K25U 2952

Reg. No. : .....

Name : .....

III Semester B.Sc. Degree (C.B.C.S.S. – O.B.E. – Supplementary/ Improvement) Examination, November 2025
(2019 to 2023 Admissions)
COMPLEMENTARY ELECTIVE COURSE IN STATISTICS FOR MATHEMATICS/COMPUTER SCIENCE
3C03STA : Probability Distributions

Time : 3 Hours Max. Marks : 40

***Instruction : Use** of calculators and statistical tables are **permitted**.*

PART – A

(Short Answer)

Answer **all 6** questions. **(6×1=6)**

1. Let X and Y be independent random variables with means 10 and 20 and variances 2 and 3 respectively. Find the mean and variance of 3X + 4Y.
2. Define moment generating function. Write down any one of its properties.
3. If X is a binomial random variable with parameters (n, p), then find the distribution of n – X.
4. Find the mean of geometric distribution.
5. Write down the distribution function of the rectangular distribution over [a, b].
6. Define beta distribution of the I kind.

PART – B

(Short Essay)

Answer **any 6** questions. **(6×2=12)**

7. Establish the addition theorem on expectation of two random variables.
8. Prove that E[E(X|Y)] = E(X).
9. Obtain the mean and variance of Bernoulli distribution.
10. If X and Y are independent and identically distributed Poisson random variables with mean 1, then find P(X + Y = 2).
11. Obtain the moment generating function of exponential distribution.

P.T.O.

12. Let X and Y be independent gamma random variables with parameters λ_1 and λ_2 respectively. Find the distribution of X + Y.

13. What do you mean by sampling distribution ? Give an example.

14. Define F-statistic. Write down the PDF of F distribution.

PART – C

(Essay)

Answer **any 4** questions. **(4×3=12)**

15. Establish the relationship between the raw and central moments of a random variable.

16. Establish the memory less property of geometric distribution.

17. Out of 800 families with 4 children each, how many families would be expected to have (i) at least one boy and (ii) at most two girls.

18. Derive the expression for the r-th raw moments of the beta distribution second kind with parameters (α, β) and hence find the mean and variance.

19. The marks obtained by a number of students for a certain subject are assumed to be approximately normally distributed with mean 65 and standard deviation 3. If 3 students are taken at random from this set, what is the probability that exactly 2 of them will have marks over 70 ?

20. Derive the sampling distribution of sample mean of a random sample of size n taken from a normal population with mean μ and standard deviation σ.

PART – D

(Long Essay)

Answer **any 2** questions. **(2×5=10)**

21. If the joint PDF of the random vector (X, Y) is given by f(x, y) = 24y(1 – x); $0 \leq y \leq x \leq 1$ and 0; otherwise. Find Var(X), Var(Y) and cov(X, Y).

22. Derive the recurrence relation for central moments of the Poisson distribution and hence find the first four central moments.

23. Explain the important properties of normal distribution.

24. a) Define chi-square distribution. Derive its MGF.

    b) Let X and Y be two independent random variables follow chi-square distribution with 1 degree of freedom. Determine the value k if P(X + Y > k) = 0.5.