Code No: R059210401 **Set No. 1**

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) Discuss Joint and conditional probability.
   (b) When are two events said to be mutually exclusive? Explain with an example?
   (c) Determine the probability of the card being either red or a king when one card is drawn from a regular deck of 52 cards. [6+6+4]

2. (a) Define rayleigh density and distribution function and explain them with their plots.
   (b) Define and explain the guassian random variable in brief?
   (c) Determine whether the following is a valid distrbution function. F(x) = 1-exp(-x/2) for x ⇒ 0 and 0 elsewhere. [5+5+6]

3. (a) State and prove properties of characteristic function of a random variable X
   (b) Let X be a random variable defined by the density function
   $f_X(x) = \begin{cases} \frac{5}{4}(1-x^4) & 0 < x \leq 1 \\ 0 & elsewhere \end{cases}$. Find E[X] ,E[$X^2$] and variance. [8+8]

4. The joint space for two random variables X and Y and corresponding probabilities are shown in table

   Find and Plot
   (a) $F_{XY}(x, y)$
   (b) marginal distribution functions of X and Y.
   (c) Find P(0.5 < X < 1.5),
   (d) Find P(X ≤ 1, Y ≤ 2) and
   (e) Find P(1 < X ≤ 2, Y ≤ 3).

X, Y	1,1	2,2	3,3	4,4
P	0.05	0.35	0.45	0.15

[3+4+3+3+3]

5. (a) Show that the variance of a weighted sum of uncorrected random variables equals the weighted sum of the variances of the random variables.
   (b) Two random variables X and Y have joint characteristic function ϕX, Y(ω_1,ω_2) = exp($-2\omega_1^2 - 8\omega_2^2$).
      i. Show that X and Y are zero mean random variables.

ii. are X and Y are correlated. [8+8]

6. Let X(t) be a stationary continuous random process that is differentiable. Denote its time derivative by $\dot{X}(t)$.

   (a) Show that $E\left[\overset{\bullet}{\times}(t)\right] = 0$.

   (b) Find $R_{\times\dot{\times}}(\tau)$ in terms of $R_{\times\times}(\tau)$sss [8+8]

7. (a) Derive the expression for PSD and ACF of band pass white noise and plot them

   (b) Define various types of noise and explain. [8+8]

8. (a) Define the following random processes

      i. Band Pass

      ii. Band limited

      iii. Narrow band. [3×2 = 6]

   (b) A Random process X(t) is applied to a network with impulse response h(t) = u(t) exp (-bt)

      where b > 0 is ω constant. The Cross correlation of X(t) with the output Y (t) is known to have the same form:
      $R_{XY}(\tau)$ = u(τ)τ exp (-bY)

      i. Find the Auto correlation of Y(t)

      ii. What is the average power in Y(t). [6+4]

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