Month	R_A	R_M
January	-0.52	0.82
February	2.20	0.04
March	2.17	2.80
April	4.17	1.72
May	2.04	0.27
June	3.00	0.39
July	1.99	1.95
August	4.00	0.64
September	-1.38	1.53
October	2.67	2.70
November	3.99	2.52
December	1.86	2.09
Average Returns	26.19	17.47
	2.1825	1.4558

Average Portfolio Return (R_p) = 2.1825

Average Portfolio Return (R_m) = 1.4558

Portfolio Risk (σ_P) = 1.6223

Market Risk (σ_m) = 0.9498

Since portfolio A is fully diversified then it can be computed with a portfolio whose beta (β) can be found as follows:

$\sigma^2_m \times \beta^2 = \sigma^2_p$

$\beta = \frac{\sigma_p}{\sigma_m} = \frac{1.6223}{0.9498}$ = 1.708 Therefore, portfolio A is comparable to a portfolio whose Beta is 1.708.

Expected monthly returns on such portfolio can be calculated as follows:

$R^1_P = R_f + \beta(R_m - R_f)$

= 1% + 1.708 (1.4558% − 1.0000%)

= 1.7785%

Return due to the net selectivity = $R_P - R^1_P$

= 2.1825% – 1.7785%

= 0.404% per month

(ii) The returns due to higher risk assumed by the portfolio manager

= 1.7785% – 1.4558% = 0.3227% per month

ADDITIONAL QUESTIONS

Question – 01

A Portfolio Manager (PM) has three mutual funds in has portfolio. Following the details of these three mutual funds:

Particulars	Growth Fund	Balanced Fund	Regular Fund	Market
Average Return (%)	7.5	6.3	5.4	
Variance				50.41
Sharpe Ratio	-0.15	-0.36	-0.48	
Treynor's Ratio	-2	-3	-4.80	

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

You are required to calculate

(i) Variance of the Funds

(ii) Coefficient of Determination of the Funds

(Exam November – 2024) (8 Marks)

Solution:

(i) Variance of different Funds can be calculated by using Sharpe Ratio as follows:

(a) Growth Fund

Let σ_G be the Standard Deviation of Growth Fund. Accordingly

$$-0.15 = \frac{7.50 - 9.00}{\sigma_G}$$

$$\sigma_G = 10$$

Hence the variance of Growth Fund $(\sigma_G)^2 = 100$

(b) Balanced Fund

Let σ_B be the Standard Deviation of Balanced Fund. Accordingly

$$-0.36 = \frac{6.30 - 9.00}{\sigma_B}$$

$\sigma_B = 7.50$

Hence the variance of Growth Fund $(\sigma_G)^2 = 56.25$

(c) Regular Fund

Let σ_R be the Standard Deviation of Regular Fund. Accordingly

$$-0.48 = \frac{5.40 - 9.00}{\sigma_R}$$

$\sigma_R = 7.50$

Hence the variance of Growth Fund $(\sigma_R)^2 = 56.25$

(ii) To determine the Coefficient of Determination we need the Coefficient of Correlation which can be determined by computing β using the Treynor Ratio as follows:

(a) Growth Fund

Let β_G be the Beta of Growth Fund. Accordingly

$$-2 = \frac{7.50 - 9.00}{\beta_G}$$

$\beta_G = 0.75$

$$\text{Since Beta} = \frac{\sigma_G \text{Corr}_{-G,M}}{\sigma_M}$$

and σ_G= 10 and $\sigma_M = \sqrt{50.41}$ = 7.1

Hence 0.75 = $\frac{10 Corr_{.G,M}}{7.10}$

$Corr._{G,M}$ = 0.5325 or 0.53 and

Coefficient of Determination of Growth Fund = $(0.5325)^2$ = 0.2836 or $(0.53)^2$ = 0.28

(b) Balanced Fund

Let β_B be the Beta of Balanced Fund. Accordingly

- 3 = $\frac{6.30 - 9.00}{\beta_B}$

β_B = 0.90

Since Beta = $\frac{\sigma_B Corr_{.B,M}}{\sigma_M}$

and σ_B= 7.50 and $\sigma_M = \sqrt{50.41}$ = 7.1

Hence 0.90 = $\frac{7.50 Corr_{.G,M}}{7.10}$

$Corr._{B,M}$ = 0.852 or 0.85 and

Coefficient of Determination of Balanced Fund = $(0.852)^2$ = 0.7259 or $(0.85)^2$ = 0.73

(C) Regular Fund

Let β_R be the Beta of Regular Fund. Accordingly

- 4.80 = $\frac{5.40 - 9.00}{\beta_R}$

β_R = 0.75

Since Beta = $\frac{\sigma_R Corr_{.B,M}}{\sigma_M}$

and $\sigma_R = 7.50$ and $\sigma_M = \sqrt{50.41} = 7.1$

Hence $0.75 = \frac{7.50 Corr_{-G,M}}{7.10}$

$Corr._{R,M} = 0.71$ and

Coefficient of Determination of Regular Fund = $(0.71)^2 = 0.5041$ or 0.50

Question – 02

Mr. DK has 1,000 units of AM Mutual Fund. NAV of it is ₹ 17.50 per unit and ₹ 18.90 per unit at the beginning and at the end of the year respectively. The Mutual Fund has given two options:

Option I: Pay ₹ 1.50 per unit as dividend and ₹ 1.20 per unit as a capital gain, or

Option II: Reinvest these distributions at an average NAV of ₹ 17.30 per unit.

You are required to compute the holding period return percentage for both the options and select which option is preferable.

Calculation up to 2 decimal points.

(Exam September – 2025)

Solution:

Holding Period Return

Option – I:

$$HPR = \frac{(18.90 - 17.50) + 1.20 + 1.50}{17.50} \times 100$$

$= 23.43\%$

Option – II:

Purchase = 1,000 units × 17.50 = ₹ 17,500

Dividend & Capital Gain = (1.20 + 1.50) × 1,000 units = ₹ 2,700

Reinvestment $= \frac{₹\ 2,700}{17.30} = 156.07$ units

Total Units = 1,000 + 156.07 = 1,156.07 units

$$\text{HPR} = \frac{(1{,}156.07 \times 18.90) - 17{,}500}{17{,}500} \times 100$$

= 24.86%

Option II is better due to higher return.

Question – 03

In 2024, Mr. Raj, an investor made a lump sum investment in an equity mutual fund that had an entry load of ₹ 0.05 per unit. By the end of the year, the NAV appreciated by 13.60%. Additionally, the fund declared a total capital gain and dividend of ₹ 5.00 per unit, which were reinvested at a year-end NAV of ₹ 25. As a result, the investor held 15,000 units at year – end.

The fund also charges an exit load of 1% if redeemed within 1 year. The investor is in the 20% tax bracket. Inflation rate during the year is 4.50%.

You are to required to

(i) Calculate the number of units purchased by Mr. Raj at the beginning of the investment.

(ii) Calculate the NAV per unit and the total investment amount made by Mr. Raj at the beginning of the year.

(iii) Appraise the return percentage and the real return percentage, if Mr. Raj decided to exit the investment at the end of the year.

Calculation up to 2 decimal points.

(Exam September – 2025) (7 Marks)

Solution:

(i) Let X be the number of units purchased at the beginning of the year, then

$$X + \frac{5.00}{25.00} \times X = 15{,}000$$

X = 12,500 units

Thus, 12,500 units was purchased by Mr. Raj at the beginning of investment.

(ii) Let NAV per unit in the beginning of the year is N then

$N \times 1.1360 = 25$, N = ₹ 22.01

Thus, NAV per unit at the beginning of the year is ₹ 22.01 and total investment made by Mr. Raj is:

= (₹ 22.01 + ₹ 0.05) × 12,500 = ₹ 2,75,750

(iii) If Mr. Raj decided to exit then Return and Real Return in percentage terms shall be computed as follows:

NAV at the end	₹ 25
No. of Units	15,000
Amount Redeemable	₹ 3,75,000
Less: Exit Load	₹ 3,750
Amount Received on Redemption of Units	₹ 3,71,250
Total Amount Realized	₹ 3,71,250
Less: Initial Investment	₹ 2,75,750
Return	₹ 95,500
Less: Tax @ 20%	₹ 19,100
Net Return	₹ 76,400
Return in Percentage Terms (₹ 76,400/₹ 2,75,750)	27.71%
Real Return in Percentage Terms (27.71%/1.045)	26.52%
Or Real Return $\frac{1 + 0.2771}{1 + 0.045} - 1$ =	22.21%

Question – 04

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 = $S_0e^{n(r-y)}$

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

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

$= 2470.00 - 2303.65$

$= 166.35$

CHAPTER – 03

DERIVATIVES

PART – 01: OPTION

(I) BASICS

Question – 01

The equity share of VCC Ltd. is quoted at ₹ 210. A 3-month call option is available at a premium of ₹ 6 per share and a 3-month put option is available at a premium of ₹ 5 per share. Ascertain the net payoffs to the option holder of a call option and a put option separately.

(i) The strike price in both cases in ₹ 220; and

(ii) The share price on the exercise day is ₹ 200,210,220,230,240.

Also indicate the price range at which the call and the put options may be gainfully exercised.

(SM TYK – 20)

Solution:

Net payout for the holder of the call option

Share Price	Action	Gross Payoff	Premium	Net Payoff
200	Lapsed	0	6	(6)
210	Lapsed	0	6	(6)
220	Lapsed	0	6	(6)
230	Exercised	10	6	4
240	Exercised	20	6	14

Net payoff for the holder of the put option

Share Price	Action	Gross Payoff	Premium	Net Payoff
200	Exercised	20	5	15
210	Exercised	10	5	5
220	Lapsed	0	5	(5)

230	Lapsed	0	5	(5)
240	Lapsed	0	5	(5)

The call option can be exercised gainfully for any price above ₹ 226 (₹ 220 + ₹ 6) and put option for any price below ₹ 215 (₹ 220 – ₹ 5).

Question – 02

Hari is holding 100 equity shares of VCC Ltd. which is being quoted at ₹ 210 per share. He is interested in hedging downside risk of his holding as he is going to sell them after 2 month. A 2-month Call option is available at a premium of ₹ 6 per share and a 2- month put option is available at a premium of ₹ 5 per share. The strike price in both cases is ₹ 220.You are required to:

(i) Suggest the position Hari should take in the option market to hedge his holding in the VCC Ltd.

(ii) Calculate his final position after 2 months if after 2 months i.e. on the day of exercise the actual market price of per share of VCC Ltd. happens to be ₹ 200, ₹ 210, ₹ 220, ₹ 230 and ₹ 240.

(MTP October – 2023)

Solution:

(i) Since Hari holds 100 equity shares, he should buy equal no. of Put option i.e. 100 put options in the same stock to hedge his position.

Total Premium amount to be paid = 5 × 100 Put = ₹ 500

(ii) Net Position after 2-months

Share Price	Action	Gross Payoff	Pre-mium	Net Payoff	Sell Share	Net Position	Total Position
200	Exercised	20	5	15	200	215	21,500
210	Exercised	10	5	5	210	215	21,500
220	Lapsed	0	5	(5)	220	215	21,500
230	Lapsed	0	5	(5)	230	225	22,500
240	Lapsed	0	5	(5)	240	235	23,500

Thus, from above table it can be observed in any case the value of holding of Hari in VCC Ltd. shall not go below ₹ 215 per share.

Question – 03

Mr. A is holding 1,000 shares of face value of ₹ 100 each of M/s. ABC Ltd. He wants to hold these shares for long term and have no intention to sell.

On 1st January 2020, M/s. XYZ Ltd. has made short sales of M/s. ABC Ltd.'s shares and approached Mr. A to lend his shares under Stock Lending Scheme with following terms:

(i) Shares to be borrowed for 3 months from 1st January 2020 to 31st March 2020.

(ii) Lending Charges/Fees of 1% to be paid every month on the closing price of the stock quoted in Stock Exchange and

(iii) Bank Guarantee will be provided as collateral for the value as on 1st January 2020.

Other Information :

(a) Cost of Bank Guarantee is 8% per annum.

(b) On 29th February 2020 M/s. ABC Ltd. declared dividend of 25%.

(c) Closing price of M/s. ABC Ltd.'s shares quoted in Stock Exchange on various dates are as follows :

Date	Share Price in Scenario – 1 Bullish	Share Price in Scenario – 2 Bearish
1st January 2020	1,000	1,000
31st January 2020	1,020	980
29th February 2020	1,040	960
31st March 2020	1,050	940

You are required to find out :

(i) Earnings of Mr. A through Stock Lending Scheme in both the scenarios,

(ii) Total earnings of Mr. A during 1st January 2020 to 31st March 2020 in both the scenarios,

(iii) What is the profit or loss to M/s. XYZ by shorting the shares using through Stock Lending Scheme in both the scenarios ?

(Exam January – 2021) (8 Marks)

Solution:

1. Earnings of Mr. A

	I	II
Lending Charges		
31/01/2020	10.20	9.80
29/02/2020	10.40	9.60
31/03/2020	10.50	9.40
Lending Charges	31.10	28.80
(×) No. of Shares	1,000	1,000
Earnings	31,100	28,800

2. Total Earnings of Mr. A

	I	II
Lending Charges	31.10	28.80
(+) Dividend [100 × 25%]	25.00	25.00
	56.10	53.80
(×) No. of Shares	1,000	1,000
Total	56,100	53,800

3. Profit/Loss to M/s XYZ

	I	II
Lending Charges	(31.10)	(28.80)
Bank Guarantee [1,000 × 8% × 3/12]	(20.00)	(20.00)
Gain/Loss on Short Selling	(50.00)	60.00
	(101.10)	11.20
(×) No. of Shares	1,000	1,000
Gain/Loss	(1,01,100)	11,200

(II) OPTION STRATEGIES

Question – 04

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

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

(2) 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.

CALCULATE profit or loss, if the price of Delta Corporation's stock:

(i) remains at ₹ 500 after 3 months.

(ii) falls at ₹ 350 after 3 months.

(iii) rises to ₹ 600.

Assume the option size is 100 shares of Delta Corporation.

(MTP April – 2022, SM TYK – 19)

Solution:

Calculation of Profit & Loss

(i) **Price of both shares on maturity ₹ 500:** In this situation, Mr. X will not exercise call option & put option, hence

Gross Payoff	= 0
(-) Cost of Strategy	= ₹ 35
Loss	= ₹ 35

Loss on 100 shares (₹ 35 × 100) = ₹ 3,500

(ii) **Price of share ₹ 350:** In this situation, Mr. X will exercise his put option but call option will lapse

Gross Payoff (450 – 350)	= ₹ 100
(-) Cost of Strategy	= ₹ 35
Profit	= ₹ 65

Profit on 100 shares (₹ 65 × 100) = ₹ 6,500

(iii) **Price of share ₹ 600:** In this situation, Mr. X will exercise his call option but put option will lapse

Gross Payoff (600 – 550)	= ₹ 50
(-) Cost of Strategy	= ₹ 35
Profit	= ₹ 15

Profit on 100 shares (₹ 15 × 100) = ₹ 1,500

Question – 05

The market received rumour about ABC corporation's tie-up with a multinational company. This has induced the market price to move up. If the rumour is false, the ABC corporation stock price will probably fall dramatically. To protect from this an investor has bought the call and put options.

He purchased one 3 months call with a striking price of ₹ 42 for ₹ 2 premium, and paid Re.1 per share premium for a 3 months put with a striking price of ` 40.

(i) Determine the Investor's position if the tie up offer bids the price of ABC Corporation's stock up to ₹ 43 in 3 months.

(ii) Determine the Investor's ending position, if the tie up program me fails and the price of the stocks falls to ₹ 36 in 3 months.

(SM TYK – 16)

Solution:

Cost of Strategy Assume = 100 shares

Cost = (₹ 2 + ₹ 1) × 100 shares

= ₹ 300

Price of Shares ₹ 43

In this situation call option will exercise but put option will lapse

Gross payoff (43 – 42)	= ₹ 1
(–) Cost of Strategy	= ₹ 3
Loss	= ₹ 2
(×) No. of shares	= 100

Loss	= ₹ 200

Price of Shares ₹ 36

In this situation call option will Lapse but put option will Exercise

Gross payoff (40 – 36)	= ₹ 4
(–) Cost of Strategy	= ₹ 3
Gain	= ₹ 1
(×) No. of shares	= 100
Gain	= ₹ 100

(III) OPTION PRICING & VALUATION

EXPECTED VALUE OF OPTION

Question – 06

Equity share of PQR Ltd. is presently quoted at ₹ 320. The Market Price of the share after 6 months has the following probability distribution:

Market Price	₹ 180	260	280	320	400
Probability	0.1	0.2	0.5	0.1	0.1

A put option with a strike price of ₹ 300 can be written.

You are required to find out expected value of option at maturity (i.e. 6 months)

(SM TYK – 17)

Solution:

Expected Value of Option

Share Price	Action	Gross Pay Off	Probability	Gross Pay Off × Probability
180	Exercised	120	0.1	12
260	Exercised	40	0.2	8
280	Exercised	20	0.5	10
320	Lapsed	0	0.1	0
400	Lapsed	0	0.1	0
			Expected Value of Option	₹ 30

Question – 07

You had purchased a 3 month call option on the Equity shares of Satya Ltd for a premium of ₹ 30 each, the current market price of the share is ₹ 560 and the exercise price is ₹ 590. You expect the price range between ₹ 540 to ₹ 640.

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

Expected price (₹)	540	560	580	600	620	640
Probability	0.10	0.15	0.05	0.35	0.20	0.15

Compute the followings:

(i) Expected share price at the end of 3 months,

(ii) Value of call option at the end of 3 months, if the exercise price prevails,

(iii) In case the option is held to its maturity, what will be the expected value of the call option?

(iv) Find out the price of the shares quoted at the stock exchange to get the value of the call option as computed in (iii) above.

(Exam May – 2022) (8 Marks)

Solution:

(i) Expected Share Price

Expected Price = (540 × 0.10) + (560 × 0.15) + (580 × 0.05) + (600 × 0.35) + (620 × 0.20) + (640 × 0.15)

= ₹ 597

(ii) Value of Call Option, If Exercise Price Prevails

[अगर Maturity को Exercise Price ही Market Price होगा]

Value of Call = 590 – 590 = 0

(iii) Expected Value of Option

Share Price	Action	Gross Pay Off	Probability	Gross Pay Off × Probability
540	Lapsed	0	0.10	0
560	Lapsed	0	0.15	0

580	Lapsed	0	0.05	0
600	Exercised	10	0.35	3.50
620	Exercised	30	0.20	6.00
640	Exercised	50	0.15	7.50
				₹ 17

(iv) Price of Share so that Value of Call be ₹ 17

Price of Share = 590 + 17

= ₹ 607

BINOMIAL MODEL

Question – 08

The current market price of an equity share of Penchant Ltd is ₹ 420. Within a period of 3 months, the maximum and minimum price of it is expected to be ₹ 500 and ₹ 400 respectively. If the risk free rate of interest be 8% p.a., what should be the value of a 3 months Call option under the "Risk Neutral" method at the strike rate of ₹ 450?
Given $e^{0.02}$ = 1.0202

(SM TYK – 24)

Solution:

Step 1: Given

S = ₹ 420

$us = \frac{₹\ 500}{₹\ 420} = ₹\ 1.1905$

$ds = \frac{₹\ 400}{₹\ 420} = ₹\ 0.9524$

E = ₹ 450

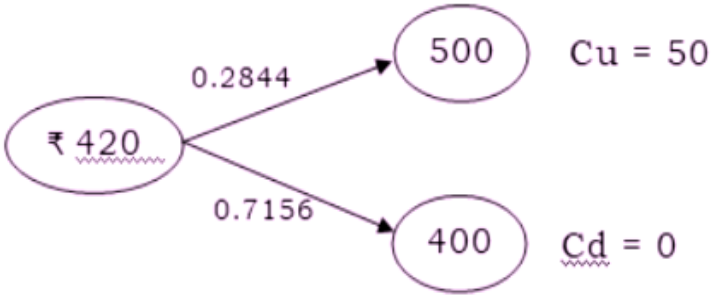
$R = 8 \times \frac{3}{12} = 2\%$

$E^{0.02}$ = 1.0202

Step 2: Risk Neutral Probability

$$P = \frac{e^{rt} - d}{u - d} = \frac{1.0202 - 0.9524}{1.1905 - 0.9524} = 0.2844$$

Step 3: Binomial Tree



Step 4: Value of Call Option

$$C_0 = \frac{Cup + Cd\,(1 - p)}{e^{rt}}$$

$$= \frac{(50 \times 0.2844) + (0 \times 0.7156)}{1.0202}$$

$$= ₹\ 13.94$$

Question – 09

Sumana wanted to buy shares of ElL which has a range of ₹ 411 to ₹ 592 a month later. The present price per share is ₹ 421. Her broker informs her that the price of this share can sore up to ₹ 522 within a month or so, so that she should buy a one-month CALL of ElL. In order to be prudent in buying the call, the share price should be more than or at least ₹ 522 the assurance of which could not be given by her broker.

Though she understands the uncertainty of the market, she wants to know the probability of attaining the share price ₹ 592 so that buying of a one-month CALL of EIL at the execution price of ₹ 522 is justified. Advice her. Take the risk-free interest to be 3.60% and $e^{0.036} = 1.037$.

(SM TYK – 21)

Solution: