U.S.N.										

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

Autonomous Institute Affiliated to VTU

April 2024 Semester End Main Examinations

Programme: B.E. **Semester: III**
Branch: Chemical Engineering / Bio-Technology **Duration: 3 hrs.**
Course Code: 19MA3BSAPM **Max Marks: 100**
Course: Applied Mathematics

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

			UNIT - 1	CO	PO	Marks
1	a)		Find the values of λ and μ such that the system of equations $x+2y+3z=5,\ x+3y-z=4$ and $x+4y+\lambda z=\mu$ has (i) No solution (ii) Unique solution.	CO1	PO1	**06**
	b)		Find the eigenvalues and the corresponding eigenvectors of the matrix $A=\begin{bmatrix} 7 & -2 & 0 \\ -2 & 6 & -2 \\ 0 & -2 & 5 \end{bmatrix}$.	CO1	PO1	**07**
	c)		Solve the following system of equations using Gauss Seidel method $27x+6y-z=85, 6x+15y+2z=72, x+y+54z=110.$ Carryout three iterations.	CO1	PO1	**07**
			UNIT - 2			
2	a)		Find the real root of the equation $\tan x=x$ near $x=4.5$ using Newton-Raphson method. Correct to three decimal places.	CO1	PO1	**06**
	b)		Evaluate $\int_0^1 \frac{dx}{1+x^2}$ by using Simpson's 1/3rd rule taking four equal strips.	CO1	PO1	**07**
	c)		Estimate the number of students who obtained marks between 40 and 45 using Newton's Forward interpolation formula.	CO1	PO1	**07**

Marks	30-40	40-50	50-60	60-70	70-80
No. of Students	31	42	51	35	31

			OR			
3	a)		Using Runge-Kutta method of 4th order, find the solution of the initial value problem $\frac{dy}{dx}=\frac{y-x}{y+x}$, $y(0)=1$ & $h=0.2$, at $x=0.2$.	CO1	PO1	**06**

		b)	Apply Lagrange's interpolation formula to find the value of y at $x=7$ for the data given below x: 0, 2, 5, 8 y: 6, 10, 12, 16	*CO1*	*PO1*	**07**
		c)	Apply Trapezoidal rule to evaluate $\int_0^1 \frac{dx}{1+x}$ by taking six equal strips.	*CO1*	*PO1*	**07**
			UNIT - 3			
	4	a)	Obtain the Fourier series expansion of $f(x)=x(2\pi-x)$ in $(0,2\pi)$.	*CO2*	*PO1*	**06**
		b)	Obtain the Fourier series of $f(x)=\begin{cases}-\pi, & \text{in} -\pi<x<0\\ x, & \text{in } 0<x<\pi\end{cases}$.	*CO2*	*PO1*	**07**
		c)	Find the inverse Fourier sine transform of $\frac{e^{-as}}{s}$, $a>0$	*CO2*	*PO1*	**07**
			OR			
	5	a)	Obtain Fourier series for the function $f(x)=e^{-x}$ in $0<x<2$.	*CO2*	*PO1*	**06**
		b)	Find the inverse Fourier transform of e^{-u^2}.	*CO2*	*PO1*	**07**
		c)	Find the Fourier series of $f(x)=\begin{cases}1+\frac{4x}{3} & \text{in } \frac{-3}{2}<x<0\\ 1-\frac{4x}{3} & \text{in } 0<x<\frac{3}{2}\end{cases}$.	*CO2*	*PO1*	**07**
			UNIT - 4			
	6	a)	Derive Crank-Nicolson formula for the solution of one-dimensional heat equation $\frac{\partial u}{\partial t}=c^2\frac{\partial^2 u}{\partial x^2}$.	*CO1*	*PO1*	**06**
		b)	Solve the initial boundary value problem $u_t=4u_{xx}$ subject to the boundary conditions $u(0,t)=0=u(8,t), t>0$ and initial condition $u(x,0)=4x-\frac{x^2}{2}, 0\le x\le 8$ by Schmidt explicit formula. Carryout the computations up to one-time level by taking $h=1$ and $k=0.1$.	*CO1*	*PO1*	**07**
		c)	By using explicit three level formula, solve the wave equation $\frac{\partial^2 u}{\partial t^2}=4\frac{\partial^2 u}{\partial x^2}$ subject to the conditions $u(0,t)=0=u(1,t)$ $t\ge 0$, $u(x,0)=\begin{cases}\frac{5x}{3} & \text{for } 0<x\le\frac{3}{5}\\ \frac{5(1-x)}{2} & \text{for } \frac{3}{5}<x<1\end{cases}$ and $u_t(x,0)=0$ up to two time levels taking $h=\frac{1}{5}$ and $k=\frac{1}{10}$.	*CO1*	*PO1*	**07**

			UNIT - 5			
	7	a)	Find the extremal of the functional $\int_0^{\frac{\pi}{2}} \left(y'^2 - y^2 + 4y\cos x\right) dx$ with $y(0) = y(\frac{\pi}{2}) = 0$.	*CO3*	*PO1*	**06**
		b)	Derive the Euler's equation in the form $\frac{\partial f}{\partial y} - \frac{d}{dx}\left(\frac{\partial f}{\partial y'}\right) = 0.$	*CO3*	*PO1*	**07**
		c)	Show that the shape of the heavy cable which hangs freely under gravity between two fixed points is a Catenary.	*CO3*	*PO1*	**07**

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