Code: 13A04304

R13

B.Tech II Year I Semester (R13) Supplementary Examinations June 2015

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) State the properties of conditional density function.

(b) What is the importance of Rayleigh distribution function?

(c) The joint density function of two discrete random variables X and Y is:

$f_{XY}(x,y) = k\,xy$; for $0 < x < 4,\ 1 < y < 5$

$= 0$; otherwise

Find the value of the constant k.

(d) Define joint characteristic functions of two random variables.

(e) Distinguish between stationary and non-stationary random process.

(f) When two different random processes are said to be statistically independent?

(g) If the PSD of x(t) is $S_{XX}(\omega)$. Find the PSD of $\frac{d\,x(t)}{dt}$.

(h) State any two differences between random variable and random process.

(i) A wide sense stationary random process x(t) is applied to the input of an LTI system whose impulse response is $5t\,e^{-2t}$. The mean of x(t) is 3. Find the mean output of the system.

(j) Give any two spectral characteristics of the system response.

PART – B

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

UNIT – I

2 (a) Define and explain the concept of random variable.

(b) Determine whether the following is a valid distribution function or not.

$F(x) = 1 - e^{-x/2}$; $for\ x \geq 0$

$= 0$; $elsewhere$

(OR)

3 (a) How do you explain statistically independent events using Baye's rule?

(b) A bag contains four balls. Two balls are drawn and are found to be white. Find the probability that all the balls are white.

UNIT – II

4 (a) Discuss the properties of conditional distribution function.

(b) If the joint PDF of two dimensional random variable (x, y) is given by:

$f_{XY}(x,y) = 2$; for $0 < x < 1,\ 0 < y < x$

$= 0$; otherwise

Find the marginal density function of X and Y.

(OR)

5 (a) Random variables X and Y have the joint density:

$f_{XY}(x,y) = \frac{1}{24}$; for $0 < x < 6\ and\ 0 < y < 4$

$= 0$; elsewhere

What is the expected value of the function $g(X,Y) = (X,Y)^2$?

(b) Briefly explain about jointly Gaussian random variables.

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UNIT – III

6 (a) Distinguish between ensemble average and time average of a random process.

(b) A random process is defined as x(t) = A sin$(\omega t + \theta)$, where A is a constant and θ is a random variable uniformly distributed over $(-\pi, \pi)$. Check x(t) for stationarity.

(OR)

7 (a) State and prove any three properties of auto correlation function.

(b) When do you call two random processes to be jointly wide sense stationary?

UNIT – IV

8 (a) Discuss the properties of cross-power density spectrum.

(b) Find the PSD of a stationary random process for which auto correlation is $R_{XX}(\tau) = 6e^{-\alpha|\tau|}$.

(OR)

9 (a) If V(f) = AT sin$\frac{(2\pi f t)}{2\pi f t}$, find the energy contained in v(t).

(b) Discuss the relationship between cross power spectrum and cross correlation function.

UNIT – V

10 (a) How mean value of the system response y(t) is calculated?

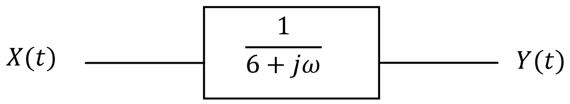
(b) Discuss the transmission of random process through linear system.

(OR)

11 (a) Discuss the following random process:

(i) Band pass. (ii) Band limited. (iii) Narrow band.

(b) Consider a linear system a shown below:



X(t) is the input and Y(t) is the output of the system. The auto correlation of X(t)is $R_{XX}(\tau) = 3\delta(\tau)$. Find the PSD, auto correlation function of the output Y(t).

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