FINAL EXAMINATION
GROUP - III
(SYLLABUS 2016)

SUGGESTED ANSWERS TO QUESTIONS

DECEMBER - 2017

Paper-14 : STRATEGIC FINANCIAL MANAGEMENT

Time Allowed : 3 Hours **Full Marks : 100**

The figures in the margin on the right side indicate full marks.
Working Notes should form part of your answers.

Wherever necessary candidates may make appropriate assumptions and clearly state them.
No present value factor table or other statistical table will be given in addition to this question paper.
This paper contains two sections, A and B. Section A is compulsory and contains question 1 for 20 marks. Section B contains question 2 to 8, each carrying 16 marks.
Answer any five questions from Section B.

Section – A
Answer all the questions. Each question carries two marks.

1. Choose the Correct Option from amongst the four alternatives given (1 mark is for the correct choice and 1 mark for justification/workings) 2×10=20

(i) A project has a 10% discounted pay back of 2 years with annual after tax cash inflows commencing from year end 2 to 4 of ₹ 400 lacs. How much would have been the initial cash outlay which was fully made at the beginning of year 1?
(A) ₹ 400 lacs
(B) ₹ 452 lacs
(C) ₹ 633.80 lacs
(D) ₹ 497.20 lacs
(Use p.v. factors only up to 3 decimal places.)

(ii) A project is expected to yield an after tax cash inflow at the end of year 2 of ₹ 150 lacs and has a cost of capital of 10%. Inflation is expected at 3% p.a. While computing the NPV of t the project, this cash flow will be taken as the following:

(A) $\frac{\frac{150}{1.03}}{(1.1)^2}$

(B) $\frac{\frac{150}{(1.03)^2}}{(1.1)^2}$

(C) $\frac{150}{(111.33\%)^2}$

(D) $\frac{150(1.03)^2}{(1.11)^2}$

(iii) A firm has an asset β = 1.3, equity β = 1.5. Then, which of the following is true?
(A) The firm is unlevered.
(B) Debt β is also 1.3.
(C) The above data is not possible.
(D) The firm is leveraged and the debt β is lower than the asset β.

(iv) For a portfolio containing three securities A, B and C,
correlation coefficients ρ_{AB} = +0.4; ρ_{AC} = +0.75; ρ_{BC} = - 0.4;
standard deviation σ_A = 9; σ_B = 11; σ_C = 6;
weights ω_A = 0.2; ω_B = 0.5; ω_C = 0.3;
the covariance of securities A and B is
(A) 3.96
(B) 24.75
(C) 39.6
(D) 247.5

(v) A ₹ 1,000 per value bond bearing a coupon rate of 14% matures after 5 years. The required rate of return on this bond is 10%. The value of the bond (to the nearest rupee) will be:
(A) 1,125
(B) 1,152
(C) 1,512
(D) 862.20

(vi) The following information is available for a mutual fund:

Return	**13%**
Risk (S.D. i.e. σ)	**16%**
Beta (β)	**0.90**
Risk Free Rate	**10%**

Treynor's Ratio of the mutual fund is:
(A) 3.85
(B) 4.43
(C) 3.33
(D) 3.73

(vii)The 90 day interest rate is 1.85% in USA and 1.35% in the UK and the current spot exchange rate is $ 1.6/£. The 90-day forward rate is
(A) $ 1.607893
(B) $ 1.901221
(C) $ 1.342132
(D) $ 1.652312

(viii) The intercept of the Security Market Line (SML) on the y axis is
(A) $E(R_m) - R_f$
(B) $1/[E(R_m) - R_f]$
(C) $R_f - E(R_m)$
(D) R_f

(ix) A mutual fund wants to hedge its portfolio of shares worth ₹ 10 crore using the NIFTY Index Futures. The contract size is 100 times the index. The index is currently quoted at 6840. The Beta of the portfolio is 0.8. The beta of the index may be taken as 1. What is the number of contracts to be traded?
(A) 110
(B) 116
(C) 145
(D) 123

(x) A call option at a strike price of ₹ 200 is selling at a premium of ₹ 24. At what share price on maturity will it break-even for the buyer of the option?
(A) ₹ 200
(B) ₹ 176
(C) ₹ 224
(D) ₹ 248

Answer:

1. (i) (B) ₹ 452 lacs

Justification:

Sum of PV Factors year 2 to 4 @10%= 2.26
Discounted cashflow after tax=400x2.26=904 lacs
Hence, Investment = $\frac{904}{2}$ = 452 lacs.

(ii) (B) $\frac{\frac{150}{(1.03)^2}}{(1.1)^2}$

Justification: Nominal Cash Flow = 150
P.V. of nominal cash flow = Real Cash Flow = $150/(1.03)^2$

P.V. of real cash flow = $\frac{\frac{150}{(1.03)^2}}{(1.1)^2}$

(iii) (D) The firm is leveraged and the debt β is lower than the asset β.
Justification: Debt β is lower than equity β. Asset β is the weighted average of debt and equity and it has to be between 1.5 and debt β.

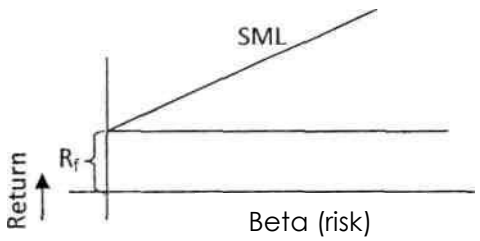
(iv) (C) 39.6
Justification: $\rho_{AB} \times \sigma_A \times \sigma_B = 0.4 \times 9 \times 11 = 39.6$

(v) (B) 1,152
Justification: Value of the bond = ₹ [140 × $PVIFA_{10\%\ 5\ year}$ + 1,000 × $PVIF_{10\%\ 5\ year}$]
= 140 × 3.7907 + 1,000 × 0.6209 = 1,151.598 = 1,152

(vi) (C) 3.33
Justification: Treynor's Ratio = $(R_p - R_f)/\beta = (13 - 10)/0.90 = 3.33$
Where, R_p = Return; R_f = Risk Free Rate of Return; β = Beta

(vii) (A) $ 1.607893
Justification: [Forward Rate / Spot Rate]
= [(1 + domestic interest rate)/(1 + foreign interest rate)]
F/$1.6 = [(1 + 0.0185)/(1 + 0.0135)] = $1.607893

(viii) (D) R_f
Justification: R_f, The risk free rate.



(ix) (B) 116

Justification: Hedge Ratio = Beta of the portfolio / Beta of the index = 0.8/1.0 = 0.8

Number of contracts to be traded

$$= \text{Portfolio Value} \times \frac{\text{Hedge Ratio}}{\text{Value of a Futures Contract}}$$

Portfolio Value = ₹10 crore

Value of a Futures Contract = 6840 x 100 = ₹ 6,84,000

$$\text{No. of Contracts} = 100000000 \times \frac{0.8}{684000} = 116.96 = 117, \text{ or, } 116.$$

(x) (C) ₹ 224

Justification: To recover the call option premium of ₹ 24, the share price on the date of expiration should rise to (₹ 200 + 24) = ₹ 224.

Section – B

Answer any five questions from question No. 2 to 8. Each question carries 16 marks.

2. (a) The following are returns in % of securities A, B and the market in excess of the risk-free rate:

Security A	Security B	Market
12	16	14
15	18	16
18	20	18

(i) Determine the characteristic line for securities A and B.

(ii) What would be the beta of a portfolio consisting of 75% investment in A and 25% in B?

(iii) When the market return is 15%, what would be the return on the portfolio? 10

(b) A firm has an investment proposal, requiring an outlay of ₹ 80,000. The investment proposal is expected to have two years economic life with no salvage value.

In year 1, there is a 0.4 probability that cash inflow after tax will be ₹ 50,000 and 0.6 probability that cash inflow after tax will be ₹ 60,000. The probability assigned to cash inflow after tax for the year 2 are as follows:

Cash inflow year end 1 (₹)	**50,000**		**60,000**	
Cash inflow year end 2 (₹)	**Probability**		**Probability**	
	0.2	**24,000**	**0.4**	**40,000**
	0.3	**32,000**	**0.5**	**50,000**
	0.5	**44,000**	**0.1**	**60,000**

The firm uses 8% discount rate for this type of investment.

Construct a DECISION TREE for the proposed investment project and calculate the expected Net Present Value (NPV). 6

Answer:

2. (a) (i)

Mkt X	A	B	X-E(X)	A-E(A)	B-E(B)	$[X-E(X)]^2$	[X-E(X)][A-E(A)]	[X-E(X)][B-E(B)]
14	12	16	-2	-3	-2	4	6	4
16	15	18	0	0	0	0	0	0
18	18	20	+2	+3	+2	4	6	4
48	45	54	0	0	0	8	12	8
Mean = 48/3=16	Mean = 45/3=15	Mean = 54/3=18				V(X) = 8/3	Cov(X,A)=12/3 = 4	Cov(X,B) = 8/3

Characteristic line of Security A : $y - E(Y) = \frac{Cov(A, Market)}{Var(Market)} \times (Market - 16)$

$$y - 15 = \frac{4}{8/3}(x-16)$$

or, y-15 = 1.5x-24

y = 1.5x - 9

or, a = 1.5m-9

(Any alphabet may be used for the variables. Market should be the independent variable and the security should be the dependent variable)

Characteristic line of Security B : $y = \frac{Cov(B, Market)}{Var(Market)} \times (Market - 16)$

$$y-18 = \frac{4}{8/3}(x-16)$$

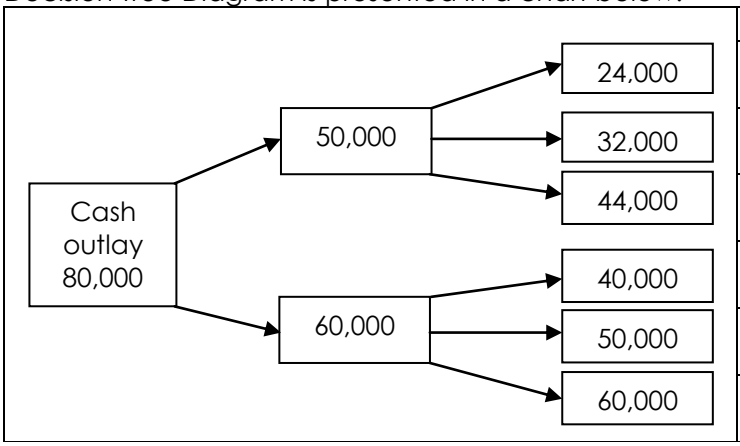
$$Or, y-18 = \frac{8/3}{8/3}(x-16)$$

y = x + 2, or, b = m + 2

(ii) β_A = 1.5 and β_B =1. Therefore, beta of a portfolio containing 75% A and 25% B will be: β_P = 0.75 x 1.5 + 0.25 x 1 = 1.375
Portfolio = 0.75A + 0.25B

(iii) When market return is 15% above risk free rate, y = (1.5 x 15)-9 = 22.5 - 9 = 13.5 and y = 15 + 2 = 17, Stock A return =13.5 and Stock B return = 17, as per the characteristic line equations. Substituting these values in the portfolio, we get, Expected return on portfolio = E(P) = E (0.75A + 0.25B) = 0.75 x 13.5 + 0.25 x 17 = 10.125+4.25 = 14.375%.
This return is above the risk - free rate.

(b) Decision Tree Diagram is presented in a chart below:



Path No.	Jt. Prob.
1	(0.4×0.2) = 0.08
2	(0.4×0.3) = 0.12
3	(0.4×0.5) = 0.20
4	(0.6×0.4) = 0.24
5	(0.6×0.5) = 0.30
6	(0.6×0.1) = 0.06

NPV of each path at 8% discount rate are:

Path	Year 1 Cash Flows (₹)	Year 2 Cash Flows (₹)	Total Cash Inflows	Cash Outflows	NPV (₹)
1	50,000x0.9259=46,295	24,000x0.8573=20,575	66,870	80,000	(-)13,130
2	50,000x0.9259=46,295	32,000x0.8573=27,434	73,729	80,000	(-) 6,271
3	50,000x0.9259=46,295	44,000x0.8573-37,721	84,016	80,000	4,016
4	60,000x0.9259=55,554	40,000x0.8573=34,292	89,846	80,000	9,846
5	60,000x0.9259=55,554	50,000x0.8573=42,865	98,419	80,000	18,419
6	60,000x0.9259=55,554	60,000x0.8573=51,438	1,06,992	80,000	26,992

Statement showing Expected NPV:

Path	NPV (₹)	Joint Probability	Expected NPV (₹)
1	(-)13,130	0.08	(-)1,050.40
2	(-) 6,271	0.12	(-) 752.52
3	4,016	0.20	803.20
4	9,846	0.24	2,363.04
5	18,419	0.30	5,525.70
6	26,992	0.06	1,619.52
			8,508.54

3. (a) The following information is given in respect of two projects X and Y:

	X		Y	
Initial outlay at the beginning of the first year	**6000**		**5000**	
After Tax year end cash inflows with probabilities:	**Cash inflow**	**Probability**	**Cash inflow**	**Probability**
Year 1	**2000**	**0.4**	**800**	**0.2**
	3000	**0.6**	**2000**	**0.8**
Year 2	**4000**	**0.3**	**2000**	**0.4**
	2000	**0.7**	**1000**	**0.6**
Year 3	**3000**	**0.5**	**2025**	**0.2**
	2200	**0.5**	**4000**	**0.8**

The risk free discount rate is 10% and the risk adjusted discount rate is 14.13%.
Assume that cash flows are independent from year to year.
It is given that the annual standard deviation of cash inflows for X are 490, 916.5 and 400 and for Y are 480, 490 and 790.
(i) Find the NPVs for both the projects and based on this, which would you choose?
(ii) Which project would you prefer in terms of risk? Why? 8

(b) The NAV of a mutual fund having 4,00,000 units are ₹ 9.25 and 9.95 per unit at the beginning and end of the year respectively. If the fund has to pay a dividend of ₹ 0.85 per unit and ₹ 0.70 as capital gain per unit what would be the annual returns expressed as a percentage?
If instead of paying dividend and capital gain, the scheme decided to reinvest the distributable amounts at an average NAV of ₹ 9.15 per unit, compute the revised returns and show how the balance sheet would appear after the reinvestment. 8

Answer:

3. (a) (i) Multiplying by the respective probabilities, cash inflows have been adjusted for certainty equivalents.
Hence, the appropriate discount rate is the risk free discount rate.

Project X:

	Cash inflow	Probability	Expected Cash flow		PV Factor	PV of Cash Inflows
Year 1	2000	0.4	800			
	3000	0.6	1800	2600	0.909	2363.4
Year 2	4000	0.3	1200			
	2000	0.7	1400	2600	0.826	2147.6
Year 3	3000	0.5	1500			
	2200	0.5	1100	2600	0.751	1952.6
Total of PV of inflows						6463.6
Less : Initial Outlay						6000.0
NPV						463.6

Project Y:

	Cash inflow	Probability	Expected Cash flow		PV Factor	PV of Cash Inflows
Year 1	800	0.2	160			
	2000	0.8	1600	1760	0.909	1599.84
Year 2	2000	0.4	800			
	1000	0.6	600	1400	0.826	1156.4
Year 3	2025	0.2	405			
	4000	0.8	3200	3605	0.751	2707.355
Total of PV of inflows						5463.595
Less : Initial Outlay						5000
NPV						463.595

Cash inflows are independent from year to year. Hence total variance = Sum of the individual variances.

Variance of Cash inflows:

Year	Std Dev X	Square of SD	PV factor	Square of PV factor	Variance PV	Std Dev Y	Square of SD	PV factor	Square of PV factor	Variance PV
1	490	240100	0.909	0.826	198322.6	480	230400	0.909	0.826	190310.4
2	916.5	839972.3	0.826	0.682	572861.1	490	240100	0.826	0.682	163748.2
3	400	160000	0.751	0.564	90240	790	624100	0.751	0.564	351992.4
					861423.7					706051
Std Deviation of PV of inflows					928.1291	Std Deviation of PV of inflows				840.2684
Coefficient of variation of inflows					928.1291/ 6463.6 = 14.36%	Coefficient of variation of inflows				840.2684/ 5463.6 =15.38%

Based on NPV, both are the same. Hence, we would prefer Y for a lower capital outlay.
The return is better per rupee invested.

(iii) Based on risk factor, X is preferable since risk per unit of investment is higher for Y than for X as measured by the coefficient of variation.
Mere standard deviation cannot be used since the outlays are almost 25% higher for X.

(b) NAV on closing date = 4,00,000 x 9.95 = ₹39,80,000
Dividend Payable = 4,00,000 x 0.85 = ₹ 3,40,000
Capital Gain to be distributed = ₹ 2,80,000
Closing Fund Assets = ₹46,00,000

$$\text{Returns} = \frac{\text{Closing Fund Assets - Opening Assets Value}}{\text{Opening Asset Value}} = \frac{4600000 - 3700000}{3700000}$$

$$= \frac{900000}{3700000} = 24.32\%$$

Total Distribution = 3,40,000 + 2,80,000 = ₹ 6,20,000
No. of units @ ₹ 9.15 per unit = 6,20,000/9.15 = 67,759.56
The return will be the same as the above.

Balance Sheet (After Reinvestment)

Liabilities	₹	Assets	₹
NAV on closing date		Fund Assets (Balancing Figure)	
4,00,000 units @ 9.95	39,80,000		
67,759.56 units @ 9.15 per unit	6,20,000		46,00,000
Total	46,00,000	Total	46,00,000

4. (a) Lee Industries wishes to install a plant in its factory at a cost of ₹ 100 lacs. It can lease the plant from LOR Co. for 3 year end payments of 34 lacs. LOR will maintain the plant at ₹ 5 lacs per annum payable at the end of each year with no charge to Lee for maintenance. Alternatively, Lee could borrow ₹ 100 lacs from the bank, either take an upfront extended warranty for 3 years for an additional 10 lacs, or incur 5 lacs maintenance charges like LOR without this extended warranty. Bank loan would involve an initial payment of ₹ 1 lac and three year end equated payments of principal together with 14% interest. The plant will qualify for annual depreciation of 31 lacs and 7 lacs is the expected salvage value. Both LOR and Lee have an after tax weighted average cost of capital of 10% and a tax rate of 50%.

Find out if the extended warranty is worthwhile.

Compute the Net Advantage to Leasing for Lee under the better option chosen for maintenance. Assume that extended warranty costs qualify for tax deduction at the end of year 1.

While evaluating this proposal for LOR, which discount rate would you use to determine the present value of the cash flows? Why?

(Show calculations in ₹ lacs up to 2 decimal places and use p.v. factors up to 3 decimal places. Present your cash flows for each year.) 8

(b) An Oil Company needs 1000 barrels of crude oil after six months. The current price per barrel of crude oil is ₹ 3,300. It is expected that after 6 months, the price per barrel of crude oil is likely to touch ₹ 3,700. The company wants to hedge against the rising price for its requirement after 6 months. The 6 months futures contract price is now traded ₹ 3,500 per barrel. The size of a futures contract is 100 barrels.

(i) If the cost of capital, insurance and storage is 15% p.a., examine whether it is beneficial for the oil company to buy now.

(ii) If the upper limit to buying price is ₹ 3,500, what strategy can the firm adopt?

(iii) If the company decided to hedge through futures, find out the effective price it would pay for crude oil if at the time of lifting the hedge the spot and future prices are: Spot price- ₹ 3,420; Futures ₹ 3,600. 8

Answer:

4. (a) Evaluation of lease proposal
Lease rentals=34 lacs
After tax LR=17lacs
Discount rate=7% after tax cost of debt
PV of lease rents=17*2.624=44.608 lacs.

Whether to take extended warranty or not:

Discount factor = after tax cost of capital, since it is a capital budgeting type of decision internally made - whether annual maintenance or one time maintenance.

This decision does not depend on whether to decide to lease or not.

End of Year	Extended Warranty	After Tax	PV Factor	PV of Cash Flows
0	-10,00,000	-10,00,000	1	-10,00,000
1	+5,00,000	+5,00,000	0.909	+4,54,500
2				
3				-5,45,500

PV of after tax annual maintenance = 50% x 5,00,000 x (PV annuity factor 10%, 3 yrs)
= 2,50,000 x 2.486 = 6,21,500

Hence, it is better to take up the one time warranty.

Evaluation of the buying proposal:

End of year	Warranty	Principal Repay-ments	Interest on O/s Principal @ 14%	Tax on interest	Tax on Depre-ciation	Salvage value	Cash inflows / (outflows)	PV factor at 7%	PVof cash flows ₹ lacs
0	(10,00,000)	(1,00,000)					(11,00,000)	1	-11
1	+5,00,000	(33,00,000)	(13,86,000)	+6,93,000	+15,50,000		(19,43,000)	0.935	-18.16
2		(33,00,000)	(9,24,000)	+4,62,000	+15,50,000		(22,12,000)	0.873	-19.31
3		(33,00,000)	(4,62,000)	+2,31,000	+15,50,000	+7,00,000	(12,81,000)	0.816	-10.45
									-58.93

PV of lease rentals is lesser by ₹14.32 lacs (58.93 - 44.61) than PV of purchase option. Hence it is better to lease.

While evaluating the proposal for LOR, it is an investment decision, being the lessor, it must be in the business of normal leasing and hence, like any other capital budgeting decision, 10%, its after tax cost of capital should be taken.

(b) (i) If the cost of carry (including interest, insurance and storage) is 15%, the fair price of the futures contract is = S_0e^{rt} = 3300 $e^{6/12x0.15}$ = 3300 x 1.0779 = ₹ 3,557.07. It implies that if the company buys crude oil today to be used after six months, it would effectively cost ₹ 3,557.07. It is not beneficial to buy now.

(ii) Since futures are trading at ₹ 3,500. It can lock up in the price of around ₹ 3,500 through a long hedge. Under the long hedge the company would buy the futures on crude oil today and sell it six months later, the firm would end up paying a price of ₹ 3,500.

(iii) If the company adopts the strategy mentioned in (ii), the effective price to be paid by the firm in the two cases of rise and fall in spot values is calculated as follows:

Quantity of crude oil to be hedged	1000 barrels
Size of futures contract	100 barrels
Number of futures contract bought = 1000 / 100	10 contracts
Futures price	₹ 3500
Value of Futures Bought = ₹ 3500 x 10 x 100	₹ 35,00,000

Six months later the company would unwind its futures position and buy its requirement from the spot market.

1.	Futures sold at price	₹ 3,600
2.	Value of futures sold = ₹ 3600 x 10 x 100	₹ 36,00,000
3.	Gain on Futures (₹ 36,00,000 - ₹ 35,00,000)	₹ 1,00,000
4.	Spot Price	₹ 3,420
5.	Actual cost of buying for 1000 barrels ₹ 3420 x 1000	₹ 34,20,000
6.	Effective cost of buying (₹ 34,20,000 - ₹ 1,00,000)	₹ 33,20,000
7.	Effective price per barrel (₹ 33,20,000/1000 barrels)	₹ 3,320

5. (a) A manufacturing company has an old machine having no book value which can be sold now for ₹ 1,00,000. It can be used for another five years after which it will have to be condemned without any sale value. The company is examining the following options:

Option I: To upgrade the existing machine at a cost of ₹ 20 lacs and continue operations for a further 5 years at the end of which the ₹ 20 lacs would have also fully been depreciated equally over the next 5 years and will fetch a sale value of ₹ 50,000 at the end of the 5th year.

Option II: To replace the old machine with a new one costing ₹ 40 lacs which will have a useful life of 5 years, during which it will be fully depreciated equally. At the end of the 5th year, this machine will have a resale value of ₹ 10 lacs.

The following figures are the after-tax cash profits in rupees without the depreciation shield and the salvage values for the existing situation and the fresh options:

End of year	Existing Machine	Upgraded Machine	New Machine
1	10,00,000	11,00,000	12,00,000
2	10,80,000	11,80,000	12,80,000
3	11,20,000	12,20,000	13,80,000
4	12,00,000	13,00,000	14,80,000
5	13,00,000	14,00,000	16,00,000

The hurdle rate used for evaluation is 15%.
Consider that the salvage values and profits will be subjected to tax at the normal tax rate of 40%.
Present an incremental analysis of options I and II and state which is better.
Evaluate the better option above over continuing with the old machine without upgrading. 8

(b) The following information is given:

Current Stock Price	**₹ 190**
Strike Price	**₹ 210**
Price of 6 months' European Put Option	**₹ 10**
Risk free interest rate p.a.	**5%**

(i) **Calculate the theoretical minimum price of the put option at the end of 6 months. Show the arbitrage process step by step and find out the gain if**
(ii) **the price on the expiration day is ₹ 200**
(iii) **the price on the expiration day is 220. 8**

Answer:

5. (a) Option I vs Option II - Incremental Analysis

End of Year	Operating Profits	PV factor	PV of cash profits (₹)
0		1	
1	100000	0.870	87,000
2	100000	0.756	75,600
3	160000	0.658	1,05,280
4	180000	0.572	1,02,960
5	200000	0.497	99,400
Total		3.353	4,70,240

New Machine Vs Upgraded Machine.

Operating Profits		₹4,70,240
Depreciation shield	(800000 - 400000) x 40% = 160000 with annuity factor 3.353 = 3.353 x 160000	₹5,36,480
Salvage value	(1000000 - 50000) x 60% = 570000 @ PVF 0.497	₹2,83,290
Incremental cost of new machine	20,00,000 with PV factor 1	₹(20,00,000)
Sale value of old machine	60% x 1 lac, PV 1	₹60,000
Decrease in NPV with new machine		₹6,49,990
Decision : Continue with the upgraded machine, Option 1		

Analysis - Continue without upgrade vs upgrade old machine

		₹
Increase in operating profits	1,00,000 x annuity factor 5 years =100000x3.353	3,35,300
Depreciation shield	400000 x 40% x 3.353	5,36,480
Salvage value at yr 5 end	50000 x 60% x 0.497	14,910
Sub Total - Incremental benefits over upgrade		886690
Incremental cost of upgrade	20,00,000 x 1	(20,00,000)
Net disadvantage of upgrade		11,13,310
Conclusion: Do not upgrade. Continue with the old machine as it is.		

(b) (i) Theoretical Minimum Price: Present value of Exercise price - Current stock price
= 210 x e^{-rt} - 190
= 210 x $e^{-0.05\times0.5}$ - 190
= 210 x $e^{-0.025}$ - 190
= 210 x 0.9753 - 190
= 204.813 - 190
= 14.813
Since value of put option is more than price of put option, recommended action is buy put option.

Arbitrage Process:

		₹
Borrow for spot purchase of stock and the put option	190 + 10	200
Amount including interest (continuous compounding)	200 x$e^{0.025}$ = 1.02532x200	205.06
(ii) Price on exercise day is 200 Action : Exercise put option, sell for 210		210
Gain after repayment of borrowal	210-205.06	4.94
(iii) Price on exercise day is 220 Action : Let the put lapse. Sell in spot market and get 220		220
Gain after repayment of borrowal	220-205.06	14.94

Thus the minimum gain is 4.94 even if the spot price on exercise day falls below the strike price. If the price rises, the gain would be 4.94 + (difference between the spot price on exercise day and 210).

6. (a) Companies M and N have the following interest rates:

	M	**N**
U.S. Dollars (floating rate)	**LIBOR + 0.5%**	**LIBOR + 1%**
Canadian Dollars Fixed Rate	**6%**	**4.5%**

M wants to borrow Canadian Dollars at fixed rate while N wants US dollars at floating rate.
F, a financial institution charges, if it arranges a swap, 50 basis points spread.
Design, if possible, a swap to share the benefits equally between M and N. Discuss the steps of action in the swap and arrive at the final effective interest rate for M and N.
In case a swap is not possible, give your calculations to substantiate why it is not possible. 8

(b) From the following information, find out the market price of risk of portfolio.

Market Return	**Standard Deviation of Market Return**	**Return on Government Bonds**	**Standard Deviation of Portfolio**
20%	**7%**	**7%**	**9%**
22%	**8%**	**8%**	**5%**
24%	**10%**	**9%**	**13%**

Also determine the expected return for each of the above cases. 8

Answer:

6. (a) M has an advantage over N in floating rate USD and N has an advantage in Canadian Dollar fixed rate.
Effective net benefit between the rates = 2% (0.5% in floating and 1.5% in fixed)
Less : Share of benefit for the banker = 0.5%
Balance to be shared by M and N equally = 1.5% totally, each getting 0.75%

M will borrow USD at floating rate and pay its banker LIBOR + 0.5%	N will borrow Canadian Dollars at fixed rate 4.5%
It will collect from N, LIBOR + 0.5% - 6%, i.e., collect, - 5.5% + LIBOR	It will collect from M, LIBOR + 1% - 4.5% , i.e., collect, LIBOR-3.5%
It will collect its share of benefit (2 - 0.5) / 2 = 0.75%	It will collect its share of benefit from the swap 0.75%
Effective interest rate = + (LIBOR + 0.5%) -(- 5.5% + LIBOR) - 0.75% = 5.25%	Effective rate = LIBOR + 1% - 0.75% = LIBOR + 0.25%
i.e., desired fixed rate 6% less advantage share 0.75% = fixed 5.25%	i.e., desired floating rate LIBOR + 1% less advantage share 0.75% = floating LIBOR + 0.25%

(b) Expected Return of the Portfolio $R_p = R_f + \lambda \times \sigma_p$
Market price of risk of the portfolio $\lambda = (R_m - R_f)/\sigma_m$

Market Return (R_m)	Standard Deviation of Market Return (σ_m)	Return on Government Bonds (R_0)	Standard Deviation of Portfolio(σ_p)	Market price of Risk (λ)	Expected Return (R_p)
1	2	3	4	5 = [1-3]/2	6=[3+(5x4)]
20%	7%	7%	9%	1.85	23.65%
22%	8%	8%	5%	1.75	16.75%
24%	10%	9%	13%	1.50	28.50%

7. (a) The following information is given:

Spot rate for 1 US Dollar	**₹ 64.0123**
180 days' forward rate for 1 USD	**₹ 64.9120**
Annualised interest rate for 6 months-Rupee	**12%**
Annualised interest rate for 6 months - US Dollar	**8%**

Does any arbitrage opportunity exist? Discuss the sequence of activities for gain using 1000 units of currency and compute the gains, if any. 8

(b) An investor has a sum of ₹ 40 lacs with which he wishes to construct a portfolio of securities X and Y. The following information is provided:

Security	Expected Return (%)	Standard Deviation (%)
X	**18**	**12**
Y	**20**	**15**

The coefficient of correlation between the returns of X and Y is 0.7.
(i) How much should he invest in X and Y in order to have a portfolio of minimum variance: What would be this minimum variance?
(ii) If he invested equally in X and Y, what would be the variance of the portfolio?
(iii) Would you consider his portfolio in (i) and (ii) sufficiently diversified? Why? 8

Answer:

7. (a) Using the interest rate parity rule, there will be an arbitrage opportunity if:

$$\frac{\text{Forward rate}}{\text{Spot rate}} \neq \frac{(1+\text{home currency interest rate for the period})}{(1+\text{foreign interest rate for the period})}$$

Here, $\frac{\text{Forward rate}}{\text{Spot rate}} = \frac{64.9120}{64.0123} = 1.01406$

And the RHS = $\frac{(1+12\%/2)}{(1+8\%/2)} = \frac{(1+0.06)}{(1+0.04)} = 1.01923$

Hence arbitrage opportunity exists in a small measure, where money invested in rupees will earn higher interest in India and can be converted to dollars after 6 months.

Arbitrage process: Borrow 1000$, convert at spot rate into INR, invest at 12% for 6 months in India, convert total amount into $ and get the gain.

Borrow 1000$	1000	
Interest @ 8% for 6 m	40	
Repay amount $ after 6 m	1040	(A)
Convert 1000$ to INR at spot rate 64.0123	= INR 64012.3	
Interest on this amount at 12% p.a. for 6 m	= INR 3840.74	
Total amount available after 6 m	= INR 67853.04	
Convert this amount at forward rate 64.9120	=$1045.31	(B)
Gain due to arbitrage (B - A)	$ 5.31	

Gain per 1000$ invested thus = 5.31$

Verification: Parity theorem approximately gives 0.00517 per $, which is 5.17 per 1000$.
(1.01923-1.01406 =-0.00517)

(b) (i) Weightage of securities for minimum variance of portfolio W, for portion in X and 1-Wx for proportion in Y.

$$W_x = \frac{\sigma_y^2 - \text{cov}(X,Y)}{\sigma_x^2 + \sigma_x^2 - 2\text{cov}(X,Y)} = \frac{225 - 0.7\times12\times15}{144+225-2(0.7\times15\times12)} = \frac{225-126}{369-252} = \frac{99}{117} = 0.8462$$

= 84.62%

Hence investment in X = 84.62% of 40 lacs = 33,84,615, or rounded off to 33.85 lacs or even 34 lacs.

Investment in Y would be 6,15,385, or, 6.15 lacs or 6 lacs.

The variance of this portfolio will be :
$V(0.8462X + 0.1538Y) = 0.8462^2V(X) + 0.1538^2V(Y)$
$+2 \times 0.8462 \times 0.1538 \times \text{cov}(X,Y) = 103.11 + 5.32 + 32.8 = 141.23$

(ii) If he invested equally in X and Y,
$V(0.5X + 0.5Y) = 0.5^2\,V(X) + 0.5^2\,V(Y) + 2 \times 0.5 \times 0.5 \times \text{cov}(X, Y)$
$= 36 + 56.25 + 63 = 155.25$

(iii) The portfolios in (i) and (ii) are not sufficiently diversified since the correlation coefficient is high at +0.7. If the securities do well individually, both do well and if one falls, the other also falls significantly.

8. Answer any four out of the following five questions:

(a) Fill in the following table - Identify the function of the bank under the appropriate classification and tick to mention whether it is a banking or a non-banking function:

(You are required to write only columns I, III, IV and V in your answer.)

I	II	III	IV	V
Sl. No	Activity	Category of Function	Banking Function	Non-Banking Function
(i)	Discounting bills of exchange			
(ii)	Electronic Funds Transfer between accounts of customers			
(iii)	Periodic payments of electricity bills of customers			
(iv)	Acceptance of Public Provident Fund Deposits			

(b) Discuss the nature of call money market in India with reference to the duration, borrowers and security.

(c) Differentiate between yield based auction and price based auction in the securities market regarding acceptance and cut off points.

(d) Identify the type of risk in each of the following (Present only the Roman numeral and state the risk in your answers without copying the statements given below.):

(i) Frauds committed by employees.

(ii) The fear of the seller of a fall in prices and of the buyer, of rise in prices.

(iii) Risk of loss arising from the inability of a debtor to pay his loan obligation.

(iv) Risk that a borrower of a housing loan prepays his loan much ahead of his scheduled duration. 4

(e) State any four features of Foreign Currency Convertible Bonds (FCCB). 4

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Candidates may choose appropriate values from the following tables for use in various answers.

PV factor $\frac{1}{(1+x)^n}$, where x is the interest rate, n is the number of years.

n →	1	2	3	4	5	6	7	8	9	10
Rate ↓										
6%	0.943	0.890	0.837	0.792	0.747	0.705	0.665	0.627	0.592	0.558
7%	0.935	0.873	0.816	0.763	0.713	0.666	0.623	0.582	0.544	0.508
8%	0.926	0.857	0.794	0.735	0.681	0.630	0.583	0.540	0.500	0.463
10%	0.909	0.826	0.751	0.683	0.621	0.564	0.513	0.467	0.424	0.386
14%	0.877	0.769	0.675	0.592	0.519	0.456	0.400	0.351	0.308	0.270
14.13%	0.876	0.768	0.673	0.589	0.516	0.452	0.396	0.347	0.304	0.267
14.3%	0.875	0.765	0.670	0.586	0.513	0.448	0.392	0.343	0.300	0.263
15%	0.870	0.756	0.658	0.572	0.497	0.432	0.376	0.327	0.284	0.247

$e^{0.005}$	1.005
$e^{0.05}$	1.0513
$e^{0.025}$	1.0253
$e^{0.25}$	1.2840
$e^{0.15}$	1.618
$e^{0.6}$	1.8221
$e^{1.5}$	4.4817
$e^{0.075}$	1.779
$e^{0.0375}$	1.0382
$e^{0.075}$	2.1170
$e^{0.9}$	2.4596
$e^{0.075}$	1.0779

$e^{-0.005}$	0.9950
$e^{-0.05}$	0.9512
$e^{-0.025}$	0.9753
$e^{-0.25}$	0.7788
$e^{-0.15}$	0.8607
$e^{-0.6}$	0.5481
$e^{-1.5}$	0.2231
$e^{-0.075}$	0.9277
$e^{-0.0375}$	0.9632
$e^{-0.75}$	0.4724
$e^{-0.9}$	0.4066

Answer:

8. (a)

I	II	III	Iv	V
Sl. No.	Activity	Category of Function	Banking Function	Non-Banking Function
(i)	Discounting bills of exchange	Advancing loans	√	
(ii)	Electronic funds transfer between accounts	Remittance of Funds	√	
(iii)	Periodic payments of electricity bills of customers	Agency service		√
(iv)	Acceptance of Public Provident Fund Deposits	General Utility Service		√

(b) Nature of call money market with reference to duration, borrowers and security are discussed below:

Duration: These loans are given for a very short duration, between 1 day to 15 days.

Borrowers: These are mainly interbank loans, among commercial banks from each other. Other borrowers are bill market, dealers in stock exchange for purpose of dealings in stock exchange, individuals of high financial status in Mumbai etc for ordinary trade purpose in order to save interest on cash credit and overdrafts.

Security: There are no collateral securities demanded against these loans, i.e., unsecured.

(c) Yield based auction: This is generally conducted when the Government issues new security. Investors bid in yield up to two decimal places, e.g., 8.19% etc. Bids are arranged in ascending order and the cut off yield is arrived at the yield corresponding to the notified amount of the auction. Since payment is by the Government at the bid rate as coupon rate, those bids above the cut off are rejected.
Price Based Auction: This is conducted when the Government re-issues securities. Prices are bids that are collected from the bidders per ₹100 face value of the securities, e.g., 102, etc. Bids are arranged in descending order and bidders quoting below the cutoff point are rejected.

(d) (i) Frauds committed by employees - operational risk.
(ii) The fear of the seller of a fall in prices and of the buyer of rise in prices-market risk or price risk.
(iii) Risk of loss arising from the inability of a debtor to pay his loan obligation – credit default risk or simply, credit risk.
(iv) Risk that a borrower of a housing loan prepays his loan much ahead of his scheduled duration -asset backed risk or prepayment risk.

(e) Features of Foreign Currency Convertible Bonds:
(i) FCCB can be either secured or unsecured.
(ii) FCCB issues have a call and put option.
(iii) Public issue shall be through reputed lead managers and private placement is subjected to certain conditions.
(iv) It is also possible to issue zero coupon bonds where the holders are generally interested in converting them into equity.
(v) The yield to maturity is normally between 2 - 7%.
(vi) FCCBs are normally listed to stock exchanges to increase liquidity.
(vii) FCCB issue related expenses shall not exceed 4% of issue size for public and 2% for private placement.