U.S.N.										

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

Autonomous Institute Affiliated to VTU

August 2023 Semester End Make-Up Examinations

Programme: B.E. **Semester: I**
Branch: Computer Science Stream **Duration: 3 hrs.**
Course Code: 22MA1BSMCS **Max Marks: 100**
Course: Mathematical Foundation for Computer Science Stream – 1 **Date: 10.08.2023**

Instructions: Answer any FIVE full questions, choosing one full question from each unit.

UNIT – I

1	a)	Find the pedal equation for the polar curve $r^n = a^n(\cos n\theta + \sin n\theta)$.	6
	b)	Find the angle of intersection for the curves $r = a\log\theta$ and $r = \dfrac{a}{\log\theta}$.	7
	c)	Find the radius of curvature for the curve $x^3 + y^3 = 3axy$ at the point $\left(\dfrac{3a}{2}, \dfrac{3a}{2}\right)$.	7

UNIT – II

2	a)	If $z(x+y) = x^2 + y^2$, Show that $\left(\dfrac{\partial z}{\partial x} - \dfrac{\partial z}{\partial y}\right)^2 = 4\left(1 - \dfrac{\partial z}{\partial x} - \dfrac{\partial z}{\partial y}\right)$.	6
	b)	If $u = f(2x-3y, 3y-4z, 4z-2x)$, prove that $\dfrac{1}{2}\dfrac{\partial u}{\partial x} + \dfrac{1}{3}\dfrac{\partial u}{\partial y} + \dfrac{1}{4}\dfrac{\partial u}{\partial z} = 0$.	7
	c)	If $u = \dfrac{yz}{x}$, $v = \dfrac{zx}{y}$ and $w = \dfrac{xy}{z}$, show that $\dfrac{\partial(u,v,w)}{\partial(x,y,z)} = 4$.	7

OR

3	a)	Expand $\log_e(1+e^x)$ by the Maclaurin's series up to the fourth-degree term.	6
	b)	If $u = x^2\tan^{-1}\left(y/x\right) - y^2\tan^{-1}\left(x/y\right)$, show that $\dfrac{\partial^2 u}{\partial x\partial y} = \dfrac{x^2 - y^2}{x^2 + y^2}$.	7
	c)	Find the extreme values of the function $f(x,y) = x^2y^2 - 5x^2 - 8xy - 5y^2$.	7

UNIT – III

4	a)	Solve the differential equation $(5x^4 + 3x^2y^2 - 2xy^3)\,dx + (2x^3y - 3x^2y^2 - 5y^4)\,dy = 0$.	6

b) Solve the differential equation $\frac{dy}{dx} + x\sin 2y = x^3 \cos^2 y$. 7

c) Show that the family of curves $y^2 = 4a(x+a)$ is self-orthogonal where a is the parameter. 7

UNIT – IV

5 a) Find the integer solution of the Diophantine equation $172x + 20y = 1000$. 6

b) Apply Chinese Remainder theorem to solve the system of linear congruences $x \equiv 2(\text{mod } 3)$, $x \equiv 3(\text{mod } 5)$, $x \equiv 2(\text{mod } 7)$. 7

c) Apply Fermat's little theorem to find the remainder when 72^{1001} is divided by 31. 7

OR

6 a) Solve the linear congruences $18x \equiv 30(\text{mod } 42)$. 6

b) Solve the polynomial congruence $x^3 + 3x + 5 \equiv 0(\text{mod } 9)$. 7

c) Apply RSA algorithm to find the public and private key using $p = 3$ and $q = 11$ and hence encrypt a certain message with plain text numeral "31". 7

UNIT - V

7 a) Investigate the values of λ *and* μ such that the system $x + y + z = 6$; $x + 2y + 3z = 10$ and $x + 2y + \lambda z = \mu$ has i) No solution ii) Unique solution and iii) infinite number of solutions. 6

b) Apply Gauss – Seidel iterative method to solve the system of equations $27x + 6y - z = 85$; $6x + 15y + 2z = 72$ and $x + y + 54z = 110$ by taking initial approximation as $(0,0,0)$. Carry out 3 iterations. 7

c) Find all the eigenvalues and the corresponding eigenvectors of the matrix 7

$$A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}.$$

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