CBCS SCHEME

USN | | | | | | | | | |

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 $\underset{x\to\infty}{Lt}\left(1+\frac{1}{x}\right)^x$.	5	L3	CO5
		Module – 3			
Q.5	a.	Solve $\frac{dy}{dx} + \frac{y}{x} = x^2 y^6$.	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 $x^2(y - Px) = P^2 y$ 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 $6x\equiv 15(\text{mod}\,21)$.	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 $x\equiv 5(\text{mod}\,3)$, $x\equiv 2(\text{mod}\,5)$, $x\equiv 1(\text{mod}\,11)$.	7	L2	CO3
	b.	Solve $7x+3y\equiv 10(\text{mod}\,16)$, $2x+5y\equiv 9(\text{mod}\,16)$.	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 $20x+y-2y=17$, $3x+20y-z=-18$, $2x-3y+20z=25$	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

* * * * *