[This question paper contains 4 printed pages.]

3073 *Your Roll No.* .....

ME **J**

Paper – ME.503

NUMERICAL ANALYSIS

Time : 3 hours *Maximum Marks : 100*

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt **all** *questions, selecting any* **two** *parts from each question.* **All** *questions carry equal marks.*

1. (a) Apply Gauss elimination method to solve the system of equations correct upto 3rd decimal place.

$$33X_1 + 16X_2 + 72X_3 = 359$$

$$-24X_1 - 10X_2 - 57X_3 = 281$$

$$-8X_1 - 4X_2 - 17X_3 = 85$$

(b) Apply Gauss Seidal iteration method to solve the system of equation upto 3rd decimal place

$$27X + 6Y - Z = 85$$

$$6X + 15Y + 2Z = 72$$

$$X + Y + 54Z = 110$$

P.T.O.

(c) Use Crout's method to solve the system of equation correct upto 3rd decimal place

$$3X + 2Y + 7Z = 4$$

$$2X + 3Y + Z = 5$$

$$3X + 4Y + Z = 7$$

2. (a) Using Regula-falsi method solve the equation correct upto 5th decimal place

$$3X - \cos X - 1 = 0$$

(b) Using Newton-Raphson method solve the equation correct upto 5th decimal place $xe^x - 1 = 0$.

(c) Solve the system of non-linear equations using Newton-Raphson method

$$x^2 + y = 11, \quad y^2 + x = 7$$

starting with $x_0 = 3.5$, $y_0 = -1.8$, correct upto 3rd decimal place.

3. (a) Calculate y(337.5) from the given table,

x:	310	320	330	340	350	360
y(x):	2.49136	2.50513	2.51851	2.53148	2.54407	2.55630

(b) Find the velocity of the slider at t = 0.3 sec. from the given table

t =	0	0.1	0.2	0.3	0.4	0.5	0.6
x(distance) =	30.13	31.62	32.87	33.64	33.95	33.81	33.24

(c) Solve the differential equation to find y(0.3) correct upto 4th decimal place, using modified Euler's method

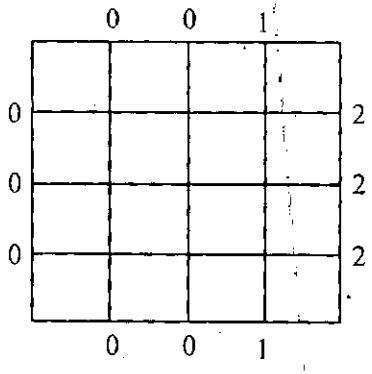
$$\frac{dy}{dx} = 3x + \frac{y}{2}, \quad y(0) = 1.$$

4. (a) Compute the integral $I = \sqrt{\frac{2}{\pi}} \int_0^1 e^{-\frac{x^2}{2}} dx$ taking $h = 0.125$ using Simpson's 1/3rd rule correct upto 5th decimal place. Also estimate the error in the result.

(b) Solve $\frac{dy}{dx} = y + e^x$, given that $y(0) = 0$ to find $y(0.2)$ in two steps using Runge-Kutta method, correct upto 4th decimal place.

(c) Find $y(1.0)$ from $\frac{dy}{dx} = \frac{x+y}{2}$ using Milne's Predictor-corrector method, given that $y(0) = 2$, using step length 0.2, correct upto 4th decimal place.

5. (a) Solve $u_{xx} + u_{yy} = 0$ for the square mesh in 3-iterations and upto 3rd decimal place.



(b) Solve the Poission's equation $\nabla^2 u = -2$, $0 \le x, y \le 1$ subject to the boundary condition $u = 0$ on the sides $x = 0$, $x = 1$, $y = 0$, and $y = 1$, taking $h = \frac{1}{4}$ in 3-iterations upto 3rd decimal place.

(c) Solve the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ subject to the condition $u(x, 0) = \sin \pi x$, $0 \le x \le 1$

$u(0, t) = u(1, t) = 0$ using Crank Nicolson method taking $h = \frac{1}{3}$ and $k = \frac{1}{36}$. Carryout computations for two levels, upto 2nd decimal place.