

M.Sc.(Maths.) Semester - 4 (CBCS) Examination
March/April - 2024 (NEW COURSE)
Financial Mathematics (Elective-1)

Time: 02:30 Hours

Marks: 70

Instructions:

1. All questions are compulsory.
2. Figures to the right indicate marks.

- Que.1 (A) Answer any two out of three (10)**
- 1) Write differences and similarities between future and forward contracts.
 - 2) A company whose share price is ₹200 and offers bonus shares in the ratio 1: 1. What will be the asset price and how should option contracts be altered?
 - 3) How much one should pay now to receive a guaranteed amount at the future time T . (Discuss both the cases, where interest rate is independent of time and dependent on time.)
- Que.1 (B) Answer any one out of two (04)**
- 1) Explain: Higher the exercising price on expiry of put options, greater the profit.
 - 2) What is an option? Explain the following terms:
 - (i) American Options
 - (ii) European Options
- Que.2 (A) Answer any two out of three (10)**
- 1) Discuss in detail the elimination of randomness.
 - 2) Give mathematical justification to the equation $\frac{ds}{s} = \sigma dx + \mu dt$.
 - 3) Derive Stochastic differential equation for the asset price.
- Que.2 (B) Answer any one out of two (04)**
- 1) Derive stochastic differential equation for the function $f(S) = e^S$.
 - 2) Define the following terms:
 - (i) Drift rate
 - (ii) Wiener process
- Que.3 (A) Answer any two out of three (10)**
- 1) Discuss in details the significance of the Black-Scholes Partial Differential Equation.
 - 2) Write the general form of diffusion (heat) equation and also derive its solution.
 - 3) Explain in detail the Put-Call Parity.
- Que.3 (B) Answer any one out of two (04)**
- 1) Explain the term arbitrage and heading.
 - 2) What is forward parabolic partial differential equation and also give one example of it.
- Que.4 (A) Answer any two out of three (10)**
- 1) Solve the Black-Scholes partial differential equation for European call options.
 - 2) Define the term dividend yield and explain in detail the constant dividend yield structure. Also, derive the Black-Scholes partial differential for constant dividend yield structure.
 - 3) Explain: Discrete dividend yield structure and also derive the jump conditions for the same.
- Que.4 (B) Answer any one out of two (04)**
- 1) Define smaller order effects on portfolio.
 - 2) Define following terms:
 - (i) Sensitivity to volatility
 - (ii) Sensitivity to interest rate
- Que.5 (A) Answer any two out of three (10)**
- 1) State and prove arbitrage theorem.
 - 2) If an investor puts funds into an account that pays interest at rate r compounded annually, how many years does it take for the funds to double?
 - 3) Explain how the call option value is a function of exercise price and time to expiry.
- Que.5 (B) Answer any one out of two (04)**
- 1) Amit holds an option on March 1, 2020 to purchase 300 shares of Pioneer Industries for ₹5500 per share after one year. If the cost of option is ₹200 per share and price of share is ₹6500 per share on March 1, 2021 then find the total profit to Amit on exercising the option. Also find the profit in percentage corresponding to up-front premium paid.
 - 2) Explain the term financial derivatives and also give any two examples of it.
