

Note: Answer ALL questions by choosing any two parts from each question.
ALL questions carry equal marks. Assume suitable missing data, if any.

1. a) Use Newton's method to find the smallest root of the equation $e^x = x^3 + \cos 25x$ to four places of decimal.

- b) Using Gauss elimination method solve

$$5x_1 + x_2 + x_3 = 7$$

$$x_1 + x_2 + 6x_3 = 8; \quad x_1 + x_2 + x_3 = 3$$

- c) Solve the following equations by Gauss-Seidal method:

$$10x_1 - 2x_2 - x_3 = 10; \quad -2x_1 + 10x_2 - x_3 = -14$$

$$-x_1 - x_2 + 10x_3 = 20$$

2. a) Using Euler's method solve $y' = x + y + xy, y(0) = 1$ and find $y(0.1)$ by taking $h = 0.025$

- b) Using R-K method, solve $y' = \frac{y^2 - x^2}{y^2 + x^2}$

with $y(0) = 1$ at $x = 0.2, 0.4$.

- c) Solve the boundary value problem for $x = 0.5$:

$$y'' + y + 1 = 0, \quad y(0) = y(1) = 0,$$

using finite difference method.

3. a) Calculate the correlation coefficient and the lines of regression from the following data:

x	57	58	59	59	60	61	62	64
y	77	78	75	78	82	82	79	81

- b) A controlled manufacturing process is 0.2% defective. What is the probability of taking 2 or more defectives from a lot of 100 pieces? (I) By using binomial distribution. (II) By using Poisson approximation.

- c) In a large institution 2.28% of employees receive income below Rs. 4500 and 15.8% of employees receive income above Rs. 7500 p.m.

Assuming the income follows normal distribution. Find the mean and S. D of the distribution.

4. a) The nicotine content in milligrams of two samples of tobacco were found to be as follows:

Sample A	24	27	26	21	25	
Sample B	27	30	28	31	22	36

Can it be said that two samples come from the same normal population ($t_{0.05} = 2.26, F_{0.05} = 6.26$).

- b) The following figures show the distribution of digits in numbers chosen at random from a telephone directory.

Digits	0	1	2	3	4	5	6	7	8	9
frequency	1126	1107	997	966	1075	933	1107	972	964	853

Test whether the digits may be taken to occur equally frequently in the directory ($\chi^2_{0.05} = 16.919$)

- c) Two groups of 100 people each were taken for testing the use of a vaccine 15 persons contracted the disease out of the inoculated persons, while 25 contacted the disease in the other group. Test the efficacy of the vaccine using χ^2 value ($\chi^2_{0.05} = 3.184$).

5. a) Using graphical method solve the following LPP:

$$\text{Minimize } z = 2x_1 + 3x_2 \text{ s.t}$$

$$x_2 - x_1 \geq 2; \quad 5x_1 + 3x_2 \leq 15; \quad 2x_1 \geq 1; \quad x_2 \leq 4,$$

$$x_1, x_2 \geq 0$$

- b) Solve the following LPP by simplex method:

$$\text{Maximize } z = 3x_1 + 2x_2 + 2x_3 \text{ s.t.}$$

$$2x_1 - x_2 + 3x_3 \leq 18; \quad x_1 + x_2 + 2x_3 \leq 12; \quad x_1, x_2, x_3 \geq 0.$$

- c) Solve the following LPP by simplex method:

$$\text{Maximize } z = 5x_1 + 3x_2 + 3x_3 \text{ s.t.}$$

$$4x_1 + 4x_2 + 3x_3 \leq 12000; \quad 0.4x_1 + 0.5x_2 + 0.3x_3 \leq 1800;$$

$$0.2x_1 + 0.2x_2 + 0.1x_3 \leq 12000; \quad x_1, x_2, x_3 \geq 0.$$