SS

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

PROBABILITY THEORY & STOCHASTIC PROCESSES

(Electrical & Electronics Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions
All questions carry equal marks
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1 (a) A pair of fair dice are thrown. Person A wins if the sum of numbers showing up is six or less and one of the dice shows four. Person B wins if the sum is five or more and one of the dice shows a four. Find: (i) The probability that A wins. (ii) The probability that both A and B wins.

(b) A manufacturing plant makes radios that each contain an integrated circuit (IC) supplied by three sources A, B, C. The probability that the IC in a radio came from one of the sources is 1/3, the same for all sources. ICs are known to be defective with probabilities 0.001, 0.003 and 0.002 for sources A, B, C respectively.
(i) What is the probability any given radio will contain a defective IC?
(ii) What is the probability that the defective IC came from source A?

2 (a) List the properties of probability density function.

(b) A random variable ‘X’ is known to be Poisson with b = 4.
(i) Plot the density and distribution functions for this random variable.
(ii) What is the probability of the event $(0 \leq X \leq 5)$?

3 (a) A Gaussian voltage random variable X has mean value zero and variance 9. The voltage X is applied to a square law full wave diode detector with a transfer characteristic Y = $5X^2$. Find the mean value of the output voltage.

(b) Find the characteristic function of a Poisson random variable.

4 Two random variable X and Y have a joint density:

$$f\mathrm{x}, y(\mathrm{x}, y) = \frac{10}{4}[u(x) - u(x-4)]u(y)y^3 exp[-(x+1)y^2]$$

Find marginal distributions of X,Y.

5 Two statistically independent random variables X and Y have mean values 2 and 4, second moments 8 and 25 respectively. Find the mean and variance of the random variable W = 3X-Y.

6 A random process is defined by X(t) = A, where A is a continuous random variable uniformly distributed on (0,1).
(a) Determine the form of the sample functions.
(b) Classify the process.
(c) Is it deterministic?
(d) Find the first-order density function of X(t) at any time t.

7 (a) List the properties of auto correlation function properties.

(b) Two random processes X(t) and Y(t) are defined as: $X(t) = A\cos(\omega_0 t) + B\,sin(\omega_0 t)\,; Y(t) = B\,cos(\omega_0 t) - A\,sin(\omega_0 t)$. Find the cross-correlation function $R_{\mathrm{xy}}(t, t+\tau)$. Show that X(t) and Y(t) are jointly wide sense stationary. Given A and B are uncorrelated zero mean random variables.

8 (a) List the properties of cross power density spectrum.

(b) Random process X(t) has the autocorrelation function as follows $R_{\mathrm{xx}}(\tau) = Pe^{\tau^2/2a^2}$ where p>0 and a>0 are constants. Find the power density spectrum of X(t).

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