Code: 15A04304 **R15**

B.Tech II Year I Semester (R15) Regular Examinations November/December 2016

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) What is the condition for a function to be a random variable?

(b) Define Gaussian random variable.

(c) How interval conditioning is different from point conditioning?

(d) When N random variables are said to be jointly Gaussian?

(e) Explain about strict-sense stationery processes.

(f) Where the Poisson random processes is used? Explain.

(g) Examine the function $\frac{\omega^2}{\omega^6 + 3\omega^2 + 3}$ for valid PSD.

(h) Correlate CPSD and CCF.

(i) Analyze the power density spectrum of response.

(j) List the properties of band limited processes.

PART – B

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

UNIT – I

2 (a) Give Classical and Axiomatic definitions of Probability.

(b) In a single through of two dice, what is the probability of obtaining a sum of at least 10?

OR

3 (a) What is the concept of Random Variable? Explain with a suitable example.

(b) 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 (i) P{-∞< X ≤ 6.5}. (ii) P{X > 4} (iii) P{6 < X ≤ 9}.

UNIT – II

4 (a) State and explain the central limit theorem.

(b) Given the function:

$$f_{XY}(x, y) = \begin{cases} b(x+y)^2, & -2 < x < 2, -3 < y < 3 \\ 0, & \text{elsewhere} \end{cases}.$$

(i) Find a constant 'b' such that this is a valid density function.

(ii) Determine the marginal density functions $f_x(x)$ and $f_y(y)$.

OR

5 (a) What are the properties of Jointly Gaussian Random variables?

(b) A random variable X has $\overline{X} = -3, \overline{X^2} = 11, and \sigma_x^2 = 2$. For a new random variable Y= 2X-3, find: (i) $\overline{Y}$. (ii) $\overline{Y^2}$. (iii) σ_y^2.

Contd. in page 2

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R15

UNIT – III

6 (a) List and explain various properties of Autocorrelation function.

(b) Given the Autocorrelation function of the processes:

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

Find the mean and variance of the process X(t).

OR

7 (a) Compare the Cross Correlation Function with Autocorrelation function.

(b) Assume that an Ergodic random process X(t) has an autocorrelation function:

$$R_{XX}(\tau) = 18 + \frac{2}{6 + \tau^2}[1 + 4\cos(12\tau)]$$

(i) Find $|\overline{X}|$. (ii) Does this process have periodic component? (iii)What is the average power in X(t)?

UNIT – IV

8 (a) State and explain the Wiener-Khintchine relation.

(b) Obtain the auto correlation function corresponding to the power density spectrum:

$$S_{XX}(\omega) = \frac{8}{(9 + \omega^2)^2}$$

OR

9 (a) Define Power Spectral Density? List out its properties.

(b) Compute the average power of the process having power spectral density $\frac{6\omega^2}{1+\omega^4}$.

UNIT – V

10 (a) What is LTI system? How the response can be obtained from LTI system.

(b) Find the system response, when a signal x(t)= u(t) e^{-2t} is applied to a network having an impulse response h(t) = 3u(t) e^{-3t}.

OR

11 (a) Explain about mean and mean square value of system response?

(b) A random process X(t) is applied to a network with impulse response: h(t) = u(t) t e^{-3t}. The cross correlation of X(t) with the output Y(t) is known to have the same form $R_{XX}(\tau)$ = u(τ) τ $e^{-3\tau}$.

(i) Find the autocorrelation of Y(t).

(ii)What is the average power in Y(t)

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