

TE sem IV 2<sup>nd</sup> scheme . Summer 2025

Time: 3 Hours

Marks: 80

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

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

EXTC

11/6/25

- 1 Attempt any FOUR [20]
- a Differentiate continuous and discrete random variable. [5]
- b 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]
- c Differentiate between WSS and SSS. [5]
- d What is the co-variance if [5]
- i) Random variables are orthogonal
- ii) Random variables are independent.
- e Define auto correlation function. Discuss its properties. [5]

- 2 a State and prove properties of CDF. [10]
- b A box contains three coins: two regular coins and one fake two-headed coin ( $P(H)=1, P(T)=0$ ), [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 a 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,  $\lambda$  is called the distribution rate.

- b 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

- a)  $1 < X < 2$  and  $0.2 < Y < 0.3$
- b)  $X < 2$  and  $Y > 0.2$
- c) Find marginal probability distributions of X and Y
- 4 a State and prove Chebyshev inequality. [10]
- b 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 a 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  $z = x + y$ .

- b 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 a Find regression line using the data [10]

X	1	3	5	7	8	10
Y	8	12	15	17	18	20

- b Discuss the properties of linear time invariant system if input to the system is a WSS process. [10]

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