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: 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.

			CO	PO	Marks
		UNIT - I			
1	a)	With usual notations, prove that $\tan \emptyset = r\frac{d\theta}{dr}$.	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 for $y^2 = \frac{a^2(a-x)}{x}$ where the curve meets the x - axis.	CO1	PO1	**7**
		UNIT - II			
2	a)	If $(x+y)z = x^2 + y^2$, show that $\left(\frac{\partial z}{\partial x} - \frac{\partial z}{\partial y}\right)^2 = 4\left(1 - \frac{\partial z}{\partial x} - \frac{\partial z}{\partial y}\right)$.	CO1	PO1	**6**
	b)	Expand $f(x,y) = e^{ax}\sin(by)$ in Maclaurin's series up to second degree term.	CO1	PO1	**7**
	c)	Find the extreme values of the function $f(x,y) = x^3 + 3xy^2 - 3x^2 - 3y^2 + 4$.	CO1	PO1	**7**
		OR			
3	a)	If $u = f\left(\frac{y-x}{xy}, \frac{z-x}{zx}\right)$ then prove that $x^2\frac{\partial u}{\partial x} + y^2\frac{\partial u}{\partial y} + z^2\frac{\partial u}{\partial z} = 0$.	CO1	PO1	**6**
	b)	If $u = \frac{xy}{z}$, $v = \frac{yz}{x}$ and $w = \frac{zx}{y}$, then prove that $JJ' = 1$.	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 point $(1,2)$. Perform two iterations.	CO1	PO1	**7**
		UNIT - III			
4	a)	Solve: $\frac{dy}{dx} = \frac{y}{x-\sqrt{xy}}$.	CO1	PO1	**6**
	b)	Solve: $y(x+y+1)\,dx + x(x+3y+2)\,dy = 0$.	CO1	PO1	**7**
	c)	Find the orthogonal trajectories of the family of curves $r = 2a(\cos\theta + \sin\theta)$.	CO1	PO1	**7**

			UNIT - IV			
	5	a)	Find the remainder when 72^{1001} is divided by 31.	*CO1*	*PO1*	**6**
		b)	Solve the system of linear congruences $x \equiv 2 \pmod 3$, $x \equiv 3 \pmod 5$ and $x \equiv 2 \pmod 7$ using Chinese remainder theorem.	*CO1*	*PO1*	**7**
		c)	A small clothing manufacturer produces two styles of sweaters: cardigan and pullover. She sells cardigans for Rs.31 each and pullovers for Rs.28 each. If her total revenue from a day's production is Rs.146, how many of each type might she manufacture in a day?	*CO1*	*PO1*	**7**
			OR			
	6	a)	Solve $20x \equiv 8 \pmod{24}$.	*CO1*	*PO1*	**6**
		b)	Find the roots of $x^5 - 3x^2 + 2 \equiv 0 \pmod{49}$.	*CO1*	*PO1*	**7**
		c)	If $p = 3, q = 11$ and the private key is $d = 7$ then find the public key using RSA algorithm and hence encrypt the number 19.	*CO1*	*PO1*	**7**
			UNIT – V			
	7	a)	Find the values of λ and μ for which the system of equations $2x + 3y + 5z = 9, 7x + 3y - 2z = 8$ and $2x + 3y + \lambda z = \mu$ has (i) Unique solution (ii) Infinitely many solutions (iii) No solution.	*CO1*	*PO1*	**6**
		b)	Apply the Gauss –Seidel iterative method to obtain an approximate solution of the system of equations $27x + 6y - z = 85$, $6x + 15y + 2z = 72$ and $x + y + 54z = 110$. Carry out three iterations, taking the initial approximation to the solution as $(2, 3, 2)$.	*CO1*	*PO1*	**7**
		c)	Apply Rayleigh's power method to find the largest eigenvalue and the corresponding eigenvector of the matrix $A = \begin{bmatrix} 4 & 1 & -1 \\ 2 & 3 & -1 \\ -2 & 1 & 5 \end{bmatrix}$ by taking $[1 \quad 0 \quad 0]^T$ as the initial eigenvector. Carry out four iterations.	*CO1*	*PO1*	**7**

******