U.S.N.										

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

Autonomous Institute Affiliated to VTU

October 2023 Semester End Main Examinations

Programme: B.E. **Semester: II**
Branch: Common to all Branches **Duration: 3 hrs.**
Course Code: 18MA2BSEM2 **Max Marks: 100**
Course: Engineering Mathematics - 2

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 - I			
1	a)		Find the Laplace transform of the function $f(t) = \frac{\cos at - \cos bt}{t} + t \sin t$.	CO2	PO1	**06**
	b)		If $f(t) = \begin{cases} t & 0 \le t \le a \\ 2a - t & a < t \le 2a \end{cases}$ where $f(t + 2a) = f(t)$, show that $L[f(t)] = \frac{1}{s^2} \tanh(as/2)$.	CO2	PO1	**07**
	c)		Express the $f(t) = \begin{cases} \cos t, & 0 < t \le \pi \\ 1, & \pi < t \le 2\pi \\ \sin t, & t > 2\pi \end{cases}$ in terms of unit step function and hence find its Laplace transform.	CO2	PO1	**07**
			UNIT - II			
2	a)		Find the inverse Laplace transform of $F(s) = \frac{1}{s+2} + \frac{3}{2s+5} - \frac{4}{3s-2}$.	CO2	PO1	**06**
	b)		Find the inverse Laplace transform of $F(s) = \frac{2s+1}{s^2+3s+1}$.	CO2	PO1	**07**
	c)		An impulsive voltage $E\delta(t)$ is applied to a circuit consisting of L, R, C in series with zero initial conditions. If *i* be the current at any subsequent time *t*, find the limit of *i* as $t \to 0$?	CO2	PO1	**07**
			OR			
3	a)		Find the inverse Laplace transform of $F(s) = \log\left(\frac{s+a}{s+b}\right)$.	CO2	PO1	**06**
	b)		Find the inverse Laplace transform of $F(s) = \frac{4s+5}{(s+1)^2(s+2)}$.	CO2	PO1	**07**
	c)		Solve the differential equation $\frac{d^2y}{dt^2} + 5\frac{dy}{dt} + 6y = e^t$ subject to the conditions $y(0) = y'(0) = 0$.	CO2	PO1	**07**

			UNIT - III			
	4	a)	Form the partial differential equation by eliminating arbitrary function from $f\left(\frac{xy}{z}, z\right) = 0$.	CO2	PO1	**06**
		b)	Solve the partial differential equation $p \cot x + q \cot y = \cot z$.	CO2	PO1	**07**
		c)	Obtain the various possible solutions of one-dimensional wave equation $u_{tt} = c^2 u_{xx}$.	CO2	PO1	**07**
			UNIT - IV			
	5	a)	Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ and $z = x^2 + y^2 - 3$ at the point (2, -1, 2).	CO2	PO1	**06**
		b)	If $\vec{r} = x\hat{\imath} + y\hat{\jmath} + z\hat{k}$ and $r = \lvert\vec{r}\rvert$ then prove that $\nabla(r^n) = nr^{n-2}\vec{r}$.	CO2	PO1	**07**
		c)	Evaluate $\oint_c [(xy + y^2)dx + x^2 dy]$ using Green's theorem where 'c' is bounded by $y = x$ and $y = x^2$.	CO2	PO1	**07**
			OR			
	6	a)	Find $div\ \vec{F}$ and $curl\ \vec{F}$ if $\vec{F} = grad(x^3 + y^3 + z^3 - 3xyz)$.	CO2	PO1	**06**
		b)	Prove that $div(\vec{F} \times \vec{G}) = \vec{G} \cdot (curl\ \vec{F}) - \vec{F} \cdot (curl\ \vec{G})$.	CO2	PO1	**07**
		c)	Apply Stokes' theorem to evaluate $\oint\{(y + x)dx + (2x - z)dy + (y + z)dz\}$ over the boundary of the triangle with the vertices (2,0,0), (0,3,0) and (0,0,6).	CO2	PO1	**07**
			UNIT - V			
	7	a)	Show that the cylindrical polar coordinate system is an orthogonal curvilinear coordinate system.	CO2	PO1	**06**
		b)	Express $\vec{F} = 2y\hat{\imath} - z\,\hat{\jmath} + 2x\hat{k}$ in spherical polar coordinates.	CO2	PO1	**07**
		c)	Derive an expression for $\nabla\emptyset$ in orthogonal curvilinear coordinate system.	CO2	PO1	**07**

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