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

Fourth Semester

Electronics and Communication Engineering

19UMA422 - Probability and Statistics

(Regulation 2019)

Duration: Three hours   Maximum: 100 Marks

PART A   10*2 =20 Marks

Answer any ten of the following questions

CO1-AP

1. A discrete random variable X with probability distribution

X	0	1	2	3	4
P(X)	a	3a	5a	7a	9a

Calculate the value of the constant 'a'

CO1-AP

2. A continuous random variable has the probability density function is given by

$$f(x) = \begin{cases} Kxe^{-x}, & x > 0 \\ 0, & elsewhere \end{cases}$$, Compute the value of the constant 'K'

3. A random variable X follows an exponential distribution with parameter $\lambda = 1/5$, Calculate the mean of the distribution.   CO1-AP

4. State the conditions for the application of Chi-square Test.

CO6- U

5. If $S_1^2 = 1.833$ and $S_2^2 = 4.178$ then compute the value of F- ratio.   CO2- AP

6. Give two types of errors in testing a statistical hypothesis.   CO6-U

7. What are the basic principles in the design of experiment?

CO6- U

8. Write down the format of ANOVA table for two factors of classification.   CO6- U

9. For a one way classification on 12 observations involving 3 treatments the sum of squares of treatment and sum of squares of total are 8 and 36 respectively, compute the value of the F – ratio.   CO3- AP

10. Compute the mean square value of the auto correlation function $R(\tau) = 16 + 9e^{-|\tau|}$ CO4- AP

11. Compute the mean of auto correlation function $R(\tau) = 25 + \dfrac{4}{1 + 6\tau^2}$ CO4- AP

12. Write down the properties of Power Spectral density.

CO6- U

13. If $\mu_x = 5$ then compute the value of μ_y

14 The input of the system with impulse response $h(t) = e^{-\beta t} U(t)$.
Compute the value of the system transfer function.

15 Compute the average power of the auto correlation function is
$Rxx_{(\tau)} = 3e^{-3|\tau|}$.

PART B 5*16 =80 Marks

Answer any five of the following questions

1. Calculate the Correlation coefficient for the following heights (in inches) of fathers X and their sons Y.

CO1 -App (16)

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

2. Two independent samples of sizes 9 and 7 from a normal population had the following values of the variables.

CO2- Ana (16)

Sample I	18	13	12	15	12	14	16	14	15
Sample II	16	19	13	16	18	13	15	--	--

Analyze the given data, test whether the variances are equal at 5 % level of Significance. (Table value of F (6, 8) = 3.58)

3. The following data represent the number of units production per day burned out by different workers, using 4 different types of machines and Monsoon. The figures (in lakhs of Rs.) are given in the following table.

CO3- Ana (16)

Workers	Machine Type			
	A	B	C	D
1	44	38	47	36
2	46	40	52	43
3	34	36	44	32
4	43	38	46	33
5	38	42	49	39

Analyze the given data (i) Test whether the five men differ with respect to mean productivity and (ii) Test whether the mean productivity is the same for the four different machine types?
(Table value of F (3, 12) = 3.49 and F (4, 12) = 3.26)

CO4- App (16)

4. If the Power spectral density of a WSS processes is given by

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

Using the Fourier transform techniques , Compute the auto correlation function.

5. If a random process X (t) is the input voltage to a circuit and y (t) is the output voltage, X (t) is a stationary random process with $\mu_x = 0$ and autocorrelation function $Rxx_{(\tau)} = e^{-2|\tau|}$. Using the concept of input and output system, Calculate the value of   CO5- App   (16)

   i) μ_y

   ii) Power Spectral Density of the output Y (t)

   (iii) Auto Correlation Function of the output Y (t).

   If the power transfer function is $H(\omega) = \dfrac{R}{(R + iL\omega)}$

6. Using the probability mass function of binomial distribution, Find the moment generating function of the distribution and hence find its mean and variance from moment generating function.   CO1 -App   (16)

7. Two horses A and B were tested according to time (in seconds) to run on a particular track with the following results: CO2- Ana   (16)

Horse A	28	30	32	33	33	29	34
Horse B	29	30	30	24	27	29	--

   Analyze the given data, test whether horse A is running faster than B at 5% level of significance   (Table value of t is 2.201)

8. Using the properties of auto correlation function, Compute the average power of a process X (t) if its power spectral density is given by   CO4- App   (16)

   $$S_{xx}(\omega) = \dfrac{10\,\omega^2 + 35}{(\omega^2 + 4)(\omega^2 + 9)},$$