[This question paper contains 2 printed pages.]

Your Roll No.....

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Sr. No. of Question Paper : 5259

Unique Paper Code : 2374000023

Name of the Paper : Statistics in Finance (NEP)

Name of the Course : **GE**

Semester : VIII

Duration : 3 Hours

Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt a total of **six** questions in all.
3. Use of a non-programmable calculator is permitted.

Q1. Attempt any three parts. All parts carry equal marks

i. Consider two possible sequences of end-of-year returns:

{20, 20, 20, 15, 10, 5} and {10, 10, 15, 20, 20, 20}.

Which sequence is preferable if the interest rates, compounded annually, were:

(i) 3%; (ii) 5%; (iii) 10%?

ii. If a bank offers sweep-account interest at a nominal rate of 7 % *p.a.* compounded continuously, what is the effective interest rate per year?

iii. If X receive 7 % interest compounded yearly, then approximately how many years will it take for his money to quadruple? What will be the amount received if this interest was only 5% ? How long will it take in case of continuous compounding?

iv. Consider a strategy, a long call option with an exercise price of ₹ 100, another long call option with an exercise price of ₹110 on the same stock and with the same maturity. Obtain the payoff for this strategy considering different stock prices? When will this strategy be preferred? (5*3=15)

Q2 (a) Three assets are available for construction of a portfolio: two stocks with corresponding expected returns $\bar{r}_1$ and $\bar{r}_2$; the respective variances σ_1^2 and σ_2^2 and covariance σ_{12} and the third asset being a risk-free security with return $\bar{r}_3$ and variance σ_3^2.

(i) What should be the value of σ_3^2 so that the asset is a 'risk free' asset?

(ii) Construct a portfolio consisting of the three assets so that it has the minimum variance in the class of all portfolios consisting of these assets.

(b) An investor has a capital of ₹ 10,500 at his disposal to buy stocks whose current price is ₹100. Further, put options on the same stock with a delivery price of K= ₹100 and a time to maturity of 1 year are quoted at a market price of ₹5 per contract. Consider two alternative investment plans:

Portfolio A: Buying 105 stocks

Portfolio B: Buying 100 stocks for 10,000 and buying 100 put options for 500.

Discuss the effect of portfolio insurance on portfolio value and return. (7,8)

P.T.O.

Q3(a). A company is considering whether or not to proceed with an investment project that requires an initial outlay of $100,000. The after-tax cash inflows are estimated to amount to $50,000 at the end of the first and second year and to $60,000 at the end of the third and fourth year. The required rate of return for the project is 7%. Compute the NPV of the capital project.

(b) Suppose that 6-months, 12-months, 18-months, 24-months, and 30-months zero rates are, respectively, 4%, 4.2%, 4.4%, 4.6%, and 4.8% per annum, with continuous compounding. Estimate the cash price of a bond with a face value of 100 that will mature in 30 months and pay a coupon of 4% per annum semiannually under continuous compounding. (7,8)

Q4(a) The correlation (ρ) between two assets 'A' and 'B' is 0.2. The expected returns and standard deviations of returns are given in the following table:

Asset	Return (%)	Standard deviation (%)
A	20	15
B	24.5	22.4

(i) Find the proportions α and (1-α) of 'A' and 'B' respectively that defines a portfolio consisting of them such that it has minimum variance.

(ii) Find the expected return and the standard deviation of this portfolio.

(b) Define the future and forward contract. Consider a long forward contract on a 4-year bond, which is currently traded at a price of 800 EUR. The delivery price is 810 EUR, and the time to maturity of the forward contract is one year. The bond pays a coupon of 60 EUR after 6^{th} and 12^{th} months. The estimated compounded annual interest rates for 6^{th} and 12^{th} months are 9% and 10%, respectively. Determine the price of the contract.

Q5(a) Assume a put option with exercise price K = ₹8 at $T = 2$, which is to be priced at $t = 0$. The current stock price is ₹10 which is expected to increase or decrease by 20% in the first period. For the second period, the stock price is expected to increase or decrease by 10%. Assuming the risk free rate of interest to be 0, find the value of the put at $t = 0$.

(b) Obtain 'theta' of a European call option. (7,8)

Q6(a) A company's stock price is S_0 = ₹ 110 today. It will either rise or fall by 20% after one period. The risk free interest rate for one period is 10%. Calculate the risk neutral probability that makes expected return of the asset equal to risk free rate

(b) Explain the terms Arbitrage and Arbitrageurs with the help of example. (7,8)

Q7(a) If we put money into an account that pays interest at rate 'r' compounded annually, how many years does it take for the funds to double? What will be the time required if the compounding is continuous?

(b) If interest rates are constant during contract period, then show that the forward and the future prices are equal. (7,8)

Q8(a) Define 'extrinsic value' of a call and put option at time t. Under what conditions is an intrinsic option said to be 'in-the-money', 'at-the-money' and 'out-of-money'.

(b) Consider a strategy: Buy one stock, one long European put with delivery price K, one short European call with delivery price K. Calculate the payoff of the strategy and explain the risk in this strategy. (7,8)

(500)