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: Common to all Branches | **Duration: 3 hrs.**
Course Code: 21MA1BSCDE | **Max Marks: 100**
Course: Calculus and Differential Equations

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)	With usual notations, prove that $\tan \emptyset = r\frac{d\theta}{dr}$.	*CO1*	*PO1*	**6**
	b)	Find the angle between the pair of curves $r = \frac{a\theta}{1+\theta}$ and $r = \frac{a}{1+\theta^2}$.	*CO1*	*PO1*	**7**
	c)	Find the radius of curvature of the curve $a^2y = x^3 - a^3$ at $(a, 0)$.	*CO2*	*PO1*	**7**
		UNIT - II			
2	a)	Find the Taylor's series expansion of $f(x) = \log(\cos x)$ about the point $x = \frac{\pi}{3}$ up to 3rd degree term.	*CO1*	*PO1*	**6**
	b)	If $z = f(x, y)$ where $x = r\cos\theta$, $y = r\sin\theta$ then show that $\left(\frac{\partial z}{\partial x}\right)^2 + \left(\frac{\partial z}{\partial y}\right)^2 = \left(\frac{\partial z}{\partial r}\right)^2 + \frac{1}{r^2}\left(\frac{\partial z}{\partial \theta}\right)^2$.	*CO1*	*PO1*	**7**
	c)	If $u = \frac{xy}{z}$, $v = \frac{yz}{x}$, $w = \frac{xz}{y}$ then find $\frac{\partial(u,v,w)}{\partial(x,y,z)}$.	*CO1*	*PO1*	**7**
		OR			
3	a)	Expand $f(x) = \sec x$ using Maclaurin's series up to the term containing x^3.	*CO1*	*PO1*	**6**
	b)	If $u = e^x \sin(yz)$ where $x = t^2, y = t - 1$ and $z = \frac{1}{t}$ then find $\frac{du}{dt}$ at $t = 1$.	*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 constant. Find the highest temperature on the surface of the sphere $x^2 + y^2 + z^2 = a^2$.	*CO2*	*PO1*	**7**

			UNIT - III			
	4	a)	Find the rank of the matrix $A = \begin{bmatrix} 2 & 1 & 3 & 5 \\ 4 & 2 & 1 & 3 \\ 8 & 4 & 7 & 13 \\ 8 & 4 & -3 & -1 \end{bmatrix}$.	*CO1*	*PO1*	**6**
		b)	Apply Gauss-Seidel iterative method to obtain an approximate solution of the system of equations $9x - y + 2z = 9$; $x + 10y - 2z = 15$ and $-2x + 2y + 13z = 17$ by taking the initial approximation as $(1, 1, 1)$. Carry out 3 iterations.	*CO1*	*PO1*	**7**
		c)	Apply Rayleigh's power method to find the numerically largest eigenvalue and the corresponding eigenvector of the matrix $A = \begin{bmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{bmatrix}$, by taking $X^{(0)} = [0 \ \ 0 \ \ 1]^T$ as the initial eigenvector. Carry out 4 approximations.	*CO1*	*PO1*	**7**
			UNIT - IV			
	5	a)	Solve: $\frac{dy}{dx} + xy = xy^3$.	*CO1*	*PO1*	**6**
		b)	Solve: $y(2x - y + 1)dx + x(3x - 4y + 3)dy = 0$.	*CO1*	*PO1*	**7**
		c)	Find the orthogonal trajectories of the family of ellipses $\frac{x^2}{a^2} + \frac{y^2}{a^2+\lambda} = 1$ where λ is the parameter.	*CO2*	*PO1*	**7**
			OR			
	6	a)	Solve: $\frac{2x}{y^3}dx + \frac{y^2 - 3x^2}{y^4}dy = 0$.	*CO1*	*PO1*	**6**
		b)	Find the orthogonal trajectories of the family of curves $r = 2a(\sin\theta + \cos\theta)$ where 'a' is the parameter.	*CO2*	*PO1*	**7**
		c)	Solve: $p^2 + 2py\cot(x) = y^2$.	*CO1*	*PO1*	**7**
			UNIT - V			
	7	a)	Solve: $y'' - 4y' + 4y = e^{2x} + 4$.	*CO1*	*PO1*	**6**
		b)	Solve $(D^2 - 2D + 2)y = e^x \tan x$ by the method of variation of parameters.	*CO1*	*PO1*	**7**
		c)	Solve: $(2x + 1)^2 y'' - 2(2x + 1)y' - 12y = 3(2x + 1)$.	*CO1*	*PO1*	**7**

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