Code No: R7210402 **R7**

II B.Tech I Semester(R07) Supplementary Examinations, May/June 2010
PROBABILITY THEORY AND STOCHASTIC PROCESSES
(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) Explain the terms Joint probability and Conditional probability.
   (b) Show that Conditional probability satisfies the three axioms of probability.
   (c) Two cards are drawn from a 52-card deck (the first is not replaced):
      i. Given the first card is a queen. What is the probability that the second is also a queen?
      ii. Repeat part (i) for the first card a queen and second card a 7.
      iii. What is the probability that both cards will be the queen? [4+6+6]

2. (a) What is gaussian random variable? Develop an equation for gaussian distribution function.
   (b) Verify that the following is a distribution function:
   F(x) = 0 for x < -a,
   = 1/2(x/a + 1) for -a < = x < = a, and
   = 1 for x > a. [10+6]

3. (a) A discrete random variable X have values x = -1, 0, 1 and 2 with respective probabilities 0.1, 0.3, 0.4 and 0.2. X is transformed to Y = 2 - X^2 + $X^3/3$. Find the density function of Y.
   (b) If X is the number scored in a throw of a fair die, show that the Chebyshev's inequality gives
   $P\left[|X-m|>2.5\right]<0.47$
   where m is the mean of X, while the actual probability is zero. [8+8]

4. (a) Explain the 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
   $\mathrm{f(x,y)} = \mathrm{a}(2\mathrm{x}+\mathrm{y}^2), \quad 0\le x\le 2, 2\le y\le 4$
   $= 0, \quad$ elsewhere
   Find:
      i. value of 'a'
      ii. P(X ≤ 1, Y > 3). [8+8]

5. (a) Write the expression for expected value of a function of random variables and prove that the mean value of a weighted sum of random variables equals the weighted sum of mean values.
   (b) X is a random variable with mean $\bar{X}=3$, variance $\sigma_X^2=2$.
      i. Determine the second moment of X about origin
      ii. Determine the mean of random variable y = where y = -6X +22. [8+8]

6. (a) Prove that autocorrelation function of a random process is even function of τ.
   (b) Prove that $\mathrm{R_{XX}}(\tau) = R_{XX}(0)$. [8+8]

7. The auto correlation function of a random process X(t) is $R_{XX}(\tau)=3+2\exp\left(-4\tau^2\right)$.
   (a) Find the power spectrum of X(t).
   (b) What is the average power in X(t)
   (c) What fractional power lies in the frequency band $\frac{-1}{\sqrt{2}}\le\omega\le\frac{1}{\sqrt{2}}$. [6+4+6]

8. (a) Explain how the available noise power in an electronic circuit can be estimated.
   (b) What are the different noise sources that may be present in an electron devices? [8+8]

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