Code No: R5210402 **R5**

II B.Tech I Semester(R05) Supplementary Examinations, May/June 2010
PROBABILITY THEORY AND STOCHASTIC PROCESS
(Common to Electronics & Communication Engineering 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 and give the concept of random variable.
   (b) Define conditional distribution and density functions and explain their properties. [6+10]

3. (a) State and prove properties of variance of a random variable
   (b) Let X be a random variable defined by the density function
   $f_X(x) = \begin{cases} \frac{\pi}{16}\cos(\pi x/8) & -4 \le x \le 4 \\ 0 & elsewhere \end{cases}$ Find E[3X] and E[X^2]. [8+8]

4. (a) State and prove the properties of conditional density functions.
   (b) Find the probability density function of W = X + Y where the densities of X and Y are given by
   $f_X(x) = u(x+1) - u(x)$
   $f_Y(y) = \frac{1}{2}[u(y+1) - u(y-1)]$. [8+8]

5. 1. Let X be a random variable that has a mean value.
   (a) $\bar{X} = 3$ and variable $\sigma x^2 = 2$. Let another random variable defined by Y=-6x+22.
      i. Find R_{XY}, Correlation of X and Y.
      ii. are X and Y orthogonal
      iii. are X and Y correlated.
   (b) Find the mean value of a sum of N weighted random variables. [5+3+3+5]

6. (a) Define various random processes
   (b) Differentiate between stationary & ergodic random processes.
   (c) Show that the random process X(t) = Acos(ω_ot+θ) is wide sense stationary assume A and ω_o are constants and θ is a uniformly distributed random variable on the interval (0,2Π). [5+5+6]

7. (a) If the PSD of X(t) is Sxx(ω). Find the PSD of $\frac{dx(t)}{dt}$
   (b) Prove that $S_{xx}(\omega) = S_{xx}$ (-ω)
   (c) If $R(\tau) = ae^{-b}|\tau|$. Find the spectral density function, where a and b are constants. [5+5+6]

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 (-bτ)
      i. Find the Auto correlation of Y(t)
      ii. What is the average power in Y(t). [6+4]

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