CBCS SCHEME

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BMATS101

First Semester B.E./B.Tech. Degree Examination, Dec.2023/Jan.2024
Mathematics – I for CSE Stream

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. VTU Formula Hand Book is permitted.
3. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	With usual notation prove that $\tan\phi = r\cdot\frac{d\theta}{dr}$.	6	L2	CO1
	b.	Find the angle between the curves $r = 6\cos\theta$ and $r = 2(1+\cos\theta)$.	7	L2	CO1
	c.	Find the radius of curvature for the Folium of De-Cartes $x^3 + y^3 = 3axy$ at the point $\left(\frac{3a}{2}, \frac{3a}{2}\right)$ on it.	7	L2	CO1
		OR			
Q.2	a.	Show that the curves $r = a(1+\sin\theta)$ and $r = a(1-\sin\theta)$ cut each other orthogonally.	8	L2	CO1
	b.	Find the pedal equation of $r^n = a(1+\cos n\theta)$.	7	L2	CO1
	c.	Using modern mathematical tool, write a program/code to plot the curve sine and cosine curve.	5	L3	CO5
		Module – 2			
Q.3	a.	Using Maclaurin's series, expand $\sqrt{1+\sin 2x}$ in powers of x upto the terms x^4.	7	L2	CO1
	b.	If $U = e^{ax+by} f(ax-by)$, prove that $b\frac{\partial U}{\partial x} + a\frac{\partial U}{\partial y} = 2abU$.	6	L2	CO1
	c.	Find the extreme values of the function $\sin x + \sin y + \sin(x+y)$.	7	L3	CO1
		OR			
Q.4	a.	Evaluate the $\lim_{x\to 0}\left[\frac{a^x+b^x+c^x+d^x}{4}\right]^{1/x}$.	8	L2	CO1
	b.	If $U = f(2x-3y, 3y-4z, 4z-2x)$, prove that $\frac{1}{2}\frac{\partial U}{\partial x} + \frac{1}{3}\frac{\partial U}{\partial y} + \frac{1}{4}\frac{\partial U}{\partial z} = 0$.	7	L2	CO1
	c.	Using modern mathematical tool, write a program/code to evaluate $\underset{x\to\infty}{\mathrm{Lt}}\left(1+\frac{1}{x}\right)^x$.	5	L3	CO5
		Module – 3			
Q.5	a.	Solve $\frac{dy}{dx} + \frac{y}{x} = x^2y^6$.	6	L2	CO2
	b.	Find the orthogonal trajectories of the family $r = a(1+\sin\theta)$.	7	L3	CO2
	c.	Find the solution of the equation $x^2(y-Px) = P^2y$ by reducing into Clairaut's form using the substitution $X = x^2$, $Y = y^2$.	7	L2	CO2
		OR			

Q.6	a.	Solve $(8xy - 9y^2)dx + 2(x^2 - 3xy)dy = 0$.	6	L2	CO2
	b.	A voltage Ee^{-at} is applied at $t = 0$ to a circuit of inductance L and resistant R. Find the current at any time t given that the current is initially zero when $t = 0$.	7	L3	CO2
	c.	Solve $x(y')^2 - (2x + 3y)y' + 6y = 0$.	7	L2	CO2
Module – 4					
Q.7	a.	i) Find the last digit in 7^{289}. ii) Find the remainder when $135 \times 74 \times 48$ is divided by 7.	7	L2	CO3
	b.	Solve the linear congruence $6x \equiv 15 \pmod{21}$.	6	L2	CO3
	c.	Using Wilson's theorem, show that $4(29)! + 5!$ is divisible by 31.	7	L2	CO3
OR					
Q.8	a.	Solve the set of simultaneous congruences $x \equiv 5 \pmod 3$, $x \equiv 2 \pmod 5$, $x \equiv 1 \pmod{11}$.	7	L2	CO3
	b.	Solve $7x + 3y \equiv 10 \pmod{16}$, $2x + 5y \equiv 9 \pmod{16}$.	6	L2	CO3
	c.	Show that $2^{340} - 1$ is divisible by 31, using Fermat's little theorem.	7	L2	CO3
Module – 5					
Q.9	a.	Find the rank of the matrix $\begin{bmatrix} 1 & 2 & 4 & 3 \\ 2 & 4 & 6 & 8 \\ 4 & 8 & 12 & 16 \\ 1 & 2 & 3 & 4 \end{bmatrix}$	6	L2	CO4
	b.	Solve the system of equation by using Gauss-Jordan method. $x + y + z = 8$, $-x - y + 2z = -4$, $3x + 5y - 7z = 14$	7	L3	CO4
	c.	Using Rayleigh's power method, find the largest eigen value and the corresponding eigen vector of the matrix $A = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$ by taking initial vector as $[1 \ 1 \ 1]^T$. Perform 6 iterations.	7	L3	CO4
OR					
Q.10	a.	Solve the system of equation by using Gauss elimination method. $x + 2y + z = 3$, $2x + 3y + 3z = 10$, $3x - y + 2z = 13$	8	L3	CO4
	b.	Solve the following system of equations by Gauss-Seidal method $20x + y - 2z = 17$, $3x + 20y - z = -18$, $2x - 3y + 20z = 25$	7	L3	CO4
	c.	Using modern mathematical tool, write a programme/code to test the consistency of the equation: $x + 2y - z = 1$, $2x + y + 4z = 2$, $3x + 3y + 4z = 1$	5	L3	CO5

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