B.Tech II Year I Semester (R13) Supplementary Examinations November/December 2016

PROBABILITY THEORY & STOCHASTIC PROCESSES

(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

PART - A

(Compulsory Question)

1 Answer the following: $(10 \times 02 = 20 \text{ Marks})$

- (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) $P{-\infty < X \le 6.5}$. (ii) $P{X > 4}$ (iii) $P{6 < X \le 9}$.

- 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 .

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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).

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- 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 |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)
