U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

July 2023 Semester End Main Examinations

Programme: B.E. **Semester: VI**
Branch: Institutional Elective **Duration: 3 hrs.**
Course Code:20MA6IENME **Max Marks: 100**
Course: Numerical Methods for Engineers **Date: 07.07.2023**

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		UNIT - I	CO	PO	Marks
1	a)	Solve the tri-diagonal system $\begin{bmatrix} 5 & 2 & & & \\ 4 & 21 & 1 & & \\ & 1 & -1 & 3 & \\ & & -3 & -4 & -5 \\ & & & 1 & 2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \end{bmatrix} = \begin{bmatrix} 9 \\ 49 \\ -13 \\ -55 \\ 16 \end{bmatrix}$ using Thomas algorithm.	CO1	PO1	**6**
	b)	Approximate the root of the system of equations $x = 0.2x^2 + 0.8$ and $y = 0.3xy^2 + 0.7$ near $(0.5, 0.5)$, using fixed point iteration method.	CO1	PO1	**7**
	c)	Compute all the eigenvalues and the eigenvectors of the matrix $A = \begin{bmatrix} 1 & \sqrt{2} & 2 \\ \sqrt{2} & 3 & \sqrt{2} \\ 2 & \sqrt{2} & 1 \end{bmatrix}$ using Jacobi's method.	CO1	PO1	**7**
		UNIT - II			
2	a)	Employ Bessel's formula to predict the value of $f(27.5)$ from the data x: 25, 26, 27, 28, 29, 30 $f(x)$: 4.000, 3.846, 3.704, 3.571, 3.448, 3.333	CO1	PO1	**6**
	b)	Predict $f'(x)$ at $x = 2.3$ from $f(x) = x^3 \cos x$ using central differences formula and refine the results using Richardson extrapolation.	CO1	PO1	**7**
	c)	Evaluate $\int_0^1 \frac{1}{1+x} dx$ by using Romberg's integration method with Trapezoidal rule by taking $h = 0.5$, 0.25 and 0.125.	CO1	PO1	**7**

			UNIT - III			
	3	a)	Apply Milne's predictor corrector method to solve $y' = x - y^2$ with $y(0) = 0$, $y(0.2) = 0.02$, $y(0.4) = 0.0795$, $y(0.6) = 0.1762$ for $y(0.8)$.	*CO2*	*PO1*	**7**
		b)	Solve the system of equations $x' = -3x + 2y$, $y' = 3x - 4y$, $x(0) = 0$, $y(0) = 0.5$ at $t = 0.4$ with $h = 0.2$ using Runge-Kutta 2nd order method.	*CO2*	*PO1*	**9**
		c)	Derive the finite difference approximations for first and second order derivatives of $f(x, y)$.	*CO2*	*PO1*	**4**
			OR			
	4	a)	Apply Adams-Bashforth predictor corrector method to compute $y(0.8)$ given $\frac{dy}{dx} = 1 + y^2$ with $y(0) = 0$, $y(0.2) = 0.2027$, $y(0.4) = 0.4228$, $y(0.6) = 0.6841$.	*CO2*	*PO1*	**7**
		b)	Solve the system of equations $\frac{dy}{dx} = z - x$, $\frac{dz}{dx} = y + x$, $y(0) = 1$, $z(0) = 1$ at $x = 0.1$ with $h = 0.1$ using Runge-Kutta 4th order method.	*CO2*	*PO1*	**9**
		c)	Reduce the differential equation $y^{iv} + y = e^{2t} + \cos(t)$, $y(0) = 0$, $y'(0) = -1, y''(0) = -1, y'''(0) = 7$ in to a system of first order initial value problems.	*CO2*	*PO1*	**4**
			UNIT - IV			
	5	a)	Find the solution of $y'' - y = 0$, $y(0) = 0$, $y(1) = 1.1752$ using cubic spline method with step size $h = 1/3$.	*CO2*	*PO1*	**10**
		b)	Find an approximate solution of the integral equation $f(x) - \int_0^1 (x+t) f(t) dt = (9x-5)/6$ at $x = 0, 1/2, 1$.	*CO2*	*PO1*	**10**
			OR			
	6	a)	Apply finite difference method to an approximate solution of $y'' + y + 1 = 0$, $0 \le x \le 1$ with $y(0) = 0$, $y(1) = 0$ by taking $h = 0.5$ and $h = 0.25$.	*CO2*	*PO1*	**10**
		b)	Solve the boundary value problem $y''(x) = y(x)$, $y(0) = 0$, $y(1) = 1.17$ by applying the shooting method with Runge-Kutta method of order 2 and step size $h = 0.5$.	*CO2*	*PO1*	**10**
			UNIT - V			
	7	a)	Find an approximate solution of $\nabla^2 u = 0$ with the conditions $u(0, y) = u(x, 0) = 0, u(1, y) = u(x, 1) = 1$ with $h = k = \frac{1}{3}$.	*CO3*	*PO1*	**10**
		b)	Solve the Poisson equation $\nabla^2 u = -81xy$, $0 < x, y < 1$ with the conditions $u(0, y) = 0$, $u(1, y) = 100$, $u(x, 0) = 0$, $u(x, 1) = 100$ with $h = k = 1/3$.	*CO2*	*PO1*	**10**

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