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

Autonomous Institute Affiliated to VTU

December / January 2024 Supplementary 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.

				CO	PO	Marks
			UNIT - I			
1	a)		With the usual notations prove that $\tan \varphi = r \frac{d\theta}{dr}$ for the curve $r = f(\theta)$.	CO1	PO1	**6**
	b)		Show that the following pairs of curves $r = a(1 + \sin\theta)$ and $r = a(1 - \sin\theta)$ intersect orthogonally.	CO1	PO1	**7**
	c)		Find the radius of curvature for the curve $x^3 + y^3 = 3axy$ at the point $\left(\frac{3a}{2}, \frac{3a}{2}\right)$.	CO1	PO1	**7**
			UNIT - II			
2	a)		Expand $\log_e \sec x$ by Maclaurin series up to the term containing x^4.	CO1	PO1	**6**
	b)		If $u = f(x - y,\ y - z,\ z - x)$ show that $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$.	CO1	PO1	**7**
	c)		Examine the function $xy(a - x - y)$ for extreme values.	CO2	PO1	**7**
			OR			
3	a)		If $u = \log(x^3 + y^3 + z^3 - 3xyz)$ show that $\left(\frac{\partial}{\partial x} + \frac{\partial}{\partial y} + \frac{\partial}{\partial z}\right)^2 u = \frac{-9}{(x+y+z)^2}$.	CO1	PO1	**6**
	b)		If $z = f(x,y)$, $x = e^u + e^{-v}$ and $y = e^{-u} - e^v$, prove that $z_u - z_v = xz_x - yz_y$.	CO1	PO1	**7**
	c)		If $x + y + z = u,\ y + z = v, z = uvw$ then show that $\frac{\partial(x,y,z)}{\partial(u,v,w)} = uv$.	CO2	PO1	**7**
			UNIT – III			
4	a)		Find the rank of the matrix $\begin{bmatrix} 1 & 1 & -1 & 0 \\ 4 & 4 & -3 & 1 \\ 2 & 2 & 2 & 2 \\ 0 & 9 & 2 & 3 \end{bmatrix}$ by reducing it to echelon form.	CO1	PO1	**6**

				CO	PO	Marks
	b)	Apply Gauss Seidel method to find the approximate solution of $20x + y - 2z = 17$, $3x + 20y - z = -18$ and $2x - 3y + 20z = 25$.		CO1	PO1	**7**
	c)	Find the largest eigen value and eigen vector of the matrix $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ using Rayleigh's power method by taking the initial vector as $[1, 1, 1]^T$.		CO2	PO1	**7**
		UNIT - IV				
5	a)	Solve $\cos x \ (e^y + 1)dx + \sin x \ e^y dy = 0$.		CO1	PO1	**6**
	b)	Find the orthogonal trajectories of the family of curves $r^n \cos n\theta = a^n$.		CO2	PO1	**7**
	c)	Solve $xy \ p^2 - (x^2 + y^2)p + xy = 0$.		CO1	PO1	**7**
		OR				
6	a)	Solve $\frac{dx}{dy} + \frac{x}{y} = x^3 y^2$.		CO1	PO1	**7**
	b)	Show that family of parabolas $y^2 = 4a(x + a)$ is self-orthogonal.		CO2	PO1	**7**
	c)	Obtain general and singular solution of $xp^3 - yp^2 + 1 = 0$.		CO1	PO1	**6**
		UNIT - V				
7	a)	Solve $\frac{d^2y}{dx^2} - 4y = \cosh(2x - 1) + 3^x$.		CO1	PO1	**7**
	b)	Solve $(D^2 - 2D + 2)y = e^x \tan x$ by the method of variation of parameters.		CO1	PO1	**7**
	c)	Solve $(x^2D^2 - xD + 1)y = x^2 \log x$.		CO2	PO1	**6**

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