CA FINAL AFM

Top 90 AFM Must-Solve Questions

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Security Valuation

Study Session 1

QUESTION NO. 8B (Nov 2019)

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.

SOLUTION 8B

(a) Working Notes:

(i) Computation of Growth Rate in Earning and EPS

Year	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

Year	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

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 NO. 9 (SM)(May 2016)

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.

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

SOLUTION 9

Value of share at present $= \frac{D_1}{K_e - g}$

$= \frac{2(1.06)}{0.08-0.06} =$ ₹ 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:

$P_O = \frac{2.50}{0.08-0.07} \times \frac{1}{(1+0.08)^3} =$ ₹ 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	$\frac{2.50}{0.08-0.07} \times \frac{1}{(1+0.08)}$	₹ 231.00
Expected market price after 1 years	$\frac{2.50}{0.08-0.07} \times \frac{1}{(1+0.08)^2}$	₹ 214.33

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.

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

Business Valuation

QUESTION NO. 5A (SM) (May 2022)

Following information's are available in respect of XYZ Ltd. which is expected to grow at a higher rate for 4 years after which growth rate will stabilize at a lower level:

Base year information:

Revenue	₹ 2,000 crores
EBIT	₹ 300 crores
Capital expenditure	₹ 280 crores
Depreciation	₹ 200 crores

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

	High Growth	Stable Growth
Growth in Revenue & EBIT	20%	10%
Growth in capital expenditure and depreciation	20%	Capital Expenditure are offset by depreciation
Risk Free Rate	10%	9%
Equity Beta	1.15	1
Market Risk Premium	6%	5%
Pre Tax Cost of debt	13%	12.86%
Debt equity ratio	1:1	2:3

For all time, working capital is 25% of revenue and corporate tax rate is 30%. What is the value of the firm?

SOLUTION 5A

High growth phase :

k_e = 0.10 + 1.15 x 0.06 = 0.169 or 16.9%.

k_d = 0.13 x (1-0.3) = 0.091 or 9.1%.

Cost of capital = 0.5 x 0.169 + 0.5 x 0.091 = 0.13 or 13%.

Stable growth phase :

k_e = 0.09 + 1.0 x 0.05 = 0.14 or 14%.

k_d = 0.1286 x (1 - 0.3) = 0.09 or 9%.

Cost of capital = 0.6 x 0.14 + 0.4 x 0.09 = 0.12 or 12%.

Determination of forecasted Free Cash Flow of the Firm (FCFF)

(₹ in crores)

	Yr. 1	Yr. 2	Yr 3	Yr. 4	Terminal Year
Revenue	2,400	2,880	3,456	4,147.20	4,561.92
EBIT	360	432	518.40	622.08	684.29
EAT	252	302.40	362.88	435.46	479.00
Capital Expenditure	96	115.20	138.24	165.89	-
Less Depreciation					
Working Capital	100.00	120.00	144.00	172.80	103.68
Free Cash Flow (FCF)	56.00	67.20	80.64	96.77	375.32

Alternatively, it can also be computed as follows:

(₹in crores)

	Yr. 1	Yr. 2	Yr 3	Yr. 4	Terminal Year
Revenue	2,400	2,880	3,456	4,147.20	4,561.92
EBIT	360	432	518.40	622.08	684.29
EAT	252	302.40	362.88	435.46	479.00
Add: Depreciation	240	288	345.60	414.72	456.19
	492	590.40	708.48	850.18	935.19
Less: Capital Exp.	336	403.20	483.84	580.61	456.19
Δ WC	100.00	120.00	144.00	172.80	103.68
	56.00	67.20	80.64	96.77	375.32

Present Value (PV) of FCFF during the explicit forecast period is:

FCFF (₹ in crores)	PVF @ 13%	PV (₹ in crores)
56.00	0.885	49.56
67.20	0.783	52.62
80.64	0.693	55.88
96.77	0.613	₹59.32
		217.38

Terminal Value of Cash Flow

$\frac{375.32}{0.12 - 0.10}$ = ₹18,766.00Crores

PV of the terminal, value is:

₹18,766.00Crores x $\frac{1}{(1.03)^4}$ = ₹18,766.00Crores x 0.613 = ₹11,503.56 Crores

The value of the firm is :

₹ 217.38 Crores + ₹ 11,503.56 Crores = ₹ 11,720.94 Crores

QUESTION NO. 5C (SM) (May 2016) (Nov 2011)

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 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. The Gross Margin Ratio, Assets Turnover Ratio, the Capital Structure Ratio 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.

Ignore Depreciation on existing strategy.

SOLUTION 5C

Projected Balance Sheet				
	Year 1	Year 2	Year 3	Year 4
Fixed Assets (40% of Sales)	9,600	11,520	13,824	13,824
Current Assets (20% of Sales)	4,800	5,760	6,912	6,912
Total Assets	14,400	17,280	20,736	20,736
Equity	14,400	17,280	20,736	20,736

Projected Cash Flows:-

	Year 1	Year 2	Year 3	Year 4
Sales	24,000	28,800	34,560	34,560
PBT (10% of sale)	2,400	2,880	3,456	3,456
PAT (70%)	1,680	2,016	2,419.20	2,419.20
Depreciation	800	960	1,152	1,382
Addition to Fixed Assets	2,400	2,880	3,456	1,382

Increase in Current Assets	800	960	1,152	-
Operating cash flow	(720)	(864)	(1,036.80)	2,419.20

Projected Cash Flows:-

Present value of Projected Cash Flows:-

Cash Flows	PVF at 15%	PV
-720	0.870	-626.40
-864	0.756	-653.18
-1,036.80	0.658	-682.21
		-1,961.79

Residual Value - 2419.20/0.15 = 16,128

Present value of Residual value	$16128/(1.15)^3$	
	16128/1.521 = 10603.55	
Total shareholders' value	10,603.55 – 1,961.79	8,641.76
Pre strategy value	1,400 / 0.15	9,333.33
Value of strategy	8,641.76 – 9,333.33	– 691.57

Conclusion: The strategy is not financially viable

QUESTION NO. 6A (SM) (June 2009)

Calculate the value of share from the following information;

Profit of the company or Earning for Equity	₹ 290crores
Equity capital of company	₹ 1,300 crores
Par value of share	₹ 40 each
Debt ratio of company	27
Long run growth rate of the company	8%
Beta 0.1, risk free interest rate	8.7%
Market return	10.3%
Capital expenditure per share	₹ 47
Depreciation per share	₹ 39
Change in Working capital per share	₹ 3.45 per share

SOLUTION 6A

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

EPS = $\frac{PAT}{No.of\ Shares}$

EPS = $\frac{₹\ 290\ crores}{32.5\ crores}$ = ₹ 8.923

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

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

= 8.923 – [5.84 + 2.5185] = 0.5645

Cost of Equity = Rf+ ß (Rm – Rf)

= 8.7 + 0.1 (10.3 – 8.7) = 8.86%

$P_0 = \frac{FCFE(1+g)}{K_e - g} = \frac{0.5645(1.08)}{0.0886-.08} = \frac{0.60966}{0.0086}$ = ₹70.89

QUESTION NO. 9B (Nov 2017)

Rahim Enterprises is a manufacturer and exporter of woollen garments to European countries. Their business is expanding day by day and in the previous financial year the company has registered a 25% growth in export business. The company is in the process of considering a new investment project. It is an all equity financed company with 10,00,000 equity shares of face value of ₹ 50 per share. The current issue price of this share is ₹ 125 ex-divided. Annual earning are ₹ 25 per share and in the absence of new investments will remain constant in perpetuity. All earnings are distributed at present. A new investment is available which will cost ₹ 1,75,00,000 in one year's time and will produce annual cash inflows thereafter of ₹ 50,00,000. Analyse the effect of the new project on dividend payments and the share price.

SOLUTION 9B

(i) Let us first compute the Cost of Equity ke = $\frac{D}{P}$ = $\frac{25}{125}$ = 20%

(ii) Current Earning = ₹ 25 x 10,00,000 = ₹ 2,50,00,000

The new project can be financed by retaining ₹ 1,75,00,000 of ₹ 2,50,00,000 earning next year, reducing dividend payment to ₹ 75,00,000 or

= $\frac{75,00,000}{10,00,000}$ = ₹ 7.50 per share

(iii) In the following years, dividend will increase due to the cash generated by the new project. Dividend per share in year 2 shall be:

= $\frac{25,00,000+50,00,000}{10,00,000}$ = ₹ 30 per share

(iv) The new share price can be calculated by finding the Present Value of the revised dividend payments:

P = $\frac{7.50}{1.20} + \frac{30.00}{0.20} \times \frac{1}{1.20}$ = ₹ 131.25 per share

QUESTION NO. 15 (RTP Nov 2011)

There are two companies ABC Ltd. and XYZ Ltd. are in same in industry. On order to increase its size ABC Ltd. made a takeover bid for XYZ Ltd.

Equity beta of ABC and XYZ is 1.2 and 1.05 respectively. Risk Free Rate of Return is 10% and Market Rate of Return is 16%. The growth rate of earnings after tax of ABC Ltd. in recent years has been 15% and XYZ's is 12%. Further both companies had continuously followed constant dividend policy.

Mr. V, the CEO of ABC requires information about how much premium above the current market price to offer for XYZ's shares.

Two suggestions have forwarded by merchant bankers.

(i) Price based on XYZ's net worth as per B/S, adjusted in light of current value of assets and estimated after tax profit for the next 5 years.

(ii) Price based on Dividend Valuation Model, using existing growth rate estimates. Summarised Balance Sheet of both companies is as follows.

(₹ In lacs)

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

Profit & Loss A/c

(₹ In lacs)

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

Additional information

(1) ABC Ltd.'s land & building have been recently revalued. XYZ Ltd.'s have not been revalued for 4 years, and during this period the average value of land & building have increased by 25% p.a.

(2) The face value of share of ABC Ltd. is ₹ 10 and of XYZ Ltd. is ₹ 25 per share.

(3) The current market price of shares of ABC Ltd. is ₹ 310 and of XYZ Ltd.'s ₹ 470 per share.

With the help of above data and given information you are required to calculate the premium per share above XYZ's current share price by two suggested valuation methods. Discuss which of these two values should be used for bidding the XYZ's shares.

State the assumptions clearly, you make.

SOLUTION 15

(a) Net Assets Method

To compute the value of shares as per this method we shall compute the Net Assets.

(i) Value of Land & Building of XYZ Ltd. = ₹ 1,500 lac $(1.25)^4$ = ₹ 3,662.11 lac. Thus, net asset value will be:

	₹
Land & Building	3,662.11 lac
Plant & Machinery	2,800.00 lac
Account Receivable	2,400.00 lac
Stock	2,100.00 lac
Bank/Cash	400.00 lac
	11,362.11 lac
Less: Bank Overdraft	100.00 lac
Sundry Creditors	1,100.00 lac
Tax Payable	400.00 lac
Dividend Payable	400.00 lac
Long Term Loan	1,000.00 lac
	8362.11 lac

(ii) Estimated profit for next 5 years

= ₹ 1,510 lac (1.12) + ₹ 1,510 lac (1.12)2 + ₹ 1,510 lac (1.12)3 + ₹ 1,510 lac (1.12)4 + ₹ 1,510 lac (1.12)5

= ₹ 1,691.20 lac + ₹ 1,894.14 lac + ₹ 2,121.44 lac + ₹ 2,376.01 lac + ₹ 2,661.14 lac

= ₹ 10,743.93 lac.

The total yield value= ₹ 8,362.11 lac + ₹ 10,743.93 lac = ₹ 19,106.04 lac

XYZ Ltd.s share's current market value = ₹ 470 x 40 lacs shares

=₹ 1,88,00,00,000

= ₹ 18,800 lac

The premium is thus ₹ 306.04 lac (₹ 19,106.04 lac – ₹ 18,800 lac) i.e. ₹ 7.65 per share or 1.63% [7.65/470].

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

(b) Dividend Valuation Model

$$Po=\frac{D1}{Ke-g}=\frac{Do\,(1+g)}{ke-g}$$

$$Do=\frac{₹760\ lac}{40\ lac}$$ = ₹19 per share

Thus D1 = ₹ 19(1+0.12) = ₹ 21.28

K_e using CAPM

K_e = Rf +βj (Rm - Rf) =10% + 1.05(16% - 10%) = 16.3%

$$P0=\frac{₹21.28}{16.3\%-12\%}=\frac{21.28}{4.3\%}$$ = ₹ 494.88 per share

The premium is ₹ 24.88 (₹ 494.88 – ₹ 470) i.e. 5.29% above the current market price.

Thus, this method should be used for bidding shares of XYZ Ltd.'s share

Assumptions

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

Mergers, Acquisitions & Corporate Restructuring

QUESTION NO. 3D (SM) (Dec 2021) (Nov 2015)

XYZ Ltd. wants to purchase ABC Ltd. by exchanging 0.7 of its share for each share of ABC Ltd. Relevant financial data are as follows :

Equity shares outstanding	1000000	400000
EPS (₹)	40	28
Market price per share (₹)	250	160

a) Illustrate the impact of merger on EPS of both the companies.

b) The management of ABC Ltd. has quoted a share exchange ratio of 1 : 1 for the merger. Assuming that P/E ratio of XYZ Ltd. will remain unchanged after the merger, what will be the gain from merger for ABC Ltd.?

c) What will be the gain / loss to shareholders of XYZ Ltd. ?

d) Determine the maximum exchange ratio acceptable to shareholders of XYZ Ltd.

SOLUTION 3D

Working Notes :

(a)

	XYZ Ltd.	ABC Ltd.
Equity shares outstanding (Nos.)	10,00,000	4,00,000
EPS	₹ 40	₹ 28
Profit	₹ 400,00,000	₹ 112,00,000
PE Ratio	6.25	5.71
Market price per share	₹ 250	₹ 160

(b) EPS after merger

No. of shares to be issued (4,00,000 x 0.70)	2,80,000
Exiting Equity shares outstanding	10,00,000
Equity shares outstanding after merger	12,80,000
Total Profit (₹ 400,00,000 + ₹ 112,00,000)	₹ 512,00,000
EPS	₹ 40

(i) Impact of merger on EPS of both the companies

	XYZ Ltd.	ABC Ltd.
EPS after Merger	₹ 40	₹ 28

EPS before Merger	₹ 40	₹ 28*
	Nil	Nil

* ₹ 40 x 0.70

(ii) Gain from the Merger if exchange ratio is 1: 1

No. of shares to be issued	4,00,000
Exiting Equity shares outstanding	10,00,000
Equity shares outstanding after merger	14,00,000
Total Profit (₹ 400,00,000 + ₹ 112,00,000)	₹ 512,00,000
EPS	₹ 36.57
Market Price of Share (₹ 36.57 x 6.25)	₹ 228.56
Market Price of Share before Merger	₹ 160.00
Impact (Increase/ Gain)	₹ 68.56

(iii) Gain/ loss from the Merger to the shareholders of XYZ Ltd.

Market Price of Share	₹ 228.56
Market Price of Share before Merger	₹ 250.00
Loss from the merger (per share)	₹ 21.44

(iv) Maximum Exchange Ratio acceptable to XYZ Ltd. shareholders

	₹ Lakhs
Market Value of Merged Entity (₹ 228.57 x 1400000)	3199.98
Less: Value acceptable to shareholders of XYZ Ltd.	2500
Value of merged entity available to shareholders of ABC Ltd. Market Price Per Share	699.98
No. of shares to be issued to the shareholders of ABC Ltd. (lakhs)	250
	2.8

Thus maximum ratio of issue shall be 2.80 : 4.00 or 0.70 share of XYZ Ltd. for one share of ABC Ltd.

QUESTION NO. 4A (SM) (June 2009)

The following information relating to the acquiring Company A Ltd. and the target Company B Ltd. are available. Both the Companies are promoted by Multinational Company, Trident Ltd.

The promoter's holding is 50% and 60% respectively in A Ltd. and B Ltd.:

	A Ltd.	B Ltd.
Share Capital (₹)	200 Lakhs	100 Lakhs
Free Reserves and Surplus (₹)	800 Lakhs	500 Lakhs
Paid up Value per share (₹)	100	10
Free Float Market Capitalization (₹)	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%

a) What is the swap ratio based on above weights?

b) What is the Book Value, EPS and expected Market price of A Ltd. after acquisition of B Ltd. (assuming P/E. ratio of A Ltd. remains unchanged and all assets and liabilities of B Ltd. are taken over at book value).

c) Calculate:

(i) Promoter's revised holding in the A Ltd.

(ii) Free float market capitalization,

(iii) Also calculate No. of Shares, Earning per Share (EPS) and Book Value (B.V.), if after acquisition of B Ltd., A Ltd. decided to:

1. Issue Bonus shares in the ratio of 1:2; and
2. Split the stock (share) as ₹5 each fully paid

SOLUTION 4A

(a)

	A Ltd.	B 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 X 40 lakh)	₹ 80 Lakh	-
(₹ 8 X 10 lakh)	-	₹ 80 Lakh

Calculation of Swap Ratio

Book Value	1 : 0.12	0.12 x 25%	0.03
EPS	01:00.2	0.20 x 50%	0.1
Market Price	01:00.1	0.08 x 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 x 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 Lakh + ₹ 150 Lakh = ₹ 350 Lakh

Reserves — ₹ 800 Lakh + ₹ 450 Lakh = ₹ 1,250 Lakh

Book Value — $\frac{350 \text{ Lakh} + 1{,}250 \text{ Lakh}}{3.5 \text{ Lakh}}$ = ₹ 457.14 per share

EPS — $\frac{\text{Total Profit}}{\text{No. of Share}} = \frac{80 \text{ Lakh} + 80 \text{ Lakh}}{3.5 \text{ Lakh}} = \frac{160 \text{ Lakh}}{3.5}$

= ₹ 45.71

Expected Market Price EPS (₹ 45.71) x P/E Ratio (10) = ₹ 457.10

(c) (1) Promoter's holding

Promoter's Revised Holding	A Ltd. 50% i.e.	1.00 Lakh shares
	B Ltd. 60% i.e.	0.90 Lakh shares
	Total	1.90 Lakh shares

Promoter's % = 1.90/3.50 x 100 = 54.29%

(2) Free Float Market Capitalization

Free Float Market Capitalization = (3.5 Lakh – 1.9 Lakh) x ₹ 457.10

= ₹ 731.36 Lakh

(3) (i) & (ii)

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 x 20 = 105 Lakh
EPS	160 Lakh / 105 Lakh = 1.523
Book Value	Cap. ₹ 525 Lakh + ₹ 1075 Lakh No. of Shares =105 Lakh = ₹ 15.238 per share

QUESTION NO. 6B (Jan 2021)

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

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

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

Poly Ltd. requires a return of 14%

n	1	2	3	4	5	6
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.

SOLUTION 6B

Calculation of Purchase Consideration

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

Net Present Value = PV of Cash Inflow + PV of Demerger of Roly Ltd. – Cash Outflow

= ₹ 4,00,000 PVAF(14%,6) + ₹ 1,50,000 PVF(14%, 6) – ₹ 13,80,000

= ₹ 4,00,000 x 3.888 + ₹ 1,50,000 x 0.456 – ₹ 13,80,000

= ₹ 15,55,200 + ₹ 68,400 – ₹ 13,80,000

= ₹ 2,43,600

Since NPV of the decision is positive it is advantageous to acquire Poly Ltd.

QUESTION NO. 11B (Nov 2020)

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:

(i) Net Worth adjusted for the current value of Land & Buildings plus the estimated average profit after tax (PAT) for the next five years.

(ii) The dividend growth formula.

(iii) ICL will push forward which method during the course of negotiations?

Period (t)	1	2	3	4	5
FVIF (30%, t)	1.300	1.690	2.197	2.856	3.713
FVIF (15%, t)	1.15	2.4725	3.9938	5.7424	7.7537

SOLUTION 11B

(i) Computation of Premium (Net Worth Formula):

Amount ₹ in Crores

Total Assets (Fixed assets + Current Assets) = (550 + 580)	1130
Less: Liabilities (Current Liabilities + Borrowings) = (240 + 105)	345
Net Assets Value	785
Current Value of Land after growing for three years @ 30% = 190 X 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 X 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 X MPS = 12.50 X 75	937.50
Premium (Total Value – Market Value)	462.62
Premium (%) = 462.62/937.50 * 100	49.35%

(ii) Computation of Premium (Dividend Growth Formula):

Existing Growth Rate	0.15
DPS= 125/12.50	10
MPS	75
Cost of Equity (D1/MP + g) = [(10 X 1.15/75) + 0.15]	0.3033
Expected growth rate after merger	0.18
Expected Market Price = 10 X [1.18 / (0.3033 - 0.18)]	95.70
Premium over current market price (95.70 - 75)/ 75 X 100	27.60%

Alternatively, if given figure of dividend is considered as D1 then Premium over Current Market Price shall be computed as follows:

Cost of Equity $\left(\frac{D1}{P}+g\right)$	$\left(\frac{10}{75}+0.15\right)$	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 (96.81 - 75)/ 75 x 100		29.08%

(iii) During the course of negotiations, ICL will push forward valuation based on Growth Rate Method as it will lead to least cash outflow.

QUESTION NO. 16A (SM) (May 2017) (Nov 2011)

The following is the Balance-sheet of XYZ Company Ltd as on March 31st, 2006. (₹ in lacs)

Liabilities	₹	Assets	₹
6 lacs equity shares of ₹100/- each	600	Land & Building	200
2 lacs 14% Preference shares of ₹ 100/- each	200	Plant & Machinery	300
13% Debentures	200	Furniture & Fixtures	50
Debenture Interest accrued and Payable	26	Inventory	150
Loan from Bank	74	Sundry debtors	70
Trade Creditors	300	Cash at Bank	130
		Preliminary Expenses	10
		Cost of Issue of debentures	5
		Profit & Loss A/c	485
Total	1400		1400

The XYZ Company did not perform well and has suffered sizable losses during the last few years. However, it is now felt that the company can be nursed back to health by proper financial restructuring and consequently the following scheme of reconstruction has been devised:

a) Equity shares are to be reduced to ₹25/- per share, fully paid up;

b) Preference shares are to be reduced (with coupon rate of 10%) to equal number of shares of ₹50 each fully paid up.

c) Debenture holders have agreed to forego interest accrued to them. Beside this, they have agreed to accept new debentures carrying a coupon rate of 9%.

d) Trade creditors have agreed to forgo 25 per cent of their existing claim; for the balance sum they have agreed to convert their claims into equity shares of ₹25/- each.

e) 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.

f) While Land and Building is to be revalued at ₹250 lacs, Plant & Machinery is to be written down to ₹104 lacs. A provision amounting to ₹5 lacs is to be made for bad and doubtful debts.

You are required to show the impact of financial restructuring/re-construction. Also, prepare the new balance sheet assuming the scheme of re-construction is implemented in letter and spirit.

SOLUTION 16A

Impact of Financial Restructuring

(i) Benefits to XYZ Ltd.

(a) Reduction of liabilities payable

	₹ in Lacs
Reduction in equity share capital (6 lakh shares x ₹75 per share)	450
Reduction in preference share capital (2 lakh shares x ₹50 per share)	100
Waiver of outstanding debenture Interest	26

	Waiver from trade creditors (₹300 Lacs x 0.25)	75
		651
(b)	Revaluation of Assets	
	Appreciation of Land and Building (₹250 Lacs- ₹200 Lacs)	50
		701
(ii)	Amount of ₹701/- Lacs utilized to write off losses, fictious assets and over- valued 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	196
	(₹300 Lacs - ₹104 Lacs)	
		701

Balance sheet of XYZ Ltd as at_____ (after re-construction)

	(₹ in Lacs)			(₹ in Lacs)
Liabilities	Amount	Assets		Amount
21 Lacs equity shares of	525	Land & Building		250
₹25/- each				
2 Lacs10% Preference shares	100	Plant & Machinery		104
of ₹50/- each				
9% debentures	200	Furnitures & Fixtures		50
		Inventory		150
		Sundry debtors	70	
		Provision for doubtful debts	-5	65
		Cash-at-Bank		206
		(Balancing figure)*		
	825			825

*Opening Balance of ₹130/- Lacs + Sale proceeds from issue of new equity shares ₹150/- Lacs - Payment of bank loan of ₹74/- Lacs = ₹206 Lacs

QUESTION NO. 18A (May 2015)

Bank 'R' was established in 2005 and doing banking in India. The bank is facing DO OR DIE situation. There are problems of Gross NPA (Non-Performing Assets) at 40% & CAR/CRAR (Capital Adequacy Ratio/ Capital Risk Weight Asset Ratio) at 4%. The net worth of the bank is not good. Shares are not traded regularly. Last week, it was traded @₹ 8 per share.

RBI Audit suggested that bank has either to liquidate or to merge with other bank.

Bank 'P' is professionally managed bank with low gross NPA of 5%.It has Net NPA as 0% and CAR at 16%. Its share is quoted in the market @ ₹128 per share. The board of directors of bank 'P' has submitted a proposal to RBI for takeover of bank 'R' on the basis of share exchange ratio.

The Balance Sheet details of both the banks are as follows:

	Bank 'R' Amt. in ₹ lakhs	Bank 'P' Amt. in ₹ lakhs
Paid up share capital(₹10)	140	500
Reserves & Surplus	70	5,500
Deposits	4,000	40,000
Other liabilities	890	2,500
Total Liabilities	5,100	48,500
Cash in hand & with RBI	400	2,500
Balance with other banks	–	2,000
Investments	1,100	15,000
Advances	3,500	27,000
Other Assets	100	2,000
Total Assets	5,100	48,500

It was decided to issue shares at Book Value of Bank 'P' to the shareholders of Bank 'R'.
All assets and liabilities are to be taken over at Book Value.
For the swap ratio, weights assigned to different parameters are as follows:

Gross NPA	30%
CAR	20%
Market price	40%
Book value	10%

a) What is the swap ratio based on above weights?
b) How many shares are to be issued?
c) Prepare Balance Sheet after merger.
d) Calculate CAR & Gross NPA % of Bank 'P' after merger.

SOLUTION 18A

(a) Swap Ratio

Gross NPA	5	:	40	i.e.	5/40 x 30%	=	0.0375
CAR	4	:	16	i.e.	4/16 x 20%	=	0.0500
Market Price	8	:	128	i.e.	8/128 x 40%	=	0.025
Book Value Per Share	15	:	120	i.e.	15/120 x 10%	=	0.0125
							0.125

Thus for every share of Bank 'R' 0.125 share of Bank 'P' shall be issued.

(b) No. of equity shares to be issued:

$\frac{140\ Lacs}{10}$ × 0.125 =1.75 lac shares

(c) Balance Sheet after Merger

Calculation of Capital Reserve	
Book Value of Shares	₹ 210.00 lac
Less: Value of Shares issued	₹ 17.50 lac
Capital	₹ 192.50 lac

Balance Sheet

	₹ lac		₹ lac
Paid up Share Capital	517.50	Cash in Hand & RBI	2900.00
Reserves & Surplus	5500.00	Balance with other banks	2000.00
Capital Reserve	192.50	Investment	16100.00
Deposits	44000.00	Advances	30500.00
Other Liabilities	3390.00	Other Assets	2100.00
	53600.00		53600.00

(d) Calculation CAR & Gross NPA % of Bank 'P' after merger

CAR/CRWAR = $\frac{\text{Total Capital Risky}}{\text{Weighted Assets}}$

	Bank 'R'	Bank 'P'	Merged
	4%	16%	
Total Capital	₹ 210 lac	₹ 6000 lac	₹ 6210 lac
Risky Weighted Assets	₹ 5250 lac	₹ 37500 lac	₹ 42750 lac

CAR = $\frac{6210\ \text{lac}}{42750\ \text{lac}}$ =14.53%

GNPA Ratio = $\frac{\text{Gross NPA}}{Gross\ Deposits}$ x 100

	Bank 'R'	Bank 'P'	Merged
GNPA (Given)	0.40	0.05	
	0.40= $\frac{GNPA_R}{₹3500\ lac}$	0.05 = $\frac{GNPA_S}{₹27000\ lac}$	
Gross NPA	₹ 1400 lac	₹ 1350 lac	₹ 2750 lac

Mutual Funds

Study Session 4

QUESTION NO. 1C (May 2014)

Based on the following data, estimate the Net Asset Value (NAV) on per unit basis of a Regular Income Scheme of a Mutual Fund:

Particulars	₹ in Lacs
Listed shares at cost (ex-dividend)	40.00
Cash in hand	2.76
Bonds & Debentures at cost (ex-interest)	8.96
Of these, bonds not listed & not quoted	2.50
Other fixed interest securities at cost	9.75
Dividend accrued	1.95
Amount payable on shares	13.54
Expenditure accrued	1.76
Number of Units (₹ 10 FV each)	2.75 lakhs
Current realizable value of fixed income securities of FV of ₹ 100 is	96.50

All the listed equity shares were purchased at a time when market portfolio index was 12,500.

On NAV date, the market portfolio index is at 19,975.

There has been a diminution of 15% in unlisted bonds and debentures valuation.

Listed bonds and debentures carry a market value of ₹ 7.5 lakhs, on NAV date.

Operating expenses paid during the year amounted to ₹ 2.24 lakhs.

SOLUTION 1C

Particulars	Adjusted Value (₹ lakhs)
Equity Shares	63.920
Cash in hand	2.760
Bonds and debentures not listed	2.125
Bonds and debentures listed	7.500
Dividends accrued	1.950
Fixed income securities	9.409
Sub total assets (A)	87.664
Less: Liabilities	
Amount payable on shares	13.54

Expenditure accrued	1.76
Sub total liabilities (B)	15.30
Net Assets Value (A) – (B)	72.364
No. of units	2,75,000
Net Assets Value per unit (₹ 72.364 lakhs / 2,75,000)	₹ 26.3142

QUESTION NO. 2E

Mr. D had invested in three mutual funds (MF) as per the following details:

Particulars	MF 'A'	MF 'B'	MF 'C'
Amount of Investment	2,00,000	5,00,000	4,00,000
NAV at the time of purchase	10.00	25.00	20.00
Dividend Yield up to 31.03.2022	3%	5%	4%
NAV as on 31.03.2022	10.50	22.80	20.80
Annualized Yield as on 31.03.2022	9.733%	- 11.185%	15%

Assume 1 Year = 365 Days.

Mr. D has misplaced the documents of his investments.

You are required to help Mr. D to find out the following:

(i) Number of units allotted in each scheme,

(ii) Value of his investments as on 31.03.2022,

(iii) Holding period of his investments in number of days as on 31.03.2022

(iv) Dates of original investments

(v) Total Return on investments,

(vi) Assuming past performance of all three schemes will continue for next one year, what action the investor should take? What will be the expected return for the next one year after the above action?

(vii) Will your answer as above point no. (vi) changes if the Mutual fund charges exit load of 5% if the investment is redeemed within one year? If so, advise the investor what and when the action to be taken to optimise the returns.

SOLUTION 2E

(i) Number of Units in each Scheme

MF 'A'	$\frac{₹\ 2,00,000}{₹\ 10.00}$	= 20,000
MF 'B'	$\frac{₹\ 5,00,000}{₹\ 25.00}$	= 20,000
MF 'C'	$\frac{₹\ 4,00,000}{₹\ 20.00}$	= 20,000

(ii) Value of Investment on 31.03.2022

MF 'A'	= 20,000 x ₹ 10.50	₹ 2,10,000
MF 'B'	= 20,000 x ₹ 22.80	₹ 4,56,000
MF 'C'	= 20,000 x ₹ 20.80	₹ 4,16,000
Total		₹ 10,82,000

(iii) Yield on each Fund

	Capital Yield	Dividend Yield	Total	Yield (%)
MF 'A'	₹ 2,10,000 - ₹ 2,00,000 = ₹ 10,000	₹ 6,000	₹ 16,000.00	8.00
MF 'B'	₹ 4,56,000 - ₹ 5,00,000 = - ₹ 44,000	₹ 25,000	- ₹ 19,000.00	-3.80
MF 'C'	₹ 4,16,000 - ₹ 4,00,000 = ₹ 16,000	₹ 16,000	₹ 32,000.00	8.00
Total			₹ 29,000.00	

No. of Days Investment Held

	MF 'A'	MF 'B'	MF 'C'
Period of Holding (Days)	$= \frac{8.00}{9.733} \times 365$ = 300 Days	$= \frac{3.80}{11.185} \times 365$ = 124 Days	$= \frac{8.00}{15.00} \times 365$ = 195 Days

(iv) Date of Original Investment 04.06.21 27.11.21 17.09.21

(v) Total Yield $= \frac{₹29,000}{₹11,00,000} \times 100 = 2.636\%$

(vi) If past of all three schemes will continue for next one year, the investor should redeem the units of MFs 'A' and 'B' and invest the proceeds in MF 'C'. The expected return next will be 15%.

(vii) If the Mutual funds are charging exit load of 5%, if investment is redeemed within one year, then investor should get redeemed units of MF 'B' now and units of MF 'A' after 65 days.

QUESTION NO. 3F (May 2023)

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

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

SOLUTION 3F

(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 = (Closing Units/NAV + Dividend) x Dividend

Alternatively, it can also be computed as follows:

(i) Dividend Plan

Average Profit = ₹ 121,824

Total Gain = ₹ 121,824 x 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.

Thus, units acquired on 01.04.18 = $\frac{1080000}{X}$

Units added on 31.03.2020 = $\frac{\frac{1080000}{X} \times 1.2}{60} = \frac{21600}{X}$

Units added on 31.03.2021 = $\frac{\frac{1080000}{X} + \frac{21600}{X}}{68} = \frac{16200}{X}$

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 x 0.084 x 5)	₹ 4,20,000
Total Value (₹ 10,00,000 + ₹ 4,20,000)	₹ 14,20,000

Where, 1.6X x ₹ 71 = ₹ 14,20,000

Therefore, X = 12,500 units

Issue Price on 01 04.2018 = ₹ 10,00,000 / 12,500 units = ₹ 80

Alternatively, it can also be computed as follows:

Average Yield = 8.40%

Investment = ₹ 10,00,000

Gain over a period of 5 years = ₹ 10,00,000*0.084*5 = ₹ 4,20,000

Thus, Maturity Value on 31 03.23 shall be ₹ 14,20,000

No. of units = $\frac{14,20,000}{71}$ = 20,000

Now let B be the NAV on 01.04.18 then

Units acquired on 01 04.18 = $\frac{10,00,000}{B}$

Units added on 31 12.19= $\frac{10,00,000}{B} \times \frac{1}{5} = \frac{2,00,000}{B}$

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 NO. 3H (SM) (Nov 2017)

Mr. X on 1.7.2000, during the initial offer of some Mutual Fund invested in 10,000 units having face value of ₹ 10 for each unit. On 31.3.2001 the dividend operated by the MF was 10% and Mr. X found that his annualized yield was 153.33%. On 31.12.2002, 20% dividend was given. On 31.3.2003 Mr. X redeemed all his balance of 11,296.11 units when his annualized yield was 73.52 %. What are the NAVs on 31.3.2001, 31.12.2002 and 31.03.2003?

SOLUTION 3H

Yield for 9 months	= (153.33 x 9/12)	=	115%
Market value of Investments as on 31.03.2001	= 1,00,000/- + (1,00,000x 115%)		
	= ₹2,15,000/-		
Therefore, NAV as on 31.03.2001	= (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 31.03.2001	= 10, 000+ 487.80	=	10,487.80
[Alternately, units as on 31.03.2001	= (2,15,000/20.50)	=	10,487.80]
Dividend as on 31.12.2002	= 10,487.80 x 10 x 0.2	=	₹20,975.60

Let X be the NAV on 31.12.2002, 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 31.03.2001). Thus, by way of equation it can be shown as follows:

$$= 11296.11 = \frac{20975.60}{X} + 10487.80$$

Therefore, NAV as on 31.12.2002 = 20,975.60/(11,296.11- 10,487.80)

= ₹25.95

NAV as on 31.03.2003 = ₹ 1,00,000 (1+0.7352x33/12)/11296.11

= ₹ 26.75

Derivatives Analysis & Valuation (Futures)

Study Session 5

QUESTION NO. 7E (Nov 2019)

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.

(i) Determine whether on September 15, the December futures were underpriced or overpriced?

(ii) What arbitrage transaction is possible to gain out this mispricing?

(iii) Calculate the gains and losses if the index on 15th December closes at (a) 1260 (b) 1175.

Assume 365 days in a year for your calculations.

SOLUTION 7E

(i) Current price of the December Future = ₹ 100 $[1195 + 1195 (0.095 - 0.03) \times \frac{91}{365}]$

= ₹ 100 [1195 + 19.37]

= ₹ 1,21,437

Since the current market price of December-15 is ₹ 1,22,500 (₹ 100 x 1225) it is overpriced.

(ii) 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.

(iii) September 15

Transaction	Cash Flow
Buy (1195 x ₹ 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	0

(a) If on December 15, the Index closes at 1260

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 $\frac{1260}{1195} \times 1,19,500$	+1,26,000.00
Dividend Earned @ 3% $\frac{91}{365} \times 1,19,500 \times 3\%$	+ 893.79
Gain due to Arbitrage	+ 1,063.44

(b) If on December 15, the Index closes at 1175

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 $\frac{1175}{1195}$×1,19,500	+ 1,17,500.00
Dividend Earned @ 3% $\frac{91}{365}$ x 1,19,500 x 3%	+ 893.79
Gain due to Arbitrage	+ 1,063.44

QUESTION NO. 8H

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 a very high risk as compared to the market risk and hence interested to reduce the portfolio's systematic risk to 0.95. Treasury Manager has suggested two below mentioned alternative strategies:

(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 up to 2 decimal points.

SOLUTION 8H

(a) Yes, the apprehension of CEO is correct as the current portfolio is more riskier than market as the beta (Systematic Risk) of market portfolio is as computed as follows:

Shares	No. of shares (lakhs) (1)	Market Price of Per Share (2) (₹)	(1) × (2) (₹ lakhs)	% to total (w)	ß (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 × p + 1.40 (1 – p)

p = 0.32 i.e. 32%

Shares to be disposed off to reduce beta (20000 × 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 contracts

(f) If there is 2% rises in Nifty there will be 2.80%(2%x1.40) 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 NO. 10B (SM) (Nov 2020) (July 2021)

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

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

Based on the above information.

Calculate:

a) Price of a future contract.

b) Calculate the gain on short futures position if it turns out to be 4,500 in 3 months.

SOLUTION 10B

(i) Current future price of the index = $5000 + 5000\ (0.09-0.06)\ \frac{4}{12}$ = 5000+ 50= 5,050

Price of the future contract = ₹50 x 5,050 = ₹2,52,500

(ii) Hedge ratio = $\frac{1010000}{252500}$ x 1.5 = 6 contracts

Index after there months turns out to be 4500

Future price will be = $4500 + 4500\ (0.09-0.06) \times \frac{1}{12}$ = 4,511.25

Therefore, Gain from the short futures position is = 6 x (5050 – 4511.25) x 50 = ₹1,61,625

QUESTION NO. 12C (May 2023) (May 2019)

Mr. V is a commodity trader and specialized himself in trading of rice.

He has 24,000 Kg. of rice. The following details are available as on date:

Spot price	₹/Kg.	70
3 month's future is trading at	₹/Kg.	68
Expected Lower price after 3 months	₹/Kg.	64
Contract size	500 Kg./contract	
You are required to advise to Mr. V:		

(i) How to mitigate the risk of fall in price.

(ii) How to use the futures market.

(iii) What will be the effective realized price for his sales if, after 3 months, spot price is ₹ 69/ Kg. and the 3 months future contract price is

a. ₹ 72/ Kg.

b. ₹ 67/Kg.

SOLUTION 12C

(i) In order to hedge its position Mr. V (trader) should use Future Contracts.

Particulars		
(a)	Quantity of Rice to be hedged	24000 kg.
(b)	Contract Size	500 kg.
(c)	No. of Contracts (a/b)	48
(d)	Future Price	₹ 68/kg.
(e)	Exposure in the future market (a x d)	₹16,32,000

(ii) Mr. V should short 48 Future contracts at the price ₹ 68/kg and cancel its position after 3 months by buying Future contract at prevailing Future price.

(iii) After 3 months, trader would cancel its position in the future by buying a future contract of same quantity and will sell Rice in the spot market and position shall be as follows:

Particulars		₹	₹
(a)	Price of Future Contract	72/kg.	67/kg.
(b)	Amount bought	17,28,000	16,08,000
(c)	Exposure	16,32,000	16,32,000
(d)	Gain/(Loss) on future position (b – c)	(96,000)	24,000
(e)	Spot Price	69/kg	69/kg
(f)	Amount realized by selling in the spot market	16,56,000	16,56,000
(g)	Effective Selling Amount (f + d)	₹ 15,60,000	₹ 16,80,000
(g)	Effective Selling Price	₹ 65/kg.	₹ 70/kg.

QUESTION NO. 21 (Nov 2024)

On January 1, 2023 an investor has a portfolio of 5 securities as given below:

Security	Price (Rs.)	No. of shares	Beta
A	612.65	3000	?
B	334.20	5000	1.15
C	454.45	6000	0.40
D	775.10	10000	0.95
E	781.05	3000	0.85

Portfolio beta is 0.859

The cost of capital to the investor is 10.5% p.a.

You are required to calculate:

(i) The beta of Security A.

(ii) The theoretical value of the Nifty futures for February, 2023. Current value of Nifty 6500.

(iii) The number of contract of Nifty the investor needs to sell to get a full hedge until February, for his portfolio, if the current value of Nifty is 6500 and Nifty futures have a minimum trade lot requirement of 200 units. Assume that the Futures are trading at their fair value.

(iv) What will be new beta if 4 Future contracts are sold to the investors? No. of days in a year be traded as 365 days

Given: ln (1.105) = 0.0998, $e.^{0.015858}$ =1.01598 and $e^{0.01668}$=1.01682

SOLUTION 21

(I) Calculation of beta of Security A

Let beta of Security A is β_A

Security	Price of the Stock	No. of shares	Value	Weightage w_i	Beta B_i	Weighted Beta
A	612.65	3,000	18,37,950	0.113	β_A	0.113 β_A
B	334.20	5,000	16,71,000	0.102	1.15	0.117
C	454.45	6,000	27,26,700	0.167	0.40	0.067
D	775.10	10,000	77,51,000	0.475	0.95	0.451
E	781.05	3,000	23,43,150	0.143	0.85	0.122
			1,63,29,800			0.757 + 0.113 β_A

Since the Portfolio beta is 0.859, the beta of Security A shall be:

0.757 + 0.113 β_A = 0.859

β_A = 0.903 or 0.90

(ii) Calculation of Theoretical Value of Future Contract

Cost of Capital = 10.5% p.a. Accordingly, the Continuously Compounded Rate of Interest ln (1.105) = 0.0998

For February 2023 contract, t = 58/365 = 0.1589

Further $F= Se^{rt}$

$F= ₹ 6,500e^{(0.0998)(0.1589)}$

$F= ₹ 6,500e^{0.015858}$

F= ₹ 6,500X1.01598 = ₹ 6,603.87

Alternatively, it can also be taken as follows:

$= ₹ 6500\ e^{0.105\times58/365}$

$= ₹ 6500\ e^{0.01668}$

= ₹ 6500 x 1.01682 = ₹ 6,609.33

(iii) When total portfolio is to be hedged:

$$= \frac{\text{Value of Spot Position requiring hedging}}{\text{Value of Future Contract}} \times \text{Portfolio Beta}$$

$$= \frac{16329800}{6603.87 \times 200} \times 0.859 = 10.62 \text{ contracts say 11 contracts}$$

Or

$$= \frac{16329800}{6609.33 \times 200} \times 0.859 = 10.61 \text{ contracts say 11 contracts}$$

(iv) Revised Portfolio Beta if 4 Future contracts are sold to investor:

$$4 = (\beta P - 0.859) \times \frac{16329800}{6603.87 \times 200}$$

$\beta P = 1.18$

Or

$$4 = (\beta P - 0.859) \times \frac{16329800}{6609.33 \times 200}$$

$\beta P = 1.18$

Derivatives Analysis & Valuation (Options)

Study Session 6

QUESTION NO. 1E (SM) (May 2019) (Nov 2011) (Nov 2020)

Mr. X established the following spread on the Delta Corporation's stock

(i) Purchased one 3-month call option with a premium of ₹ 30 and an exercise price of ₹ 550.

(ii) Purchased one 3-month put option with a premium of ₹ 5 and an exercise price of ₹ 450.

Delta Corporation's stock is currently selling at ₹ 500. Determine profit or loss, if the price of Delta Corporation's:

(i) Remains at ₹ 500 after 3 months.

(ii) Falls at ₹ 350 after 3 months.

(iii) Rises to ₹ 600. Assume the size option is 100 shares of Delta Corporation.

SOLUTION 1E

Total premium paid on purchasing a call and put option

= (₹30 per share × 100) + (₹5 per share × 100).

= 3,000 + 500 = ₹3,500

In this case, X exercises neither the call option nor the put option as both will result in a loss for him.

Ending value = - ₹3,500 + zero gain = - ₹3,500

i.e Net loss = ₹3,500

Since the price of the stock is below the exercise price of the call, the call will not be exercised. Only put is valuable and is exercised.

Total premium paid = ₹3,500

Ending value = – ₹3,500 + ₹[(450 – 350) × 100] = – ₹3,500 + ₹10,000 = ₹6,500

Net gain = ₹6,500

In this situation, the put is worthless, since the price of the stock exceeds the put's exercise price. Only call option is valuable and is exercised.

Total premium paid = ₹3,500

Ending value = -3,500 +[(600 – 550) × 100]

Net Gain = -3,500 + 5,000 = ₹1,500

QUESTION NO. 7A (SM) (Nov 2018)

You as an investor had purchased a 4 month call option on the equity shares of X Ltd. of ₹ 10, of which the current market price is ₹ 132 and the exercise price ₹ 150. You expect the price to range between ₹ 120 to ₹ 190.

The expected share price of X Ltd. and related probability is given below:

Expected Price (₹)	120	140	160	180	190
Probability	.05	.20	.50	.10	.15

Compute the following:

a) Expected Share price at the end of 4 months.
b) Value of Call Option at the end of 4 months, if the exercise price prevails.
c) In case the option is held to its maturity, what will be the expected value of the call option?

SOLUTION 7A

(1) Expected Share Price

= ₹120X 0.05 + ₹140X 0.20 + ₹160X 0.50 + ₹180X 0.10 + ₹190X 0.15

= ₹6 + ₹28 + ₹80 + ₹18 + ₹28.50 = ₹160.50

(2) Value of Call Option

= ₹150 - ₹150 = Nil

(3) 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:

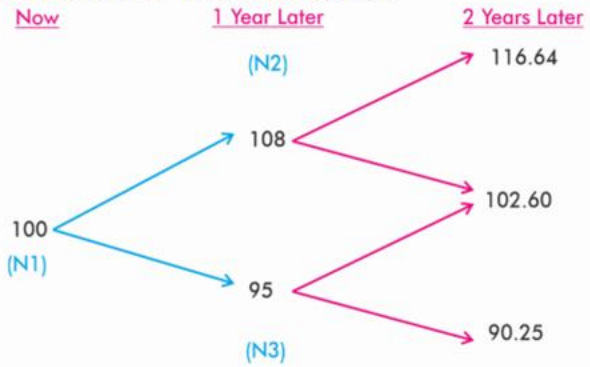
Expected Value of Option

(120 – 150) X 0.1	Not Exercised*
(140 – 150) X 0.2	Not Exercised*
(160 – 150) X 0.5	5
180 – 150) X 0.1	3
(190 – 150) X 0.15	6
	14

* If the strike price goes below ₹ 150, option is not exercised at all.

QUESTION NO. 9C (Nov 2020)

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:

(i) The probability of price moving up and down;

(ii) Expected pay offs at each nodes i.e. N1, N2 and N3 (round off upto 2 decimal points).

SOLUTION 9C

(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 NO. 11B (Nov 2019)

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:

(i) If the investor wants a perfect hedge, what combination of the share and option should he select ?

(ii) Explain how the investor will be able to maintain identical position regardless of the share price.

(iii) 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?

SOLUTION 11B

(i) To compute perfect hedge we shall compute Hedge Ratio (Δ) as follows:

$$\Delta = \frac{C1-C2}{S1-S2} = \frac{100-0}{650-450} = \frac{100}{200} = 0.50$$

The investor should purchase 0.50 share for every 1 call option

Or, the investor should purchase 1 share for every 2 Call Option.

(ii) How the investor will be able to maintain his position if he purchase 0.50 share for 1 call option written.

(a) If price of share goes upto ₹ 650 then value of purchased share will be:

Sale Proceeds of Investment (0.50 x ₹ 650)	₹ 325
Loss on account of Short Position (₹ 650 – ₹ 550)	₹ 100
	₹ 225

(b) If price of share comes down to ₹ 450 then value of purchased share will be:

Sale Proceeds of Investment (0.50 x ₹ 450) ₹ 225

(iii) The Value of Option, say, P at the beginning of the period shall be computed as follows:

(₹ 250 – P) 1.05 = ₹ 225

₹ 262.50 – 1.05P = ₹ 225

₹ 37.5 = 1.05P P = ₹ 35.71

(iv) Expected Return on the Option

Expected Option Value = (₹ 650 – ₹ 550) × 0.70 + ₹ 0 × 0.30 = ₹70

Expected Rate of Return $= \frac{70-35.71}{35.71} \times 100 = 96.02\%$

QUESTION NO. 12B (SM) (MTP May 2020)

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
$e^{0.12 \times 0.5} = 1.062$	
In 1.0667 = 0.0646	

SOLUTION 12B

Applying the Black Scholes Formula, Value of the Call option now:

The Formula Value of option = $V_S\, N(d_1) - \frac{E}{e^{rt}}\, N(d_2)$

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

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

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.

In = natural logarithim

d1

$$= \frac{In(1.0667) + (0.12 + 0.08)0.50}{0.40\sqrt{0.50}}$$

$$= \frac{0.0646+0.20\times0.50}{040\times0.7071}$$

$$= \frac{0.1646}{0.2828}$$

= 0.5820

d2 = 0.5820 – 0.2828 = 0.2992

N(d1) = N (0.5820)=0.7197

N(d2) = N (0.2992)=0.6176

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

= 80 x 0.7197 - $\frac{75}{1.062}$×0.6176

= 57.57 – 70.62 x 0.6176

= 57.57 – 43.61

= ₹13.96

Teaching Notes:

Students may please note following important point:

Values of N(d1) and N(d2) 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

Foreign Exchange Exposure & Risk Management

Study Session 7

QUESTION NO. 1C (Nov 2022)

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:

(a) 2 months forward rates.

(b) How many US dollars should the firm sell to get ₹ 10 lakhs in the spot market and after 2 months?

(c) 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?

SOLUTION 1C

(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 = US $ 13,513.51

(2) To get ₹ 10 lakh after 2 month the firm should sell

= ₹ 10,00,000/ ₹ 75.00 = US $ 13,333.33

(c) (1) Rupees required to obtain US $ 80,000 in Spot Market:

US $ 80,000 × ₹ 74.25 = ₹ 59,40,000

(2) Rupees required to obtain US $ 80,000 after 2 months:

US $ 80,000 × ₹ 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 × ₹ 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 be answered as follows:

Computation of Annual Premium on US $ = (1.00/74.00) × (12/2) × 100 = 8.108% 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 NO. 9F (Nov 2018)

Spot rate 1 US$ = ₹ 68.50

USD premium on a six month forward is 3%. The annualized interest in US is 4% and 9% in India.

Is there any arbitrage possibility? If yes, how a trader can take advantage of the situation if he is willing to borrow USD 3 million.

SOLUTION 9F

Spot Rate = ₹68.50

Forward Rate = ₹ 68.50 x 1.03 = ₹ 70.56

Forward Premium on US$ = 3.00% x 12/6 = 6.00%

Interest rate differential = 9% - 4% = 5%

Since the Interest rate differential is less than forward premium there is a possibility of arbitrage outflow from India.

The advantage of this situation can be taken in the following manner:

1. Borrow equivalent amount of US$ 3000000 in India for 6 months at Spot Rate

   ₹ 68.50 x US$ 3000000 = ₹ 20,55,00,000

   Amount to be repaid after 6 months

   = ₹20,55,00,000 (1+0.09 x 6/12) = ₹ 21,47,47,500

2. Convert ₹ 20,55,00,000 into US$ and get the principal i.e. = US$ 30,00,000

   Interest on Investments for 6 months – US$ 3000000 x 0.02 = US$ 60,000

   Total amount at the end of 6 months = US$ (30,00,000 + 60,000) = US$ 30,60,000

   Converting the same at the forward rate

   = US$ 30,60,000 x ₹ 70.56 = ₹ 21,59,13,600

   Hence the gain is ₹ (21,59,13,600 – 21,47,47,500) = ₹ 11,66,100 or

   ₹ 11,66,100/ ₹ 70.56 = US$ 16,526

QUESTION NO. 10B

ABC Exporters Company, a UK company, is due to receive 500000 Northland dollars in 6 months' time for goods supplied. The company decides to hedge its currency exposure by using forward market. The short-time interest rate in the UK is 12% per annum and the equivalent rate in Northland is 15%. Spot rate of exchange is 2.5 Northland dollars to the UKP.

You are required: To calculate how much Exporters Company actually gains or losses as a result of the hedging transaction if, at the end of six months, the UKP in relation to Northland dollar, had

a) gained 4%,

b) lost 2% or

c) Remained stable.

You may assume that forward rate of exchange simply reflects interest differential in the two countries (i.e. it reflects the interest rate parity analysis of forward rates).

SOLUTION 10B

(i) As per IRPT, forward rate can be calculated by using following relation:

$$\frac{FR(Nd/Pound)}{2.5(Nd/Pound)} = \frac{1+.15/2}{1+.12/2} \Rightarrow FR\ (Nd/Pound) = 2.535$$

The exchange rate in six months time is therefore. 1UKP = 2.535 Nd.

If Spot Rate of UKP strengthens or gained by 4% in relation to Northland dollar ie. From Nd 2.5 to Nd 2.6. Then the amount which the company would have received.

Amount Received under Forward Cover	=	$\frac{5,00,000}{2.535}$	=	UKP 197239
Amount Received without Forward Cover	=	$\frac{5,00,000}{2.60}$	=	UKP 192308
Gain by having Forward Cover is			=	+ UKP 4931

(ii) If the spot rate of UKP weakens by 2% in relation to Northland dollar ie. From Nd 2.50 to Nd 2.45 then,

Amount Received under Forward Cover	=	$\frac{5,00,000}{2.535}$	=	UKP 197239
Amount Received without Forward Cover	=	$\frac{5,00,000}{2.45}$	=	UKP 204082
Loss by taking Forward Cover			=	- UKP 6843,

(iii) If the Spot Rate of UKP remained unchanged in relation to Northland Dollar at 2.50 then,

Amount Received under Forward Cover	=	$\frac{5,00,000}{2.535}$	=	UKP 197239
Amount Received without Forward Cover	=	$\frac{Nd\ 5,00,000}{2.50}$	=	UKP 200000
Loss by taking Forward Cover			=	- UKP 2761

QUESTION NO. 13 (Dec 2021)

DK Ltd. is considering an investment proposal in Sri Lanka involving an initial investment of LKR 25 billion. The current spot exchange rate is INR/LKR 0.37. The risk free rate in India is 6% and the same in Sri Lanka is 5.02%. The project will generate a cash flow of LKR 5 billion in the first year. The cash flow will increase by LKR 1 billion each year for the next 4 years. The project will bind up on completion of 5 years with no salvage value.

The required rate of return for the project is 8%

(i) You are required to find out the investment worth of the project by
  (1) Home Currency Approach
  (2) Foreign Currency Approach

(ii) Compare the outcome under both the approaches.

Given:

t	1	2	3	4	5
PVIF (8%, t)	0.92593	0.85734	0.79383	0.73503*	0.68058
PVIF (7%, t)	0.93457	0.87344	0.81630	0.76290	0.71299

SOLUTION 13

(a) Working Notes:

Calculation of Forward Exchange Rates

End of Year	₹	₹/KR
1	$0.37 \times \frac{1.06}{1.052}$	0.373
2	$0.373 \times \frac{1.06}{1.052}$	0.376
3	$0.376 \times \frac{1.06}{1.052}$	0.380
4	$0.379 \times \frac{1.06}{1.052}$	0.384
5.	$0.382 \times \frac{1.06}{1.052}$	0.388

1. 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
					10.4073
Less: Investment	25	0.37			9.2500
NPV					1.1573

* Alternatively if students have used the PVIF (8%, 4) as given in the question paper then answer NPV would be 1.2188 instead of 1.1573.

2. Foreign Currency Approach

(1 + 0.06) (1+ Risk Premium) = 1.08

1 + Risk Premium = 1.08/1.06 = 1.01887

Therefore, Risk adjusted LKR Rate = 1.01887 × 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
			28.1477
Less: Investment			25.0000

NPV	3.1477

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 NO. 16B (Nov 2018)

On 19th January, Bank A entered into forward contract with a customer for a forward sale of US $ 7,000, delivery 20th March at ₹ 46.67. On the same day, it covered its position by buying forward from the market due 19th March, at the rate of ₹ 46.655. On 19th February, the customer approaches the bank and requests for early delivery of US $. Rates prevailing in the interbank markets on that date are as under:

Spot (₹/$)	46.5725/5800
March	46.3550/3650

Interest on outflow of funds is 16% and on inflow of funds is 12%. Flat charges for early delivery are ₹ 100.

What is the amount that would be recovered from the customer on the transaction?

Note: Calculation should be made on months basis than on days basis.

SOLUTION 16B

(a) The bank would sell US $ to its customer at the agreed rate under the contract. However, it would recover loss from the customer for early delivery.

On 19th February bank would buy US$ 7000 from market and shall sell to customer. Further, Bank would enter into one month forward contract to sell the US $ acquired under the cover deal.

(i) Swap Difference

Bank sells at	₹ 46.3550
Bank buys at	₹ 46.5800
Swap loss per US $	0.225
Swap loss for US $ 7000	₹ 1,575

(ii) Interest on Outlay of Funds

On 19th February, Bank sell to customer	₹ 46.67
It buys from spot Market	₹ 46.58
Inflow of funds per US $	₹ 0.09

Inflow of funds for US $ 7000 is ₹ 630

Interest on ₹ 630 at 12% for one month ₹ 6.30

(b) Charges for early delivery

Swap loss	₹ 1,575.00
Flat charges	₹ 100.00
Less: Interest on outflow of funds	₹ 6.30
	₹ 1,668.70

(c) Total amount to be recovered from the customer

Amount as per Forward Contract ₹ 46.67 x 7000	₹ 3,26,690.00

Add: Charges for early delivery	₹ 1,668.70
	₹ 3,28,358.70

QUESTION NO. 17B (Nov 2016)(Nov 2023)

On 10th July, an importer entered into a forward contract with bank for US $ 50,000 due on 10th September at an exchange rate of ₹ 66.8400. The bank covered its position in the interbank market at ₹ 66.6800.

How the bank would react if the customer requests on 20th September:

(i) to cancel the contract?

(ii) to execute the contract?

(iii) to extend the contract with due date to fall on 10th November?

The exchange rates for US$ in the interbank market were as below:

	10th September	13th September
Spot US$1 =	66.1500/1700	65.9600/9900
Spot/September	66.2800/3200	66.1200/1800
Spot/October	66.4100/4300	66.2500/3300
Spot/November	66.5600/6100	66.4000/4900

Exchange margin was 0.1% on buying and selling.

Interest on outlay of funds was 12% p.a.

You are required to show the calculations to:

a) cancel the Contract,

b) execute the Contract, and

c) extend the Contract as above.

SOLUTION 17B

In each of the case first the FEADI Rule of Automatic Cancellation shall be applied and customer shall pay the charges consisted of following:

(a) Exchange Difference

(b) Swap Loss

(c) Interest on Outlay Funds

(a) Exchange Difference

(1) 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	₹ 65.9600
Less: Exchange Margin @ 0.10%	₹ 0.0660
	₹ 65.8940

Rounded off to ₹ 65.8950

(2) Amount payable on $ 50,000

Bank sells $50,000 @ ₹ 66.8400	₹ 33,42,000
Bank buys $50,000 @ ₹ 65.8950	₹ 32,94,750
Amount payable by customer	₹ 47,250

(b) Swap Loss

On 10th September the bank does a swap sale of $ at market buying rate of ₹ 66.1500 and forward purchase for September at market selling rate of ₹ 66.3200.

Bank buys at	₹ 66.3200
Bank sells at	₹ 66.1500
Amount payable by customer	₹ 0.1700

Swap Loss for $ 50,000 in ₹ = ₹ 8,500

(c) Interest on Outlay of Funds

On 10thSeptember, the bank receives delivery under cover contract at ₹ 66.6800 and sell spot at ₹ 66.1500.

Bank buys at	₹ 66.6800
Bank sells at	₹ 66.1500
Amount payable by customer	₹ 0.5300

Outlay for $ 50,000 in ₹ 26,500

Interest on ₹ 26,500 @ 12% for 10 days ₹ 87

(d) Total Cost

Cancellation Charges	₹ 47,250.00
Swap Loss	₹ 8,500.00
Interest	₹ 87.00
	₹ 55,837.00

(e) New Contract Rate

The contract will be extended at current rate

$/ ₹ Market forward selling Rate for November	₹ 66.4900
Add: Exchange Margin @ 0.10%	₹ 0.0665
	₹ 66.5565

Rounded off to ₹ 66.5575

(i) Charges for Cancellation of Contract = ₹ 55,838.00 or ₹ 55,837.00

(ii) Charges for Execution of Contract

Charges for Cancellation of Contract	₹55,837.00
Spot Selling US$ 50,000 on 20th September at ₹ 65.9900 + 0.0660 (Exchange Margin) = ₹ 66.0560 rounded to ₹ 66.0550	₹ 33,02,750.00
	₹ 33,58,587.00

(iii) Charges for Extension of Contract

Charges for Cancellation of Contract	₹ 55837
New Forward Rate	₹ 66.5575

QUESTION NO. 20D (RTP Nov 2021)

XYZ Ltd. has imported goods to the extent of US$ 8 Million. The payment terms are as under:

(a) 1% discount if full amount is paid immediately; or

(b) 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.

(i) Pay immediately after utilizing cash available and for balance amount take 90 days loan from bank.

(ii) Pay the supplier on 60th day and avail bank's loan (after utilizing cash) for 30 days.

(iii) Avail supplier offer of 90 days credit and utilize cash available.

Further presume that the cash available with XYZ Ltd. will fetch a return of 4% p.a. in India till it is utilized.

Assume year has 360 days. Ignore Taxation.

Compute your working upto four decimals and cash flows in Crore.

SOLUTION 20D

To evaluate which option would be better we shall compute the outflow under each option as follows:

(i) Pay Immediately availing discount

Spot Rate	₹ 66.98
Amount required in US$ [US$ 8 Million (1 – 0.01)]	US$ 7.92 Million
Amount required in ₹ [₹ 66.98 x US$ 7.92 Million]	₹ 53.0482 Crore
Cash Available	₹ 0.2500 Crore
Loan required	₹ 52.7982 Crore
Interest for 90 days @ 9%	₹ 1.1880 Crore
Total Outflow	₹ 53.9862 Crore

(ii) Pay the supplier on 60th day and avail bank's loan (after utilizing cash) for 30 days.

Applicable Forward Rate	₹ 67.16
Amount required in [₹ 67.16 x US$ 8 Million]	₹ 53.7280 Crore
Loan required [₹53.7280 Crore – ₹₹0.25 Crore]	₹ 53.4780 Crore
Interest for 30 days @ 9%	₹ 0.4011 Crore
	₹ 53.8791 Crore

Interest earned on Cash for 60 days @ 4%	₹ 0.0017 Crore
Total Outflow	₹ 53.8774 Crore

(iii) Avail supplier offer of 90 days credit and utilize cash available

Amount Payable	US$ 8 Million
Interest for 30 days @ 8%	US$ 0.0533 Million
Amount required in ₹	US$ 8.0533 Million
Applicable Forward Rate	₹ 68.03
Amount required in ₹ [₹68.03 x US$ 8.0533 Million]	₹ 54.7866 Crore
Cash Available	₹ 0.2500 Crore
Interest earned on Cash for 90 days @ 4%	₹ 0.0025 Crore
Total Outflow	₹ 54.5341 Crore

Decision: Cash outflow is least in case of Option (ii) same should be opted for

QUESTION NO. 21C (July 2021)

XP Pharma Ltd., has acquired an export order for ₹ 10 million for formulations to a European company. The Company has also planned to import bulk drugs worth ₹ 5 million from a company in UK. The proceeds of exports will be realized in 3 months from now and the payments for imports will be due after 6 months from now. The invoicing of these exports and imports can be done in any currency i.e. Dollar, Euro or Pounds sterling at company's choice. The following market quotes are available.

	Spot Rate	Annualised Premium
₹/$	67.10/67.20	$ - 7%
₹ /Euro	63.15/63.20	Euro - 6%
₹ /Pound	88.65/88.75	Pound - 5%

Advice XP Pharma Ltd. about invoicing in which currency.

(Calculation should be upto three decimal places).

SOLUTION 21C

(a) (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 x $ 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 x € 1,58,353.127 = ₹ 1,01,50,435
£	₹ 100,00,000/ ₹ 88.65	₹ 88.65 (1 + 0.05/4)	₹ 89.76 x £ 1,12,803.158

	= £ 1,12,803.158	= ₹ 89.76	= ₹ 1,01,25,211

(ii) Payment of Import in INR = ₹ 5 Million

Position of outflow under three currencies will be as follows:

Currency	Invoice at Spot Rate	Expected Rate after 6-months	Conversion in INR after 6-months
$	₹ 50,00,000/ ₹ 67.20 = $ 74404.762	₹ 67.20 (1 + 0.07/2) = ₹ 69.55	₹ 69.55 x $ 74404.762 = ₹ 51,74,851
€	₹ 50,00,000/ ₹ 63.20 = € 79,113.924	₹ 63.20 (1 + 0.06/2) = ₹ 65.10	₹ 65.10 x € 79,113.924 = ₹ 51,50,316
£	₹ 50,00,000/ ₹ 88.75 = £ 56,338.028	₹ 88.75 (1 + 0.05/2) = ₹ 90.97	₹ 90.97 x £ 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 NO. 25C

A Ltd. Operating a garment store in US has imported garments from Indian exporter of invoice amount of ₹ 1,38,00,000 (equivalent to US$ 3,00,000). The amount is payable in 3 months. It is expected that the exchange rate will decline by 5% over 3 months period. A Ltd. is interested to take appropriate action in foreign exchange market. The three month forward rate is quoted at ₹ 44.50. You are required to calculate expected loss which A Ltd. would suffer due to this decline if risk is not hedged. If there is loss, then how he can hedge this risk?

SOLUTION 25C

Spot rate of US$ against Indian Rupee = ₹ 1,38,00,000 /US$3,00,000	₹ 46/$
3 month forward rate of US$ 1 against Rupee	₹ 44.50
Anticipate decline in Exchange Rate	5%
Expected spot rate after 3 months = ₹ 46 – ₹ 2.30	₹ 43.70
Expected Loss	US$
Present cost of ₹ 138 lakh	3,00,000
Cost after 3 months ₹ 138 lakh/₹ 43.70	3,15,789
	15,789
Hedging of Risk (Using Forward Contract)	US$
Present cost	3,00,000
Cost if forward contract is taken at ₹ 44.50/$	3,10,112
	10,112

QUESTION NO. 26 (SM) (MTP Mar 2023)

You have following quotes from Bank A and Bank B :

	Bank A	Bank B
SPOT	USD/CHF 1.4650/55	USD/CHF 1.4653/60
3 months	5/10	
6 months	10/15	
SPOT	GBP/USD 1.7645/60	GBP/ USD 1.7640/50
3 months	25/20	
6 months	35/25	

Calculate:

a) How much minimum CHF amount you have to pay for 1 Million GBP spot ?

b) Considering the quotes from Bank A only, for GBP/CHF what are the Implied Swap points for Spot over 3 months?

SOLUTION 26

(i) To Buy 1 Million GBP Spot against CHF

First to Buy USD against CHF at the cheaper rate i.e. from Bank A. 1 USD = CHF 1.4655

Then to Buy GBP against USD at a cheaper rate i.e. from Bank B 1 GBP=USD 1.7650 By applying chain rule Buying rate would be

1 GBP = 1.7650 * 1.4655 CHF

1 GBP = CHF 2.5866

Amount payable CHF 2.5866 Million or CHF 25,86,600

(ii) Spot rate Bid rate GBP 1 = CHF 1.4650 * 1.7645 = CHF 2.5850

Offer rate GBP 1 = CHF 1.4655 * 1.7660 = CHF 2.5881

GBP / USD 3 months swap points are at discount

Outright 3 Months forward rate GBP 1 = USD 1.7620 / 1.7640

USD / CHF 3 months swap points are at premium

Outright 3 Months forward rate USD 1 = CHF 1.4655 / 1.4665

Hence

Spot rate GBP 1 = CHF 2.5850 / 2.5881

Therefore 3 month swap points are at discount of 28/12.

QUESTION NO. 27A (Jan 2021)

Interest rates for 3 months in USA and Canada are as follows:

Currency		Borrow	Interest
(i)	US $	4%	2.5%
	Canadian $	4.5%	3.5 %
(ii)	Can $/ US $ spot	1.235 ---- 1.240	
	3 months forward	1.25 5---- 1.260	

Advice, the currency in which borrowing and lending for 3 months needs to be done for the US company. Take 3 months = 90/360 days.

SOLUTION 27A

(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 $\left(\$1{,}000 \times \frac{90}{360} \times 4\%\right)$	10
Outflow	1010
If borrowing is made in Can $	
	Can $
Equivalent Can $	1,240
Interest $\left(\$1{,}240 \times \frac{90}{360} \times 4.5\%\right)$	13.95
Outflow	1,253.95

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 $\left(\$1{,}000 \times \frac{90}{360} \times 2.5\%\right)$	6.25
	1,006.25
If money is lent in Can $	
	Can $
Equivalent amount lent in Can $	1,235
Interest $\left(\$1{,}235 \times \frac{90}{360} \times 3.5\%\right)$	10.81
	1,245.81

Equivalent inflow in US $ = $\frac{\text{Can\$ } 1{,}245.81}{1.260}$ = $ 988.74

Since inflow is least in Can $, amount should invest in US $.

Thus, borrowing should be made in Canadian $ and lending should be made in US$.

QUESTION NO. 27B (SM0029 (Nov 2013)

Your bank's London office has surplus funds to the extent of US$ 500000 for a period of 3 months. The cost of funds to the bank is 4 % p.a. It proposes to invest these funds in London, New York or Frankfurt and obtain the best yield, without any exchange risk to the bank. The following rates of interest are available at the three centres of domestic funds there at for a period of 3 months.

London	5 % p.a.

New York	8 % p.a.
Frankfurt	3% p.a.

The market rates in London for US dollars and EURO are as under:

London on New York

Spot	1.5350/90
1 month	15/18
2 months	30/35
3 months	80/85

London on Frankfurt

Spot	1.8260/90
1 month	60/55
2 months	95/90
3 months	145/140

At which centre, will the investment be made & what will be the net gain (to the nearest pound) to the bank on the invested funds?

SOLUTION 27B

(i) If investment is made at London

Convert US$ 5,00,000 at Spot Rate (5,00,000/1.5390)	£ 3,24,886
Add: £ Interest for 3 months on £ 324,886 @ 5%	£ 4,061
	£ 3,28,947
Less: Amount Invested	$ 5,00,000
Interest accrued thereon	$5,000
	$ 5,05,000
Equivalent amount of £ required to pay the above sum ($ 5,05,000/1.5430)	£ 3,27,285
Arbitrage Profit	£ 1,662

(ii) If investment is made at New York

Gain $ 5,00,000 (8% - 4%) x 3/12	$5,000
Equivalent amount in £ 3 months ($ 5,000/ 1.5475)	£ 3,231

(iii) If investment is made at Frankfurt

Convert US$ 500,000 at Spot Rate (Cross Rate) 1.8260/1.5390	€ 1.19
Euro equivalent US$ 500,000	€ 5,93,250
Add: Interest for 3 months @ 3%	€ 4,449
	€ 5,97,699

3 month Forward Rate of selling € (1/1.8150)	£ 0.5510
Sell € in Forward Market € 5,97,699 x £ 0.5510	£ 3,29,332
Less: Amounted invested and interest thereon	£ 3,27,285
Arbitrage Profit	£ 2,047

Since out of three options the maximum profit is in case investment is made in New York. Hence it should be opted.

QUESTION NO. 27E (May 2023) (Nov 2020)

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.

SOLUTION 27E

(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
Amount available at the end of 6-months			2.0780
Conversion after 6 months		0.0100	₹ 207.80
Gain			₹ 7.80

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

(i) If investment is made in Index Fund (GBP)

Initial Investment (₹ 200 Billion x 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 x 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 NO. 29A (SM)

XYZ Ltd. is an export oriented business house based in Mumbai. The Company invoices in customer's currency. Its receipt of US $ 1,00,000 is due on September 1,2005. Market information as at June, 1,2005.

Exchange Rates	
	US$/ ₹
Spot	0.02140
1 month forward	0.02136
3 month forward	0.02127

Currency Futures	
Contract Size	₹ 4,72,000
	US $/₹
June	0.02126
September	0.02118

	Initial Margin	Interest Rates in India
June	₹10,000	7.50%
September	₹15,000	8.00%

On September 1st, 2005. The spot rate US $/₹ is 0.02133 and currency future rate for

September contract is 0.02134. Comment which of the following methods would be most advantageous for XYZ Ltd.

a) Using Forward Contract

b) Using Currency Futures

c) Not Hedging Currency Risks.

It may be assumed that variation in margin would be settled on the maturity of the futures contract.

SOLUTION 29A

Receipts using a forward contract (1,00,000/0.02127)	₹47,01,457
Receipts using currency futures	
The number of contracts needed is (1,00,000/0.02118)/4,72,000 = 10	
Initial margin payable is 10 x ₹15,000 = ₹1,50,000	
On September 1 Close at 0.02133	
Receipts = US$1,00,000/0.02133	46,88,233
Variation Margin = [(0.02134 – 0.02118) x 10 x 472000/-]/0.02133	
OR (0.00016x10x472000)/.02133 = 755.2/0.02133	35,406
	47,23,639
Less: Interest Cost – 1,50,000 x 0.08 x 3/12	₹3,000
Net Receipts	₹47,20,639
Receipts under different methods of hedging	
Forward contract	₹47,01,457
Futures	₹47,20,639
No hedge	
US$ 1,00,000/0.02133	₹46,88,233
The most advantageous option would have been to hedge with futures.	

QUESTION NO. 30A (SM)

Best of Luck Ltd. London will have to make a payment of $ 3,64,897 in six months' time. The company is considering the various choices it has in order to hedge its transaction exposure.

Exchange rates:	
Spot rate	$1.5617-1.5673
Six month forward rate	$1.5455-1.5609

Money Market rates:

	Borrow (%)	Invest (%)
US	6	4.5
UK	7	5.5

Foreign currency option prices (1 unit is £12,500):

Exercise price	Call option (March)	Put option (March)
$ 1.70	$ 0.037	$ 0.096

By making the appropriate calculations decide which of the following hedging alternatives is the most attractive to Best of Luck Ltd:

a) Forward market

b) Money market Cover

c) Currency options

OLUTION 30A

In the given case, the exchange rates are indirect. These can be converted into direct rates as follows:

Spot rate

1 USD = $\frac{1}{1.5673}$ GBP ---- $\frac{1}{1.5617}$ GBP

1 USD = GBP 0.63804 ---- GBP 0.64033

6 months' forward rate

1 USD = $\frac{1}{1.5609}$ GBP ---- $\frac{1}{1.5455}$ GBP

1 USD = GBP 0.64066 ---- GBP 0.64704

Payoff in 3 alternatives

(i) Forward Cover

Amount payable	USD 3,64,897
Forward rate	GBP 0.64704
Payable in	GBP 2,36,103

(ii) Money market Cover

Amount payable	USD 3,64,897
PV @ 4.5% for 6 months i.e $\frac{1}{1.0225}$ = 0.9779951	USD 3,56,867
Spot rate purchase	GBP 0.64033
Borrow GBP 3,56,867 × 0.64033	GBP 2,28,512
Interest for 6 months @ 7 %	GBP 7,998
Payable after 6 months	GBP 2,36,510

(iii) Currency options

Amount payable	USD 3,64,897
Unit in Options contract	GBP 12,500
Value in USD at strike rate of 1.70 (GBP 12,500 × 1.70)	USD 21,250
Number of contracts USD 3,64,897/ USD 21,250	17.17
Exposure covered USD 21,250 × 17	USD 3,61,250

Exposure to be covered by Forward (USD 3,64,897 - USD 3,61,250)	USD 3,647
Options premium 17 × GBP 12,500 × 0.096	USD 20,400
Premium in GBP (USD 20,400 × 0.64033)	GBP 13,063
Total payment in currency option	
Payment under option (17 × 12,500)	GBP 2,12,500
Premium payable	GBP 13,063
Payment for forward cover (USD 3,647 × 0.64704)	GBP 2,360
	GBP 2,27,923

Thus total payment in:

(i)	Forward Cover	2,36,103 GBP
(ii)	Money Market	2,36,510 GBP
(iii)	Currency Option	2,27,923 GBP

The company should take currency option for hedging the risk.

QUESTION NO. 30B (Nov 2023)

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	Bid Price	Offer/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 (X) (¥/$)	Premium (%) for Call & Put Options
Call & Put	145.20	1.6766% (Call) & 1.7414% (Put)
Call & Put	146.00	1.3505% (Call) & 2.1006% (Put)

The expected spot price at expiry is ¥/$: 144.90/145.05

Suggest the best strategy for CFO of the Japanese Company to protect against uncertainty, with respect to the following alternatives :

(i) Forward Hedge

(ii) Buy 3 months call, X = 145.20

(iii) Sell 3 months put, X = 145.20

(iv) Buy call & sell put both having X = 146.00

SOLUTION 30B

(i) Forward Hedge

Amount payable after 3 months	$ 1000000
3 month applicable buying rate	¥ 145/$
Amt. payable in Yen	¥ 145 million

(ii) 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 x 1.6766%x $ 1 million	¥ 2.43 million
	¥ 147.48 million

(iii) 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 x 1.7414%x $ 1 million	¥ 2.53 million
	¥ 142.67 million

(iv) Buying Call and selling Put at X = ¥ 146

Net Premium receipt

Premium paid on call option = ¥ 146.00 x 1.3505%	¥ 1.9717 million
Premium Receipt on Put option = ¥ 146.00 x 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 NO. 31D (MTP April 2019)

With the relaxation of investment norms in India in international market upto $ 2,50,000 Mr. X to hedge himself against the risk of declining Indian economy and weakening of Indian Rupee during last few year decided to diversify into International Market.

Accordingly, Mr. X invested a sum of ₹ 1.58 crore on 1.1.20x1 in Standard & Poor Index. On 1.1.20x2 Mr. X sold his investment. The other relevant data is given below:

	1.1.20x1	1.1.20x2
Index of Stock Market in India	7395	?

Standard & Poor Index	2028	1919
Exchange Rate	62.00/62.25	67.25/67.50

You are required to:

(i) Determine the return for a US investor.

(ii) Determine return of Mr. X of holding period.

(iii) Determine the value of Index of Stock Market in India as on 1.1.20x2 at which Mr. X would be indifferent between investment in Standard & Poor Index and Indian Stock Market.

SOLUTION 31D

(i) Return of a US Investor

$$= \frac{\text{Ending Price} - \text{Initial Price}}{\textit{Initial Price}} \times 100$$

$$= \frac{1919-2028}{2028} \times 100 = -5.37\%$$

(ii) Return of Mr. X

Initial Investment (₹)	1.58 Crore
Applicable Exchange Rate on 1.1.20x1	₹ 62.25
Equivalent US$	US$ 2,53,815.26
Purchase Price of Standard & Poor Index	2028
No. of Standard & Poor Indices Purchased	125.16
Ending Price of Standard & Poor Index	1919
Proceeds realised in US$ on sale of Standard & Poor Index	US$ 2,40,182.04
Applicable Exchange Rate on 1.1.20x2	₹ 67.25
Proceeds realised in INR on sale of Standard & Poor Index	₹ 1,61,52,242
Rate of Return $\left(\frac{16152242-15800000}{15800000} \times 100\right)$	2.23%

(iii) Rate of Return had the amount been invested in India

Initial Investment (₹)	1.58 Crore
Purchase Price of Indian Index	7395
No. of Standard & Poor 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	7559.90 say 7560

QUESTION NO. 31F (Jan 2021)

A US investor chose to invest in Sensex for a period of one year. The relevant information is given below.

Size of investment ($)	20,00,000
Spot rate 1year ago (₹/$)	42.50/60
Spot rate now (₹/$)	43.85/90
Sensex 1 year ago	3,256
Senex now	3,765
Inflation in US	5%
Inflation in India	9%

(i) Compute the nominal rate of return to the US investor.

(ii) Compute the real depreciation /appreciation of Rupee.

(iii) What should be the exchange rate if relevant purchasing power parity holds good?

(iv) What will be the real return to an Indian investor in Sensex?

SOLUTION 31F

(i) Nominal rate of return to the US investor

Size of investment ($)	20,00,000
Size of investment (₹) ($ 20,00,000 x 42.50)	8,50,00,000
Sensex at To	3,256
No. of units of Sensex that can be purchased at To	
(₹ 8,50,00,000/3,256)	26,105
Sensex at T1	3,765
Sale of Sensex (26,105 x 3,765)	9,82,85,325
US$ at T1	₹ 43.90
Equivalent Amount in US$	22,38,846
Gain in US$	2,38,846
Nominal rate to US investor	11.94%

(ii) Real Appreciation/Depreciation of Rupee

Real Exchange Rate (Buying) = $43.85 \frac{1+0.05}{1+0.09} = 42.24$

Real Appreciation of ₹ = $\frac{42.50-42.24}{42.50}$ x 100 = 0.61%

(iii) Exchange rate if relevant purchasing power parity holds

Buying Rate = $42.50 \frac{1+0.09}{1+0.05} = 44.12$

Selling rate = $42.60 \frac{1+0.09}{1+0.05} = 44.22$

Exchange rate = 44.12/44.22

(iv) Real return to Indian Investor in Sensex

Nominal Return = $\frac{3765-3256}{3256}$ x 100 = 15.63%

Real return = $\frac{1.1563}{1.09}$ - 1 = 0.0608 or 6.08%

QUESTION NO. 34B (Nov 2019)

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.

SOLUTION 34B

Net Cost under each of the Options is as follows:

(i) Loan from German Bank 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

Interest Rate Risk Management

QUESTION NO. 1F (May 2010)

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.

a) What should be 3 months FRA rate at 3 months forward?

b) The 6 & 12 months LIBORS are 5% & 6.5% respectively.

c) A bank is quoting 6/12 USD FRA at 6.50 - 6.75%. Is any arbitrage opportunity available? Calculate profit in such case.

SOLUTION 1F

1. 3 Months Interest rate is 4.50% & 6 Months Interest rate is 5% p.a.

   Future Value 6 Months from now is a product of Future Value 3 Months now & 3 Months Future Value from after 3 Months.

   (1+0.05*6/12) = (1+0.045*3/12) x (1+i i3,6 *3/12)

   i3,6 = [(1+0.05* 6/12) /(1+0.045 *3/12) – 1] *12/3

   i.e. 5.44% p.a.

2. 6 Months Interest rate is 5% p.a & 12 Month interest rate is 6.5% p.a.

   Future value 12month from now is a product of Future value 6 Months from now and 6 Months Future value from after 6 Months.

   (1+0.065) = (1+0.05*6/12) x (1+ i6,6 *6/12)

   i6,6 = [(1+0.065/1.025) – 1] *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) = (1.05959) say 1.060

QUESTION NO. 1G (Nov 2018)

An Indian company obtains the following quotes (₹/$)

Spot:	35.90/36.10
3 - Months forward rate:	36.00/36.25
6 - Months forward rate:	36.10/36.40

The company needs $ funds for six months. Determine whether the company should borrow in $ or ₹

Interest rates are :

3 - Months interest rate	₹ : 12%, $: 6%
6 - Months interest rate :	₹ : 11.50%, $: 5.5%

Also determine what should be the rate of interest after 3-months to make the company indifferent between 3-months borrowing and 6-months borrowing in the case of:

(i) Rupee borrowing

(ii) Dollar borrowing

Note: For the purpose of calculation you can take the units of dollar and rupee as 100 each.

SOLUTION 1G

(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	36.4
Amount of Cash outflow in Indian Rupees	₹ 3,740.10

If company borrows equivalent amount in Indian Rupee, then outflow would be as follows:

Equivalent ₹ amount ₹ 36.10 x 100	₹ 3,610.00
Add: Interest @11.50%	₹ 207.58
Amount of Cash outflow in Indian Rupees	₹ 3817.58

Since cash outflow is more in ₹ borrowing then borrowing should be made in $.

(ii) (a) Let 'Ir' be the interest rate of ₹ borrowing make indifferent between 3 months borrowings and 6 months borrowing then

$(1 + 0.03)(1 + Ir) = (1 + 0.0575)$

Ir = 2.67% or 10.68% (on annualized basis)

(b) Let 'id' be the interest rate of $ borrowing after 3 months to make indifference between 3 months borrowings and 6 months borrowings. Then,

$(1 + 0.015)(1 + id) = (1 + 0.0275)$

id = 1.232% or 4.93% (on annualized basis)

QUESTION NO. 2B (SM) (May 2011)

A Inc. and B Inc. intend to borrow $ 200,000 and $ 200,000 in ¥ respectively for a time horizon of one year. The prevalent interest rates are as follows:

Company	¥ Loan	$ Loan
A Inc	5%	9%
B Inc	8%	10%

The prevalent exchange rate is $1 = ¥120.

They entered in a currency swap under which it is agreed that B Inc will pay A Inc @ 1% over the ¥ Loan interest rate which the later will have to pay as a result of the agreed currency swap whereas A Inc will reimburse interest to B Inc only to the extent of 9%. Keeping the exchange rate invariant, quantify the opportunity gain or loss component of the ultimate outcome, resulting from the designed currency swap.

SOLUTION 2B

Opportunity gain of A Inc under currency swap	Receipt	Payment	Net
Interest to be remitted to B. Inc in			
$ 2,00,000x9%=$18,000		¥21,60,000	
Converted into ($18,000x¥120)			
Interest to be received from B. Inc in $	¥14,40,000	-	
converted into Y (6%x$2,00,000 x ¥120)			
Interest payable on Y 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 x(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 x 6%)		$12,000	
Interest to be received from A. Inc in Y converted into	$18,000		
$ =¥21,60,000/¥120			
Interest payable on $ loan@10%	-	$20,000	
	$18,000	$32,000	
Net Payment	$14,000	-	
	$32,000	$32,000	
Y equivalent paid $14,000 X ¥120			¥16,80,000

Interest payable without swap in ¥ ($2,00,000X¥120X8%)			¥19,20,000
Opportunity gain in Y			¥ 2,40,000

Alternative Solution

Cash Flows of A Inc

(i) At the time of exchange of principal amount

Transactions		Cash Flows
Borrowings	$2,00,000 x ¥120	+ ¥240,00,000
Swap		- ¥240,00,000
Swap		+$2,00,000
Net Amount		+$2,00,000

(ii) At the time of exchange of principal amount

Transactions		Cash Flows
Interest to the lender	¥240,00,000X5%	¥12,00,000
Interest Receipt from B Inc.	¥2,00,000X120X6%	¥14,40,000
Net Saving (in $)	¥2,40,000/¥120	$2,000
Interest to B Inc.	$2,00,000X9%	-$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

(i) At the time of exchange of principal amount

Transactions		Cash Flows
Borrowings		+ $2,00,000
Swap		- $2,00,000
Swap	$2,00,000X¥120	+¥240,00,000
Net Amount		+¥240,00,000

(ii) At the time of exchange of principal amount

Transactions		Cash Flows
Interest to the lender	$2,00,000X10%	- $20,000
Interest Receipt from A Inc.		+$18,000
Net Saving (in ¥)	-$2,000X¥120	- ¥2,40,000
Interest to A Inc.	$2,00,000X6%X¥120	- ¥14,40,000
Net Interest Cost		- ¥16,80,000

B Inc. used ¥240,00,000 at the net cost of borrowing of ¥16,80,000 i.e. 7%. If it had not opted for swap agreement the borrowing cost would have been 8%. Thus there is saving of 1%.

QUESTION NO. 3B (Nov 2023)

Suppose a dealer bank quotes for a generic swap "AIC 8%/8.20% vs. 6M LIBOR Flat". Notional principal amount of swap is ₹ 1 Million, and the same is for a period of three years, reset after every six months.

In this context, answer the following questions:

(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]

SOLUION 3B

(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 x 8.20% x 1/2 = ₹ 41,000

(5) Floating Rate Payment

= N (LIBOR) $\times \frac{dt}{360}$

= 10,00,000 × 0.05 $\times \frac{181}{360}$

= 10,00,000 × 0.05 (0.503) or 5,00,000 × 0.05 (0.502777)

= 10,00,000 × 0.02515 or 10,00,000 × 0.02514 = ₹ 25,150 or ₹ 25,140

(6) Net Settlement

₹ 41,000 - ₹ 25,150 = ₹ 15,850 Or ₹ 41,000 - ₹ 25,140 = ₹ 15,860

or ₹ 41,000 - ₹ 25,138.89 = ₹ 15,861.11

QUESTION NO. 3D (May 2023)

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.

SOLUTION 3D

(i) 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)

= (BPLR + 1.50% - BPLR - 0.50%) + (3% - 3.50%) = 0.50%

Less: Banker's commission (To be shared equally) = *0.20%

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.

(ii) Yes, a beneficial swap can be arranged

(iii) Effective cost of borrowing = pays to lenders + pays to other party - receives from other party + banker's commission

IF = BPLR + 0.50% + 2.70%** - (BPLR + 0.50%) + 0.10% = 2.80%

(** has been arrived as 3% - 0.20% - 0.10%)

SF = 3.50% + BPLR + 0.50% - 2.70% + 0.10% = BPLR + 1.40%

QUESTION NO. 4A (MTP Oct 2021)

Two companies ABC Ltd. and XYZ Ltd. approach the DEF Bank for FRA (Forward Rate Agreement). They want to borrow a sum of ₹ 100crores after 2 years for a period of 1 year. Bank has calculated Yield Curve of both companies as follows:

Year	XYZ Ltd.	ABC ltd.*
1	3.86	4.12
2	4.20	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.

a) 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.

b) Suppose bank offers Interest Rate Guarantee for a premium of 0.1% of the amount of loan, you are required to calculate the interest payable by XYZ Ltd. if interest rate in 2 years turns out to be (i) 4.50%, (ii) 5.50%

SOLUTION 4A

(i) DEF Bank will fix 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.

$(1+r)\,(1+0.0548)^2 = (1+0.0578)^3$

$(1+r)\,(1.0548)^2 = (1+0.0578)^3$

r = 6.38%

Bank will quote 6.38% for a 2V3 FRA.

(ii)

		4.50%- Allow to Lapse	5.50%-Exercise
Interest	₹ 100 crores X 4.50%	₹ 4.50 crores	-
	₹ 100 crores X 5.04%	-	₹ 5.04 crores
Premium (Cost of Option)	₹ 100 crores X 0.1%	₹ 0.10 crores	₹ 0.10 crores
		4.60 crores	5.14 crores

QUESTION NO. 5D (May 2022)

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:

(i) Effective Interest paid out at each six reset dates, (Round off to the nearest rupee)

(ii) Average overall effective rate of interest p.a. (round off to 2 decimals)

SOLUTION 5D

(i) The pay-off of each leg shall be computed as follows:

Cap Receipt

Max {0, [Notional principal x (LIBOR on Reset date – Cap Strike Rate) x (No. of days in settlement period/ 365)}

Floor Pay-off

Max {0, [Notional principal x (Floor Strike Rate – LIBOR on Reset date) x (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

(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 NO. 6 (MTP Oct 2021)

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.

You are required to determine the net payment to be received/ paid at the end of each quarter if Sensex turns out to be 21860, 21780, 22080 and 21960.

SOLUTION 6

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

Bond Valuation

Study Session 9

QUESTION NO. 4B (May 2015)

On 31st March, 2013, the following information about Bonds is available:

Name of Security	Face Value ₹	Maturity Date	Coupon Rate	Coupon Date(s)
Zero coupon	10,000	31st March, 2023	N.A.	N.A.
T-Bill	1,00,000	20th June, 2013	N.A.	N.A.
10.71% GOI 2023	100	31st March, 2023	10.71	31st March
10 % GOI 2018	100	31st March, 2018	10.00	31st March & 30th September

Calculate:

(i) If 10 years yield is 7.5% p.a. what price the Zero Coupon Bond would fetch on 31st March, 2013?

(ii) What will be the annualized yield if the T-Bill is traded @ 98500?

(iii) If 10.71% GOI 2023 Bond having yield to maturity is 8%, what price would it fetch on April 1, 2013 (after coupon payment on 31st March)?

(iv) If 10% GOI 2018 Bond having yield to maturity is 8%, what price would it fetch on April 1, 2013 (after coupon payment on 31st March)?

SOLUTION 4B

(i) Rate used for discounting shall be yield. Accordingly ZCB shall fetch:

$= \frac{10000}{(1+0.075)^{10}}$ = ₹ 4,852

(ii) The day count basis is actual number days / 365. Accordingly annualized yield shall be:

Yield $\frac{\text{FV}-\text{Price}}{\text{Price}} \times \frac{365}{\text{No.of days}} = \frac{100000-98500}{98500}$ = 6.86%

Note: Alternatively, it can also computed on 360 days a year.

(iii) Price GOI 2023 would fetch

= ₹ 10.71 PVAF(8%, 10) + ₹ 100 PVF (8%, 10)

= ₹ 10.71 x 6.71 + ₹ 100 x 0.4632

= ₹ 71.86 + ₹ 46.32 = ₹ 118.18

(iv) Price GOI 2018 Bond would fetch:

= ₹ 5 PVAF (4%, 10) + ₹ 100 PVF (4%, 10)

= ₹ 5 x 8.11 + ₹ 100 x 0.6756

= 40.55 + 67.56 = 108.11

QUESTION NO. 13B

MP Ltd. issued a new series of bonds on January 1,2000. The bonds were sold at par (₹ 1,000), having a coupon rate 10% p.a. and mature on 31st December, 2015. Coupon payments are made semi-annually on June 30th and December 31st each year. Assume that you purchased an outstanding MP Ltd. Bond on 1st March, 2008 when the going interest rate was 12%.

Required:

a) What was the YTM of MP Ltd. Bonds as on January 1, 2000?

b) What amount you should pay to complete the transaction for purchasing the bond on 1st March 2008 ? Of that amount how much should be accrued interest and how much would represent bonds basic value.

SOLUTION 13B

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

$$YTM = \frac{\text{Interest}}{\text{Principal}} = \frac{₹\,100}{₹\,1000} = 10\%$$

Price of the bond as on 1st July, 2018 = ₹ 50 x 9.712 + ₹ 1,000 x 0.417

= ₹ 485.60 + ₹ 417

= ₹ 902.60

Total value of the bond on the next = ₹ 902.60 +₹50 interest date= ₹952.60

Value of bond at purchase date $= ₹\,952.60 \times \frac{1}{(1+0.06)^{2/3}}$

= ₹ 952.60 x 0.9620 (by using excel)

= ₹ 916.40†

The amount to be paid to complete the transaction is ₹916.40. Out of this amount ₹ 16.67 represent accrued interest* and ₹899.73 represent the bond basic value.

† 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 ₹ 16.67 represent accrued interest* and ₹899.29 represent the bond basic value.

* Accrued Interest can also be calculated as follows:

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

QUESTION NO. 20B (Nov 2008)

XL Ispat Ltd. has made an issue of 14 per cent non-convertible debentures on January 1, 2007. These debentures have a face value of ₹ 100 and is currently traded in the market at a price of ₹ 90.

Interest on these NCDs will be paid through post-dated cheques dated June 30 and December

31. Interest payments for the first 3 years will be paid in advance through post-dated cheques while for the last 2 years post-dated cheques will be issued at the third year. The bond is redeemable at par on December 31, 2011 at the end of 5 years.

Required :

(i) Estimate the current yield and YTM of the bond.

(ii) Calculate the duration of the NCD.

(i) Assuming that intermediate coupon payments are, not available for reinvestment calculate the realised yield on the NCD.

SOLUTION 20B

(i) Current yield $=\frac{7}{90} \times \frac{12}{6} = 0.1555$ or 15.55%

YTM can be determined from the following equation

7 × PVIFA (YTM, 10) + 100 × PVIF (YTM, 10) = 90

Let us discount the cash flows using two discount rates 7.50% and 9% as follows:

Year	Cash Flows	PVF@7.50%	PV@7.50%	PVF@9%	PV@9%
0	-90	1	-90	1	-90
1	7	0.930	6.51	0.917	6.419
2	7	0.865	6.055	0.842	5.894
3	7	0.805	5.635	0.772	5.404
4	7	0.749	5.243	0.708	4.956
5	7	0.697	4.879	0.650	4.550
6	7	0.648	4.536	0.596	4.172
7	7	0.603	4.221	0.547	3.829
8	7	0.561	3.927	0.502	3.514
9	7	0.522	3.654	0.460	3.220
10	107	0.485	51.90	0.422	45.154
			6.560		-2.888

Now we use interpolation formula

$$= 7.50\% + \frac{6.560}{6.560 - (-2.888)} \times 1.50\%$$

$7.50\% + \frac{6.560}{9.448} \times 1.50\% = 7.50\% + 1.041\%$

YTM = 8.541% say 8.54%

Note: Students can also compute the YTM using rates other than 15% and 18%.

(ii) The duration can be calculated as follows:

Year	Cash Flow	PVF@ 8.54%	PV @ 8.54%	Proportion of NCD value	Proportion of NCD value × time
1	7	0.921	6.447	0.0717	0.0717
2	7	0.849	5.943	0.0661	0.1322
3	7	0.782	5.474	0.0608	0.1824

4	7	0.721	5.047	0.0561	0.2244
5	7	0.664	4.648	0.0517	0.2585
6	7	0.612	4.284	0.0476	0.2856
7	7	0.563	3.941	0.0438	0.3066
8	7	0.519	3.633	0.0404	0.3232
9	7	0.478	3.346	0.0372	0.3348
10	107	0.441	47.187	0.5246	5.2460
			89.95		7.3654

Duration = 7.3654 half years i.e. 3.683 years.

(iii) Realized Yield can be calculated as follows:

$\frac{(7\times10)+100}{(1+R)^{10}}$ =90

$(1+R)^{10}=\frac{170}{90}$

R= $\left(\frac{170}{90}\right)^{1/10}$ -1= 0.06380 or 6.380% for half yearly and 12.76% annually.

QUESTION NO. 21C (Nov 2020)

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:

(i) Current market price of the Bond,

(ii) Macaulay's Duration,

(iii) Volatility of the Bond,

(iv) Convexity of the Bond,

(v) Expected market price, if there is a decrease in the YTM by 200 basis points

  (a) By Macaulay's Duration based estimate

  (b) By Intrinsic Value Method.

Given

Years	1	2	3	4	5
PVIF (10%, n)	0.909	0.826	0.751	0.683	0.621
PVIF (8%, n)	0.926	0.857	0.794	0.735	0.681

SOLUTION 21C

(i) Current Market Price of Bond

= ₹ 850 (PVIAF 10%, 5) + ₹ 10,000 (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 x time (years)
1	850	0.909	772.65	0.082	0.082
2	850	0.826	702.10	0.074	0.148
3	850	0.751	638.35	0.068	0.204
4	850	0.683	580.55	0.062	0.248
5	10,850	0.621	6,737.85	0.714	3.57
			9431.50	1.000	4.252

Duration of the Bond is 4.252 years

(iii) Volatility of Bond

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

(iv) Convexity of Bond

C* x $(\Delta y)^2$ x100

C* = $\frac{V_+ + V_- - 2V_0}{2V_0(\Delta^2)}$

Year	Cash flow		P.V. @ 8%		P.V @12%
1	850	0.926	787.10	0.892	758.20
2	850	0.857	728.45	0.797	677.45
3	850	0.794	674.90	0.712	605.20
4	850	0.735	624.75	0.636	540.60
5	10,850	0.681	7388.85	0.567	6,151.95
			10204.05		8,733.40

C* = $\frac{10,204.05+8733.40-2\times9431.50}{2\times9431.50\times0.02^2}$

= $\frac{74.45}{7.5452} = 9.867$

Convexity of Bond = 9.867 x 0.02^2 x 100 = 0.395%

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

(A) By Macaulay's duration-based estimate

= ₹ 9431.50× 2 (3.865/100) = ₹ 729.05

Hence expected market price is ₹ 9431.50 + ₹ 729.05 = ₹ 10,160.55

Hence, the market price will increase.

(B) By Intrinsic Value method

Intrinsic Value at YTM of 10%	₹ 9,431.50
Intrinsic Value at YTM of 8%	₹ 10,204.05
Price increased by	₹ 772.55

Hence, expected market price is ₹ 10,204.05

QUESTION NO. 22F (May 2018)

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:

a) Conversion Value of Debenture
b) Market Conversion Price
c) Conversion Premium per share
d) Ratio of Conversion Premium
e) Premium over Straight Value of Debenture
f) Favourable income differential per share
g) Premium pay back period

SOLUTION 22F

1. Conversion Value of Debenture

= Market Price of one Equity Share × Conversion Ratio = ₹ 25 × 30 = ₹ 750

2. Market Conversion Price

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

3. Conversion Premium per share

= Market Conversion Price - Market Price of Equity Share

= ₹ 30 - ₹ 25 = ₹ 5

4. Ratio of Conversion Premium

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

5. Premium over Straight Value of Debenture

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

6. Favourable income differential per share

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

$$= \frac{85 - 30 \times 1}{30} = ₹\ 1.833$$

7. Premium pay back period

$$= \frac{Conversion\ Premium\ per\ Share}{\text{Favorable Income differential per share}} = 5\ 1.833 = 2.73 \text{ Years}$$

QUESTION NO. 23A (Nov 2018) (Dec 2021)

T is contemplating calling ₹ 3 crores of 30 years, ₹ 1,000 bond issued 5 years ago with a coupon interest rate of 14%. 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% coupon rates, 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 cost of debt is 8%. As the new bonds must first be sold and their proceeds, then used to retire old bonds, the company expects a two months period of overlapping interest during which interest must be paid on both the old and new bonds. What is the feasibility of refunding bonds?

SOLUTION 23A

Net Initial Outflow

Initial outflow for replacement of old bond : $\frac{3,00,00,000}{1000} \times 1140 = ₹\ 342,\ 00,000$

Initial Inflow on issue of New bonds: Issue value Less Issue Cost

i.e. 30,000,000 - 4,00,000 = 296,00,000

Net Initial Outflow = [342 lakh - 296 lakh] = 46 lakh

Call Premium, Unamortised issue cost and Unamortised Discount.

The call premium, unamortised issue cost and unamortised amount of discount on old bonds can be written off as an expense in the year in which the call is made. It is assumed normally that there will be tax benefit available immediately on these three expenses.

Call premium [1140-1000] x 30,000	42 lakh.
Unamortised Issue cost: $\frac{3,60,000}{30}$ X 25	3 lakh
Unamortised Discount on Old Bonds: $\frac{9,00,000}{30}$ X 25	7.5 lakh
Total amount to be written offf	52.5 lakh
Tax saving due to above claim : 40% of 52.5	21 lakh
Annual Cash Outflow :	
Existing :	
Annual Interest : 14% 300 lacs	= 42 lacs
Amortisation of issue cost p.a.	$\left[\frac{3.6 \text{ lakh}}{30}\right]$ = .12 lacs
Amortisaiton of discount	$\left[\frac{9 \text{ lakh}}{30}\right]$ = .30 lacs

Tax saving on above	=	40% (42 lakh + . 12 lakh + .30 lakh) = 16.968 lacs
Net Annul cash Outflow	=	42-16.968 = ₹ 25.032 lacs

New Issue

Annual Interest : = 12% of 300 lacs = 36 lacs

Amortisation of issue cost p.a. = $\frac{4,00,000}{25}$ = .16 lacs

Tax saving on above : = 40% (36+ .16) lacs = 14.469.

Net annual cash outflow = (36-14.469) = 21.536 lacs.

Annual saving on cash outflow Due to New Issue = (25.032-21.536) lacs = 3.496 lacs .

Overlapping Interest

300 lacs x 14% x $\frac{2}{12}$ = 7,00,000

(-) tax saving @ 40% = 2,80,000

Net cost = 4,20,000

Calculation of Total Net Saving by Replacing outstanding Bods with New Issue of Bonds :

Particulars	Time	PVF @ 8%	Amt. (in lakh)	PV (in lakh)
Initial cash outflow taxa saving on call premium	0	1	46	-46
Unamortised issue cost and discount amount	0	1	21	+21
Overlapping Interest net of tax	0	1	4.2	-4.20
Annul Saving	1-25	10.675	3.496	37.31980
Net Present Value				8.1198

Recommendation : Refunding of bonds is recommended as NPV is positive.

QUESTION NO. 24E (Jan 2021)

Following are the yields on Zero Coupon Bonds (ZCB) having a face value of ₹ 1,000

Maturity (Years)	Yield to Maturity (YTM)
1	10%
2	11%
3	12%

Assume that the term structure of interest rate will remain the same.

You are required to

(i) Calculate the implied one year forward rates

(ii) Expected Yield to Maturity and prices of one year and two year Zero Coupon Bonds at the end of the first year.

SOLUTION 24E

(i) Calculation of Forward Rates

Maturity	YTM (%)	PVIF	Face value	Price	Forward rate	
1	10	0.909	1,000	909.09		
2	11	0.812	1,000	811.62	0.1201 i.e.	12.01%
3	12	0.712	1,000	711.78	0.1403 i.e.	14.03%

(ii) Calculation of Expected Prices and YTM

Maturity	Forward rate	Face value	Price	YTM	
2	0.1201	1,000	$\frac{1000}{1+0.1201}=892.78$	0.1201 i.e.	12.01%
3	0.1403	1,000	$\frac{1000}{(1+0.1201)(1+0.1403)}=782.093$	0.1302* i.e.	13.02%

* $\sqrt{\left(\frac{1000}{782.93}\right)} - 1 = 0.1302$

QUESTION NO. 25B (Nov 2018)

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.

(ii) 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 immunise the portfolio.

(iii) 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	t1	t2	t3	t4	t5
PVIF0.09, t	0.917	0.842	0.772	0.708	0.650
	t6	t7	t8	t9	t10
PVIF0.09, t	0.596	0.547	0.502	0.460	0.4224

SOLUTION 25B

(a) Calculation of Bond Duration

Bond A

Year	Cash flow		P.V. @ 9%	Proportion of bond value	Proportion of bond value x time (years)
1	10	0.917	9.17	0.086	0.086

2	10	0.842	8.42	0.079	0.158
3	10	0.772	7.72	0.073	0.219
4	10	0.708	7.08	0.067	0.268
5	10	0.650	6.50	0.061	0.305
6	10	0.596	5.96	0.056	0.336
7	10	0.547	5.47	0.051	0.357
8	10	0.502	5.02	0.047	0.376
9	10	0.460	4.60	0.043	0.387
10	110	0.4224	46.46	0.437	4.370
			106.40	1.000	6.862

Duration of the bond is 6.862 years or 6.86 year

Bond B

Year	Cash flow	P.V. @ 9%		Proportion of bond value	Proportion of bond value x time (years)
1	11	0.917	10.087	0.091	0.091
2	11	0.842	9.262	0.083	0.166
3	11	0.772	8.492	0.076	0.228
4	11	0.708	7.788	0.070	0.280
5	11	0.650	7.150	0.064	0.320
6	11	0.596	6.556	0.059	0.354
7	11	0.547	6.017	0.054	0.378
8	111	0.502	55.772	0.502	4.016
			111.224	1.000	5.833

Duration of the bond B is 5.833 years or 5.84 years

Bond C

Year	Cash flow	P.V. @ 9%		Proportion of bond value	Proportion of bond value x time (years)
1	9	0.917	8.253	0.082	0.082
2	9	0.842	7.578	0.076	0.152
3	9	0.772	6.948	0.069	0.207
4	9	0.708	6.372	0.064	0.256
5	109	0.650	70.850	0.709	3.545
			100.00	1.000	4.242

Duration of the bond C is 4.242 years or 4.24 years

(ii) Amount of Investment required in Bond B and C

Period required to be immunized	6.000 Year
Less: Period covered from Bond A	3.087 Year
To be immunized from B and C	2.913 Year

Let proportion of investment in Bond B and C is b and c respectively then

$b + c = 0.55$ (1)

$5.883b + 4.242c = 2.913$ (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

$0.45 \times 7.15 + 0.36 \times 6.03 + 0.19 \times 4.27 = 6.20$ 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 NO. 26 (MTP April 2021)

In March 2020, XYZ Bank sold some 7% Interest Rate Futures underlying Notional 7.50% Coupon Bonds. The exchange provides following details of eligible securities that can be delivered:

Security	Quoted Price of Bonds	Conversion Factor
7.96 GOI 2023	1037.40	1.0370
6.55 GOI 2025	926.40	0.9060
6.80 GOI 2029	877.50	0.9195
6.85 GOI 2026	972.30	0.9643
8.44 GOI 2027	1146.30	1.1734
8.85 GOI 2028	1201.70	1.2428

Recommend the Security that should be delivered by the XYZ Bank if Future Settlement Price is 1000.

SOLUTION 26

The XYZ Bank shall choose those CTD (Cheapest-to-Deliver) Bonds from the basket of deliverable Bonds which gives maximum profit computed as follows:

Profit = Future Settlement Price x Conversion Factor – Quoted Spot Price of Deliverable Bond Accordingly, the profit of each bond shall be computed as follows:

Security (1)	Future Settlement Price (2)	Conversion Factor (3)	(4) = (2) x (3)	Quoted Price of Bonds (5)	Profit (6)
7.96 GOI 2023	1000	1.0370	1037.00	1037.40	- 0.40
6.55 GOI 2025	1000	0.9060	906.00	926.40	- 20.40
6.80 GOI 2029	1000	0.9195	919.50	877.50	42.00
6.85 GOI 2026	1000	0.9643	964.30	972.30	- 8.00
8.44 GOI 2027	1000	1.1734	1173.40	1146.30	27.10
8.85 GOI 2028	1000	1.2428	1242.80	1201.70	41.10

Since maximum profit to the Bank is in case of 6.80 GOI 2029, same should be opted for.

Portfolio Management

Study Session 10

QUESTION NO. 2K (Dec 2021)

On 01/04/2020 Mr. K Invested in the following companies to make his portfolio:

Name of Company	No. of Equity Share Purchase	Face Value per Equity Share	Purchase Price per Equity Share
PK Ltd.	2000	₹ 10	₹ 210
KD Ltd.	1000	₹ 10	₹ 290

Mr. K expects that-

(i) Dividend for the financial year 2020-21 of PK Ltd. & KD Ltd. will be 40% & 50% respectively.

(ii) Probabilities of the Market Price as on 31/03/2021 as under-

Probability Factor	Market Value per Equity Share of PK Ltd.	Market Value per Equity Share of KD Ltd.
0.4	₹ 200	₹ 300
0.4	₹ 240	₹ 320
0.2	₹ 260	₹ 350

You are required to –

(i) Calculate the Expected Market Price of Equity Shares of both the Companies as on 31/03/2021.

(ii) Calculate the Expected Average Return of the Portfolio for the year 2020-21.

SOLUTION 2K

(i) Expected Market Price of Shares on 31/03/2021

	PK Ltd.	KD Ltd.
(200 x 0.4) + (240 x 0.4) + (260 x 0.2)	228.00	-
(300 x 0.4) + (320 x 0.4) + (350 x 0.2)	-	318.00

(ii) Calculation of estimated return on Portfolio for 2020-21

	(Calculation in ₹ / share)	
	PK Ltd.	KD Ltd.
Expected dividend	4.00	5.00
Capital gain by 31.03.21	(228 – 210) = 18.00	(318 – 290) = 28.00
Yield	22.00	33.00
Market Value 01.04.20	210	290
% return	10.48%	11.38%

Weight in portfolio (2,000 x 210) : (1000 x 290)	59.15	40.85
Weighted average (Expected) return (59.15 x 10.48%) + (40.85 x 11.38%)	10.85%	

QUESTION NO. 7E (SM)(New Solution)(Nov 2013)(May 2015)

Mr. Shyam is holding the following securities:

Particulars of Securities	Cost ₹	Dividend Interest ₹	Market Price ₹	Beta
Gold Ltd.	10,000	1,725	9,800	0.60
Silver Ltd.	15,000	1,000	16,200	0.80
Bronze Ltd.	14,000	700	20,000	0.60
GOI Bonds	36,000	3,600	34,500	0.01

Average return of the portfolio is 15.7%. Using Average Beta, Calculate:

a) Expected rate of return in each case, using the Capital Asset Pricing Model (CAPM)

b) Risk free rate of return.

SOLUTION 7E

Particulars of Securities	Cost ₹	Dividend	Capital gain
Gold Ltd.	10,000	1,725	-200
Silver Ltd.	15,000	1,000	1,200
Bronz Ltd.	14,000	700	6,000
GOI Bonds	36,000	3,600	-1,500
Total	75,000	7,025	5,500

Expected rate of return on market portfolio

$$\frac{\text{Dividend Earned} + \text{Capital appreciation}}{\text{Initial investment}} \times 100$$

$$= \frac{₹\,7,025 + ₹\,5,500}{₹\,75,000} \times 100 = 16.7\%$$

Risk free return

$$\text{Average of Betas} = \frac{0.6 + 0.8 + 0.6 + 0.01}{4}$$

Average of Betas* = 0.50

Average return = Risk free return + Average Betas (Expected return – Risk free return)

15.7 = Risk free return + 0.50 (16.7 – Risk free return)

Risk free return = 14.7%

* Alternatively it can also be calculated through Weighted Average Beta.

Expected Rate of Return for each security is

Rate of Return = Rf + B (Rm – Rf)

Gold Ltd. = 14.7 + 0.6 (16.7 – 14.7) = 15.90%

Silver Ltd. = 14.7 + 0.8 (16.7 – 14.7) = 16.30%

Bronze Ltd. = 14.7 + 0.6 (16.7 – 14.7) = 15.90%

GOI Bonds = 14.7 + 0.01 (16.7 – 14.7) = 14.72%

* Alternatively it can also be computed as follows:

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

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

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

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

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

Rp = Rf + β(Rm - R f)

15.7% = 5.83% + 0.387(Rm – 5.83%)

QUESTION NO. 11E (SM) (May 2015)

There are two Mutual Funds viz. D Mutual Fund Ltd. and K Mutual Fund Ltd. Each having close ended equity schemes.

NAV as on 31-12-2014 of equity schemes of D Mutual Fund Ltd. is ₹70.71 (consisting 99% equity and remaining cash balance) and that of K Mutual Fund Ltd. is 62.50 (consisting 96% equity and balance in cash).

Following is the other information:

Particular	Equity Schemes	
	D Mutual Fund Ltd.	K Mutual Fund Ltd.
Sharpe Ratio	2	3.3
Treynor Ratio	15	15
Standard deviation	11.25	5

There is no change in portfolios during the next month and annual average cost is ₹ 3 per unit for the schemes of both the Mutual Funds.

If Share Market goes down by 5% within a month, calculate expected NAV after a month for the schemes of both the Mutual Funds.

For calculation, consider 12 months in a year and ignore number of days for particular month.

SOLUTION 11E

Working Notes:

(i) Decomposition of Funds in Equity and Cash Components

	D Mutual Fund Ltd.	K Mutual Fund Ltd.
NAV on 31.12.14	₹ 70.71	₹ 62.50
% of Equity	99%	96%
Equity element in NAV	₹ 70	₹ 60
Cash element in NAV	₹ 0.71	₹ 2.50

(ii) Calculation of Beta

(a) D Mutual Fund Ltd.

Sharpe Ratio = 2 $= \frac{E(R) - R_f}{\sigma_D} = \frac{E(R) - R_f}{11.25}$

E(R) - R_f = 22.50

Treynor Ratio = 15 = $\frac{E(R) - R_f}{\beta_D} = \frac{22.50}{\beta_D}$

β_D = 22.50/15= 1.50

(b) K Mutual Fund Ltd.

Sharpe Ratio = 3.3 = $\frac{E(R) - R_f}{\sigma_K} = \frac{E(R) - R_f}{5}$

$E(R) - R_f$ = 16.50

Treynor Ratio = 15 = $\frac{E(R) - R_f}{\beta_K} = \frac{16.50}{\beta_K}$

β_K = 16.50/15= 1.10

(iii) Decrease in the Value of Equity

	D Mutual Fund Ltd.	K Mutual Fund Ltd.
Market goes down by	5.00%	5.00%
Beta	1.50	1.10
Equity component goes down	7.50%	5.50%

(iv) Balance of Cash after 1 month

	D Mutual Fund Ltd.	K Mutual Fund Ltd.
Cash in Hand on 31.12.14	₹ 0.71	₹ 2.50
Less: Exp. Per month	₹ 0.25	₹ 0.25
Balance after 1 month	₹ 0.46	₹ 2.25

NAV after 1 month

	D Mutual Fund Ltd.	K Mutual Fund Ltd.
Value of Equity after 1 month		
70 x (1 - 0.075)	₹ 64.75	-
60 x (1 - 0.055)	-	₹ 56.70
Cash Balance	0.46	2.25
	65.21	58.95

QUESTION NO. 14D (SM) (Jan 2021) (May 2015)

Following are the details of a portfolio consisting of three shares:

Share	Portfolio Weight	Beta	Expected return in %	Total variance
A	0.20	0.40	14	0.015
B	0.50	0.50	15	0.025
C	0.30	1.10	21	0.100

Standard Deviation of Market Portfolio Returns = 10%

You are given the following additional data:

Covariance (A, B) = 0.030

Covariance (A, C) = 0.020

Covariance (B, C) = 0.040

Calculate the following:

a) The Portfolio Beta

b) Residual variance of each of the three shares

c) Portfolio variance using Sharpe Index Model

d) Portfolio variance (on the basis of modern portfolio theory given by Markowitz)

SOLUTION 14D

(i) Portfolio Beta

0.20 x 0.40 + 0.50 x 0.50 + 0.30 x 1.10 = 0.66

(ii) Residual Variance

To determine Residual Variance first of all we shall compute the Systematic Risk as follows:

$\beta_A^2 \sigma_M^2$ = (0.40)2(0.01) = 0.0016

$\beta_B^2 \sigma_M^2$ = (0.50)2(0.01) = 0.0025

$\beta_C^2 \sigma_M^2$ = (1.10)2(0.01) = 0.0121

Residual Variance

A 0.015 – 0.0016 = 0.0134

B 0.025 – 0.0025 = 0.0225

C 0.100 – 0.0121 = 0.0879

(iii) Portfolio variance using Sharpe Index Model

Systematic Variance of Portfolio = (0.10)2 × (0.66)2 = 0.004356

Unsystematic Variance of Portfolio = 0.0134 × (0.20)2 + 0.0225 × (0.50)2 + 0.0879 × (0.30)2 = 0.014072

Total Variance = 0.004356 + 0.014072 = 0.018428

(iv) Portfolio variance on the basis of Markowitz Theory

$= (w_A \times w_A \times \sigma_A^2) + (w_A \times w_B \times Cov_{AB}) + (w_A \times w_C \times Cov_{AC}) + (w_B \times w_A \times Cov_{AB}) + (w_B \times w_B \times \sigma_B^2) + (w_B \times w_C \times Cov_{BC}) + (w_C \times w_A \times Cov_{CA}) + (w_C \times w_B \times Cov_{CB}) + (w_C \times w_C \times \sigma^2)$

= (0.20 × 0.20 × 0.015) + (0.20 × 0.50 × 0.030) + (0.20 × 0.30 × 0.020) + (0.20 × 0.50 × 0.030) + (0.50 × 0.50 × 0.025) + (0.50 × 0.30 × 0.040) + (0.30 × 0.20 × 0.020) + (0.30 × 0.50 × 0.040) + (0.30 × 0.30 × 0.10)

= 0.0006 + 0.0030 + 0.0012 + 0.0030 + 0.00625 + 0.0060 + 0.0012 + 0.0060 + 0.0090

= 0.0363

QUESTION NO. 14E (SM) (Nov 2016)

Mr. Abhishek is interested in investing ₹ 2,00,000 for which he is considering following three alternatives:

(i) Invest ₹ 2,00,000 in Mutual Fund X (MFX)

(ii) Invest ₹ 2,00,000 in Mutual Fund Y (MFY)

(iii) Invest ₹ 1,20,000 in Mutual Fund X (MFX) and ₹ 80,000 in Mutual Fund Y (MFY)

Average annual return earned by MFX and MFY is 15% and 14% respectively. Risk free rate of return is 10% and market rate of return is 12%.

Covariance of returns of MFX, MFY and market portfolio Mix are as follow:

	MFX	MFY	Mix
MFX	4.800	4.300	3.370
MFY	4.300	4.250	2.800
Mix	3.370	2.800	3.100

You are required to calculate:

a) Variance of return from MFX, MFY and market return,

b) Portfolio return, beta, portfolio variance and portfolio standard deviation,

c) Expected return, systematic risk and unsystematic risk; and

d) Sharpe ratio, Treynor ratio and Alpha of MFX, MFY and Portfolio Mix

SOLUTION 14E

(i) Variance of Returns

$Cor_{i,j} = \frac{Cov\,(i,j)}{\sigma_j \sigma_j}$

Accordingly, for MFX

$1 = \frac{Cov\,(X,X)}{\sigma_X \sigma_X}$

$\sigma_X^2 = 4.800$

Accordingly, for MFY

$1 = \frac{Cov\,(Y,Y)}{\sigma_Y \sigma_Y}$

$\sigma_Y^2 = 4.250$

Accordingly, for Market Return

$1 = \frac{Cov\,(M,M)}{M\sigma_M}$

$\sigma_M^2 = 3.100$

(ii) Portfolio return, beta, variance and standard deviation

Weight of MFX in portfolio = $\frac{1,20,000}{2,00,000}$ =0.60

Weight of MFY in portfolio = $\frac{80,000}{2,00,000}$ =0.40

Accordingly Portfolio Return

0.60 × 15% + 0.40 × 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 x 1.087 + 0.40 x 0.903 = 1.013

Portfolio Variance

$$\sigma_{XY}^2 = W_X^2\sigma_X^2 + W_Y^2\sigma_Y^2 + 2w_X w_Y Cov_{X,Y}$$

= (0.60)2 (4.800) + (0.40)2 (4.250) + 2(0.60) (0.40) (4.300)

= 4.472

Or Portfolio Standard Deviation

$\sigma_{XY} = \sqrt{4.472}$ = 2.115

(iii) Expected Return, Systematic and Unsystematic Risk of Portfolio

Portfolio Return	= 10% + 1.0134(12% - 10%)	= 12.03%
MF X Return	= 10% + 1.087(12% - 10%)	= 12.17%
MF Y Return	= 10% + 0.903(12% - 10%)	= 28.06%
Systematic Risk	= $\beta^2\ \sigma^2$	

Accordingly,

Systematic Risk of MFX	= (1.087)2 x 3.10	= 3.663
Systematic Risk of MFY	= (0.903)2 x 3.10	= 2.528
Systematic Risk of Portfolio	= (1.013)2 x 3.10	= 3.181
Unsystematic Risk	= Total Risk - Systematic Risk	

Accordingly,

Unsystematic Risk of MFX	= 4.80 - 3.663	= 1.137
UnSystematic Risk of MFY	= 4.250 - 2.528	= 1.722
UnSystematic Risk 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

$$\text{MFX} = \frac{15\% - 10\%}{1.087} = 4.60$$

$$\text{MFY} = \frac{14\% - 10\%}{0.903} = 4.43$$

Portfolio = $\frac{14.6\%-10\%}{1.0134}$ = 4.54

Alpha

MFX = 15% - 12.17% = 2.83%

MFY = 14% - 11.81% = 2.19%

Portfolio = 14.6% - 12.03% = 2.57%

QUESTION NO. 15B (Nov 2020)

The following are the details of three mutual funds of MFL:

	Growth Fund	Balanced Fund	Regular Fund	Market
Average Return (%)	7	6	5	9
Variance	92.16	54.76	40.96	57.76
Coefficient of Determination	0.3025	0.6561	0.9604	

The yield on 182 days Treasury Bill is 9 per cent per annum.

You are required to:

(i) Rank the funds as per Sharpe's measure.

(ii) Rank the funds as per Treynor's measure.

(iii) Compare the performance with the market.

SOLUTION 15B

	Growth Fund	Balanced Fund	Regular Fund	Market
Average Return (%)	7	6	5	9
Variance	92.16	54.76	40.96	57.76
Std. Deviation	9.60	7.40	6.40	7.60
Coefficient of Determination	0.3025	0.6561	0.9604	
Coefficient of Correlation	0.55	0.81	0.98	
Beta (β)	$\frac{9.60}{7.60}\times 0.55$	$\frac{7.40}{7.60}\times 0.81$	$\frac{6.40}{7.60}\times 0.98$	
	= 0.695	= 0.789	= 0.825	

(i) Ranking of Funds as per Sharpe Ratio

Sharpe Ratio = $\frac{\text{Expected Return} - \text{Risk Free Rate of Return}}{\textit{Standard Deviation}}$

	Growth Fund	Balanced Fund	Regular Fund
Sharpe Ratio	$\frac{7-9}{9.60}$ = - 0.208	$\frac{6-9}{7.40}$ = - 0.405	$\frac{5-9}{6.40}$ = - 0.625
Ranking	1	2	3

(ii) Ranking of Funds as per Treynor Ratio

Treynor Ratio = $\frac{\text{Expected Return} - \text{Risk Free Rate of Return}}{Beta}$

	Growth Fund	Balanced Fund	Regular Fund
Treynor Ratio	$\frac{7-9}{0.695}$ = - 2.878	$\frac{6-9}{0.789}$ = - 3.802	$\frac{5-9}{0.825}$ = - 4.84
Ranking	1	2	3

(iii) Comparison of performance with the Market

Sharpe Ratio	$\frac{9-9}{7.60}$ = 0
Treynor Ratio	$\frac{9-9}{1}$ = 01

Thus, the performance of funds is very poor since all values are negative as compared to market performance.

QUESTION NO. 16A (May 2012)

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 would 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.

SOLUTION 16A

Maximum decline in one month = $\frac{5326-4793.40}{5326}$ x 100 = 10%

(1) Immediately to start with

Investment in equity = Multiplier x (Portfolio value – Floor value) = 2 (3,00,000 – 2,70,000) = ₹ 60,000

Indira may invest ₹ 60,000 in equity and balance in risk free securities.

(2) After 10 days

Value of equity = 60,000 x 5122.96/5326 = ₹ 57,713

Value of risk free investment = ₹ 2,40,000

Total value of portfolio = ₹ 2,97,713

Investment in equity = Multiplier x (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

(3) After another 10 days

Value of equity = 55,426 x 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 x (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 NO. 17C (SM) (Nov 2018)(June 2009)

Mr. X owns a portfolio with the following characteristics:

	Security A	Security B	Risk Free Security
Factor 1 sensitivity	0.80	1.50	0
Factor 2 sensitivity	0.60	1.20	0
Expected Return	15%	20%	10%

It is assumed that security returns are generated by a two factor model.

a) If Mr. X has ₹ 1,00,000 to invest and sells short ₹ 50,000 of security B and purchases ₹ 1,50,000 of security A what is the sensitivity of Mr. X's portfolio to the two factors?

b) If Mr. X borrows ₹ 1,00,000 at the risk free rate and invests the amount he borrows along with the original amount of ₹ 1,00,000 in security A and B in the same proportion as described in part (i), what is the sensitivity of the portfolio to the two factors?

c) What is the expected return premium of factor 2?

SOLUTION 17C

(i) Mr. X's position in the two securities are +1.50 in security A and -0.5 in security B. Hence the portfolio sensitivities to the two factors:-

β prop. 1 =1.50 x 0.80 + (-0.50 x 1.50) = 0.45

β prop. 2 = 1.50 x 0.60 + (-0.50 x 1.20) = 0.30

(ii) Mr. X's current position:-

Security A ₹ 3,00,000 / ₹ 1,00,000 = 3

Security B -₹ 1,00,000 / ₹ 1,00,000 = -1

Risk free asset -₹ 100000 / ₹ 100000 = -1

β prop. 1 = 3.0 x 0.80 + (-1 x 1.50) + (- 1 x 0) = 0.90

β prop. 2 = 3.0 x 0.60 + (-1 x 1.20) + (-1 x 0) = 0.60

(iii) Expected Return = Risk Free Rate of Return + Risk Premium Let λ_1 and λ_2 are the Value Factor 1 and Factor 2 respectively. Accordingly

$15 = 10 + 0.80\ \lambda_1 + 0.60\ \lambda_2$

$20 = 10 + 1.50\ \lambda_1 + 1.20\ \lambda_2$

On solving equation, the value of $\lambda_1 = 0$, and Securities A & B shall be as follows:

Security A

Total Return = 15%

Risk Free Return = 10%

Risk Premium = 5%

Security B

Total Return = 20%

Risk Free Return = 10%

Risk Premium = 10%

International Financial Management

QUESTION NO. 1A (SM) (July 2021)

A multinational company is planning to set up a subsidiary company in India (where hitherto it was exporting) in view of growing demand for its product and competition from other MNCs. The initial project cost (consisting of Plant and Machinery including installation) is estimated to be US$ 500 million. The net working capital requirements are estimated at US$ 50 million. The company follows straight line method of depreciation.

Presently, the company is exporting two million units every year at a unit price of US$ 80, its variable cost per unit being US$ 40.

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

(i) Variable operating cost will be US $ 20 per unit of production;

(ii) Additional cash fixed cost will be US $ 30 million p.a. and project's share of allocated fixed cost will be US $ 3 million p.a. based on principle of ability to share;

(iii) Production capacity of the proposed project in India will be 5 million units;

(iv) Expected useful life of the proposed plant is five years with no salvage value;

(v) Existing working capital investment for production & sale of two million units through exports was US $ 15 million;

(vi) Export of the product in the coming year will decrease to 1.5 million units in case the company does not open subsidiary company in India, in view of the presence of competing MNCs that are in the process of setting up their subsidiaries in India;

(vii) Applicable Corporate Income Tax rate is 35%, and

(viii) Required rate of return for such project is 12%.

Assuming that there will be no variation in the exchange rate of two currencies and all profits will be repatriated, as there will be no withholding tax, estimate Net Present Value (NPV) of the proposed project in India.

Present Value Interest Factors (PVIF) @ 12% for five years are as below:

Year	1	2	3	4	5
PVIF	0.8929	0.7972	0.7118	0.6355	**0.5674**

SOLUTION 1A

Financial Analysis whether to set up the manufacturing units in India or not may be carried using NPV technique as follows:

I. Incremental Cash Outflows

	$ Million
Cost of Plant and Machinery	500
Working Capital	50

Release of existing Working Capital	-15
	535

II. Incremental Cash Inflow after Tax (CFAT)

(a) Generated by investment in India for 5 years

	$ Million
Sales Revenue (5 Million × $80)	400
Less: Costs (5 Million × $20)	100
Variable Cost	
Fixed Cost	30
Depreciation ($500 Million / 5)	100
EBIT	170
Taxes@35%	59.5
EAT	110.5
Add: Depreciation	100
CFAT (1-5 years)	210.5
Cash flow at the end of the 5 years	35

(b) Cash generation by exports

	$ Million
Sales Revenue (1.5 Million x $80)	120
Less: Variable Cost (1.5 Million x $40) Contribution before tax	60
Tax@35%	21
CFAT (1-5 years)	39

(c) Additional CFAT attributable to Foreign Investment

	$ Million
Through setting up subsidiary in India Through Exports in India	210.5
Exports in India	39
CFAT (1-5 years)	171.5

III. Determination of NPV

Year	CFAT ($ Million)	PVF@12%	PV($ Million)
1-5	171.5	3.6048	618.2232
5	35	0.5674	19.859
			638.0822

Less: Initial Outflow	535
	103.0822

Since NPV is positive the proposal should be accepted.

QUESTION NO. 1B (SM) (May 2013)

XY Limited is engaged in large retail business in India. It is contemplating for expansion into a country of Africa by acquiring a group of stores having the same line of operation as that of India. The exchange rate for the currency of the proposed African country is extremely volatile. Rate of inflation is presently 40% a year. Inflation in India is currently 10% a year. Management of XY Limited expects these rates likely to continue for the foreseeable future.

Estimated projected cash flows, in real terms, in India as well as African country for the first three years of the project are as follows:

	Year-0	Year-1	Year-2	Year-3
Cash flows in Indian ₹ (000)	-50,000	-1,500	-2,000	-2,500
Cash flows in African Rands (000)	- 2,00,000	50,000	70,000	90,000

XY Ltd. assumes the year 3 nominal cash flows will continue to be earned each year indefinitely. It evaluates all investments using nominal cash flows and a nominal discounting rate. The present exchange rate is African Rand 6 to ₹ 1.

You are required to calculate the net present value of the proposed investment considering the following:

(i) African Rand cash flows are converted into rupees and discounted at a risk adjusted rate.

(ii) All cash flows for these projects will be discounted at a rate of 20% to reflect its high risk.

Ignore taxation.

	Year - 1	Year - 2	Year - 3
PVIF @ 20%	0.833	0.694	0.579

SOLUTION 1B

Calculation of NPV

Year	0	1	2	3
Inflation factor in India	1.00	1.10	1.21	1.331
Inflation factor in Africa	1.00	1.40	1.96	2.744
Exchange Rate (as per IRP)	6.00	7.6364	9.7190	12.3696
Cash Flows in ₹ '000				
Real	-50000	-1500	-2000	-2500
Nominal (1)	-50000	-1650	-2420	-3327.50
Cash Flows in African Rand '000				
Real	-200000	50000	70000	90000
Nominal	-200000	70000	137200	246960
In Indian ₹ '000 (2)	-33333	9167	14117	19965

Net Cash Flow in ₹ '000 (1)+(2)	-83333	7517	11697	16637
PVF@20%	1	0.833	0.694	0.579
PV	-83333	6262	8118	9633

NPV of 3 years = -59320 (₹ '000)

NPV of Terminal Value = $\frac{16637}{0.20}$ × 0.579 = 48164 (₹ '000)

Total NPV of the Project = -59320 (₹ '000) + 48164 (₹ '000) = -11156 (₹ '000)

QUESTION NO. 2E (RTP May 2021)(May 2019)

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 (βp) of 1.45, balance value is applied on Spares and Consumables Division, which has an Asset Beta (βsc) of 1.20 KGFL Debt beta (βD) is 0.24.

You are required to calculate:

(i) Equity Beta (βE),

(ii) Ascertain Equity Beta (βE), 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 (βD1) is 0.35 and any further funds raised by way of Debt will have a Beta (βD2) of 0.40.

(i) Whether the new Equity Beta (βE) justifies increase in the value of equity on account of leverage?

SOLUTION 2E

(i) Equity Beta

To calculate Equity Beta first we shall calculate Weighted Average of Asset Beta as follows:

= 1.45 x 0.74 + 1.20 x 0.26

= 1.073 + 0.312 = 1.385

Now we shall compute Equity Beta using the following formula:

$$\beta_{Asset} = \beta_{Equity} \times \frac{\text{Equity}}{\text{Equity+Debt (1-tax)}} + \beta_{Debt} \times \frac{\text{Debt (1-tax)}}{\text{Equity+Debt (1-tax)}}$$

$$1.385 = \beta_{Equity}\left[\frac{410}{410+170}\right] + \beta_{Debt}\left[\frac{170}{410+170}\right]$$

$$1.385 = \beta_{Equity}\left[\frac{410}{580}\right] + 0.24\left[\frac{170}{580}\right]$$

$\beta_{Equity} = 1.86$

(ii) 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 = Total Value x Debt Ratio / Debt Ratio +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

Weighted Average Beta of KGFL:

Source of Finance	Investment (₹ Cr)	Weight	Beta of the Division	Weighted Beta
Equity	200	0.345	β(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)

β_{KGFL} = 0.248 + 0.345x

1.385 = 0.248 + 0.345x

0.345x = 1.385 – 0.248

X = 1.137/0.345 = 3.296

β_{KGFL} = 3.296

(iii) Yes, it justifies the increase as it leads to increase in the Value of Equity due to increase in Beta.

QUESTION NO. 4C (July 2021)

M/s. Raghu Ltd. is interested in expanding its operation and planning to install manufacturing plant at US. It requires 8.82 million USD (net of issue expenses/ floatation cost) to fund the proposed project. GDRs are proposed to be issued to finance this project. The estimated floatation cost of GDRs is 2%.

Additional information:

(i) Expected market price of share at the time of issue of GDR is ₹ 360 (Face Value ₹ 100)

(ii) Each GDR will represent two underlying Shares.

(iii) The issue shall be priced at 10% discount to the market price.

(iv) Expected exchange rate is INR/USD 72.

(v) Dividend is expected to be paid at the rate of 20% with growth rate of 12%.

(1) You, as a financial consultant, are required to compute the number of GDRs to be issued and cost of the GDR.

(2) What is your suggestion if the company receives an offer from a US Bank willing to provide an equivalent loan with an interest rate of 12%?

(3) How much company can save by choosing the option as recommended by you?

SOLUTION 4C

Net Issue Size = $ 8.82 million

Gross Issue = $\frac{8.82}{0.98}$ = $9.00 million

Issue Price per GDR in ₹ (360 x 2 x 90%)	₹ 648
Issue Price per GDR in $ (₹ 648/ ₹ 72)	$ 9.00
Dividend Per GDR (D_1) = ₹ 20 x 2 =	₹ 40
Net Proceeds Per GDR = ₹ 648 x 0.98 =	₹ 635.04

(1) (a) Number of GDR to be issued

$$\frac{\$\ 9.00\ \text{million}}{\$\ 9} = 1.00\ \text{million}$$

(b) Cost of GDR

$$ke = \frac{40}{635.04} + 0.12 = 18.30\%$$

(2) If the company receives an offer from US Bank willing to provide an equivalent amount of loan with interest rate of 12%, it should accept the offer.

(3) If the offer is accepted there will be net saving of 6.30%.

Advanced Capital Budgeting Decisions

Study Session 12

QUESTION NO. 3B :

A Ltd. are purchasing a machine at a cost of ₹ 3,000. Life is two years The CFAT for two years is as follows:

Year ₹		Year 2	
Cash Flow (₹)	Initial Probability	Cash Flow (₹)	Conditional Probability
1,500	0.4	2,200	0.5
		1,800	0.5
2,500	0.6	1,800	0.7
		2,000	0.3

(a) What are the various joint probabilities of occurrences/arising of various branches?

(b) If the risk free rate is 12%, what are the Mean and Standard Deviation of the probability distribution of possible NPVs?

SOLUTION 3B

(i) There are four branches/outcome/events. There will be four joint probabilities.

Probability	Probability	Joint Probability
Year1	Year2	Year1 x Year2
0.40	0.50	0.20
0.40	0.50	0.20
0.60	0.70	0.42
0.60	0.30	0.18

(ii) Computation of Present Values of Cash Flows (₹)

Branch/Events	Year0	Year1	Year2	Net Present Value
1	-3000	1,339.50	1,753.40	92.90
2	-3000	1,339.50	1,434.60	(225.9)
3	-3000	2,232.50	1,434.60	667.10
4	-3000	2,232.50	1,594.00	826.50

Computing Mean of Expected NPV or Expected NPV of the Project.

Branch	NPV	Joint Probability	NPV x Joint Probability
1	92.90	0.20	18.58
2	(225.90)	0.20	(45.18)

3	667.10	0.42	280.182
4	826.50	0.18	148.77
Expected Net Present Value			402.75

Computing Standard Deviation of probability distribution of possible NPVs.

NPV (X)	(X-X)	$(X-X)^2$	Prob.	Prob. X $(X-X)^2$
92.90	-309.45	9,5759.3	0.20	19,151.9
-225.90	-628.25	3,94,698.1	020	78,739.6
667.10	264.75	70,092.6	0.42	29,438.9
826.50	424.15	1,79,903	0.18	32,382.6
			σ^2	15,9913

$\sigma = \sqrt{159913}$ = 399.891

Conclusion: Mean NPV is ₹ 402.35 Project has a positive NPV. Project can be accepted. The standard deviation of probability distribution of possible NPVs is ₹ 399.891, or say ₹ 400.00.

QUESTION NO. 3C : (SM)

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

(i) The expected NPV of the project.

(ii) The best case and the worst case NPVs.

(iii) The probability of occurrence of the worst case if the cash flows are

(a) Perfectly Dependent Overtime

(b) Independent Overtime.

(iv) 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.

(v) Coefficient of variation of X Ltd. on its average project ranges between of 0.95 to 1.0.If the coefficient of variation of the project is found to be less riskier than average, 100 basis points are deducted from the Company's Cost of Capital.

Should then the project be accepted by X Ltd.?

SOLUTION 3C

(a) (i) Expected cash flows:-

Year			Net cash flows	P.V.	PV. @ 10%
0	(4,00,000 x 1)	=	(-)4,00,000	1.000	(-)4,00,000
1 to 4	(1,00,000x0.3+1,10,000x0.5	=	1,09,000	3.170	3,45,530
	+ 1,20,000 x 0.2)				
5	[1,09,000 + (20,000 x 0.3 +	=	1,52,000	0.621	94,392
	50,000 x 0.5 + 60,000 x 0.2)]				
			NPV=		39,922

(ii) ENPV of the worst case

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

20,000 x 0.621 = ₹ 12,420/-

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

ENPV of the best case

ENPV = (-) 4,00,000 + 1,20,000 x 3.790 + 60,000 x 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 x 3.79) + (50,000 x 0.621)

= ₹ 47,950/-

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

Therefore,

$\sigma_{ENPV} = \sqrt{0.3(-8580-39813)2+0.5(47950-39813)2+0.2(92060-39813)2}$ =₹35,800

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

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

NPV

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

Therefore, the project should be accepted.

QUESTION NO. 3E : (SM) (May 2013)

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

Year 1	Year 2	Year 3

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

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

(i) The expected NPV of this venture assuming independent probability distribution with 6 per cent risk free rate of interest.

(ii) The possible deviation in the expected value.

(i) How would standard deviation of the present value distribution help in Capital Budgeting decisions?

SOLUTION 3E

(i) Expected NPV

(₹ in lakhs)

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

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

(ii) Possible deviation in the expected value

Year I				
X - X	X - X	$(X - X)^2$	P_1	$(X - X)^2 P_1$
14 – 27	-13	169	0.1	16.9
18 – 27	-9	81	0.2	16.2

25 – 27	-2	4	0.4	1.6
40 – 27	13	169	0.3	50.7
				85.4

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

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

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

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

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

Standard deviation about the expected value:

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

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

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

A project, which has a lower coefficient of variation will be preferred if sizes are heterogeneous.

Besides this, if we assume that probability distribution is approximately normal we are able to calculate the probability of a capital budgeting project generating a net present value less than or more than a specified amount.

QUESTION NO. 5D : (SM)

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

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

Other information available is:

Profit Volume ratio is	70 %
Variable Cost is	₹ 60/- per unit.
Annual Cash Flow	₹ 57,500

Ignore depreciation on initial investment and impact of taxation.

Calculate:

(i) Initial Investment

(ii) Net present value of the project

(iii) Annual fixed cost

(iv) Estimated annual unit of sales

(v) Break Even units.

Cumulative Discounting Factor for 5 Years

8%	9%	10%	11%	12%	13%	14%	15%	16%	17%	18%
3.993	3.890	3.791	3.696	3.505	3.517	3.433	3.352	3.274	3.199	3.127

SOLUTION 5D

(i) Initial Investment

IRR = 16% (Given)

At IRR, NPV shall be zero, therefore

Initial Cost of Investment = PVAF (16%,5) x Cash Flow (Annual)

= 3.274 x ₹ 57,500

= ₹ 1,88,255

(ii) Net Present Value (NPV)

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

X = 10%

Thus NPV of the project

= Annual Cash Flow x PVAF (10%, 5) – Initial Investment

= ₹ 57,500 x 3.791 – ₹ 1,88,255

= ₹ 2,17,982.50 – ₹ 1,88,255 = ₹ 29,727.50

(iii) Annual Fixed Cost

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

₹ 29,727.50 – 3.791X = 0

Thus X = ₹ 7,841.60

Let original Fixed Cost be Y then,

Y × 7.8416% = ₹ 7,841.60

Y = ₹ 1,00,000

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

(iv) Estimated Annual Units of Sales

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

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

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

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

(v) Break Even Units

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

QUESTION NO. 6D : (SM)

XYZ Ltd. requires ₹ 8,00,000 for an unit.

Useful life of project	4 years
Salvage Value	Nil
Depreciation Charge	₹ 2,00,000 p.a.
Tax Rate	60%
Cost of Capital	10%

Expected Revenues & Costs (excluding depreciation) ignoring inflation.

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

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

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

SOLUTION 6D

Computation of Annual Cash Flow

(i) Inflation adjusted Revenues

Year	Revenues (₹)	Revenues (Inflation Adjusted) (₹)
1	6,00,000	6,00,000(1.10) = 6,60,000
2	7,00,000	7,00,000(1.10)(1.09) = 8,39,300

3	8,00,000	8,00,000(1.10)(1.09)(1.08) = 10,35,936
4	8,00,000	8,00,000(1.10)(1.09)(1.08)(1.07) = 11,08,452

(ii) Inflation adjusted Costs

Year	Revenues (₹)	Revenues (Inflation Adjusted) (₹)
1	3,00,000	3,00,000(1.12) = 3,36,000
2	4,00,000	4,00,000(1.12)(1.10) = 4,92,800
3	4,00,000	4,00,000(1.12)(1.10)(1.09) = 5,37,172
4	4,00,000	4,00,000(1.12)(1.10)(1.09)(1.08) = 5,80,124

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

(iv) Net Profit after Tax

Year	Revenues (Inflation Adjusted) (₹)(1)	Costs (Inflation Adjusted) (₹)(2)	Net Profit (₹) (3) = (1) - (2)	Tax (₹) (4) = 60% of (3)	Net after Profit (₹) (3) - (4)
1	6,60,000	3,36,000	3,24,000	1,94,400	1,29,600
2	8,39,300	4,92,800	3,46,500	2,07,900	1,38,600
3	10,35,936	5,37,172	4,98,764	2,99,258	1,99,506
4	11,08,452	5,80,124	5,28,328	3,16,997	2,11,331

Present Value of Cash Inflows

Year	Net after Profit (₹)	Tax Benefit on Depreciation (₹)	Cash Inflow (₹)	PVF@ 10%	PV (₹)
1	1,29,600	1,20,000	2,49,600	0.909	2,26,886
2	1,38,600	1,20,000	2,58,600	0.826	2,13,604
3	1,99,506	1,20,000	3,19,506	0.751	2,39,949
4	2,11,331	1,20,000	3,31,331	0.683	2,26,299
					9,06,738

NPV = ₹ 9,06,738 – ₹ 8,00,000 = ₹ 1,06,738

QUESTION NO. 8B : (May 2015)

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

Particulars	Plant A	Plant B
Cost	₹ 20,00,000	₹ 38,00,000
Installation charges	₹ 4,00,000	₹ 2,00,000

Life	20 years	15 years
Scrap value after full life	₹ 4,00,000	₹ 4,00,000
Output per minute (units)	200	400

The annual costs of the two plants are as follows:

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

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

Note: 10 percent interest tables

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

SOLUTION 8B

Working Notes:

Calculation of Equivalent Annual Cost

	Machine A	Machine B
Cash Outlay	₹ 24,00,000	₹ 40,00,000
Less:PV of Salvage Value		
4,00,000 x 0.1486	₹ 59,440	
4,00,000 x 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 x 60 x 200	2500 x 60 x 400
	= 3,00,00,000	= 6,00,00,000
Annual Cost (b)	₹	₹

Wages	1,00,000	1,40,000
Indirect Material	4,80,000	6,00,000
Repairs	80,000	1,00,000
Powers	2,40,000	2,80,000
Fixed Cost	60,000	80,000
Equivalent Annual Cost	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 NO. 9A : (SM) (May 2024)

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

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

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

SOLUTION 9A

Working Notes

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

One Year Replacement Cycle

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

Two Years Replacement Cycle

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

Three Years Replacement Cycle

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

Four Years Replacement Cycle

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

Now we shall calculate NPV for each replacement cycles

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

Replacement Cycles		EAC (₹)
1 Year	$\frac{46,086}{0.8696}$	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 year₹

QUESTION NO. 12E (May 2013)

Ramesh owns a plot of land on which he intends to construct apartment units for sale. No. of apartment units to be constructed may be either 10 or 15. Total construction costs for these alternatives are estimated to be ₹ 600 lakhs or ₹ 1025 lakhs respectively. Current market price for each apartment unit is ₹ 80 lakhs. The market price after a year for apartment units will depend upon the conditions of market. If the market is buoyant, each apartment unit will be sold for ₹ 91 lakhs, if it is sluggish, the sale price for the same will be ₹ 75 lakhs. Determine the value of vacant plot of land. Assuming that the construction cost will remain same in year 1 should Ramesh start construction now or keep the land vacant? The yearly rental per apartment unit is ₹ 7 lakhs and the risk free interest rate is 10% p.a.

Assume that the construction cost will remain unchanged.

SOLUTION 12E

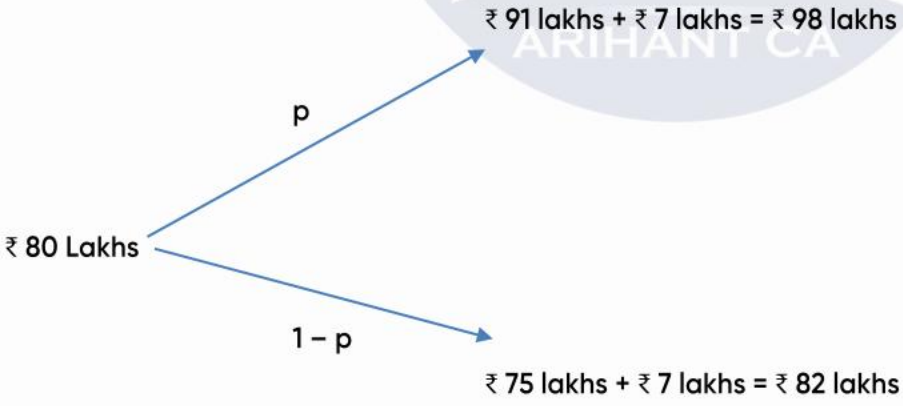
Presently 10 units apartments shall yield a profit of ₹ 200 lakh (₹ 800 lakhs – ₹ 600 lakhs) and 15 unit apartment will yield a profit of ₹ 175 lakh (₹ 1200 lakhs – ₹ 1025 lakhs). Thus 10 units apartment is the best alternative if Ramesh has to construct now.

However, Ramesh waits for 1 year his pay-off will be as follows:

	Market Conditions	
10 units apartments	₹ 91 lakhs X 10 – ₹ 600 lakhs = ₹ 310 lakhs	₹ 75 lakhs X 10 – ₹ 600 lakhs = ₹ 150 lakhs
15 units apartments	₹ 91 lakhs X 15 – ₹ 1025 lakhs = ₹ 340 lakhs	₹ 75 lakhs X 15 – ₹ 1025 lakhs = ₹ 100 lakhs

Thus if market conditions turnout to be buoyant the best alternative is 15 units apartments and net pay-off will be ₹ 340 lakhs and if market turnout to be sluggish the best alternative is the 10 units apartments and net pay-off shall be ₹ 150 lakhs.

To determine the value of vacant plot we shall use Binomial Model (Risk Neutral Method) of option valuation as follows:



Alternatively student can calculate these values as follows (Sale Value + Rent):

If market is buoyant then possible outcome = ₹ 91 lakh + ₹ 7 lakh = ₹ 98 lakhs

If market is sluggish then possible outcome = ₹ 75 lakh + ₹ 7 lakh = ₹ 82 lakhs

Let p be the probability of buoyant condition then with the given risk-free rate of interest of 10% the following condition should be satisfied:

$$₹\ 80\ \text{lakhs} = \frac{[(p \times ₹\ 98\text{lakhs}) + (1-p) \times ₹\ 82\text{lakhs}]}{1.10}$$

p= $\frac{3}{8}$ i.e. 0.375

Thus 1-p = 0.625

Expected cash flow next year

0.375 × ₹ 340 lakhs + 0.625 X ₹ 150 lakhs = ₹ 221.25 lakhs

Present Value of expected cash flow:

₹ 221.25 lakhs (0.909) = ₹ 201.12 lakhs

Thus, the value of vacant plot is ₹ 201.12 lakhs

Since the current value of vacant land is more than profit from 10 units apartments now (₹ 200 lakh) the land should be kept vacant.

Risk Management

Study Session 13

QUESTION NO. 4 : (Nov 2020)

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

Given

Standard Normal Probabilities										
z	0.00	.01	.02	.03	0.04	.05	.06	.07	.08	.09
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9998	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9923	.9925	.9929	.9931	.9932	.9934	.9936

You are required to determine the maximum possible investment.

SOLUTION 4

Particulars	Amount (₹)
Amount available in bank account	7,00,000
Minimum balance to be kept	1,000
Available amount which can be used for potential investment for 4 days	6,99,000
Maximum Loss for 4 days at 99% level	6,99,000
Maximum Loss for 1 day at 99 % level = Maximum Loss for 4 days / √No. of days = 699000/ √4	3,49,500
Z Score at 99% Level	2.33
Volatility in terms of Rupees (Maximum Loss/ Z Score at 99% level) = 349500/ 2.33	1,50,000
Maximum Possible Investment (Volatility in Rupees/Std Deviation) = 150000/.015	1,00,00,000

QUESTION NO. 6 : (May 2023)

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.

SOLUTION 6 :

(a) Working Notes:

(1) Security X

Return (1)	Prob. (2)	(1) x (2)	Dev.	Dev.2	Dev.2 x 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 ($\sigma^2 2$) = 1.30

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

(2) Security Y

Return (1)	Prob. (2)	(1) x (2)	Dev.	Dev.^{2}	Dev.^{2} x 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 ($\sigma^2 2$) = 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 / $\sqrt{\text{No. of days}}$	1	₹ 58170780	₹ 58170780
= 116341560 / $\sqrt{4}$			
Z Score at 99% level		2.33	2.33
Volatility in terms of ₹ (Maximum Loss/Z Score at 99% Level)		₹ 24966000	₹ 24966000
Standard Deviation		0.0114	0.0219
Maximum Investment (Volatility in terms of ₹ / SD)		₹ 2190000000	₹1140000000

Recommendation: Position should be taken in X.

Miscellaneous Topics

QUESTION NO. 2E (Nov 2023)

The following information of AB Ltd., is available below: Market Value per share - ₹ 20 per share

Equity Share Capital - 12,00,000 shares @ the face value of ₹ 10 per share.

The company is planning to issue Rights Shares to the existing shareholders and raise ₹ 60,00,000 to finance a new project. You are required:

(i) To calculate the ex-right price of shares and the value of right, if

(a) The company offers one right share for every three shares held.

(b) The company offers two right shares for every five shares held.

(ii) To show the effect of the rights issue on the wealth of a Shareholder X, who has 1,500 shares, when the company offers one right share for every three shares held, assuming :

(a) He subscribes to the Rights issue

(b) He ignores the Rights issue

SOLUTION 2E

(i) Ex-right price of share and the value of right

(a) Number of shares to be issued : 4,00,000

Subscription price ₹ 60,00,000 / 4,00,000 = ₹ 15

Ex-Right Price $= \frac{₹240\ lakh + ₹60\ lakh}{16\ lakh}$ = ₹ 18.75

Value of a Right = ₹ 18.75 – ₹ 15 = ₹ 3.75

Value of a Right Per Share Basis $= \frac{₹3.75}{3}$ = ₹ 1.25

Number of shares to be issued : 4,80,000

Subscription price ₹ 60,00,000 / 4,80,000 = ₹ 12.50

Ex-Right Price $= \frac{₹240\ lakh + ₹60\ lakh}{16.80\ lakh}$ = ₹ 17.86

Value of a Right = ₹ 17.86 – ₹ 12.50 = ₹ 5.36

Value of a Right Per Share Basis $= \frac{₹5.36 \times 2}{5}$ = ₹2.14 or $\frac{₹5.36}{5}$ = ₹ 1.07

(ii) (a) Shareholder's wealth that is holding 1500 shares when firm offers one share for three shares held and subscribes the offer.

Value of Shares after right issue (2000 X ₹ 18.75)	₹ 37,500
Less: Amount paid to acquire right shares (500 X ₹15)	₹ 7,500
	₹ 30,000

Wealth before Right Issue = 1500 x 20 = ₹ 30,000

Thus, there is no change in the wealth

(b) Shareholder's wealth that is holding 1500 shares when firm offers one share for three shares held and does not subscribe the offer.

Value of Shares after right issue (1500 X ₹ 18.75) ₹ 28,125

Thus, if shareholder does not subscribe right offer there will be loss of wealth of ₹ 1,875.

QUESTION NO. 2F (Nov 2024)

AMN Ltd. has surplus cash of ₹ 200 lakhs and wants to distribute 30% of it to the shareholders. The company decides to buy back shares. The Finance officer of the company estimates that it share price after repurchase is likely to be 15% above the buyback price if the buyback route is taken. The number of shares outstanding at present is 15 lakhs and the current EPS is ₹ 3.00. Bought Back price is to be rounded off to one decimal point. You are required to determine.

(i) The price at which the shares can be repurchased, if the market capitalisation of the company should be ₹ 250 lakhs after buyback.

(ii) The number of shares that can be repurchased.

(iii) The impact of share repurchase on the EPS, assuming that net income is the same.

SOLUTION 2F

(i) Number of new equity shares to be offered for each rights head

Subscription Price = ₹ 40 × 0.80 = ₹ 32 per share

Ex Right Price to be restricted to = ₹ 40 × 0.90 = ₹ 36

Let R be the ratio in which right share to be issued then

$₹ 36 = \frac{₹40 + ₹32 \times R}{1+R}$

36 + 36R = ₹ 40 + 32R

R = 1

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

(ii) Theoretical Value of right = ₹ 36 – ₹ 32 = ₹ 4

(iii) No. of equity share to be issued = $\frac{₹12\ crore}{32}$ = 37,50,000 or 0.375 shares

QUESTION NO. 5C (July 2021)

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:

(i) Repo Rate

(ii) Dirty Price and

(iii) Clean Price

SOLUTION 5C

(i) Second Leg (Repayment at Maturity) = Start Proceed x(1+ Repo rate × $\frac{No.of\ days}{360}$)

= ₹ 2,00,06,750 x (1+Repo Rate×$\frac{9}{360}$) = ₹ ₹2,00,31,759

1.00125 = (1+Repo Rate×$\frac{9}{360}$)

Repo Rate = 0.05 = 5%

(ii) First Leg (Start Proceed) = = Nominal Value x$\frac{Dirty\ Price}{100}$×$\frac{100-Initial\ margin}{100}$

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

10003.375 = 98.75 x Dirty Price

Dirty Price = ₹ 101.30

(iii) Dirty Price = Clean Price + Interest Accrued

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

Clean Price = ₹ 97.30

QUESTION NO. 7D

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

Days	Date	Closing Values of NIFTY Index
1	03/01/2022	17626
2	04/01/2022	17805
3	05/01/2022	17925
4	06/01/2022	17746
5	07/01/2022	17813
6	10/01/2022	18003
7	11/01/2022	18056
8	12/01/2022	18212

The simple moving average of NIFTY Index for the month of December 2021 was 17174.

You are required to calculate

(i) The value of exponent for 15 days EMA.

(ii) The average (EMA) of NIFTY during the above period. (Calculations to be done up to 2 decimals only)

(iii) Analyse the buy & sell signal on the basis of your calculations

SOLUTION 7D

		Scenario 1	Scenario 2
(i)	Earnings of Mr. A through stock lending scheme		
	Lending fee		
	31-01-20 1020 x 1% and 980 x 1%	10.20	9.80
	29-02-20 1040 x 1% and 960 x 1%	10.40	9.60
	31-03-20 1050 x 1% and 940 x 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

QUESTION NO. 8A (SM)

The closing value of Sensex for the month of October, 2007 is given below:

Date Closing	Sensex Value
1.10.07	2800
3.10.07	2780
4.10.07	2795
5.10.07	2830
8.10.07	2760
9.10.07	2790
10.10.07	2880
11.10.07	2960
12.10.07	2990
15.10.07	3200
16.10.07	3300
17.10.07	3450
19.10.07	3360

22.10.07	3290
23.10.07	3360
24.10.07	3340
25.10.07	3290
29.10.07	3240
30.10.07	3140
31.10.07	3260

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

Following value can be used :

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

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

SOLUTION 8A

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

Total of sign of price changes (r) = 8

No of Positive changes = n_1 = 11

No. of Negative changes = n_2 = 8

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

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

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

$$\hat{\sigma_r} = \sqrt{\frac{(2 \times 11 \times 8)\,(2 \times 11 \times 8 - 11 - 8)}{(11 + 8)^2\,(11 + 8 - 1)}} = \sqrt{\frac{176 \times 157}{(19)^2\,(18)}} = \sqrt{4.252} = 2.06$$

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

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

The lower limit

$= \mu - t \times \hat{\sigma_r}$ = 10.26 – 2.101 × 2.06 = 5.932

Upper limit

$= \mu + t \times \hat{\sigma_r}$ = 10.26 + 2.101 × 2.06 = 14.588

At 10% level of significance at 18 degrees of freedom

Lower limit

= 10.26 – 1.734 × 2.06 = 6.688

Upper limit

= 10.26 + 1.734 × 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 NO. 14 (May 2023)(July 2021)

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:

(i) The interest amount which can be paid for availing the bank loan.

(ii) The loan amount to be raised.

(iii) Buy back premium per share.

SOLUTION 14

(i) The interest amount which can be paid for availing the bank loan

Current Market Price per Share = ₹ 600 × 25 = ₹ 15,000

No. of Shares before Buyback $= \frac{\text{Market capitalisation}}{Market\ Price\ of\ share}$

$= \frac{15{,}000\ crore}{15{,}000}$ = 1 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

Post Buyback EPS = $\frac{10000}{25}$ = ₹ 400

EAT before Buyback = ₹ 600 × 1 crore = ₹ 600 crore

EBT before Buyback = $\frac{600}{(1-.30)}$ = ₹ 857.1429 crore

EAT after Buyback = ₹ 400.00 × 80 lakh = ₹ 320 crore

EBT after Buyback = $\frac{320}{(1-0.30)}$ = ₹ 457.1429 crore

Interest which can be paid for availing bank loan:

EBT before Buyback	₹ 857.1429 crore
(-) EBT after Buyback	₹ 457.1429 crore
	₹ 400.0000 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 (₹ 600x 5) D = B X 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) X (B)	₹ 320 crore
Pre Buy back Earning 1 Crore X ₹ 600 (D)	₹ 600 crore
Post Tax Earning available for interest payment (D) – (C)	₹ 280 Crore
Pre- Tax amount of Interest $\frac{280\ Crore}{(1-.30)}$	₹ 400 Crore

(ii) Loan Amount raised = $\frac{400\ Crore}{0.16}$ = ₹ 2500 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