3112N1163

Candidate's Seat No:____

B.Sc. Sem.-3 Examination
CC 201
Statistics

Time : 2.30 Hours] **December-2025** **[Max.Marks : 70**

Instructions 1. All questions are compulsory and carry equal marks.
2. Statistical tables and graph papers will be provided on request.
3. Use of Scientific calculator is allowed.

Q. 1 (a) Define terms: Random Variable, probability mass function, probability density function, For a random variable X, its probability density function is

$$f(x) = \begin{cases} 2x, & 0 \le x \le 1 \\ 0, & other\ wise, \end{cases}$$

Find $P(X < 1/2)$, $P(1/4 < X < 3/4)$.

(b) Define Cumulative distribution function. State and prove the properties of the distribution function of a random variable X.

OR

(a) Define joint probability mass function and joint probability distribution function.

Y	X		
	0	1	2
1	0.15	0.17	0.10
2	0.18	0.15	0.25

Find marginal probability function of Y and conditional probability function of X given Y=1.

(b) For the continuous probability density function of a random variable X with the probability density function

$$f(x) = \begin{cases} c/\sqrt{x} & 0 < X < 4 \\ 0 & elsewhere \end{cases}$$

Obtain the value of a constant "c" and find the distribution function. Also, find F(2).

Q.2 (a) Define Mathematical Expectation.
In usual notations, prove that if X and Y are two independent random variables, then, E (XY) = E (X) E (Y)

(b) Define terms: moments, raw moments, central moments, moment generating function of a random variable X.
If $f(-2)=0.15, f(-1)=0.20, f(0)=0.30, f(1)=0,20, f(2)=0.15$, then find $E(X)$, $E(5X-3)$,

OR

(a) A random variable X has a probability density function, Find first three raw moments for the probability density function $f(x) = \begin{cases} x, & 0 < x < 1 \\ 0, & othereise \end{cases}$

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(b) In usual notations, State and prove properties of moment generating function

Q.3 (a) State probability mass function of binomial distribution. State its mean and variance. If *X* follows a binomial distribution with parameters n and p and if mean is *12* and Variance is *3*, do you suggest that *X* follows a binomial distribution?

(b) If X ~ $Bn(n, p)$, in usual notations, derive moment generating function of X.

OR

(a) For the Poisson distribution, in usual notations, derive the recurrent relation for Raw moments.

(b) State and prove additive property of Poisson distribution.

Q. 4 (a) For Rectangular Distribution with parameters (a,b), then, in usual notations, show that Mean = $\frac{a+b}{2}$ and variance = $\frac{(b-a)^2}{12}$

(b) Derive mean and harmonic mean of beta distribution of 1st kind.

OR

(a) Derive moment generating function of one parameter exponential distribution.

(b) In certain experiments, the error made in determining the density of a substance is a Random variable and following rectangular distribution with α = 0.2 and β = 0.5. Find the probability that such an error will (i) be between 0.25 and 0.30, (ii) exceed 0.35 in absolute value.

Q.5 **Answer following:**

(a) Define cumulative distribution function. Also, state moment generating function of exponential distribution with parameter m.

(b) Give one illustration, each of discrete and continuous random variable.

(c) If a random variable X has rectangular distribution over ($\alpha = -1, \beta = 3$) and a random variable Y follows exponential distribution with parameter β, then, find β, such that *V(X) = V(Y).*

(d) State the cumulant generating function of poisson distribution and state 2nd cumulant.

(e) If a random variable X has cumulative distribution function

$$F(x) = \begin{cases} 0, & if\ X < \alpha \\ \frac{(x-\alpha)}{\beta-\alpha}, & if\ \alpha \leq X \leq \beta \\ 1, & if\ X \geq \beta \end{cases}$$

, then identify the probability distribution of X and state its first raw moment.

(f) If the Distribution function of a random variable X is $F(x) = 1 - \beta e^{-\beta x}, x > 0, \beta > 0$ Then, identify the distribution and state its mean and variance.

(g) If a random variable X has poisson distribution with parameter β, then find β, such that *P(X=1)= P(X=2)*

End of Paper