Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

FIRST SEMESTER M.TECH. (AUTOMOBILE ENGINEERING)

END SEMESTER MAKEUP EXAMINATIONS, FEBRUARY 2023

APPLIED NUMERICAL METHODS [MAT 5155]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 17 February 2023** **Max. Marks: 50**

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

Q.NO	Questions	Marks	CO	BTL
1A.	Fit an interpolating polynomial $f(x)$, for the data given below x: 0, 2, 4, 6, 8, 10 y: 0, 4, 56, 204, 496, 980	3	CO1	3
1B.	Solve the following system of equations by LU decomposition method: $x + y + z = 1\,; 4x + 3y - z = 6\,;\ 3x + 5y + 3z = 4$	3	CO2	4
1C.	Using 4th order Runge- Kutta method, solve $y' = x + y^2$ with $y(0) = 1$ at $x =$ 0.2 in steps of length $h = 0.1$.	4	CO4	4
2A.	Using Milne Predictor-Corrector method, obtain the solution of $\frac{dy}{dx} = \frac{1}{2}(x + y)$ at $x = 2$ for the data given below x: 0, 0.5, 1.0, 1.5 y: 2, 2.636, 3.595, 4.968	3	CO4	3
2B.	From the following table, find the velocity and acceleration at $x = 2.03$ x: 1.96, 1.98, 2.00, 2.02, 2.04 y: 0.7825, 0.7739, 0.7651, 0.7563, 0.7473	3	CO1	3
2C.	Use Birge-Vieta method to find the positive root of the equation $x^4 + 7x^3 + 24x^2 + x - 15 = 0$, take initial approximation as 0.5. Carryout two iterations. Also find the deflated polynomial.	4	CO2	4

3A.	Find the approximate value of the real root of the equation $2x - logx_{10} - 7 = 0$ by using Newton's Raphson method root lies between 3 and 4	**3**	**CO2**	**3**
3B.	Using Lagrange formula, evaluate f(18) for the data given below x: 10, 12, 19, 22 y: 24, 48, 162, 280	**3**	**CO1**	**4**
3C.	Solve the equations by Gauss-Seidel method $2x + y + 6z = 9$; $8x + 3y + 2z = 13$; $x + 5y + z = 7$, carryout three iterations	**4**	**CO2**	**4**
4A.	Solve the boundary value problem $x\frac{d^2y}{dx^2} + y = 0$ with $y(1) = 1, y(2) = 2$ by taking n = 4	**3**	**CO5**	**4**
4B.	Derive Newtons Cotes formula in numerical integration	**3**	**CO1**	**3**
4C.	Find all the eigen values and one eigen vector corresponding to the largest eigen value of the matrix $A = \begin{bmatrix} 8 & -8 & -2 \\ 4 & -3 & -2 \\ 3 & -4 & 1 \end{bmatrix}$	**4**	**CO3**	**4**
5A.	Solve the equation $\nabla^2 u = 8x^2y^2$ for the square with sides $x = -2, y = -2$, $x = 2, y = 2$ with $u = 0$ on the boundary of mesh length 1, using finite difference method.	**5**	**CO5**	**5**
5B.	Solve the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ subject to $u(x, 0) = 20$, $0 < x < 5$, $t > 0$ u(0, t) = 0 ,u(5, t) = 100 using Crank-Nicolson method. Carryout computation for two levels by taking	**5**	**CO5**	**5**