Code No. 6074 / M

FACULTY OF INFORMATICS

B.E. 2/4 (I.T.) II - Semester (Main) Examination, June 2014

Subject : Probability and Random Process

Time : 3 Hours **Max. Marks: 75**

Note: Answer all questions of Part - A and answer any five questions from Part-B.

PART – A (25 Marks)

1 Define properties of Joint cumulative distribution function. (2)

2 If A and B are independent events, prove that $\overline{A}$ and $\overline{B}$ are also independent. (2)

3 State any three properties of characteristic function. (3)

4 Define Axiomatic definition of probability. (2)

5 What is the difference between random variable and random process? (3)

6 Find mean and variance of Poisson distribution. (3)

7 Write any three properties of auto correlation. (3)

8 Define Guassian process. (3)

9 State any three properties of power spectral density function. (2)

10 State Wiener – Khinchin theorem. (2)

PART – B (50 Marks)

11 (a) Suppose box 1 contains **a** white ball and **b** black balls and box 2 contain **c** white balls and d black balls. One ball of unknown color is transferred from the first box into the second one and then a ball is drawn from the latter. What is the probability that it will be a white ball? (5)

(b) Show that $P(A_1 U A_2 A_3 U \ldots U A_n) = P(A_1) + P(A_2) + \ldots + P(A_n) - P(A_1 \cap A_2 \cap A_3 \ldots A_n)$ (5)

12 Three switches S_1, S_2 and S_3 connected in parallel operate independently and each switch remains closed with probability p. (10)

(a) Find the probability of receiving an input signal at the output.

(b) Find the probability that the switch S_1 is open given that an input signal is received at the output.

13 Give $f_{xy}(x,y) = C\,x\,(x - y)$, $0 < x < 2$, and 0 elsewhere,

(a) evaluate C, (b) find $f_{x,}(x)$ (c) find $f_{y/x}$ (y/x)

14 (a) If $Y = X^2$ where X is a Gaussian random variable with zero mean and variance σ^2, find the pdf of the random variable Y.

(b) If the continuous random variable X has pdf $f_x(x) = 2/9\,(x + 1)$, $-1 < x < 2$ and 0, elsewhere. Find the pdf of $Y = X^2$.

15 (a) Show that the random process $X(t) = a \cos(w_0 t + \theta)$ is wide-sense stationary, if A and w_0 are constants and uniformly distributed random variable in $(0, 2\pi)$. (5)

(b) Find the power spectral density of a WSS process with autocorrelation function $R(t) = a^2 e^{-2\beta|t|}$ (5)

16 (a) If the power spectral density of a WSS process is given by $S(w) = b / a (a - |w|), |w| \le a, 0, |w| > a$

Find the autocorrelation function of the process. (5)

(b) Write a short notes on : (5)

(i) Thermal Noise (ii) Filters

17 Consider a white Gaussian noise of zero mean and power spectral density $N_0/2$ applied to a low-pass RC filter whose transfer function is $H(f) = \frac{1}{1 + i2\pi fRC}$. Find the autocorrelation function of the output random process. (10)

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