Code: 13A04304

R13

B.Tech II Year I Semester (R13) Supplementary Examinations June 2017

PROBABILITY THEORY & STOCHASTIC PROCESSES

(Electronics & 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) Define probability of the event with an example.

(b) Determine the value of K, such that the given density function is valid

$f_X(x) = K, \ a < x < b$

$0, \quad elsewhere$

(c) State the central limit theorem.

(d) Derive the expression of 'constant a' in terms of moments of X & Y, if V & W are orthogonal, where V = X+aY & W = X-aY.

(e) List the various classifications of random processes.

(f) Prove the statement $R_{XX}(-\tau) = R_{XX}(\tau)$.

(g) List any two properties of cross PSD.

(h) What is the average power in X(t), if the $R_{XX}(\tau) = 3 + 2\exp(-4\tau^2)$?

(i) Write the relation between $S_{XY}(\omega), H(\omega)$ & $S_{XX}(\omega)$.

(j) Describe the condition for stable system.

PART - B

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

UNIT - I

2 (a) State and prove the Bayes theorem.

(b) A random variable X has the density function $f_X(x) = \frac{1}{2}u(x)\,exp\left(-\frac{x}{2}\right)$, evaluate the probabilities of events $A = \{1 < X \le 3\}, \ B = \{X \le 2.5\}$.

OR

3 (a) Compute the joint and conditional probabilities based on the given data. In a box there are 100 resistors having resistances and tolerance as shown in below table. Define the three events, A as "draw a 470 Ω resistor", B as "draw a 5% tolerance resistor", and C as "draw a 100 Ω resistor".

Resistance (Ω)	Tolerance		Total
	5%	10%	
22	10	14	24
47	28	16	44
100	24	08	32
Total	62	38	400

(b) Define and explain the following distribution and densities with an application.
(i) Exponential
(ii) Uniform.

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UNIT - II

4 (a) State and prove the joint density function properties.

(b) Identify the value of moment μ_{22}, if statistically independent random variables X and Y have moments $m_{10} = 2,\ m_{20} = 14,\ m_{02} = 12$ and $m_{11} = -6$.

OR

5 (a) If statistically independent random variables X and Y having respective densities $f_X(x) = 5u(x)e^{-5x}$, $f_Y(y) = 2u(y)e^{-2y}$ then derive the density function of W = X+Y.

(b) Two random variables X and Y have means $\bar{X} = 1$ and $\bar{Y} = 2$ variances $\sigma_X^2 = 4$ and $\sigma_Y^2 = 1$ and a correlation coefficient $\rho_{XY} = 0.4$. New random variables W and V are defined by V = -X+2Y, W = X+3Y. Find (i) The means (ii) The variances (iii) The correlations (iv) The correlation coefficient ρ_{VW} of V and W.

UNIT - III

6 (a) If a random process X(t) = A Cos(wt) + B Sin(wt) is given, where A & B are uncorrelated, zero mean random variables having same variance σ^2, then check X(t) is WSS or not.

(b) Evaluate the mean, average power and variance of random process having $R_{XX}(\tau) = 36 + 25exp(-|\tau|)$.

OR

7 (a) Define the terms:

(i) Random process.

(ii) Stationary random process.

(iii) Wide sense stationary random process.

(iv) Ergodic random process.

(b) Let X(t) be a stationary continuous random process that is differentiable.

Denoted by $\dot{X}(t) = \frac{d}{dt}(X(t))$

Determine (i) $\dot{X}(t)$ (ii) Express auto correlation function $R_{\dot{X}\dot{X}}(\tau)$ in terms of $R_{XX}(\tau)$.

UNIT - IV

8 (a) Interpret the Wiener Khintchine relation for auto power spectral density and autocorrelation of a random process.

(b) Find spectrum of random process whose auto correlation function $R_{XX}(\tau) = \frac{{A_0}^2}{2} Cos(\omega_0 \tau)$, plot correlation and its spectrum.

OR

9 Discuss the properties of auto power spectral density in detail.

UNIT - V

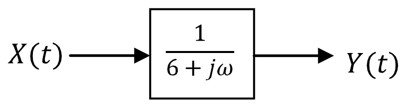
10 (a) Derive the expression for mean and mean squared value of system response.

(b) A stationary random process X(t) with zero mean and autocorrelation $R_{XX}(\tau) = e^{-2|\tau|}$ is applied to a system of function $H(\omega) = \frac{1}{2+j\omega}$ develop the PSD of output.

OR

11 (a) Write a short note on band limited, band pass and narrow band process.

(b) Consider a linear system as shown in figure:



X(t) is the input and Y(t) is the output of the system. The autocorrelation of X(t) is $R_{XX}(\tau) = 5\delta(\tau)$ determine the PSD and autocorrelation.

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