4E4131

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B. Tech. IV Sem. (Main) Exam., June/July-2014
Electronics & Communication Engg.
4EC2A Random Variables & Stochastic Processes

Time: 3 Hours | **Maximum Marks: 80**
Min. Passing Marks: 24

Instructions to Candidates:-

*Attempt any **five questions**, selecting **one question** from **each unit**. All Questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.*

Units of quantities used/ calculated must be stated clearly.

Use of following supporting material is permitted during examination.

UNIT-I

Q.1. (a) A bag Contains 4 bad and 6 good mobile phones. Two are drawn out from the bag at a time. One of them is tested and found to be good. What is the probability that the other phone is also good? [8]

(b) Prove the followings:-

(i) If A and B are mutually exclusive events, then [4]

$P(A/B) = P(B/A) = 0$

(ii) If $P(A) > P(B)$ then [4]

$P(A/B) > P(B/A)$

OR

Q.1. (a) What is meant by probability? How, it can be explained in various ways? [4]

(b) Determine P (A/B), if

(i) $A \cap B = \phi$ [4]

(ii) $A \subset B$ [4]

(iii) $B \subset A$ [4]

UNIT-II

Q.2. (a) What is a random Variable? Classify them. [6]

(b) Explain the Binomial distribution. Also, calculate the mean and variance of Binomial distribution. [10]

OR

Q.2. (a) A continuous random variable can assume any value between x = 2 and x = 5. It has a density function given by

$$f_X(x) = k(1+x)$$

Find $P(x < 4)$? [6]

(b) Explain the Rayleigh distribution. Also, calculate its mean and variance. [10]

UNIT-III

Q.3. (a) The joint pdf of a bivariate random variable is given by

$$f_{xy}(x,y) = \begin{cases} \dfrac{kx}{y} & ; \quad 1<x<2, \; 1<y<2 \\ 0 & ; \text{ Otherwise} \end{cases}$$

Where K is a constant. Determine the value of K. Are X and Y independent? [10]

(b) State and explain central limit theorem. [6]

OR

Q.3. (a) The joint pmf of a bivariate random variable is given by

$$P_{xy}(x_i,y_j) = \begin{cases} k(2x_i + y_j) & ; \quad x_i = 1, 2 \\ & \quad\;\; y_j = 1, 2 \\ 0 & ; \text{ Otherwise} \end{cases}$$

Where, K is a constant. Determine the value of K and also the marginal pmf's of x and y. [8]

(b) If X and Y are two random variable, given by X = Cos ψ and Y = Sin ψ where, ψ is another random variable, uniformly distributed over (0, 2π). Show that, X and Y are uncorrelated. [8]

UNIT-IV

Q.4. (a) Explain the strict and wide sense stationary random processes along with their necessary conditions. [8]

(b) Explain the auto correlation function. Also, prove that it is maximum at $\tau = 0$, i.e.

$$|R_{XX}(\tau)| \leq R_{XX}(0)$$ [8]

OR

Q.4. (a) Explain the random processes and classify them. [6]

(b) Explain the auto and cross covariance functions with necessary equations. [5×2= 10]

UNIT-V

Q.5. When a random process is transmitted through a linear system, calculate the mean and auto correlation function of output of LTI system. [16]

OR

Q.5. (a) Let X (t) be the WSS process with the auto correlation function given by

$$R_{XX}(\tau) = \left(\frac{Ao^2}{2}\right) \text{Cos}\,(Wo\tau)$$

Where, Ao and Wo are constants. Determine the power spectral density (psd) of X(τ). [8]

(b) Explain the power spectral density. Also, state and prove the various properties of psd. [8]