

OR

- 6 a. Find the maximum and minimum values of $Q(x) = 9x_1^2 + 4x_2^2 + 3x_3^2$ subject to the constraint $X^T X = 1$. (10 Marks)

- b. Find the singular value decomposition of $A = \begin{bmatrix} 1 & -1 \\ -2 & 2 \\ 2 & -2 \end{bmatrix}$. (10 Marks)

Module-4

- 7 a. Find the correlation coefficient and the line of regression of y on x for the

x	1	2	3	4	5
y	2	5	3	8	7

(10 Marks)

- b. Fit a straight line for the following data:

x	1	2	3	4	5	6	7
y	9	8	10	12	11	13	14

(10 Marks)

OR

- 8 a. Show that $\tan \theta = \left(\frac{1-r^2}{r} \right) \left(\frac{\sigma_x \sigma_y}{\sigma_x^2 + \sigma_y^2} \right)$ where θ is acute angle. Explain the significance of the formula when $r = 0$ and $r = \pm 1$. (10 Marks)

- b. Fit a parabola $y = a + bx + cx^2$ for the following data:

x	1	2	3	4
y	1.7	1.8	2.3	3.2

(10 Marks)

Module-5

- 9 a. A random variable X has the following pmf for various values of X.

X	0	1	2	3	4	5	6	7	8
F(X)	K	3K	5K	7K	9K	11K	13K	15K	17K

Solve: (i) Value of K (ii) $P(X < 3)$, $P(X \geq 3)$, $P(0 < X \leq 5)$

(iii) Find cumulative distribution function

(iv) What is the smallest value of X for which $P(X \leq x) > 0.5$? (10 Marks)

- b. A certain injection administered to each of 12 patients resulted in the following increases of B.P: 5, 2, 8, -1, 3, 0, 6, -2, 1, 5, 0, 4. Can it be concluded that the injection will be, in general, accompanied by an increase in BP? (10 Marks)

OR

- 10 a. A random variable X has the following pdf:

$$P(X) = \begin{cases} Ke^{-x} & 0 < x < 1 \\ 0 & \text{otherwise} \end{cases}$$

Solve: (i) Value of constant K (ii) Mean (iii) Variance (iv) $F(0.5)$ (10 Marks)

- b. The following data show defective articles produced by 4 machines:

Machine	A	B	C	D
Production time	1	1	2	3
No. of defective	12	30	63	98

Do the figures indicate a significant difference in the performance of the machines?

[Use $\chi_{0.05}^2 (\gamma = 3) = 7.815$] (10 Marks)