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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

M.Tech(Integrated)

SEM: IV - THEORY EXAMINATION (2023 - 2024)

Subject: Engineering Mathematics- IV

Time: 3 Hours

Max. Marks: 100

General Instructions:

IMP: Verify that you have received the question paper with the correct course, code, branch etc.

1. This Question paper comprises of **three Sections -A, B, & C**. It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.
2. Maximum marks for each question are indicated on right -hand side of each question.
3. Illustrate your answers with neat sketches wherever necessary.
4. Assume suitable data if necessary.
5. Preferably, write the answers in sequential order.
6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION A

20

1. Attempt all parts:-

- 1-a. Curve which are more sharply peaked than normal curve is called: (CO1) 1
- (a) Leptokurtic curve
 - (b) Mesokurtic curve
 - (c) Platykurtic curve
 - (d) None of these
- 1-b. Karl Pearson's coefficient of skewness of a distribution is 0.32, its S.D. is 6.5 and mean is 29.6. then mode of the distribution is: (CO1) 1
- (a) 27
 - (b) 27.52
 - (c) 28.20
 - (d) 27.3
- 1-c. Z-test is used when: (CO2) 1
- (a) When Sample size is small
 - (b) When Sample size is Large

(c) When Sample size is small or large

(d) When Sample size takes any value

- 1-d. The distribution used to compare two variances is? (CO2) 1
- (a) T – Test
 - (b) Normal Distribution
 - (c) Poisson Distribution
 - (d) F – Test
- 1-e. If $\sum P(x) = k^2 - 8$ then, the value of k is? (CO3) 1
- (a) 0
 - (b) 1
 - (c) 3
 - (d) Insufficient data
- 1-f. The joint pdf of X and Y is given by: 1
- $$f(x,y) = \begin{cases} ke^{-(x+y)}, & x \geq 0, y \geq 0 \\ 0, & \text{otherwise} \end{cases}$$
- , then find the value of k. (CO3)
- (a) 2
 - (b) 1
 - (c) 0
 - (d) 1/2
- 1-g. Consider a random variable with exponential distribution with $\lambda=1$, then the probability $P(X>3)$ is: (CO4) 1
- (a) e^{-3}
 - (b) e^{-1}
 - (c) e^{-2}
 - (d) e^3
- 1-h. The shape of the Normal Curve is _____ (CO4) 1
- (a) Bell Shaped
 - (b) Circular Shaped
 - (c) Spiked Shaped
 - (d) Spiral Shaped
- 1-i. Probability of getting a numbered card when a card is drawn from the pack of 52 cards: (CO5) 1
- (a) 5/13

- (b) 9/13
- (c) 4/13
- (d) None of these

- 1-j. If the scaling function $\Phi(t)$ is defined in the range $[0,2]$ then $\Phi(2t)$ will be defined in: (CO5) 1
- (a) $[0,1]$
 - (b) $[0,0.5]$
 - (c) $[0,4]$
 - (d) None of these

2. Attempt all parts:-

- 2.a. Write down the formula for first four Moments about mean. (CO1) 2
- 2.b. Write the short note on Confidence limits. (CO2) 2
- 2.c. Define conditional probability distribution. (CO3) 2
- 2.d. Find the mean of exponential distribution. (CO4) 2
- 2.e. Write the necessary properties of a function to become wavelet? (CO5) 2

SECTION B

30

3. Answer any five of the following:-

- 3-a. The first four moments of a distribution are 3, 10.5, 40.5, 168. Comment upon the nature of the distribution. (CO1) 6

- 3-b. Calculate the rank correlation coefficient between x and y from the following data – (CO1) 6

x	15	20	27	13	45	60	20	75
y	50	30	55	30	25	10	30	70

- 3-c. A die is thrown 276 times and the results of these throws are given below: (CO2) 6

No. appeared on die	1	2	3	4	5	6
Frequency	40	32	29	59	57	59

Test whether the die is biased or not. Given that tabular value of Chi-Square at 5% LOS for 5 degree of freedom is 11.09.

- 3-d. Two independent sample of Sizes 7 and 6 had the following values: 6
- Sample A: 28 30 32 33 31 29 34
- Sample B: 29 30 30 24 27 28 -

Examine whether the samples have been drawn from normal populations having the same variance. Given the tabulated value for d.f. (5, 6) at 5% LOS is 4.39. (CO2)

- 3.e. The joint probability distribution of two random variables X and Y is given by: 6
 $P(X=0, Y=1) = 1/3, P(X=1, Y=-1) = 1/3, P(X=1, Y=1) = 1/3.$
 Find i) marginal distribution of X and Y
 ii) the conditional probability distribution of X given Y=1. (CO3)
- 3.f. Find the mean and variance of the theoretical binomial distribution. (CO4) 6
- 3.g. Calculate the number of words that can be formed using all the letters of the world ALLAHABAD: (CO5) 6
 (i) When the vowel occupy the even position.
 (ii) Both L do not occur together.

SECTION C

50

4. Answer any one of the following:-

- 4-a. An incomplete distribution of families according to their expenditure per week is given below. The median and mode for the distribution is ₹ 25 and ₹ 24 respectively. Calculate the missing frequencies. (CO1) 10

Expenditure	0-10	10-20	20-30	30-40	40-50
No. of families	14	?	27	?	15

- 4-b. Determine the normal equation if the curve $y = \frac{C_0}{x} + C_1\sqrt{x}$ is fitted to the data $(x_i, y_i), i = 1, 2, \dots, n$ by method of least square. Hence fit this curve to the data - (CO1) 10

x	0.1	0.2	0.4	0.5	1	2
y	21	11	7	6	5	6

5. Answer any one of the following:-

- 5-a. The following figures relate to the production in kg of three varieties I, II, III of wheat shown in 12 plots: 10

Variety I	14	16	18		
Variety II	14	13	15	22	
Variety III	18	16	19	19	20

Determine if there is a significant difference in production of three varieties? Given tabulated values for degree of freedom (2, 9) at 5% LOS is 4.26. (CO2)

- 5-b. In a manufacturing process, the number of defectives found in the inspection of 20 lots of 100 samples is given below: 10

Lot No. : 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
20
Defective: 5 4 3 5 4 6 9 15 11 6 7 6 3 5 4 2 8 7 6
4

Determine the control limits of P-chart and state whether the process is in control. (CO2)

6. Answer any one of the following:-

6-a. If the joint distribution function of X and Y is given by: 10

$$F_{XY}(x,y) = \begin{cases} 2, & 0 < x < 1, 0 < y < x \\ 0, & \text{elsewhere} \end{cases}$$

- a) Find the marginal densities of X and Y ,
b) Are X and Y independent? (CO3)

6-b. A random variable X has the following probability function: (CO3) 10

x	0	1	2	3	4	5	6	7
p(x)	0	k	2k	2k	3k	k ²	2k ²	7k ² +k

- Then (i) find k
(ii) Evaluate P(X<6), P(X≥6), P(3<X≤6)
(iii) Find the minimum value of x so that P(X≤x) > 1/2

7. Answer any one of the following:-

7-a. State the Poisson Probability distribution. Prove that Poisson distribution is limiting case of Binomial distribution. (CO4) 10

7-b. In 800 families with 5 children each, how many families would be expected to have- (CO4) 10

- I. 3 boys and 2 girls
- II. 2 boys and 3 girls
- III. No girl
- IV. At most 2 girls. (Assume probabilities for boys and girls to be equal)

8. Answer any one of the following:-

8-a. Let A = R - {3} and B = R - {2}. Consider the function f: A → B defined by $f(x) = \frac{x-2}{x-3}$. 10

Determine if the function f is one - one and onto. (CO5)

8-b. If the number 3422213pq is divisible by 99, find the missing digits p and q. (CO5) 10