Question – 34

A Mutual Fund is holding the following assets in ₹ Crores :

Investments in diversified equity shares	90.00
Cash and Bank Balances	10.00
	100.00

The Beta of the equity shares portfolio is 1.1. The index future is selling at 4300 level. The Fund Manager apprehends that the index will fall at the most by 10%. How many index futures he should short for perfect hedging? One index future consists of 50 units.

Substantiate your answer assuming the Fund Manager's apprehension will materialize.

(SM TYK – 07)

Solution:

Note: In this question, ICAI assumed that cash is not part of the portfolio.

No. of Contracts

$$= \frac{V_P(B_T - B_P)}{F \times M \times B_F}$$

$$= \frac{₹\ 90\ Cr.\ (0 - 1.10)}{4{,}300 \times 50 \times 1} = 4{,}605\ \text{Contracts Short}$$

Substantiate

If Nifty down by 10%

Loss on Equity	(90 × 10% × 1.1)	9.90 Cr.
Gain on Nifty	(4,300 × 50 × 4,605) × 10%	9.90 Cr.
		0

Question – 35

Shyam buys 10,000 shares of X Ltd., @ ₹ 25 per share and obtains a complete hedge of shorting 400 Nifty at ₹ 1,100 each. He closes out his position at the

closing price of the next day when the share of X Ltd., has fallen by 4% and Nifty Future has dropped by 2.5%.

What is the overall profit or loss from this set of transaction?

(Exam January – 2021)

Solution:

Today Investment

Long Position in X Ltd. (10,000 × 25)	= 2,50,000
Short Position in Nifty (400 × 1,100)	= 4,40,000

Calculation of Profit/Loss

Loss on Long Position of X Ltd (2,50,000 × 4%)	= 10,000
Gain on Short Position of Nifty (4,40,000 × 2.5%)	= 11,000
Overall Gain	= 1,000

Alternative [ICAI]

Cash Flow Today (Initial Cashflows)

Buy X Ltd share	(2,50,000)
Sell Nifty	+ 4,40,000
Net Cash Inflow	1,90,000

Cash Flow Next Day (Cashflow at Closes Out)

Sell X Ltd. (10,000 × 25 × 96%)	+ 2,40,000
Buy Nifty (4,40,000 × 97.5%)	(4,29,000)
Net Cash Outflow	1,89,000

Gain or Loss = 1,90,000 – 1,89,000 = 1,000 Profit.

Question – 36

Which position on the index future gives a speculator, a complete hedge against the following transactions:

(i) The share of Right Limited is going to rise. He has a long position on the cash market of ₹ 50 lakhs on the Right Limited. The beta of the Right Limited is 1.25.

(ii) The share of Wrong Limited is going to depreciate. He has a short position on the cash market of ₹ 25 lakhs on the Wrong Limited. The beta of the Wrong Limited is 0.90.

(iii) The share of Fair Limited is going to stagnant. He has a short position on the cash market of ₹ 20 lakhs of the Fair Limited. The beta of the Fair Limited is 0.75.

(SM TYK – 09)

Solution:

Statement Showing Position in Nifty

Company	Position in Cash Market	Amount	Beta	Position in Future
Right Ltd.	Long	50,00,000	1.25	62,50,000 Short
Wrong Ltd.	Short	25,00,000	0.9	22,50,000 Long
Fair Ltd.	Short	20,00,000	0.75	15,00,000 Long
			Net Position in Future	25,00,000 Short

Question – 37

Ram buys 10,000 shares of X Ltd. at a price of ₹ 22 per share whose beta value is 1.5 and sells 5,000 shares of A Ltd. at a price of ₹ 40 per share having a beta value of 2. He obtains a complete hedge by Nifty futures at ₹ 1,000 each. He closes out his position at the closing price of the next day when the share of X Ltd. dropped by 2%, share of A Ltd. appreciated by 3% and Nifty futures dropped by 1.5%.

What is the overall profit/loss to Ram?

(SM TYK – 10)

Solution:

Statement Showing Net Position in Nifty

Company	Position in Cash Market	Amount	Beta	Position in Future
X Ltd.	Long	2,20,000	1.5	3,30,000 Short
A Ltd.	Short	2,00,000	2	4,00,000 Long
			Net Position in Nifty	70,000 Long

No. of Contract $= \frac{70,000}{1,000}$ = 70 Contracts Long

Overall Profit/Loss

Loss in Long Position of X Ltd. (2,20,000 × 2%)	= 4,400
Loss on Short Position of A Ltd. (2,00,000 × 3%)	= 6,000
Loss on Long Position of Nifty (70,000 × 1.5%)	= 1,050
Overall Loss	= 11,450

Question – 38

On 1 April 2015, Sunidhi was holding a portfolio of 10 securities whose value was ₹ 9,94,450, the weighted average of beta of 9 securities was 1.10.

Since she was expecting a fall in the prices of the shares in near future to hedge her portfolio she sold 5 contract of NIFTY Futures (Multiplier of 25) expiring in May 2015, which was trading at 8767.07 on 1 April.

(a) Calculate the beta of the 10th security.

(b) Reconcile the reasons in spite of 2% fall in the market as per Sunidhi's apprehension if she would have earned some profit on her cash position.

(MTP March – 2018)

Solution:

(i) To compute the beta of 10th security first we shall compute overall weighted beta as follows:

Let weighted β be w, then

$$5 = \frac{9,94,450}{8,767.07 \times 25} \times w$$

w = 1.102 approximately

Let beta of 10th security is β then,

$1.102 = 0.90 \times 1.10 + 0.10 \times \beta$

$\beta = 1.12$

(ii) The main reason for the profit in cash position might due to reason that contrary to her expectation fall in the value of cash position there may be increase in value of cash position.

(VIII) COMODITY FUTURE

Question – 39

The following information is available about standard gold.

Spot Price (SP)	₹ 15,600 per 10 gms.
Future Price (FP)	₹ 17,100 for one year future contract
Risk free interest Rate $(R)^f$	8.5%
Present Value of Storage Cost	₹ 900 per year

From the above information you are requested to calculate the Present Value of Convenience yield (PVC) of the standard gold.

Solution:

Future Price	= (Spot Price + Present Value of Storage Cost – Present Value of Convenience Yield) (1 + r)
17,100	= (15,600 + 900 – x) (1.085)
PVCY	= 740

Question – 40

A company is long on 10 MT of copper @ ₹ 534 per kg (spot) and intends to remain so for the ensuing quarter. The variance of change in its spot and future prices are 16% and 36% respectively, having correlation coefficient of 0.75. The contract size of one contract is 1,000 kgs.

Required:

(i) Calculate the Optimal Hedge Ratio for perfect hedging in Future Market.

(ii) Advice the position to be taken in Future Market for perfect hedging.

(iii) Determine the number and the amount of the copper futures to achieve a perfect hedge.

(RTP November – 2021)

Solution:

(i) The optional hedge ratio to minimize the variance of Hedger's position is given by:

$$H = \rho \frac{\sigma S}{\sigma F}$$

Where,

σS = Standard deviation of ΔS (Change in Spot Prices)

σF = Standard deviation of ΔF (Change in Future Prices)

ρ = Coefficient of correlation between ΔS and ΔF

H = Hedge Ratio

ΔS = Change in spot price.

ΔF = Change in Future price.

Accordingly

Standard deviation of $\Delta S = \sqrt{16\%} = 4\%$ and

Standard deviation of $\Delta F = \sqrt{36\%} = 6\%$ and

$$H = 0.75 \times \frac{0.04}{0.06} = 0.5$$

(ii) Since the company is long position in Spot (Cash) Market it shall take Short Position in Future Market.

(iii) Since contact size of one contract is 1,000 Kg,

$$\text{No. of contract to be short} = \frac{10{,}000 \text{ Kgs}}{1{,}000 \text{ Kgs}} \times 0.50 = 5 \text{ Contracts}$$

Amount = ₹ 5,000 × 534 = ₹ 26,70,000

Question – 41

A Rice Trader has planned to sell 22,000 kg of Rice after 3 months from now. The spot price of the Rice is ₹ 60 per kg and 3 months Future on the same is trading at ₹ 59 per kg. Size of the contract is 1000 kg. The price is expected to fall as low as ₹ 56 per kg, 3 months hence.

Required:

(i) To interpret the position of trader in the Cash Market.

(ii) To advise the trader the trader should take in Future Market to mitigate its risk of reduced profit.

(iii) To demonstrate effective realized price for its sale if he decides to make use of future market and after 3 months, spot price is ₹ 57 per kg and future contract price for closing the contract is ₹ 58 per kg.

(RTP Nov – 2020 & MTP May – 2019)

Solution:

(1) Rice Trader hold the stock for 3 months & expects that price rise. Hence, he has Long Position in cash market.

(2) He should take Short Position in future market to hedge risk of price fall.

(3) Effective Realized Price per kg.

Sell (22,000 kg × ₹ 57)	= ₹ 12,54,000
(+) Gain on short position (59 – 58) × 22,000	= ₹ 22,000
Total	= ₹ 12,76,000
(÷) Quantity	= ₹ 22,000
Effective Price	= ₹ 58/kg

Question – 42

A call option on gold with exercise price ₹ 26,000 per ten gram and three months to expire is being traded at a premium of ₹ 1,010 per ten gram. It is expected that in three months time the spot price might change to ₹ 27,300 or 24,700 per ten gram. At present this option is at-the-money and the rate of interest with simple compounding is 12% per annum. Is the current premium for the option justified?

Evaluate the option and comments.

Solution:

Risk Neutral

Step 1: Risk Neutral Probability

$R = 1.03$

$u = \frac{27,300}{26,000} = 1.05$

$d = \frac{24,700}{26,000} = 0.95$

$P = \frac{R - d}{u - d}$

$= \frac{1.03 - 0.95}{1.05 - 0.95} = 0.8$

Step 2: Value of Call

$C_0 = \frac{(1,300 \times 0.8) + (0 \times 0.2)}{1.03}$

$= 1,010$

REAL OPTION

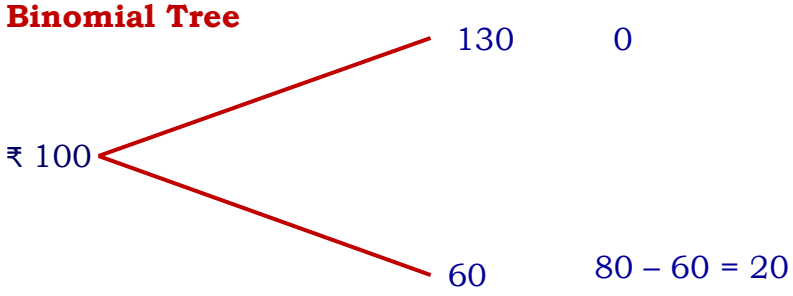
Question – 43

IPL already in production of Fertilizer is considering a proposal of building a new plant to produce pesticides. Suppose the PV of proposal is ₹ 100 crore without the abandonment option. However, if market conditions for pesticide turns out to be favorable the PV of proposal shall increase by 30%. On the other hand, market conditions remain sluggish the PV of the proposal shall be reduced by 40%. In case company is not interested in continuation of the project it can be disposed of for ₹ 80 crore.

If the risk-free rate of interest is 8% then what will be value of abandonment option.

Solution:

(i) Binomial Tree



(ii) Risk Neutral Probability

$30\ P + (-40)\ (1 - P) = 8$

$30\ P - 40 + 40\ P = 8$

$70\ P = 48 \quad P = \frac{48}{70} = 0.686$

(iii) Value of Abandonment Option

$$\text{Value} = \frac{(0 \times 0.686) + (20 \times 0.314)}{1.08}$$

= ₹ 5.81 Cr. (Put option)

Question – 44

Suppose MIS Ltd. is considering installation of solar electricity generating plant for light the staff quarters. The plant shall cost ₹ 2.50 crore and shall lead to saving in electricity expenses at the current tariff by ₹ 21 lakh per year forever.

However, with change in Government in state, the rate of electricity is subject to change. Accordingly, the saving in electricity can be of ₹ 12 lakh or ₹ 35 lakh per year and forever.

Assuming WACC of MIS Ltd. is 10% and risk-free rate of rate of return is 8%.

Decide whether MIS Ltd. should accept the project or wait and see.

Solution:

If Project Install New

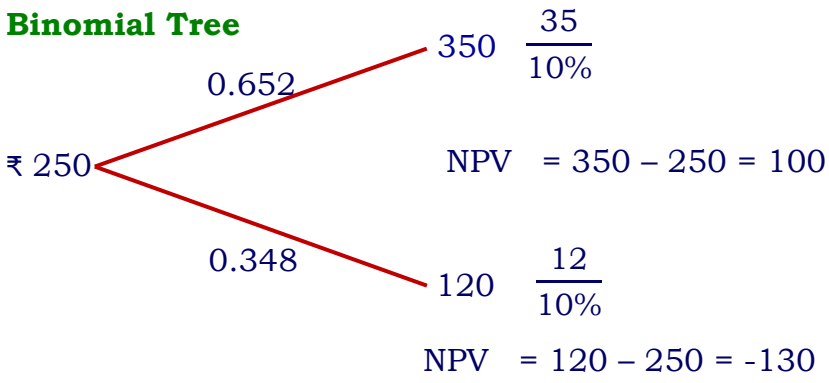
NPV = PVCI – PVCO

$= \frac{21}{10\%} - 250$ lacs

= - 40 lacs (0.4 Crore)

Wait for 1 year

(i) Binomial Tree



(ii) Risk Neutral Probability

- Return if PVCI = 350

$= \frac{350-250}{250} \times 100 = 40\%$

- Return if PVCI = 120

$= \frac{120-250}{250} \times 100 = -52\%$

40 P + (-52) (1-P) = 8

40 P – 52 + 52 P = 8

92 P = 60

$P = \frac{60}{92}$

= 0.652

(iii) Value of Abandonment Option

$\text{Value} = \frac{(100 \times 0.652) + (-130 \times 0.348)}{1.08}$

= ₹ 18.48 lacs

It is better to wait for 1 year due to higher NPV.

Question – 45

ABC Ltd. is a pharmaceutical company possessing a patent of a drug called 'Aidrex', a medicine for aids patient. Being an approach drug ABC Ltd. holds the right of production of drugs and its marketing. The period of patent is 15 years after which any other pharmaceutical company produce the drug with same formula. It is estimated that company shall require to incur $ 12.5 million for development and market of the drug. As per a survey conducted the expected present value of cash flows from the sale of drug during the period of 15 years shall be $ 16.7 million. Cash flow from the previous similar type of drug have exhibited a variance of 26.8% of the present value of cash flows. The current yield on Treasury Bonds of similar duration (15 years) is 7.8%.
Determine the value of the patent.

Given ln(1.336) =0.2897

$e^{-1.0005}$ = 0.3677 and $e^{-1.17}$ = 0.3104

Solution:

Given

E = $ 12.5

So = $ 16.7

t = 15 years

Variance = 0.268

σ = $\sqrt{0.268}$ = 0.5177

r = 0.078

y = 1/15 = 0.0667

Step 1 d_1 & d_2

$$d_1 = \frac{\text{Ln}\frac{S_0}{E} + \left[(r-y) + \frac{\sigma^2}{2}\right] t}{\sigma\sqrt{t}}$$

$$= \frac{\text{Ln}\ \frac{16.7}{12.50} + \left[(0.78 - 0.0667) + \frac{0.268}{2}\right] 15}{\sqrt{0.268} \times \sqrt{15}}$$

$$= \frac{\text{Ln}\ 1.336 + 2.1795}{2.005}$$

$$= \frac{0.2897 + 2.1795}{2.005} = 1.2315$$

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

$= 1.2315 - 2.005$

$= -0.7735$

N (d_1)

N (1.2315)

1.20	———	0.1151
1.25	———	0.1056
0.05		0.0095

$$0.1151 - \left(\frac{0.0095}{0.05} \times 0.0315\right) = 0.1091$$

N (d_1) = 1 − 0.1091 = 0.8909

N (d_2)

N (-0.7735)

N (d_2) = 0.2196

Value of Patent

Value of patent $= So\ e^{-yt} \times N(d_1) - E\ e^{-rt} \times N(d_2)$

$= 16.7 \times e^{-0.0667 \times 15} \times 0.8909 - 12.5 \times e^{-0.078 \times 15} \times 0.2196$

$= 16.7 \times e^{-1.0005} \times 0.8909 - 12.5 \times e^{-1.17} \times 0.2196$

$= 16.7 \times 0.3677 \times 0.8909 - 12.5 \times 0.3104 \times 0.2196$

= $ 5.4707 – $ 0.8520

= $ 4.619 Millions.

ADDITIONAL QUESTIONS

Question – 01

A firm is considering a proposal to set up a cement manufacturing plant with an initial investment of ₹ 150 crore. The firm has the option to abandon the project after one year by selling it to a competitor for ₹ 100 crore if the market conditions are unfavorable and the demand is low, the project's value will decline by 60%. However, if the market conditions turn out to be favorable and the demand for cement is high, the value of the project at the end of year 1 will increase by 50%.

Given that the risk free rate of interest as 8%, what will be the value of the abandonment option and the value of the project with abandonment option?

(Exam November – 2024) (4 Marks)

Solution:

Decision Tree showing pay off

Year 0	Year 1	Option Pay off
	225	0
-150		
	60	100 - 60 = 40

First of all, we shall calculate probability of high demand (p) using risk neutral method as follows:

8% = p × 50% + (1-p) × (-60%)

0.08 = 0.50 p – 0.60 + 0.60p

p = 068/1.10= 0.618 or 0.62

The value of abandonment option will be as follows:

Expected Payoff at Year 1

= p × 0 + [(1-p) × 40]

= 0.618 × 0 + [0.382 × 40]

= ₹ 15.28 crore

Since expected pay off at year 1 is ₹ 15.28 crore. Present value of expected pay off will be:

$$\frac{15.28}{1.08} = ₹ 14.15 \text{ crore}$$

Thus, the value of abandonment option is ₹ 14.15 crore.

Value of Project with abandonment option -

(i) If PVF is not considered

Expected Value of the Project without abandonment option

= (0.618 ×₹ 225 crore + 0.382 × ₹ 60 crore) – ₹ 150 crore

= ₹ 11.97 crore

Value of Project with abandonment Option

= ₹ 11.97 crore +₹ 14.15 crore

= ₹ 26.12 crore

Or

Expected Value of the Project without abandonment option

= (0.62 × ₹ 225 crore + 0.38 × ₹ 60 crore) – ₹ 150 crore

= ₹ 12.30 crore

Value of Project with abandonment Option

= ₹ 12.30 crore + ₹ 14.15 crore

= ₹ 26.45 crore

(ii) If PVF is considered

Expected Value of the Project without abandonment option

= (0.618 × ₹ 225 crore + 0.382 × ₹ 60 crore)/1.08 – ₹ 150 crore

= - ₹ 0.028 crore OR - ₹ 0.03

Value of Project with abandonment Option

= - ₹ 0.028 crore + ₹ 14.15 crore

= ₹ 14.122 crore OR ₹ 14.12 crore

Or

Expected Value of the Project without abandonment option

= (0.62 × ₹ 225 crore + 0.38 × ₹ 60 crore)/1.08 – ₹ 150 crore

= ₹ 00.28 crore

Value of Project with abandonment Option

= ₹ 0.28 crore + ₹ 14.15 crore

= ₹ 14.43 crore

Question – 02

Mohan buys 10,000 shares of X Ltd. @ ₹ 25 per share whose beta value is 1.5 and sells 5,000 shares of A Ltd. @ ₹ 40 per share having a beta value of 2. He obtains a complete hedge by buying 25 Nifty Futures. He closes out his position at the closing price of the next day when the share of X Ltd. has fallen by 4% and Nifty Futures has dropped by 2.50%. In the process he suffered a loss of ₹ 16,625.

You are required to determine

(i) The value of the Nifty future

(ii) Initial cash outlay

(iii) Cash inflow at the close out

(iv) Percentage Gain/loss to Shares of A Ltd. at the time of closure

(Exam November – 2024) (4 Marks)

Solution:

(i) Let N be the value of Nifty Future Contract then:

$$\frac{10,000 \times 25 \times 1.50 - 5,000 \times 40 \times 2}{N} = 25$$

N = - 1,000

Since Mohan has bought Nifty Futures the above value shall be considered as positive i.e. value of per one Nifty Future is ₹ 1,000.

Alternatively, it can also be computed as follows:

$$\frac{5,000 \times 40 \times 2 - 10,000 \times 25 \times 1.50}{N} = 25$$

N = 1,000

Accordingly, the value of Nifty Future is ₹ 1,000.

(ii) Initial Cash Outlay

= 10,000 × ₹ 25 + 1,000 × ₹ 25 – 5000 × ₹ 40

= ₹ 2,50,000 + ₹ 25,000 – ₹ 2,00,000

= ₹ 75,000

(iii) Cash inflow at the closeout

= ₹ 75,000 – ₹ 16,625 = ₹ 58,375

(iv) Percentage Gain/loss to Shares of A Ltd. at the time of closure

Let the amount realized from the sale of share of A Ltd. is A.

Accordingly, next day at the time of closing out the position will be as follows:

10,000 × ₹ 25 (1 – 0.04) + 25 × ₹ 1,000 × (1 – 0.025) - A = ₹ 58,375

A = ₹ 2,06,000

Thus, percentage of loss to shares of A Ltd. $= \frac{2,06,000 - 2,00,000}{2,00,000}$

= 0.03 i.e. 3%

Alternative Presentation-

Percentage Gain / Loss to shares of A Ltd. at the time of closure:

Loss suffered by Mohan when he closes out his position at the closing price of the next day		₹ 16,625
Less:		
a. Loss suffered in purchase of shares of X Ltd. (10,000 × 25 × 0.04)	10,000	
b. Loss suffered in Nifty Futures (1,000 × 25 × 0.025)		₹ 10,625
Loss suffered in sale of shares of A Ltd.	625	
		₹ 6,000

Thus, percentage of loss to shares of A Ltd.= (6,000/2,00,000) × 100 = 0.03 i.e. 3%.

Question – 03

Mr. X, is a Senior Portfolio Manager at ABC Asset Management Company. He expects to purchase a portfolio of shares in 90 days. However, he is worried about the expected price increase in shares in coming day and to hedge against this potential price increase he decides to take a position on a 90-day forward contract on the Index. The index is currently trading at 2290. Assuming that the continuously compounded dividend yield on the same index is 1.75% and risk-free rate of interest is 4.16%, you are required to determine:

(a) The justified forward price on this contract.

(b) The position Mr. X should take in forward contract on the Index.

(c) Gain/ loss on the position taken if after 28 days of the purchase of the contract the Index value stands at 2450.

(d) Gain/ loss on the position taken if at expiration of 90 days the Index Value is 2470.

Note: Take 365 days in a year and value of $e^{0.005942}$ = 1.005960, $e^{0.001849}$ = 1.001851.

(RTP May – 2025)

Solution:

(a) The Forward Price shall be = $S_0 e^{n(r-y)}$

Where S_0 = Spot price

n = period

r = risk free rate of interest

y = dividend yield

Accordingly,

Forward Price = $2290\ e^{90/365(0.0416 - 0.0175)}$

= $2290\ e^{0.005942}$

= 2290(1.005960)

= 2303.65

(b) Mr. X shall take long position in the Forward Contract on Index.

(c) Gain/loss on Long Position after 28 days

= $2450 - 2290\ e^{(0.0416 - 0.0175)28/365}$

= $2450 - 2290\ e^{0.001849}$

= 2450 – 2290(1.001851)

= 2450 – 2294.24

= 155.76

(d) Gain/loss on Long Position at maturity

= $S_n - S_0 e^{n(r-y)}$

= 2470.00 – 2303.65

= 166.35

Question – 04

Mr. SK buys 5,000 shares of P Ltd. @ ₹ 50 per share whose beta value is 1.5 and sells 2,500 shares of Q Ltd. @ ₹ 80 per share having a beta value of 2. He obtains a complete hedge by Nifty Futures at ₹ 1,000 each.

He closes out his position at the closing price of the next day when the share of P Ltd. has fallen by 2%, share of Q Ltd. appreciated by 5% and Nifty Futures has dropped by 2.50%.

You are required to compute the overall profit or loss to Mr. SK from these set of transactions.

(Exam September – 2025) (4 Marks)

Solution:

No. of the Future Contract to be obtained to get a complete hedge

$$= \frac{5,000 \times 50 \times 1.50 - 2,500 \times 80 \times 2}{1,000}$$

$$= \frac{3,75,000 - 4,00,000}{1,000} = -25 \text{ Contracts or 25 contracts}$$

Thus, by purchasing 25 Nifty Futures contracts Mr. SK can obtain a complete hedge.

Cash Outlay

= 5,000 × ₹ 50 – 2,500 × ₹ 80 + 25 × ₹ 1,000

= ₹ 2,50,000 – ₹ 2,00,000 + ₹ 25,000

= ₹ 75,000

Cash Inflow at Close Out

= 5,000 × ₹ 50 × 0.98 – 2500 × ₹ 80 × 1.05 + 25 × ₹ 1,000 × 0.975

= ₹ 2,45,000 – ₹ 2,10,000 + ₹ 24,375

= ₹ 59,375 Gain/ Loss = ₹ 59,375 – ₹ 75,000

= - ₹ 15,625 (Loss)