B.M.S. College of Engineering, Bengaluru-560019
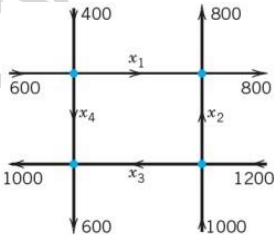
Autonomous Institute Affiliated to VTU

October 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.

				CO	PO	Marks
			UNIT - I	*CO*	*PO*	**Marks**
1	a)		Find the pedal equation of the curve $r^m \cos(m\theta) = a^m$.	*CO1*	*PO1*	**6**
	b)		Find the angle of intersection of the curves $r = 3\cos(\theta)$ and $r = 1 + \cos(\theta)$.	*CO1*	*PO1*	**7**
	c)		Find the radius of curvature of the curve $x = a\ln(\sec t + \tan t)$ and $y = a\sec t$.	*CO1*	*PO1*	**7**
			UNIT – II			
2	a)		If $\theta = t^n e^{-r^2/4t}$ then for what value of n will θ satisfy the equation $\frac{1}{r^2}\left[\frac{\partial}{\partial r}\left(r^2 \frac{\partial \theta}{\partial r}\right)\right] = \frac{\partial \theta}{\partial t}$?	*CO1*	*PO1*	**6**
	b)		Expand the function $f(x,y) = xy^2 + \cos xy$ in powers of $(x-1)$ and $\left(y - \frac{\pi}{2}\right)$ up to the second degree term.	*CO1*	*PO1*	**7**
	c)		Divide 120 into three parts so that the sum of their products taken two at a time shall be maximum.	*CO1*	*PO1*	**7**
			OR			
3	a)		If $V = f(r,s,t)$ and $r = \frac{x}{y}, s = \frac{y}{z}, t = \frac{z}{x}$ then show that $x\frac{\partial V}{\partial x} + y\frac{\partial V}{\partial y} + z\frac{\partial V}{\partial z} = 0$.	*CO1*	*PO1*	**6**
	b)		Verify $JJ' = 1$ for the function $x = \sqrt{vw}, y = \sqrt{uw}, z = \sqrt{uv}$.	*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: $y^2 y' - y^3 \tan x - \sin x \cos^2 x = 0$.	*CO1*	*PO1*	**6**

SUPPLEMENTARY EXAMS 2024

	b)	Solve: $\left(xy^3 + y\right)dx + 2\left(x^2y^2 + x + y^4\right)dy = 0$.	CO1	PO1	**7**
	c)	The population of a community is known to increase at a rate proportional to the number of people present at time t. An initial population p_o has doubled in 5 years. Suppose it is known that the population of the community is 10,000 after 3 years. What will the population be in 10 years? How fast is the population growing at $t = 10$?	CO1	PO1	**7**
		UNIT - IV			
5	a)	Find the remainder when 72^{1001} is divisible by 31.	CO1	PO1	**6**
	b)	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	**7**
	c)	Apply RSA algorithm to encrypt the text DB by choosing $p = 3$ and $q = 11$.	CO1	PO1	**7**
		OR			
6	a)	Solve $91x \equiv 119 \pmod{28}$.	CO1	PO1	**6**
	b)	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**
	c)	Solve the polynomial congruence $x^3 + 3x + 5 \equiv 0 \pmod{9}$.	CO1	PO1	**7**
		UNIT - V			
7	a)	Find the traffic flow in the net of one-way streets directions shown in the figure.	CO1	PO1	**6**
	b)	Apply Gauss-Seidel iteration method to obtain an approximate solution of the system of equations $-x + 2y = 3$, $2x + y + 4z = 16$ and $4x + 2y + z = 11$ and by taking initial approximation as $(0,0,0)$. Perform three iterations.	CO1	PO1	**7**
	c)	Apply Rayleigh's power method to find the dominant eigenvalue and the corresponding eigenvector of the matrix $\begin{bmatrix} 1 & 2 & -1 \\ 2 & 1 & 1 \\ -1 & 1 & 0 \end{bmatrix}$ by taking initial vector as $\begin{bmatrix} 1 & 1 & 1 \end{bmatrix}^T$. Perform 4 iterations.	CO1	PO1	**7**

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