U.S.N.										

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

Autonomous Institute Affiliated to VTU

September 2024 Supplementary Examinations

Programme: B.E. **Semester: I**
Branch: CV, EEE, ETE, ECE, MD, EIE, ME, IEM, AS, CH **Duration: 3 hrs.**
Course Code: 22MA1BSMES / 22MA1BSMME / 22MA1BSMCV/23MA1BSCEM **Max Marks: 100**
Course:
Mathematical Foundation for Electrical Stream – 1
Mathematical Foundation for Mechanical Engineering Stream – 1
Mathematical Foundation for Civil Engineering – 1
Mathematical Foundation for Civil, Electrical and Mechanical Engineering Stream – 1

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)	Show that the pair of curves $r = a\theta$ and $r = \frac{a}{\theta}$ intersect each other orthogonally.	CO1	PO1	**6**
	b)	Find the pedal equation of the curve $r^m \cos(m\theta) = a^m$.	CO1	PO1	**7**
	c)	Find the radius of curvature at the point $\left(3a/2, 3a/2\right)$ on the curve $x^3 + y^3 = 3axy$.	CO1	PO1	**7**
		UNIT – II			
2	a)	If $u = \frac{x+y}{1-xy}$, $v = \tan^{-1}x + \tan^{-1}y$ then show that u and v are functionally dependent and hence find their functional relationship.	CO1	PO1	**6**
	b)	If $x^x y^y z^z = c$ then show that $\frac{\partial^2 z}{\partial x \partial y} = -(x \log ex)^{-1}$ when $x = y = z$.	CO1	PO1	**7**
	c)	The temperature T at any point (x, y, z) in space is $T(x, y, z) = kxyz^2$ where k is a positive constant. Find the highest temperature on the surface of the sphere $x^2 + y^2 + z^2 = a^2$.	CO1	PO1	**7**
		OR			
3	a)	Expand $f(x, y) = e^x \log_e(1+y)$ in powers x and y up to second degree term.	CO1	PO1	**6**
	b)	If $u = u\left[\frac{y-x}{xy}, \frac{z-x}{xz}\right]$ then show that $x^2\frac{\partial u}{\partial x} + y^2\frac{\partial u}{\partial y} + z^2\frac{\partial u}{\partial z} = 0$.	CO1	PO1	**7**
	c)	The diameter and height of a right circular cylinder are measured as 4 cm and 6 cm respectively. The possible error in each measurement is 0.1 cm. Find approximately the corresponding errors in the volume and the surface area of the cylinder.	CO1	PO1	**7**

			UNIT – III			
	4	a)	Solve: $\frac{dy}{dx}=\frac{x^2+y^2+1}{2xy}$.	*CO1*	*PO1*	**6**
		b)	Solve: $\left(xy^2-e^{1/x^3}\right)dx-x^2ydy=0$.	*CO1*	*PO1*	**7**
		c)	Show that family of confocal conics $\frac{x^2}{a^2+\lambda}+\frac{y^2}{b^2+\lambda}=1$, λ being the parameter, is self orthogonal.	*CO1*	*PO1*	**7**
			UNIT - IV			
	5	a)	Apply the method of variation of parameters to solve the differential equation $y''+y=\sec x$.	*CO1*	*PO1*	**6**
		b)	Solve: $\left(D^2-D+1\right)y=\sinh(x)$.	*CO1*	*PO1*	**7**
		c)	Solve: $x^2y''+9y+xy'=3x^2+\sin\left[3\log(x)\right]$.	*CO1*	*PO1*	**7**
			OR			
	6	a)	Solve: $y''+y'=x^2+2x+4$.	*CO1*	*PO1*	**6**
		b)	Apply the method of variation of parameters to solve the differential equation $y''-6y'+9y=\frac{e^{3x}}{x^2}$.	*CO1*	*PO1*	**7**
		c)	Solve: $(x-1)^3\frac{d^3y}{dx^3}+2(x-1)^2\frac{d^2y}{dx^2}-4(x-1)\frac{dy}{dx}+4y=4\log(x-1)$.	*CO1*	*PO1*	**7**
			UNIT - V			
	7	a)	Show that the system of equations $3x+4y+5z=a$, $4x+5y+6z=b$ and $5x+6y+7z=c$ do not have a solution unless $a+c=2b$. Also solve when $(a,b,c)=(1,2,3)$.	*CO1*	*PO1*	**6**
		b)	Apply Gauss-Seidel iteration method to obtain an approximate solution of the system of equations $20x+y-2z=17$, $3x+20y-z=-18$ and $2x-3y+20z=25$.	*CO1*	*PO1*	**7**
		c)	Find the eigenvalues and the corresponding eigenvectors of the matrix $A=\begin{bmatrix}6&-2&2\\-2&3&-1\\2&-1&3\end{bmatrix}$.	*CO1*	*PO1*	**7**

****