Code No: R059210401 **Set No. 3**

II B.Tech I Semester Regular Examinations, November 2007
PROBABILITY THEORY AND STOCHASTIC PROCESS
(Common to Electronics & Communication Engineering, Electronics & Telematics and Electronics & Computer Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
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1. (a) Define probability based on set theory and fundamental axioms.
   (b) When two dice are thrown, find the probability of getting the sums of 10 or 11. [8+8]

2. (a) Define cumulative probability distribution function. And discuss distribution function specific properties.
   (b) The random variable X has the discrete variable in the set $\{-1, -0.5, 0.7, 1.5, 3\}$ the corresponding probabilities are assumed to be $\{0.1, 0.2, 0.1, 0.4, 0.2\}$. plot its distribution function and state is it a discrete or continuous ditribution function. [8+8]

3. (a) Explain the concept of a transformation of a random variable X
   (b) A Gaussian random variable X having a mean value of zero and variance one is transformed to an another random variable Y by a square law transformation. Find the density function of Y. [8+8]

4. Discrete random variables X and Y have a joint distribution function
   $F_{XY}(x, y) = 0.1u(x + 4)u(y - 1) + 0.15u(x + 3)u(y + 5) + 0.17u(x + 1)u(y - 3)+$
   $0.05u(x)u(y - 1) + 0.18u(x - 2)u(y + 2) + 0.23u(x - 3)u(y - 4)+$
   $0.12u(x - 4)u(y + 3)$
   Find
   (a) Sketch $F_{XY}(x, y)$
   (b) marginal distribution functions of X and Y.
   (c) P$(-1 < \mathrm{X} \leq 4, -3 < \mathrm{Y} \leq 3)$ and
   (d) Find P$(\mathrm{X} < 1, \mathrm{Y} \leq 2)$. [4+6+3+3]

5. (a) let Y = X_1 + X_2 + ...+X_N be the sum of N statistically independent random variables X_i, i=1,2............. N. If Xi are identically distributed then find density of Y, f_y(y).
   (b) Consider random variables Y_1 and Y_2 related to arbitrary random variables X and Y by the coordinate rotation. Y_1=X Cos θ + Y Sin θ Y_2 = -X Sin θ + Y Cos θ
      i. Find the covariance of Y_1 and Y_2, C_{Y1Y2}
      ii. For what value of θ, the random variables Y_1 and Y_2 uncorrelated. [8+8]

6. (a) Define cross correlation function of two random processes X(t) and Y(t) and state the properties of cross correlation function.

   (b) let two random processes X(t) and Y(t) be defined by
   X(t) = A cos ω_0t + B sin ω_0t
   Y(t) = B cos ω_0t - A sin ω_0t
   Where A and B are random variables and ω_0 is a constant. Assume A and B are uncorrelated, zero mean random variables with same variance. Find the cross correlation function R_{XY} (t,t+τ) and show that X(t) and Y(t) are jointly wide sense stationary. [6+10]

7. (a) If the PSD of X(t) is Sxx(ω). Find the PSD of $\frac{dx(t)}{dt}$

   (b) Prove that S_{xx} (ω) = S_{xx} (-ω)

   (c) If $R(\tau) = ae^{|by|}$. Find the spectral density function, where a and b are constants. [5+5+6]

8. (a) A Stationary random process X(t) having an Auto Correlation function $R_{XX}\,\tau = 2e^{-4|\tau|}$ is applied to the network shown in figure 8a find

      i. S_{XX} (ω)
      ii. IH(ω)I^2
      iii. $S_{YY}(\omega$). [4+4+2]

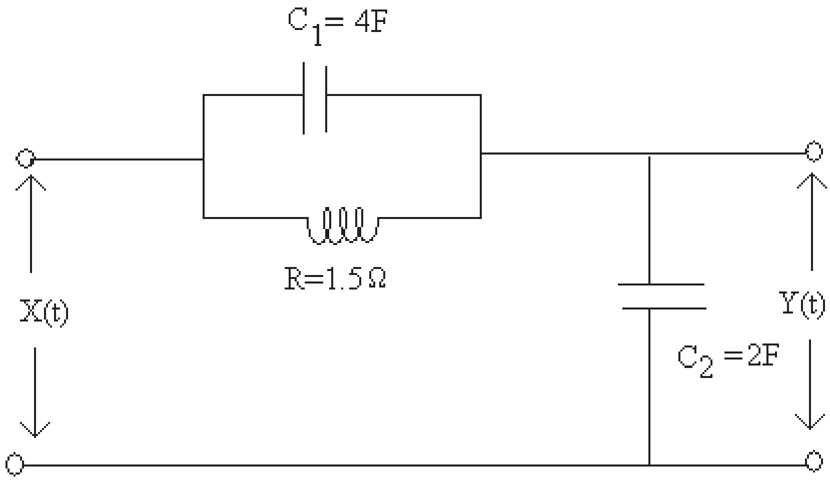

Figure 8a

   (b) Write short notes on different types of noises. [6]

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