

19

N.B.:

- Question No. 1 is compulsory.
- Answer any **three** from the remaining five questions.
- Assume suitable data if necessary and justify the same.
- Figures to the right indicate the marks.

1 Each question carry 5 marks

20

a Define the following:

- (i) True error and Approximate error
- (ii) Absolute error and Relative error

b Write the algorithm for computing a simple root of an equation $f(x)=0$ using bisection method.

c Write the formula to calculate error in interpolation. Write any one method to reduce it.

d Compare Picard's method with Runge Kutta method for solving a differential equation.

2 a Give the algorithm for secant Method. Find the root of $\cos(x)=3x-1$ using secant method with initial guesses of $x_{i-1} = 1$ and $x_i=2$ and iterate till the relative error is less than 0.5%. 10

b Solve the following system of equations using LU decomposition. 10

$$3x_1 - 0.1x_2 - 0.2x_3 = 7.85$$

$$0.1x_1 + 7x_2 - 0.3x_3 = -19.3$$

$$0.3x_1 - 0.2x_2 + 10x_3 = 71.4$$

[TURN OVER

- 3 a What is meant by curve fitting with sinusoidal function? Find a sinusoidal function that fits the temperature of a city for 6 months with the following data. Use this data to find the mean, amplitude and time of maximum temperature.

Month	1	2	3	4	5	6
Temperature	21°C	6°C	10°C	28°C	44°C	40°C

- b Solve the following NLPP using Kuhn Tucker Method. 10

$$\text{Max } Z = 10x_1 + 10x_2 - x_1^2 - x_2^2$$

$$\text{subjected to } x_1 + x_2 \leq 8, \quad -x_1 + x_2 \leq 5, \quad x_1, x_2 \geq 0.$$

- 4 a Solve the following differential equations using fourth order Runge Kutta method for $t=1$ Given the initial condition when $t=0$ as, $y(0)=1, z(0)=2$ and step size $h=1$. 10

$$\frac{dy}{dt} = z; \quad \frac{dz}{dt} = -z + \sin(ty);$$

- b What do you understand by extrapolation and interpolation? What are the various methods for interpolation? Using Newton's Divided difference method of order '3' find 'y' at $x = 2.5$ from the following data with maximum accuracy. 10

x	0	1.5	2	3	3.5
y	1	-1.625	-1	7	15.875

- 5 a What are the necessary conditions for solving multivariable optimization using Lagrange's Multiplier. Solve the following optimization problem using Lagrange's Multiplier. 10

$$\text{Optimize } Z = 7x_1 - 0.3x_1^2 + 8x_2 - 0.4x_2^2$$

$$\text{subjected to } 4x_1 + 5x_2 = 100, \quad x_1, x_2 \geq 0.$$

[TURN OVER

b Define Feasible solution and Optimal feasible solution. 10

Solve the following LPP and identify the Feasible & Optimal feasible region graphically.

$$\begin{aligned} \text{Max } Z &= 40x_1 + 50x_2 \\ \text{subjected to } &3x_1 + x_2 \leq 9 \\ &x_1 + 2x_2 \leq 8 \\ &x_1, x_2 \geq 0 \end{aligned}$$

6 a Solve the following LP problem using simplex method. 10

$$\begin{aligned} \text{Min } Z &= -3x_1 - 2x_2 \\ \text{subjected to } &x_1 - x_2 \leq 1 \\ &-3x_1 + 2x_2 \geq -6 \\ &x_1, x_2 \geq 0 \end{aligned}$$

b Explain what is meant by multi step method to solve differential equation? 10

What is the advantage of this method over single step method? Use Adam Bashforth's method to solve $\frac{dy}{dx} = 4e^{0.8x} - 0.5y$ in the interval $(-3, 1)$ with a step size of 1. Do only two iterations. The previous values of x and y are given in the following table.

X	-3	-2	-1	0
Y	-4.547	-2.306	-0.393	2