

Code No: 153CH

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**B. Tech II Year I Semester Examinations, April/May - 2023****MATHEMATICAL AND STATISTICAL FOUNDATIONS****(Common to CSE(CS), CSE(DS), AI&ML)****Time: 3 Hours****Max. Marks: 75****Note:** i) Question paper consists of Part A, Part B.

ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.

iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A**(25 Marks)**

- 1.a) What are Fermat numbers? [2]
- b) Which decimal digits occur as the final digit of a fourth power of an integer? [3]
- c) Define linear regression. [2]
- d) Define Random variable. Give an example for it. [3]
- e) Mention the various possible areas under the Normal curve. [2]
- f) Define Population and Sample with examples. [3]
- g) How do you estimate the variance of a Population? [2]
- h) Outline the procedure to be followed for Hypothesis testing. [3]
- i) Define the Random process and give an example. [2]
- j) What do you understand by Markov chain process and state all the types of Markov chains? [3]

PART – B**(50 Marks)**

- 2.a) State and prove the Lame's Theorem.
- b) Find all solutions of the congruence $3x \equiv 12 \pmod{6}$. [5+5]

OR

- 3.a) Show that every common multiple of the positive integers a and b is divisible by the least common multiple of a and b.
- b) What is System of Linear congruences? Give example and applications of it. [5+5]

- 4.a) Define Correlation. Find the coefficient of correlation of x and y from the given data:

x	78	89	97	69	59	79	68	57
y	125	137	156	112	107	138	123	108

- b) A continuous Random Variable X has the distribution function

$$f(x) = \begin{cases} 0, & \text{if } x \leq 1 \\ k(x-1)^2, & \text{if } 1 \leq x \leq 3 \\ 1, & \text{if } x > 3 \end{cases}$$

Find (i) f(x) (ii) k (iii) mean and (iv) Variance.

[5+5]

OR

5.a) Given that $p(x=2) = 9p(x=4) + 90 p(x=6)$ for a Poisson variate X .

Find: (i) $p(x < 2)$ and (ii) $p(x > 4)$

b) Fit a Straight line $y=a+bx$ to the following data by the method of least squares: [5+5]

x	0	1	3	6	8
y	1	3	2	5	4

6.a) Write the properties and applications of Normal Distribution.

b) i) Explain Sampling distribution with example.

ii) State Central Limit Theorem.

[5+5]

OR

7.a) Find the mean and standard deviation of a normal distribution in which 7% of items are under 35 and 89% are under 63.

b) A population consists of six numbers 4,8,12,16,20,24 consider all samples of size two, which can be drawn without replacement from this population. Find

i) The population mean.

ii) The population standard deviation.

iii) The mean of the sampling distribution of means.

iv) The standard deviation of the sampling distribution of means.

[5+5]

8.a) Explain the method for the test of significance for a single mean for large samples.

b) According to the norms established for a mechanical aptitude test, persons who are 18 years old should average 73.2 with a standard deviation of 8.6. If 45 randomly selected persons of that age averaged 76.7, test the null hypothesis $\mu = 73.2$ against the alternative hypothesis $\mu > 73.2$ at the 0.01 level of significance. [5+5]

OR

9. The Nicotine Content in Milligrams of Two Samples of Tobacco Were found to be as follows and test whether there is any difference between 2 means at 0.05 level. [10]

Sample A	24	27	26	23	25	28
Sample B	29	30	30	31	24	36

10. Define Periodic and Aperiodic states. For the given transition probability matrix p and check whether the states are periodic or aperiodic. [10]

$$p = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1/2 & 1/2 & 0 \end{bmatrix}$$

OR

11.a) What is a Steady-state condition in a Markov chain? How is it related to the long-term behavior of the chain?

b) Illustrate how the process of Markov analysis can be used to study the behavior of a Markov chain. [5+5]