U.S.N.										

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

Autonomous Institute Affiliated to VTU

February / March 2024 Semester End Main 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)	Obtain the pedal equation of the curve $r^2 = a^2 \sec(2\theta)$.	*CO1*	*PO1*	**6**
	b)	Find the angle of intersection of the polar curves $r = 3\cos\theta$ and $r = 1+\cos\theta$.	*CO1*	*PO1*	**7**
	c)	If ρ be the radius of curvature at any point P on the parabola $y^2 = 4ax$ and S be its focus then show that ρ^2 varies as SP^3.	*CO1*	*PO1*	**7**
		UNIT - II			
2	a)	If $v = \log_e(x^2+y^2+z^2)$ then prove that $(x^2+y^2+z^2)\left[v_{xx}+v_{yy}+v_{zz}\right] = 2$.	*CO1*	*PO1*	**6**
	b)	Expand $f(x,y) = x^y$ in powers of $(x-1)$ and $(y-1)$ up to second degree term.	*CO1*	*PO1*	**7**
	c)	In estimating the cost of a pile of bricks measured as $2m \times 15m \times 1.2m$, the tape stretched 1% beyond the standard length. If the count is 450 bricks to 1 cu. m. and bricks cost Rs530 per 1000, find the approximate error in the cost.	*CO1*	*PO1*	**7**
		OR			
3	a)	If $u = \tan^{-1}x + \tan^{-1}y$ and $v = \dfrac{x+y}{1-xy}$ then show that u and v are functionally dependent using its Jacobian and find their functional relationship.	*CO1*	*PO1*	**6**
	b)	Expand $f(x,y) = e^x \log_e(1+y)$ in powers of x and y up to second degree term.	*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**
			UNIT - III			
	4	a)	Solve $y' + \frac{y}{2x} = \frac{x}{y^3}$ given that $y(1) = 2$.	*CO1*	*PO1*	**6**
		b)	Solve $y(2xy + 1)dx - xdy = 0$.	*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)	Solve $(D^2 + 2)y = x^2 + \cos 3x$.	*CO1*	*PO1*	**6**
		b)	Solve $(2x + 3)^2 y'' - 2(2x + 3)y' - 12y = 6x$.	*CO1*	*PO1*	**7**
		c)	Solve $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = e^x \log x$ by the method of variation of parameters.	*CO1*	*PO1*	**7**
			OR			
	6	a)	Solve $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 5y = 2\cosh(x)$.	*CO1*	*PO1*	**6**
		b)	Solve $x^2y'' + xy' + y = 2\cos^2(\log x)$.	*CO1*	*PO1*	**7**
		c)	Solve $\frac{d^2y}{dx^2} + y = \tan x$ by the method of variation of parameters.	*CO1*	*PO1*	**7**
			UNIT - V			
	7	a)	Find the values of λ and μ for which the system of equations $2x + 3y + 5z = 9$, $7x + 3y - 2z = 8$ and $2x + 3y + \lambda z = \mu$ has (i) no solution (ii) unique solution (iii) infinitely many solutions.	*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 $2x - 3y + 20z = 25$. Perform three iterations.	*CO1*	*PO1*	**7**
		c)	Find the eigenvalues and the corresponding eigenvectors of the matrix $A = \begin{bmatrix} 1 & 2 & 2 \\ 0 & 2 & 1 \\ -1 & 2 & 2 \end{bmatrix}$.	*CO1*	*PO1*	**7**

****