Reg. No. : | | | | | | | | | | |

Question Paper Code: 44004

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2017

Fourth Semester

Electronics and Communication Engineering

14UMA424 - PROBABILITY AND RANDOM PROCESSES

(Regulation 2014)

Duration: Three hours | Maximum: 100 Marks

Answer ALL Questions

(Smith chart may be permitted)

PART A - (10 x 1 = 10 Marks)

1. The mean value of Poisson distribution is
   (a) θ (b) 1 (c) 0 (d) λ

2. If X is a Random Variable, where Var(x) =4, then predict the Var (3X+8)
   (a) 36 (b) 0 (c) 26 (d) 44

3. When will the two Regression Lines be coincide
   (a) r=0 (b) r=1 (c) r= ± 1 (d) r= ∞

4. If $X=Y$ then correlation coefficient between them is
   (a) 0 (b) ∞ (c) 1 (d) ± 1

5. A Non-Null Persistent and Aperiodic state is called
   (a) Return state (b) Irreducible (c) Ergodic (d) Recurrent

6. Every Strongly stationary process of order 2 is a
   (a) Orthogonal process (b) Stationary Process
   (c) WSS Process (d) None of these

7. The power spectral density of *X (t)* is defined by

(a) $y(t)=\int_{-\infty}^{\infty}h(u)X(t-u)du$

(b) $X(t)=\int_{-\infty}^{\infty}h(u)X(t-u)du$

(c) $s_{XX}(\omega)=\int_{-\infty}^{\infty}R_{XX}(\tau)e^{i\omega\tau}d\tau$

(d) $s_{XX}(\omega)=\int_{-\infty}^{\infty}R_{XX}(\tau)e^{-i\omega\tau}d\tau$

8. $R_{XX}(\tau)$ is an _________ function of τ

(a) Positive (b) 1 (c) Even (d) Odd

9. White noise is also called as

(a) System

(b) White Gaussian noise

(c) Functional white noise

(d) Stationary

10. A _________ is a functional relationship between the input *X (t)* and the output *Y (t)*

(a) system (b) process (c) functional (d) stationary

PART - B (5 x 2 = 10 Marks)

11. State Axioms of Probability.

12. Define covariance.

13. Define random telegraph signal process.

14. State Winear–Khinchine theorem.

15. If *X(t)* is a WSS process and if *Y(t)*= $\int_{-\infty}^{\infty}h(u)X(t-u)du$, then formulate $R_{XY}(\tau)=R_{XY}(\tau)*h(\tau)$.

PART - C (5 x 16 = 80 Marks)

16. (a) (i) Deduce the moment generating function of exponential distribution and hence find its mean and variance. (8)

(ii) The marks obtained by a number of students in a certain subject are approximately normally distributed with mean 65 and standard deviation 5. If 3 students are taken at random from this set, interpret the probability that at least one of them would have scored above 75? (Given the area between z=0 and z=2 under the standard normal curve is 0.4772). (8)

Or

(b) A random variable X has the following probability function

Value of x	0	1	2	3	4
$P(x)$	k	$3k$	$5k$	$7k$	$9k$

Find the value of k, $P(x < 3)$ and distribution function of x. (16)

17. (a) The joint probability distribution of X and Y is given below:

Y \ X	-1	1
0	1/8	3/8
1	2/8	2/8

Find the correlation coefficient between X and Y. (16)

Or

(b) (i) If the joint probability density function of a two dimensional random variable (X,Y) is given by $f(x,y) = xy^2 + \frac{x^2}{8}, 0 \le x \le 2, 0 \le y \le 1$.

Find out (i) $P(X > 1)$, (ii) $P(Y < ½)$. (8)

(ii) Analyse the correlation coefficient between the heights (in inches) of fathers X and their sons Y from the following data. (8)

X	65	66	67	67	68	69	70	72
Y	67	68	65	68	72	72	69	71

18. (a) Generalize the postulates of a Poisson process and derive the probability distribution for the Poisson Process. Also Show that the sum of two independent Poisson process is again a Poisson process. (16)

Or

(b) (i) Explain the classification of random process. (8)

(ii) The transition probability of a Markov chain $\{X\}$, $n = 1, 2, 3.......$, having 3 states 1, 2 and 3 $P = \begin{pmatrix} 0.1 & 0.5 & 0.4 \\ 0.6 & 0.2 & 0.2 \\ 0.3 & 0.4 & 0.3 \end{pmatrix}$ and the initial distribution is $p^{(0)} = (0.7, 0.2, 0.1)$.

Find (1) $P\{X_2 = 3\}$ and (2) $P = \{X_3 = 2, X_2 = 3, X_1 = 3, X_0 = 2\}$. (8)

19. (a) (i) State and Prove Wiener-Khinchine theorem. (8)

(ii) Given that the autocorrelation function of a stationary random process is $R_{xx}(\tau) = \frac{25\tau^2+36}{6.25\tau^2+4}$. Predict the mean and variance of the process {X(t)}. (8)

Or

(b) (i) Define cross-correlation function and write the properties of cross-correlation function. (8)

(ii) State and Prove Wiener-Khinchine theorem. (8)

20. (a) (i) The input to a time- invariant, stable linear system is a WSS process, Enumerate that the output will also be a WSS process. (8)

(ii) If *X(t)* is a band limited process such that $S_{xx}(\omega) = 0, |\omega| > \sigma$, then formulate $2[R_{xx}(0) - R_{xx}(\tau)] \leq \sigma^2\tau^2 R_{xx}(0)$. (8)

Or

(b) (i) Show that $S_{yy}(\omega) = S_{xx}(\omega)|H(\omega)|^2$ where $S_{xx}(\omega)$ and $S_{yy}(\omega)$ are the power spectral density functions of the input *X(t)*, output *Y(t)* and *H(ω)* is the system transfer function. (8)

(ii) If the input to a time- invariant, stable linear system is a WSS process, Enumerate that the output will also be a WSS process. (8)