Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

FIRST SEMESTER M.TECH. (AUTOMOBILE ENGINEERING)

END SEMESTER EXAMINATIONS, JANUARY 2023

APPLIED NUMERICAL METHODS [MAT 5155]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 10 January 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 u_x satisfying, $u_3 = 6$, $u_4 = 24$, $u_5 = 60$, $u_6 = 120$, $u_7 = 210$, $u_8 = 336$. And hence find $u_{5/2}$	3	CO1	3
1B.	Solve the following system of equations by Cholesky method: $x + 2y + 3z = 5$; $2x + 8y + 22z = 6$; $3x + 22y + 82z = -10$	3	CO2	4
1C.	Using Runge–Kutta method of order four, solve $\frac{d^2y}{dx^2} = y + x\frac{dy}{dx}$, $y(0) = 1$, $y^1(0) = 0$, to find $y(0.2)$ and $y^1(0.2)$.	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 $x = 2.0$ x: 2, 4, 6, 8, 10 y: 105, 42.7, 25.3, 16.7, 13	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 real root of the equation $x \sin x + cosx = 0$, near to $x_0 = \pi$. Correct up-to 4 decimal places by using Newton-Raphson method.	**3**	**CO2**	**3**
3B.	Using Newton's divided difference formula, evaluate f(8) and f(15) for the data given below x: 4, 5, 7, 10, 11, 13 y: 48, 100, 294, 900, 1210, 2028	**3**	**CO1**	**4**
3C.	Solve the system of equations $10x + 2y + z = 9, x + 10y - z = -22; -2x + 3y + 10z = 22,$ by Relaxation method	**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 an error formula in Trapezoidal rule	**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.	Using Crank-Nickolson's Scheme, solve $u_t = \frac{1}{16}u_{xx}; \ 0 < x < 1, t > 0,$ $u(x,0) = 100 \sin \pi x, \ u(0,t) = 0, \ u(1,t) = 0$ Take k =1 and compute "u" for 2-time step with $h = 0.25$	**5**	**CO5**	**5**
5B.	Solve the boundary value problem $\frac{\partial^2 u}{\partial t^2} = 4\frac{\partial^2 u}{\partial x^2}$ with the conditions $u(0, t) = u(4, t) = 0, \ u(x,0) = x(4-x)$ and $\frac{\partial u}{\partial t}(x,0) = 0, \ 0 \le x \le 4,$ taking $h = 1$ and $k = 0.5$, for third level solution in time t.	**5**	**CO5**	**5**