SS

Code: 9A04303

B.Tech III Year I Semester (R09) Supplementary Examinations December 2015

PROBABILITY THEORY & STOCHASTIC PROCESSES

(Electronics and Communication Engineering)

Time: 3 hours Max Marks: 70

Answer any FIVE questions
All questions carry equal marks

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1 (a) A class consists of 6 girls and 10 boys. If a committee of 3 is chosen at random from the class, what is the probability of 3 boys are selected?

(b) A and B throws alternatively with a pair of dice. One who first throws a total of 8 wins. What is the probability of B winning if A starts the game?

2 A random variable 'X' has the density function:

$$f_x(X) = K/6, \text{ for } -3 \le x \le 3;$$
$$= 0; \text{else where}$$

(i) Find 'K'. (ii) $P(X < 1)$. (iii) $P(|X| > 1)$. (iv) $P(X + 3 > 4)$.

3 (a) A random variable X has the density function $f_x(X) = (1/a)e^{-b|x|}$, $-\infty \le x \le \infty$. Find $E[X], E[X]^2$ and variance.

(b) Prove that $E[X] = E[X/Y]$, if X and Y are independent random variables.

4 The joint probability density function of two random variables X and Y given by:

$$f(x, y) = A(2x + y^2) \text{ for } 0 \le x \le 2,\ 2 \le y \le 4;$$
$$= 0; \text{else where}$$

Find: (i) the value of 'A'. (ii) $P(X \le 1, Y > 3)$.

5 Prove the following:

(a) Covariance of $(X, Y) = E(XY) - E(X).E(Y)$.

(b) Variance $(X + Y) = Var(X) + Var(Y) + 2Cov(X, Y)$.

6 Two statistically independent random variables X and Y have mean value 2 and 4 respectively. They have second moments as 8 and 25 respectively. Find the mean and variance of the random variable $W = 3X - Y$.

7 (a) $N(t)$ is a zero mean wide sense stationary noise process for which $R_{NN}(\tau) = (N_0/2)\delta(t)$. Where $N_0 > 0$ is a finite constant. Determine whether $N(t)$ is mean ergodic.

(b) A random process $X(t)$ is defined as $X(t) = \cos \omega t$, where 'ω' is a uniform random variable over $(0, \omega_0)$. Find whether $X(t)$ is stationary or not.

8 (a) Derive the relation between cross correlation and cross power spectral density.

(b) Find the power spectral density of a wide sense stationary process if its autocorrelation function is defined as $R(\tau) = K \exp(-|\tau|)$.

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