



**PRESIDENCY UNIVERSITY
BENGALURU**

SCHOOL OF ENGINEERING
End Term Examination – AUG 2024

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

Date: 05/08/2024
Time: 9:30am to 12:30pm
Max Marks: 100
Weightage: 50%

Instructions:

- (i) Read all the questions carefully and answer accordingly.
(ii) Question paper consists of 3 parts.
(iii) Scientific and Non-programmable calculators 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 $3x + 2y + 7z = 4$, $2x + 3y + z = 5$, $3x + 4y + z = 7$ using the equations LU decomposition method. (CO1) [Knowledge]
2. Identify the root of the equation $x^3 - 2x - 5 = 0$ that lies between 2 and 3. Find the real root by the Newton-Raphson method and carry out for 2 iterations only. (CO1) [Knowledge]

3. Identify Δy_0 and $\Delta^2 y_0$ for the following table

x	0	2	4
f(x)	64	70	79

(CO2) [Knowledge]

4. Identify $y_1^{(1)}$ using the modified Euler's formula if $\frac{dy}{dx} = x + y$, $y(0) = 1$, and $h=0.2$. (CO3) [Knowledge]
5. State the formula of Trapezoidal and Simpson's $\left(\frac{1}{3}\right)^{rd}$ rule for the function $y = f(x)$ taking the values $y_0, y_1, y_2, \dots, y_6$ corresponding to the $x_0, x_1, x_2, \dots, x_6$. (CO2) [Knowledge]
6. 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 4th order method. (CO3) [Knowledge]
7. State the formula of Lagrange interpolation and Newton's divided difference for the function $y = f(x)$ taking the values y_0, y_1, y_2, y_3 corresponding to the x_0, x_1, x_2, x_3 . (CO2) [Knowledge]

PART B

ANSWER ANY FIVE QUESTION

5Q x 10M = 50M

8. Obtain the solution of the system of equations $20x + y - 2z = 17$, $3x + 20y - z = -18$ and $2x - 3y + 20z = 25$ by using Gauss Seidel iteration method correct to three decimal places. Carry out three iterations. (CO1) [Comprehension]
9. Estimate the root of the equation $x^3 + 5x - 11 = 0$ that lies between 1 and 2 by Newton-Raphson method. (CO1) [Comprehension]
10. Using the Newton's forward and backward interpolation formula, compute $f(1895)$ and $f(1925)$ given that

x	1891	1901	1911	1921	1931
f(x)	46	66	81	93	101

(CO2) [Comprehension]

11. 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)	46	66	81	93

(CO2) [Comprehension]

12. Compute $y(0.2)$ given that, $\frac{dy}{dx} = x + 2y$, $y(0) = 1$ and $h = 0.2$ using modified Euler's method and correct to four decimal places? (CO3) [Comprehension]
13. Given $\frac{dy}{dx} = 3x + \frac{y}{2}$, $y(0) = 1$ and $h = 0.1$ estimate $y(0.1)$ and $y(0.2)$ 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, $10x + y + z = 12$, $2x + 10y + z = 13$ and $2x + 2y + 10z = 14$. (CO1) [Application]
15. Find approximate value of $\int_0^6 \frac{1}{1+x^2} dx$ using (i) Trapezoidal rule (ii) Simpson's $\left(\frac{1}{3}\right)^{rd}$ rule and (iii) Simpson's $\left(\frac{3}{8}\right)^{th}$. (CO2) [Application]
16. Apply modified Euler's method to find $y(0.2)$ and $y(0.4)$ for given $\frac{dy}{dx} = e^x + y$, $y(0) = 0$ by taking $h = 0.2$. (carry out computations correct to 4 decimal places). (CO3) [Application]