CBCS SCHEME

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18CV752

Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024
Numerical Methods and Applications

Time: 3 hrs. Max. Marks: 100

Note: 1. ***Answer any FIVE full questions, choosing ONE full question from each module.***
2. ***Missing Data may be suitably assumed.***

Module-1

1 a. Solve the following system of equation by Gauss elimination method.

$$x + y + z = 9$$
$$x - 2y + 3z = 8$$
$$2x + y - z = 3$$

(10 Marks)

b. Apply Gauss – Siedal iteration method to solve the following equation

$$5x + 2y + z = 12$$
$$x + 4y + 2z = 15$$
$$x + 2y + 5z = 20$$

Carry out 4 iterations taking the initial approximation with solution as (1, 0, 3). **(10 Marks)**

OR

2 a. Solve the following equation by Gauss – Jordan method.

$$2x + y + z = 10$$
$$3x + 2y + 3z = 18$$
$$x + 4y + 9z = 16$$

(10 Marks)

b. Use Newton – Raphson method to find $\sqrt[3]{37}$ correct to 3 decimal places. **(10 Marks)**

Module-2

3 a. Find y(1.4) given the data use forward interpolation.

x	1	2	3	4	5
y	10	26	58	112	194

(10 Marks)

b. Find the missing value from the table

x	1	2	4	5	6
y	14	15	5	-	9

(10 Marks)

OR

4 a. Use Lagrange's interpolation formula to fit a polynomial for the data. Hence estimate y at x = 2.

x	0	1	3	4
y	-12	0	6	12

(10 Marks)

b. The following value of x and y are given

x	1	2	3	4
y	1	2	5	11

Find the cubic spline and calculate y(1.5). **(10 Marks)**

Module-3

5 a. Use Simpson's 1/3rd rule to find $\int_0^{0.6} e^{-x^2} dx$ by taking 6 intervals. **(10 Marks)**

b. Evaluate the integral $\int_0^{0.5} \frac{x}{\sin x} dx$ using Romberg's method. **(10 Marks)**

OR

6 a. Using 3 point Gauss quadrature evaluates $\int_{0.2}^{0.6} \frac{1}{1+x^2} dx$. **(10 Marks)**

b. Apply Simpson's rule to evaluate the integral
$I = \int_2^{2.6} \int_4^{4.4} \frac{dx\ dy}{xy}$. Taking 2 sub intervals. **(10 Marks)**

Module-4

7 a. Find by Taylor series method, value of y at x = 0.1 and x = 0.2 to five decimal places from $\frac{dy}{dx} = x^2y - 1$, y(0) = 1. **(10 Marks)**

b. Using Euler's method find y at x = 0.2. Given,
$\frac{dy}{dx} = 3x + \frac{1}{2}y$, where $y_{(0)} = 1$. Taking h = 0.1. Perform 3 iterations at each steps. **(10 Marks)**

OR

8 a. Use fourth order Runge – Kutta method to find y(0.2) for the equation $\frac{dy}{dt} = \frac{y-x}{y+x}$, y(0) = 1 taking h = 0.2. **(10 Marks)**

b. Given $\frac{dy}{dx} = x - y^2$, y(0) = 0, y(0.2) = 0.02, y(0.4) = 0.0795, y(0.6) = 0.1762.
Find y at x = 0.8 by Adam's Bashforth method. **(10 Marks)**

Module-5

9 Solve the elliptic equation $U_{xx} + U_{yy} = 0$ for the following square mesh with the boundary values shown in Fig Q9

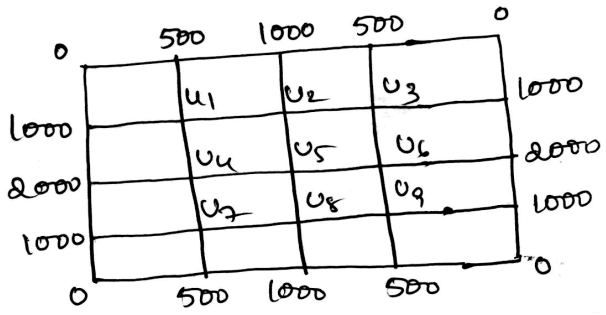

Fig Q9 **(20 Marks)**

OR

10 Solve by Crank Nicolson formula
$\frac{\partial^2 u}{\partial x^2} - \frac{\partial u}{\partial t} = 0,\ 0 \le x \le 1$
u(0, t) = 0, u(1, t) = 0
u(x, 0) = 100x (1 – x). Take h = 0.25 for one step. **(20 Marks)**