

11/06/2025 TE EXTC SEM-V C-SCHEME RSA QP CODE: 10082843

Time: 3 Hours

Marks: 80

N.B. : (1) Question No 1 is Compulsory.

(2) Attempt any three questions out of the remaining five.

- 1 **Attempt any FOUR** [20]
- Differentiate continuous and discrete random variable. [5]
 - If 1% of the total screws made by a factory are defective, Find the probability that less than 3 screws are defective in a sample of 100 screws. [5]
 - Differentiate between WSS and SSS. [5]
 - What is the co-variance if [5]
 - Random variables are orthogonal
 - Random variables are independent.
 - Define auto correlation function. Discuss its properties. [5]
- 2
 - State and prove properties of CDF. [10]
 - A box contains three coins: two regular coins and one fake two-headed coin ($P(H)=1P(H)=1$), [10]
 - You pick a coin at random and toss it. What is the probability that it lands heads up?
 - You pick a coin at random and toss it, and get heads. What is the probability that it is the two-headed coin?
- 3
 - Find the mean and variance of exponential distribution. [10]

$$f_x(x) = \begin{cases} \lambda e^{-\lambda x} & x > 0 \\ 0 & x \leq 0 \end{cases}$$
 Where, λ is called the distribution rate.
 - The joint probability density of two random variables is given by [10]

$$f_{x,y}(X,Y) = \begin{cases} 15e^{-3x-5y} & x > 0, y > 0 \\ 0 & \text{Otherwise} \end{cases}$$
 Find the probability that
 - $1 < X < 2$ and $0.2 < Y < 0.3$
 - $X < 2$ and $Y > 0.2$
 - Find marginal probability distributions of X and Y
- 4
 - State and prove Chebyshev inequality. [10]
 - If $\{X(t)\} = A \cos \lambda t + B \sin \lambda t$; $t \geq 0$ is a random process, where A and B are independent random variables each of which assumes the values -2 and 1 with probabilities 1/3 and 2/3 respectively, Prove that the $X(t)$ is WSS. [10]
- 5
 - x and y are two independent random variables with density function of the form [10]

$$f(t) = \begin{cases} te^{-t} & t > 0 \\ 0 & \text{Otherwise} \end{cases}$$
 Find pdf of $z = x + y$.
 - Find characteristic function and hence find mean and variance of following binomial distribution $P(x) = \binom{n}{x} p^x q^{n-x}$ [10]
- 6
 - Find regression line using the data [10]

X	1	3	5	7	8	10
Y	8	12	15	17	18	20
 - Discuss the properties of linear time invariant system if input to the system is a WSS process. [10]
