U.S.N.										

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

Autonomous Institute Affiliated to VTU

October 2024 Supplementary Examinations

Programme: B.E. **Semester: I**
Branches: CV/EEE/ETE/ECE/MD/EIE/ME/IEM/AS/CH **Duration: 3 hrs.**
Course Code: **Max Marks: 100**
22MA1BSMES/22MA1BSMME/22MA1BSMCV/23MA1BSCEM
Course: 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.

			CO	PO	Marks
		UNIT - I			
1	a)	Prove that $\tan\Phi = \dfrac{r}{\dfrac{dr}{d\theta}}$ with usual notation.	CO 1	PO 1	**06**
	b)	Show that the following pair of curves intersect orthogonally $r^2\sin 2\theta = a^2$ and $r^2\cos 2\theta = b^2$.	CO 1	PO 1	**07**
	c)	Find the radius of curvature for the curve $x^3 + y^3 = 3axy$ at the point $\left(3a/2, 3a/2\right)$.	CO 1	PO 1	**07**
		UNIT - II			
2	a)	If $u = \log_e\left(x^3 + y^3 - x^2y - xy^2\right)$, then show that $u_{xx} + 2u_{xy} + u_{yy} = -\dfrac{4}{(x+y)^2}$.	CO 1	PO 1	**06**
	b)	If $u = F(x-y, y-z, z-x)$, then prove that $\dfrac{\partial u}{\partial x} + \dfrac{\partial u}{\partial y} + \dfrac{\partial u}{\partial z} = 0$.	CO 1	PO 1	**07**
	c)	Expand $f(x,y) = x^2 + xy + y^2$ in powers of $(x-1)$ and $(y-2)$ up to second degree terms.	CO 1	PO 1	**07**
		OR			
3	a)	If $(x+y)z = x^2 + y^2$, then show that $\left(\dfrac{\partial z}{\partial x} - \dfrac{\partial z}{\partial y}\right)^2 = 4\left[1 - \dfrac{\partial z}{\partial x} - \dfrac{\partial z}{\partial y}\right]$.	CO 1	PO 1	**06**
	b)	Find $\dfrac{\partial(u,v)}{\partial(r,\theta)}$, where $u = x^2 - 2y^2, v = 2x^2 - y^2$ and $x = r\cos\theta$, $y = r\sin\theta$.	CO 1	PO 1	**07**

		c)	Sum of three numbers is a constant. Prove that their product is maximum when they are equal.	*CO* 1	*PO* 1	**07**
			UNIT - III			
	4	a)	Solve: $(x^3 y^2 + x y)\,dx = dy$.	*CO* 1	*PO* 1	**06**
		b)	Solve: $\left[y\left(1+\frac{1}{x}\right)+\cos y \right]dx+\left(x+\log x - x\sin y\right)dy = 0$.	*CO* 1	*PO* 1	**07**
		c)	Find the orthogonal trajectories of the family of curve $r^2 = a^2 \cos 2\theta$.	*CO* 1	*PO* 1	**07**
			UNIT - IV			
	5	a)	Solve: $\left(D^2+2\right)y = x^3 + e^{-2x} + \cos 3x$	*CO* 1	*PO* 1	**06**
		b)	Solve by the method of variation of parameters: $y'' - 6y' + 9y = \frac{e^{3x}}{x^2}$	*CO* 1	*PO* 1	**07**
		c)	Solve: $(1+x)^2 \frac{d^2y}{dx^2} + (1+x)\frac{dy}{dx} + y = \sin[2\log(1+x)]$	*CO* 1	*PO* 1	**07**
			OR			
	6	a)	Solve: $\frac{d^3y}{dx^3} - 3\frac{d^2y}{dx^2} + 3\frac{dy}{dx} - y = 0$	*CO* 1	*PO* 1	**06**
		b)	Solve: $\frac{d^2y}{dx^2} - y = 2x^4 - 3x + 1$	*CO* 1	*PO* 1	**07**
		c)	Solve: $x^2 \frac{d^2y}{dx^2} - 4x\frac{dy}{dx} + 6y = 4x - 6$	*CO* 1	*PO* 1	**07**
			UNIT - V			
	7	a)	Check the consistency and hence solve: $4x - 2y + 6z = 8$ $x + y - 3z = -1$ $15x - 3y + 9z = 21$	*CO* 1	*PO* 1	**06**
		b)	Solve the following system of equations using Gauss – Seidel method: $54x + y + z = 110$ $2x + 15y + 6z = 72$ $-x + 6y + 27z = 85$	*CO* 1	*PO* 1	**07**
		c)	Find the eigenvalues and eigenvectors of the matrix $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$	*CO* 1	*PO* 1	**07**

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