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

Question Paper Code: 54024

B.E. / B.Tech. DEGREE EXAMINATION, DEC 2020

Fourth Semester

Electronics and Communication Engineering

15UMA424 - PROBABILITY AND RANDOM PROCESSES

(Common to Biomedical Engineering)

(Regulation 2015)

(Statistical tables may be permitted)

Duration: One hour Maximum: 30 Marks

PART A - (6 x 1 = 6 Marks)

(Answer any six of the following questions)

1. When X and Y are independent random variables $M_{X+Y}(t)$ = CO1-R

   (a) M_X (t) M_Y(t) (b) M_{XY}(t) (c) M_{YX} (t) (d) M_X (t) + M_Y(t)

2. If the moment generating function of a binomial random variable X is of the form $(0.4e^t + 0.6)^8$, then its mean is CO1-R

   (a) 16 (b) 16/5 (c) 16/3 (d) 14/16

3. If the joint probability density function of a bivariate random variable (X,Y) is f(x,y) = k , 0 < x< 1, 0 < y < 1, then the value of k is CO2-R

   (a) 1 (b) 4 (c) 2 (d) 3

4. When X and Y are uncorrelated random variables , the covariance of X and Y is i.e., cov(x,y) = CO2-R

   (a) 1 (b) -1 (c) 0 (d) 0.5

5. If both parameter set T and state space S are discrete, then the random process is known as CO3-R

   (a) discrete random sequence (b) continuous random process

   (c) discrete random process (d) continuous random sequence

6. Sum of two independent Poisson processes is a CO3-R

   (a) Gaussian process (b) Poisson process (c) Ergodic process (d) Binomial process

7. Auto correlation function is an CO4-R

   (a) odd function (b) complex function (c) invalid function (d) even function

8. If $\{X(t)\}$ and $\{Y(t)\}$ are two random processes then $|R_{XY}(\tau)| \leq$ CO4-R

(a) $\sqrt{R_{XX}(0)R_{YY}(0)}$ (b)$R_{XX}(0) + R_{YY}(0)$ (c)$R_{XX}(0)/R_{YY}(0)$ (d) 0

9. The convolution form of the output Y(t) of a linear time invariant system with the input X(t) and the system weighting function h(t) is CO5-R

(a) $\int_{-\infty}^{\infty} h(u)\ du$ (b)$\int_{-\infty}^{\infty} h(u)\, X(t - u\, du$ (c) $\int_{-\infty}^{\infty} h(u)\, y(t-u)\, du$ (d) $\int_{-\infty}^{\infty} X(t - u\, du$

10. When the auto correlation function of the random telegraph signal process is $R(\tau) = a^2 e^{-2\gamma|\tau|}$ then its power spectral density is given by CO5-R

(a) $\frac{4a^2\gamma}{4\gamma^2 + \omega^2}$ (b) $2\ \delta(\tau)$ (c) $4a^2\gamma$ (d) $\delta(\tau)$

PART – B (3 x 8= 24 Marks)

(Answer any three of the following questions)

11. A student buys 1000 integrated circuits (ICs) from supplier A, 2000 ICs from supplier B, and 3000 ICs from supplier C. He tested the ICs and found that the probability of getting a defective IC given that it came from supplier A is 0.05, probability of getting a defective IC given that it came from supplier B is 0.10 and probability of getting a defective IC given that it came from supplier C is 0.10. If the ICs from the three suppliers are mixed together and one is selected at random, what is the probability that it is defective? CO1 -App (8)

12. The two dimensional random variable (X,Y) has the joint density function $f(x,y) = x + 2y$, $x = 0,1,2$; $y = 0,1,2$ CO2 -App (8)
    (1) Find the value of k.
    (2) Find the marginal distribution of X and Y.
    (3) Find the conditional distribution of Y for X=x.

13. Show that the random process $X(t) = Kcos\,(\omega t + \theta)$ is wide sense stationary if K & ω are constant and 'θ' is uniformly distributed random variable in (0, 2π). CO3- Ana (8)

14. Two random processes X(t) and Y(t) are defined as follows: $X(t) = A\ COS(\omega t + \Theta)$; $Y(t) = B\ Sin(\omega t + \Theta)$ where A, B and ω are constants and Θ is a random variable that is uniformly distributed between 0 and 2π.Find the cross correlation function of X(t) and Y(t). CO4- App (8)

15. Let Y(t) = X(t) + N(t) be a wide-sense stationary process where X(t) is the actual signal and N(t) is a zero-mean noise process with variance σ_N^2 and independent of X(t). Find the power spectral density of Y(t). CO5 -U (8)

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