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

Question Paper Code: 34004

B.E. / B.Tech. DEGREE EXAMINATION, DEC 2021

Fourth Semester

Electronics and Communication Engineering

01UMA424 - PROBABILITY AND RANDOM PROCESSES

(Regulation 2013)

Duration: Three hours   Maximum: 100 Marks

(Statistical tables may be permitted)

Answer ALL Questions.

PART A - (10 x 2 = 20 Marks)

1. Define exponential distribution.

2. The mean and variance of the binomial distribution are 4 and 3 respectively. Find $(X \leq 1)$.

3. If $Y = -2X + 3$, find the $Cov(X, Y)$.

4. If the joint pdf of (X,Y) is $f(x,y)= \begin{cases} \frac{1}{4}, 0 \leq x, y \leq 2 \\ 0, otherwise \end{cases}$, find $p\ (x + y \leq 1)$.

5. Prove that a first order stationary random process has a constant mean.

6. State any two properties of Poisson process.

7. Define: Power spectrum.

8. State any two properties of an auto correlation function.

9. Define White noise.

10. State casual system.

PART - B (5 x 16 = 80 Marks)

11. (a) Find moment generating function of gamma distribution and hence find its mean and variance. (16)

Or

(b) The contents of bags I, II, III with balls are as follows. 1 white, 2 black and 3 red; 2white, 1 black and 1 red; 4 white, 5 black and 3 red. One bag is chosen at random and two balls are drawn from it. They happen to be white and red. What is the probability that they come from bags I, II and III? (16)

12. (a) The joint probability density function of a random variable is given by

$$f(x,y)=\begin{cases} Kxye^{-(x^2+y^2)} & , x>0, y>0 \\ 0 \text{ , otherwise} \end{cases}$$

. Find the value of K and prove also that x and y are independent. (16)

Or

(b) (i) The joint pdf of X and Y is given by $f(x,y)=e^{-(x+y)}, x>0, y>0$. Find the probability density function of $U=\frac{X+Y}{2}$. (16)

13. (a) Discuss the stationarity of the random process $X(t)=A\cos(\omega_0 t+\theta)$ if A and ω_0 are constants and θ is uniformly distributed random variable in $(0,2\pi)$. (16)

Or

(b) Prove that the random process {X(t)} and {Y(t)} are defined by $X(t)=A\cos\omega_0 t+B\sin\omega_0 t, Y(t)=B\cos\omega_0 t-A\sin\omega_0 t$ are jointly wide-sense stationary, if A and B are uncorrelated zero mean random variables with the same variance. (16)

14. (a) State and Prove Wiener-Khintchine theorem, and hence find the power Spectral density of a WSS process *X(t)* which has an autocorrelation

$$R_{xx}(\tau)= A_0\left[1-\frac{|\tau|}{T}\right], \quad -T\leq\tau\leq T. \quad (16)$$

Or

(b) The autocorrelation function for a stationary process *X(t)* is given by $R_{XX}(\tau) = 9 + 2e^{-|\tau|}$. Find the mean of random variable $Y = \int_0^2 X(t)\,dt$ and variance of *X (t)*. (16)

15. (a) Given the power spectral density of the continuous process, $\frac{\omega^2 + 2}{\omega^4 + 13\omega^2 + 36}$.

Find the mean square value of the process. (16)

Or

(b) Show that if the input x(t) is a WSS process for a linear system, then output y(t) is a WSS process. (16)