Roll No											

PRESIDENCY UNIVERSITY
BENGALURU

SET A

SCHOOL OF ENGINEERING
END TERM EXAMINATION - MAY/JUNE 2024

Semester : Semester IV - 2022
Course Code : MAT2003
Course Name : Numerical Methods for Engineers
Program : Mathematics for B.Tech

Date : June 06, 2024
Time : 09.30AM to 12.30AM
Max Marks : 100
Weightage : 50%

Instructions:
(i) Read all questions carefully and answer accordingly.
(ii) Question paper consists of 3 parts.
(iii) Scientific and non-programmable calculator are permitted.
(iv) Do not write any information on the question paper other than Roll Number.

PART A

Answer any FIVE questions **5Q X 4M = 20M**

1. Identify the lower triangular matrix for the equations $4x+y+3z=11; 3x+4y+2z=11; 2x+3y+z=7$ using the LU decomposition method.

(CO1) [Knowledge]

2. Identify the root of the equation $x^3+5x-11=0$ that lies between 1 and 2. Find the real root by the Newton-Raphson method, and carry out for 2 iterations only.

(CO1) [Knowledge]

3. State the formula of Simpson's 3/8 rule and Trapezoidal rule for the function $y=f(x)$ taking the values $y_0, y_1, ..., y_n$ corresponding to $x_0, x_1, ..., x_n$.

(CO2) [Knowledge]

4. Using Newton's divided difference formula to find the $f(3)$ given the data:

x	0	2	6
$f(x)$	648	704	792

(CO2) [Knowledge]

5. For y_0, y_1, y_2 corresponding to x_0, x_1, x_2 define the forward difference Δy_0 and $\Delta^2 y_0$. Further, write Newton's forward interpolation formula.

(CO2) [Knowledge]

6. Identify $y_1^{(1)}$ using modified Euler's formula if $\frac{dy}{dx} = (x+y)^2, y(0)=1$ and $h=0.2$

(CO3) [Knowledge]

7. For the differential equation $\frac{dy}{dx} = x+y^2, y(0)=1, h=0.2$ find K_1 and K_2 from Runge-Kutta 4^{th} order method.

(CO3) [Knowledge]

PART B

Answer any FIVE questions **5Q X 10M = 50M**

8. Obtain the solution of the system of equations $2x + y + 6z = 9, 8x + 3y + 2z = 13$ and $x + 5y + z = 7$ by using Gauss Seidel iteration method correct to three decimal places. Carry out three iterations.

(CO1) [Comprehension]

9. Estimate the root of the equation $4x - e^x = 0$ that lies between 2 and 3 by Newton-Raphson method.

(CO1) [Comprehension]

10. Compute $f(9)$ using (i) Newton's divided difference formula (ii) Lagrange's interpolation formula for the following table.

x	5	7	11	13
$f(x)$	150	392	1452	2366

(CO2) [Comprehension]

11. Using the appropriate interpolation formula, compute $f(1.5)$ and $f(4.5)$, given that

x	1	2	3	4	5
$f(x)$	1	8	27	64	125

12. Compute $y(0.3)$ given that $\frac{dy}{dx} = x + y, y(0) = 1 \; and \; h = 0.3$ using modified Euler's method and correct it to four decimal places.

(CO3) [Comprehension]

13. Given $\frac{dy}{dx} = x^3 + y, y(0) = 2, h = 0.1$, estimate $y(0.2)$ by Runge-Kutta method of fourth order.

(CO3) [Comprehension]

PART C

Answer any TWO questions **2Q X 15M = 30M**

14. Apply LU decomposition method to solve the system of linear equations,

$$3x + y - z = 3, 2x - 8y + z = -5 \; and \; x - 2y + 9z = 8$$

(CO1) [Application]

15. Find approximate value of $\int_0^6 x \; sec(x) \; dx$ using (i) Trapezoidal rule (ii) Simpson's $\frac{1}{3}^{rd}$ rule (iii) Simpson's $\frac{3}{8}^{th}$ rule, by dividing the range into 7 ordinates.

(CO2) [Application]

16. Determine Modified Euler's method to solve $\frac{dy}{dx} = x + |\sqrt{y}| \;\; , \;\; y(0) = 1$ for the range $0 < x < 0.6$ taking $h = 0.2$. (carry out computations correct to 3 decimal places)

(CO3) [Application]