CBCS SCHEME

USN | | | | | | | | | | |

BMATS101

First Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
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.	Find the angle between the curves, $r = \frac{a}{1+\cos\theta}$ and $r = \frac{b}{1-\cos\theta}$.	6	L2	CO1
	b.	Find the pedal equations of the curve $r^m = a^m \cos(m\theta)$.	7	L2	CO1
	c.	Determine the radius of curvature of the curve $r^2 \sec(2\theta) = a^2$.	7	L2	CO1
		OR			
Q.2	a.	With usual notation prove that $\tan\phi = r\frac{d\theta}{dr}$.	8	L2	CO1
	b.	Show that tangents to the cardioid $r = a(1+\cos\theta)$ at the points $\theta = \frac{\pi}{3}$ and $\theta = \frac{2\pi}{3}$ are respectively parallel and perpendicular to the initial line.	7	L2	CO1
	c.	Using modern mathematical tool write a programme/code to plot $r = 2\lvert\cos 2\theta\rvert$.	5	L3	CO5
		Module – 2			
Q.3	a.	Expand $\sqrt{1+\sin 2x}$ as Maclaurin's series up to fourth degree terms.	6	L2	CO1
	b.	If $u = f(y-z, z-x, x-y)$, prove that $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$.	7	L2	CO1
	c.	Compute $J = \frac{\partial(x,y,z)}{\partial(\rho,\phi,z)}$ for $x = \rho\cos\phi$, $y = \rho\sin\phi$ and $z = z$	7	L2	CO1
		OR			
Q.4	a.	If $u = e^{(ax+by)} f(ax-by)$, prove that $b\frac{\partial u}{\partial x} + a\frac{\partial u}{\partial y} = 2abu$.	8	L2	CO1
	b.	Prove that $x^2\frac{\partial u}{\partial x} + y^2\frac{\partial u}{\partial y} + z^2\frac{\partial u}{\partial z} = 0$ for $u = f\left(\frac{y-x}{xy}, \frac{z-x}{xz}\right)$	7	L2	CO1
	c.	Using modern mathematical tool write a programe/code to show that $u_{xx} + u_{yy} = 0$, given that $u = e^x(x\cos y - y\sin y)$.	5	L2	CO5
		Module – 3			
Q.5	a.	Solve $\left[y\left(1+\frac{1}{x}\right) + \cos y\right]dx + [x + \log x - x\sin y]dy = 0$	6	L2	CO2
	b.	Show that the curve $y^2 = 4a(x+a)$ is self-orthogonal.	7	L3	CO2
	c.	A 12-volts battery connected to a series circuit in which the inductance is $\frac{1}{2}$ henry and resistance is 10 ohms. Find the current 'i' if the initial current is zero.	7	L3	CO2

		OR			
Q.6	**a.**	Solve $x\frac{dy}{dx}+y=x^3y^6$.	6	L2	CO2
	b.	Find orthogonal trajectories of the family $r^n\cos n\theta=a^n$.	7	L3	CO2
	c.	Find the general solutions of the equations $(px-y)(py+x)=a^2P$ by reducing into Clairaut's form by taking $u=x^2$, $v=y^2$.	7	L2	CO2
		Module – 4			
Q.7	**a.**	Find remainder when $(349\times 74\times 36)$ is divided by 3.	6	L1	CO3
	b.	Solve linear Diophantine equations $13x+17y=5$.	7	L2	CO3
	c.	Solve the system of linear congruence $x\equiv 2(\text{mod}3)$, $x\equiv 3(\text{mod}5)$ and $x\equiv 2(\text{mod}7)$, using remainder theorem.	7	L2	CO3
		OR			
Q.8	**a.**	Find the last digit in 7^{126}.	6	L2	CO3
	b.	Solve $2x+6y\equiv 1(\text{mod}7)$ $4x+3y\equiv 2(\text{mod}7)$	7	L2	CO3
	c.	Find the remainder when 7^{121} is divisible by 13.	7	L2	CO3
		Module – 5			
Q.9	**a.**	Solve the system of equation by using Gauss-Jordan method. $x+y+z=9$, $2x+y-z=0$, $2x+5y+7z=52$.	6	L2	CO4
	b.	For what values λ and μ the system of equations, $x+y+z=6$, $x+2y+3z=10$, $x+2y+\lambda z=\mu$ has (i) no solution (ii) a unique solution and (iii) Many solutions.	7	L2	CO4
	c.	Using power method, find the largest eigen value and corresponding vector of the matrix, $A=\begin{bmatrix}6 & -2 & 2\\ -2 & 3 & -1\\ 2 & -1 & 3\end{bmatrix}$.	7	L2	CO4
		OR			
Q.10	**a.**	Determine the rank of the matrix $A=\begin{bmatrix}91 & 92 & 93 & 94 & 95\\ 92 & 93 & 94 & 95 & 96\\ 93 & 94 & 95 & 96 & 97\\ 94 & 95 & 96 & 97 & 98\\ 95 & 96 & 97 & 98 & 99\end{bmatrix}$.	8	L1	CO4
	b.	Using the Gauss-Seidel iteration method, solve the equation $27x+6y-z=85$, $6x+15y+2z=72$, $x+y+54z=110$. Carry out four iterations.	7	L2	CO4
	c.	Using modern mathematical tool, write a program/code to find the largest eigen value of $A=\begin{bmatrix}1 & 1 & 3\\ 1 & 5 & 1\\ 3 & 1 & 1\end{bmatrix}$ by power method.	5	L3	CO5

* * * * *