

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)
- What is the condition for a function to be a random variable?
  - Define Gaussian random variable.
  - How interval conditioning is different from point conditioning?
  - When N random variables are said to be jointly Gaussian?
  - Explain about strict-sense stationery processes.
  - Where the Poisson random processes is used? Explain.
  - Examine the function  $\frac{\omega^2}{\omega^6 + 3\omega^2 + 3}$  for valid PSD.
  - Correlate CPSD and CCF.
  - Analyze the power density spectrum of response.
  - 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)  $P\{-\infty < X \leq 6.5\}$ . (ii)  $P\{X > 4\}$  (iii)  $P\{6 < X \leq 9\}$ .**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  $\bar{X} = -3, \overline{X^2} = 11, \text{ and } \sigma_x^2 = 2$ . For a new random variable  $Y = 2X - 3$ , find:  
 (i)  $\bar{Y}$ . (ii)  $\overline{Y^2}$ . (iii)  $\sigma_y^2$ .

Contd. in page 2

**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  $R_{XX}(\tau) = u(\tau) \tau e^{-3\tau}$ .  
 (i) Find the autocorrelation of Y(t).  
 (ii) What is the average power in Y(t)

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