



DCST301

Reg. No.

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III Semester B.Sc. Degree Examination, March/April - 2024

STATISTICS - III

Calculus and Probability Distributions

(NEP Scheme F+R)

Paper : III



Time : 2½ Hours

Maximum Marks : 60

Instructions to Candidates:

1. Answer any **Eight** Questions from section A and **three** questions from section B.
2. Scientific **calculators** are allowed.

SECTION - A

I. Answer any **EIGHT** questions from the following.

(8×3=24)

1. a. Define Jacobian if $u = x - y$ and $v = y$ obtain the Jacobian of x and y w.r.t. u and v .
- b. Examine the convergence of the series $x + xy + xy^2 + xy^3 + \dots$, where $0 < x < 1$ and $y = 1 - x$, what is conclusion if $xy > 1$?
- c. If X and Y are two independent random variables show that their covariance is zero.
- d. If (X, Y) has joint p.d.f $f(xy) = e^{-(x+y)}$ $x > 0$ and $y > 0$ find marginal p.d.f. of x .
- e. Find k if $f(xy) = k(x + y)$; $0 < x < 1$ and $0 < y < 1$ is the joint p.d.f of (x, y) , Also find $E(X)$.
- f. State central limit theorem for independent and identically distributed random variables.
- g. Define negative binomial distribution. Mention its mean and variance.
- h. Define multinomial distribution.
- i. Define Weibull-distribution and mention its applications.
- j. What is Sampling distribution? Explain.

[P.T.O.]



SECTION - B

II. Answer any **Three** questions from the following :

(3×12=36)

2. a. State the conditions for continuity and differentiability of a real function.
- b. If $E = \sum_{i=1}^n (y_i - a - b x_i)^2$ then find partial derivative of E w.r.t. 'a' and 'b'.
- c. Evaluate $\int_0^1 \int_0^1 (2x + y) / 4 \, dx \, dy$ (4+4+4)
3. a. The joint p.d.f of random variable X and Y is given by
 $f(xy) = (x + y) 0 < x < 1, 0 < y < 1$
 $= 0 \text{ otherwise}$
- Find marginal distribution of X and Y. Also find $E(X)$ and $E(Y)$.
- b. Define moment generating function (m.g.f.) of two random variable.
- c. State and Prove Chebyshev's inequality. (6+2+4)
4. a. Find mean of Hyper-Geometric distribution.
- b. Obtain mgf of negative binomial distribution.
- c. Define Cauchy and standard Cauchy distribution. Show that Cauchy distribution is symmetrical. (4+4+4)
5. a. Given a random sample $X = (X_1, X_2, \dots, X_n)$ from $N(\mu, \sigma^2)$ distribution, obtain the sampling distribution of sample mean.
- b. Obtain m.g.f of chi-square distribution and hence find mean.
- c. State the properties t-distribution. (4+5+3)
6. a. Obtain mode of F-distribution.
- b. Explain a method of drawing random sample from uniform distribution.
- c. Explain a method of drawing a random sample from exponential distribution.

(5+3+4)
