A **Reg. No. :** | | | | | | | | | | |

Question Paper Code: 94024

B.E./B.Tech. DEGREE EXAMINATION, NOV 2022

Fourth Semester

Bio Medical Engineering

19UMA424 - Probability and Inferential Statistics

(Common to Bio Technology)

(Regulations 2019)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The mean of the random variable is denoted by CO6-R

   (a) E(X) (b) $E(X^2)$ (c) 0 (d) 1

2. Probability of sure event is CO6-R

   (a) 0 (b) 1 (c) 2 (d)10

3. The Conditional density function of Y given X is CO6-U

   (a) f(x) (b) $f(y/x)$ (c) $f(x/y)$ (d) f(y)

4. The marginal density function of X is CO6-R

   (a) f(y) (b) f(x,y) (c) f(x) (d) $f(x/y)$

5. If the Random Process {X(t)} with mean has Auto correlation function $R(\tau) = 16 + 9e^{-|\tau|}$ Then the Variance of the process is CO3- App

   (a) 16 (b)25 (c) 6 (d) 9

6. Autocorrelation function is maximum at $\tau =$ CO6-R

   (a) 0 (b)1 (c) -1 (d) ∞

7. The system is said to be stable if CO6-R

   (a) $\int_{-\infty}^{\infty} h(t)\ dt < \infty$ (b) $\int_{-\infty}^{\infty} h(t)\ dt > \infty$ (c) $\int_{-\infty}^{\infty} h(t)\ dt > 0$ (d) None of the above

8. If $S_{XX}(\omega)$ *and* $S_{YY}(\omega)$ *are the* input and output power spectral density and H(ω) is the transfer function then CO6-R

(a) $S_{XX}(\tau) = |H(\omega)|^2 S_{YY}(\omega)$ (b) $S_{XY}(\tau) = |H(\omega)|^2 S_{XX}(\omega)$

(c) $S_{YY}(\omega) = |H(\omega)|^2 S_{XX}(\omega)$ (d) None of the above

9. Large sample size is _____ CO6-U

(a) 30 (b) >30 (c)<30 (d) None of the above

10. The degrees of freedom for Binomial distribution is _____ CO6-U

(a) (n -1)(n-2) (b) n -2 (c) (n -1)(n-3) (d) n -1

PART – B (5 x 2= 10Marks)

11. If X is geometric variate then find P(X is odd). CO1-App

12. The joint probability mass function of (X, Y) is CO2-App
$P(x, y) = kxy \quad x = 1,2,3; \quad y = 1,2,3$ Determine the value of constant k.

13. Prove that $|R_{xx}(\tau)| \leq R_{xx}(0)$ CO3-U

14. Calculate the value of the system transfer function,if the input of the system with impulse response $h(t) = e^{-3t}U(t)$. CO4-U

15. Give two types of errors in testing a statistical hypothesis CO2-U

PART – C (5 x 16= 80Marks)

16. (a) Let X be a continuous random variable with probability function f(X) =KX(2-X) : 0 < X < 2, Find (i) K (ii) Mean (iii) Variance (iv) distribution function of the random variable X. CO1-App (16)

Or

(b) (i) If $f(x) = \begin{cases} \frac{k}{1+x^2}, -\infty < x < \infty \\ o \quad , elsewhere \end{cases}$ is the Probability Density Function of a Random variable X , (i) Find K (ii) distribution function of F(x) CO1- App (8)

(ii) State and Prove the memory less property for an Exponential Property. CO1- App (8)

17. (a) (i) If X and Y are two random variables having joint probability mass function $f(x, y) = \frac{(2x + y)}{27}$, x= 0, 1, 2 and y = 0, 1, 2 find the marginal distribution of X and Y CO2-App (8)

(ii) If the joint probability density function of X&Y is given by $f(x,y) = e^{-(x+y)}$, $x > 0, y > 0$ Are X & Y independent. CO2-App (8)

Or

(b) (i) If X and Y are two random variables having joint probability mass function $f(x,y) = \frac{(2x+y)}{27}$, x= 0, 1, 2 and y = 0, 1, 2 find the marginal distribution of X and Y — CO2 -App — (8)

(ii) Obtain the Correlation coefficient for the following heights (in inches) of fathers X and their sons Y. — CO2 -App — (8)

X	65	66	67	67	68	60	70	72
Y	67	68	65	68	72	72	69	71

18. (a) (i) Find the Average power of a process X(t) if its PSD is given by $S(\omega) = \frac{10\omega^2 + 35}{(\omega^2+4)(\omega^2+9)}$ — CO3-App — (8)

(ii) A stationary process has an autocorrelation function given by $R(\tau) = 25 + \frac{4}{1+6\tau^2}$ Find the Mean and Variance — CO3-App — (8)

Or

(b) (i) If the Power spectral density of a WSS processes is given by — CO3-App — (8)

$$S(\omega) = \begin{cases} \frac{b}{a}(a - |\omega|) & ; \quad |\omega| \le a \\ 0 & ; \quad |\omega| > a \end{cases}$$

Find the auto correlation function of the Process.

(ii) Find power spectral densities of the following auto correlation function $R(\tau) = e^{\frac{-\alpha^2\tau^2}{2}}$ — CO3-App — (8)

19. (a) A random process X (t) having the autocorrelation function $R_{xx}(\tau) = a\, e^{-2|\tau|}$ Where 'a' is a constant is applied to the input of the system with impulse responseh (t) = e^{-3t} U(t). Find the Power Spectral Density of the output Y (t) and find the autocorrelation of the output Y (t). — CO4-App — (16)

Or

(b) If X (t) is a WSS process and if — CO4-App — (16)

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

(i). $R_{XY}(\tau) = R_{XX}(\tau) * h(\tau)$ (ii). $R_{YY}(\tau) = R_{XY}(\tau) * h(-\tau)$

(iii). $S_{XY}(\omega) = S_{XX}(\omega) * H(\omega)$ (iv). $S_{YY}(\omega) = S_{XX}(\omega) * |H(\omega)|^2$

20. (a) (i) Five coins are tossed 256 times. The number of heads observed is given below. Examine if the coins are unbiased, by employing χ^2 goodness of fit. CO5-Ana (8)

No of Heads	0	1	2	3	4	5
Frequency	5	35	75	84	45	12

(ii) The following data are collected on two characters. CO5-Ana (8)

	Skilled	Non Skilled
Male	40	20
Female	10	30

Using chi-square test to find is there any relation between skilled and Non Skilled

Or

(b) (i) A company keeps records of accidents. During a recent safety review, a random sample of 60 accidents was selected and classifieds by the day of the week on which they occurred. CO5- Ana (8)

Days	Mon	Tue	Wed	Thu	Fri
No.of. accidents	8	12	9	14	17

(ii) Two random samples gave the following results: CO5- Ana (8)

Samples	Size	Sample Mean	Sum of the squares of deviation from the mean
1	10	15	90
2	12	14	108

Examine whether the samples come from the same normal population