

PROBABILITY THEORY & STOCHASTIC PROCESSES

(Electronics and Communication Engineering)

Time: 3 hours

Max. Marks: 70

PART – A
(Compulsory Question)

- 1 Answer the following: (10 X 02 = 20 Marks)
- Clearly explain about certainty and uncertainty with suitable examples.
 - What is the condition for a function to be a random variable?
 - When N random variables are said to be jointly Gaussian?
 - How interval conditioning is different from point conditioning?
 - What is stationery processes? Explain.
 - Test the function " $e^{-\tau} u(\tau)$ " for a valid ACF.
 - Examine the function " $\frac{\omega^2}{\omega^6 + 3\omega^2 + 3}$ " for valid PSD.
 - Define power spectral density.
 - Analyze the power density spectrum of response.
 - Explain about mean square value of system response.

PART – B
(Answer all five units, 5 X 10 = 50 Marks)**UNIT – I**

- 2 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) $P\{6 < X \leq 9\}$.

OR

- 3 For the random variable X whose density function is:

$$f(x) = \begin{cases} \frac{1}{b-a}, & a \leq x \leq b \\ 0, & \text{Otherwise} \end{cases}$$

Determine Mean and Variance.

UNIT – II

- 4 Given the function:

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

- Find a constant b such that this is a valid density function.
- Determine the marginal density functions $f_x(x)$ and $f_y(y)$.

OR

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

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UNIT – III

6 What is ACF? State and explain any four properties of ACF.

OR

7 Explain about first order, second order, wide-sense and strict-sense stationary processes.

UNIT – IV

8 Find the auto correlation function corresponding to the power density spectrum:

$$S_{XX}(\omega) = \frac{157 + 12\omega^2}{(16 + \omega^2)(9 + \omega^2)}$$

OR

9 What is PSD? State and explain any four properties of PSD.

UNIT – V

10 $X(t)$ is stationary random process with zero mean and auto correlation function $R_{XX}(\tau) = e^{-2|\tau|}$ is applied to a system of function: $H(\omega) = \frac{1}{2 + j\omega}$. Find Power Spectral Density of its output

OR

11 A random process $X(t)$ is applied to a network with impulse response $h(t) = u(t) t e^{-bt}$, where $b > 0$ is a constant. The cross correlation of $X(t)$ with the output $Y(t)$ is known to have the same form $R_{XX}(\tau) = u(\tau) \tau e^{-b\tau}$.

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

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