Code: 13A04304

R13

B.Tech II Year I Semester (R13) Regular Examinations December 2014

PROBABILITY THEORY & STOCHASTIC PROCESSES

(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) State Baye's theorem.

(b) Three coins are tossed in succession. Find out the probabilities of occurrence of two consecutive heads.

(c) State central limit theorem.

(d) Find the expected value of the face value while rolling fair die?

(e) Define cross-covariance function.

(f) Give any two examples for poisson random process.

(g) A random process has the power density spectrum $S_{XX}(\omega) = \frac{6\omega^2}{1+\omega^4}$. Find the average power in the process.

(h) What is power spectral density? Mention its importance.

(i) Define the following random process: (i) Band limited. (ii) Narrow band.

(j) What are the two conditions that are to be satisfied by the power spectrum $\frac{\omega^2}{\omega^6+3\omega^2+3}$ to be a valid power density spectrum?

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT - I

2 (a) A pack contains 4 white and 2 green pencils, another contains 3 white and 5 green pencils. If one pencil is drawn from each pack, find the probability that (i) Both are white. (ii) One is white and another is green

(b) Explain about joint and conditional probability.

OR

3 (a) Consider the experiment of tossing four fair coins. The random variable X is associated with the number of tails showing. Compute and sketch the CDF of X.

(b) Define probability density function. List its properties.

UNIT - II

4 (a) Let X and Y be jointly continuous random variables with joint density function

$$f_{XY}(x,y) = xy\, e^{-\left(\frac{x^2+y^2}{2}\right)};\ \text{for } x>0,\ y>0$$
$$= 0;\ \text{otherwise}$$

(i) Check whether x and y are independent.

(ii) Find P (x≤1, y≤1).

(b) How expectation is calculated for two random variables?

OR

5 (a) Prove the following:

$\mathrm{Var}(ax+by) = a^2\,\mathrm{var}(x) + b^2\,\mathrm{var}(y) + 2ab\,\mathrm{cov}(x,y)$

(b) Explain central limit theorem.

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UNIT - III

6 (a) Explain about mean-ergodic process.

(b) If x (t) is a stationary random process having mean = 3 and auto correlation function: $R_{XX}(\tau) = 9 + 2e^{-|\tau|}$. Find the mean and variance of the random variable.

OR

7 (a) Explain the significance of auto correlation.

(b) Find auto correlation function of a random process whose power spectral density is given by $\frac{4}{1+\frac{\omega^2}{4}}$

UNIT – IV

8 (a) Briefly explain the concept of cross power density spectrum.

(b) Find the cross correlation of functions sin ωt and cos ωt.

OR

9 (a) The power spectral density of a stationary random process is given by

$$S_{XX}(\omega) = A;\ -k < \omega < k$$
$$= 0;\ \text{otherwise}$$

Find the auto correlation function.

(b) Discuss the properties of power spectral density.

UNIT – V

10 (a) A Gaussian random process X (t) is applied to a stable linear filter. Show that the random process Y(t) developed at the output of the filter is also Gaussian.

(b) Discuss about cross correlation between the input X (t) and output Y (t).

OR

11 (a) Derive the relation between PSDs of input and output random process of an LTI system.

(b) The input voltage to an RLC series circuit is a stationary random process X(t) with E[X (t)] = 2 and $R_{XX}(\tau) = 4 + \exp(-2|\tau|)$. Let Y (t) is the voltage across capacitor. Find E[Y(t)] .

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