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: CS, IS, ML, BT, DS, IOT, CSB **Duration: 3 hrs.**
Course Code: 22MA1BSMCS / 23MA1BSMCS **Max Marks: 100**
Course: Mathematical Foundation for Computer Science 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)	Find the angle between the curves $r = a\log\theta$ and $r = \frac{a}{\log\theta}$.	*CO1*	*PO1*	**6**
	b)	Find the pedal equation of the polar curve $r^m = a^m(\cos m\theta + \sin m\theta)$.	*CO1*	*PO1*	**7**
	c)	Find the radius of curvature of the curve $x^2y = a\,(x^2 + y^2)$ at $(-2a, 2a)$.	*CO1*	*PO1*	**7**
		UNIT - II			
2	a)	If $u = f(2x - 3y, 3y - 4z, 4z - 2x)$ prove that $(1/2)\,u_x + (1/3)\,u_y + (1/4)\,u_z = 0$.	*CO1*	*PO1*	**6**
	b)	If $x = r\sin(\theta)\cos(\emptyset)$, $y = r\sin(\theta)\sin(\emptyset)$ and $z = r\cos(\theta)$, find $\frac{\partial(x,y,z)}{\partial(r,\theta,\emptyset)}$.	*CO1*	*PO1*	**7**
	c)	Apply Gradient descent method to approximate the minimum point of the function $f(x,y) = 3x^2 + y^2$ near the given point $(6,3)$. Perform two iterations.	*CO1*	*PO1*	**7**
		OR			
3	a)	Find the total derivative $\frac{dz}{dt}$ of $z = xy^2 + yx^2$ where $x = at$ and $y = 2at$.	*CO1*	*PO1*	**6**
	b)	Find extreme values of the function $f(x,y) = x^3 + y^3 - 3x - 12y + 20$.	*CO1*	*PO1*	**7**
	c)	Expand $e^{ax}\sin(by)$ in Maclaurin's series up to second degree term.	*CO1*	*PO1*	**7**
		UNIT - III			
4	a)	Solve: $(8xy - 9\,y^2)\,dx + 2(x^2 - 3xy)dy = 0$.	*CO1*	*PO1*	**6**
	b)	Solve: $x^3\frac{dy}{dx} - x^2y = -y^4\,cosx$.	*CO1*	*PO1*	**7**
	c)	Find the orthogonal trajectories of the family of curves $r = a\,(1 + \sin\theta)$.	*CO1*	*PO1*	**7**

			UNIT - IV			
	5	a)	Prove that $8^{86} - 6$ is divisible by 29 by Fermat's Little theorem.	*CO1*	*PO1*	**6**
		b)	Solve $18\,x \equiv 30 \pmod{42}$.	*CO1*	*PO1*	**7**
		c)	A boy buys large shirts for Rs.18 each and small shirts for Rs.11 each. The total amount paid is Rs.1188. What is the total number of shirts, the boy has bought?	*CO1*	*PO1*	**7**
			OR			
	6	a)	Find the least positive integer *x* which leaves a remainder 2 when divided by 3, remainder 3 when divided by 5 and remainder 2 when divided by 7.	*CO1*	*PO1*	**6**
		b)	Solve the polynomial congruence $x^3 + 3x + 5 \equiv 0 \pmod{9}$.	*CO1*	*PO1*	**7**
		c)	Apply RSA algorithm to encrypt the text DB by choosing $p = 3$ and $q = 11$.	*CO1*	*PO1*	**7**
			UNIT - V			
	7	a)	Show that the system of equations $2x + 5y + 7z = 52$, $2x + y - z = 0$ and $x + y + z = 9$ is consistent and hence solve.	*CO1*	*PO1*	**6**
		b)	Apply Gauss-Seidel iterative method to obtain an approximate solution of the system of equations $x + y + 54z = 110$, $27x + 6y - z = 85$ and $6x + 15y + 2z = 72$. Carry out three iterations.	*CO1*	*PO1*	**7**
		c)	Apply Rayleigh's power method to find the largest eigenvalue and the corresponding eigenvector of the matrix $\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ by taking $[1 \quad 1 \quad 1]^T$ as the initial eigenvector. Carry out four iterations.	*CO1*	*PO1*	**7**

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