Initial Margin	1,73,000
Profit	18,000

Question 6

Spot price of L&T Ltd. on 4th June is ₹1,701 per share and June futures on this is being traded at a price of ₹1,740 per share. The lot size is 400 shares. Mr. Rohan takes long on this futures for six lots. Subsequently, on 12th June spot price move to ₹1,750 per share and June futures is being traded at a price of ₹1,798, he squares-up two lots at this price. On 23rd June spot price falls to ₹1,690 per share and June futures is being traded at ₹1,720 per share, he squares-up three lot. On the value date the closing spot price is ₹1,725 per share and his open position is settled through cash difference. Show his outcomes.

Answer:

Date	L&T Share	L&T Futures	Action	Profit / Loss	Open Interest
4/06	1701	1740	Long 6 lots	-	6 lots long futures
12/06	1750	1798	Short 2 lots	$[1798 - 1740] \times 400 \times 2 = 46400$	4 lots long futures
23/06	1690	1720	Short 3 lots	$[1720 - 1740] \times 400 \times 3 = -24000$	1 lot long futures
Expiry	1725	1725	Settle	$[1725 - 1740] \times 400 \times 1 = -6000$	-

Question 7

Mr. V decides to sell short 10000 shares of ABC plc, when it was selling at yearly high of £5.60. His broker requested him to deposit a margin requirement of 45% and commission of £1550 while Mr. V was short the share, the ABC paid a dividend of £0.25 per share. At the end of one-year Mr. V

buys 10000 shares of ABC plc at £4.50 to close out position and was charged a commission of £1450. You are required to calculate the return on investment of Mr. V. RTP Nov 11

Answer:

To compute the return on investment we shall first compute profit on short sale which will be as follows: = Beginning value – Ending value – Dividends – Trans. Cost – Interest

Accordingly beginning value of investment = £5.60 × 10000 = £56000

Mr V's investment	Mr V's Requirement	Commission
	= 0.45 × £56000 + £1550	
	= £25200 + £1550 = £26750	
Ending value of investment (Closing out position)	= £4.50 × 10000 = £45000	
Dividend	= £0.25 × 10000 = £2500	
Transaction cost	= £1550 + £1450 = £3000	
Thus, Profit	= £56000 - £45000 - £2500 - £3000 = £5500	
The rate of return on investment	= £5500/£26750 = 20.56%	

Question 8

The NSE-50 Index futures are traded with rupee value being ₹100 per index point. On 15th September, the index closed at 1195, and December futures (last trading day December 15) were trading at 1225. The historical dividend yield on the index has been 3% per annum and the borrowing rate was 9.5% per annum.

- Determine whether on September 15, the December futures were underpriced or overpriced?
- What arbitrage transaction is possible to gain out this mispricing?
- Calculate the gains and losses if the index on 15th December closes at (a) 1260 (b) 1175.

Assume 365 days in a year for your calculations.

Nov 19 (8 Marks)

Answer:**Current price of the December Future**

$$\begin{aligned}
 &= ₹100 [1195 + 1195(0.095-0.03)91/365] \\
 &= ₹100[1195 + 19.37] \\
 &= ₹1,21,437
 \end{aligned}$$

Since the current market price of December-15 is ₹1,22,500 (₹100 × 1225) it is **overpriced**.

- Since the actual future is overpriced, the cash and carry arbitrage is possible i.e. **sell the future contract and borrow to buy the stock**.
- September 15

Transaction	Cash Flow
Buy (1195 × ₹100) = ₹1,19,500 worth of Stocks	- ₹1,19,500.00
Borrow ₹1,19,500 @ 9.50% for 91 days	+ ₹1,19,500.00

Sell a Future Contract @ 1225	0
Total	?

On December 22, the Index closes at 1225

Transaction	Cash Flow (₹)
Repay ₹1,19,500 @ 9.50% for 91 days	- 1,22,330.35
Cancellation of Future Contract (1,22,500 – 1,26,000)	- 3,500.00
Sell 1,19,500 worth of Stocks @ 1,260 = $\left(\frac{1260}{1195}\right) \times 1,19,500$	+ 1,26,000.00
Dividend Earned @ 3% = $\left(\frac{91}{365}\right) \times 1,19,500 \times 3\%$	+ 893.79
Gain due to Arbitrage	₹ 2,22,222.22

On December 22, the Index closes at 1225

Transaction	Cash Flow (₹)
Repay ₹1,19,500 @ 9.50% for 91 days	- 1,22,330.35
Cancellation of Future Contract (1,22,500 – 1,17,500)	+5,000.00
Sell 1,19,500 worth of Stocks @ 1,175 = $\left(\frac{1,175}{1,195}\right) \times 1,19,500$	+1,17,500.00
Dividend Earned @ 3% = $\left(\frac{91}{365}\right) \times 1,19,500 \times 3\%$	+ 893.79
Gain due to Arbitrage	₹ 2,22,222.22

Question 9

On 1st 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 1st April.

- Calculate the beta of the 10th security.
- 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.

MTP Mar 18 (8 Marks), StudyMat

Answer:

- 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,

$$1.102 = 0.90 \times 1.10 + 0.10 \times \beta$$

$$\beta = 1.12$$

- (ii) There is a profit in cash position, and it might be due to the reason that **contrary to her expectation of fall in the value of cash position there may be increase in value of cash position.**

Question 10

Following information is available for consideration:

BSE Index	25,000
Value of portfolio	₹50,50,000
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 4 months maturity is used to hedge the value of portfolio over next 3 months. One future contract is for delivery of 50 times the index.

Based on the above information calculate:

- Price of future contract.
- Gain on short futures position if index turns out to be 22,500 in 3 months.

Note: Daily compounding (exponential) formula is not required to be used.

RTP May 22, July 21 (8 Marks), Nov 20 (8 Marks), RTP May 19, RTP Nov 13, RTP Nov 15, RTP May 16, MTP Sep 22 (8 Marks), MTP Sept 14 (5 Marks), MTP Aug 17 (5 Marks), MTP April 18 (5 Marks)

Answer:

- Current future price of the index

$$\begin{aligned} F &= \text{Spot Price} + \text{Cost} - \text{Dividend} \\ &= 25000 + 25000 (0.09 - 0.06) \frac{4}{12} \\ &= 25000 + 250 \\ &= 25250 \end{aligned}$$

$$\therefore \text{Price of the future contract} = ₹50 \times 25,250 = ₹12,62,500$$

-

$$\text{Hedge Ratio} = \frac{50,50,000}{12,62,500} \times 1.5 = 6 \text{ Contracts}$$

Index after three months turns out to be 22500

$$\text{Future price will be} = 22500 + 22500 (0.09 - 0.06) \times \frac{1}{12} = 22556.25$$

Therefore, **gain from the short futures position** is

$$\begin{aligned} &= 6 \times (25250 - 22556.25) \times 50 \\ &= ₹8,08,125 \end{aligned}$$

Alternative Solution: If daily compounding (exponential) formula is used.

(i)

$$\begin{aligned}\text{Current future price of the index} &= F \times e^{(r-y)t} \\ &= 25,000 \times e^{(0.09 - 0.06) \times (4/12)} \\ &= 25,000 \times 1.010050 = 25,251.25 \\ \therefore \text{Price of the future contract} &= ₹50 \times 25,251.25 = ₹12,62,562.50\end{aligned}$$

(ii)

$$\text{Hedge Ratio} = \frac{50,50,000}{12,62,562.50} \times 1.50 = 6 \text{ Contracts}$$

Index after three months turns out to be 22,500

$$\begin{aligned}\text{Future price will be} &= 22,500 \times e^{(0.09 - 0.06) \times \left(\frac{1}{12}\right)} \\ &= 22,500 \times 1.002503 = 22,556.32\end{aligned}$$

$$\begin{aligned}\text{Therefore, gain from the short futures position is} &= 6 \times (25,251.25 - 22,556.32) \times 50 \\ &= ₹8,08,479\end{aligned}$$

Question 11

On January 1, 2018 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 2018.
- 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 $e^{(0.015858)} = 1.01598$

Nov 23 (8 Marks), May 13 (8 Marks), MTP Mar 15 (8 Marks), MTP Mar 19 (8 Marks), MTP Oct 19 (8 Marks), RTP May 20, StudyMat

Answer:

ii) Calculation of Portfolio Beta

Security	Price of the Stock	No. of shares	Value	Weightage W_i	Beta β_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

iii) 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 2013 contract, $t = 58/365 = 0.1589$

Further

$$F = Se^{rt}$$

$$F = ₹5,900e^{(0.0998)(0.1589)}$$

$$F = ₹5,900e^{0.015858}$$

$$F = ₹5,900 \times 1.01598$$

$$F = ₹5,994.28$$

Alternatively, it can be taken as follows:

$$= ₹5900 e^{0.105 \times 58/365}$$

$$= ₹5900 e^{0.01668}$$

$$= ₹5900 \times 1.01682$$

$$= ₹5,999.24$$

iii) Then total portfolio is to be hedged

$$\begin{aligned}
 &= \frac{\text{Value of Spot Position requiring hedging}}{\text{Value of Future Contract}} \times \text{Portfolio Beta} \\
 &= \frac{1,88,54,860}{5994.28 \times 200} \times 0.849 \\
 &= 13.35 \text{ Contracts say 13 or 14 contracts}
 \end{aligned}$$

iii) Then total portfolio beta is to be reduced to

Number of Contracts to be sold

$$\begin{aligned}
 &= \frac{P(\beta_o - \beta_n)}{F} \\
 &= \frac{1,88,54,860(0.849 - 0.600)}{5994.28 \times 200} \\
 &= 3.92 \text{ contracts say 4 contracts}
 \end{aligned}$$

Question 12

A future contract on BSE Index with 4 months maturity is used to hedge the value of the portfolio over the next 3 months. One future contract for delivery is 50 times of the index.

The following information is available:

Value of the portfolio	₹1,16,00,000
BSE Sensex on 1 st January 2022	58580
(Anticipated on 1 st September 2021)	
BSE Sensex on 1 st January 2022	56641.25
(Anticipated on 1 st December 2021)	
Dividend Yield of Index	6% p.a.
181 days' treasury bills offers a rate of interest	9% p.a.
Beta of the portfolio	1.5

You are required to calculate:

- The present value of the Sensex as on 1st September 2021
- Turned out value of the Sensex as on 1st December 2021
- The number of contracts to hedge the portfolio.

Dec 21 (8 Marks)

Answer:

(i) Let X be the present value of the Sensex as on 1st September, 2021

$$58,580 = X + X[9\% - 6\%] \times \frac{4}{12}$$

$$58,580 = X + \frac{X}{100}$$

$$X = 58,000$$

Thus, the present value of Sensex as on 1st September 2021 is 58,000

(ii) Let turned out value of Sensex on 1st Dec 2021 is Y, then

$$56,641.25 = Y + Y[9\% - 6\%] \times \frac{1}{12}$$

$$56,641.25 = Y + \frac{Y}{100}$$

$$Y = 56,500$$

Thus, turned out value of Sensex on 1st December 2021 is 56,500

(iii) No. of Contract to hedge the Portfolio

$$= \frac{₹1,16,00,000 \times 1.50}{58,580 \times 50} = 5.95 \text{ Say 6 Contracts}$$

Question 13

The Following data relate to A Ltd.'s Portfolio:

Shares	X Ltd.	Y Ltd.	Z Ltd.
No. of Shares (lakh)	6	8	4
Price per share (₹)	1000	1500	500
Beta	1.50	1.30	1.70

The CEO is of opinion that the portfolio is carrying an extremely high risk as compared to the market risk and hence interested to reduce the portfolio's systematic risk to 0.95. Treasury Manager has suggested two below mentioned alternative strategies:

- (i) Dispose off a part of his existing portfolio to acquire risk free securities, or
- (ii) Take appropriate position on Nifty Futures, currently trading at 8250 and each Nifty points multiplier is ₹210.

You are required to:

- (a) Interpret the opinion of CEO, whether it is correct or not.
- (b) Calculate the existing systematic risk of the portfolio,
- (c) Advise the value of risk-free securities to be acquired,
- (d) Advise the number of shares of each company to be disposed off,
- (e) Advise the position to be taken in Nifty Futures and determine the number of Nifty contracts to be bought/sold; and
- (f) Calculate the new systematic risk of portfolio if the company has taken position in Nifty Futures and there is 2% rise in Nifty.

Note: Make calculations in ₹lakh and upto 2 decimal points.

RTP May 21

Answer:

- (a) **Yes, the apprehension of CEO is correct** as the current portfolio is riskier than market as the beta (Systematic Risk) of market portfolio is as computed as follows:

Shares	No. of shares (lakhs) (1)	Market Price of Per Share (2) (₹)	(1) × (2) (₹ lakhs)	% to total (w)	β (x)	Wx
X Ltd.	6.00	1000.00	6000.00	0.30	1.50	0.45
Y Ltd.	8.00	1500.00	12000.00	0.60	1.30	0.78
Z Ltd.	4.00	500.00	2000.00	0.10	1.70	0.17
			20000.00	1.00		1.40

- (b) Since the Beta of existing portfolio is 1.40, the systematic risk of the current portfolio is **1.40**.

- (c) **Required Beta 0.95**

Let the proportion of risk-free securities for target beta $0.95 = p$

$$0.95 = 0 \times p + 1.40 (1 - p)$$

$$p = 0.32 \text{ i.e. } 32\%$$

Shares to be disposed off to reduce beta $(20000 \times 32\%)$ **₹6,400 lakh** and Risk-Free securities to be acquired for the same amount.

- (d) **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)
X Ltd.	0.30	1920.00	1000.00	1.92
Y Ltd.	0.60	3840.00	1500.00	2.56
Z Ltd.	0.10	640.00	500.00	1.28

- (e) Since, the company is in long position in cash market it shall take short position in Future Market.

Number of Nifty Contract to be sold

$$\frac{(1.40-0.95) \times 20000 \text{ lakh}}{8,250 \times 210} = 519 \text{ contracts}$$

- (f) If there is 2% rises in Nifty there will be 2.80%(2%×1.40) rise for portfolio of shares

	₹ Lakh
Current Value of Portfolio of Shares	20000
Value of Portfolio after rise	20560
Mark-to-Market Margin paid (8250 × 0.020 × ₹210 × 519)	179.83
Value of the portfolio after rise of Nifty	20380.17
% change in value of portfolio (20380.17 – 20000)/ 20000	1.90%
% rise in the value of Nifty	2%
New Systematic Risk Beta	0.95

Question 14

A company is long on 10 MT of copper @ ₹474 per kg (spot) and intends to remain so for the ensuing quarter. The standard deviation of changes of its spot and future prices are 4% and 6% respectively, having correlation coefficient of 0.75. What is its hedge ratio? What is the amount of the copper future it should short to achieve a perfect hedge?

RTP Nov 23, RTP Nov 21, May 12 (5 Marks), RTP Nov 13, RTP Nov 14, RTP May 17, MTP Sept 14 (6 Marks), MTP April 18 (6 Marks)

Answer:

The optimal hedge ratio to minimize the variance of Hedger's position is given by:

$$H = \rho \frac{\sigma_S}{\sigma_F}$$

Where

σ_S = Standard deviation of ΔS

σ_F = Standard deviation of ΔF

ρ = Coefficient of correlation between ΔS and ΔF

H = Hedge Ratio

ΔS = Change in Spot price

ΔF = Change in Future price.

Accordingly

$$H = 0.75 \times \frac{0.04}{0.06} = 0.5$$

No. of contract to be short = 10 × 0.5 = 5

Amount = 5000 × ₹474 = ₹23,70,000

Question 15

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) Advise 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.

MTP Oct 20 (6 Marks), RTP Nov 21

Answer:

- (i) The Optimal hedge ratio to minimize the variance of Hedger's position is given by:

$$H = \rho \frac{\sigma_S}{\sigma_F}$$

σ_S = Standard deviation of ΔS (Change in Spot Prices)

σ_F = Standard deviation of ΔF (Change in Future Prices)

ρ = coefficient of correlation between ΔS and ΔF

H = Hedge Ratio

ΔS = change in Spot price.

ΔF = change in Future price.

Accordingly

Standard deviation of $\Delta S = \sqrt{16\%} = 4\%$ and

Standard deviation of $\Delta F = \sqrt{36\%} = 6\%$ and

$$H = 0.75 \times \frac{0.04}{0.06} = 0.5$$

- (ii) Since the company has 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, the

$$\text{No. of contract to be short} = \frac{10,000 \text{ Kgs}}{1,000 \text{ Kgs}} \times 0.50 = 5 \text{ Contracts}$$

$$\text{Amount} = 5000 \times ₹534 = ₹26,70,000$$

Question 16

Mr. Careless was employed with ABC Portfolio Consultants. The work profile of Mr. Careless involves advising the clients about taking position in Future Market to obtain hedge in the position they are holding. Mr. ZZZ, their regular client purchased 100,000 shares of X Inc. at a price of \$22 and sold 50,000 shares of A plc for \$40 each having beta 2. Mr. Careless advised Mr. ZZZ to take short position in Index Future trading at \$1,000 each contract. Though Mr. Careless noted the name of A plc along with its beta value during discussion with Mr. ZZZ but forgot to record the beta value of X Inc.

On next day Mr. ZZZ closed out his position when:

- (i) Share price of X Inc. dropped by 2%
- (ii) Share price of A plc appreciated by 3%
- (iii) Index Future dropped by 1.5%

Mr. ZZZ, informed Mr. Careless that he has made a loss of \$114,500 due to the position taken. Since record of Mr. Careless was incomplete, he approached you to help him to find the number of contracts of Future contract he advised Mr. ZZZ to be short to obtain a complete hedge and beta value of X Inc.

You are required to find these values.

RTP May 15

Answer:

Let the number of contracts in Index future be y and Beta of X Inc. be x. Then,

$$\frac{100,000 \times 22 \times x - 50,000 \times 40 \times 2}{1,000} = -y^*$$

* Negative (-) sign indicates the sale (short) position

$$2,200,000x - 4,000,000 = -1,000y$$

Cash Outflow

Purchase of 100,000 shares of X Inc. at a price of \$22 (100,000 × 22)	2,200,000
Sale of 50,000 shares of A plc for \$40 (50,000 × 40)	- 2,000,000
Short Position in Index Futures (1,000 × y)	-1,000y*
Net	200,000 - 1,000y

* Negative (-) sign indicates the indicates inflow due to sale (short) position

Cash Inflow

Sale of 100,000 shares of X Inc. (100,000 × 22 × 0.98)	2,156,000
Purchase of 50,000 shares of A plc (50,000 × 40 × 1.03)	- 2,060,000
Long Position in Index Futures (1,000 × y × 0.985)	-985y
Net	96,000 - 985y

* Negative (-) sign indicates the indicates outflow due to purchase (long) position

Position on Close

$$(200,000 - 1,000y) - (96,000 - 985y) = 114,500$$

$$y = -700$$

Thus, number of future contract short is 700

Beta of X Inc. can be calculated as follows:

$$2,200,000x - 4,000,000 = -1000 \times 700$$

$$2,200,000x = 3,300,000$$

$$x = 1.5$$

Thus, Beta of X Inc. is 1.5

Question 17

Mr. X is having a portfolio of shares worth ₹170 lakhs at current price 8 and cash ₹30 lakhs. The beta of share portfolio is 1.6. After 3 months the price of shares dropped by 3.2%.

Determine:

- (i) Current portfolio beta.

- (ii) Portfolio beta after 3 months if Mr. X on current date goes for long position on 200 lakhs Nifty futures.

July 21 (8 Marks), May 2017 (5 Marks), RTP May 2020, RTP Nov 17, RTP Nov 16, MTP Mar 24 (8 Marks), MTP Mar 19 (8 Marks), MTP April 14 (8 Marks), RTP May 14, MTP April 18 (4 Marks), StudyMat

Answer:

(i) Current Portfolio Beta

$$\begin{aligned}\text{Current Beta for share portfolio} &= 1.6 \\ \text{Beta for cash} &= 0 \\ \text{Current portfolio beta} &= 0.85 \times 1.6 + 0.15 \times 0 = 1.36\end{aligned}$$

(ii) Portfolio beta after 3 months:

$$\begin{aligned}\text{Beta for portfolio of shares} &= \frac{\text{Change in value of portfolio of share}}{\text{Change in value of market portfolio (Index)}} \\ 1.6 &= \frac{0.032}{\text{Change in value of market portfolio (Index)}} \\ \text{Change in value of market portfolio (Index)} &= (0.032 / 1.6) \times 100 = 2\% \\ \text{Position taken on 200 lakh Nifty futures} &: \text{Long} \\ \text{Value of index after 3 months} &= ₹200 \text{ lakh} \times (1.00 - 0.02) \\ &= ₹196 \text{ lakh} \\ \text{Mark-to-market paid} &= ₹4 \text{ lakh} \\ \text{Cash balance after payment of mark-to-market} &= ₹26 \text{ lakh} \\ \text{Value of portfolio after 3 months} &= ₹170 \text{ lakh} \times (1 - 0.032) + ₹26 \text{ lakh} \\ &= ₹190.56 \text{ lakh} \\ \text{Change in value of portfolio} &= \frac{200 \text{ lakh} - 190.56 \text{ lakh}}{200 \text{ lakh}} \times 100 = 4.72\% \\ \text{Portfolio beta} &= 0.0472 / 0.02 = 2.36\end{aligned}$$

Question 18

Mr. John established the following spread on the TTK Ltd.'s stock:

- (i) Purchased one 3-month put option with a premium of ₹15 and an exercise price of ₹900.
- (ii) Purchased one 3-month call option with a premium of ₹90 and an exercise price of ₹1100.

TTK Ltd.'s stock is currently selling at ₹1000. Calculate gain or loss, if the price of stock of TTK Ltd.

- (i) Remains at ₹1000 after 3 months.
- (ii) Falls to ₹700 after 3 months.
- (iii) Raises to ₹1200 after 3 months.

Assume the size of option is 200 shares of TTK Ltd.

May 19 (8 Marks), Nov 11 (8 Marks), Nov 08 (6 Marks), RTP May 24, MTP Oct 18 (8 Marks), MTP Mar 24 (8 Marks), RTP May 18, StudyMat

Answer:

?? Total premium paid on purchase of a call and put option

$$\begin{aligned}&= (\text{₹15 per share} \times 200) + (\text{₹90 per share} \times 200) \\ &= ₹3,000 + ₹18,000 \\ &= ₹21,000\end{aligned}$$

In this case, Mr. John exercises neither the call option nor the put option as both will result in a loss for him.

$$\text{Ending value} = \text{zero gain} - ₹21000 = - ₹21000$$

Net loss ₹ ₹21000

?? 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.

$$\text{Net Gain} = (\text{Exercise Price} - \text{Current Price}) \times \text{No of Shares} - \text{Premium Paid}$$

$$\text{Ending value} = ₹ [(900 - 700) \times 200] - ₹21000 = ₹19,000$$

Net gain ₹ ₹19000

?? 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.

$$\text{Ending value} = ₹ [(1200 - 1100) \times 200] - ₹21000 = - ₹1000$$

Net loss ₹ ₹1000

Question 19

As an investor you had purchased a 4-month call option on the equity shares of X Ltd. of ₹10, of which the current market price is ₹132 and the exercise price ₹150. You expect the price to range between ₹120 to ₹190. The expected share price of X Ltd. and related probability is given below:

Expected Price (₹)	120	140	160	180	190
Probability	.05	.20	.50	.10	.15

Compute the following:

- (1) Expected share price at the end of 4 months.
- (2) Value of Call Option at the end of 4 months, if the exercise price prevails.
- (3) In case the option is held to its maturity, what will be the expected value of the call option?

MTP March 22 (8 Marks), Nov 12 (8 Marks), Feb 14 (5 Marks), MTP Feb 15 (5 Marks), MTP Apr 18 (8 Marks), Nov 18 (8 Marks), MTP Oct 19 (8 Marks), StudyMat

Answer:

a) Expected share Price

$$= ₹120 \times 0.05 + ₹140 \times 0.20 + ₹160 \times 0.50 + ₹180 \times 0.10 + ₹190 \times 0.15$$

$$= ₹6 + ₹28 + ₹80 + ₹18 + ₹28.50 = ₹160.50$$

b) Value of Call Option = ₹150 - ₹150 = Nil

c) 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	₹6
Total			₹14

Alternatively, it can also be calculated as follows:

Expected Value of Option		
$(120 - 150) \times 0.05$	Not Exercised*	* If the strike price goes below ₹150, option is not exercised at all.
$(140 - 150) \times 0.20$	Not Exercised*	
$(160 - 150) \times 0.50$	5	
$(180 - 150) \times 0.10$	3	
$(190 - 150) \times 0.15$	6	
	₹??	

Question 20

A call option has been entered into by Arnav for delivery of share of X Ltd. at ₹460. The expected future prices at the time of expiry of contract are as follows:

Price (₹)	Prob.
470	0.20
450	0.25
480	0.35
490	0.05
500	0.15

Determine the premium at which Arnav will break even. MTP Feb 16 (5 Marks), MTP Mar 16 (5 Marks)

Answer: Let Premium be P, then

$$0 = (470 - 460 - P)0.20 + (-P)0.25 + (480 - 460 - P)0.35 + (490 - 460 - P)0.05 + (500 - 460 - P)0.15$$

$$0 = (10 - P) 0.20 - 0.25 P + (20 - P) 0.35 + (30 - P) 0.05 + (40 - P) 0.15$$

$$0 = 2 - 0.20P - 0.25P + 7 - 0.35P + 1.5 - 0.05P + 6 - 0.15P$$

$$0 = 16.50 - P$$

$$P = 16.50$$

Question 21

Following is the information available pertaining to shares of Omni Ltd.:

Current Market Price (₹)	₹420.00
Strike Price (₹)	₹450.00
Maximum Price (₹) expected in next 3 months' time	₹525.00
Minimum Price (₹) expected in next 3 months' time	₹378.00
Continuously Compounded Rate of Interest (p.a.) (%)	8.00%
e^{rt}	1.0202

From the above:

i. Calculate the 3 months call option by using Binomial Method and Risk Neutral Method.

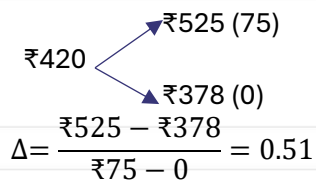
Are the calculated values under both the models are same?

ii. State also clearly the basis of Valuation of options under these models.

Nov 23 (8 Marks), May 11 (5 Marks), RTP May 13, MTP Sep 22 (4 Marks), MTP Oct 18 (6 Marks)

Answer:

(i)

a. Call Option value using Binomial ModelInitial Investment = $0.51 \times 420 = 214.20$

Value of Portfolio if Price goes down to ₹378

Value of holding $0.51 \times ₹378 = 192.78$

Accordingly Let 'P' be the option price, then

 $₹214.20 - P = ₹192.78 / 1.0202 = ₹188.96$ **P = ₹25.24****b. Value of Call Option using Risk Neutral Method**

Let "P" be the probability of Price increase, then

 $p \times 525 + (1 - p) \times 378 = 420(1.0202)$ $147p = 50.48$ $p = 0.34$

Probability of Price increase = 0.34, Probability of Price decrease = 0.66

$$\frac{0.34 \times 75 + 0.66 \times 0}{1.0202} = ₹25.24$$

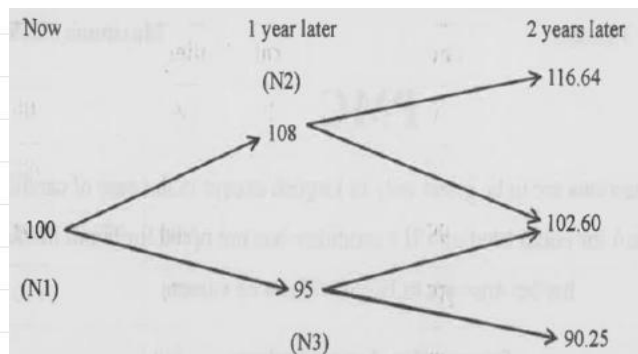
Yes, the value of option under both Models is same.

(ii) Basis of valuation of options :

- Binomial model uses an approach called "Risk less Hedge Approach" to find the price of the option, by creating a portfolio which will have same value at expiration irrespective of any price. Hedge means to create an equal and opposite position for protecting the value of portfolio.
- In Risk Neutral Model, valuation of options is based on arbitrage and is therefore independent of risk preferences; one should be able to value options assuming any set of risk preferences and get the same.

Question 22

A two-year tree for a share of stock in ABC Ltd., is as follows:



Consider a two years American call option on the stock of ABC Ltd., with a strike price of ₹98. The current price of the stock is ₹100. Risk free return is 5 per cent per annum with a continuous compounding and $e^{0.05} = 1.05127$.

Assume two time periods of one year each.

Using the Binomial Model, calculate:

- (iv) The probability of price moving up and down;
- (v) Expected pay offs at each nodes i.e. N1, N2 and N3 (round off upto 2 decimal points).

Nov 20 (8 Marks), RTP May 23

Answer:

- (i) Using the single period model, the probability of price moving up is

$$P = \frac{R-d}{u-d} = \frac{1.05127 - \frac{95}{100}}{\frac{108}{100} - \frac{95}{100}} = \frac{0.10127}{0.13} = 0.779 \text{ say } 0.78 \text{ i.e. } 78\%$$

Therefore, the probability of price moving down = $1 - 0.78 = 0.22$ i.e. 22%

- (ii) Expected pay-off at

Node N2

$$\frac{0.78 \times 18.64 + 0.22 \times 4.60}{1.05127} = \frac{15.55}{1.05127} = ₹14.79$$

Node N3

$$\frac{0.78 \times 4.60 + 0.22 \times 0}{1.05127} = \frac{3.588}{1.05127} = ₹3.41$$

Node N1

$$\frac{0.78 \times 14.79 + 0.22 \times 3.41}{1.05127} = \frac{12.286}{1.05127} = ₹11.69$$

Question 23

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 rate of interest is 5% p.a. and standard deviation (volatility) of share price is 22%.

- (i) 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?
- (ii) Calculate value of the call option based on Black Scholes valuation model if the current price is considered as ₹380.
- (iii) What would be the worth of put option if the current price is considered ₹380?
- (iv) If TIC share price 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: $\ln(1.0375) = 0.03681$; $\ln(0.95) = -0.05129$; $\ln(0.9952) = -0.00481$; $e^{0.0125} = 1.012578$; $e^{0.008333} = 1.0084$

MTP Oct 22 (10 Marks), Study Material

Answer:

- 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:

$$d_1 = \frac{\ln\left(\frac{415}{400}\right) + \left[0.05 + \frac{1}{2}(0.22^2)\right] 0.25}{0.22\sqrt{0.25}} = \frac{0.03681 + 0.01855}{0.11} = 0.5032727$$

$$d_2 = \frac{\ln\left(\frac{415}{400}\right) + \left[0.05 - \frac{1}{2}(0.22^2)\right] 0.25}{0.22\sqrt{0.25}} = \frac{0.03681 + 0.0645}{0.11} = 0.3932727$$

$$N(d_1) = N(.50327) = 1 - .3072 = .6928$$

$$N(d_2) = N(.39327) = 1 - .3471 = .6529$$

Value of Option

$$= 415 (.6928) - \frac{400}{e^{(0.05)(0.25)}} (0.6529)$$

$$= 287.512 - \frac{400}{1.012578} (0.6529)$$

$$= 287.512 - 257.916$$

$$= ₹29.60$$

NB: N(0.39327) can also be found as under :

Step 1: From table of area under normal curve find the area of variable 0.39 i.e. 0.6517.

Step 2: From table of area under normal curve find the area of variable 0.40.

Step 3: Find out the difference between above two variables and areas under normal curve.

Step 4: Using interpolation method find out the value of 0.00327. Which is as follows:

$$\frac{0.0037}{0.01} \times 0.00327 = 0.0012$$

Step 5: Add this value, computed above to the N(0.39). Thus N (0.39327) = 0.6517 + 0.0012 = 0.6529

Since market price of ₹25 is less than ₹27.60 (Black Scholes Valuation model) indicate that option is underpriced, hence worth buying.

Q12] If the current price is taken as ₹380 the computations are as follows?

$$d_1 = \frac{\ln\left(\frac{380}{400}\right) + \left[0.05 + \frac{1}{2}(0.22^2)\right] 0.25}{0.22\sqrt{0.25}} = \frac{-0.05129 + 0.01855}{0.11} = -0.297636$$

$$d_2 = \frac{\ln\left(\frac{380}{400}\right) + \left[0.05 - \frac{1}{2}(0.22^2)\right] 0.25}{0.22\sqrt{0.25}} = \frac{-0.05129 + 0.0645}{0.11} = -0.407636$$

$$N(d_1) = N(-0.297636) = .3830$$

$$N(d_2) = N(-0.407636) = .3418$$

Value of Call Option

$$V_0 = V_s N(d_1) - \frac{E}{e^{rt}} N(d_2)$$

$$380 \times (.3830) - \frac{400}{e^{(0.05)(0.25)}} \times (0.3418)$$

$$145.54 - \frac{400}{1.012578} \times (0.3418)$$

$$= 145.54 - 135.02$$

$$= ₹10.52$$

Value of option = ₹10.52

Current Market Value = ₹415

$$\text{Present Value of Exercise Price} = \frac{400}{1.0125} = 395.06 \text{ or } \frac{400}{1.012578} = 395.03$$

Value of Put Option can be found by using Put Call Parity relations as follows

$$V_p = -V_s + V_c + PV(E)$$

$$V_p = -380 + 10.52 + 395.06 = ₹25.58$$

$$\text{or } -380 + 10.52 + 395.03 = ₹25.55$$

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 (using continuous discounting) = Dividend $\times e^{-rt}$

$$= ₹10 \times e^{-.05 \times .1666}$$

$$= ₹10 \times e^{-.008333}$$

$$= ₹9.917 \text{ (Please refer Exponential Table)}$$

Adjusted price of shares is ₹408 – 9.917 = ₹398.083

This can be used in Black Scholes model

$$d_1 = \frac{\ln\left(\frac{398.083}{400}\right) + \left[.05 + \frac{1}{2}(.22)^2\right] \cdot .25}{.22\sqrt{.25}} = \frac{-0.00480 + .01855}{.11} = .125$$

$$d_2 = \frac{\ln\left(\frac{398.083}{400}\right) + \left[.05 - \frac{1}{2}(.22)^2\right] \cdot .25}{.22\sqrt{.25}} = \frac{-0.00480 + .00645}{.11} = .015$$

$$N(d_1) = N(.125) = .5498$$

$$N(d_2) = N(.015) = .5060$$

$$\text{Value of Option} = 398.083 \times (.5498) - \frac{400}{e^{(0.05)(.25)}} \times (.5060)$$

$$= 218.866 - \frac{400}{1.012578} \times (.5060)$$

$$= 218.866 - 199.8858$$

$$= ₹18.98$$

Question 24

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
$e^{0.12 \times 0.5} = 1.062$	
$\ln 1.0667 = 0.0646$	

RTP May 20, MTP May 20 (8 Marks), StudyMat

Answer:

Applying the Black Scholes Formula,

Value of the Call option now:

The Formula

$$C = SN(d_1) - Ke^{-rt}N(d_2)$$

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

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

Where,

C = Theoretical call premium

S = Current stock price

t = time until option expiration

K = option striking price

r = risk-free interest rate

N = Cumulative standard normal distribution

e = exponential term

σ = Standard deviation of continuously compounded annual return.

$\ln$ = natural logarithm

$$d_1 = \frac{\ln(1.0667) + (0.12 + 0.08)0.5}{0.40\sqrt{0.50}}$$

$$= \frac{0.0646 + (0.2)0.5}{0.40 \times 0.7071}$$

$$= \frac{0.1646}{0.2828}$$

$$= 0.5820$$

$$d_2 = 0.5820 - 0.2828 = 0.2992$$

$$N(d_1) = N(0.5820)$$

$$N(d_2) = N(0.2992)$$

$$\text{Price} = SN(d_1) - Ke^{(-rt)}N(d_2)$$

$$= 80 \times N(d_1) - \frac{75}{1.062} \times N(d_2)$$

$$N(d_1) = N(0.5820) = 0.7197$$

$$N(d_2) = N(0.2992) = 0.6176$$

$$\text{Price} = 80 \times 0.7197 - \frac{75}{1.062} \times 0.6176$$

$$= 57.57 - 70.62 \times 0.6176$$

$$= 57.57 - 43.61$$

$$= ₹13.96$$

Teaching Notes

Students may please note following important point: Values of $N(d_1)$ and $N(d_2)$ have been computed by interpolating the values of areas under respective numbers of SD from Mean (Z) given in the question.

It may also be possible that in question paper areas under Z may be mentioned otherwise e.g.

Cumulative Area or Area under Two tails. In such situation the areas of the respective Zs given in the question will be as follows:

Cumulative Area

Number of S.D. from Mean, (z)	Cumulative Area
0.25	0.5987
0.30	0.6179
0.55	0.7088
0.60	0.7257

Two tail area

Number of S.D. from Mean, (z)	Area of the left and right (two tail)
0.25	0.8026
0.30	0.7642
0.55	0.5823
0.60	0.5485

Question 25

AB Ltd.'s equity shares are presently selling at a price of ₹500 each. An investor is interested in purchasing AB Ltd.'s shares. The investor expects that there is a 70% chance that the price will go up to ₹650 or a 30% chance that it will go down to ₹450, three months from now. There is a call option on the shares of the firm that can be exercised only at the end of three months at an exercise price of ₹550.

Calculate the following:

- If the investor wants a perfect hedge, what combination of the share and option should he select?
- Explain how the investor will be able to maintain identical position regardless of the share price.
- If the risk-free rate of return is 5% for the three months period, what is the value of the option at the beginning of the period?
- What is the expected return on the option?

Nov 19 (8 Marks)

Answer:

To compute perfect hedge we shall compute Hedge Ratio (Δ) as follows:

$$\Delta = \frac{C_1 - C_2}{S_1 - S_2} = \frac{100 - 0}{650 - 450} = \frac{100}{200} = 0.50$$

The investor should purchase 0.50 share for every 1 call option

Or, the investor should purchase 1 share for every 2 Call Option.

Now the investor will be able to maintain his position if he purchases shares for 2 call option written

- If price of share goes upto ₹650 then value of purchased share will be:

Sale Proceeds of Investment (0.50 × ₹650) ₹325

Loss on account of short position (₹650 - ₹550) ₹100

Cash Flow ₹225

- If price of share comes down to ₹450 then value of purchased share will be:

Sale Proceeds of Investment (0.50 × ₹450) ₹225

- The value of option**, say, P at the beginning of the period shall be computed as follows:

$$(\text{₹}250 - P) 1.05 = \text{₹}225$$

$$\text{₹}262.50 - 1.05P = \text{₹}225$$

$$\text{₹}37.5 = 1.05P$$

$$P = \text{₹}35.71$$

Expected Return on the option

$$\text{Expected Option Value} = (\text{₹}650 - \text{₹}550) \times 0.70 + \text{₹}0 \times 0.30 = \text{₹}70$$

$$\text{Expected Rate of Return} = \frac{70 - 35.71}{35.71} \times 100 = 96.02\%$$

Question 26

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.

MTP Oct 21 (5 Marks), MTP Mar 17 (5 Marks), MTP Oct 17 (5 Marks), RTP May 18

Answer:

Qtrs.	Sensex	Sensex Return (%)	Amount Payable (₹ Crore)	Fixed Return (Receivable) (₹ Crore)	Net (₹ Crore)
(1)	(2)	(3)	(4)	(5)	(5) – (4)
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 27

ABC Ltd. is a pharmaceutical company possessing a patent of a drug called 'Aidrex', a medicine for aids patient. Being an approach drug ABC Ltd. holds the right of production of drugs and its marketing. The period of patent is 15 years after which any other pharmaceutical company produce the drug with same formula. It is estimated that company shall require to incur \$ 12.5 million for development and market of the drug. As per a survey conducted the expected present value of cashflows from the sale of drug during the period of 15 years shall be \$ 16.7 million. Cash flow from the previous similar type of drug have exhibited a variance of 26.8% of the present value of cashflows. The current yield on Treasury Bonds of similar duration (15 years) is 7.8%.

Determine the value of the patent.

Given

$$\ln(1.336) = 0.2897$$

$$e^{1.0005} = 0.3677$$

$$e^{-1.17} = 0.3104$$

StudyMat

Answer:

The given solution is like valuation of stock option wherein delay in introduction of drug 'Aidrex' shall cause the loss of cash flow 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. 0.27

R (Risk Free Rate of Return) = 7.8%

D (Expected cost of Delays) = $1/15 = 0.0667 = 6.67\%$

Value call option

$$C = SN(d_1) - Ke^{-rt}N(d_2)$$

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

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

Where,

C = Theoretical call premium

S = Current stock price

t = time until option expiration

K = option striking price

r = risk-free interest rate

N = Cumulative standard normal distribution

e = exponential term

σ = Standard deviation of continuously compounded annual return.

ln = natural logarithm

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

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

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

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

$$d_1 = 1.2315$$

$$d_2 = 1.2315 - 2.005$$

$$d_2 = -0.7735$$

$$N(d_1) = 0.8910$$

$$N(d_2) = 0.2196$$

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

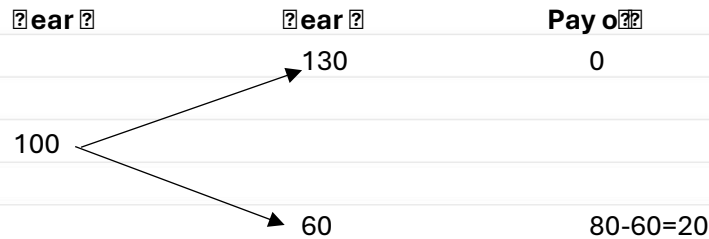
Question 28

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 the value of an abandonment option?

Answer:

Decision Tree showing pay off



First of all we shall calculate probability of high demand (P) using risk neutral method as follows:

$$\begin{aligned}
 8\% &= p \times 30\% + (1-p) \times (-40\%) \quad 0.08 \\
 &= 0.30p - 0.40 + 0.40p \\
 p &= 0.48 / 0.70 \\
 &= 0.686
 \end{aligned}$$

The value of abandonment option will be as follows:

Expected Payoff at

$$\begin{aligned}
 \text{Year 1} &= p \times 0 + [(1-p) \times 20] \\
 &= 0.686 \times 0 + [0.314 \times 20] \\
 &= ₹6.28 \text{ crore}
 \end{aligned}$$

Since expected pay off at year 1 is ₹6.28 crore.

Present value of expected pay off will be: $6.28/1.08 = ₹5.81$ crore.

This is the value of abandonment option (Put Option).

Question 29

Suppose MIS Ltd. is considering installation of solar electricity generating plant for light the staff quarters. The plant shall cost ₹2.50 crore and shall lead to saving in electricity expenses at the current tariff by ₹21 lakh per year forever. However, with change in Government in state, the rate of electricity is subject to change. Accordingly, the saving in electricity can be of ₹12 lakh or ₹35 lakh per year and forever. Assuming WACC of MIS Ltd. is 10% and risk-free rate of rate of return is 8%.

StudyMat

Answer:

Decide whether MIS Ltd. should accept the project or wait and see.

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 lakhs / 0.10 = ₹2.1 crore

$$\text{NPV} = ₹2.1 \text{ crore} - ₹2.5 \text{ crore} = - ₹0.4 \text{ crore}$$

Since NPV is negative, it does not worth to accept the project.

(2) After one Year After one year these are two possible situations, either rate of electricity decreases or increase.

a. If price of electricity increases

At cost of Capital of 10%, the value of saving forever = 35 lakh / 0.10 = ₹3.50 crore

The position of the NPV will be as follows: = ₹3.50 crore - ₹2.50 crore = ₹1 crore

And Rate of Return will be $(3.5/2.5) - 1 = 0.40$ is 40%

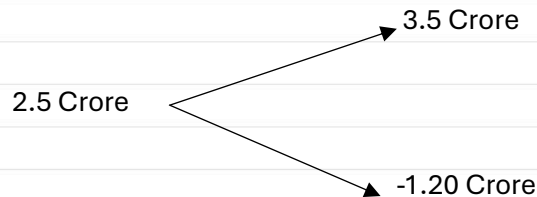
b. If the price of electricity decreases, then value of saving forever will be lakh

At cost of Capital of 10%, the value of saving forever = 12 / 0.10 = ₹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 lakh / 1.08 = ₹18.48 lakh.

Thus, it shall be advisable to wait and see as NPV may turn out to be positive after one year.

CHAPTER 10

INTERST RATE RISK MANAGEMENT

Question 1

M/s. Parker & Co. is contemplating to borrow an amount of ₹60 cores for a period of 3 months in the coming 6 months' time from now. The current rate of interest is 9% p.a., but it may go up in 6 months' time. The company wants to hedge itself against the likely increase in interest rate.

The Company's Bankers quoted an FRA (Forward Rate Agreement) at 9.30% p.a.

What will be the effect of FRA and actual rate of interest cost to the company, if the actual rate of interest after 6 months happens to be (i) 9.60% p.a. and (ii) 8.80% p.a.?

May 13 (8 Marks), RTP Nov 18, MTP Oct 22 (8 Marks), MTP March 18 (8 Marks), StudyMat

Answer:

Final settlement amount shall be computed using formula:

$$= \frac{(N)(RR-FR) \left(\frac{dtm}{DY} \right)}{\left[1 + RR \left(\frac{dtm}{DY} \right) \right]}$$

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%

$$= \frac{(\text{₹}60\text{crore})(0.096-0.093)\left(\frac{3}{12}\right)}{\left[1 + 0.096\left(\frac{3}{12}\right)\right]}$$

$$= \frac{(\text{₹}60\text{crore})(0.00075)}{1.024}$$

$$= \text{₹}4,39,453$$

Thus, banker will pay Parker & Co. a sum of ₹4,39,453

If actual rate of interest after 6 months happens to be 8.80%

$$= \frac{(\text{₹}60\text{crore})(0.088-0.093)\left(\frac{3}{12}\right)}{\left[1 + 0.088\left(\frac{3}{12}\right)\right]}$$

$$= \frac{(\text{₹}60\text{crore})(0.00125)}{1.022}$$

$$= - \text{₹}7,33,855$$

Thus Parker & Co. will pay banker a sum of ₹7,33,855

Note: It might be possible that students may solve the question on basis of days instead of months (as considered in above calculations). Further there may be also possibility that the FRA days and Day Count convention may be taken in various plausible combinations such as 90 days/360 days, 90 days/ 365 days, 91 days/360 days or 91 days/365days.

Actual Rate	9.60%	8.80%
Interest payable		
₹60 crore × 0.096 × 3/12	(₹1,44,00,000)	
₹60 crore × 0.088 × 3/12		(₹1,32,00,000)
Compensation Receivable: ₹60 crore × (0.096 – 0.093) × 3/12	₹4,50,000	
Compensation Payable: ₹60 crore × (0.088 – 0.093) × 3/12		(₹7,50,000)
Interest Cost to Company (In ₹)	₹1,39,50,000	₹1,39,50,000
Annual Interest Cost to Company (in %) (₹1,39,50,000/ ₹60crore) × 12/3	9.30%	9.30%

Question 2

TM Fincorp has bought a 6 × 9 ₹100 crore Forward Rate Agreement (FRA) at 5.25%. On fixing date reference rate i.e. MIBOR turns out to be as follows:

Period	Rate (%)
3 months	5.50
6 months	5.70
9 months	5.85

You are required to calculate:

- Profit/Loss to TM Fincorp. in term of basis points
- The settlement amount.

(Assume 360 days in a year)

MTP March 19 (8 Marks), RTP Nov 12, MTP Feb 16 (5 Marks), StudyMat

Answer:

❓ TM will make a profit of **25 basis points** since a 6 × 9 FRA is a contract on 3-month interest rate in 6 months, which turns out to be 5.50% (higher than FRA price).

❓ The settlement amount shall be calculated by using the formula:

$$\frac{N(RR-FR)(dtm/360)}{1 + RR(dtm/360)}$$

Where,

- N = Notional Principal Amount
 RR = Reference Rate
 FR = Agreed upon Forward Rate
 Dtm = FRA period specified in days.

Accordingly:

$$= \frac{100 \text{ crore}(5.50\%-5.25\%)(92^*/360)}{1 + 0.055(92^*/360)} = ₹6,30,032$$

Hence there is profit of ₹6,30,032 to TM Fincorp.

*Alternatively, it can also be taken as 90 days.

Question 3

Consider the following data for Government securities:

Face Value	Coupon Rate (%)	Maturity (years)	Current Price	Yield to Maturity (%)
10,000	12.40	1	8,897	12.546
10,000	12.75	2	9,937	13.128
10,000	13.50	3	10,035	13.351
10,000	13.50	4	9,971	13.599

Calculate the forward rates for Year 1, Year 2, Year 3 & Year 4.

StudyMat

Answer:

Year 1

To get forward interest rates, begin with the one-year Zero Coupon Bond:

$$8,897 = 10,000 / (1 + r_1)$$

Where,

r_1 is the one-year spot rate i.e. the discount rate applicable to a risk less cash flow receivable a year hence.

Solving for r_1 , we get **$r_1 = 0.124$ or 12.40%**

Year 2

Next, consider the two-year government security and split its benefits into two parts, the interest of ₹1,275 receivable at the end of year 1 and ₹11,275 (representing the interest and principal repayment) receivable at the end of year 2. The present value of the first part is:

$$\frac{11,275}{(1+r_1)(1+f_2)} = \frac{11,275}{1.124(1+f_2)}$$

To get the present value of the second year's cash flow of ₹11,275, discount it twice at r_1 (the discount rate for year 1) and f_2 (the discount rate for year 2) (please use f notation for the forward rate so as to make a distinction between the spot rate and forward rate)

$$\frac{1,275}{(1+r_1)(1+f_2)} = \frac{1,275}{1.124(1+f_2)}$$

f_2 is called the 'forward rate' for after one for next one year i.e., the current expected estimate of the next year's one-year spot interest rate. Since r_1 , the market price of the bond, and the cash flow associated with the bond are known the following equation can be set up:

$$9,937 = \frac{1,275}{(1.124)} + \frac{11,275}{(1.124)(1+r_2)}$$

$$9,937(1.124)(1+r_2) = 1,275(1+r_2) + 11,275$$

$$11,169 + 11,169 r_2 = 1,275 + 1,275 r_2 + 11,275$$

$$11,169 r_2 - 1,275 r_2 = 11,275 - 11,169 + 1,275$$

$$9,894 r_2 = 1,381$$

$$r_2 = \frac{1,381}{9,894} = 0.1396 \text{ or } 13.96\%$$

Thus solving this equation we get **$r_2 = 0.1396$ say 14%**

Year 3

To get the forward rate for year 3 (r_3), set up the equation for the value of the three-year bond:

$$10,035 = \frac{1,350}{(1+r_1)} + \frac{1,350}{(1+r_1)(1+r_2)} + \frac{11,350}{(1+r_1)(1+r_2)(1+r_3)}$$

$$10,035 = \frac{1,350}{(1.124)} + \frac{1,350}{(1.124)(1.140)} + \frac{11,350}{(1.124)(1.140)(1+r_3)}$$

$$10,035 = \frac{1,350}{(1.124)} + \frac{1,350}{1.28136} + \frac{11,350}{1.28136(1+r_3)}$$

$$7780 = \frac{11,350}{1.28136(1+r_3)}$$

$$1 + r_3 = 1.13853$$

$$r_3 = 0.13853$$

Solving this equation we get $r_3 = 0.13853$ or **13.85%**. This is the forward rate for year three.

Year 4

Continuing in a similar fashion, set up the equation for the value of the four -year bond:

$$9,971 = \frac{1,350}{(1+r_1)} + \frac{1,350}{(1+r_1)(1+r_2)} + \frac{1,350}{(1+r_1)(1+r_2)(1+r_3)} + \frac{11,350}{(1+r_1)(1+r_2)(1+r_3)(1+r_4)}$$

Solving this equation we get $r_4 = 0.1462$ or **14.62%** (approx.).

Question 4

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.

May 10 (8 Marks), RTP Nov 23, RTP Nov 17, RTP May 18, MTP Feb 15 (6 Marks), MTP March 19 (8 Marks)

Answer:

- (i) **3 Months Interest rate is 4.50% 3 Months Interest rate is 4.50% 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.

$$(1 + 0.05 \times 6/12) = (1 + 0.045 \times 3/12) \times (1 + i_{3,6} \times 3/12)$$

$$i_{3,6} = [(1 + 0.05 \times 6/12) / (1 + 0.045 \times 3/12) - 1] \times 12/3$$

$$i_{3,6} = 7.80\% \text{ p.a.}$$

- (ii) **6 Months Interest rate is 6.50% 6 Months interest rate is 6.50% 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.

$$(1 + 0.065) = (1 + 0.05 \times 6/12) \times (1 + i_{6,6} \times 6/12)$$

$$i_{6,6} = [(1 + 0.065 / 1.025) - 1] \times 12/6$$

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

$$\# (1 + 0.05/2) (1 + .0675/2) = 1.0125 \text{ say } 1.0125$$

Question 5

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.

- (i) 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.
- (ii) 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 in 2 years turns out to be
 - (a) 4.50%
 - (b) 5.50%

MTP Oct 21 (5 Marks), RTP Nov 20, RTP May 19, RTP Nov 14

Answer:

DEF Bank will quote interest rate for 2V3 FRA after 2 years as follows

XYZ Ltd.

$$(1 + r) (1 + 0.0420)^2 = (1 + 0.0448)^3$$

$$(1 + r) (1.0420)^2 = (1.0448)^3$$

$$r = 5.04\%$$

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.

Interest Rate Guarantee

		4.50% Allow to Lapse	5.50% Exercise
Interest	₹100 crores × 4.50%	₹4.50 crores	-
	₹100 crores × 5.04%	-	₹5.04 crores
Premium (Cost of Option)	₹100 crores × 0.1%	₹0.10 crores	₹0.10 crores
		₹4.60 crores	₹5.14 crores

Question 6

Espaces plc is consumer electronics wholesaler. The business of the firm is highly seasonal in nature. In 6 months of a year, firm has a huge cash deposits and especially near Christmas time and other 6 months firm cash crunch, leading to borrowing of money to cover up its exposures for running the business.

It is expected that firm shall borrow a sum of £25 million for the entire period of slack season in about 3 months.

The banker of the firm has given the following quotations for Forward Rate Agreement (FRA):

Spot	5.50% - 5.75%
3 × 6 FRA	5.59% - 5.82%
3 × 9 FRA	5.64% - 5.94%

3-month £50,000 future contract maturing in a period of 3 months is quoted at 94.15. You are required to:

- Advise the position to be taken in Future Market by the firm to hedge its interest rate risk and demonstrate how 3 months Future contract shall be useful for the firm, if later interest rate turns out to be (i) 4.5% and (ii) 6.5%
- Evaluate whether the interest cost to Espace plc shall be less had it adopted the route of FRA instead of Future Contract.

Note: - Ignore the time value of money in settlement amount for future contract.

RTP May 21

Answer:

(a)

- Since firm is a borrower it would 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.

$$\begin{aligned}
 \text{No. of Contracts} &= \frac{\text{Amount of Borrowing}}{\text{Contract Size}} \times \frac{\text{Duration of Loan}}{3 \text{ months}} \\
 &= \frac{£ 25,000,000}{£ 50,000} \times \frac{6}{3} = 1000 \text{ Contracts}
 \end{aligned}$$

(ii) 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	$£50,000 \times 1000 \times 1.35\% \times \frac{3}{12} = £1,68,750$	$£50,000 \times 1000 \times 0.65\% \times \frac{3}{12} = (£81,250)$
Interest for 6 months on £50 million at actual rates	$£25 \text{ million} \times 4.5\% \times \frac{1}{2} = £5,62,500$	$£25 \text{ million} \times 6.5\% \times \frac{1}{2} = £8,12,500$
	₹7,31,250	₹7,31,250

$$\text{Thus, the firm locked itself in interest rate} = \frac{£7,31,250}{£25,000,000} \times 100 \times \frac{12}{6} = 5.85\%$$

(b) No, the interest cost shall not be less for Espace plc had it taken the route of FRA, as the 3 × 9 FRA contract are available at 5.64% - 5.94% i.e. borrowing rate of 5.94%. Hence, the interest cost under this option shall be nearby by 5.94% which is more than interest rate under Future contract rate of 5.85%.

Question 7

A trader expects a long-term interest rate to rise. He decides to sell interest rate futures contracts as he shall benefit from falling future prices.

- Trade Date: 05 Oct 2017
- Futures Delivery Date: 1st Dec 2019
- Current Futures Price: ₹93.50
- Futures yield – 7.36%
- Lot Size: 2000

Trader sell 250 contracts of the December 17, 10-year futures contract on NSE on 5th Oct 2017 at ₹93.50. Show daily mark to market transaction due to change in the futures price as below

Date	Settlement Price
05 Oct	93.6925
06 Oct	93.4625
07 Oct	93.4575
08 Oct	93.1275
09 Oct	93.1125

Answer:

Statement of Margin

Date	Price	Calculation	MTM (₹)
5 th Oct, 2017	93.6925	$[93.5000 - 93.6925] \times 2000 \times 250$	-96250
6 th Oct, 2017	93.4625	$[93.6925 - 93.4625] \times 2000 \times 250$	+115000
7 th Oct, 2017	93.4575	$[93.4625 - 93.4575] \times 2000 \times 250$	+2500
8 th Oct, 2017	93.1275	$[93.4575 - 93.1275] \times 2000 \times 250$	+165000
9 th Oct, 2017	93.1125	$[93.1275 - 93.1125] \times 2000 \times 250$	+7500
Net Gain		$[93.50 - 93.1125] \times 2000 \times 250$	+193750

Question 8

You have a housing loan with one of India's top housing finance companies. The amount outstanding is ₹1,89,540. You have now paid an installment. Your next installment falls due a year later. There are five more installments to go, each being ₹50,000. Another housing finance company has offered to take over this loan on a seven-year repayment basis. You will be required to pay ₹36,408 p.a. with the first installment falling a year later. The processing fee is 3% of amount taken over. For swapping you will have to pay ₹12,000 to the first company. Should you swap the loan?

[Given (PVAF 10%, 5) = 3.791 and (PVAF 8%, 7) = 5.206]

RTP May 16

Answer:**Present Interest Rate**

For a loan of ₹1,89,540 annuity being ₹50,000, PVAF = 3.791 (₹1,89,540 / ₹50,000).

From PVAF table for 5 years, this corresponds to 10%.

New Interest Rate

For a similar loan, annuity being ₹36,408, PVAF = 5.206 (₹1,89,540 / ₹36,408).

From PVAF table for 7 years, this corresponds to 8%.

Interest Rate is prima facie beneficial.

Additional Charges

Swap Charges	₹12,000
Processing fee 3% on loan amount ($3/100 \times ₹1,89,540$)	₹5,686

Let us compute the IRR as follows:

$$₹1,89,540 - ₹12,000 - ₹5,686 = \frac{36,408}{(1+IRR)^1} \dots\dots\dots \frac{36,408}{(1+IRR)^7}$$

$$\text{IRR} = 10.947\%$$

Since interest rate on existing loan is 10% while proposed loan is 10.947% hence proposed loan is more expensive and it is advisable not to swap.

Question 9

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. MTP April 21 (8 Marks)

Answer:

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 × Conversion Factor – Quoted Spot Price of Deliverable Bond

Accordingly, the profit of each bond shall be computed as follows:

Security (1)	Future Settlement Price (2)	Conversion Factor (3)	(4) = (2) × (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 10

A manufacturer of electronic components has taken floating interest rate loan of ₹2 Crore on 1st April, 2023. The rate of interest at the inception of loan is 9% per annum. Interest is to be paid every year on 31st March.

In the month of October 2023, the Central Bank of the country releases the following projections about the interest rates likely to prevail in future.

- (i) On 31st March, 2024 — 9.25%
- On 31st March, 2025 — 9.50%
- On 31st March, 2026 — 10.00%
- On 31st March, 2027 — 9.00%
- On 31st March, 2028 — 8.25%

You are required to 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 9% per annum.

- (ii) Assume that the premium negotiated by both the parties is 0.80% to be paid at once on 1st October, 2023 and the actual rate of interest on the respective due dates happens to be as:

On 31st March, 2024 — 9.50%

On 31st March, 2025 — 11.00%

On 31st March, 2026 — 9.25%

On 31st March, 2027 — 9.00%

On 31st March, 2028 — 8.50%

You are required to show how the settlement will be executed on the perspective interest due dates.

- (iii) State whether this option is advantageous when compared to Interest Rate Collar option. Explain. May 24 (10 Marks)

Answer:

- (i) As borrower does not want to pay more than 9.00% p.a., on this loan where the rate of interest is likely to rise beyond this, hence, he has to hedge the risk by entering into an agreement to buy interest rate caps with the following parameters:

- **Notional Principal:** ₹2,00,00,000
- **Strike Rate:** 9% per annum
- **Reference Rate:** Rate of interest declared by Central Bank. or the rate of interest applicable to this loan.
- **Calculation and Settlement Date:** 31st March every year
- **Duration of the Caps:** Till 31st March 2028
- **Premium for Caps:** Negotiated between both 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 9.00%. 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 9.00% calculated on ₹2,00,00,000. This implies that in none of the cases the cost of this loan will rise above 9.00%. This hedging benefit is received at the respective interest due dates at the cost of premium to be paid only once.

- (ii) 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:

Date	Interest Rate	Option	Payment of Interest ₹	Settlement / Compensation Amount ₹	Net Interest ₹
31.03.2024	9.50%	Exercise	19,00,000	1,00,000	18,00,000
31.03.2025	11.00%	Exercise	22,00,000	4,00,000	18,00,000
31.03.2026	9.25%	Exercise	18,50,000	50,000	18,00,000
31.03.2027	9.00%	Lapse*	18,00,000	-----	18,00,000
31.03.2028	8.50%	Lapse*	17,00,000	-----	17,00,000

* Since actual rate of interest ≤ Strike Rate.

Conclusion From the discussion above it can be said that the overall interest cost for the borrower shall not exceed 9%.

- (iii) Comparing to Interest Rate Collar, Cap Option appears to be better because even though Collar may not involve initial outflow of cash on account of Premium but selling Put Option at 9% can lead to cash outflow if interest rate goes below 9%.

Question 11

MPD Ltd. issues a ₹50 Million Floating Rate Loan on July 1, 2018 with resetting of coupon rate every 6 Months equal to LIBOR + 50 bps.

MPD is interested in an Interest rate Collar Strategy of selling a Floor and buying a cap.

MPD buys the 3 years cap and sell 3 years Floor as per the following details on July 1, 2018:

Principal Amount	₹50 Million
Strike Rate	5% for Floor & 8% for Cap
Reference Rate	6 months LIBOR
Premium	NIL, since premium paid for cap = premium received for Floor

The Reset dates & Interest rates p.a., on that dates are:

Reset Date	31/12/2018	30/06/2019	31/12/2019	30/06/2020	31/12/2020	30/06/2021
LIBOR (%)	7.00	8.00	6.00	4.75	4.25	5.25

Using the above data, you are required to determine:

- Effective Interest paid out at each six reset dates, (Round off to the nearest rupee)
- Average overall effective rate of interest p.a. (round off to 2 decimals)

May 22 (8 Marks), RTP May 14, RTP May 19, MTP Oct 18 (8 Marks)

Answer:

- (i) The pay-off of each leg shall be computed as follows:

Cap Receipt

Max {0, [Notional principal × (LIBOR on Reset date – Cap Strike Rate) × (No. of days in settlement period/ 365)]}

Floor Pay-off

Max {0, [Notional principal × (Floor Strike Rate – LIBOR on Reset date) × (No. of days in settlement period/ 365)]}

Statement showing effective interest on each payment date

Reset Date	LIBOR (%)	Date of Payment	Days	Interest Payment (₹) LIBOR+0.50%	Cap Receipts (₹)	Floor Pay-off (₹)	Effective Interest
31-12-2018	7.00	30-06-2019	181	18,59,589	0	0	18,59,589
30-06-2019	8.00	31-12-2019	184	21,42,466	0	0	21,42,466
31-12-2019	6.00	30-06-2020	182	16,16,120	0	0	16,16,120
30-06-2020	4.75	31-12-2020	184	13,19,672	0	62,842	13,82,514
31-12-2020	4.25	30-06-2021	181	11,77,740	0	1,85,959	13,63,699
30-06-2021	5.25	31-12-2021	184	14,49,315	0	0	14,49,315
Total			1096	98,13,703	0	1,85,959	99,99,662

- (ii) Average Annual Effective Interest Rate shall be computed as follows:

$$\frac{98,13,703}{5,00,00,000} \times \frac{365}{1096} \times 100 = 6.54\%$$

Question 12

Suppose a dealer bank quotes for a generic swap "AIC 8%/8.20% vs. 6M LIBOR Flat". Notional principal amount of swap is ₹1 Million, and the same is for a period of three years, reset after every six months.

In this context, the following questions:

- (1) Interpret the dealer bank quote.
- (2) If a firm is buying a swap, what is the nature of cash flows?
- (3) If a firm is selling a swap, what is the nature of cash flows?
- (4) Calculate semi-annual fixed payment for the buyer of swap at the end of every six months
- (5) If the six month period from the effective date of swap to the settlement date comprises of 181 days and that the corresponding LIBOR was 5% on the effective date of swap, then what will be the first floating rate payment for the buyer?
- (6) If the settlement is on "Net Basis", how much the buyer of swap has to pay or receive at the end of first six months?

[Assume 30/360 days basis]

Nov 23 (8 Marks)

Answer:**(1) Interpretation of dealer bank quote:**

- AIC in the dealer bank quote refers to 'All in cost' i.e. cost of swap all inclusive.
- First part of the quote i.e. '8%/8.20%' refers to the fixed leg part and the second part of the quote i.e. '6m LIBOR Flat' refers to the floating leg part.
- The difference in the fixed rates i.e. 20 bps refers to the margin charged by the
- Bank on the fixed leg of transactions.
- The term 'flat' on the floating leg quote, indicates that the Bank does not charge any commission on the floating leg. Therefore, bank charges 20 bps for transacting swap as a whole.

- (2) **A buyer of swap pays** 'Fixed' cash flows and receives 'Floating'. As per the quote, the buyer would pay 8.2% (higher of 8%, 8.2%) to the Bank and would receive '6M LIBOR' against it.
- (3) **A seller of swap pays** 'floating' cash flows and receives 'fixed'. As per the quote, the seller would pay '6M LIBOR' to the bank and would receive 8% (lower of 8%, 8.2%) against it.

(4) Semi-annual Payment every six-month for buyer of Swap:

$$₹10,00,000 \times 8.20\% \times \frac{1}{2} = ₹41,000$$

(5) Floating Rate Payment

$$\begin{aligned}
 &= N(\text{LIBOR}) \left(\frac{dt}{360} \right) \\
 &= 10,00,000 \times 0.05 \times \frac{181}{360} \\
 &= 10,00,000 \times 0.05 (0.503) \text{ or } 5,00,000 \times 0.05 (0.502777) \\
 &= 10,00,000 \times 0.02515 \text{ or } 10,00,000 \times 0.02514 = ₹25,150 \text{ or } ₹25,140
 \end{aligned}$$

(6) Net Settlement

$$\begin{aligned}
 &₹41,000 - ₹25,150 = ₹15,850 \text{ or } ₹41,000 - ₹25,140 = ₹15,860 \\
 &\text{Or } ₹41,000 - ₹25,138.89 = ₹15,861.11
 \end{aligned}$$

Question 13

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%, and 8.15%. If Derivative Bank received ₹317 net on settlement, calculate fixed rate and interest under both legs. Notes:

- (a) Sunday is Holiday.
- (b) Work in rounded rupees and avoid decimal working

RTP Nov 21, Nov 10 (8 Marks), RTP May 12, RTP May 14, RTP Nov 17, MTP Sep 22 (8 Marks), MTP April 14 (8 Marks), MTP Aug 17 (8 Marks), MTP Oct 20 (8 Marks), Nov 17 (8 Marks), StudyMat

Answer:

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	22,358
Total Interest @ Floating			1,53,740
Less: Net Received			317
Expected Interest @ fixed			1,53,423
Thus Fixed Rate of Interest			0.07999914
Approx.			8%

(*) i.e. interest for two days.

Note: Alternatively, can also be calculated on the basis of 360 days in a year.

Question 14

IF an Indian firm has its subsidiary in Singapore and SF a Singapore firm has its subsidiary in India and face the following interest rates:

Company	IF	SF
INR Floating Rate	BPLR+0.5%	BPLR+ 1.5%
SGD (fixed rate)	3%	3.50%

SF wishes to borrow Rupee loan at a floating rate and IF wishes to borrow SGD at a fixed rate. The amount of loan required by both the companies is same at the current exchange rate. A Bank arranges a swap and requires 50 basis points as its commission, which is to be shared equally. IF requires a minimum gain of 20 basis points and SF requires a minimum gain of 10 basis points for structuring the deal. The Bank is very keen to structure the deal, even if, it has to forego a part of its commission.

You are required to find out:

- (i) Whether there are any advantages available to IF and SF?
- (ii) Whether a swap can be arranged which may be beneficial to both the firms?
- (iii) What rate of interest will they end up paying? Show detailed working. May 23 (8 Marks)

Answer:

Though firm IF has an advantage in both the markets but it has comparative more advantage in the INR floating-rate market. Firm SF has a comparative advantage in the SGD fixed interest rate market. However, firm IF wants to borrow in the SGD fixed interest rate market and firm SF wants to borrow in the INR floating-rate market. This gives rise to the swap opportunity.

IF raises INR floating rate at BPLR + 0.50% and SF raises SGD at 3.50%

Total Potential Gain = (INR interest differential) - (SGD rate differential)

$$= (\text{BPLR} + 1.50\% - \text{BPLR} - 0.50\%) + (3\% - 3.50\%) = 0.50\%$$

$$\text{Less: Banker's commission (To be shared equally)} = *0.20\%$$

$$\text{Net gain (To be shared as: 0.20\% for IF and 0.10\% for SF)} = 0.30\%$$

*Since, bank's commission is 0.50% which constitutes the entire gain, and it is mentioned that bank will forego a part of its commission to structure the deal. Thus, it will forego the minimum gain required by IF and SF i.e. 0.20% and 0.10% respectively.

- (i) Yes, a beneficial swap can be arranged
- (ii) Effective cost of borrowing = pays to lenders + pays to other party - receives from other party + banker's commission

$$\text{IF} = \text{BPLR} + 0.50\% + 2.70\%^{**} - (\text{BPLR} + 0.50\%) + 0.10\% = 2.80\%$$

(** has been arrived as $3\% - 0.20\% - 0.10\%$)

$$\text{SF} = 3.50\% + \text{BPLR} + 0.50\% - 2.70\% + 0.10\% = \text{BPLR} + 1.40\%$$

Question 15

A Ltd. is considering ₹50 crores 3-year interest rate swap. The company is interested in borrowing at floating rate however, due to its good credit rating, it has a comparative over lower rated companies in fixed rate market. It can borrow at fixed rate of 6.25% or floating rate MIBOR + 0.75%. Presently, MIBOR is 5.25% but is expected to change in 6 months due to political situation in the country. X Ltd. an intermediary bank agreed to arrange a swap. The bank will offset the swap risk with a counter party (B. Ltd.) a comparative lower credit rated company, which could borrow at a fixed rate of 7.25% and floating rate of MIBOR + 1.25%. X Ltd. would charge ₹12,00,000 per year as its fee from each party. Mr. Fin the CFO, of A Ltd. desires that A Ltd. should receive 60% of any arbitrage saving (before payment of fees) from the swap as A Ltd. enjoying high credit rating.

Any fees paid to the bank are tax allowable. The applicable tax rate is 30%.

You are required to:

- (a) Evaluate whether the proposal is beneficial for both parties or not.
- (b) Assuming that MIBOR was to increase to 5.75% immediately after political crisis over and shall remain constant for the period of swap. Evaluate the present value of savings from the swap for A Ltd., assuming that interest payment is made semi- annually in arrears.

RTP Nov 11

Answer:

(a) Swap Position

	Fixed Rate	Floating Rate
A Ltd.	6.25%	MIBOR +0.75%
B Ltd.	7.25%	MIBOR +1.25%
Difference	1.00%	0.50%

Thus, there is potential saving of 0.50% from the swap proposal.

	₹
Saving on the amount of loan (₹50 Crores × 0.50%)	25,00,000
Evaluation from A Ltd.'s Point of view	
Share of A Ltd. in benefit (60% of ₹25,00,000)	15,00,000
Post Tax benefit (70% of ₹15,00,000) (A)	10,50,000
Chares payable to X Ltd. (Bank)	12,00,000
Post tax charges (70% of ₹12,00,000) (B)	8,40,000
Net Benefit (A) - (B)	2,10,000
Evaluation from B. Ltd.'s Point of view	
Share of B Ltd. in benefit (40% of ₹25,00,000)	10,00,000
Post Tax benefit (70% of ₹10,00,000) (A)	7,00,000
Charges payable to X Ltd. (Bank)	12,00,000
Post tax charges payable (B)	8,40,000
Net Benefit (A)-(B)	(1,40,000)

Thus, the proposal of swap will leave B Ltd. in a loss of ₹1,40,000.

Hence, the proposal is not beneficial for all parties at all.

- (b) A Ltd. will pay floating rate as a result of swap. If A Ltd. receives 60% of the arbitrage saving, it will save 0.3% (0.60) of its rates comparing to borrowing in floating rate market and shall effectively pay MIBOR + 0.45% or 5.70% at current rates. If MIBOR moves to 5.75% in 6 months' time A Ltd. will then pay 6.20% floating interest rate for the remaining swap period.

Interest Saving (6 months) ₹50 crore × 0.30% × 0.5 = ₹7,50,000

Assuming that market is efficient, the relevant discount rate will be prevailing interest paid by A Ltd.

The present value of saving from swap will be as follows:

	Period	Savings	PVF	Present Value (₹)
1	6 months	7,50,000	0.972(@5.7%)	7,29,000
2	6 months	7,50,000	0.941(@6.2%)	7,05,750
3	6 months	7,50,000	0.912(@6.2%)	6,84,000
4	6 months	7,50,000	0.885 (@6.2%)	6,63,750

5	6 months	7,50,000	0.858 (@ 6.2%)	6,43,500
6	6 months	7,50,000	0.833 (@ 6.2%)	6,24,750
				40,50,750

The interest rate swap is estimated to produce interest rate saving with present value of ₹40,50,750 relative to borrowing floating rate directly. Thus, swap would be beneficial for A Ltd. even after a payment of ₹12,00,000 as charges per year.

Question 16

Euroloan Bank has a differential advantage in issuing variable-rate loans but wishes to avoid the income risk associated with such loan. Currently bank has a portfolio €25,000,000 loans with PLR + 150bp, reset monthly PLR is currently 4%. IB an investment bank has arranged for Euroloan to swap into a fixed interest payment of 6.5% on notional amount of loan for its variable interest income. If Euroloan agrees to this, what amount of interest is received and given in the first month? Further, assume that PLR increased by 200 bp. RTP Nov 11

Answer:

$$\text{Euro loan earns} = €25,000,000 \times \frac{0.055}{12} = €114,583.33$$

$$\text{This amount will be swapped in exchange of } €25,000,000 \times \frac{0.065}{12} = €135,416.67$$

$$\text{If PLR jumps by 200 bp, Euro loan earns } €25,000,000 \times \frac{0.075}{12} = €156,250$$

This amount will be returned to IB and will get €135,416.67

Thus, with increase in PLR, bank shall loose.

CHAPTER 11 FOREIGN EXCHANGE EXPOSURE & RISK MANGEMENT

Question 1

Place the following strategies by different persons in the Exposure Management Strategies Matrix.

Strategy 1: Kuljeet a wholesaler of imported items imports toys from China to sell them in the domestic market to retailers. Being a sole trader, he is always so much involved in the promotion of his trade in domestic market and negotiation with foreign supplier that he never pays attention to hedge his payable in foreign currency and leaves his position unhedged.

Strategy 2: Moni, is in the business of exporting and importing brass wares to USA and European countries. In order to capture the market he invoices the customers in their home currency. Lavi enters into forward contracts to sell the foreign exchange only if he expects some profit out of it otherwise, he leaves his position open.

Strategy 3: TSC Ltd. is in the business of software development. The company has both receivables

and payables in foreign currency. The Treasury Manager of TSC Ltd. not only enters into forward contracts to hedge the exposure but carries out cancellation and extension of forward contracts on regular basis to earn profit out of the same. As a result management has started looking Treasury Department as Profit Centre.

Strategy 4: DNB Publishers Ltd. in addition to publishing books are also in the business of importing and exporting of books. As a matter of policy the movement company invoices the customer or receives invoice from the supplier immediately covers its position in the Forward or Future markets and hence never leave the exposure open even for a single day. RTP Nov 18

Answer:

Strategy 1: This strategy is covered by **High Risk: Low Reward** category and worst as it leaves all exposures unhedged. Although this strategy does not involve any time and effort, it carries high risk.

Strategy 2: This strategy covers **Low Risk: Reasonable reward** category as the exposure is covered wherever there is anticipated profit otherwise it is left.

Strategy 3: This strategy is covered by **High Risk: High Reward** category as to earn profit, cancellations and extensions are carried out. Although this strategy leads to high gains, but it is also accompanied by high risk.

Strategy 4: This strategy is covered by **Low Risk: Low Reward** category as company plays a very safe game.

Diagrammatically all these strategies can be depicted as follows:



Question 2

Given:

US\$ 1 = ¥ 107.31

£ 1 = US\$ 1.26

A\$ 1 = US\$ 0.70

- Calculate the cross rate for Pound in Yen terms
- Calculate the cross rate for Australian Dollar in Yen terms
- Calculate the cross rate for Pounds in Australian Dollar terms

RTP Nov 20

Answer:

(a) The cross rate for Pounds in Yen terms

1£ = ? ¥

US\$1 = ¥ 107.31

£1 = US\$ 1.26

$$\frac{¥}{\$} \times \frac{\$}{£} = \frac{¥}{£}$$

$$\frac{¥}{£} = 107.31 \times 1.26$$

$$£1 = ¥ 135.21$$

(b) The cross rate for Australian Dollar in Yen terms

$$A\$1 = ¥?$$

$$US\$1 = ¥ 107.31$$

$$A\$ 1 = US\$ 0.70$$

$$\frac{¥}{\$} \times \frac{\$}{A\$} = \frac{¥}{A\$}$$

$$\frac{¥}{A\$} = 107.31 \times 0.70$$

$$A\$ 1 = ¥ 75.12$$

(c) The cross rate for Pounds in Australian Dollar terms

$$£1 = A\$?$$

$$A\$ 1 = US\$ 0.70$$

$$US\$ 1 = A\$ 1.4286$$

$$£1 = US\$1.26$$

$$\frac{A\$}{\$} \times \frac{\$}{£} = \frac{A\$}{£}$$

$$\frac{A\$}{£} = 1.4286 \times 1.26 = 1.80$$

$$£1 = A\$ 1.80$$

Question 3

With relaxation of norms in India for investment in international market upto \$2,50,000, Mr. X to hedge himself against the risk of declining Indian economy and weakening of Indian Rupee during last few years, decided to diversify in the International Market.

Accordingly, Mr. X invested a sum of ₹1.58 crore on 1.1.20x1 in Standard & Poor Index. On 1.1.20x2 Mr. X sold his investment. The other relevant data is given below:

	1.1.20x1	1.1.20x2
Index of Stock Market in India	7395	?
Standard & Poor Index	2028	1919
Exchange Rate (₹/\$)	62.00/62.25	67.25/67.50

You are required to Calculate:

- The return for a US investor.
- Holding Period Return to Mr. X.
- The value of Index of Stock Market in India as on 1.1.20x2 at which Mr. X would be indifferent between investment in Standard & Poor Index and India Stock Market.

MTP March 16 (10 Marks), MTP April 19 (7 Marks)

Answer:

ii) Return of an Investor

$$= \frac{\text{Ending Price} - \text{Initial Price}}{\text{Initial Price}} \times 100$$

$$= \frac{1919 - 2028}{2028} \times 100$$

$$= -5.37\%$$

iii) Return of Mr. X

Initial Investment (₹)	1.58 Crore
Applicable Exchange Rate on 1.1.20 × 1	₹62.25
Equivalent US\$	2,53,684.21
Purchase Price of Standard & Poor Index	2028
No. of Standard & Poor Indices Purchased	125
Ending Price of Standard & Poor Index	1919
Proceeds realized in US\$ on sale of Standard & Poor Index	2,40,875
Applicable Exchange Rate on 1.1.20 × 2	₹67.25
Proceeds realized in INR on sale of Standard & Poor Index	₹1,61,52,242

$$\text{Rate of Return} = \left(\frac{16152242 - 15800000}{15800000} \times 100 \right)$$

2.32%

iii) Rate of Return and the amount been invested in India

Initial Investment (₹)	1.58 Crore
Purchase Price of Indian Index	7395
No. of Indian Indices Purchased	2136.58
Let Ending Price of Indian Index	X
Then to be indifferent with return in International Market	$\frac{2136.58 \times X - 1.58}{1.58} \times 100 = 2.23$

Price of Indian Index to be indifferent

₹74.3200 say ₹74.32

Question 4

You, a foreign exchange dealer of your bank, are informed that your bank has sold a T.T. in Copenhagen for Danish Kroner 10,00,000 at the rate of Danish Kroner 1 = ₹6.5150. You are required to cover the transaction either in London or New York market. The rates on that date are as under:

Mumbai-London	₹74.3000	₹74.3200
Mumbai-New York	₹49.2500	₹49.2625
London-Copenhagen	DKK 11.4200	DKK 11.4350
New York-Copenhagen	DKK 07.5670	DKK 07.5840

In which market will you cover the transaction, London or New York, and what will be the exchange profit or loss on the transaction? Ignore brokerages.

Nov 13 (5 Marks), RTP May 20, MTP March 15 (5 Marks), MTP May 20 (6 Marks), StudyMat

Answer:

Amount realized on selling Danish Kroner 10,00,000 at ₹6.5150 per Kroner = ₹65,15,000.

Coer 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

Coer at New York

Bank buys Kroners at New York at the market selling rate.

Dollars required for the purchase of Danish Kroner

(DKK10,00,000 ÷ 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 5

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?

June 09 (6 Marks), MTP Oct 19 (8 Marks)

Answer:

The amount of EURO bought by selling US\$

US\$10,00,000 x EURO1.4400 = Euro14,40,000

The amount of EURO sold for buying USD 10,00,000 x 1.4450 = Euro 14,45,000

Net Loss in the Transaction	₹ Euro 2,222

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 = ₹21.8403

Loss in the Transaction ₹21.8403 × 5,000 = ₹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 ₹5,000

To acquire EURO 5,000 from market @

US \$ 1 = EURO 1.4400

US \$ 1 = INR 31.45

Cross Currency = $\frac{31.45}{1.440} = ₹21.8403$

Loss in Transaction ₹21.8403 × 5,000 = ₹1,09,201.50

Question 6

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.

May 16 (8 Marks), MTP April 18 (5 Marks), MTP Aug 18 (5 Marks), StudyMat

Answer:

$$\text{Forward Rate} = \frac{2.50 (1+0.075)}{(1+0.060)} = \text{Can\$}2.535/\text{£}$$

(i) Spot rate decline by 2%

$$\text{Spot Rate} = \text{Can\$} 2.50 \times 1.02 = \text{Can\$}2.55/\text{£}$$

	£
£ 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
Loss due to Forward contract	1,161

(ii) Spot rate gains 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 7

On April 3 2016, a Bank quotes the following:

Spot exchange Rate (US \$1)

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.

RTP Nov 22, MTP March 19 (8 Marks), Nov 16 (5 Marks), StudyMat

Answer:

ii) 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

iii) 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 20th 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	$\frac{0.0115}{66.2583} \times \frac{12}{2.5} \times 100$	$\frac{0.0138}{67.6014} \times \frac{12}{2.5} \times 100$
	6.94%	6.94%

Question 8

If the present interest rate for 6 months borrowings in India is 9% per annum and the corresponding rate in USA is 2% per annum, and the US\$ is selling in India at ₹64.50/\$. Then:

- Will US \$ be at a premium or at a discount in the Indian forward market?
- Find out the expected 6 month forward rate for US\$ in India.
- Find out the rate of forward premium/discount.

MTP April 19 (6 Marks), Nov 17 (5 Marks), StudyMat

Answer:

- Under the given circumstances, the USD is expected to quote at a **premium** in India as the interest rate is higher in India.

ii Calculation of the forward rate

$$\frac{1+R_h}{1+R_f} = \frac{F_1}{E_0}$$

Where: R_h is home currency interest rate, R_f is foreign currency interest rate, F_1 is end of the period forward rate, and E_0 is the spot rate. Therefore

$$\begin{aligned} \frac{1+(0.09/2)}{1+(0.02/2)} &= \frac{F_1}{64.50} \\ \frac{1+0.045}{1+0.01} &= \frac{F_1}{64.50} \\ \frac{1.045}{1.01} \times 64.50 &= F_1 \\ \frac{67.4025}{1.01} &= F_1 \end{aligned}$$

$$F_1 = ₹66.74$$

iii Rate of premium

$$\frac{66.74-64.50}{64.50} \times \frac{12}{6} \times 100 = 6.94\%$$

Question 9

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? Jan 21 (5 Marks), RTP May 22

Answer:**(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 T ₀	3,256
No. of units of Sensex that can be purchased at T ₀ (₹8,50,00,000/3,256)	26,105
Sensex at T ₁	3,765
Sale of Sensex (26,105 × 3,765)	98,29,225
US\$ at T ₁	₹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

$$\text{Real Exchange Rate (Buying)} = 43.85 \frac{(1+0.05)}{(1+0.09)} = 42.24$$

$$\text{Real Appreciation of ₹} = \frac{42.50 - 42.24}{42.50} \times 100 = 0.61\%$$

(iii) Exchange rate if relevant purchasing power parity holds

$$\text{Buying Rate} = 42.50 \frac{(1+0.09)}{(1+0.05)} = 44.12$$

$$\text{Selling rate} = 42.60 \frac{(1+0.09)}{1+0.05} = 44.22$$

$$\text{Exchange rate} = 44.12/44.22$$

(iv) Real return to Indian Investor in Sensex

$$\text{Nominal Return} = \frac{(3765-3256)}{3256} \times 100 = 15.63\%$$

$$\text{Real return} = \frac{(1.1563)}{(1.09)} - 1 = 0.0608 \text{ or } 6.08\%$$

Question 10

Mr. Mammen, an Indian investor invests in a listed bond in USA. If the price of the bond at the beginning of the year is USD 100 and it is USD 103 at the end of the year. The coupon rate is 3% payable annually.

Find the return on investment in terms of home country currency if:

- (i) USD is Flat.
- (ii) USD appreciated 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 differs if Mr. Mammen invests in the bond just before the interest payable.

July 21 (6 Marks), RTP May 22, MTP Oct 22 (6 Marks)

Answer:**(i) If USD is flat**

$$\begin{aligned}\text{Return} &= \frac{(\text{Price at end} - \text{Price at beginning}) + \text{Interest}}{\text{Price at beginning}} \\ &= \frac{(103 - 100) + 3}{100} \\ &= \frac{3 + 3}{100} = 0.06 \text{ say } 6\%\end{aligned}$$

(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%

$$(1 + 0.06)(1 - 0.05) - 1 = 1.06 \times 0.95 - 1 = 0.007 \text{ i.e. } 0.7\%.$$

??? No, our will not differ even if Mr. Mammen invests in bond just before the interest is payable

Question 11

The following table shows interest rates for the United States Dollar and French Franc. The spot exchange rate is 7.05 Franc per Dollar. Complete the missing entries:

	3 Months	6 Months	1 Year
Dollar interest rate (annually compounded)	11½%	12¼%	?
Franc interest rate (annually compounded)	19½%	?	20%
Forward Franc per Dollar	?	?	7.5200
Forward discount per Franc percent per year	?	6.3%	?

RTP Nov 23

Answer:

Computation of Missing Entries in the Table: For computing the missing entries in the table we will use Interest Rates Parity (IRP) theorem. This theorem states that the exchange rate of two countries will be affected by their interest rate differential.

In other words, the currency of one country with a lower interest rate should be at a forward premium in terms of currency of country with higher interest rates and vice versa.

This implies that the exchange rate (forward and spot) differential will be equal to the interest rate differential between the two countries i.e.

Interest rate differential = Exchange rate differential

$$\text{or, } \frac{1+r_f}{1+r_d} = \frac{S_{f/d}}{F_{f/d}}$$

Where r_f is the rate of interest of country F (say the foreign country), r_d is rate of interest of country D (say domestic country), $S_{f/d}$ is the spot rate between the two countries F and D and $F_{f/d}$ is the forward rate between the two countries F and D.

2 months

Dollar interest rate = $11\frac{1}{2}\%$ (annual compounded)

Franc interest rate = $19\frac{1}{2}\%$ (annual compounded)

Then Forward Franc per Dollar rate would be

$$= 7.05 \left(\frac{1 + \frac{0.195}{4}}{1 + \frac{0.115}{4}} \right) = 7.05 \left(\frac{1 + 0.04875}{1 + 0.02875} \right) = \text{Franc } 7.19 \text{ per US Dollar}$$

Further Forward discount per Franc per cent per year

= Interest Differential i.e.

$$= 19\frac{1}{2}\% - 11\frac{1}{2}\%$$

$$= 8\%$$

Alternatively, more precisely it can also be computed as follows:

Spot Per Franc Rate = $1 / 7.05 = \text{US Dollar } 0.142 \text{ per Franc}$

One Year Forward Rate = $0.142 \left(\frac{1 + 0.115}{1 + 0.195} \right) = \text{US Dollar } 0.132 \text{ per Franc}$

Accordingly, the discount per annum will be = $\frac{0.142 - 0.132}{0.142} \times 100 = 7.04\%$

2 months

Forward discount on Franc % per year = -6.3% or - 3.15% for 6 months

Hence 6 months Forward rate = $7.05 / (100\% - 3.15\%)$

Forward Francs per Dollar = **7.28 Francs**

Let r be the Franc interest rate (annually compounded) then as per IRP Theory:

$$= 7.05 \left(\frac{1 + \frac{r}{2}}{1 + \frac{0.1225}{2}} \right)$$

= Franc 7.28 per Dollar

On solving the equation we get the value of $r = 19.17\%$ i.e. Franc interest rate (annually compounded)

2 year

Franc interest rate = 20% (annually compounded)

Forward Franc per Dollar = 7.5200

As per Interest Rate Parity the relationship between the two countries rate and spot rate is

$$\text{i.e., } 1 + \frac{\text{Dollar interest rate}}{1 + 0.20} = \frac{7.05}{7.52}$$

Accordingly, the Dollar interest rate

$$= 1.20 \times 0.9374 - 1$$

$$= 1.125 - 1$$

$$= 0.125 \text{ or } 12.5\%$$

Discount on Franc

$$= S/F - 1 \times 100$$

$$= (7.05/7.52) - 1 \times 100$$

$$= -6.25\% \text{ p.a.}$$

The completed Table will be as follows:

	3 Months	6 Months	1 Year
Dollar interest rate (annually compounded)	11½%	12¼%	12.50%
Franc interest rate (annually compounded)	19½%	19.17%	20%
Forward Franc per Dollar	7.19	7.28	7.52
Forward discount per Franc percent per year	7.04% or 8%	6.3%	6.25%

Question 12

A German subsidiary of an US based MNC has to mobilize 100000 Euro's working capital for the next 12 months. It has the following options:

Loan from German Bank : @ 5% p.a.

Loan from US Parent Bank : @ 4% p.a.

Loan from Swiss Bank : @ 3% p.a.

Banks in Germany charge an additional 0.25% p.a. towards loan servicing. Loans from outside Germany attract withholding tax of 8% on interest payments. If the interest rates given above are market determined, examine which loan is the most attractive using interest rate differential.

Nov 19 (5 Marks)

Answer:

Net Cost under each of the Options is as follows:

(i) **Loan from German Bank**

$$\text{Cost} = 5\% + 0.25\% = 5.25\%$$

(ii) Loan from US Parent Bank

Effective Rate of Interest $\left(\frac{4\%}{1-0.08}\right)$	4.35%
Premium on US\$ $\left(\frac{1.05}{1.04}-1\right)$	0.96%
Net Cost	5.31%

(iii) Loan from Swiss Bank

Effective Rate of Interest $\left(\frac{3\%}{1-0.08}\right)$	3.26%
Premium on US\$ $\left(\frac{1.05}{1.03}-1\right)$	1.94%
Net Cost	5.20%

Thus, loan from Swiss Bank is the best option as the Total Outflow including Interest is Less i.e.

€105200

Question 13

Following 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 USD 1,00,00,000. Assuming that there are no transaction costs, explain whether there is any arbitrage gain possible from the quoted spot exchange rates.

RTP Nov14, RTP May 20, MTP Aug 16 (5 Marks), StudyMat

Answer:

The arbitrageur can proceed as stated below to realize arbitrage gains.

Buy ₹ from USD 10,000,000 at Mumbai $48.30 \times 10,000,000$	₹483,000,000
Convert these ₹ to GBP at London (₹483,000,000/₹77.52)	GBP 6,230,650.155
Convert GBP to USD at New York (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 14

Merry is a Forex Dealer with XYZ Bank. She notices following information relating to Canadian Dollar (CAD) and German Deutschmark (DEM):

Exchange rate	- CAD 0.775 per DEM (spot)
	CAD 0.780 per DEM (3 months)
Interest rates	- DEM 7% p.a.
	CAD 9% p.a.

- (i) Assuming that there is no transaction cost, determine does the Interest Rate Parity hold in above quotations.
- (ii) If yes, then explain the steps that would be required to make an arbitrage profit if Merry is authorized to work with CAD 1 Million for the same purpose. Also determine the profit that would be made in CAD.

Note: Ignore the decimal points in the amounts.

MTP Oct 19 (8 Marks)

Answer:

- For 3 months, $r_{CAD} = 2.25\%$ and $r_{DEM} = 1.75\%$. Since the exchange rate is in CAD/DEM term the appropriate equation for Interest Rate Parity is as follows:

$$\frac{F}{S} = \frac{(1+r_{CAD})}{(1+r_{DEM})} = \frac{0.780}{0.775} = \frac{(1+0.0225)}{(1+0.0175)} = 1.00645 \neq 1.00491$$

Since both sides are not equal, Interest Rate Parity does not hold.

- Since IRP does not hold there is an arbitrage opportunity.

Interest Differential = $2.25\% - 1.75\% = 0.5\%$

$$\text{Premium} = \frac{0.780 - 0.775}{0.775} \times 100 = 0.645\%$$

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 CAD 1 Million at 9 per cent for 3- months;
- ii) Change this sum into DEM at the spot rate = $(1,000,000/0.775) = 1,290,323$
- iii) Place DEM 1,290,323 in the money market for 3 months to obtain a sum of DEM

Principal:	1,290,323
Add: Interest @ 7% for 3 months =	22,581
Total	1,312,904

- iv) Sell DEM at 3-months forward to obtain CAD = $(1,312,904 \times 0.780) = \text{CAD } 1,024,065$

- v) Refund the debt taken in CAD with the interest due on it, i.e.,

	CAD
Principal	1,000,000
Add: Interest @9% for 3 months	22,500
Total	1,022,500

- vi) Net arbitrage gain = $\text{CAD } 1,024,065 - \text{CAD } 1,022,500 = \text{CAD } 1,565$

Question 15

The risk-free rate of interest rate in USA is 8% p.a. and in UK is 5% p.a. The spot exchange rate between US \$ and UK £ is $1\$ = \text{£}0.75$.

Assuming that interest is compounded on daily basis then at which forward rate of 2 year there will be no opportunity for arbitrage.

Further, show how an investor could make risk-less profit, if two year forward price is
 $1\$ = 0.85 \text{ £}$.

Given $e^{-0.06} = 0.9413$ & $e^{-0.16} = 0.852$, $e^{0.16} = 1.1735$, $e^{-0.1} = 0.9051$

RTP May 12

Answer:

2 year Forward Rate will be calculated as follows:

$$F = S e^{(r_{UK} - r_{US})t}$$

Where F = Forward Rate
 S = Spot Rate
 r_{UK} = Risk Free Rate in UK
 r_{US} = Risk Free Rate in US
 t = Time

Accordingly,

$$F = 0.75 e^{(0.05 - 0.08)2} = 0.75 \times 0.9413 = 0.706$$

Thus,

0.706 - 0.706 = 0

If forward rate is $1 \text{ US \$} = 0.85 \text{ £}$ then an arbitrage opportunity exists. Take following steps.

- Should borrow UK £
- Buy US \$
- Enter into a short forward contract on US \$

Accordingly,

The riskless profit would be

- Say borrow $\text{£}0.706 e^{-(0.05)(2)} = \text{£}0.639$ and invest in US for 2 years.
- Now buy US \$ at $\text{US \$ } 1 e^{-(0.08)2} = \text{US \$ } 0.852$, so that after two year it can be used to close out the position.
- After two year the investment in US \$ will become $\text{US \$ } 0.852 e^{(0.08)(2)} = \text{US \$ } 0.852 \times 1.1735 = 1 \text{ US \$}$
- Sell this US \$ for $\text{£}0.85$ and repay loan of $\text{£}0.639$ along with interest i.e. $\text{£}0.706$. Thus, arbitrage profit will be

0.85 - 0.706 = 0.144

Question 16

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-Month's interest rate: ₹:12%, \$:6%

6-Month's interest rate: ₹:11.50%, \$:5.5%

Also determine what should be the rate of interest after 3-months to make the company indifferent between 3-months borrowing and 6-months borrowing in the case of:

- (i) Rupee borrowing
- (ii) Dollar borrowing

Note: For the purpose of calculation you can take the units of dollar and rupee as 100 each.

Nov 2018 (8 Marks), MTP May 20 (8 Marks), MTP March 21 (8 Marks)

Answer:

- (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	102.75
Applicable 6-month forward rate	36.40
Amount of Cash outflow in Indian Rupees	₹3,727.50

- (ii) 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
Amount of Cash outflow in Indian Rupees	₹3,817.58

Since cash outflow is more in ₹ borrowing then borrowing should be made in \$.

- (iii) Indifferent Interest Rate

- (a) Let 'I_r' be the interest rate of ₹ borrowing make indifferent between 3 months borrowings and 6 months borrowing then

$$(1 + 0.03)(1 + I_r) = (1 + 0.0575)$$

$$I_r = 2.67\% \text{ or } 10.68\% \text{ (on annualized basis)}$$

- (b) Let 'I_d' be the interest rate of \$ borrowing after 3 months to make indifference between 3 months borrowings and 6 months borrowings. Then,

$$(1 + 0.015)(1 + I_d) = (1 + 0.0275)$$

$$I_d = 1.232\% \text{ or } 4.93\% \text{ (on annualized basis)}$$

Question 17

M/s Omega Electronics Ltd. exports air conditioners to Germany by importing all the components from Singapore. The company is exporting 2,400 units at a price of Euro 500 per unit. The cost of imported components is S\$ 800 per unit. The fixed cost and other variables cost per unit are ₹1,000 and ₹1,500 respectively. The cash flows in foreign currencies are due in six months. The current exchange rates are as follows:

₹/Euro	51.50/55
₹/S\$	27.20/25

After six months the exchange rates turn out as follows:

₹/Euro	52.00/05
₹/\$	27.70/75

- (1) You are required to calculate loss/gain due to transaction exposure.
- (2) Based on the following additional information calculate the loss/gain due to transaction and operating exposure if the contracted price of air conditioners is ₹25,000:
- (i) the current exchange rate changes to

₹/Euro	51.75/80
₹/\$	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.

Nov 09 (12 Marks), MTP March 19 (8 Marks), StudyMat

Answer:

Profit at current exchange rates

$$2400 [€ 500 \times ₹51.50 - (\$ 800 \times ₹27.25 + ₹1,000 + ₹1,500)]$$

$$2400 [₹25,750 - ₹24,300] = ₹34,80,000$$

Profit after change in exchange rates

$$2400 [€500 \times ₹52 - (\$ 800 \times ₹27.75 + ₹1000 + ₹1500)]$$

$$2400 [₹26,000 - ₹24,700] = ₹31,20,000$$

Loss due to Transaction Exposure

$$₹34,80,000 - ₹31,20,000 = ₹3,60,000$$

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

$$₹18,72,000 - ₹7,20,000 = ₹11,52,000$$

$$\text{Current price of each unit in €} = \frac{₹25,000}{₹51.50} = €485.44$$

$$\text{Price after change in Exch. Rate} = \frac{₹25,000}{₹51.75} = €483.09$$

Change in Price due to change in Exch. Rate

$$€485.44 - €483.09 = €2.35 \text{ or } (-) 0.48\%$$

Price elasticity of demand

?

Increase in demand due to fall in price $0.48 \times 1.5 = 0.72\%$ Size of increased order = $2400 \times 1.0072 = 2417$ unitsProfit = $2417 [₹25,000 - (800 \times ₹27.75 + ₹1,000 + ₹1,500)]$ = $2417 [₹25,000 - ₹24,700] = ₹7,25,100$ **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 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 18**

a. The following 2-way quotes appear in the foreign exchange market:

	Spot	2-months spread
₹/US \$	74.00/74.25	1.00/1.25

(i) You are required to calculate:

- 2 months forward rates.
- How many US dollars should the firm sell to get ₹10 lakhs in the spot market and after 2 months?
- How many Rupees is the firm required to pay to obtain US \$80,000 in the spot market and after 2 months?

(ii) Assume the firm has US \$27,600 in current account earning no interest. ROI on Rupee investment is 10% p.a. should the firm encash the US \$ now or after 2 months?

Nov 22 (8 Marks), MTP Oct 18 (8 Marks), RTP May19, StudyMat

Answer:

(i)

(a) Two Month Forward Rates:

Buying Rate ₹74.00 + ₹1.00 = ₹75.00

Selling Rate ₹74.25 + ₹1.25 = ₹75.50

(b)

(1) To get ₹10 lakh at Spot Market the firm should sell= $₹10,00,000 / ₹74.00 = \text{US } \$13,513.51$

(2) To get ₹10 lakh after 2 month the firm should sell

$$= ₹10,00,000 / ₹75.00 = \text{US } \$13,333.33$$

(c)

(1) Rupees required to obtain US \$ 80,000 in Spot Market:

$$\text{US } \$80,000 \times ₹74.25 = ₹59,40,000$$

(2) Rupees required to obtain US \$ 80,000 after 2 months:

$$\text{US } \$80,000 \times ₹75.50 = ₹60,40,000$$

(ii) If US\$ are converted in ₹ now and get invested in India, then fund position after 2 months will be as follows:

US \$27,600 × ₹74.00	₹20,42,400
ROI @ 10% p.a. for 2 month	₹34,040
Amount after 2 months	₹20,76,440

If US\$ are converted after 2 month, then fund position will be:

$$\$27,600 \times ₹75.00 = ₹20,70,000$$

Thus, it is better to get converted US\$ into ₹ now and get them invested in India.

Alternatively, this sub part can also been as follows:

$$\text{Computation of Annual Premium on US } \$ = (1.00/74.00) \times (12/2) \times 100 = 8.108\% \text{ or } 8.11\%$$

Since, the premium on US \$ in lesser than ROI on Indian ₹, it is better to convert

US \$ in Indian ₹ now and get them invested in India.

Question 19

KGF Bank's Sydney branch has surplus funds of USD \$7,00,000 for a period of 2 months. Cost of funds to the bank is 6% p.a. They propose to invest these funds in Sydney, New York or Tokyo and obtain the best yield, without any exchange risk to the bank. The Following rates of interest are available at the three center's for investment of domestic funds there for a period of 2 Months.

Sydney	7.5% p.a.
New York	8% p.a.
Tokyo	4% p.a.

The market rates in Australia for US Dollars and Yen are as under:

Sydney on New York

Spot	₹122.22/₹122.22
1 Months	10/20
2 Months	25/30

Sydney on Tokyo

Spot	₹122.22/₹122.22
1 Months	40/30
2 Months	55/50

At which centre, will the investment be made & what will be the net gain to the bank on the invested funds?

May 19 (8 Marks)

Answer:

i) Investment is made at Sydney

Convert US\$ 7,00,000 at Spot Rate (7,00,000/0.7300)	= A\$9,58,904
Add: A\$ Interest for 2 months on A\$ 9,58,904 @ 7.5%	= A\$11,986
	= A\$9,70,890
Less: Amount Invested	\$7,00,000
Interest accrued thereon	\$7,000
	\$7,07,000
Equivalent amount of £ required to pay the above sum (\$ 7,07,000/0.7125*)	= A\$9,92,281
Arbitrage Loss	= A\$21,391
Or Equivalent Amount in US\$(21391 × 0.7125)	= \$15,241

ii) Investment is made at New York

Gain \$ 7,00,000 (8% - 6%) × 2/12	= \$ 2,333.33
Or Equivalent amount in £3 months (\$ 2,333/ 0.7330)	= A\$ 3,183

iii) Investment is made at Tokyo

Convert US\$ 700,000 at Spot Rate (Cross Rate) 79.0900/0.7300	= ¥ 108.34
Yen equivalent US\$ 700,000	= ¥ 7,58,38,000
Add: Interest for 2 months @ 4%	= ¥ 5,05,587
	¥ 8,03,93,587
2 months Forward Rate of selling ¥ (1/79.1950)	= A\$ 0.0126
Sell ¥ in Forward Market ¥ 7,63,43,587 × A\$ 0.0126	= A\$ 9,61,929
Less: Amount invested and interest thereon	= A\$ 9,92,281
Arbitrage Loss	= A\$ 30,352
Or Equivalent Loss in \$(30352 × 0.7125)	= \$ 21,624

Out of three options the profit is in case of investment is made in New York. Hence it should be opted.

* Due to conservative outlook.

Question 20

Suppose you are a treasurer of XYZ plc in the UK. XYZ have two overseas subsidiaries, one is based in Amsterdam and another in Switzerland. The surplus position of funds in hand is as follows which it does not need for the next three months but will be needed at the end of that period (91 days).

Holding Company	£150,000
Swiss Subsidiary	CHF1,996,154
Dutch Subsidiary	€1,450,000

Exchange Rate as on date are as follows:

Spot Rate (€)	£0.6858 - 0.6869
91-day Pts	0.0037 0.0040
Spot Rate (£)	CHF2.3295 - 2.3326
91-day Pts	0.0242 0.0228

91-Day Interest rates on p.a. basis on the Deposits in Money Market are as follows:

Amount of Currency	£	€	CHF
0 – 200,000	1.00	0.25	Nil
200,001 – 1,000,000	2.00	1.50	0.25
1,000,001 – 2,000,000	4.00	2.00	0.50
Over 2,000,000	5.38	3.00	1.00

You have been approached by your banker wherein the above-mentioned surplus was lying, requesting you to swap the surplus lying with other two subsidiaries and place them in deposit with them. Determine the minimum interest rate per annum (up to 3 decimal points) that should be offered by the bank to your organization so that your organization is ready to undertake such swap arrangement. Note: Consider 360 days a year. RTP Nov 23, RTP Nov 20, MTP Feb 16 (8 Marks)

Answer:

XYZ plc shall be ready to undertake this swap arrangement only if it receives the interest on the surplus funds if invested on individual basis as follows:

	Interest	Amt. after 91 days	Conversion in £
✖ Holland € 1,450,000 × 0.02 × 91/360	€7,330.56	€1,457,330.56	£1,004,829.42 (1,457,330.56 × 0.6895)
✖ Switzerland CHF 1,996,154 × 0.005 × 91/360	CHF2,522.92	CHF1,998,676.92	£865,303.02 (1,998,676.92 ÷ 2.3098)
✖ ✖ £150,000 × 0.01 × 91/360	£379.17	£150,379.17	£150,379.17
Total GBP at 91 days			??,???,????

Swap to Sterling

Sell €1,450,000 (Spot at 0.6858) buy £	£994,410.00
Sell CHF1,996,154 (Spot at 2.3326) buy £	£855,763.53
Independent GBP amount	£150,000.00
	??,???,???
Amount accrued on Individual Basis (Principal + Interest)	£2,020,511.61
Interest Required	£20,338.08
Required Interest Rate on Per Annum Basis $\frac{20,338.08}{2,000,173.53} \times \frac{360}{91} \times 100$	??%

Thus, the minimum rate that should be offered is **4.023%**

Question 21

- (i) Interest rates for 3 months in USA and Canada are as follows:

Currency	Borrow	Interest
US \$	4%	2.5%
Canadian \$	4.5%	3.5 %

- (ii) Can \$/ US \$ spot 1.235 ---- 1.240
 3 months forward 1.255 ---- 1.260

Advise the currency in which borrowing and lending for 3 months needs to be done for the US company. Take 3 months = 90/360 days. Jan 21 (8 Marks)

Answer:

- (i) Suppose we have to borrow \$1,000. The outflow under the two options shall be as follows:

If borrowing is made in US \$

	\$
Principal amount	1,000
Interest $(\$1,000 \times \frac{90}{360} \times 4\%)$	10
Outflow	?,???

If borrowing is made in Can \$

	Can \$
Equivalent Can \$	1,240
Interest $(\text{Can } \$1,240 \times \frac{90}{360} \times 4.5\%)$	13.95
Outflow	1,253.95

$$\text{Conversion @ forward rates} = \frac{\text{Can } \$1,253.95}{1.255} = \$999.16$$

Since US\$ outflow is least in Can \$, the borrowings should be made in Can \$.

(ii) If money is lent in US \$

	\$
Amount lent	1,000
Interest ($\$1,000 \times \frac{90}{360} \times 2.5\%$)	6.25
	2,222.22

If money is lent in Can \$

	Can \$
Equivalent amount lent in Can \$	1,235
Interest ($\text{Can } \$1,235 \times \frac{90}{360} \times 3.5\%$)	10.81
	1,245.81

$$\text{Equivalent inflow in US \$} = \frac{\text{Can } \$1,245.81}{1.260} = \$988.74$$

Since inflow is least in Can \$, amount should be invested in US \$.

Thus, borrowing should be made in Canadian \$ and lending should be made in US\$.

Question 22

Hopeful Ltd., an Indian MNC is executing a plant in Nepal. It has raised ₹400 Billion. Half of the amount will be required after six months' time. Hopeful Ltd. is looking for an opportunity to invest this amount for a period of six months. It is considering following two options:

Market	UK	Europe
Nature of Investment	Index Fund (GBP)	Treasury Bills (Euro)
Dividend (GBP in Billions)	0.1369	-
Income from stock lending (GBP in Billions)	0.0007	-
Discount on the investment value at the end	2%	-
Interest	-	7.8 percent per annum
Exchange Rate (Spot)	GBP/ INR 0.0099	EUR/INR 0.011
Exchange Rate (6 month Forward)	GBPI INR 0.0100	EUR/INR 0.011

As an investment manager advise the best option to invest. May 23 (8 Marks), Nov 20 (8 Marks)

Answer:

(i) Investment in UK Market

(in billions)

Particulars	Currency INR	ER	Currency GBP
Available amount	200	0.0099	1.98
Dividend Income			0.1369
Stock Lending Income			0.0007
Investment value at the end after discount @ 2%			1.9404
			2.0780

Amount available at the end of 6- months		0.0100	₹207.80
Conversion after 6 months			₹7.80
Gain			

Investment in Europe**(in billions)**

Particulars	Currency INR	ER	EUR
Available amount	200	0.011	2.2000
Interest for 6 months @ 7.80% p.a.			0.0858
Amount available at the end			2.2858
Amount available at the end of 6-months			
Conversion after 6 months		0.011	₹207.80
Gain			₹7.80

The gain amount is same in both the options so Hopeful Ltd. is indifferent. However, Treasury Bills are risk free, so investment in Treasury Bills (Euro) is suggested.

Alternative Solution**If investment is made in Index Fund (GBP)**

Initial Investment (₹200 Billion × 0.0099)	GBP 1.9800 billions
Dividend Income	GBP 0.1369 billions
Income from Stock Lending	GBP 0.0007 billions
Discount	(GBP 0.0396 billions)
Value of Investment after 6 months	GBP 2.0780 billions
Value of Investment after 6 months in ₹ @ GBP/ INR	₹207.8000 billions

(ii) If investment is made in Treasury Bills (Europe)

Initial Investment (₹200 Billion × 0.011)	EUR 2.2000 billions
Interest for 6 months @ 7.8% p.a.	EUR 0.0858 billions
Value of Investment after 6 months	EUR 2.2858 billions
Value of Investment after 6 months in ₹ @ EUR/ INR 0.011	₹207.8000 billions

The equivalent amount is same in both the options so Hopeful Ltd. is indifferent. However, Treasury Bills are risk free, so investment in Treasury Bills (EUR) is suggested.

Question 23

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:

- Exchange rate quoted to the company
- Cash inflow to the company
- Interest amount to be paid to bank by the company.

Jan 21 (8 Marks)

Answer:

- 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

₹?? ? D	₹67.8000
Add: Premium for 2 months	₹0.2100
	₹?? ?? ?? ?
Less: Exchange margin @ 0.1%	₹0.0680
Bid rate for USD	₹?? ?? ?? ?
?? ? D?? ? R	USD 1.0775
Add: Premium	USD 0.0040
	?? ? D ?? ?? ?? ?
₹/EUR Rate (67.9420 × 1.0815)	₹73.4793
Amount of Export Bill	EUR 5,00,000
Less: EEFC	EUR 2,50,000
	EUR ? ,?? ,?? ?
Exported Rate	₹?? ?? ?? ?

- Cash Inflow = 2,50,000 × ₹73.4793 = ₹1,83,69,825
- Interest for 80 days = ₹1,83,69,825 × 8% × 80/365 = ₹3,22,101

Question 24

XYZ Ltd. has imported goods to the extent of US\$ 8 Million. The payment terms are as under:

- 1% discount if full amount is paid immediately or
- 60 days interest free credit. However, in case of a further delay up to 30 days, interest at the rate of 8% p.a. will be charged for additional days after 60 days. M/s XYZ Ltd. has ₹25 Lakh available and for remaining it has an offer from bank for a loan up to 90 days @ 9.0% p.a.

The quotes for foreign exchange are as follows:

Spot Rate INR/ US\$ (buying)	₹66.98
60 days Forward Rate INR/ US\$ (buying)	₹67.16
90 days Forward Rate INR/ US\$ (buying)	₹68.03

Advise which one of the following options would be better for XYZ Ltd.

- Pay immediately after utilizing cash available and for balance amount take 90 days loan from bank.
- Pay the supplier on 60th day and avail bank's loan (after utilizing cash) for 30 days.
- Avail supplier offer of 90 days credit and utilize cash available.

Further presume that the cash available with XYZ Ltd. will fetch a return of 4% p.a. in India till it is utilized. Assume year has 360 days. Ignore Taxation. Compute your working upto four decimals and cash flows in ₹ in Crore.

RTP Nov 21, MTP Oct 20 (10 Marks)

Answer:

To evaluate which option would be better we shall compute the outflow under each option as follows:

(i) Pay Immediately availing discount

Particulars		
Spot Rate		₹66.98
Amount required in US\$	[US\$ 8 Million (1 – 0.01)]	US\$ 7.92 Million
Amount required in ₹	[₹66.98 × US\$ 7.92 Million]	₹530.28 Crore
Cash Available		₹0.2500 Crore
Loan required		₹529.93 Crore
Interest for 90 days @ 9%		₹1.1880 Crore
Total Outflow		₹531.1180 Crore

(ii) Pay the supplier on 60th day and avail bank's loan (after utilizing cash) for 30 days.

Particulars		
Applicable Forward Rate		₹67.16
Amount required in ₹	[₹67.16 × US\$ 8 Million]	₹537.280 Crore
Loan required	[₹537.280 Crore – ₹ 0.25 Crore]	₹537.03 Crore
Interest for 30 days @ 9%		₹0.4011 Crore
		₹537.4311 Crore
Interest earned on Cash for 60 days @ 4%		₹0.0017 Crore
Total Outflow		₹537.4294 Crore

(iii) Avail supplier offer of 90 days credit and utilize cash available

Particulars		
Amount Payable		US\$ 8 Million
Interest for 30 days @ 8%		US\$ 0.0533 Million
Amount required in ₹		₹538.4664 Million
Applicable Forward Rate		₹68.03
Amount required in ₹	[₹68.03 × US\$ 8.0533 Million]	₹547.8222 Crore
Cash Available		₹0.2500 Crore
Interest earned on Cash for 90 days @ 4%		₹0.0025 Crore
Total Outflow		₹547.5722 Crore

Decision: Cash outflow is least in case of Option (ii) same should be opted for.

Question 25

A company is considering hedging its foreign exchange risk. It has made a purchase on 1st July, 2016 for which it has to make a payment of US\$ 60,000 on December 31, 2016. The present exchange rate is 1 US \$ = ₹65. It can purchase forward 1 \$ at ₹64. The company will have to make an upfront premium @ 2% of the forward amount purchased. The cost of funds to the company is 12% per annum.

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 \$.

Nov 16 (8 Marks), RTP Nov 12, MTP Oct 15 (8 Marks), StudyMat

Answer:

	(₹)
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%	4,608
Total Hedging cost	81,408
If exchange rate is ₹68	
Then gain (₹68 – ₹64) for US\$ 60,000	2,40,000
Less: Hedging cost	81,408
Net Gain	1,58,592
If US\$ = ₹62	
Then loss (₹64 – ₹62) for US\$ 60,000	1,20,000
Add: Hedging Cost	81,408
Total Loss	1,91,408
If US\$ = ₹70	
Then Gain (₹70 – ₹64) for US\$ 60,000	3,60,000
Less: Hedging Cost	81,408
Total Gain	2,78,592
If US\$ = ₹65	
Then Gain (₹65 – ₹64) for US\$ 60,000	60,000
Less: Hedging Cost	81,408
Net Loss	21,408

Question 26

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).

July 21 (8 Marks)

Answer:**(i) Proceeds of Exports in INR = ₹10 Million**

Position of Inflow under three currencies will be as follows:

Currency	Invoice at Spot Rate	Expected Rate after 3-months	Conversion in INR after 3-months
\$	₹100,00,000/ ₹67.10 ₹ 149031.297	₹67.10 (1 + 0.07/4) ₹ 68.27	₹68.27 × \$149031.297 ₹ 1,01,74,367
€	₹100,00,000/ ₹63.15 ₹ 1,58,353.127	₹63.15 (1 + 0.06/4) ₹ 64.10	₹64.10 × €1,58,353.127 ₹ 1,01,50,435
£	₹100,00,000/ ₹88.65 ₹ 1,12,803.158	₹88.65 (1 + 0.05/4) ₹ 89.76	₹89.76 × £1,12,803.158 ₹ 1,01,25,211

(ii) Payment of Import in INR = ₹5 Million

Position of outflow under three currencies will be as follows:

Currency	Invoice at Spot Rate	Expected Rate after 6-months	Conversion in INR after 6-months
\$	₹50,00,000/ ₹67.20 ₹ 74404.762	₹67.20 (1 + 0.07/2) ₹ 70.97	₹70.97 × \$74404.762 ₹ 51,74,851
€	₹50,00,000/ ₹63.20 ₹ 79,113.924	₹63.20 (1 + 0.06/2) ₹ 65.10	₹65.10 × €79,113.924 ₹ 51,50,316
£	₹50,00,000/ ₹88.75 ₹ 56,338.028	₹88.75 (1 + 0.05/2) ₹ 90.97	₹90.97 × £56,338.028 ₹ 51,25,070

Advice: Since cash inflow is highest (1,01,74,367) in case of \$ hence invoicing for Export should be in \$. However, cash outflow is least (51,25,070) in case of £ the invoicing for import should be in £.

Question 27

Telereal Trillium, a UK Company is in the process of negotiating an order amounting €5.5 million with a large German retailer on 6 month's credit. If successful, this will be first time for Telereal Trillium has exported goods into the highly competitive German Market. The Telereal Trillium is considering following 3 alternatives for managing the transaction risk before the order is finalized.

- (i) Mr. Grand, the Marketing head has suggested that in order to remove transaction risk completely Telereal Trillium should **invoice the German firm in Sterling** using the current €/£ average spot rate to calculate the invoice amount.
- (ii) Mr. John, CE is doubtful about Mr. Grand's proposal and suggested an alternative of invoicing the German firm in € and using a **forward exchange contract** to hedge the transaction risk.
- (iii) Ms. Royce, CFO is agreed with the proposal of Mr. John to invoice the German first in €, but she is of opinion that Telereal Trillium should use sufficient 6-month **sterling future contracts** (to the nearest whole number) to hedge the transaction risk.

Following data is available

Spot Rate	€ 1.1980 - €1.1990/£
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	£70,500
After 6-month Spot rate and future rate	€ 1.1873/£

You are required to

- (a) Advise the alternative you consider to be most appropriate.
- (b) Interpret the proposal of Mr. Grand from non-financial point of view.

Note: Calculate (to the nearest £) the £ receipt.

MTP August 17 (8 Marks), RTP Nov 11, RTP May 2020, RTP May 21, StudyMat

Answer:**(a) Receipt under three proposals****(i) Proposal of Mr. Grand**

$$\text{Invoicing in £ will produce} = \frac{\text{€5.5 million}}{1.1985} = \text{£45,89,070}$$

(ii) Proposal of Mr. John

$$\text{Forward Rate} = \text{€1.1990} - 0.0055 = 1.1935$$

$$\begin{aligned} \text{Using Forward Market hedge Sterling receipt would be} &= \frac{\text{€5.5 million}}{1.1935} \\ &= \text{£46,08,295} \end{aligned}$$

(iii) Proposal of Ms. Royce

The equivalent sterling of the order placed based on future price (€1.1943)

$$= \frac{\text{€5.5 million}}{1.1943} = \text{£46,05,208 (rounded off)}$$

$$\text{Number of Contracts} = \frac{\text{£46,05,208}}{70,500} = 65 \text{ Contracts (to the nearest whole number)}$$

Thus, € amount hedged by future contract will be = $65 \times \text{£70,500} = \text{£45,82,500}$

Buy Future at	€1.1943
Sell Future at	€1.1873
	€0.0070

Total loss on Future Contracts = $65 \times £70,500 \times €0.0070 = €32,078$

After 6 months

Amount Received	€55,00,000
Less: Loss on Future Contracts	€ 32,078
	€ 54,67,922

Sterling Receipts

$$\text{On sale of € at spot} = \frac{€54,67,922}{1.1873} = \text{£46,05,342}$$

Proposal of option (ii) is preferable because the option (i) & (iii) produces least receipts.

- (b) Further, in case of proposal (i) there must be a doubt as to whether this would be acceptable to German firm as it is described as a competitive market and Telereal Trillium is moving into it first time.

Question 28

Doom Ltd. is an export business house. The company prepares invoice in customers' currency. Its debtors of US\$ 48, 00,000 is due on April 1, 2020.

Market information as of January 1, 2020 is:

Exchange rates US\$/INR		Currency Futures US\$/INR	
Spot	0.014285	Contract size: ₹2,88,16,368	
1-month forward	0.014184	1-month	0.014178
3-months forward	0.013889	3-month	0.013881

	Initial Margin	Interest rates in India
1-Month	₹27,500	5.5%
3-Months	₹32,500	9%

On April 1, 2020 the spot rate US\$/INR is 0.013894 and currency future rate is 0.013893.

Recommend as to which of the following methods would be most advantageous to Doom Ltd.

- (i) Using forward contract
- (ii) Using currency futures
- (iii) Not hedging the currency risk

Note: Round off calculation upto zero decimal points.

RTP May 21, MTP April 22 (6 Marks), StudyMat

Answer:

Receipts using a forward contract	=	₹34,55,97,235
Receipts using currency futures		

The number of contracts needed is (\$ 48,00,000/0.013881)/28,816,368	=	12
Initial margin payable is 12 contracts × ₹32,500	=	₹3,90,000
On April 1, 2020 Close at 0.013893		
Receipts = US\$ 48,00,000/0.013894	=	₹34,54,72,866
Variation Margin		
$[(0.013893 - 0.013881) \times 12 \times 28,816,368] / 0.013894$		
OR $(0.000012 \times 12 \times 28,816,368) / 0.013894$ = 4149.5570/0.013894	=	₹2,98,658
Less: Interest Cost – ₹3,90,000 × 0.09 × 3/12		₹8,775
Net Receipts		₹32,22,22,222

Receipts under different methods of hedging		
Forward contract		₹32,22,22,222
Future Contract		₹32,22,22,222
No hedge		₹32,22,22,222

The most advantageous option would have been to hedge with futures as it is slightly higher than Forward Option but comparing to no hedge option it is better proposition.

Question 29

An American firm is under obligation to pay interests of Can\$1010000 and Can\$705000 on 31st July and 30th September respectively. The Firm is risk averse and its policy is to hedge the risks involved in all foreign currency transactions. The Finance Manager of the firm is thinking of hedging the risk considering two methods i.e. fixed forward or option contracts.

It is now June 30. Following quotations regarding rates of exchange, US\$ per Can\$, from the firm's bank were obtained:

Spot	1 Month Forward	3 Months Forward
0.9284-0.9288	0.9301	0.9356

Price for a Can\$ /US\$ 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?

MTP Sep 22 (8 Marks), MTP March 22 (10 Marks), MTP Nov 21 (10 Marks), Nov 13 (8 Marks)

Answer:

Forward Market Cover		
Hedge the risk by buying Can\$ in 1- and 3-months' time will be:		
July	=	$1010000 \times 0.9301 = \text{US \$ } 939401$
September	=	$705000 \times 0.9356 = \text{US \$ } 659598$
Option Contracts		
July	=	$1010000 / 50,000 = 20.20$
September	=	$705000 / 50,000 = 14.10$

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	9301	5000	4678
Option Costs:				
Can \$ $50000 \times 20 \times 0.0102$		10200	---	
Can \$ $50000 \times 14 \times 0.0164$	---			11480
Total cost under Option Contract		10200		11480

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 30

A Japanese company imports hi-tech printer cartridges from US worth \$1 million. The chief financial officer of the company wishes to know the best strategy for protection against uncertainty, for the payment that has to be made at the end of 3 months.

Financial team of the company has collected the following options for evaluation:

Table-1: Exchange rates quoted in FOREX Market:

Quotations	Mid Price	Buyer's Ask Price
Spot Rates	146.03	146.63
3M – Forward Rates	144.03	145.00
6M – Forward Rates	146.35	146.70

Table-2: Options Market rates for European options with 3 months expiry:

Type of Option	Strike Price (¥/\$)	Premium % for Call / Put Options
Call & Put	145.20	1.6766% (Call) & 1.7414% (Put)
Call & Put	146.00	1.3505% (Call) & 2.1006% (Put)

The expected spot price at expiry is ¥/\$: 144.90/145.05

Suggest the best strategy for CFO of the Japanese Company to protect against uncertainty, with respect to the following alternatives:

- Forward Hedge
- Buy 3 months call, $X = 145.20$
- Sell 3 months put, $X = 145.20$
- Buy call & sell put both having $X = 146.00$

Nov 23 (8Marks)

Answer:**(ii) Forward Hedge**

Amount payable after 3 months	\$1000000
3 month applicable buying rate	¥145/\$
Amt. payable in Yen	¥145 million

(iii) Buy 3 month call option $X = ¥145.20$

If expected spot price after 3 month is ¥ 145.05

Then company would not exercise its option. Accordingly the cost of import will be

Buying Yen in spot Market after 3 month	¥145.05 million
Add: Premium Paid $¥145.20 \times 1.6766\% \times \$1 \text{ million}$	¥2.43 million
	¥147.48 million

(iv) Selling 3 month Put at $X = ¥145.20$

If expected spot price after 3 month ¥144.90, then Put Option buyer will exercise his/her option.

Accordingly the import Bill will be:

Buying Yen in under option after 3 month	¥145.20 million
Less: Premium Receipt $¥145.20 \times 1.7414\% \times \$1 \text{ million}$	¥2.53 million
	¥142.67 million

(v) Buying Call and selling Put at $X = ¥146$

Net Premium receipt

Premium paid on call option = $¥146.00 \times 1.3505\%$	¥1.9717 million
Premium Receipt on Put option = $¥146.00 \times 2.1006\%$	¥3.0669 million
	¥1.0952 million

If expected spot Rate expiry happens to be ¥ 144.90/145.05, then call option will be lapsed and Put option by buyer will be exercised. Accordingly, the import bill will be:

Buying US\$ under Put Option	¥146.00 million
Less: Receipt of Net Premium	¥1.09520 million
	¥144.905 million

Decision: Since expected outflow is least in case of selling Put option, the same strategy is recommended.

Question 31

XYZ Ltd. a US firm will need £ 3,00,000 in 180 days. In this connection, the following Information is available:

Spot rate $1 \text{ £} = \$ 2.00$

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%

The company has following four choices:

- (i) A forward contract;
- (ii) A money market hedge;
- (iii) An option contract;
- (iv) No hedging.

Recommend the alternative (among the four choices mentioned above) that would be preferable by the company.

Nov 15 (8 Marks), MTP Feb 15 (10 Marks), MTP March 18 (8 Marks), MTP April 18

Answer:

i) Forward contract: Dollar needed in 180 days = £3,00,000 × \$ 1.96 = \$5,88,000/-

ii) 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

iii) Call option:

Expected Spot rate in 180 days	Prem./ unit	Exercise Option	Total price per unit	Total price for £3,00,000×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
			* (\$1.97+\$0.04)			5,94,900
Add: Interest on Premium @ 5.5% (12,000 × 5.5%)						660
						5,95,560

??? 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 32

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.

May 11 (8 Marks), RTP May 24, RTP Nov 13, RTP May 20, StudyMat

Answer:

Opportunity gain of A Inc under currency swap	Receipt	Payment	Net
Interest to be remitted to B. Inc in $\$2,00,000 \times 9\% = \$18,000$		₹21,60,000	
Converted into $(\$18,000 \times ₹120)$			
Interest to be received from B. Inc in \$ converted into ₹ $(6\% \times \$2,00,000 \times ₹120)$	₹14,40,000	-	
Interest payable on ₹ loan	-	₹12,00,000	
	₹14,40,000	₹33,60,000	
Net Payment	₹19,20,000	-	
	₹33,60,000	₹33,60,000	
\$ equivalent paid $₹19,20,000 \times (1/₹120)$			\$16,000
Interest payable without swap in \$			\$18,000
Opportunity gain in \$			\$ 2,000

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%	-	\$20,000	
	\$18,000	\$32,000	
Net Payment	\$14,000	-	
	\$32,000	\$32,000	
¥ equivalent paid \$14,000 × ¥120			¥16,80,000
Interest payable without swap in ¥ (\$2,00,000 × ¥120 × 8%)			¥19,20,000
Opportunity gain in ¥			¥2,40,000

Alternative Solution

Cash Flows of A Inc

At the time of receipt of principal amount

Transactions		Cash Flows
Borrowings	\$2,00,000 × ¥120	+ ¥240,00,000
Swap		- ¥240,00,000
Swap		+\$2,00,000
Net Amount		+\$2,00,000

At the time of receipt of interest amount

Transactions		Cash Flows
Interest to the lender	¥240,00,000 × 5%	¥12,00,000
Interest Receipt from B Inc.	¥2,00,000 × 120 × 6%	¥14,40,000
Net Saving (in \$)	¥2,40,000/¥120	\$2,000
Interest to B Inc.	\$2,00,000 × 9%	-\$18,000
Net Interest Cost		-\$16,000

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

At the time of receipt of principal amount

Transactions		Cash Flows
Borrowings		+ \$2,00,000
Swap		- \$2,00,000

Swap	$\$2,00,000 \times \text{¥}120$	+¥240,00,000
Net Amount		+¥240,00,000

ii) At the time of receipt of interest amount

Transactions		Cash Flows
Interest to the lender	$\$2,00,000 \times 10\%$	- \$20,000
Interest Receipt from A Inc.		+\$18,000
Net Saving (in ¥)	$-\$2,000 \times \text{¥}120$	- ¥2,40,000
Interest to A Inc.	$\$2,00,000 \times 6\% \times \text{¥}120$	- ¥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 33

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:

- Do Nothing.
- Opting for NDF Contract.

Note: Both Rs./ SKW Rate and final payment (to be computed in Rs. Lakh) to be rounded off upto 4 decimal points.

MTP April 21 (10 Marks)

Answer:**Do Not in**

We shall compute the cross rates in Spot Market on both days and shall compare the amount payable in INR on these two days.

1st February

Rupee – Dollar selling rate	= ₹75.50
Dollar – SKW	= SKW 1190.00
Rupee – SKW cross rate = ₹75.50 / 1190.00	= ₹0.0634
Amount payable to Importer as per above rate (1190 Million × ₹0.0634)	= ₹754.4600 Lakh

2nd March

Rupee – Dollar selling rate	= ₹75.75
Dollar – SKW	= SKW 1188.00
Rupee – SKW cross rate = ₹75.75 / 1188.00	= ₹0.0638
Amount payable to Importer as per above rate (1190 Million × ₹0.0638)	= ₹759.2200 Lakh

Thus, Exchange Rate Loss = (₹759.2200 Lakh - ₹754.4600 Lakh) ₹4.7600 Lakh

ii) Hedged 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	₹4219,000

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 = (₹756.0347 Lakh - ₹754.4600 Lakh) ₹1.5747 Lakh

Decision: Since Exchange Rate Loss is less in case of NDF same can be opted for

Question 34

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.

Nov 15 (5 Marks), StudyMat

Answer:

First the contract will be cancelled at TT Selling Rate	
USD/ Rupee Spot Selling Rate	₹49.4455
Add: Premium for April	₹0.4200
	₹49.8655
Add: Exchange Margin @ 0.10%	₹0.04987
	₹49.91537 ₹49.91537
USD/ Sw. Fcs One Month Buying Rate	Sw. Fcs. 1.5150
Sw. Fcs. Spot Selling Rate (₹49.91537/1.5150) Rounded Off	₹32.9475 ₹32.9475
Bank buys Sw. Fcs. Under original contract	₹32.4000
Bank Sells under Cancellation	₹32.9475
Difference payable by customer	₹0.5475
Exchange difference of Sw. Fcs. 1,00,000 payable by customer (Sw. Fcs. 1,00,000 × ₹0.5475)	₹54,750

Question 35

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. (Cancellation on Due Date)

Answer:

Bank will buy from customer at the agreed rate of ₹65.3450.

Since this is sale contract 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	₹0.0653
	₹65.2247
Rounded to	₹65.2250
Dollar sold to customer at	₹65.3450
Dollar bought from customer	₹65.2250
Net amount payable by the customer per US\$	₹65.2250
Amount payable by the customer	
Flat Charges	₹100
Cancellation Charges ($₹0.12 \times 250000$)	₹30,000.00
	₹30,100.00

Question 36

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:

- The cost to the importer in respect of the extension of the forward contract, and
- The rate of new forward contract.

MTP Sept 16 (8 Marks), MTP Aug 18 (8 Marks), May 17 (6 Marks), StudyMat

Answer:

The contract is to be cancelled on 30-10-2010 at the spot buying rate of 41.5000 = ₹41.5000

Less: Margin Money 0.075% = ₹0.0311

= ₹41.4689 or ₹41.47

US\$ 20000 @ 41.47 = ₹829400

US\$ 20000 @ 42.32 = ₹846400

The difference in favour of the Bank/Cost to the importer = ₹17000

Q12 The rate of New Forward Contract

Spot Selling Rate US \$1	=	₹41.5200
Add: Premium @ 0.93%	=	₹0.3861
	=	₹41.9061
Add: Margin Money 0.20%	=	₹0.0838
	=	₹41.9899 or ₹41.99

Question 37

Suppose you as a banker entered into a forward purchase contract for US\$ 50,000 on 5th March with an export customer for 3 months at the rate of ₹59.6000. On the same day you also covered yourself in the market at ₹60.6025. However on 5th May your customer come 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. (Early Extension) StudyMat

Answer:**Q2 Cancellation Charges**

Original Contract Forward Buy		₹59.6000
Cancel 1 Month Forward Sell	59.2425	
(+) Margin @ 0.10%	0.0592	59.3017
Rounded Off		₹59.3017
Cancellation Charges payable to Customer		₹59.3017
Contract Value		\$50000
Total Payable to customer		₹14875

Q12 New Contract Rate

2 Months Forward Buy	59.6300
(-) Margin @0.10%	0.0596
	59.5704
Rounded off	59.5700

Question 38

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%.
MTP Sep 23 (8 Marks), MTP Oct 19 (8 Marks), StudyMat

Answer:

Bank will buy from customer at the agreed rate of ₹65.40. In addition to the same if bank will charge / pay swap difference and interest on outlay funds.

	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

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 ($\text{US\$}100000 \times 00.18 \times 31/365 \times 18\%$)	₹275.00
Charges for early delivery	
Swap loss	₹20,000.00
Interest on Outlay fund for US\$ 1,00,000 for 31 days	₹275.00
	₹20275.00
Net Inflow to Mr. X	
Amount received on sale ($\text{₹}65.40 \times 1,00,000$)	₹65,40,000
Less: Charges for early delivery payable to bank	(₹20,275)
	₹65,19,725

Question 39

On 1st October, 2020 Mr. Guru, an exporter, enters into a forward contract with the Bank to sell USD 1,00,000 on 31st December 2020 at INR/USD 75.40. However, at the request of the importer, Mr. Guru received the amount on 30th November, 2020. Mr. Guru requested the bank take delivery of the remittance on 30th November, 2020 i.e. before due date.

The inter-bank rate on 30th November 2020 was as follows:

Spot INR/USD 75.22 - 75.27

One Month Premium 10/15

Assume 365 days in a year.

- (i) If bank agrees to take early delivery then what will be net inflow to Mr. Guru assuming that the prevailing prime lending rate is 18% per annum.
- (ii) If Mr. Guru can deploy these funds in USD, he gets return at the rate of 3% per annum. Which is better? Why?
- July 21 (10 Marks)

Answer:

(i) If Bank agrees to take early delivery-

Working Notes-

(1) Swap Difference

Bank Sells at Spot Rate on 30 th November 2020	₹75.22
Bank Buys at Forward Rate of 31 st December 2020 (75.27 + 0.15)	₹75.42
Swap loss per US\$ (a – b)	– ₹0.20
Swap loss for US\$ 1,00,000 (1,00,000 × -0.20)	₹20,000

(2) Interest on Outlay Funds

(a) On 30th November Bank sells at	₹75.22
(b) It buys from customer at	₹75.40
Outlay of Funds per US\$ (b – a)	₹0.18
Interest on Outlay fund for US\$ 1,00,000 for 31 days (US\$100000 × 00.18 × 31/365 × 18%)	₹275.18

(3) Charges for early delivery

Swap loss	₹20,000.00
Interest on Outlay fund for US\$ 1,00,000 for 31 days	₹275.18
Total charges of early delivery	₹20,275.18

Net Inflow to Mr. Guru

Amount received on sale (₹75.40 × 1,00,000)	₹75,40,000
Less: Charges for early delivery payable to bank	₹20,275.18

Net Inflow to Mr. Guru ₹55,11,724.82

(ii) If Mr. Guru deploys these funds in US\$, then inflow will be -

Receipt of US\$ on 30th November 2020	US\$ 1,00,000
Add: Interest for 31 Days	US\$ 254.79
$\left(100000 \times 3\% \times \frac{31}{365}\right)$	
US\$ available on 31 st December 2020 for sale	US\$ 1,00,254.79

Sale of US\$ 1,00,000 to bank as per agreed rate (₹75.40) ₹75,40,000.00

Sale of US\$ 254.79 @ ₹75.32 i.e. Forward Rate ₹19,190.78

Amount of Inflows ₹75,59,190.78

Advice: Since Cash Inflow will be higher in deployment of funds option the same should be chosen.

Question 40

An import customer booked a forward contract with the bank on 10th April for USD 20,000 due on 10th June at ₹49.4000. The bank covered its position in the market at ₹49.2800.

The exchange rate for dollar in the interbank market on 10th June and 20th June were:

	10 th June	20 th June
Spot	USD 1 = ₹48.8000/8200	48.6800/7200
Spot/ June	48.9200/9500	48.8000/8500
Spot/July	49.0500/0900	48.9300/9900
Spot/August	49.3000/3500	49.1800/2500
Spot/September	49.6000/6600	49.6000/6600
Exchange margin is 0.10%		
Interest on outlay of funds 12%		

Calculate how the bank will react, if the customer requires on 20th June:

- To cancel the contract.
 - Exchange difference,
 - Swap loss,
 - Interest on outlay of funds and
 - Cancellation charges
- To Execute the contract.
- To Extend the contract with due date to fall on 10th August.

Nov 23 (8 Marks)

Answer:**i. Cancellation of Contract****(a) Exchange Difference:**

The forward sale contract shall be cancelled at Spot TT Purchase for \$ prevailing on the date of cancellation as follows:

\$/ ₹Market Buying Rate	₹48.6800
Less: Exchange Margin @ 0.10%	₹0.0487
	₹48.6325

Rounded off to ₹48.6325

Exchange Difference Payable

Bank sells \$ 20,000 @ ₹49.4000	₹9,88,000
Bank buys \$ 20,000 @ ₹48.6325	₹9,72,650
Amount payable by customer	₹15,350

(b) Swap Loss

On 10th June the bank does a swap sale of \$ at market buying rate of ₹48.8000 and forward purchase for June at market selling rate of ₹48.9500.

Bank buys at	₹48.9500
Bank sells at	₹48.8000
Amount payable by customer	₹0.1500

Swap Loss for \$ 20,000 is = ₹3,000

(c) Interest on Outlay of Funds

On 10th June, the bank receives delivery under cover contract at ₹49.2800 and sell spot at ₹48.8000.

Bank buys at	₹49.2800
Bank sells at	₹48.8000
Amount payable by customer	₹0.4800

Outlay for \$ 20,000 is ₹9,600

Interest on ₹9,600 @ 12% for 10 days ₹31.56 or ₹32.00

(d) Cancellation Charges

Particulars	Amount (₹)
Exchange Difference	15,350
Swap Loss	3,000
Interest on Outlay of Funds	32.00
Cancellation Charges payable by Customer	??,???

OR

Particulars	Amount (₹)
Exchange Difference	15,350
Swap Loss	3,000
Interest on Outlay of Funds	31.56
Cancellation Charges payable by Customer	??,?????

ii. Execution of Contract

Cancellation charges of ₹18,382 or ₹18,381.56 as computed above will be recovered. The contract will be executed at the spot TT selling rate calculated as follows:

Dollar/₹ interbank spot selling rate	₹48.7200
Add: exchange margin at 0.10%	+ 0.0487
	₹??,??,??,??,??

iii. Extension of Contract

Cancellation charges of ₹18,382 or ₹18,381.56 as computed above will be recovered.

The contract will be extended at the current rate.

Dollar/₹ market forward selling rate for August	₹49.2500
Add: Exchange margin at 0.10%	+ 0.0492
	₹49.2992

The exchange rate applied for the extended contract is ₹49.3000 or ₹49.2992.

Question 41

Z has to remit USD \$1,00,000 for her daughter's education on 4th April 2021. Accordingly, she has booked a forward contract with his bank on 4th January 2021 @ ₹73.8775. The Bank has covered its position in the market @ ₹73.7575.

The exchange rates for USD \$ in the interbank market on 4th, 7th and 14th April 2021 were:

	4th April ₹	7th April ₹	14th April ₹
Spot USD 1=	73.2775/73.2975	73.1575/73.1975	73.1375/73.1775
Spot/April	73.3975/73.4275	73.2775/73.3275	73.2575/73.3075
May	73.5275/73.5675	73.4075/73.4650	73.3875/73.4475
June	73.7775/73.8250	73.6575/73.7275	73.6375/73.7050
July	74.0700/74.1325	73.9575/74.0675	73.9500/74.0525

Exchange margin of 0.10 percent and interest outlay of funds @ 12 percent are applicable. The remitter, due to rescheduling of the semester, has requested on 14th April 2021 for extension of contract with due date on 14th June 2021.

Calculate:

- (i) Cancellation Rate;
- (ii) Amount Payable on \$100,000;
- (iii) Swap loss;
- (iv) Interest on outlay of funds, if any;
- (v) New Contract Rate; and
- (vi) Total Cost

Note: Rates must be rounded to 4 decimal places in multiples of 0.0025 and assume 365 days in a year.

MTP Oct 21 (10 Marks)

Answer:

(i) Cancellation Rate:

The forward sale contract shall be cancelled at Spot TT Purchase for \$ prevailing on the date of cancellation as follows:

\$/ ₹ Market Buying Rate	₹73.1575
Less: Exchange Margin @ 0.10%	₹0.0732
	₹73.0843
Rounded off to	₹73.0843

(ii) Amount payable on \$1,00,000

Bank sells \$1,00,000 @ ₹73.8775	₹73,87,750
Bank buys \$1,00,000 @ ₹73.0850	₹73,08,500
Amount payable by customer	₹7,79,250

(iii) Swap Loss

On 4th April, the bank does a swap sale of \$ at market buying rate of ₹73.4275 and forward purchase for April at market selling rate of ₹73.2775.

Bank buys at	₹73.4275
Bank sells at	₹73.2775
Amount payable by customer	₹15,000

Swap Loss for \$ 1,00,000 in ₹ = ₹15,000

(iv) Interest on Outlay of Funds

On 4th April, the bank receives delivery under cover contract at ₹73.7575 and sell spot at ₹73.2775.

Bank buys at	₹73.7575
Bank sells at	₹73.2775
Amount payable by customer	₹48,000

Outlay for \$ 1,00,000 in ₹48,000

Interest on ₹48,000 @ 12% for 3 days ₹47

(v) New Contract Rate

The contract will be extended at current rate

\$/ ₹ Market forward selling Rate for June	₹73.7050
Add: Exchange Margin @ 0.10%	₹0.0737
	₹73.7787
Rounded off to	₹73.7800

(i) Total Cost

Cancellation Charges	₹79,250.00
Swap Loss	₹15,000.00
Interest	₹47.00
	₹94,297.00

Question 42

ABN-Amro Bank, Amsterdam, wants to purchase ₹15 million against US\$ for funding their Vostro 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. MTP Aug 17 (5 Marks), RTP Nov 13, StudyMat

Answer:

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)

Equivalent of US\$ for ₹15 million at this rate will be

$$= \frac{15,000,000}{51.3625} = \text{US\$2,92,041.86}$$

Question 43

You as a dealer in foreign exchange have the following position in GBP on 31st October, 2019:

	GBP
Balance in the Nostro A/c Credit	2,00,000
Opening Position Overbought	1,00,000
Purchased a bill on London	1,60,000
Sold forward TT	1,20,000
Forward purchase contract cancelled	60,000
Remitted by TT	1,50,000
Draft on London cancelled	60,000

Decide the steps would you take, if you are required to maintain a credit Balance of GBP 65,000 in the Nostro A/c and keep as oversold position on GBP 20,000?

MTP March 22 (8 Marks), MTP Oct 20 (8 Marks), StudyMat

Answer:

Exchange Position:

Particulars	Purchases (GBP)	Sales (GBP)
Opening Balance Overbought	1,00,000	
Bill on London	1,60,000	
Forward Sales – TT		1,20,000
Cancellation of Forward Contract		60,000
TT Sales		1,50,000
Draft on London cancelled	60,000	—
	3,20,000	3,30,000
Closing Balance Oversold	10,000	—
	2,22,222	2,22,222

Cash Position (Nostro A/c)

	Credit	Debit
Opening balance credit	2,00,000	—
TT sales	—	1,50,000
	2,22,222	2,22,222
Closing balance (credit)	—	50,000
	2,22,222	2,22,222

The Bank has to buy spot TT GBP 15,000 to increase the balance in Nostro account to GBP 65,000. This would bring the overbought position on GBP to 5,000. Since the bank requires an oversold position of GBP 20,000, it has to sell forward GBP 25,000.

CHAPTER 12

INTERNATIONAL FINANCIAL MANAGEMENT

Question 1

Skylark Systems Ltd. is interested to expand its operations in US for which it requires funds of \$20 million, net of issue expenses and floatation costs etc., which amounts to 3% of the issue size. To finance this project it proposes to issue GDR.

Following factors are considered in pricing the issue:

- Expected market price of share at the time of issue of GDR is ₹300 (FV ₹10)
- 3 shares shall underlay each GDR and shall be priced at 10% discount to market price.
- Expected exchange rate is ₹75/\$
- 20% Dividend is expected to be paid for next year with growth rate of 15%

You are required to compute the number of GDRs to be issued and cost of GDR to Skylark Systems Ltd.

If the company is able to raise the funds in US at the rate of 4% p.a. and the company is able to repay the loan along with interest from revenues generated from the operations of US, what is your advise to the company?

May 24 (4 Marks), May 2022 (8 Marks)

Answer:

a. Working Notes:

Net Issue Size = \$20 million

$$\text{Gross Issue} = \frac{20.00}{0.97} = \$ 20.619 \text{ million}$$

Issue Price per GDR in ₹ (300 × 3 × 90%) ₹810

Issue Price per GDR in \$ (₹810/ ₹75) \$10.80

Dividend Per GDR (D1) = ₹2 × 3 = ₹6.00

Net Proceeds Per GDR = ₹810 × 0.97 = ₹785.70

Number of GDR to be issued

$$\frac{\$20.619 \text{ million}}{\$10.80} = 1.9092 \text{ million}$$

Cost of GDR

$$k_e = \frac{6.00}{785.70} + 0.15 = 15.76\%$$

If the company receives an offer from US Bank willing to provide an equivalent amount of loan with interest rate of 4%, it should accept the offer.

Question 2

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	₹15,00,000
Manpower cost (80 software professional will be working for 10 hours each day)	₹400 per man hour
Administrative and other costs	₹12,00,000

Advise the US Company on the financial viability of the project. The rupee-dollar rate is ₹48/\$.

Note: Assume 365 days a year.

RTP Nov 22, RTP Nov 21, MTP Feb 15 (6 Marks), RTP Nov 12, StudyMat

Answer:

Proforma profit and loss account of the Indian software development unit

	₹	₹
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		??,??,??,???
Less: Tax		10,81,50,000
Earnings after tax		??,??,??,???
Less: Withholding tax (TDS)		2,52,35,000
Repatriation amount (in rupees)		??,??,??,???
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, it is assumed that since foreign subsidiary has paid taxes it will not pay withholding taxes then solution will be as under:

	₹	₹
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		??,??,??,???

Less: Tax		10,81,50,000
Earnings after tax		??,??,??,???
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 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:

	₹	₹
Revenue		48,00,00,000
Less: Costs:		
Rent	15,00,000	
Manpower ($₹400 \times 80 \times 10 \times 365$)	11,68,00,000	
Administrative and other costs	12,00,000	11,95,00,000
Earnings before tax		??,??,??,???
Less: Withholding Tax		3,60,50,000
Earnings after Withholding tax @ 10%		??,??,??,???
Less: Corporation Tax net of Withholding Tax		7,21,00,000
Repatriation amount (in rupees)		??,??,??,???
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 3

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:

- (i) The viability of the project using foreign currency approach.
- (ii) What will be the impact if there is a withholding tax of 10% applicable on the project.

Jan 21 (8 Marks)

Answer:

(i) Viability of the Project

$(1 + 0.12) (1 + \text{Risk Premium})$

$= (1 + 0.14)$

Or, $1 + \text{Risk Premium}$

$= 1.14/1.12 = 1.0179$

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
			???
		Less: Investment	16.50
		NPV	???

Therefore, Rupee NPV of the project is $= ₹72 \times \text{US\$ } 1.52 \text{ Million} = ₹109.44 \text{ Million}$

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	???
Less: Initial Investment	US\$ 16.50 Million
NPV	???

Therefore, Rupee NPV of the project is $= ₹72 \times (\text{US\$ } 0.282 \text{ Million}) = - ₹20.304 \text{ Million}$

Thus, if there is a withholding tax of 10% then the project will **not be viable**.

Question 4

DK Ltd. is considering an investment proposal in Sri Lanka involving an initial investment of LKR 25 billion. The current spot exchange rate is INR/LKR 0.37. The risk free rate in India is 6% and the same in Sri Lanka is 5.02%. The project will generate a cash flow of LKR 5 billion in the first year. The cash flow will increase by LKR 1 billion each year for the next 4 years. The project will bind up on completion of 5 years with no salvage value.

The required rate of return for the project is 8%.

- (i) You are required to find out the investment worth of the project by

- (1) Home Currency Approach
- (2) Foreign Currency Approach

(ii) Compare the outcome under both the approaches

Given:

t	1	2	3	4	5
PVIF (8%,t)	0.92593	0.85734	0.79383	0.75503	0.68058
PVIF (7%,t)	0.93457	0.87344	0.81630	0.76290	0.71299

Dec 21 (8 Marks), MTP Mar 24 (8 Marks)

Answer:

Calculation of Forward Exchange Rates

End of Year	₹	₹/KR
1	$0.37 \times \frac{₹1.06}{1.052}$	0.3712
2	$0.373 \times \frac{₹1.06}{1.052}$	0.3743
3	$0.376 \times \frac{₹1.06}{1.052}$	0.3774
4	$0.380 \times \frac{₹1.06}{1.052}$	0.3805
5	$0.384 \times \frac{₹1.06}{1.052}$	0.3836

Home Currency Approach

Year	Cash Flow Billion LKR	₹ / LKR	Cash flow Billion ₹	PVF @ 8%	PV Billion ₹
1	5	0.373	1.865	0.92593	1.7269
2	6	0.376	2.256	0.85734	1.9342
3	7	0.380	2.660	0.79383	2.1116
4	8	0.384	3.072	0.73503	2.2580
5	9	0.388	3.492	0.68058	2.3766
					11.4073
Less: Investment	25	0.37			9.2500
				NPV	2.1573

Alternatively if students have used the PVIF (8%, 4) as given in the question paper then NPV would be 1.2188 instead of 1.1573.

Foreign Currency Approach

$$(1 + 0.06)(1 + \text{Risk Premium}) = 1.08$$

$$1 + \text{Risk Premium} = 1.08/1.06 = 1.01887$$

$$\text{Therefore, Risk adjusted LKR Rate} = 1.01887 \times 1.0502 - 1 = 0.07$$

Calculation of NPV

Year	Cash Flow (Billion LKR)	PVF @ 7%	PV (Billion LKR)
1	5	0.93457	4.6729
2	6	0.87344	5.2406
3	7	0.81630	5.7141

4	8	0.76290	6.1032
5	9	0.71299	6.4169
			??12222
Less: Investment			25.0000
NPV			222222

Thus, Rupee NPV of the Project = ₹0.37 × 3.1477 = ₹1.1646 billion

Decision NPV is positive in the approach so, project will worth investment.

Question 5

MNO Ltd., a company based in India, manufactures very high quality modern furniture and sells them to a small number of retail outlets in India and Nepal. It is facing tough competition. Recent studies on marketability of product 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 wood in bulk from Nepalese supplier.

The estimate of net India (₹) and Nepalese Currency (NC) cash flow in nominal terms for this proposal is shown below:

Years	Net cash flow (in Millions)	
	NC	India (₹)
0	—38	0
1	1.8	1.9
2	3.2	3.5
3	4.1	4.4
4	5.4	5.8
5	6.5	6.9

The following information is relevant:

- (1) MNO Ltd. evaluates all investment by using a discount rate of 11% p.a. All Nepalese customers are invoiced in NC. NC cash flows are converted to Indian ₹ at the forward rate and discounted at the Indian rate.
- (2) Inflation rate in Nepal and India are expected to be 11% and 10% p.a. respectively
- (3) The current exchange rate is ₹1 = NC 1.65

You are required to calculate Net Present value of the proposal.

Nov 22 (8 Marks)

Answer:

Working Notes:

(i) Computation of Forward Rates

End of Year	NC	NC/₹
1	$NC\ 1.65 \times \left(\frac{(1 + 0.11)}{(1 + 0.10)} \right)$	1.665
2	$NC\ 1.665 \times \left(\frac{(1 + 0.11)}{(1 + 0.10)} \right)$	1.680
3	$NC\ 1.680 \times \left(\frac{(1 + 0.11)}{(1 + 0.10)} \right)$	1.695

4	$NC\ 1.695 \times \left(\frac{(1 + 0.11)}{(1 + 0.10)} \right)$	1.710
5	$NC\ 1.710 \times \left(\frac{(1 + 0.11)}{(1 + 0.10)} \right)$	1.726

(ii) NC Cash Flows converted in Indian Rupees

Year	NC (Million)	Conversion Rate	₹ (Million)
0	-38.00	1.650	-23.03
1	1.80	1.665	1.081
2	3.20	1.680	1.905
3	4.10	1.695	2.419
4	5.40	1.710	3.158
5	6.50	1.726	3.766

Net Present Value

Year	Cash Flow in India	Cash Flow in Nepal	Total Cash Flow	PVF @ 11%	PV
0	---	-23.030	-23.030	1.000	-23.030
1	1.900	1.081	2.981	0.901	2.686
2	3.500	1.905	5.405	0.812	4.389
3	4.400	2.419	6.819	0.731	4.985
4	5.800	3.158	8.958	0.659	5.903
5	6.900	3.766	10.666	0.593	6.325
					1.258

Question 6

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 at 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.

Jan 21 (8 Marks), MTP Mar 23 (8 Marks)

Answer:

(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 x 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	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:

$$\text{Expected CFAT} = \text{US\$ } 32,26,000$$

$$\text{Expected Growth Rate} = 3\%$$

$$\begin{aligned} \text{Expected Value of inflow in perpetuity} &= \frac{\text{US\$ } 32,26,000 (1.03)}{0.11 - 0.03} \\ &= \frac{33,22,780}{0.08} = \text{US\$ } 4,15,34,750 \end{aligned}$$

	US \$
Value of Inflows	4,15,34,750
Less: Initial Outlay	2,50,00,000
NPV of project	1,65,34,750

Since NPV is positive, project is viable.

Question 7

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.

Nov 20 (8 Marks), MTP Apr 24 (8 Marks), MTP Apr 23 (8 Marks)

Answer:

(i) 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				??,??,??

(ii) 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				??,??,??

(iii) 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.

Question 8

Opus Technologies Ltd., an Indian IT company is planning to make an investment through a wholly owned subsidiary in a software project in China with a shelf life of two years. The inflation in China is estimated as 8 percent. Operating cash flows are received at the year end.

For the project an initial investment of Chinese Yuan (CN¥) 30,00,000 will be in a piece of land. The land will be sold after the completion of project at estimated value of CN¥ 35,00,000. The project also requires an office complex at cost of CN¥ 15,00,000 payable at the beginning of project. The complex will be depreciated on straight-line basis over two years to a zero-salvage value. This complex is expected to fetch CN¥ 5,00,000 at the end of project.

The company is planning to raise the required funds through GDR issue in Mauritius. Each GDR will have 5 common equity shares of the company as underlying security which are currently trading at ₹200 per share (Face Value = ₹ 10) in the domestic market. The company has currently paid a dividend of 25% which is expected to grow at 10% p.a. The total issue cost is estimated to be 1 percent of issue size.

The annual sales are expected to be 10,000 units at the rate of CN¥ 500 per unit. The price of unit is expected to rise at the rate of inflation. Variable operating costs are 40 percent of sales. Current Fixed Operating costs is CN¥ 22,00,000 per year which is expected to rise at the rate of inflation.

The tax rate applicable in China for business income and capital gain is 25 percent and as per GOI Policy no further tax shall be payable in India. The current spot rate of CN¥ 1 is ₹9.50. The nominal interest rate in India and China is 12% and 10% respectively and the international parity conditions hold. You are required to

- Identify expected future cash flows in China and determine NPV of the project in CN¥.
- Determine whether Opus Technologies should go for the project or not, assuming that there neither there is any restriction nor any charges/taxes payable on the transfer of funds from China to India.

RTP May 16, StudyMat

Answer:

Working Notes:

1. Calculation of Cost of Capital (GDR)

Current Dividend (D_0)	2.50
Expected Dividend (D_1)	2.75
Net Proceeds (200 – 1% of 200)	198.00
Growth Rate	10.00%
$k_e = \frac{2.75}{198} + 0.10 = 0.1139$ 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
Cost of Land	3000000
Capital Gain	???
Tax paid	125000
Amount realized net of tax	???

4. Realization on the disposal of Office Complex

	(CN¥)
Sale value at the end of project	500000
WDV	0.00
Capital Gain	???
Tax paid	125000
Amount realized net of tax	???

5. Computation of Annual Cash Inflows

Year	1	2
Annual Units	10000	10000
Price per bottle (CN¥)	540	583.20
Annual Revenue (CN¥)	54,00,000	58,32,000
Less: Expenses		
Variable operating cost (CN¥)	21,60,000	23,32,800
Depreciation (CN¥)	7,50,000	7,50,000
Fixed Cost per annum (CN¥)	23,76,000	25,66,080
PBT (CN¥)	1,14,000	1,83,120
Tax on Profit (CN¥)	28,500	45,780
Net Profit (CN¥)	85,500	1,37,340
Add: Depreciation (CN¥)	7,50,000	7,50,000
Cash Flow	8,35,500	8,87,340

(a) Computation of NPV of the project in CN¥ (CN¥)

Year	0	1	2
Initial Investment	-4500000		
Annual Cash Inflows		835500	887340
Realization on the disposal of			
Land net of Tax			3375000
Realization on the disposal of			
Office Complex			375000
Total	₹22,22,222	₹22,22,222	₹22,22,222
PVF @11.39%	1.000	0.898	0.806
PV of Cash Flows	₹22,22,222	₹22,22,222	₹22,22,222
NPV			₹22,22,222

(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¥)	-45,00,000	8,35,500	46,37,340
Exchange Rate (₹/CN¥)	9.50	9.67	9.85
Cash Flows (₹)	-4,27,50,000	80,79,285	4,56,77,799
PVF @ 12%	1.00	0.893	0.797
	-4,27,50,000	72,14,802	3,64,05,206
NPV			8,70,008

- (ii) Assuming that inflow funds are transferred at the end of the project i.e. second year.

Year	0	2
Cash Flows (CN¥)	-45,00,000	54,72,840
Exchange Rate (₹/CN¥)	9.50	9.85
Cash Flows (₹)	-4,27,50,000	5,39,07,474
PVF	1.00	0.797
	-4,27,50,000	4,29,64,257
NPV		2,14,257

Though in terms of CN¥ the NPV of the project is negative but in ₹ it has positive NPV due to weakening of ₹ in comparison of CN¥. Thus, Opus can accept the project.

Question 9

A US based company is planning to set up a subsidiary company in India (where so far it was exporting) in view of growing demand for its product and competition from other US based companies. The initial project cost consisting of plant and machinery including installation is estimated to be US\$ 490 million. The net working capital requirements are estimated at US\$ 60 million. The company follows straight line method of depreciation. Currently, the company is exporting two million units every year at a unit price of US\$ 90, its variable cost per unit being US\$ 50. The CFO of the Company has estimated the following operating cost and other data in respect of proposed project:

- (i) Variable operating cost will be US \$30 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) Expected useful life of the proposed plant is five years with no salvage value;
- (iv) Production capacity of the proposed project in India will be 5 million units;
- (v) Existing working capital investment for production and sale of two million units through exports was US \$25 million;
- (vi) Export of the product in the coming year will decrease to 1.5 million units, provided the company does not set up subsidiary company in India, in view of the presence of competing other US based companies 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 of the proposed project in India and give your advice. Present Value Interest Factors (PVIF) @ 12% for five years is as below:

Year	1	2	3	4	5
PVIF	0.8929	0.7972	0.7118	0.6355	0.5674

July 21 (8 Marks), Nov 19 (8 Marks), RTP May 23, MTP Oct 22 (10 Marks), MTP Oct 18 (8 Marks), RTP Nov 2018, RTP Nov 2016, May 14 (5 Marks), RTP May 17, RTP Nov 2019, MTP May 20 (10 Marks)

Answer:

Financial Analysis whether to set up the manufacturing units in India or not may be carried using NPV technique as follows:

Incremental Cash Outflows

	\$ Million
Cost of Plant and Machinery	490.00
Working Capital	60.00
Release of existing Working Capital	(25.00)
	?

Incremental Cash Inflow after Tax (CFAT) generated by investment in India for 5 years

	\$ Million
Sales Revenue (5 Million × \$90)	450.00
Less: Costs	
Variable Cost (5 Million × \$30)	150.00
Fixed Cost	30.00
Depreciation (\$490 Million/5)	98.00
EBIT	222.00
Taxes @ 35%	60.20
EAT	161.80
Add: Depreciation	98.00
CFAT 5 years	259.80

Cash flow at the end of the 5 years (Release of Working Capital) \$35.00 Million**Cash generation by exports (Opportunity Cost)**

	\$ Million
Sales Revenue (1.5 Million × \$90)	135.00
Less: Variable Cost (1.5 Million × \$50)	75.00
Contribution before tax	60.00
Tax @ 35%	21.00
CFAT 5 years	39.00

Additional CFAT:

	\$ Million
Through setting up subsidiary in India	209.80
Through Exports in India	39.00
CFAT (1-5 years)	248.80

Determination of NPV

Year	CFAT (\$ Million)	PVF@12%	PV (\$ Million)
1-5	170.80	3.6048	615.6998
5	35	0.5674	19.8590
			635.5588
Less: Initial Outflow			525.0000
		NPV	110.5588

Advice: Since NPV is positive the proposal should be accepted.

Question 10

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, reside in India. He has many friends in different parts of India, leading to frequent visits. Along with Mr. Pramod, he is

interested in setting up a business in India and has formally incorporated a company called “Aerious Private Ltd.in” Mumbai.

To start with, he received a business proposal from one of his friends, Nimish, a consultant. It is estimated that 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. Mr. Vishwas wishes to evaluate whether the business proposal is viable or not.

The information related to exchange rate and inflation rate is as follows:

Parameter	Value
Spot Rate for 1 Mauritian Dollar (MUR)	1.88 Indian Rupee (INR)
Inflation in India	6%
Inflation in Mauritius	5%
Inflation rate expectation	Unchanged for the next 4 years

Additionally:

- INR 8 crore out of the initial investment shall be required for setting up a plant.
- The useful life of the plant is 4 years.
- At the end of the 4th year, the estimated salvage value of the plant shall be INR 80 lakhs.
- Depreciation of the plant shall be charged on the basis of the straight-line method.
- 40% of the investment shall be through debt funds from Mauritius at a post-tax cost of 10%, while the remaining funds shall be arranged by Mr. Vishwas and his friends who expect a 12% return on their funds.

Expected revenues and costs (excluding depreciation) in real terms are as follows:

Year	Revenues (INR Crore)	Costs (INR Crore)
1	6.00	3.00
2	7.00	4.00
3	8.00	4.00
4	8.00	4.00

Assume that the applicable tax rate in India is 30%. Since there is a Double Tax Avoidance Agreement (DTAA) 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 and costs are as follows:

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

Mr. Vishwas seeks an expert opinion on whether the investment in this project is a viable option or not.

Note:

1. Round off calculations up to 4 decimal points.
2. Show INR calculations in Crore and MUR calculations in Million.

RTP May 24

Answer:

To evaluate whether investment in same project is a viable option or not, we shall compute the NPV of the project.

Working Note:

Expected Exchange Rates

End of Year	Calculation for Exchange Rate INR/MUR	Exchange Rate INR/MUR
1	INR 1.88 x (1 + 0.06) / (1 + 0.05)	1.8979
2	INR 1.8979 x (1 + 0.06) / (1 + 0.05)	1.9160
3	INR 1.9160 x (1 + 0.06) / (1 + 0.05)	1.9342
4	INR 1.9342 x (1 + 0.06) / (1 + 0.05)	1.9526

Initial Investment	= MUR 100 Million × INR 1.88	= INR 18.80 crore
Working Capital (Year 1)	= MUR 2 Million × 1.8979	= INR 0.3796 crore
Working Capital (Year 2)	= MUR 2 Million × 1.9160	= INR 0.3832 crore
Working Capital (Year 3)	= MUR 2 Million × 1.9342	= INR 0.3868 crore
Working Capital (Year 4)	= MUR 2 Million × 1.9526	= INR 0.3905 crore

WACC = 40% × 10% + 60% × 12% = 11.20%

Inflation adjusted Revenue

Year	Revenue (₹)	Revenue (Inflation Adjusted) (₹)
1	6.00 crore	6.60 crore
2	7.00 crore	8.393 crore
3	8.00 crore	10.3594 crore
4	8.00 crore	11.0845 crore

Inflation adjusted Cost

Year	Cost (₹)	Cost (Inflation Adjusted) (₹)
1	3.00 crore	3.3600 crore
2	4.00 crore	4.9280 crore
3	4.00 crore	5.3715 crore
4	4.00 crore	5.8012 crore

Annual cash flows

₹ Crore

	Year 1	Year 2	Year 3	Year 4
Revenue (₹ crore)	6.6	8.393	10.3594	11.0845
Less: Cost (₹ crore)	3.36	4.928	5.3715	5.8012
Less: Depreciation (₹ crore)	1.8	1.8	1.8	1.8
Profit before Tax (PBT) (₹ crore)	1.44	1.665	3.1879	3.4833
Tax @ 30% (₹ crore)	0.432	0.4995	0.9564	1.045
Profit after Tax (₹ crore)	1.008	1.1655	2.2315	2.4383
Add: Depreciation (₹ crore)	1.8	1.8	1.8	1.8
Cash Flows (₹ crore)	2.808	2.9655	4.0315	4.2383

NPV of the Project

	Year 0	Year 1	Year 2	Year 3	Year 4
Initial Investment (₹ Crore)	(18.8)				
Working Capital (₹ Crore)		(0.3796)	(0.3832)	(0.3868)	(0.3905)
Scrap Value (₹ Crore)	0.8				
W.C Recovered (₹ Crore)	1.5401				
Annual Cash Flows (₹ Crore)		2.808	2.9655	4.0315	4.2383
Net Cash Flow (₹ Crore)	(18.8)	2.4284	2.5823	3.6447	6.1879
Exchange Rate	1.88	1.8979	1.916	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	0.654
Present value (in Million MUR)	(100)	11.5067	10.8993	13.7048	20.7257

Net Present Value = - MUR 43.1635 Million

Advise: Since NPV of the project is negative the proposal is not a viable option for investment.

Question 11

K Ltd. currently operates from 4 different buildings and wants to consolidate its operations into one building which is expected to cost ₹90 crores. The Board of K Ltd. had approved the above plan and to fund the above cost, agreed to avail an External Commercial Borrowing (ECB) of GBP 10 m from G Bank Ltd. on the following conditions:

- The Loan will be availed on 1st April, 2019 with interest payable on half yearly rest.
- Average Loan Maturity life will be 3.4 years with an overall tenure of 5 years.
- Upfront Fee of 1.20%.
- Interest Cost is GBP 6 months LIBOR + Margin of 2.50%.
- The 6-month LIBOR is expected to be 1.05%.

K Ltd. also entered into a GBP-INR hedge at 1 GBP = INR 90 to cover the exposure on account of the above ECB Loan and the cost of the hedge is coming to 4.00% p.a.

As a Finance Manager, given the above information and taking the 1 GBP = INR 90:

- Calculate the overall cost both in percentage and rupee terms on an annual basis.
- What is the cost of hedging in rupee terms?
- If K Ltd. wants to pursue an aggressive approach, what would be the net gain/loss for K Ltd. if the INR depreciates/appreciates against GBP by 10% at the end of the 5 years assuming that the loan is repaid in GBP at the end of 5 years?

Ignore time value and taxes and calculate to two decimals.

May 19 (8 Marks)

Answer:

(vi) Calculation of Overall Cost

Upfront Fee (GBP 10 M @ 1.20%)	₹1,20,000
Interest Payment (GBP 10 M × 3.55% × 3.4)	₹12,07,000
Hedging Cost (GBP 10 M × 4% × 3.4)	₹13,60,000
Total	₹26,87,000 Or ₹2.687 million

Overall cost in % terms on Annual Basis

$$= \frac{2.687 \text{ million}}{(1,00,00,000 - 1,20,000)} \times \frac{1}{3.4} = \frac{2.687}{9.88} \times \frac{1}{3.4} \times 100 = 8\%$$

Overall Cost in Rupee terms @ ₹90/GBP

$$= 90 \times \frac{2.687}{3.4} \times 100 = ₹7112.647 \text{ Millions}$$

OR**Overall cost in % terms on Annual Basis**

$$= \frac{2.687 \text{ million}}{(1,00,00,000)} \times \frac{1}{3.4} = \frac{2.687}{1.00} \times \frac{1}{3.4} \times 100 = 7.9\%$$

$$\text{Overall Cost in Rupee terms @ ₹90/GBP} = 10,00,000 \times 7.90\% \times 90 = ₹71,100,000$$

OR**Calculation of Overall cost**

Interest & Margin	(A)	= 3.55%
Hedging cost	(B)	= 4%
		= 7.55%

Onetime fee	1.20%	
Average loan maturity	3.4 years	
Per annum cost	1.2/3.4 (C)	= 0.35%
Annual overall cost in % terms (A+B+C)		= 7.9%

$$\text{Overall Cost in Rupee terms @ ₹90/GBP} = 10,00,000 \times 7.90\% \times 90 = ₹71,100,000$$

(ii) Cost of Hedging in terms of Rupees

$$₹13,60,000 \times 90 = ₹12,24,00,000 = ₹12.24 \text{ crores OR}$$

$$\text{GBP } 10,00,000 \times 90 \times 4\% = ₹3,60,00,000 \text{ on Annual Basis}$$

(iii) If K Ltd. pursues an aggressive approach then Gain/Loss in INR Depreciation/ Appreciation shall be computed as follows:**(a) If INR depreciates by 10%**

Re. loss per GBP = 90 × 10%	= ₹9
Total Losses GBP 10M	= ₹90 Million
Less: Cost of Hedging	= ₹36 Million
Net Loss	= ₹54 million

(b) If INR appreciates by 10%

₹ Gains per GBP = ₹90 × 10%	= ₹9
Total Gain on Repayment of loan	= 90 Million
Add: Saving in Cost of Hedging	= 36 Million
Net Gain	= 126 Million

Question 12

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 lacs.

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.

StudyMat

Answer:

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

Asset's 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)

$$= 8.00\% + 1.83(11.00\% - 8.00\%) = \mathbf{13.49\%}$$

$$\text{WACC} = 13.49\% \times 0.55 + 9\%(1 - 0.20) \times 0.45 = \mathbf{10.66\%}$$

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

4. Calculation of Present of Free Cash Flow

Year	0	1	2	3	4	5
Expected Annual Visitors			2222222	2222222	2222222	2222222
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)			222222	222222	222222	222222
Total Revenue (NPR crores)			222222	222222	222222	222222
Less:						
Annual Staffing Cost (NPR crores)			71.66	75.25	79.01	82.96
Annual Insurance Cost (NPR crores)			5.51	5.79	6.08	6.38
Other running and maintenance cost (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)			222222	222222	222222	222222
Profit (NPR crores)			22222	22222	22222	22222
Tax on Profit (NPR crores)			2.13	3.68	4.96	6.01
Net Profit (NPR crores)			2222	22222	22222	22222
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	22222	22222	22222	222222
PVF at discount rate	1.00	0.904	0.817	0.738	0.667	0.603
Present values (NPR crores)	-225.00	-262.16	22222	22222	22222	222222
Net Present value (NPR crores)					222222	

Decision: Since NPV of the project is negative the Entertainment Ltd. should not undertake Water Park project in Nepal.

CHAPTER 13

BUSINESS VALUATION

Question 1

ABC Limited is considering acquisition of DEF Ltd., which has 3.10 crore shares issued and outstanding. The market price per share is ₹440.00 at present. ABC Ltd.'s average cost of capital is 12%. The cash inflows of DEF Ltd. for the next three years are as under:

Year	₹ in cores
1	460.00
2	600.00
3	740.00

You are required to calculate the range of valuation that ABC Ltd. has to consider.

Take P.V.F. (12%, 3) = 0.893, 0.797, 0.712

May 13 (5 Marks), MTP Oct 22 (6 Marks), MTP April 14 (8 Marks)

Answer:

Valuation based on Market Price	₹440.00
Thus, value of total business is (3.10crore × ₹440) Valuation Based on Discounted Cashflow	₹1364.00crore
Present Value of cash flows (₹460 crore × 0.893) + (₹600 crore × 0.797) + (₹740 crore × 0.712) =	₹1,415.86crore
Value of per share (₹1415.86 crore / 3.10 crore)	₹456.73 per share

Range of Valuation

	Per Share (₹)	Total (₹ Crore)
Minimum	440.00	1364.00
Maximum	456.73	1415.86

Question 2

Excellent Ltd., reported a profit of ₹154 lakhs after 30% tax for the financial year 2019-20. An analysis of the accounts revealed that there is an extraordinary loss of ₹20 lakhs and the income included extraordinary items of ₹16 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	140
Material costs	40
Labour costs	24
Fixed costs	20

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 Excellent Ltd.'s share capital being comprised of 2,00,000 at 13% preference shares of ₹ 100 each and 100,00,000 equity shares of ₹ 10 each and the P/E ratio being 12 times. (Ignoring Corporate Dividend Tax)

July 21 (8 Marks), Nov 12 (8 Marks), RTP May 23, MTP April 18 (5 Marks), MTP Sep 22 (8

Marks), RTP May 19, RTP Nov18, StudyMat

Answer:**(i) Computation of Business Value**

		(₹ Lakhs)
Profit before tax $\frac{154}{1-0.30}$		220
Less: Extraordinary income		(16)
Add: Extraordinary losses		20
Profit from new product		224
Sales	140	
Less: Material costs 40		
Labour costs 24		
Fixed costs 20	(84)	56
		280
Less: Taxes @30%		84.00
Future Maintainable Profit after taxes		196
Relevant Capitalisation Factor		0.14
Value of business (₹196/0.14)		1400

(ii) Determination of Market Price of Equity Share

Future maintainable profits (After Tax)	₹1,96,00,000
Less: Preference share dividends 2,00,000 shares of ₹100 @ 13%	₹26,00,000
Earnings available for Equity Shareholders	₹1,70,00,000
No. of Equity Shares	1,00,00,000
Earning per share = $\frac{₹1,70,00,000}{1,00,00,000}$	₹1.70
PE ratio	12
Market price per share	₹20.40

Question 3

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 31 st 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:

- (3) 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.
- (4) Both the companies envisage a capitalization rate of 8%.
- (5) H Ltd. has a contingent liability of ₹300 crores as on 31st March, 2012.
- (6) 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:

- (iii) Net Asset Value Method
- (iv) Earnings Capitalisation Method
- (v) 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.)

Nov 12 (12 Marks), StudyMat

Answer:

Net Assets Value

H Ltd.	$\frac{₹1300 \text{ crores} - ₹300 \text{ crores}}{3.50 \text{ crores}} = ₹285.71$
B Ltd.	$\frac{₹31.50 \text{ crores}}{0.65 \text{ crores}} = ₹48.46$

Earnings Capitalization Value

H Ltd.	$\frac{₹300 \text{ crores} / 0.08}{3.50 \text{ crores}} = ₹1071.43^*$
B Ltd.	$\frac{₹10 \text{ crores} / 0.08}{0.65 \text{ crores}} = ₹192.31$

*Alternatively, Contingent Liability can also be deducted from this valuation

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 the contingent liability will materialize at its full amount.

Question 4

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	1,050	1,300	660	785
Borrowing		655		105
Capital Employed		1,955		890

Market Price Share (₹)	52	75

ICL's Land & Buildings are stated at current prices. SVL's Land & Buildings are revalued three years ago. There has been an increase of 30 per cent per year in the value of Land & Buildings.

SVL is expected to grow @18 per cent each year, after merger.

ICL's Management wants to determine the premium on the shares over the current market price which can be paid on the acquisition of SVL. You are required to determine the premium using:

- (iv) Net Worth adjusted for the current value of Land & Buildings plus the estimated average profit after tax (PAT) for the next five years.
- (v) The dividend growth formula.
- (vi) 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

Nov 20 (12 Marks)

Answer:

(iv) **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 over current market price	462.62

(v) **Computation of Premium (Dividend Growth Formula):**

Existing Growth Rate	0.15
DPS = $125/12.50$	10
MPS	75
Cost of Equity ($D1/MP + g$) = $[(10 \times 1.15/75) + 0.15]$	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	22.80

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 $\left(\frac{D_1}{P} + g\right)$	$\left(\frac{10}{75} + 0.15\right)$	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		

- (vi) During the course of negotiations, ICL will push forward **valuation based on Growth Rate Method** as it will lead to least cash outflow.

Question 5

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 centres. 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

Nov 11 (8 Marks), May 18, MTP Aug 16 (8 Marks), MTP Oct 17 (8 Marks), MTP Aug 18 (5 Marks)

Answer:

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-Sales	Segment Sales	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-Sales	Segment Sales	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

$$= \frac{4,005,000 + 2,880,000 + 5,650,000}{3}$$

$$= 4,178,333.33 \text{ say } 4,178,000$$

Average theoretical value of Cornett GMBH. = €4,178,000

Question 6

A valuation done of an established company by a well-known analyst has estimated a value of ₹500 lakhs, based on the expected free cash flow for next year of ₹20 lakhs and an expected growth rate of 5%.

While going through the valuation procedure, you found that the analyst has made the mistake of using the book values of debt and equity in his calculation. While you do not know the book value weights, he used, you have been provided with the following information:

- (i) Company has a cost of equity of 12%,
- (ii) After tax cost of debt is 6%,
- (iii) The market value of equity is three times the book value of equity, while the market value of debt is equal to the book value of debt.

You are required to estimate the correct value of the company.

Nov 10 (8 Marks), May 18 (8 Marks), RTP May 14, RTP Nov 14, RTP May 20, MTP

Oct 19 (8 Marks), RTP May 19, Nov 14 (6 Marks)

Answer:

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, ₹500 lakhs = ₹20 lakhs / ($K_c - g$)

Since $g = 5\%$, then $K_c = 9\%$

Now, let X be the weight of debt and given

Cost of equity = 12% and cost of debt = 6% ,

Then $12\% (1 - X) + 6\% X = 9\%$

Hence, $X = 0.50$, so book value weight for debt was 50%

Correct weight should be 150% of equity and 50% of debt.

Cost of capital = $K_c = 12\% (0.75) + 6\% (0.25) = 10.50\%$

And correct firm's value = ₹20 lakhs / $(0.105 - 0.05) = ₹363.64$ lakhs.

Question 7

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?

StudyMat

Answer:

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

$$= \text{Cost of Equity} + \text{Cost of Debt}$$

$$= 20.84 (60/100) + 12.0 (1-0.3) (40/100)$$

$$= 15.864\%$$

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 8

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

Year:	1	2	3	4	5
Cash flows (₹ in lakh)	1,760	480	640	860	1,170

It is further estimated that beyond 5th year, cash flows will perpetuate at a constant growth rate of 8% per annum, mainly on account of inflation. The perpetual cash flow is estimated to be ₹10,260 lakh at the end of the 5th year.

Required:

- (iv) What is the value of the firm in terms of expected future cash flows, if the cost of capital of the firm is 20%?
- (v) The firm has outstanding debts of ₹3,620 lakh and cash/bank balance of ₹2,710 lakh. Calculate the shareholder value per share if the number of outstanding shares is 151.50 lakh.
- (vi) The firm has received a takeover bid from XYZ Ltd. of ₹225 per share. Is it a good offer?
[Given: PVIF at 20% for year 1 to Year 5: 0.833, 0.694, 0.579, 0.482, 0.402] Nov 19 (8 Marks)

Answer:

(iii) Value of Firm

Year	Cash Flow (₹ in lakhs)	PVF	PV (₹ in lakhs)
1	1760	0.833	1466.08
2	480	0.694	333.12
3	640	0.579	370.56
4	860	0.482	414.52
5	1170	0.402	470.34
PV of Cash flows upto year 5			272.15

If PV of Terminal Value is considered with the growth rate (at the end of 5th year)

$$\begin{aligned}
 &= \frac{10,260(1+0.08)}{0.20-0.08} \\
 &= \frac{11,080.80}{0.12} \\
 &= ₹92,340 \text{ lakh}
 \end{aligned}$$

Now, PV (at the beginning of the year)

$$\begin{aligned}
 &= ₹92,340 \times 0.402 \\
 &= ₹37,120.68 \text{ Lakhs}
 \end{aligned}$$

So, Present Value of the firm = ₹3054.62 + ₹37120.68 = ₹40175.30 Lakhs

(iv) Value per share

= Value of Firm – Value of Debt / No of shares

= (40175.30 – 3620)/151.50

= ₹241.29

Takeover bid of ₹225 per share seems to be not a good offer as it is lesser than the intrinsic value i.e. value per share of ₹241.29.

Question 9

Mantra Ltd. is planning to buy Alay Ltd. Following information is given in respect of Alay Ltd. which is expected to grow at a rate of 18% p.a. for the next three years, after which the growth rate will stabilize at 8% p.a. normal level, in perpetuity:

Particulars	For the year ended March 31, 2022
Revenues	₹6,800 Crores
Cost Of Goods Sold (COGS)	₹2,800 Crores
Operating Expenses	₹2,100 Crores
Capital Expenditure	₹750 Crores
Depreciation (included in Operating Exp.)	₹600 Crores

During high growth period, Revenues & Earnings Before Interest & Tax (EBIT) will grow at 18% p.a. and capital expenditure net of depreciation will grow at 12% p.a. From 4th year 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.

Corporate Income Tax rate is 30%.

The Weighted Average Cost of Capital (WACC) for both the companies is 15%

You are required to estimate the value of Alay Ltd. using Free Cash Flows to Firm (FCFF) & WACC methodology.

The PVIF for the three years are as below:

Year	t1	t2	t3
PVIF @ 15%	0.870	0.756	0.756

Nov 22 (8 Marks), May 14 (8 Marks), RTP Nov 20, MTP Mar 24 (8 Marks), StudyMat

Answer:**Determination of forecasted Free Cash Flow of the Firm (FCFF) (₹in crores)**

	Yr. 1	Yr. 2	Yr. 3	Terminal Year
Revenue	8,024.00	9,468.32	11,172.62	12,066.43
COGS	3,304.00	3,898.72	4,600.49	4,968.53
Operating Expenses* (*Excluding Depreciation)	1,770.00	2,088.60	2,464.55	2,661.71
Depreciation	708.00	835.44	985.82	1,064.68
EBIT	2,242.00	2,645.56	3,121.76	3,371.51
Tax @30%	672.60	793.67	936.53	1,011.45
EAT	1,569.40	1,851.89	2,185.23	2,360.06
Capital Exp. – Dep.	168.00	188.16	210.74	-----
Δ Working Capital	306.00	306.00	426.07	223.45
Free Cash Flow (FCF)	1,095.40	1,302.65	1,548.42	1,548.42

Terminal value is:

$$\frac{2136.61}{0.15 - 0.08} = ₹30,523 \text{ Crore}$$

Present Value (PV) of FCFF:

FCFF (₹in crores)	PVF @ 15%	PV (₹in crores)
1,095.40	0.870	953.00
1,302.65	0.756	984.80
1,548.42	0.658	1,018.86
30,523	0.658	20,084.13
		23,040.79

The value of the firm is ₹23,040.79 Crores

Note: The may vary due to rounding off difference

Question 10

Calculate the value of share from the following information:

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

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

MTP Aug 16 (8 Marks)

Answer:

$$\text{No of shares} = \frac{€13000 \text{ million}}{€40} = 325 \text{ million}$$

$$\text{EPS} = \frac{\text{PAT}}{\text{No. of shares}} = \frac{€2900 \text{ million}}{325 \text{ million}} = €8.923$$

$$\begin{aligned} \text{FCFE} &= \text{Net income} - [(1-b)(\text{capex-dep}) + (1-b)(\Delta \text{WC})] \\ &= 8.923 - [(1-0.25)(€47 - €39) + (1-0.25)(€3.45)] \\ &= €8.923 - [€6.00 + €2.5875] \\ &= €0.3355 \end{aligned}$$

β unlevered for the proxy company

$$= 0.20 \times 2 / [2 + (1 - 0.30)] = 0.148$$

$$0.148 = \beta \text{ equity geared } 3 / [3 + (1 - 0.3)]$$

$$\beta \text{ Equity geared} = 0.1825$$

$$\text{Cost of Equity } R_e = R_f + \beta(R_m - R_f) = 8.7 + 0.1825(10.3 - 8.7) = 8.992\%$$

$$P_0 = \frac{\text{FCFE}(1+g)}{K_e - g} = \frac{0.3355(1.08)}{0.8992 - 0.08} = \frac{0.36234}{0.00992} = \text{€}36.53$$

Question 11

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.

MTP Nov 21 (8 Marks) RTP May 20, RTP May 17, MTP April 19 (8 Marks), StudyMat

Answer:

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
Total 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	3,200	3,840	4,608	1,382

Present Value of Protected 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
		22,222.22

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
∴ Value of strategy	=	8,641.76 – 9,333.33	=	(691.57)

Conclusion: The strategy is not financially viable.

Question 12

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 Fund 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:

- (d) Per Share Earning Value of the Company.
 (e) Equity Value of the company if applicable EBITDA multiple is 5.

StudyMat

Answer:

(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 13

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%

- (v) Compute the operating income or EBIT earned by Delta Ltd. in the current year.
- (vi) What is Delta Ltd.'s Economic Value Added (EVA) for the current year?
- (vii) 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?

Nov 10 (8 Marks), RTP Nov 22, RTP Nov 15, MTP Mar 19 (8 Marks), StudyMat

Answer:

$$\begin{aligned}
 \text{(i) Taxable income} &= \text{Net Income} / (1 - 0.40) \\
 &= ₹15,00,000 / (1 - 0.40) \\
 &= ₹25,00,000.
 \end{aligned}$$

Again, taxable income = EBIT – Interest

or, EBIT = Taxable Income + Interest

$$= ₹25,00,000 + ₹15,00,000$$

$$= ₹40,00,000$$

$$\begin{aligned}
 \text{(ii) EVA} &= \text{EBIT} - \text{WACC} \times \text{Invested capital} \\
 &= ₹40,00,000(1 - 0.40) - (0.126 \times ₹1,00,00,000) \\
 &= ₹24,00,000 - ₹12,60,000 \\
 &= ₹11,40,000
 \end{aligned}$$

$$\text{(iii) Dividend} = ₹11,40,000 / 2,50,000 = ₹4.56$$

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 14

Calculate economic value added (EVA) with the help of the following information of Hypothetical Limited:

Financial leverage	:	1.4 times
Capital structure	:	Equity Capital ₹170 lakhs
		Reserves and surplus ₹130 lakhs
		10% Debentures ₹400 lakhs
Cost of Equity	:	17.5%
Income Tax Rate	:	30%.

Nov 12 (4 Marks), MTP Oct 14 (6 Marks), MTP Sept 16 (5 Marks)

Answer:

Financial leverage = PBIT / (PBIT - Interest)

$$1.4 = \text{PBIT} / (\text{PBIT} - \text{Interest})$$

$$1.4 = \text{PBIT} / (\text{PBIT} - 40)$$

$$1.4 (\text{PBIT} - 40) = \text{PBIT}$$

$$1.4 \text{ PBIT} - 56 = \text{PBIT}$$

$$1.4 \text{ PBIT} - \text{PBIT} = 56$$

$$0.4 \text{ PBIT} = 56$$

$$\text{or PBIT} = \frac{56}{0.4} = ₹140 \text{ lakhs}$$

$$\text{NOPAT} = \text{PBIT} - \text{Tax} = ₹140 \text{ lakhs} (1 - 0.30) = ₹98 \text{ lakhs.}$$

Weighted average cost of capital (ACC)

$$= 17.5\% \times (300 / 700) + (1 - 0.30) \times (10\%) \times (400 / 700) = 11.5\%$$

Economic Value Added (EVA) = NOPAT - ACC × Total Capital

$$= ₹98 \text{ lakhs} - 0.115 \times ₹700 \text{ lakhs}$$

$$= ₹17.5 \text{ lakhs}$$

Question 15

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

	₹
Sales	1000 lakhs
Operating Expenses Including Interest	620 lakhs
8% Debentures	250 lakhs
Equity Share Capital (Face Value of ₹10 each)	250 lakhs
Reserves and Surplus	250 lakhs
Market Value of DY Ltd.	900 lakhs
Corporate Tax Rate	30%
Risk free Rate of Return	7%
Market Rate of Return	12%
Equity Beta	1.4

You are required to

- Calculate Weighted Average Cost of Capital of DY Ltd.
- Calculate Economic Value Added
- Calculate Market Value Added

Dec 21 (8 Marks)

Answer:

i) Weighted Average Cost of Capital of DY Ltd.

Cost of Equity as per CAPM

$$k_e = R_f + \beta \times \text{Market Risk Premium}$$

$$= 7\% + 1.4 \times [12\% - 7\%]$$

$$= 7\% + 7\% = 14\%$$

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

$$\text{WACC } (k_o) = k_e \times \frac{E}{E+D} + k_d \times \frac{D}{E+D} = 14.00\% \times \frac{500}{750} + 5.60\% \times \frac{250}{750}$$

$$= 9.33\% + 1.87\% = 11.20\%$$

ii) Economic Value Added of DY Ltd.

		₹ Lakhs
Sales		₹1,000
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	250
Total Capital Employed	750

$$\text{EVA} = \text{NOPAT} - (\text{WACC} \times \text{Total Capital})$$

$$\text{EVA} = ₹280 \text{ Lakh} - 0.1120 \times ₹750 \text{ lakhs}$$

$$\text{EVA} = 196.00 \text{ lakhs}$$

iii) Determination of Market Value Added of DY Ltd.

	₹ Lakh
Market value of Equity Stock [₹900 Lakh - ₹250 Lakh]	650
Equity Fund [₹250 Lakh + ₹250 Lakh]	500
Market Value Added	1150

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 16

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		100
EBIT	410	Equity	700
Interest	-10	Reserves	100
EBT	400	Non-Current Borrowings	100
Tax Expense	-120	Current Liabilities & Provisions	400
EAT	280		

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%.

MTP Sep 23 (8 Marks), StudyMat

Answer:

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 = Cost of equity + 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 17

STR Ltd.'s current financial year's income statement reported its net income after tax as ₹50 Crore.

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

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

Following data is given to estimate cost of equity capital:

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

The applicable corporate income tax rate is 30%.

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

RTP Nov 21, MTP Oct 20 (8 Marks)

Answer:

First of all, to calculate Cost of Equity we shall compute the Equity Beta of STR Ltd. as follows:

$$\beta_a = \beta_e \left[\frac{E}{E+D(1-t)} \right]$$

$$1.11 = \beta_e \left[\frac{250}{250 + 80(1-0.30)} \right]$$

$$\beta_e = 1.22$$

Then we shall compute the Cost of Equity as per CAPM as follows:

$k_e = R_f + \beta \times \text{Market Risk Premium}$

$$= 8.5\% + 1.36 \times 9\%$$

$$= 8.5\% + 12.24\%$$

$$= 20.74\%$$

Cost of Debt (k_d) = $11\%(1 - 0.30) = 7.7\%$

$$\text{WACC}(k_o) = k_e \times \frac{E}{E+D} + k_d \times \frac{D}{E+D}$$

$$= 20.74 \times \frac{250}{330} + 7.70 \times \frac{80}{330}$$

$$= 15.71 + 1.87$$

$$= 17.58\%$$

Taxable Income = ₹50 Crore/(1 - 0.30) = ₹7142.86 lakhs

Operating Income = Taxable Income + Interest = ₹7142.86 lakhs + ₹880 lakhs = ₹8022.86 lakhs

EAT EIT Rate- ACC Invested Capital

= ₹8022.86 lakhs (1 - 0.30) - 17.58% × ₹330 Crore

= ₹5616.00 lakhs - ₹5801.40 lakhs

= - ₹185.40 lakhs

Question 18

Fragrance Ltd. has reported a Net Operating Profit after Tax (NOPAT) to Capital Employed as 2.5% plus Weighted Average Cost of Capital (WACC) for the year 31st March 2021. Economic Value added is ₹4 crore as on 31st March 2021.

You are required to calculate:

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

Dec 21 (4 Marks)

Answer:

EAT NOPAT ACC Capital Employed

₹4 Crore = NOPAT - WACC × Capital Employed

₹4 Crore = [WACC + 0.025] Capital Employed - WACC × Capital Employed

₹4 Crore = Capital Employed [0.025]

Capital Employed = ₹160 Crore

EAT NOPAT ACC is

₹4 Crore = NOPAT - 0.10 × ₹160 crore

NOPAT = ₹20 crore

Question 19

XY Ltd., a Cement manufacturing Company has hired you as a financial consultant of the company. The Cement Industry has been very stable for some time and the cement companies SK Ltd. & AS Ltd. are similar in size and have similar product market mix characteristic. Use comparable method to value the equity of XY Ltd. In performing analysis, use the following ratios:

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

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

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

MTP Oct 21 (8 Marks), Nov 19 (5 Marks)

Answer:

Sl. No.	Particulars	SK Ltd.	AS Ltd.	Average
(i)	Market to Book Value	$\frac{450}{400} = 1.125$	$\frac{400}{300} = 1.333$	1.2290
(ii)	Market to Replacement Cost	$\frac{450}{600} = 0.750$	$\frac{400}{550} = 0.727$	0.7385
(iii)	Market to Sales	$\frac{450}{550} = 0.818$	$\frac{400}{450} = 0.889$	0.8535
(iv)	Market to Net Income	$\frac{450}{18} = 25$	$\frac{400}{16} = 25$	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

CHAPTER 14

MERGERS, ACQUISITIONS & CORPORATE RESTRUCTURING

Question 1

Alfa Ltd. wants to acquire Beta Ltd. and has offered a swap ratio of 1:2 (0.5 shares for every one share of Beta Ltd.). Following information is provided:

	Alfa Ltd.	Beta 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

(i) You are required to determine:

- The number of equity shares to be issued by Alfa Ltd. for acquisition of Beta Ltd.
- The EPS of Alfa Ltd. after the acquisition.
- The equivalent earnings per share of Beta Ltd.

- d. The expected market price per share of Alfa Ltd.* after the acquisition, if PE increases to 12 times.
- e. The market value of the merged firm.
- (ii) If you are the shareholder of Beta Ltd and holding 100 shares, will you be interested to sell your stake? Why?

Nov 22 (8 Marks)

Answer:

(i)

(a) The number of shares to be issued by Alfa Ltd.:

The Exchange ratio is 0.5

So, new Shares = $1,80,000 \times 0.5 = 90,000$ shares.**(b) EPS of Alfa Ltd. after 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

(c) Equivalent EPS of Beta Ltd.:

No. of new Shares	0.5
EPS	₹3.13
Equivalent EPS ($₹3.13 \times 0.5$)	₹1.57 or ₹1.56

(d) New Market Price of Alfa Ltd. (P/E = 12):

Revised P/E Ratio of Alfa Ltd.	12 times
Expected EPS after merger	₹3.13
Expected Market Price ($₹3.13 \times 12$)	₹37.56

(e) Market Value of merged firm:

Total number of Shares	6,90,000
Expected Market Price	₹37.56
Total value ($6,90,000 \times 37.56$)	₹2,59,16,400

(ii)

Present market Value of share of Beta Ltd. ($100 \times ₹14$)	₹1,400
Revised market price of each share of Alfa Ltd. after Merger	₹37.56
Equivalent No. of Alfa Ltd. share in exchange of Beta Ltd. (0.50×100)	50
Equivalent Value of Alfa Ltd. share in exchange of Beta Ltd. ($100 \times 0.50 \times ₹37.56$)	₹1,878
Increase in Market Value ($₹1,878 - ₹1,400$)	₹478
No, I am not agreed to sell the stake as there is increase in market value.	

Question 2

Big Ltd. (BL), a listed company, is enjoying a price earnings ratio (PER) of 15 on an Earnings Per Share (EPS) of ₹5. The Total number of outstanding shares are 2,00,000.

BL is proposing to acquire Small Pvt. Ltd. (SPL) an unlisted company by issuing shares in the ratio 4:5 i.e. for 5 shares of SPL 4 shares of BL will be issued. The outstanding shares of SPL are 50,000. SPL will be listed before the actual merger to discover its value. The EPS of the merged entity will be 5.5.

No other information is available for SPL.

You are required to calculate:

- (i) Pre-merger EPS of SPL.
- (ii) Expected Market Price per Share of SPL at the time of listing, if it expects a PER of 10 and,
- (iii) Number of shares of BL to be issued to SPL if pre-merger EPS of BL is to be maintained.

May 23 (8 Marks)

Answer:

(a)

(i) Pre Merger EPS

No. of shares to be issued by BL to SPL ($50,000 \times 4/5$)	40,000
Existing number of shares of BL	2,00,000
Total no. of shares Post Merger	2,40,000
EPS (Post Merger)	₹5.50
Post-Merger (Total Earning)	₹13,20,000
Less: Pre-Merger Earning of BL ($2,00,000 \times 5$)	₹10,00,000
Pre-Merger Earning of SPL	₹3,20,000
Number of shares of SPL (Existing)	50,000
EPS ($₹3,20,000/50,000$)	₹6.40

(ii) Expected Market Price of SPL share at the day of listing

$$\text{EPS} \times \text{PE Ratio} (6.40 \times 10) = ₹64.00$$
(iii) Number of shares to be issued to SPL to maintain Pre-Merger EPS

$$5.00 = 13,20,000 / (2,00,000 + X)$$

$$10,00,000 + 5X = 13,20,000$$

$$X = 64,000$$

Thus, 64,000 shares to be issued by BL to SPL to maintain pre-merger EPS.

Alternatively, it can also be computed as follows:

Swap Ratio if EPS before merger is maintained by BL

$$\text{Then, Swap Ratio} = 6.4 / 5 = 1.28$$

Number of shares of BL is to be issued to SPL is $50000 \text{ shares} \times 1.28 = 64000 \text{ shares}$

Question 3

B Ltd. wants to acquire S Ltd. and has offered a swap ratio of 2:3 (2 shares for every 3 share of S Ltd.)

Following information is available:

Particulars	B Ltd.	S Ltd.
Profit after tax (in ₹)	21,00,000	4,50,000
Equity shares outstanding (Nos.)	6,00,000	1,80,000
EPS (in ₹)	₹3.50	₹2.50
PE Ratio	10 times	7 times
Price quoting per share on BSE before the merger announcement	₹35	₹17.50

Required:

- (i) The number of equity shares to be issued by B Ltd. for acquisition of S Ltd.
- (ii) What is the EPS of B Ltd. after the acquisition?
- (iii) Determine the equivalent earnings per share of S Ltd. and calculate per share gain or loss to shareholders of S Ltd.

- (iv) What is the expected market price per share of B Ltd. after the acquisition, assuming its PE Multiple remains unchanged?
- (v) Determine the market value of the merged firm.
- (vi) After the announcement of merger, price of shares of S Ltd. rose by 10% on BSE. Mr. X, an investor, having 10,000 shares of S Ltd. is having another investment opportunity, which yields annual return of 14% is seeking your advice whether he needs to offload the shares in the market or accept the shares from B Ltd.

Jan 21 (8 Marks), May 18 (8 Marks), RTP May 22, StudyMat

Answer:

(i) The number of shares to be issued by B Ltd.:

The Exchange ratio is 2:3

So, new Shares = $1,80,000 \times 2/3 = 1,20,000$ shares

(ii) EPS of B Ltd. after acquisition:

Total Earnings ($\text{₹}21,00,000 + \text{₹}4,50,000$)	₹25,50,000
No. of Shares ($6,00,000 + 1,20,000$)	7,20,000
EP	(₹25,50,000/7,20,000) ₹3.54 or ₹3.54

(iii) Equivalent EPS of S Ltd. and gain/loss to shareholders:

Equivalent EPS of S Ltd. ($\text{₹}3.54 \times 2/3$)	₹2.36
Less: EPS before merger	₹2.50
Loss	(₹0.14)

(iv) New Market Price of B Ltd. (P/E remaining unchanged):

Present P/E Ratio of B Ltd.	10 times
Expected EPS after merger	₹3.54
Expected Market Price (₹3.54 × 10)	₹35.40

(v) Market Value of merged firm:

Total number of Shares	7,20,000
Expected Market Price	₹35.40
Total Value	₹25,42,80,000

(vi) Decision regarding offloading of shares

(1) Equivalent EPS of S Ltd.	₹2.36
(2) BSE price per share before merger announcement	₹17.50
(3) After the merger announcement 10% increase in price of share	₹1.75
(4) Present Market Price of share (2 + 3)	₹19.25
(5) Return on Market Price per share (1/4)	12.26

As Mr. X is having another opportunity to earn 14% and expected return on S Ltd.'s share is 12.26%, it is advisable to offload in market.

Question 4

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?

May 24 (4 Marks), Nov 14 (5 Marks), MTP Feb 16 (5 Marks), StudyMat

Answer:

5 lakhs are holders of Doom Ltd. will get 5 lakhs shares of Elrond Limited, so they will get

$$= \frac{5 \text{ lakhs}}{20 \text{ lakh} + 5 \text{ lakh}} = 20\% \text{ of shares Elrond Limited}$$

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 5

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.

July 21 (8 Marks), MTP Mar 23 (8 Marks)

Answer:

(i) Net cost of acquisition shall be computed as follows:

Cash Paid for the shares of Tall Ltd. ($₹60 \times 18,00,000$)	₹10,80,00,000
Less: Value of Tall Ltd., as a separate entity ($18,00,000 \times ₹50$)	₹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
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.

$$= D1/P0 + g$$

Growth rate under new management after acquisition = $₹3/50 + 0.06 = 12\%$

Value of Merged company assuming perpetual growth = 8%

Value of merged company

$$(\text{₹}180 \times 30,00,000) + (\text{₹}3 / (0.12 - 0.08) \times 18,00,000 = \text{₹}67,50,00,000$$

$$= 54,00,00,000 + (75 \times 18,00,000)$$

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 ($6,00,000 \times 187.50$) 11,25,00,000

Less: CMP ($18,00,000 \times 50$) 9,00,00,000

Net Cost of acquisition 2,25,00,000

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	₹9,00,00,000
Net Cost of acquisition of Tall Ltd.	₹1,80,00,000

(iii) Calculation of gain from acquisition:

Total Earnings of Long Ltd. ($₹12 \times 30,00,000$)	₹3,60,00,000
Total Earnings of Tall Ltd. ($₹5 \times 18,00,000$)	₹90,00,000
Combined Earnings	₹4,50,00,000
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. ($₹180 \times 30,00,000$)	₹54,00,00,000
Tall Ltd. ($₹50 \times 18,00,000$)	₹9,00,00,000
Gain from Acquisition	₹4,50,00,000

Question 6

SK Ltd. has a surplus cash of ₹150 lakhs and wants to distribute 30% of it to the shareholders. The company decided to buy-back shares. The company estimates that its share price after the buy-back is likely to be 15% above the buy-back price. The number of shares outstanding at present is 15 lakhs and the current EPS is ₹4.

You are required to determine:

- The price at which the shares can be bought-back, if the market capitalization of the company should be ₹400 lakhs after buy-back.
- The number of shares that can be bought-back, and
- The impact of this buy-back on the EPS, assuming that the net income remains the same.

July 21 (8 Marks), May 19 (8 Marks), MTP Sep 22 (8 Marks)

Answer:**(i) Let P be the buyback price decided by SK Ltd.**

Market Capitalisation after Buyback

$1.15P$ (Original Shares - Shares Bought Back)

$$400 \text{ lakhs} = 1.15P \left(15 \text{ lakhs} - \frac{30\% \text{ of } 150 \text{ lakhs}}{P} \right)$$

$$400 \text{ Lakhs} = 17.25 \text{ lakhs} \times P - 45 \text{ lakhs} \times 1.15 = 17.25 \text{ lakhs } P - 51.75 \text{ lakhs}$$

$$\text{Again, } 400 \text{ Lakhs} = 17.25 \text{ lakhs } P - 51.75 \text{ lakhs}$$

$$\text{or } 17.25 \text{ lakhs } P = 400 \text{ lakhs} + 51.75 \text{ lakhs}$$

$$\text{or } P = \frac{451.75}{17.25} = ₹26.19 \text{ per share}$$

(ii) Number of Shares to be Bought Back :

$$\frac{₹45 \text{ lakh}}{₹26.19} = 1.718 \text{ lakhs (approx.) or } 171821 \text{ share}$$

(iii) Impact of Buy Back on the EPS:

No. of equity shares after buy back :-

$$15 \text{ lakhs} - 1.718 \text{ lakhs} = 13.282 \text{ lakhs or}$$

$$15,00,000 - 1,71,821 = 13,28,179 \text{ shares}$$

$$\therefore \text{EPS} = \frac{4 \times 15 \text{ lakhs}}{13.282 \text{ lakhs}} = ₹4.52 \text{ or } \frac{4 \times 15 \text{ lakhs}}{13,28,179} = ₹4.52$$

Thus, EPS of SK Ltd., increases to ₹4.52 or increases by ₹0.52 (4.52 - 4.00)

Question 7

High Growth Ltd. (HGL) was having an excellent growth over a number of years. The Board of Directors is considering a proposal to reward its shareholders by buying back 20% shares at a premium. The premium is to be paid by raising a loan from the Bank. The interest on loan is to be serviced by internal accruals as supported by the financials of HGL. The company has a market capitalization of ₹15,000 crore and the current Earnings Per Share (EPS) is ₹600 with a Price Earnings Ratio (PER) of 25. The Board expects a post buy back Market Price per Share (MPS) of ₹10,000. The PER, post buy back, will remain the same. The loan can be availed at an interest rate of 16 % p.a.

Applicable corporate tax rate is 30%.

You are required to calculate:

- The interest amount which can be paid for availing the bank loan.
- The loan amount to be raised.
- Buy back premium per share.

May 23 (10 Marks)

Answer:

- (i) The interest amount which can be paid for availing the bank loan

Current Market Price per Share = ₹600 × 25 = ₹15,000

$$\text{No. of Shares before Buyback} = \frac{\text{Market capitalisation}}{\text{Market price of share}} = \frac{15,000 \text{ crore}}{15,000} = 1 \text{ crore}$$

No. of Shares proposed to Buyback = 20% of 1 crore = 20 lakh

Total No. of Share after Buyback = 1 crore – 20 lakh = 80 lakh

Post Buy back Market Price per Share = ₹10,000

PE Ratio = 25

$$\text{Post Buyback EPS} = \frac{10000}{25} = ₹400$$

EAT before Buyback = ₹600 × 1 crore = ₹600 crore

$$\text{EBT before Buyback} = \frac{600}{(1 - 0.30)} = ₹857.1429 \text{ crore}$$

EAT after Buyback = ₹400.00 × 80 lakh = ₹320 crore

$$\text{EBT after Buyback} = \frac{320}{(1 - 0.30)} = ₹457.1429 \text{ crore}$$

Interest which can be paid for availing bank loan:

EBT before Buyback ₹857.1429 crore

(-) EBT after Buyback ₹457.1429 crore

₹400 crore

Alternatively, it can also be computed as follows:

Pre Buy back Market Capitalization (A)	₹15000 crore
Pre Buy back EPS (B)	₹600
Pre Buy back PER (C)	25
Pre Buy back Market Price Per Share (₹600×5) D = B×C	₹15000
Pre Buy back No. of Shares (A)/ (D)	1 Crore
Post Buy back EPS (A) (₹10000/ 25)	₹400
Post Buy back No. of shares (B)	80 Lakh
Post Buy back Earning (C) = (A) × (B)	₹320 crore
Pre Buy back Earning 1 Crore × ₹600 (D)	₹600 crore
Post Tax Earning available for interest payment (D) – (C)	₹280 Crore
Pre – Tax amount of Interest $\frac{280 \text{ crore}}{1 - 0.30}$	₹400 Crore

- (ii)

$$\text{Loan Amount raised} = \frac{400 \text{ crore}}{0.16} = ₹2500 \text{ crore}$$

(iii) Buyback Premium per Share

Amount of Loan for Buyback of 20 % Shares = ₹2500 crore

No. of Shares Buyback = 20 Lakh

Buyback price per Share = ₹2500 Crore/ 20 Lakh = ₹12500

Market Price after Buyback = ₹10000

Buyback Premium Per Share = ₹12500 – ₹10000 = ₹2500

Alternatively, it can also be computed as follows:

Amount of Loan (A)	₹2500 crore
No. of Shares to be bought back (B)	20 Lakh
Price Per Share to be paid (C) = (A)/ (B)	₹12,500
Post Buy back Share Price (D)	₹10,000
Buy Back Premium per share (C) – (D)	₹2,500

Question 8

The following are the financial statements of A Ltd., and B Ltd. for the financial year ended 31st March, 2020. Both the companies are working in the same industry.

Balance sheet (₹)		
Particulars	A Ltd.	B Ltd.
Total Current Assets	15,00,000	12,00,000
Total Net Fixed Assets	12,00,000	6,00,000
Total Assets	27,00,000	18,00,000
Equity Capital (Face Value ₹10)	10,00,000	8,00,000
Retained Earnings	3,00,000	-
14% Long Term Debt	7,00,000	5,00,000
Total Current Liabilities	7,00,000	5,00,000
Total Liabilities	27,00,000	18,00,000
Income Statement (₹)		
Particulars	A Ltd.	B Ltd.
Net Sales	33,10,000	16,60,000
Gross Profit	2,22,222	2,22,222
Operating Expenses	2,00,000	1,00,000
Interest	98,000	70,000
EBT	2,22,222	2,22,222
Tax @30%	1,17,600	51,000
PAT	2,22,222	2,22,222
Additional information:		
Dividend Pay-out Ratio	40%	60%
Market Price per Share	40	15

You are required to calculate:

- Earnings Per Share (EPS), Profit Earning Ratio (PER), Return on Equity (ROE) and Book Value Per Share (BVPS) for both the firms.
- Estimate future EPS growth rate for both the firms.
- If on acquisition of B Ltd. by A Ltd., intrinsic value of B Ltd., will be ₹20 per share, develop range of justifiable Exchange Ratio (ER) that can be offered by A Ltd., to shareholders of B Ltd.

- (iv) Based on your analysis in (i) and (ii) whether the negotiated ratio will be close to upper or lower range, Justify.
- (v) Post-merger EPS on an ER of 0.4:1. What will be immediate accretion or dilution to EPS to the shareholders of both the firms?
- (vi) Post-Merger MPS on the basis of ER of 0.4:1

Jan 21 (12 Marks), MTP April 18, MTP Aug 18 (12 Marks), MTP Oct 18 (8 Marks)

Answer:

Market price per share (MPS) = EPS × P/E ratio or P/E ratio = MPS/EPS

(i) Determination of EPS, P/E ratio, ROE and BVPS of A Ltd. and B Ltd.

		A Ltd.	B Ltd.
Profit After Tax	(PAT)	₹2,74,400	₹1,19,000
No. of Shares	(N)	100000	80000
EPS	(PAT/N)	₹2.744	₹1.4875
Market price per share	(MPS)	40	15
P/E Ratio	(MPS/EPS)	14.58	10.08
Equity Funds	(EF)	₹13,00,000	₹8,00,000
BVPS	(EF/N)	13	10
ROE	(EAT/EF) × 100	21.11%	14.88%

(ii) Estimation of growth rates in EPS for A Ltd. and B Ltd.

Retention Ratio	(1-D/P ratio)	0.6	0.4
Growth Rate	(ROE × Retention Ratio)	12.67%	5.95%

(iii) Range of Justifiable exchange ratio

(a) Intrinsic value based		= ₹20 / ₹40	= 0.5:1 (upper limit)
(b) Market price based	= MPS _{DA} /MPS _{BA}	= ₹15 / ₹40	= 0.375:1 (lower limit)

- (iv) Since, A Ltd. has a higher EPS, ROE, P/E ratio and even higher EPS growth expectations, the negotiable terms would be expected to be closer to the **lower limit**, based on the existing share prices.

(v) Calculation of Post merger EPS and its effects

Particulars			A Ltd.	B Ltd.	Combined
EAT	(₹)	(i)	2,74,400	1,19,000	3,93,400
Share outstanding		(ii)	100000	80000	132000*
EPS	(₹)	(i) / (ii)	2.744	1.4875	2.980
EPS Accretion (Dilution)	(₹)		0.236	(0.296***)	

(vi) Estimation of Post merger MPS

Particulars			A Ltd.	B Ltd.	Combined
EPS	(₹)	(i)	2.744	1.4875	2.980
P/E Ratio		(ii)	14.58	10.08	14.58
MPS	(₹)	(i) × (ii)	40	15	43.45

* Shares outstanding (combined) = 100000 shares + (.40 × 80000) = 132000 shares

** EPS claim per old share = ₹2.98 × 0.4 ₹1.192

***EPS dilution = ₹1.4875 – ₹1.192 ₹0.296

Question 9

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 (₹ 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.

MTP April 21 (8 Marks)

Answer:

Working Notes:

i) The Earnings of S Ltd.

	₹ lakh
Earnings of C Ltd.	10000
Earnings of D Ltd.	5800
	15800
Growth	0.08
Earnings of S Ltd. (15800 × 1.08)	17064

ii) Market Value of S Ltd.

	₹ 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	₹65818.29 lakh
Market Value of P Ltd. before merger (5800 × 10)	₹58000.00 lakh
Gains to Shareholders	₹7818.29 lakh
No. of Shares (before merger)	1000 lakh
Gain Per Share	₹7.82

Question 10

T Ltd. and E Ltd. are in the same industry. The former is in negotiation for acquisition of the latter. Important information about the two companies as per their latest financial statements is given below:

	T Ltd.	E Ltd.
₹10 Equity shares outstanding	12 Lakhs	6 Lakhs
Debt:		
10% Debentures (₹ Lakhs)	580	--
12.5% Institutional Loan (₹ Lakhs)	--	240
Earnings 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%.

ANALYZE the following under both alternatives i.e. as per T Ltd.'s offer and E Ltd.'s plan:

- Net consideration payable.
- No. of shares to be issued by T Ltd.
- EPS of T Ltd. after acquisition.
- Expected market price per share of T Ltd. after acquisition.
- State briefly the advantages to T Ltd. from the acquisition.

Note: Calculations (except EPS) may be rounded off to 2 decimals in lakhs.

May 10 (16 Marks), RTP May 18, MTP Oct 18 (8 Marks), StudyMat

Answer:

As per T Ltd.'s Plan

	₹ in lakhs
(i) Net Consideration Payable	
7 times EBIDAT, i.e. $7 \times ₹115.71$ lakh	809.97
Less: Debt	240.00
	569.97
(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)	88.00
	₹428.57
Less: 30% Tax	128.57
Total earnings (NPAT)	300.00
Total no. of shares outstanding (12 lakh + 2.59 lakh)	14.59 lakh
EPS (₹300 lakh/ 14.59 lakh)	₹20.56

Expected Market Price

	₹ in lakhs
Pre-acquisition PE multiple	
EBIDAT	400.86
Less: Interest $\left(580 \times \frac{10}{100}\right)$	58.00
	342.86
Less: 30% Tax	102.86
	240.00
No. of shares (lakhs)	12.00
EPS	₹20.00
Hence, PE multiple $\frac{220}{20}$	11
Expected market price after acquisition (₹20.56 $\times$ 11)	₹226.16

As per E Ltd.'s Plan

	₹ in lakhs
Net consideration payable (6 lakhs shares $\times$ ₹110)	660

No. of shares to be issued by T Ltd (₹660 lakhs ÷ ₹220 or 6 lakhs × 0.50)	3 lakhs
EPS of T Ltd after Acquisition	
NPAT (as per earlier calculations)	300.00
Total no. of shares outstanding (12 lakhs + 3 lakhs)	15 lakhs
Earning Per Share (EPS) ₹300 lakh/15 lakh	₹20.00
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 11

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 lakhs	100 lakhs
Free Reserve and Surplus (₹)	800 lakhs	500 lakhs
Paid up Value per share (₹)	100	10
Free float Market Capitalisation (₹)	400 lakhs	128 lakhs
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%

Qa? What is the swap ratio based on above weights?

Qb? 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)?

Qc? Calculate:

- a. Promoter's revised holding in the Abhiman Ltd.
- b. Free float market capitalization.
- c. Also calculate No. of Shares, earning per Share (EPS) and Book Value (B.V.), if after acquisition of Abhishek Ltd., Abhiman Ltd. decided to:
 - i. Issue Bonus shares in the ratio of 1:2; and

- ii. Split the stock (share) as ₹5 each fully paid.

June 09 (20 Marks), RTP May 20, MTP March 17 (8 Marks), StudyMat

Answer:

2a2

Swap Ratio

	Abhiman Ltd.	Abhishek Ltd.
Share Capital	200 Lakh	100 Lakh
Free Reserves	800 Lakh	500 Lakh
Total	1000 Lakh	600 Lakh
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. relating to Public's holding	400 Lakh	128 Lakh
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 × 40 lakh)	₹80 lakh	-
(₹8 × 10 lakh)	-	₹80 lakh

Calculation of Swap Ratio

Book Value	1 : 0.12	$0.12 \times 25\%$	0.03
EPS	1 : 0.2	$0.20 \times 50\%$	0.10
Market Price	1 : 0.08	$0.08 \times 25\%$	0.02
		Total	0.15

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 Lakh × 0.15 = 1.50 lakh shares

(b) Book Value, EPS & Market Price

Total No. of Shares	2 Lakh + 1.5 Lakh	= 3.5 Lakh
Total Capital	200 Lakhs + 150 Lakh	= ₹350 Lakh
Reserves	800 Lakhs + 450 Lakhs	= ₹1250 Lakhs
Book Value	$(350 + 1250)/3.5$ Lakh	= ₹457.14 per share
EPS	Total Profit/ No. of Share = $(80+80)/3.5$	= ₹45.71
Expected Market Price	= EPS × PE Ratio = 45.71×10	= ₹457.10

Q.2

Q.2 Promoters Revised Holding

Abhiman 50% 1.00 Lakh Shares

Abhishek 60% 0.90 Lakh Shares

1.90 Lakh Shares

Promoters Holding % $1.90/3.50 = 54.29\%$ **Q.2 Free Float Market Capitalisation**Free Float Market = $(3.5 \text{ lakh} - 1.9 \text{ lakh}) \times ₹457.10$ **Capitalisation** = ₹731.36 lakh**Q.2 Stock Split and Bonus Issue**

Revised Capital (₹350 Lakh + ₹175 Lakh) = ₹525 Lakh

No. of shares before Split (F.V ₹100) = 5.25 Lakh

No. of Shares after Split (F.V. ₹5) 5.25×20 = 105 Lakh

EPS 160 Lakh / 105 Lakh = ₹1.523

Book Value $(525+1075)/105$ = ₹15.238 per share**Question 12**

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 percent.

The promoters holding is to be restricted to 75 per cent as per the norms of listing requirement.

The Board of Directors have decided to fall in line to restrict the Promoters' holding to 75 percent by issuing Bonus Shares to minority shareholders while maintaining the same Price Earnings Ratio (P/E).

You are required to calculate:

- (i) Bonus Ratio;
- (ii) MPS after issue of Bonus Shares; and
- (iii) Free float Market capitalisation after issue of Bonus Shares

MTP Oct 21 (8 Marks), May 18 (8 Marks)

Answer:**(i) No. of Bonus Shares to be issued**

Free Float Capitalization = ₹45 crore

Market Price Per Share = ₹150

Shares of Minority = $\frac{₹45 \text{ Crore}}{₹150}$ = 30 LacsMinority Share Holding $(100\% - 80\%)$ = 20%Hence Total shares = $\frac{30 \text{ lacs}}{0.20}$ = ₹150 Lacs

Promoters holding 80%, = 120 lacs shares

Shares remains the same, but holding % to be taken as 75%

$$\text{Hence Total shares} = \frac{120 \text{ lacs}}{0.75} = 160 \text{ Lacs}$$

$$\text{Shares of Minority} = 160 \text{ lacs} - 120 \text{ lacs} = 40 \text{ lacs}$$

Bonus 10 lacs for 30 lacs i.e. 1 share for 3 shares held.

(ii) Market price after Bonus issue

Let us compute PE with given k_e as follows:

$$PE = \frac{1}{K_e} = \frac{1}{0.20} = 5$$

$$\text{Market Price Given} = ₹150$$

$$\text{Hence EPS will be } (₹150/5) = ₹30$$

$$\text{Total No. of shares before bonus issue} = 150 \text{ lacs}$$

$$\text{Accordingly, Total PAT shall be } (₹30 \times 150 \text{ lacs}) = ₹4500 \text{ lacs}$$

$$\text{Total No. of shares after bonus issue} = 150 \text{ lacs} + 10 \text{ lacs} = 160 \text{ lacs}$$

$$\text{EPS after Bonus Issue} = ₹4500 \text{ lacs} / 160 \text{ lacs} = ₹28.125$$

$$\text{Market Price After Bonus Issue} = ₹28.125 \times 5 = ₹140.63$$

(iii) Free Float Capitalization after Bonus Issue

$$₹140.63 \times 40 \text{ lacs} = ₹5,625.20 \text{ lacs i.e. ₹56.252 crore}$$

Note: Since the information regarding the promoters' holding is missing in the question, above solution is based on assumption of promoter's holding as 80%. However, student can assume any % other than 80% and solve the question accordingly.

Question 13

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/Capital Risk Weight Asset Ratio)	5	16	28
Market price per Share (MPS)	12	96	32
Book value			10
Trading on Stock Exchange	Irregular	Frequent	

Balance Sheet

(₹ in Lakhs)

Particulars	Weak Bank (W)	Strong Bank (S)
Paid up Share Capital (₹10 per share)	150	500
Reserves & Surplus	80	5,500
Deposits	4,000	44,000
Other Liabilities	890	2,500

Total Liabilities	5,120	52,500
Cash in Hand & with RBI	400	2,500
Balance with Other Banks		2,000
Investments	1,100	19,000
Advances	3,500	27,000
Other Assets	70	2,000
Preliminary Expenses	50	-
Total Assets	5,120	52,500

You are required to

- Calculate Swap ratio based on the above weights:
- 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.

May18 (12 Marks), MTP April 22 (10 Marks), MTP Oct 19 (8 Marks), StudyMat

Answer:

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

No. of Equity Shares to be issued

$$\frac{150}{10} \times 0.1750 = \mathbf{2.625 \text{ lakh shares}}$$

iii) 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
	₹5500.00		₹5500.00

iv) Calculation CAR of Weak Bank 'S' after merger

$$\frac{\text{CAR}}{\text{CRWAR}} = \frac{\text{Total Capital}}{\text{Risky Weighted Assets}} = \frac{6180}{41100} \times 100 = 15.04\%$$

	Weak Bank	Strong Bank	Merged
CAR	5%	16%	
Total Capital	₹180 lac	₹6000 lac	₹6180 lac
Risky Weighted Assets	₹3600 lac	₹37500 lac	₹41100 lac

$$\text{GNPA Ratio} = \frac{\text{Gross NPA}}{\text{Gross Advances}} \times 100 = \frac{2750}{30500} \times 100 = 9.02\%$$

	Weak Bank	Strong Bank	Merged
GNPA (given)	0.40	0.05	
Gross Advances	₹3500 lacs	₹27000 lacs	₹30500 lacs
Risky Weighted Assets	₹1400 lacs	₹1350 lacs	₹2750 lacs

Question 14

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.

Dec 21 (8 Marks), RTP May 21, Nov 18 (12 Marks), MTP March 21 (12 Marks)

Answer:

(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,

$$\frac{₹3200 \text{ Lakh}}{\left(\frac{1600 \text{ Lakh}}{D+400}\right) \times 8} = D$$

$$D = 133.333 \text{ lakh Shares}$$

$$\text{Exchange Ratio} = 133.333 / 200 = 0.6666:1$$

(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,

$$\frac{₹2800 \text{ Lakh}}{\left(\frac{1600 \text{ Lakh}}{D+400}\right) \times 10} = D$$

$$D = 84.8485 \text{ lakh Shares}$$

$$\text{Exchange Ratio} = 84.8485 / 200 = 0.4242:1$$

Question 15

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?

May 24 (6 Marks), May 14 (5 Marks), MTP Sep 22 (8 Marks), MTP Oct 18 (8 Marks), StudyMat

Answer:

Q2 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 Over-payment	₹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,

$$40 = \frac{24 \times 10,00,000 + 40 \times 15,00,000 + 80,00,000 + 30,00,000}{15,00,000 + 10,00,000 \times ER}$$

$$ER = 0.875$$

$$MP = PE \times EPS \times ER = \frac{40}{4} \times ₹4 \times 0.875 = ₹35$$

Q1 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 16

R Ltd. and S Ltd. operating in same industry are not experiencing any rapid growth but providing a steady stream of earnings. R Ltd.'s management is interested in acquisition of S. Ltd. due to its excess plant capacity. Share of S Ltd. is trading in market at ₹3.20 each. Other data relating to S Ltd. is as follows:

Balance Sheet of S Ltd.

Liabilities	Amount (₹)	Assets	Amount (₹)
Current Liabilities	1,59,80,000	Current Assets	2,48,75,000
Long Term Liabilities	1,28,00,000	Other Assets	94,00,000
Reserve & Surplus	2,79,95,000	Property Plants & Equipment	3,45,00,000
Share Capital (80 Lakhs shares of ₹1.5 each)	1,20,00,000		
Total	₹5,87,70,000	Total	₹6,87,75,000

Particulars	R Ltd. (₹)	S Ltd. (₹)	Combined Entity (₹)
Profit after Tax	86,50,000	49,72,000	1,21,85,000
Residual Net Cash Flows per year	90,10,000	54,87,000	1,85,00,000
Required return on equity	13.75%	13.05%	12.5%

You are required to compute the following:

- Minimum price per share S Ltd. should accept from R Ltd.
- Maximum price per share R Ltd. shall be willing to offer to S Ltd.
- Floor Value of per share of S Ltd., whether it shall play any role in decision for its acquisition by R Ltd.

May 19 (8 Marks)

Answer:**Calculation of Minimum price per share S Ltd. should accept from R Ltd.**

Value of S Ltd.	$= \frac{\text{Residual Cash Flow}}{k_e - g} = \frac{54,87,000}{0.1305 - 0} = ₹4,20,45,977$
Value per share of S Ltd.	$= \frac{4,20,45,977}{80,00,000} = ₹5.26$
Book Value of per share of S Ltd.	$= \frac{3,99,95,000}{80,00,000} = ₹4.99 \text{ or } ₹5$

Therefore, the minimum price per share S Ltd. should accept from R Ltd. is ₹5 (current book value)

Calculation of Maximum price per share R Ltd. shall be willing to offer to S Ltd.

$$\text{Value of R Ltd.} = \frac{\text{Residual Cash Flow}}{k_e - g} = \frac{90,10,000}{0.1375 - 0} = ₹6,55,27,273$$

$$\text{Value of Combined entity} = \frac{1,85,00,000}{0.125-0} = ₹14,80,00,000$$

Value of synergy = Value of Combined entity – Individual values of R Ltd. and S Ltd.

$$= ₹14,80,00,000 - (₹4,20,45,977 + ₹6,55,27,273)$$

$$= ₹4,04,26,750$$

Maximum price per share R Ltd. shall be willing to offer to S Ltd. shall be computed:

$$\begin{aligned} &= \frac{\text{Value of S Ltd. as per Residual cash flows} + \text{Synergy benefits}}{\text{No. of Shares}} \\ &= \frac{4,20,45,977 + 4,04,26,750}{80,00,000} \\ &= ₹10.31 \end{aligned}$$

Floor value of per share of S Ltd shall be **₹3.20 (current market price)** and it shall not play any role in decision for the acquisition of S Ltd. as it is lower than its current book value.

Question 17

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

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

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

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

Poly Ltd. requires a return of 14%

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

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

Jan 21 (6 Marks), Nov 13 (10 Marks), StudyMat

Answer:

Calculation of Purchase Consideration

	₹
Issue of Share 35000 × ₹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 of Project of Cash Inflow of Project of Demerger of Leopard Ltd. – Cash Outflow

$$= ₹5,00,000 \text{ PVAF } (16\%, 6) + ₹2,00,000 \text{ PVF } (16\%, 6) - ₹10,75,000$$

$$= ₹5,00,000 \times 3.684 + ₹2,00,000 \times 0.410 - ₹10,75,000$$

$$= ₹18,42,000 + ₹82,000 - ₹10,75,000$$

$$= ₹8,49,000$$

Since NPV of the decision is positive it is advantageous to acquire Leopard Ltd.

Question 18

Yes Ltd. wants to acquire No Ltd. and the cash flows of Yes Ltd. and the merged entity are given below:

	(₹ in lakhs)				
Year	1	2	3	4	5
Yes Ltd.	175	200	320	340	350
Merged Entity	400	450	525	590	620

Earnings would have witnessed 5% constant growth rate without merger and 6% with merger on account of economies of operations after 5 years in each case. The cost of capital is 15%.

The number of shares outstanding in both the companies before the merger is the same and the companies agree to an exchange ratio of 0.5 shares of Yes Ltd. for each share of No Ltd.

PV factor at 15% for years 1-5 are 0.870, 0.756; 0.658, 0.572, 0.497 respectively.

You are required to:

- Compute the Value of Yes Ltd. before and after merger.
- Value of Acquisition and
- Gain to shareholders of Yes Ltd.

Nov 12 (8 Marks), RTP Nov 14, RTP Nov 18, MTP Feb 14 (8 March), MTP Aug 17 (8 Marks), StudyMat

Answer:

Working Notes:

Present Value of Cash Flows 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	173.95	620	308.14
			782.44		1683.27

PV of Cash Flows of Yes Ltd. after the forecast period

$$TV_5 = \frac{CF_5(1+g)}{K_e - g} = \frac{350(1+0.05)}{0.15-0.05} = \frac{367.50}{0.10} = ₹3675 \text{ lakhs}$$

$$PV \text{ of } TV_5 = ₹3675 \text{ lakhs} \times 0.497 = ₹1826.475 \text{ lakhs}$$

PV of Cash Flows of Merged Entity after the forecast period

$$TV_5 = \frac{CF_5(1+g)}{K_e - g} = \frac{620(1+0.06)}{0.15-0.06} = \frac{657.20}{0.09} = ₹7302.22 \text{ lakhs}$$

$$PV \text{ of } TV_5 = ₹7302.22 \text{ lakhs} \times 0.497 = ₹3629.20 \text{ lakhs}$$

(ii) 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	1826.475	3629.20
	2708.915	5308.47

(iii) Value of Acquisition

$$= \text{Value of Merged Entity} - \text{Value of Yes Ltd.}$$

$$= ₹5308.47 \text{ lakhs} - ₹2708.915 \text{ lakhs}$$

$$= ₹2599.555 \text{ lakhs}$$

(iv) Gain to Shareholders of Yes Ltd.

$$\text{Share of Yes Ltd. in merged entity} = ₹5308.47 \text{ lakhs} \times \frac{1}{1.5} = ₹3538.98 \text{ lakhs}$$

$$\begin{aligned} \text{Gain to shareholder} &= \text{Share of Yes Ltd. in merged entity} - \text{Value of Yes Ltd. before merger} \\ &= ₹3538.98 \text{ lakhs} - ₹2708.915 \\ &= ₹830.065 \text{ lakhs} \end{aligned}$$

Question 19

Two companies Bull Ltd. and Bear Ltd. recently have been merged. The merger initiative has been taken by Bull Ltd. to achieve a lower risk profile for the combined firm in spite of fact that both companies belong to different industries and disclose a little co-movement in their profit earning streams. Though there is likely to synergy benefits to the tune of ₹7 crore from proposed merger. Further both companies are equity financed and other details are as follows:

	Market Capitalization	Beta
Bull Ltd.	₹1000 crore	1.50
Bear Ltd.	₹500 crore	0.60

Expected Market Return and Risk-Free Rate of Return are 13% and 8% respectively. Shares of merged entity have been distributed in the ratio of 2:1 i.e. market capitalization just before merger. You are required to:

- (c) Calculate return on shares of both companies before merger and after merger.
 (d) Calculate the impact of merger on Mr. X, a shareholder holding 4% shares in Bull Ltd. and 2% share of Bear Ltd.

RTP Nov 15

Answer:**Qa Expected Return using CAPM****Qa Before Merger**

Share of Bull Ltd.	$8\% + 1.50(13\% - 8\%) =$	15.50%
Share of Bear Ltd.	$8\% + 0.60(13\% - 8\%) =$	11.00%

Qib After Merger

Beta of merged company shall be weighed average of beta of both companies as follows: $= \frac{2}{3} \times 1.50 + \frac{1}{3} \times 0.60 = 1.20$

Thus, expected return shall be: $8\% + 1.20(13\% - 8\%) = 14\%$

Qib Impact of merger on Mr. X

After merger his % holding in merged company shall be:

$$\frac{2}{3} \times 4\% + \frac{1}{3} \times 2\% = 3\frac{1}{3}\%$$

The value of Mr. X's holdings before merger was:

Bull Ltd.	$4\% \times ₹1000 \text{ crore}$	₹40 crore
Bear Ltd.	$2\% \times ₹500 \text{ crore}$	₹10 crore
		₹50 crore

To compute the value of holding of Mr. X, after merger first we have to compute the value of merged entity as follows:

Bull Ltd.	$15.50\% \times ₹1000 \text{ crore}$	₹155 crore
Bear Ltd.	$11.00\% \times ₹500 \text{ crore}$	₹55 crore
Synergy Benefits		₹7 crore
		₹217 crore

$$\text{Market Capitalization of Merged Entity} = \frac{₹217 \text{ crore}}{0.14} = ₹1550 \text{ crore}$$

$$\text{Value of Mr. X's holding} = ₹51.67 \text{ crore. } \left(₹1550 \text{ crore} \times 3\frac{1}{3}\% \right)$$

Value of Mr. X's holding as increased by ₹21.67 Crores

Question 20

MS Stones has different divisions of home interiors products. Recently, due to economic slowdown, the Managing Director of the Company expressed its desire to divestiture its ceramic tile business. The relevant financial details of this business are as follows:

Estimated Pre-Tax Cash Flow Next Year	=	₹200 Crore
Book Value of Liabilities	=	₹780 Crore

In an order to increase its share in the ceramic tile market, the Tripati Tiles Ltd. showed its interest in the acquisition of this unit and offered a proceed of ₹950 Crore for the same to MS Stones.

The other data pertaining to the business are as follows:

Tax Rate	30%
Growth Rate	4%
Applicable Discount Rate for Tile Business	12%

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

MTP March 17 (8 Marks)

Answer:

First of all, we shall compute PV of Cash Inflows as follows:

$$PVCF = \frac{200 \text{ crore} (1-0.30)}{0.12-0.04} = ₹1750 \text{ Crore}$$

Market Value of Liabilities = ₹780 Crore + ₹40 Crore = ₹820 Crore

Net Asset Value = ₹930 Crore

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

Question 21

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

Particulars	Unit 1	Unit 2
Reported Profit After Tax	147	140
Extra Ordinary Gains	16	8
Extra Ordinary Losses	20	12
Expected Profit from the branch of the new product	56	12
Price Earnings Ratio	10	12.5
Corporate tax Rate (%)	30	30

You are required to advise the Board on the following:

- The price at which the units can be divested,
- The unit which can be divested so as to minimize the borrowings from the market and
- The amount of borrowing.

Dec 21 (10 Marks)

Answer:**ii) Price at which units can be Disposed**

Particulars	Unit I	Unit II
Reported Profit after Tax (a)	147	140
Reported profit before Tax [(a) / 0.70]	210	200
Less: Extra Ordinary Gains	16	8
Add: Extra Ordinary Losses	20	12
	214	204
Profit from New Product	56	12
Profit before Tax	270	216
Less : Tax @ 30%	81	64.80
Future Maintainable Profit after Tax (b)	189	151.20
PE Ratio	10	12.5
Relevant Capitalization Factor (1/PE Ratio) (c)	10%	8%
Price of Unit [(b) / (c)]	1890	1890

iii) The unit I can be disposed as it has lower PE Ratio**iv) The amount of borrowings ₹2000 crore ₹1890 crore ₹110 crore****Question 22**The following is the Balance-sheet of XYZ Ltd as on March 31st 2013.

Liabilities	(₹in lakhs)	Assets	(₹in lakhs)
6 lakh Equity Shares of ₹100 each	600	Land and Building	200
2 lakh 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	300	Cash at bank	130
		Preliminary expenses	10
		Cost of issue of debentures	5
		Profit and Loss account	485
	1400		1400

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 devised:

- (i) Equity shares are to be reduced to ₹25/- per share, fully paid up;

- (ii) Preference shares are to be reduced (with Dividend rate of 10%) to equal number of shares of ₹50 each, fully paid up.
- (iii) Debenture holders have agreed to forgo the accrued interest due to them. Beside this, they have agreed to accept new debentures carrying a coupon rate of 9%.
- (iv) Trade creditors have agreed to forego 25 percent of their existing claim; for the balance sum they have agreed to convert their claims into equity shares of ₹25/- each.
- (v) 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.
- (vi) While Land and Building is to be revalued at ₹250 lakhs, Plant and Machinery was to be written down by ₹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.

Nov 11 (10 Marks), RTP Nov 23, RTP Nov 14, RTP Nov 18, RTP Nov 19, RTP Nov 20, May17 (8 Marks), MTP Apr 24 (8 Marks), MTP Apr 23 (8 Marks), MTP Aug 18 (8 Marks)

Answer:

Impact of Financial Restructuring

(i) Benefits to X Ltd

Reduction of Liabilities payable

	₹ in lakhs
Reduction in Equity Share capital (6 lakh shares × ₹75 per share)	450
Reduction in Preference Share capital (2 lakh shares × ₹50 per share)	100
Waiver of outstanding Debenture Interest	26
Waiver from Trade Creditors (₹300 lakhs × 0.25)	75
	651

Revaluation of Assets

Appreciation of Land and Building (₹250 lakhs - ₹200 lakhs)	50
	50

(ii) Amount of ₹701 lakhs utilized to write off losses, fictitious assets and overvalued assets

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 lakh - ₹104 lakhs)	196
	701

(iii) Balance sheet of XYZ Ltd as at 31st March 2024 after reconstruction (₹ in lakhs)

Liabilities	Amount	Assets	Amount
121 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 debtors	70
		Prov. for Doubtful Debts	-5
		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 23

Equity of KGF Ltd. (KGFL) is ₹410 Crores, its debt, is worth ₹170 Crores. Printer Division segments value is attributable to 74%, which has an Asset Beta (β_p) of 1.45, balance value is applied on Spares and Consumables Division, which has an Asset Beta (β_{sc}) of 1.20 KGFL Debt beta (β_D) is 0.24.

You are required to calculate:

- Equity Beta (β_E),
- Ascertain Equity Beta (β_E), if KGF Ltd. decides to change its Debt Equity position by raising further debt and buying back of equity to have its Debt Equity Ratio at 1.90. Assume that the present Debt Beta (β_{D1}) is 0.35 and any further funds raised by way of Debt will have a Beta (β_{D2}) of 0.40.
- Whether the new Equity Beta (β_E) justifies increase in the value of equity on account of leverage?

May 19 (8 Marks), MTP May 20 (12 Marks), RTP May 21

Answer:**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:

$$\beta_{\text{Asset}} = \beta_{\text{Equity}} \left[\frac{E}{E+D(1-t)} \right] + \beta_{\text{Debt}} \left[\frac{D(1-t)}{E+D(1-t)} \right]$$

Accordingly,

$$1.385 = \beta_{\text{Equity}} \left[\frac{410}{410+170} \right] + \beta_{\text{Debt}} \left[\frac{170}{410+170} \right]$$

$$1.385 = \beta_{\text{Equity}} \left[\frac{410}{580} \right] + 0.24 \left[\frac{170}{580} \right]$$

$$\beta_{\text{Equity}} = 1.86$$

Q12 Equity Beta on change in Capital Structure

Amount of Debt to be raised:

Particulars	Value
Total Value of Firm (Equity ₹410 Cr + Debt ₹170 Cr)	₹580 Cr
Desired Debt Equity Ratio	1.90 : 1.00
Desired Debt Level = $\frac{\text{Total Value} \times \text{Debt Ratio}}{\text{Debt Ratio} + \text{Equity Ratio}}$	₹380 Cr
Less: Value of Existing Debt	(₹170 Cr)
Value of Debt to be Raised	₹210 Cr

Equity after Repurchase	= Total value of Firm – Desired Debt Value
	= ₹580 Cr – ₹380 Cr
	= ₹200 Cr

Q13 Weighted Average Beta of FFL

Source of Finance	Investment (₹Cr)	Weight	Beta of the Division	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)

$$\beta_{KGFL} = 0.248 + 0.345x$$

$$1.385 = 0.248 + 0.345x$$

$$0.345x = 1.385 - 0.248$$

$$x = 1.137/0.345 = 3.296$$

$$\beta_{KGFL} = 3.296$$

Q14 Yes, it justifies the increase as it leads to increase in the value of Equity due to increase in beta

Question 24

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.

RTP May 21

Answer:

(i) 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:

$$\beta_{\text{Asset}} = \beta_{\text{Equity}} \left[\frac{E}{E+D(1-t)} \right] + \beta_{\text{Debt}} \left[\frac{D(1-t)}{E+D(1-t)} \right]$$

Accordingly,

$$1.496 = \beta_{\text{Equity}} \left[\frac{500}{500+290} \right] + \beta_{\text{Debt}} \left[\frac{290}{500+290} \right]$$

$$1.496 = \beta_{\text{Equity}} \left[\frac{500}{790} \right] + 0.28 \left[\frac{290}{790} \right]$$

$$\beta_{\text{Equity}} = 2.20$$

(ii) 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 = $\frac{\text{Total Value} \times \text{Debt Ratio}}{\text{Debt Ratio} \times \text{Equity Ratio}}$	
Less: Value of Existing Debt	(290)
Value of Debt to be Raised	184

$$\begin{aligned} \text{Equity after Repurchase} &= \text{Total value of Firm} - \text{Desired Debt Value} \\ &= ₹790 \text{ Crore} - ₹474 \text{ Crore} \\ &= ₹316 \text{ Crore} \end{aligned}$$

Weighted Average Beta of ABC

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)

$$\beta_{\text{ABCL}} = 0.282 + 0.4x$$

$$1.496 = 0.282 + 0.4x$$

$$0.4x = 1.496 - 0.282$$

$$X = 1.214/0.4 = 3.035$$

$$\beta_{\text{New Equity}} = 3.035$$

- (iii) Yes, it justifies the increase as it leads to increase in the Value of Equity due to increase in Beta.

Question 25

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

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 lakh
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 (i) : If the required amount is raised through debt, and

Option (ii) : If the required amount is raised through equity and the new shares will be issued at a price of ₹25 each.

Nov 19 (8 Marks)

Answer:

Working Notes

Calculation of Return on Capital Employed (ROCE)

	(₹ in crores)
Capital Employed:	
Share Capital (₹10 × 40 lakhs)	4
Reserves	8
Debt (₹1 cr. × 100/10)	10
	22
PBIT	5
ROCE	22.73%

Revised P/E IT

Existing Capital Employed	22
Additional	3

ROI	22.73%
Revised PBIT	5.6825

?? New Debt-Equity

Existing Debt	10
Additional Under Option (i)	3
Total Debt	13
Total Equity	12

$$\text{New Debt to Capital Employed Ratio} = \frac{13}{25} = 0.52$$

So, P/E Ratio to be reduced **to 8 times**

?? Debt to Capital Employed Ratio in Option ii $\frac{10}{25} = 0.40$

So, P/E Ratio to be reduced to 8 times in this case also

?? 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 (Option – I) Option – I is preferred.

Question 26

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:

- The amount of External Fund Requirement (EFR)
- The amount to be raised from Short Term, Long Term and Equity funds.

Jan 21 (8 Marks), MTP Mar 23 (8 Marks)

Answer:**(i) External Funds Requirement (EFR):**

	(₹)
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:

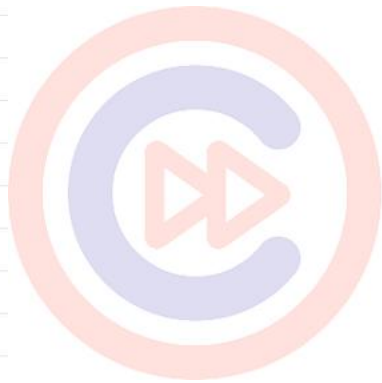
	(₹)
New amount of short-term loans and payables & provision $\left(\frac{3}{4} \times 600\right)$	450
Less: Existing Amount of short-term loans and payables & provision	500
Amount to be raised from short term funds	Nil

(2) Amount to be raised from Long term funds:

	(₹)
New fixed assets ($₹600 + 20\%$ 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:

	(₹)
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



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