STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI-86.
(For the academic year 2015-2016 & thereafter)

Subject Code: 15MT/PI/FM24

CORE: POSTGRADUATE INDEPENDENT ELECTIVE

PAPER: FINANCIAL MATHEMATICS **TIME: 3 HRS**
MARKS: 100

Section – A

Answer all the questions **(10×2=20)**

1. Define Brownian motion.
2. What is the volatility parameter?
3. Suppose that you borrow amount P to be repaid after one year along with rate r per year compounded semi-annually. How much is owed in a year?
4. If a bank offers interest at a nominal rate of 5% compounded continuously, what is the effective interest rate per year?
5. State law of one price.
6. Define convex function.
7. Define Risk-Neutral probabilities.
8. Prove $C(s,t,K,\sigma,r) = s\,\Phi(\omega) - K\,e^{-rt}\Phi(\omega - \sigma\sqrt{t})$
9. Prove $E[I] = P(St > K) = \Phi(\omega - \sigma\sqrt{t})$
10. What is meant by "Value At Risk"?

Section – B

Answer any five questions **(5×8=40)**

11. Discuss Geometric Brownian Motion as a limit of simpler models.
12. If you borrow Rs.1000 for one year at an interest rate of 8% per year compounded quarterly how much do you owe at the end of the year?
13. Explain: One should never exercise an American style call options before its expiration time t.
14. State and prove the Arbitrage theorem.
15. Initial price of stock is 100 and the price after one period is assumed to be either 200 or 50. At a cost of C per share we can purchase at time 0 the

options to buy the stock at time 1 for the price of 150. For what value of C is no sure win possible?

16. Prove $e^{-rt}E[IS(t)] = s\,\Phi(\omega)$.

17. State and prove Jensen's inequality.

Section – C

Answer any two questions **(2×20=40)**

18. a) Discuss rate of return.

b) Find the rate of return from an investment that for an initial payment of 100 yields returns of 60 at the end of each of the first two periods.

(10+10)

19. The September 4, 1998, edition of the New York Times gives the following listing for the price of a German Mark(or DM)

- today: .5777;
- 90-day forward: .5808

Why are these prices different?

20. Derive the Black – Scholes option pricing formula