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B028415(028)

B. Tech. (Fourth Semester) Examination, April-May 2021

(AICTE Scheme)

(ETC Branch)

PROBABILITY THEORY and STOCHASTIC PROCESSES

Time Allowed : Three hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : *Attempt all questions. Every question has four parts. Part (a) is compulsory. Attempt any* ***two*** *parts from (b), (c) and (d).*

Unit-I

1. (a) State and explain Baye's theorem. 4

(b) In a communication system the signal sent. From point 'a' to point 'b' arrives by two path in parallel. Over each path the signal passes through two repeaters (in series). Each repeater in one path has a probability of Failiny (becoming an open circuit) of 0·006. This probability is 0·008 for each repeater on the other path. All repeaters Rail independently of each other. Find the probability that the signal will not arrive at point 'b'. 8

(c) A student is known to arrive late for a class 40% of the time. If the class meets five time each week find (i) the probability the student is late for at least three classes in a given week and (ii) the probability the student will not be late at all during a given week. 8

(d) Explain with application the Bernaulli trials. 8

Unit-II

2\. (a) Define random variable and give one example of random variable. 4

(b) Define commulative probability distribution function and explain its properties. 8

(c) Find a constant $b > 0$ so that the function

$$f_X(x) = \begin{cases} e^{3x/4} & 0 \le x \le b \\ 0 & \text{otherwise} \end{cases}$$

is valid probability density. 8

(d) A random variable X has the distribution function

$$F_X(x) = \sum_{n=1}^{12} \frac{n^2}{650} u(x-n)$$

Find the probabilities : 8

(i) $P\{-\infty < x \le 6 - b$

(ii) $P\{X > 4\}$

(iii) $P\{6 < X \le 9\}$

Unit-III

3\. (a) Define co-relation between random variable. 4

(b) Let z be a random variable with pdf $f(z) = \frac{1}{2}$ in the range $-| \le z \le |$ and the random variable $x = z$ and the random variable $y = z^2$. Find out the co-relation between x and y. 8

(c) Let X and Y are independent random variable and $Z = X + Y$ than show that 8

$$\text{var}(Z) = \text{var}(X) + \text{var}(Y)$$

(d) Define Average value, Variance and Moment of random variable. 8

Unit-IV

4. (a) Define random process with one example. 4

(b) State and explain the properties of random processes Auto correlation function. 8

(c) Given auto correlation function, for a stationary ergodic process with no periodic components is :

$$R_{XX}(Z) = 25 + \frac{4}{1 + 6Z^2}$$

find the mean value and variance of the process $X(t)$. 8

(d) Explain the Poisson random process. 8

Unit-V

5. (a) Define the power density spectrum for the random process. 4

(b) Consider the random process

$$X(t) = A_0 \cos(w_0 t + \theta)$$

where A_0 and w_0 are real constants and θ is a random variable uniformly distributed on the interval $(0, z_1/2)$. Find the average power P_{XX} in $X(t)$. 8

(c) Derive the relationship between power spectrum and Auto correlation function. 8

(d) State and explain the properties of power density spectrum of random processes. 8