FINAL EXAMINATION

GROUP III

(SYLLABUS 2016)

SUGGESTED ANSWERS TO QUESTIONS

DECEMBER 2019

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 the respective 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. Candidates may use the values tabulated at the end of this question paper.

This paper contains two sections, **A** *and* **B. Section A** ***is*** *compulsory and contains question no. 1 for* ***20 marks.*** **Section B** *contains question numbers 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. (a) Choose the correct option from the four alternatives given: (1 mark is for the correct choice and 1 mark for justification/workings. You may present only the Roman numeral, your choice and the reason/workings, without copying the question.) 2×10=20

(i) Which of the following investment avenues has the least risk associated with it?

(A) Corporate Fixed Deposits

(B) Deposits in commercial banks

(C) Public Provident Fund

(D) Non-convertible zero coupon bonds

(ii) M uses 12% as nominal required rate of return to evaluate its new investment projects. It has recently been decided to protect shareholders' interest against loss

of purchasing power due to inflation. If the expected inflation rate is 5%, the real discount rate will be

(A) 6.67%

(B) 6%

(C) 17.6%

(D) 7%

(iii) A wants to hedge its portfolio of shares worth ₹ 150 million using the Index futures. The contract size is 100 times the index. The index is currently quoted at 7500. The beta of the portfolio is 0.9. Consider the beta of the index as 1. The number of contracts to be traded is

(A) 18000

(B) 180

(C) 22

(D) 200

(iv) The following information is extracted from MF, a mutual fund scheme. NAV on 01-11-2019 is ₹ 65.78, annualized return is 15%. Distributions of income and capital gains were ₹ 0.50 and ₹ 0.30 per unit in the month. What is the NAV on 30-11-2019?

(A) ₹ 67.50

(B) ₹ 66.14

(C) ₹ 65.80

(D) ₹ 66.96

(v) A portfolio holding 90% of its assets in CNX Nifty stocks in proportion to their market capitalization and 10% in Treasury Bills is more sensitive to

(A) Systematic Risk

(B) Unsystematic Risk

(C) Interest Rate Risk

(D) Index Risk

(vi) Project X is to be financed by 40% debt (with zero beta) and balance with equity (with 1.3 beta). If the risk free rate is 13% and return on market portfolio is 22%, the return from the project will be

(A) 13.07%

(B) 13.70%

(C) 24.70%

(D) 20.02%

(vii) Z Ltd. invests ₹ 20 lacs in a project with life 5 years and no salvage value. Tax rate is 50% and straight line depreciation is used. The uniform expected cash flows after tax and before depreciation shield are:

Year end	1	2	3	4	5
Cash flows after tax (₹ lacs)	4	5	6	6	7

The payback period is

(A) 3 years

(B) 3 years and 11 months

(C) 2 years and 11 months

(D) 2 years and 6 months

(viii) The probability distribution of security N is given below:

Probability	Return (%)
0.30	30
0.40	20
0.30	10

The risk of the return of the security will be around

(A) 60%

(B) 8%

(C) 20%

(D) 24%

(ix) A company's share is currently trading at ₹ 240. After 6 months, the price will be either ₹ 250 with probability of 0.80 or ₹ 220 with probability 0.20. A European call option exists with an exercise price of ₹ 230. The expected value of call option at maturity date will be

(A) ₹ 10

(B) ₹ 16

(C) ₹ 4

(D) ₹ 14

(x) The value of beta of a security does not depend on

(A) standard deviation of the security

(B) standard deviation of the market

(C) correlation between the security and the market

(D) risk free rate

Answer:

(i) (C) Public Provident Fund

The other three are subject to only capital adequacy norms and the funds can be invested freely to fetch returns commensurate with the risk. PPF is required to invest only in specified risk free securities.

(ii) (A) 6.67%

Real rate = $\frac{(1+\text{nominal rate})}{(1+\text{inflation rate})}-1$ or $\frac{(1+\text{nominal rate})}{(1+\text{inflation rate})}$ = 1 + Real rate

Real rate = (1.12/1.05) – 1 = 1.0667 – 1 = 6.67%

(iii) (B) 180

Value per future contract = 7500 × 100 = ₹7.5 lacs

Value of portfolio = 1500 lacs

Hedge ratio = 0.9/1 = 0.9

No. of futures contracts to be traded = Value of portfolio x hedge ratio/ value per contract.

= 0.9 × 1500/7.5 = 180 contracts.

(iv) (C) 65.80

Monthly return = 1.25% = (NAV – 65.78 + 0.5 + 0.3)/65.78

0.82225 = NAV – 64.98

NAV = 65.80225 = 65.80

(v) (A) Systematic risk

Unsystematic risk is eliminated since the portfolio follows the index. Only 10% is invested in T Bills and therefore the portfolio is not too much affected by interest rate risk. Systematic risk is the market risk which is replicated by the portfolio.

(vi) (D) 20.02%

Project beta = 0.4 x 0 + 0.6 x 1.3 = 0.78

$R_p = R_f + \beta_p (R_m – R_f)$

= 0.13 + 0.78 (0.22 – 0.13) = 0.13 + 0.78 × 0.09 = 0.13 + 0.0702 = 0.2002 = 20.02%

(vii) (C) 2 years and 11 months.

CFAT, depn shield = 6,7,8,8,9 For years 1,2,3,4,5.

Cum flows = 6, 13, 21, 29, 38

Pay back = 2 years + 7/8 × 12 = 2 +10.5 = 2 years and 11 months

(viii) (B) 8%

Probability Pi	Return Xi	xi-20	$(xi-20)^2$	Pi $(xi-20)^2$
0.3	30	+10	100	30
0.4	20	0	0	0
0.3	10	-10	100	30
		Mean = 0		60

Variance = 60

Std deviation = $\sqrt{60}$ = 7.746% = 8%

(ix) (B) 16

If price is 250, option is exercised and profit = 250 – 230 = 20. Probability = 0.8

If price is 220, option lapses and profit = 0.

Expected value = 20 × 0.8 + 0 × 0.2 = 16

(x) (D) Risk free rate

$\beta = r\ \sigma_y/\sigma_m$ where r is correlation coefficient, σ_y is standard deviation of security and σ_m is the standard deviation of market. Hence beta is independent of risk free rate.

Section-B

Answer* any five *questions.

Each question carries *16* marks.

2. (a) R Ltd., a profitable company is considering the purchase of a new machine for ₹ 75,00,000. The machine's useful life is 5 years, with annual maintenance, insurance and administration costs of ₹ 12 lacs. Depreciation is over its life on straight line basis, considering zero scrap value. The tax rate is 30%. R Ltd. has a capital structure of 60% debt and 40% equity. Cost of debt before tax is 8% and the cost of equity is 12%. R Ltd. is interested in leasing out this machine to a lessee 'L' on year end annual lease rents and R will have to maintain the equipment at the costs stated above.

What should be the lease rents to be billed to 'L' for the lease proposal to break-even if:

(i) R Ltd. acquires the machine from its total finance pool.

(ii) R Ltd. uses a bank borrowing specifically for this purpose at 10% interest rate on outstanding principal at the beginning of each year, with year-end installments comprising ₹15 lacs towards principal and balance towards interest for the year?

Present calculations to the nearest rupee. 10

(b) GLOBAL Limited, an Indian company will need $ 5,00,000 in 90 days. The following information is given:

Spot Rate $ 1 = ₹ 69-50

90 days forward rate of $ 1 as of today = ₹ 71.50

Interest Rates are as follows:

Particulars	US	India
90 days deposit rate	1.25%	2%
90 days borrowing rate	2.00%	3%

Compare the strategies of money market hedge vs. no hedging and compute the net advantage. Present calculations up to two decimal places. 6

Answer:

(a) Depreciation per annum = ₹75/5 = ₹15 lacs ; tax shield = 0.3 × 15 = ₹4.5 lacs

Capital: 60% debt at 8% before tax = 5.6% after tax; 40% equity = 12%

Weighted average cost of capital after tax = 0.6 × 5.6 + 0.4 × 12 = 3.36 + 4.8 = 8.16%

After tax cost of bank loan = 10% (1 – 0.3) = 7%.

Annual Cash cost = ₹12 lacs before tax = ₹8.4 lacs after tax.

Annual cash cost after tax and depn shield = ₹(8,40,000 – 4,50,000) = ₹3,90,000

(i) If the funding is out of the general finance pool, discount rate to be used = wacc = 8.16%.

End of year	Factor	Cash (₹) Inflows/(outflows)	PV of cash flows
0	PV1	(75,00,000)	(75,00,000)
1-5	Annuity factor 8.16%, 5 years = 3.976	(3,90,000)	(15,50,640)
			90,50,640

P.V. of After tax lease rents to break even = ₹90,50,640

After tax annual lease rentals = 90,50,640/3.976 = ₹22,76,318

Annual billable lease rents = 22,76,318/70% = ₹32,51,883

(ii) This is a lease v/s borrow decision applicable to the lessor. The break -even lease rents should cover the after tax cost of specific borrowing. The applicable discount rate = 7%.

End of year	Outstanding principal	Interest	After tax interest	Principal payments	Cash outflow	PV factor	PV of outflows
0	75,00,000						
1	60,00,000	7,50,000	5,25,000	15,00,000	20,25,000	0.935	18,93,375
2	45,00,000	6,00,000	4,20,000	15,00,000	19,20,000	0.873	16,76,160
3	30,00,000	4,50,000	3,15,000	15,00,000	18,15,000	0.816	14,81,040
4	15,00,000	3,00,000	2,10,000	15,00,000	17,10,000	0.763	13,04,730
5	0	1,50,000	1,05,000	15,00,000	16,05,000	0.713	11,44,365
							74,99,670

Total outflows including maintenance, etc = 3,90,000 x annuity factor 7%, 5 years + 74,99,670

= 390000 × 4.10 + 7499670 =15,99,000 + 74,99,670 = ₹90,98,670

After tax annual lease rentals to break even = 90,98,670/4.10 = ₹22,19,188

Billable lease rentals = 22,19,188/0.7 = ₹ 31,70,269

(b) Spot Rate = 69.50 ; Theoretical forward rate = 69.50 (1 + 2%) = 69.50 × 1.02 = 70.90,

Which is < 71.50, the forward rate.

Therefore cannot invest in India.

Money Market Hedge:

Invest in US at 1.25%,

Borrow in India at 3%, convert at 69.50, Invest in USA at 1.25%.

To get 1.25%, Investment = 5,00,000/ 1.0125 = $4,93,827.16

Equivalent INR = 493827.16 × 69.50 = ₹3,43,20,987.62

Interest at 3% = ₹10,29,629.63

Total Outflow INR = ₹3,53,50,617.25

No hedge option:

Outflow after 3 m INR = 71.50 × 5,00,000 = ₹3,57,50,000

Net advantage by hedging = ₹3,57,50,000 – ₹3,53,50,617 = ₹3,99,383

Alternative:

Money market hedge:

Borrow in ₹, convert to $, invest $, repay ₹ loan in 90 days

Amount in $ to be invested = 5,00,000/1.0125 = $4,93,827

Amount of ₹ needed to convert into $ = 4,93,827 x 69.50 = ₹3,43,20,977

Interest and principal on ₹ loan after 90 days = ₹3,43,20,977 x 1.03 = ₹3,53,50,606

No hedge option:

Outflow after 3months INR = 71.50 x 5,00,000 = ₹3,57,50,000

Net advantage by hedging = ₹3,57,50,000 – ₹3,53,50,606 = ₹3,99,394

3. (a) A silver merchant requires in three months' time, 3000 kg of silver for making silver articles during a wedding season. He expects the price to increase. Silver sells at spot rate of ₹ 5,100 per kg. Each silver futures contract (for 50 kg), expiring in three months sells at ₹ 5,200 per kg. The merchant wants to hedge half his requirement through futures and leave the remaining half uncovered. Explain his position and the gains/losses in the spot and futures market, the number of futures to trade in, the effective price per kg for his entire requirement if after 3 months,

(i) Spot rate is ₹ 5,250/kg and futures is at ₹ 5,400 per kg.

(ii) Spot rate is ₹ 5,000/kg and futures is at ₹ 4,900 per kg. 10

(b) Mr. NK has categorized stock in the market into four types, viz. Small cap growth stocks, Small cap value stocks, Large cap growth stocks and Large cap value stocks.

Mr. NK also estimated the weights of the above categories of stocks in the market index. Further, the sensitivity of returns on these categories of stocks to three important factors are estimated to be:

Category of Stocks	Weight in the Market Index	Factor I (Beta)	Factor II (Book Price)	Factor III (Inflation)
Small cap growth	25%	0.80	1.39	1.35
Small cap value	10%	0.90	0.75	1.25
Large cap growth	50%	1.165	2.75	8.65
Large cap value	15%	0.85	2.05	6.75
Risk Premium		6.85%	– 3.5%	0.65%

The rate of return on treasury bonds is 4.5%.

(i) Using Arbitrage Pricing Theory, determine the expected return on the market index.

(ii) Mr. NK wants to construct a portfolio constituting only the 'small cap value' and 'large cap growth' stocks. If the target beta for the desired portfolio is 1, determine the composition of his portfolio. 6

Answer:

(a) Requirement = 3000 kg

Covered		**Uncovered**
1500 kg		1500 kg
Spot Market	Futures Market	Spot = 5100
Short position	Long position	3m = 5250
	1500/50 = 30 contracts	Effective price 5250 per kg for 1500 kg
(i) After 3 months		
Loss = (5100-5250) x1500 kg	Gain = (5400-5200) ×1500 kg	
= -150 × 1500	= 200 × 1500	
Net gain = ₹ 50 per kg		
Price paid = 5200 per kg for 1500 kg		Price paid = 5250 per kg for 1500 kg
Effective price for total requirement of 3000 kg = 5225 ₹/kg		

(ii) After 3 months		
Gain = (5100-5000) x 1500 kg	Loss = (5200-4900) × 1500 kg	
= 100 × 1500	= 300 × 1500	
Net loss = ₹ 200 per kg		
Price paid = 5000 + 200 = 5200 per kg for 1500 kg		Price paid = 5000 per kg for 1500 kg
Effective price for total requirement of 3000 kg = 5100 ₹/kg		

(b) (i)

Category	Wts	Factor I	Factor II	Factor III	Wts x FI	Wts x FII	Wts x FIII
S Cap Gr	0.25	0.80	1.39	1.35	0.2	0.3475	0.3375
S Cap V	0.10	0.90	0.75	1.25	0.09	0.075	0.125
L Cap Gr	0.50	1.165	2.75	8.65	0.5825	1.375	4.325
L Cap Va	0.15	0.85	2.05	6.75	0.1275	0.3075	1.0125

Total					1	2.105	5.8
Risk Premium					6.85	-3.5	0.65
Product					6.85	-7.3675	3.77
Total					3.2525		

Expected Return on market index under APT = 4.5 + 3.2525 = 7.7525%

(ii) Let S be the investment in small cap value and L in large cap growth

Thus, 0.9S + 1.165L/(S+L) = 1

S(0.9-1) = L(1-1.165)

0.1S = 0.I 65L, or S = 1.65L, i.e. 1/1 + 1.65 = 1/2.65 = 37.74% in Land 62.26 or 62.3% in S

Alternative solution:

(i) Stock's return according to Arbitrage Pricing Theory:

Small cap growth = 4.5 + 0.80 × 6.85 + 1.39 × (-3.5) + 1.35 × 0.65 = 5.9925%

Small cap value = 4.5 + 0.90 × 6.85 + 0.75 × (-3.5) + 1.25 × 0.65 = 8.8525%

Large cap growth = 4.5 +1.165 × 6.85 +2.75 × (-3.5) + 8.65 × 0.65 = 8.478%

Large cap value = 4.5 + 0.85 × 6.85 + 2.05 × (-3.5) + 6.75 × 0.65 = 7.535%

Expected return on the market index

= 0.25 × 5.9925 + 0.10 × 8.8525 + 0.50 × 8.478 + 0.15 × 7.535 = 7.7526%

(ii) Let us assume that Mr. Nirmal will invest X1 % in small cap value stock and X2% in large cap growth stock.

XI + X2 =1

0.90X1 + 1.165 X 2 =1

0.90X1 + 1.165(1-X1) =1

0.90X1 + 1.165 - 1.165X1 =1

0.165 = 0.265X1

XI = 0.165/0.265 = 0.623

X2 = 0.377

Thus, composition of his portfolio would be 62.3% in small cap value & 37.7% in large cap growth stocks.

4. (a) On 1st August 2019, a bank entered into a forward purchase contract with an export customer for USD 25,000 due on 1st November at an exchange rate of INR 72.6000 and covered its position in the market at INR 72.6500. The customer remained silent on the due rate. On 16th November, the bank cancelled the contract without further notice as fifteen days had expired after the contract due date. The following exchange rates prevailed:

1st November	**Inter bank TT rates**	**USD 1 = INR 72.7500/7600**
	1 month forward	**INR 72.9500/9600**
	Merchant TT rates	**INR 72.6700/9000**
16th November	**Interbank TT rates**	**INR 72.7000/7100**
	Merchant TT rates	**INR 72.6400/7800**

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

Explain the position of the bank in relation to the customer and the market on various dates, compute the swap loss/gain, ignore margin and find out the charges payable by the customer on cancellation. 10

(b) The following information about two funds, TB (all equity fund) and MB (equal debt and equity fund) is given below:

Particulars	**TB**	**MB**
Average return (%)	**25**	**18**
Standard deviation (%)	**10**	**5**
Coefficient of Correlation with market	**0.3**	**0.7**

RBI Bond carries an interest rate of 5% and the expected return on market portfolio is 16% with a standard deviation of 4%.

(i) Find the covariance of each fund with the market

(ii) Find the systematic risk and the expected return of each fund under the Capital Asset Pricing Model (CAPM) 6

Answer:

(a) Export Customer.

Customer wants to sell US $ after three months.

Bank will purchase after 3 m from this customer.

1st Aug: Forward contract by bank to purchase on 1st November 25000 $ at 72.6000

1st Aug: Bank covers its position by forward sale agreement due on 1st Nov in inter-bank market at 72.65

1st Nov: Customer default.

Bank sells in inter bank market at 72.6500, buys for this purpose in spot at 72.7600

1st Nov: Bank enters into 1 m forward sale with inter-bank market at 72.9500, due 16th November.

Bank's position is open until 16th November

16th November: Bank has to close its position by selling at 72.9500 and purchasing at

72.7100, while charged customer as if it purchased for 72.7800

Exchange Difference: 72.7800 - 72.6000 = 0.1800 per $ x 25000 = 4500, Charged to Customer

Swap Difference: 72.76-72.95 = 0.19 favorable, not passed on to customer

Gain to bank = 0.19 per $ x 25000$ = ₹4,750

Interest for outlay of funds for 15 days from 1st to 15th Nov 72.76-72.65 = 0.11 per $ per day

Interest = 0.11 x 12% x 15/365 x 25000 = ₹ 13.56 or ₹ 14, Charged to Customer.

(b) (i) Covariance of TB (Market) = Correln coefft × std dev TB × std dev mkt

= 0.3 × 10 × 4 = 12%

Covariance of MB (Market) = 0.7 x 5 x 4 = 14%

(ii) Systematic risk TB = (β_{TB}) = Corr coefft x std dev TB/ std dev market

= 0.3 × 10/4 = 0.75

β_{MB} = 0.7 x 5/4 = 0.875

CAPM Return TB = $R_f + \beta_{TB} (R_m - R_f)$

= 5% + 0.75 x (16-5) %

= 5% +11 x 0.75

= 13.25%

CAPM Return MB = 5% + 0.875 × (16-5) %

= 14.625%

5. (a) A has invested in different points in time, in three schemes of a mutual fund. The following details are given:

Scheme	MF-P	MF-Q	MF-R
Amount of investment (₹)	**2,00,000**	**4,00,000**	**2,00,000**
NAV (₹/unit) on purchase date	**10.30**	**10.10**	**10.0**
Dividend received up to 30-11-2019 (₹)	**6000**	**0**	**5000**
NAV (₹/unit) on 30-11-2019	**10.25**	**10.0**	**10.20**
Effective annual yield (%) as on 30-11-2019	**9.66**	**-11.66**	**24.15**

Find out the following:

Number of units			
Holding period (no. of days)			
Holding period yield (%) up to two decimal places			
NAV (₹) on 30-11-2019			

Also compute the overall effective annual yield for A. Consider 365 days p.a. **10**

(b) An investor holds the following securities:

Securities	**Cost (₹)**	**Dividend/ Interest (₹)**	**Market Value (₹)**	**Beta**
Equity Shares				
A Ltd.	**1,00,000**	**17,250**	**98,000**	**0.6**
B Ltd.	**1,50,000**	**10,000**	**1,62,000**	**0.8**
C Ltd.	**1,40,000**	**7,000**	**1,85,000**	**0.6**
GOI Bonds	**3,60,000**	**36,000**	**3,60,000**	**0.01**

Calculate:

(i) Portfolio beta using market value weights (up to two decimal places).

(ii) Market rate of return using CAPM, taking a risk free rate of 7%.

(iii) Would you rate the investor as risk-averse? **6**

Answer:

(a)

		P	**Q**	**R**
Investment	(a)	2,00,000	4,00,000	2,00,000
NAV per unit on purchase date	(b)	10.30	10.10	10.00
No of units	(c) = (a)/(b)	19417.48	39603.96	20000
NAVp.u.30/11	(d)	10.25	10.00	10.20
NAV Rs 30/11	(e) = (c)x(d)	199029.17	396039.6	204000
Dividend/u	(f)	0.31	0	0.25

Cap gain/u	(g) = (d)-(b)	-0.05	-0.10	+0.20
Return p.u	(h) = (f) + (g)	0.26	-0.10	+0.45
Annual yield	(i)	9.66	-11.66	24.15
Holding period (days)	(j) = $\frac{(h \times 365)}{(i)x(b)}$	95.38 = 95	30.99 = 31	68.01 = 68
Holding period yield (%)	(k) = (j x i)/365	2.52%	-0.989%	4.5%

Overall effective annual yield = (a) × (i) / 8,00,000 = 2.62%

Alternative solution:

(i) Number of units in each Scheme

MF-P	$\frac{₹\ 2,00,000}{₹\ 10.30}$	= 19,417.48
MF-Q	$\frac{₹\ 4,00,000}{₹\ 10.10}$	= 39,603.96
MF-R	$\frac{₹\ 2,00,000}{₹\ 10.00}$	= 20,000.00

(ii) Total NAV on 30.11.2019

MF-P	= 19,417.48 x 10.25	₹ 1,99,029.17
MF-Q	= 39,603.96 x 10.00	₹ 3,96,039.60
MF-R	= 20,000.00 x 10.20	₹ 2,04,000.00
Total		₹ 7,99,068.77

(iii) Total Yield

	Capital Yield	Dividend Yield	Total
MF-P	₹1,99,029.17 - ₹2,00,000 = - ₹970.83	₹6,000	₹5,029.17
MF-Q	₹3,96,039.60 - ₹400000 = - ₹3,960.40	Nil	- ₹3,960.40
MF-R	₹2,04,000 - ₹2,00,000 = ₹4,000	₹5,000	₹9,000.00
Total			₹ 10,068.77

(iv) No. of days investment held

	MF-P	MF-Q	MF-R
Initial investment (₹)	2,00,000	4,00,000	2,00,000
Yield (₹)	5,029.17	-3,960.40	9,000.00
Yield (%)	2.5146	-0.9901	4.5
Period of Holding (days)	$\frac{2.5146}{9.66} \times 365$	$\frac{-0.9901}{-11.66} \times 365$	$\frac{4.5}{24.15} \times 365$
	= 95 days	= 31 days	= 68 days

Overall effective annual yield = $\frac{19320^{*} - 46640^{*} + 48300^{*}}{8,00,000} \times 100 = 2.62\%$

*(Yield x 365)/ Period of holding in days

(b)

	Cost	**Income**	**Capital Gain**	**Total Return**	**Market Value**	**B**	**Mv × β**
Equity Share: A Ltd.	1,00,000	17,250	-2,000	15,250	98,000	0.6	58,800
B Ltd.	1,50,000	10,000	+12,000	22,000	1,62,000	0.8	129,600
C Ltd.	1,40,000	7,000	+45,000	52,000	1,85,000	0.6	1,11,000
GOI Bonds	3,60,000	36,000	0	36,000	3,60,000	0.01	3,600
	7,50,000	**70,250**	**55,000**	**1,25,250**	**8,05,000**		**3,03,000**

(i) Portfolio $\beta = \frac{303000}{805000} = 0.376 = 0.38$

(ii) Average return of portfolio = $\frac{125250}{750000} = 16.7\%$

$\therefore 16.7 = R_f + (R_M - R_f)\beta$

$= 7 + (R_M - R_f)0.38$

$R_M - R_f = \frac{16.7 - 7}{0.38} = 25.53$

$R_M = 7 + 25.53 = 32.53\%$

(iii) The investor is risk averse because his portfolio β = 0.38, due to a high GOI investment proportion, which yields 10% against a risky market yield of 32.53%.

6. (a) A company has to replace its machine with either machine EM or LM. The following details are given:

Particulars	EM	LM
Purchase price (₹)	20,00,000	10,00,000
Scrap value at the end of its life (₹)	3,00,000	3,00,000
Life (no. of years)	12	6
Overhauling due at the end of year	8	4
Overhauling cost (₹)	4,00,000	2,00,000
Annual repair cost (₹)	2,00,000	2,80,000

If LM is chosen, it has to be replaced by another LM machine at the end of the 6th year at ₹ 12,00,000. Ignore depreciation and taxes. Use a discount rate of 10% p.a. with annual rests. Present annual pre-discounted cash flows for each machine, then apply the PV or annuity factors and show computations to the nearest rupee.

Compare the equivalent annual cash flows for the machines.

Which machine should the company choose based on NPV? 8

(b) The equity shares of MNB Ltd. are being sold at ₹ 315. A 3-month call option is available for a premium of ₹ 9 per share and a 3 month put option is available for a premium of ₹ 8 per share. Find out the net pay off of the holder of the call option and put option given that:

(i) The strike price in both cases is ₹ 330 and

(ii) The share price on the exercise day is ₹ 300 or ₹ 315 or ₹ 345 or ₹ 360. 8

Answer:

(a)

EM:

Year	Cash flows	Factor	PV
0	- 20,00,000	1	- 20,00,000
1-12	- 2,00,000	6.814	- 13,62,800
8	- 4,00,000	0.467	-1,86,800
12	+ 3,00,000	0.319	+ 95,700
NPV			**- 34,53,900**

LM:

Year	Cash flows	Factor	PV
0	-10,00,000	1	-10,00,000
1-12	-2,80,000	6.814	-19,07,920
4	-2,00,000	0.683	- 1,36,600
10	-2,00,000	0.386	-77,200
6	+3,00,000 -12,00,000	0.564	-5,07,600
12	+3,00,000	0.319	+95,700
NPV			**-35,33,620**

Equivalent annual cash flows EM: -34,53,900/12 = - 2,87,825

LM: -35,33,620/12 = - 2,94,468

EM is better

(b)

Call option holder

Exercise Price	330	330	330	330
Spot Price	300	315	345	360
Option	Lapse	Lapse	Exercise	Exercise
Gain	-	-	15	30
Premium	-9	-9	-9	-9
Net Pay off	(9)	(9)	+6	+21

Put option holder

Option	Exercise	Exercise	Lapse	Lapse
Gain	30	15	-	-
Premium	-8	-8	-8	-8
Net Pay off	+22	+7	(8)	(8)

7. (a) JASPAL Ltd. is currently considering two mutually exclusive projects, A and B. The following are some of the information concerning the two projects:

	Project A	Project B
Initial investment	₹ 15,000	₹ 20,000
Project life	3 years	3 years
Annual cash inflow	₹ 7,000	₹ 10,000
Risk index	0.4	1.8

In addition, the firm uses two different techniques to adjust for the different risk levels of projects: certainty equivalent factors and risk adjusted discount rate. Additional information is provided below:

Certainty equivalent factors		
Year	Project A	Project B
0	100	100
1	0.95	0.90
2	0.90	0.85
3	0.90	0.70

Risk index	RADR (%)	Risk index	RADR (%)
0.0	7.0	1.0	12.0
0.2	8.0	1.2	13.0
0.4	9.0	1.4	14.0
0.6	10.0	1.6	15.0
0.8	11.0	1.8	16.0

The company's cost of capital is 10%.

(i) Calculate the NPV of Project A and Project B at 10% discount rate.

(ii) Determine the NPV of Project A and Project B using certainty equivalent (CE) to account for Risk.

(iii) Determine the NPV of Project A and Project B using Risk Adjusted Discount Rate (RADR) to account for Risk.

(iv) Compare and explain your findings in (i), (ii) and (iii) 10

(b) The spot price of a share of Bevel Ltd. is ₹ 356 with a face value of ₹ 10 per share. The 3 months' futures contract is ₹ 386 per share.

Other features of the contract and the related information are as follows:

(i) Time to expiration of the contract is 3 months

(ii) Annual dividend of the stock of 30% is payable after 3 months

(iii) Borrowing rate is 20% p.a. continuously compounded.

Based on the above information, as an investor, you are required to calculate the theoretical forward price for Bevel share. Also explain whether any arbitrage opportunity exists or not. 6

Answer:

(a)

(i) NPV at 10% Discount rate

End of year	PV factor	Cash flows A	PV Proj A	Cash flows B	PV Proj B
0	1	-15,000	-15,000	-20,000	-20,000
1-3	2.487	+7,000	+17,409	+10,000	+24,870
NPV			+2,409		+4,870

B is preferred

(ii) Rf = 7%

End of year	PV factor 7%	Cash flow A (Certainty Eq) C/I x CE Factor	PV Proj A	Cash flow B (Certainty Eq) C/I x CE Factor	PV Proj B
0	1	-15,000	-15,000	-20,000	-20,000
1	0.935	+6,650	+6,218	+9,000	+8,415
2	0.873	+6,300	+5,500	+8,500	+7,421
3	0.816	+6,300	+5,141	+7,000	+5,712
NPV			+1,858		+1,548

A is preferred

(iii) RADR. Discount factor for A is 9% and for B 16%

End of year	PV factor 9%	Cash flows A	PV Proj A	PV factor 16%	Cash flows B	PV Proj B
0	1	-15,000	-15,000	1	-20,000	-20,000

1-3	2.531	7,000	+17,717	2.246	10,000	+22,460
NPV			+2,717			+2,460

A is better.

(iv) When we ignore risk we see that both projects give NPV of greater than zero. Since they are mutually exclusive, we need to select the project which gives **higher NPV.** Therefore, we select Project B. When we apply the **certainty equivalent approach,** we see that Project A is better with a higher NPV. Similarly **even under RADR** method, Project A gives higher NPV. The choice is therefore obvious that we should select Project A as it gives a higher NPV even after adjusting for risk under both the methods.

(b)

(i) Calculation of future price

Spot Price (ST)	= ₹ 356
Expected Rate of Dividend	= ₹ 30% or 0.30
Borrowing rate	= 20% p.a. continuously compounded
Time to expiration of the contract	= 3 months = (0.25 year)
Present value of dividend	= (30%, ₹10) x $e^{-0.20\times0.25}$ = 3x $e^{-0.05}$
	= ₹ 3/1.05127 = ₹ 2.8537
Adjusted spot price	= ₹ 356 - 2.8537 = ₹ 353.1463
[Spot price-Present value of dividend]	
Theoretical Future Price	= ₹ 353.1463 x $e^{0.20\times0.25}$ = ₹ 353.1463×1.05127
	= ₹ 371.25211
3-month Futures Price	= ₹ 386

So, 3-month future price is greater than the theoretical Future price and it is overvalued. In this case, buy spot and sell futures.

(ii) Here arbitrage opportunity exists

The following steps to be followed.

(a) Borrow ₹ 356 for a period of 3 months at the rate of 20% p.a. continuously compounded.

(b) Buy one unit of share for ₹ 356 at T_0

(c) Receive the dividend at the end of 3 months [₹ 10 x 30% = ₹ 3]

(d) Sell the stock future at the rate of ₹ 386 for 3 months

(e) Repay of borrowing together with interest = ₹ 356 x $e^{\mathbf{0.20\times0.25}}$ = ₹ 374.25

(f) Net Cash inflow = ₹ [386+3-374.25] = ₹ 14.75

8. Answer *any four* out of the following *five* questions: 4x4=16

(a) (i) B is an Indian buyer of goods from S, a seller in USA. B's bank, BK, issues a document undertaking to pay S, a sum of $ 5000 on presenting evidence of shipping the goods. BK's agent bank in USA, upon confirmation by BK, pays S the $ 5000.

You are required to identify the document.

(ii) 'K' is a short term instrument issued by the RBI on behalf of the Government. K is issued at a discount to face value and is repaid at par on maturity. K is negotiable, with no default risk and eligible for SLR purposes. It is issued through the SGL account and only in book entry form. K has a secondary market also.

You are required to identify instrument 'K'. 4

(b) If σ_A, σ_B denote risk of return of securities A and B and Cov (A, B) is the covariance of the return of securities A and B in a portfolio consisting of only these two securities, what should be the proportion of investment in A so that the portfolio is of minimum variance? Explain. 4

(c) M is a person who has studied the trends and analyzed the equity market. He feels that he is certain to gain due to increasing prices, but does not have the required money to invest and hold shares. He would like to benefit from the purchase of 10,000 shares of A Ltd. which is trading on BSE at ₹ 205 per share. According to his estimate, it will fetch him at least ₹ 215 per share within a month. He can spare only ₹ 3,00,000 for a month. Advise him on whether and how he can or cannot fulfill his desire, assuming that he will not borrow and invest, but is willing to trade in the equity market and assuming that his prediction comes true. 4

(d) If A and B are the only two securities of equal value in a portfolio, σ_A, σ_B the respective standard deviations of their returns and 'ρ' the correlation coefficient between A and B and if A has almost the same return as the market, explain whether the following statements are valid or not.

(i) If $\rho = 1$ and the market is doing well as of now, the portfolio has maximum risk and the investment can be wiped out later.

(ii) If $\rho = -1$, even if the market is doing well now, the returns will be almost negligible, but the investment will be safe. 4

(e) State the equation which has to be violated so that there is arbitrage opportunity. Define the variables in die equation:

(i) Domestic vs. foreign currency and interest rates.

(ii) CAPM return vs. expected return 4

	PV factor table						Annuity factor table		
End of yr.	1	2	3	4	5		3	4	5
Rate									
4.00%	0.962	0.925	0.889	0.855	0.822		2.775	3.630	4.452

4.80%	0.954	0.910	0.869	0.829	0.791		2.733	3.562	4.353
5.00%	0.952	0.907	0.864	0.823	0.784		2.723	3.546	4.329
5.60%	0.947	0.897	0.849	0.804	0.762		2.693	3.497	4.259
6.00%	0.943	0.890	0.840	0.792	0.747		2.673	3.465	4.212
7.00%	0.935	0.873	0.816	0.763	0.713		2.624	3.387	4.100
8.00%	0.926	0.857	0.794	0.735	0.681		2.577	3.312	3.993
8.16%	0.925	0.855	0.790	0.731	0.676		2.570	3.300	3.976
9.00%	0.917	0.842	0.772	0.708	0.650		2.531	3.239	3.889
9.60%	0.912	0.832	0.760	0.693	0.632		2.504	3.198	3.830
10.00%	0.909	0.826	0.751	0.683	0.621		2.487	3.170	3.791
11.00%	0.901	0.812	0.731	0.659	0.593		2.444	3.102	3.696
12.00%	0.893	0.797	0.712	0.636	0.567		2.402	3.037	3.605
13.00%	0.885	0.783	0.693	0.613	0.543		2.361	2.974	3.517
14.00%	0.877	0.769	0.675	0.592	0.519		2.322	2.914	3.433
15.00%	0.870	0.756	0.658	0.572	0.497		2.283	2.855	3.352
16.00%	0.862	0.743	0.641	0.552	0.476		2.246	2.798	3.274

	PV factor table							Annuity factor table			
End of yr.	6	7	8	9	10	11	12	6	10	11	12
Rate											
10.00%	0.564	0.513	0.467	0.424	0.386	0.350	0.319	4.355	6.145	6.495	6.814

$e^{-0.05}$	0.95123
$e^{0.05}$	1.05127
$e^{0.15}$	1.16183
$e^{-0.15}$	0.86071
$e^{0.35}$	1.41907
$e^{-0.35}$	0.70469

Answer:

(a) (i) Letter of Credit.

(ii) Treasury Bills.

(b) In a portfolio of two securities, w_1, & 1 – w_1, are the respective weights of A & B, the minimum variance portfolio will have for weightage of A,

$$\omega_1 = \frac{\sigma_B^2 - \text{cov}(A, B)}{\sigma_A^2 + \sigma_B^2 - 2\,\text{cov}\,(A, B)}$$

This is derived from the following:

Variance of portfolio = V_p

$V_p = \omega_1^2 V_A + \omega_2^2 V_B + 2\,\omega_1\,\omega_2\,\sigma_A\sigma_B\,\rho_{AB}$

$= \omega_1^2\,\sigma_A^2 + \omega_2^2\,\sigma_B^2 + 2\omega_1\,\omega_2\,\sigma_A\sigma_B\,\rho_{AB}$

where ρ_{AB} = correlation coefficient between

A & B, given by $\frac{\text{Cov}\,(A, B)}{\sigma_A\sigma_B}$

and where $w_2 = 1 - w_1$, when w_1 & w_2 are expressed in % or fraction or ratios.

Minimising the equation with respect to w_1 after substitution will give the formula stated above.

(c) He can trade in the futures market.

215 x10000 = 2150000.

Approx 10 % margin = 2.15 lacs. He can buy futures for 10000 shares and with 3 lacs, maintain the margin.

His gain will be 10 x 10000 = 100000 for an investment of less than 3 lacs for the month.

However, in the event of fall in prices, he will have to use the cash or liquidate part of the futures if he cannot provide for the maintenance margin. But if his prediction comes true, his margin will be restored when prices move up.

(d) When ρ = 1, both A and B move proportionally in the same direction which is as per the market. If the market is doing well, the returns are the best, but when the market falls, both fall. The portfolio's investment is at risk, which is the highest. There is no diversification at all. Hence the unsystematic risk is maximum.

When *p* = -1, A will do as well as the market, but B will have the opposite value, i.e. capital depreciation. Hence returns on A will be offset exactly by B, Total returns are almost nil, but there is perfect diversification and therefore, unsystematic risk is zero and the investment is safe.

(e) **(i)** $\frac{\text{Forward rate}}{\text{Spot Rate}} = \frac{(1+\text{interest rate in home currency})}{(1+\text{interest rate in foreign currency})}$

i.e. Expected forward rate or theoretical forward rate = spot rate $\times \frac{(1+r_h)}{(1+r_f)}$

If this equation is violated, there will be arbitrage.

(ii) if CAPM return = Expected return, there is no arbitrage.

i.e. $R_f + \beta(R_m - R_f) = E(R)$

Where R_f = risk free rate of return,

β is the risk of security or portfolio,

R_m = market return.

If E(R) is higher, it is overpriced. Stock is sold.

If E(R) is lower, it is underpriced. Stock is bought.