Code: EC3T2

II B.Tech - I Semester – Regular Examinations - January 2014

PROBABILITY THEORY AND STOCHASTIC PROCESS
(ELECTRONICS & COMMUNICATION ENGINEERING)

Duration: 3 hours   Marks: 5x14=70

Answer any FIVE questions.   All questions carry equal marks

1. a) Define probability in classical and axiomatic approach with suitable examples.   7 M

   b) A coin is tossed. If it turns up tail, two balls will be drawn from box A, otherwise two balls will be drawn from box B. Box A contains four black and three white balls. Box B contains five black and two white balls. In both cases, selections are to be made with replacement. What is the probability that Box A is used, given that both balls drawn are black?   7 M

2. a) What is an Event? Explain the methods of defining Conditioning Event.   7 M

   b) The Rayleigh density function is given by
   $$f(x) = \begin{cases} -x\,e^{\frac{-x^2}{2}} & x \geq 0 \\ 0 & x < 0 \end{cases}$$

i) Find the distribution function F(x)

ii) Compute $P(0.5 \leq x < 2)$

iii) Compute $P(0.5 < x \leq 2)$ 7 M

3. a) Define characteristic function of a random variable X and discuss its properties.   7 M

b) The density function of a random variable X is given by

$$f_X(x) = \begin{cases} 2\,e^{-2x} & 0 \leq x < \infty \\ 0 & \text{otherwise} \end{cases}$$

Find   i) $E(x)$ (ii) $E(4x-1)$ (iii) $E(x^2)$ 7 M

4. a) State & prove central limit theorem.   7 M

b) Find the density function of $W = X + Y$ where the densities of X and Y are given as

$$f_X(x) = \frac{1}{a}[\, u(x) - u(x - a)]$$

$$f_Y(x) = \frac{1}{b}[\, u(y) - u(y - b)], \quad \text{where } 0 < a < b. \quad \text{7 M}$$

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{X1 X2 X3 X4}=E[X1 X2]E[X3 X4]+E[X1X3] E[X2X4]
            + E[X2X3]E[X1X4]   7 M

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 = 4X +2   7 M

6. a) State the properties of cross correlation.   7 M

   b) Explain in detail First order stationary random process.

                                           7 M

7. a) Derive the relationship between Cross-Power spectrum

    and Cross-Correlation function   7 M

   b) $R_{XY}(\tau) = 4 + 2\,e^{-2\tau^2}$. Find SXY ($\omega$).   7 M

8. a) Define the following random processes

    i) Band Pass   ii) Band limited

    iii) Narrow band   7 M

   b) Find out mean square value of the output response, for a system having $h(t) = e^{-t}\,u(t)$ and input of white noise.   7 M