13MPST1

M.PHIL. (STATISTICS) DEGREE EXAMINATIONS, EVEN SEMESTER 2021

I YEAR I SEMESTER

Research Methodology

Maximum Marks : 75

SECTION – A (5 X 15 = 75 marks)

(Answer any FIVE questions)

1. **(a) Write a note on definite quadratic form X' AX. If X' AX is positive definite, Then prove that (i) det A > 0 and (ii) every principal minor of A is positive**

   (b) Given the random variables X, Y, Z satisfying

   X = 3Y + 2Z, Var[Y] = Var[Z] = 1, E[Y] = 2, Cov[Y, Z] = −0.5, E[Z] = −3

   Compute the following:

   (i) **E[X].**
   (ii) **Var[X].**
   (iii) **Cov[X, Y]**

2. **(a) Define generalized inverse. Prove that a generalized inverse always exists although it is not unique.**
   (b) For any matrix A: m x n and any g-inverse A^- : m x n, then
   (i) AA^- and A^-A are idempotent
   (ii) rank(A) = rank(AA^-) = rank(A^-A)
   (iii) rank(A) ≤ rank(A^-)

3. **(a) State and prove Monotone convergence theorem.**
   (b) Define convergence in probability and convergence in distribution. Also prove that the convergence in probability implies convergence in distribution.

4. **(a) State and prove Central Limit theorem.**
   (b) Discuss Kolmogorov strong law of large numbers.

5. **Explain in detail how the genetic algorithm works?**

6. **(a) What do you mean by bivariate distribution? Derive PGF of bivariate Poisson distribution.**
   (b) Explain in detail bootstraping technique with example.

7. **(a) Explain in detail the criteria of a good research.**
   (b) Discuss the layout of a research report.

8. **(a) Define research. List out its types.**
   (b) Explain the types of optimization techniques.