N 1128

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2004.

Fourth Semester

Electronics and Communication Engineering

MA 034 — RANDOM PROCESSES

Time : Three hours — Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Event A and B are such that $P(A+B)=\frac{3}{4}$, $P(AB)=\frac{1}{4}$ and $P(\overline{A})=\frac{2}{3}$ find $P(B)$.

2. Write a note on Chebychev inequality.

3. Give an example for conditional distribution.

4. Distinguish between correlation and regression.

5. Give an example for a continuous time random process.

6. Define a Stationary process.

7. State the properties of an ergodic process.

8. Explain the concept of cross correlation function.

9. What is meant by spectral analysis?

10. Describe a linear system.

PART B — ($5 \times 16 = 80$ marks)

11. State and establish the spectral representation theorem for a wide sense stationary process. Also obtain the covariance function and spectral devising function average process. (16)

12. (a) (i) If the MGF of X is $(5-4e^t)^{-1}$, find the distribution of X and $P(X=5 \text{ or } 6)$. (8)

(ii) If X has exponential distribution EXPO (λ), find the distribution of $Y = e^{-\lambda x}$. (8)

Or

(b) (i) The first four moments of a distribution about X 4 are 1, 4, 10 and 45 respectively. Show that the mean is 5, variance is 3, $\mu_3 = 0$ and $\mu_4 = 26$. (8)

(ii) Define Gamma distribution and derive the moment generating function. Hence obtain the mean and variance. (8)

13. (a) (i) Suppose the point probability density function (PDF) is given by

$$f(x, y) = \begin{cases} \frac{6}{5}(x+y^2); & 0 \le x \le 1, 0 \le y \le 1 \\ 0 & \text{otherwise} \end{cases}$$

Obtain the marginal PDF of X and that of Y. Hence or otherwise find $P\left[\frac{1}{4} \le y \le \frac{3}{4}\right]$. (8)

(ii) The joint probability mass function of X and Y is given below

x/y	−1	+1
0	1/8	3/8
1	2/8	2/8

Find correlation coefficient of (X, Y). (8)

Or

(b) (i) The joint probability mass function (PMF) of X and Y is

$P(x, y)$		0	1	2
	0	0.1	.04	.02
X	1	.08	.20	.06
	2	.06	.14	.30

Compute the marginal PMF X and of Y, $P[X \leq 1, Y \leq 1]$ and check if X and Y are independent. (8)

(ii) Two random variables X and Y have the joint density

$$f(x, y) = \begin{cases} 2 - x - y, & 0 < x < 1,\ 0 < y < 1 \\ 0 & \text{otherwise} \end{cases}$$

Show that corr $(X, Y) = -1/11$. (8)

(a) Define a Markov chain (MC). Explain :

(i) How you would clarify the states and identify different classes of a MC. Give an example to each class. (8)

(ii) Explain any two applications of a Binomial Process. (8)

Or

(b) (i) State the postulates of a Poisson process. State its properties and establish the additive property for the Poisson process. (8)

(ii) Write a detailed note on sine–wave process. (8)

(a) Distinguish strict stationarity from wide sense stationarity and establish any two results for a weekly stationary time service involving autocorrelation function. (16)

Or

(b) Write a detailed note on each of the following :

(i) Correlation integrals. (8)

(ii) Linear system with random inputs. (8)