| Roll No. | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

# PRESIDENCY UNIVERSITY

## BENGALURU

**End - Term Examinations – MAY 2025**

**Date:** 21-05-2025 **Time:** 01:00 pm – 04:00 pm

| | | |
|---|---|---|
| **School:** SOE/SOCSE | **Program:** B. Tech - CAI/CBC/CCS/CDV/CIT/COM/CSD/ CSE/CSG/CSI/CSN/ISE/IST/CBD/CIV/ECE/EEE/MEC/PET/VLSI | |
| **Course Code :** MAT2003 | **Course Name:** NUMERICAL METHODS FOR ENGINEERS | |
| **Semester**: IV | **Max Marks**: 100 | **Weightage**: 50% |

| **CO - Levels** | **CO1** | **CO2** | **CO3** |
|---|---|---|---|
| **Marks** | **34** | **33** | **33** |

**Instructions:**

*(i) Read all questions carefully and answer accordingly.*

*(ii) Do not write anything on the question paper other than roll number.*

## Part A

**Answer ALL the Questions. Each question carries 2marks.** **10Q x 2M=20M**

| | | | | |
|---|---|---|---|---|
| **1.** | Define algebraic equation and give an example. | **2 Marks** | **L1** | **CO1** |
| **2.** | State the truncation error and its order in Simpson's $1/3^{rd}$ rule. | **2 Marks** | **L1** | **CO2** |
| **3.** | State the formula for Taylor's series expansion of the function y(x) about the point $x_0$ | **2 Marks** | **L1** | **CO3** |
| **4.** | Outline the steps and identify the range in which the root of the equation $e^x - 4sinx = 0$ lies. | **2 Marks** | **L1** | **CO1** |
| **5.** | Define Interpolation. | **2 Marks** | **L1** | **CO2** |
| **6.** | List any two numerical methods to solve initial value problem. | **2 Marks** | **L1** | **CO3** |
| **7.** | Write the second divided difference formula. | **2 Marks** | **L1** | **CO2** |
| **8.** | Describe Milne's predictor and corrector formulae. | **2 Marks** | **L1** | **CO3** |
| **9.** | State Newton's backward interpolation formula. | **2 Marks** | **L1** | **CO2** |
| **10.** | Name two numerical methods to solve one dimensional heat equation. | **2 Marks** | **L1** | **CO3** |

## Part B

**Answer the Questions.** **Total Marks 80M**

| | | | | | |
|---|---|---|---|---|---|
| **11.** | **a.** | Use Regula-falsi method to find the real root of the equation $\boldsymbol{x^3 - 3x + 4 = 0}$ correct to four decimal places. Carry out 4 iterations. | **10 Marks** | **L3** | **CO1** |
| | | **Or** | | | |
| **12.** | **a.** | Find the approximate root of the equation $x \log_{10} x = 1.2$ using Newton-Raphson method correct to four decimal places. | **10 Marks** | **L3** | **CO1** |

| | | | | | |
|---|---|---|---|---|---|
| **13.** | **a.** | Estimate the value of $\boldsymbol{y}$ for $\boldsymbol{x = 25}$ using appropriate interpolation formula for the following data.<br>$x$: 10, 20, 30, 40, 50<br>$y$: 20, 65, 180, 390, 505 | **10 Marks** | **L3** | **CO2** |
| | | **Or** | | | |
| **14.** | **a.** | Fit a polynomial for the following using Lagrange's interpolation formula and hence find $f(4)$.<br>$x$: 0, 1, 2, 5<br>$f(x)$: 2, 3, 12, 147 | **10 Marks** | **L3** | **CO2** |

| | | | | | |
|---|---|---|---|---|---|
| **15.** | **a.** | Use Taylor's series method to find $\boldsymbol{y}$ at $\boldsymbol{x = 0.1}$ considering terms up to 4th degree, given that $\frac{dy}{dx} = x - y^2$, $y(0) = 1$. | **10 Marks** | **L3** | **CO3** |
| | | **Or** | | | |
| **16.** | **a.** | Apply Adams-Bashforth predictor and corrector formula to compute $y$ at $x = 0.4$ given $\frac{dy}{dx} + y + xy^2 = 0$, $y(0) = 1$, $y(0.1) = 0.9008$, $y(0.2) = 0.8066$, $y(0.3) = 0.7220$. Apply corrector formula twice. | **10 Marks** | **L3** | **CO3** |

| | | | | | |
|---|---|---|---|---|---|
| **17.** | **a.** | Evaluate $\int_0^6 \frac{1}{1+x^2}\, dx$ taking seven ordinates by applying (i) Trapezoidal rule (ii) Simpson's 1/3rd rule (iii) Simpson's 3/8th rule. | **15 Marks** | **L3** | **CO2** |
| | | **Or** | | | |
| **18.** | **a.** | Evaluate $\int_0^{0.6} e^{-x^2}\, dx$ taking six subintervals by applying (i) Trapezoidal rule (ii) Simpson's 3/8th rule (iii) Weddle's rule. | **15 Marks** | **L3** | **CO2** |

| | | | | | |
|---|---|---|---|---|---|
| **19.** | **a.** | Using Modified Euler's method, find an approximate value of $\boldsymbol{y}$ when $\boldsymbol{x = 0.3}$ given that $\frac{\boldsymbol{dy}}{\boldsymbol{dx}} = \boldsymbol{x + y}$, $\boldsymbol{y(0) = 1}$, taking $\boldsymbol{h = 0.3}$ | **8 Marks** | **L3** | **CO3** |
| | **b.** | Using Runge-Kutta method of fourth order, find $y(0.2)$ for the equation $\frac{dy}{dx} = \frac{y-x}{y+x}$, $y(0) = 1$. taking $h = 0.2$ | **7 Marks** | **L3** | **CO3** |
| | | **Or** | | | |
| **20.** | **a.** | Solve $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial t^2}$ in $0 < x < 5, t \geq 0$ given that $u(x, 0) = 20$, $u(0, t) = 0$, $u(5, t) = 100$. Compute $u$ for the time step with $h = 1$ by Crank-Nicholson method. | **15 Marks** | **L3** | **CO3** |

| | | | | | |
|---|---|---|---|---|---|
| **21.** | **a.** | Using Jacobi's method, find all the eigenvalues and the eigenvectors of the matrix $\begin{bmatrix} \mathbf{1} & \sqrt{\mathbf{2}} & \mathbf{2} \\ \sqrt{\mathbf{2}} & \mathbf{3} & \sqrt{\mathbf{2}} \\ \mathbf{2} & \sqrt{\mathbf{2}} & \mathbf{1} \end{bmatrix}$ | **10 Marks** | **L3** | **CO1** |
| | b. | Solve the following system of equations using Gauss-Seidel iterative method correct it to three decimal places, carry out 3 iterations.<br>$8x + 3y + 2z = 13,\ \ x + 5y + z = 7,\ \ 2x + y + 6z = 9.$ | **10 Marks** | **L3** | **CO1** |
| | | **Or** | | | |
| **22.** | **a.** | Solve $2x + 3y + z = 9,\ x + 2y + 3z = 6$ and $3x + y + 2z = 8$ using LU-decomposition method. | **20 Marks** | **L3** | **CO1** |

**********