U.S.N.										

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

Autonomous Institute Affiliated to VTU

December 2023 Supplementary Examinations

Programme: B.E. **Semester: I**
Branch: CSE, ISE, ML, IOT, DS, BT and CSB **Duration: 3 hrs.**
Course Code: 22MA1BSMCS **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)	Derive an expression to find the angle between radius vector and tangent to the polar curve $r = f(\theta)$.	CO1	PO1	**6**
	b)	Find the pedal equation for the polar curve $r^m = a^m(\cos m\theta + \sin m\theta)$.	CO1	PO1	**7**
	c)	Find the radius of curvature of the Folium $x^3 + y^3 = 3axy$ at the point $\left(\frac{3a}{2}, \frac{3a}{2}\right)$.	CO1	PO1	**7**
		UNIT - II			
2	a)	If $u = f\left(\frac{x}{y}, \frac{y}{z}, \frac{z}{x}\right)$ then prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} + z\frac{\partial u}{\partial z} = 0$.	CO1	PO1	**6**
	b)	If $u = x^2 + 3y^2 - z^3, v = 4x^2yz, w = 2z^2 - xy$, evaluate $\frac{\partial(u,v,w)}{\partial(x,y,z)}$ at $(1, -1, 0)$.	CO1	PO1	**7**
	c)	Determine the Maclaurin series expansion of $\sqrt{1 + \sin 2x}$ up to the fourth degree.	CO1	PO1	**7**
		OR			
3	a)	If $u = \log\left(x^3 + y^3 + z^3 - 3xyz\right)$ then prove that $u_x + u_y + u_z = \frac{3}{x+y+z}$ and hence 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 $x = r\sin\theta\cos\phi, y = r\sin\theta\sin\phi, z = r\cos\theta$ find $J\left(\frac{x,y,z}{r,\theta,\phi}\right)$.	CO1	PO1	**7**
	c)	Find the extreme values of the function $f(x,y) = x^4 + y^4 - 2x^2 + 4xy - 2y^2$.	CO1	PO1	**7**
		UNIT - III			
4	a)	Solve $\frac{dy}{dx} + y\tan x = y^3 \sec x$.	CO1	PO1	**6**
	b)	Solve $(xy^3 + y)\,dx + 2(x^2y^2 + x + y^4)\,dy = 0$.	CO1	PO1	**7**

		c)	Find the orthogonal trajectories of the family of curves $\frac{x^2}{a^2}+\frac{y^2}{b^2+\lambda}=1$, where λ is the parameter.	CO2	PO1	**7**
			UNIT - IV			
	5	a)	Find the remainder when 7^{30} is divided by 15.	CO1	PO1	**6**
		b)	Apply Chinese Remainder theorem to solve the system of linear congruences $x \equiv 5 \pmod 3$, $x \equiv 2 \pmod 5$, $x \equiv 1 \pmod{11}$.	CO1	PO1	**7**
		c)	Solve the polynomial congruence $x^3+3x+5 \equiv 0 \pmod 9$.	CO1	PO1	**7**
			OR			
	6	a)	Solve the linear Diophantine equation $70x+112y=168$.	CO1	PO1	**6**
		b)	Apply Chinese Remainder theorem to solve the system of linear congruences $x \equiv 2 \pmod 3$, $x \equiv 3 \pmod 5$, $x \equiv 2 \pmod 7$.	CO1	PO1	**7**
		c)	Encode STOP using RSA algorithm with key $(2537, 13)$ by taking $p=43$ and $q=59$.	CO2	PO1	**7**
			UNIT - V			
	7	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)	Find the values of λ and μ for which the system $x+y+z=6$, $x+2y+3z=10$ and $x+2y+\lambda z=\mu$ has (i) Unique solution, (ii) Infinitely many solutions, (iii) No solution.	CO1	PO1	**7**
		c)	Apply Gauss Seidel iterative method to find the approximate solution of the system of equations $x+3y+10z=24$, $2x+17y+4z=35$ and $28x+4y-z=32$. Perform three iterations.	CO1	PO1	**7**

****