Code No: R059210401 **Set No. 4**

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 and explain the following with an example:
   i. Equally likely events
   ii. Exhaustive events
   iii. Mutually exclusive events
   (b) Give the classical definition of probability.
   (c) Find the probability of three half-rupee coins falling all heads up when tossed simultaneously. [6+4+6]

2. (a) What is poisson random variable? Explain in brief.
   (b) What is binomial density and distrbution function?
   (c) Assume automobile arrives at a gasoline station are poisson and occur at an average rate of 50/hr. The station has only one gasoline pump. If all cars are assumed to require one minute to obtain fuel. What is the probability that a waiting line will occur at the pump? [5+5+6]

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. Given the function $f(x, y) = \begin{cases} (x^2 + y^2)/8\pi & x^2 + y^2 < b \\ 0 & elsewhere \end{cases}$
   (a) Find the constant 'b' so that this is a valid joint density function.
   (b) Find $P(0.5b < X^2 + Y^2 < 0.8b)$. [7+9]

5. Three statistically independent random variables X_1,X_2 and X_3 have mean values $\bar{X}_1 = 3$, $\bar{X}_2 = 6$ and $\bar{X}_3 = -2$. Find the mean values of the following functions.
   (a) $g(X_1,X_2,X_3) = X_1 + 3X_2 + 4X_3$
   (b) $g(X_1,X_2,X_3) = X_1\ X_2\ X_3$
   (c) $g(X_1,X_2,X_3) = -2X_1,X_2 - 3X_1\ X_3 + 4X_2\ X_3$
   (d) $g\ (X_1,X_2,X_3) = X_1+X_2+X_3$. [16]

6. Statistically independent zero mean random processes X(t) and Y(t) have auto correlations functions
   $R_{XY}(\tau) = \mathrm{e}^{-|\tau|}$ and
   $\mathrm{R_{YY}}(\tau) = \cos(2\Pi\tau)$ respectively.
   (a) find the auto correlation function of the sum W_1(t) = X(t) + Y(t)
   (b) find the auto correlation function of difference W_2(t) = X(t) - Y(t)
   (c) Find the cross correlation function of W_1(t) and W_2(t). [5+5+6]

7. (a) Find the ACF of the following PSD's
      i. $S_{\chi\chi}(\omega) = \frac{157+12\omega^2}{(16+\omega^2)(9+\omega^2)}$
      ii. $S_{\chi\chi}(\omega) = \frac{8}{(9+\omega^2)^2}$
   (b) State and Prove wiener-Khinchin relations. [8+8]

8. A random noise X(t) having power spectrum $S_{XX}(\omega) = \frac{3}{49+\omega^2}$ is applied to a to a network for which $h(t) = u(t)t^2\exp(-7t)$. The network response is denoted by Y(t)
   (a) What is the average power is X(t)
   (b) Find the power spectrum of Y(t)
   (c) Find average power of Y(t). [5+6+5]

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