Code No: R059210401 **Set No. 2**

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) With an example define and explain the following:
   i. Equality likely events
   ii. Exhaustive events.
   iii. Mutually exclusive events.

   (b) In an experiment of picking up a resistor with same likelihood of being picked up for the events; A as "draw a 47 Ω resistor", B as "draw a resistor with 5% tolerance" and C as "draw a 100 Ω resistor" from a box containing 100 resistors having resistance and tolerance as shown below. Determine joint probabilities and conditional probabilities. [6+10]

   Table 1

   Number of resistor in a box having given resistance and tolerance.

Resistance(Ω)	Tolerance		
	5%	10%	Total
22	10	14	24
47	28	16	44
100	24	8	32
Total	62	38	100

2. (a) What is binomial density function? Find the equation for binomial distrbution function.

   (b) What do you mean by continuous and discrete random variable? Discuss the condition for a function to be a random variable. [6+10]

3. (a) Define moment generating function.

   (b) State properties of moment generating function.

   (c) Find the moment generating function about origin of the Poisson distribution. [3+4+9]

4. (a) Define conditional distribution and density function of two random variables X and Y

   (b) The joint probability density function of two random variables X and Y is given by

   $f(x, y) = \begin{cases} a(2x + y^2) & 0 \le x \le 2\ ,\quad 2 \le y \le 4 \\ 0 & elsewhere \end{cases}$. Find

i. value of ‘a’

ii. $P(X \leq 1, Y > 3)$. [8+8]

5. (a) let X_i, i = 1,2,3,4 be four zero mean Gaussian random variables. Use the joint characteristic function to show that E $\{X_1\ X_2\ X_3\ X_4\}$ = E$[X_1\ X_2]$ E$[X_3\ X_4]$ + E$[X_1 X_3]$E$[X_2 X_4]$ + E$[X_2 X_3]$ E$[X_1 X_4]$

   (b) Show that two random variables X_1 and X_2 with joint pdf. $f_{X1X2}(X_1, X_2) = 1/16\ |X_1| < 4, 2 < X_2 < 4$ are independent and orthogonal.[8+8]

6. A random process Y(t) = X(t)- X(t $+\tau$) is defined in terms of a process X(t) that is at least wide sense stationary.

   (a) Show that mean value of Y(t) is 0 even if X(t) has a non Zero mean value.

   (b) Show that $\sigma Y^2 = 2[R_{XX}(0) - R_{XX}(\tau)]$

   (c) If Y(t) = X(t) +X(t + τ) find E[Y(t)] and σY^2. [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} (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 Signal x(t) = u(t) exp (-αt) is applied to a network having an impulse response h(t)= ω u(t) exp (-ω t). Here α & ω are real positive constants. Find the network response? (6M)

   (b) Two systems have transfer functions $H_1(\omega)$ & $H_2(\omega)$. Show the transfer function H(ω) of the cascade of the two is H(ω) =$H_1(\omega)$ H_2 (ω).

   (c) For cascade of N systems with transfer functions $H_n(\omega)$, n=1,2,.... .N show that H(ω) = $\pi H_n(\omega)$. [6+6+4]

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