Code No. 9074

FACULTY OF INFORMATICS

B.E. 2/4 (I.T.) II - Semester (Suppl.) Examination, December / January 2014-15

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 State multiplication theorem for n events. (2)

2 State Winner Khinchin relation. (2)

3 Show that for any two events A and B, (3)
$P(A \cap B) \leq P(A) \leq P(A \cup B) \leq P(A)+P(B)$

4 Define probability density function of a r.v. in discrete and continuous cases. (2)

5 The pdf of the r.v. X and Y is $f_{XY}(x, y) = Ae^{-(x+y)}$, $x \geq 0$, $y \geq 0$. Find the constant A. (3)

6 Write the properties of characteristic function of a r.v. (2)

7 What is first order stationery process? (3)

8 If X and Y are r.v.s. a and b are constant prove that (3)
$V(aX - bY) = a^2V(X) + b^2V(Y) - 2ab\, COV(X, Y)$

9 Define while noise. (2)

10 State the properties of spectral density function. (3)

PART – B (50 Marks)

11 (a) State and prove Baye's Theorem. (5)

(b) State and prove addition theorem of probability of n events. (5)

12 Joint distribution of X and Y is given by $f_{XY}(x, y) 4xy^{e-(x^2+y^2)}; x \geq 0, y \geq 0$ (10)

(i) Test whether X and Y are independent

(ii) For the above joint distribution, find the conditional density X given Y = y and conditional density Y given X = x.

13 (a) State the Properties auto correlation. (4)

(b) If X(t) is random telegraph signal process with E(X(t)) = 0 and $R(T) = e^{-2\lambda|T|}$ then find mean and variance of the time average of {x(t)} over (-T, T). Is it mean ergodic? (6)

14 If U(t) = X cost + Y sin t and V(t) = Y cost + X sin t where X and Y are independent r.vs. such that E(X) = 0 = E(Y); E(X2) = E(Ye) = 1; show that {U(t)} and {V(t)} are individually stationary in the wide sense (WSS) but they are not jointly W.S.S. (10)

15 (a) Give the autocorrelation function for a stationary process is $R_{xx}(\tau) = 25 + \frac{4}{1+6\tau^2}$

Find the mean and variance of the process X(t). (5)

(b) Given a stationary random process X(t)=10 cos(100t+θ) where θis a r.v. with a uniform probability distribution in the interval [-π, π]. Show that X(t) is ergodic in the autocorrelation function. (5)

16 The joint random variable (x, Y) probabilities function is given by (10)

X \ Y	1	2	3	4	5	6
0	0	0	$1/32$	$2/32$	$2/32$	$2/32$
1	$1/16$	$1/16$	$1/8$	$1/8$	$1/8$	$1/8$
2	$1/32$	$1/32$	$1/64$	$1/64$	0	$2/64$

Find

(i) $P(X \le 1)$ (ii) $P(X \le 1, Y \le 3)$

(iii) $P(X \le 1 / Y \le 3)$ (iv) $P(X+Y \le 4)$ (v) $P(Y \le 3 / X \le 1)$

17 A white noise of Gaussian process is zero, and $S(w) = \frac{N_0}{2}$ applied to a low pass RC filter whose transfer function $H(f) = \frac{1}{1+2\pi i f RC}$. Find the autocorrelation function of the output random process. (10)

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