

Duration: 3hrs

[Max Marks:80]

- N.B.:** (1) Question No 1 is Compulsory.
 (2) Attempt any three questions out of the remaining five.
 (3) All questions carry equal marks.
 (4) Assume suitable data, if required and state it clearly.

1 Attempt any **FOUR** [20]

a By using matrices, solve the following system of linear equation [5]

$$x + y + z = 3$$

$$x + 2y + 3z = 4$$

$$x + 4y + 9z = 6$$

b What are Eigen vectors? Describe the properties of Eigen vectors. [5]

c Obtain the graph of $y = e^{-4x}$ [5]

d Describe feature engineering [5]

e A die rolled 3 times. Let Y be the number of times a 6 is rolled find (i) The probability distribution of Y (ii) Mean of Y (iii) Cumulative Distribution Function of Y. [5]

2 a Find the SVD [10]

$$A = \begin{bmatrix} 2 & 2 \\ -1 & 1 \end{bmatrix}$$

b In a manufacturing industry, item supplied on a critical raw material have been received in ten lots against a monthly order or 200 units. Test at 5% level of significance whether the supplies are uniform (Chi Square method) [10]

Lot	1	2	3	4	5	6	7	8	9	10
No of Units	25	12	21	18	14	20	30	15	22	23

3 a Describe stem and leaf plot. Display data in stem and leaf plot the following 20 student's right data (cm). [10]

143, 163, 154, 159, 172, 165, 162, 171, 146, 165, 176, 145, 165, 182, 175, 186, 160, 158, 167, 172. Find mode.

- b Write a short note on linear Discriminant Analysis (LDA) and Principal Component Analysis (PCA). [10]
- 4 a Draw two Pie diagram to represent the following data given profits of different patterns in a firm. [10]

Partner	Profit (in Rs) 2021	Profit (in Rs) 2022
A	14	9
B	16	10
C	29	27
D	17	25
E	16	18
F	8	11
Total	100	100

- b Explain types of data. Compare and contrast quantitative and qualitative data. [10]
- 5 a Partition the given data into 4 bins using Equi-depth binning method and perform smoothing according to the following method [10]
- Smoothing by bin mean
 - Smoothing by bin median
 - Smoothing by bin boundaries

Data : 11, 13, 13, 15, 15, 16, 19, 20, 20, 20, 21, 21, 22, 23, 24, 30, 40, 45, 45, 45, 71, 72, 73, 75

- b Minimize $f(x_1, x_2) = 4x_1 - 2x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$. Starting from point $x_1 = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$ [10]
- 6 a i) Non gradient based optimization technique. [10]
- ii) Supervised Learning Model

- b Compute the SD for the following sets [10]
- Set 1 = [0 8 12 20]
- Set 2 = [8 9 11 12]
