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: Common to AS/CV/EEE/ECE/EIE/IEM/ME/ML/TCE **Duration: 3 hrs.**
Course Code: 19MA3BSEM3 **Max Marks: 100**
Course: Engineering Mathematics - 3

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.

			CO	PO	Marks
		UNIT - 1			
1	a)	Find the rank of the matrix $A = \begin{pmatrix} 2 & 3 & 4 & -1 \\ 5 & 2 & 0 & -1 \\ -4 & 5 & 12 & -1 \end{pmatrix}$.	CO1	PO1	**06**
	b)	Apply Gauss elimination method to solve the system of equations $2x - 3y + z = -1,\ x + 4y + 5z = 25,\ 3x - 4y + z = 2$.	CO1	PO1	**07**
	c)	Find eigen values and eigen vectors of the matrix $A = \begin{bmatrix} 2 & 0 & 1 \\ 0 & 2 & 0 \\ 1 & 0 & 2 \end{bmatrix}$.	CO1	PO1	**07**
		UNIT - 2			
2	a)	Find the Fourier series expansion of $f(x) = e^{-ax}$ in the interval $[-\pi, \pi]$.	CO2	PO1	**06**
	b)	Obtain 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**
	c)	The following table gives the variation of periodic current over a period. *t sec* | 0 | T/6 | T/3 | T/2 | 2T/3 | 5T/6 | T *A amp* | 1.98 | 1.30 | 1.05 | 1.30 | -0.88 | -0.25 | 1.98 Show that there is a direct current part of 0.75 amp in the variable current and obtain the amplitude of the first harmonic.	CO2	PO1	**07**
		UNIT - 3			
3	a)	Find the Fourier transform of $f(x) = \begin{cases} 1, & \lvert x \rvert \le 1 \\ 0, & \lvert x \rvert > 1 \end{cases}$. Hence evaluate $\int_0^\infty \frac{\sin x}{x} dx$.	CO2	PO1	**06**
	b)	Find Fourier sine transform of $e^{-\lvert x \rvert}$. Hence show that $\int_0^\infty \frac{x \sin mx}{1+x^2} dx = \frac{\pi}{2} e^{-m}, m > 0$.	CO2	PO1	**07**
	c)	Using Parseval's identity for Fourier Cosine transforms to the functions $f(x) = e^{-ax}$ and $g(x) = e^{-bx}$ prove that $\int_0^\infty \frac{dx}{(a^2+x^2)(b^2+x^2)} = \frac{\pi}{2ab(a+b)},\ a > 0,\ b > 0$.	CO2	PO1	**07**
		OR			

	4	a)	Find the Fourier transform of $f(x) = \begin{cases} 1-x^2, & \lvert x\rvert \le 1 \\ 0, & \lvert x\rvert > 1 \end{cases}$. Hence evaluate $\int_0^\infty \frac{x\cos x - \sin x}{x^3}\cos\frac{x}{2}\,dx$.	*CO2*	*PO1*	**06**
		b)	Find the Fourier cosine transform of $f(x) = \begin{cases} x, & 0 < x < 1 \\ 2-x, & 1 < x < 2 \\ 0, & x > 2 \end{cases}$	*CO2*	*PO1*	**07**
		c)	Solve the Integral equation $\int_0^\infty f(x)\cos sx\,dx = \begin{cases} 1-s, & 0 \le s \le 1 \\ 0, & s > 1 \end{cases}$. Hence deduce that $\int_0^\infty \frac{1-\cos x}{x^2}\,dx = \frac{\pi}{2}$.	*CO2*	*PO1*	**07**
			UNIT - 4			
	5	a)	Find the real root of the equation $\cos x = xe^x$, which is nearer to $x = 0.5$ by Newton-Raphson method, correct to three decimal places.	*CO1*	*PO1*	**06**
		b)	Find y at $x = 5$ if $y(1) = -3,\ y(3) = 9,\ y(4) = 30,\ y(6) = 132$ using Lagrange's interpolation formula.	*CO1*	*PO1*	**07**
		c)	Apply Runge-Kutta method of fourth order to find an approximate value of y when $x = 0.2$ given that $\frac{dy}{dx} = x + y$, $y(0) = 1$ taking $h = 0.2$.	*CO1*	*PO1*	**07**
			UNIT - 5			
	6	a)	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*	**06**
		b)	Find the equation of a plane curve on which a particle in the absence of friction, will slide from one point to another in shortest time under the action of gravity.	*CO3*	*PO1*	**07**
		c)	Find the z transform of the following: (i) $\sin(3n+5)$ (ii) $\cos\left(\frac{n\pi}{2} + \frac{\pi}{4}\right)$.	*CO2*	*PO1*	**07**
			OR			
	7	a)	A heavy cable hangs freely under the gravity between two fixed points. Show that the shape of a cable is a Catenary.	*CO3*	*PO1*	**06**
		b)	Find an extremal of the functional $\int_0^{\frac{\pi}{2}} \left(y'^2 - y^2 + 4y\cos x\right)dx$ with $y(0) = y\left(\frac{\pi}{2}\right) = 0$.	*CO3*	*PO1*	**07**
		c)	Find the Z-transform of $\cosh n\theta$ and $\sinh n\theta$.	*CO2*	*PO1*	**07**

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