

CBCS SCHEME

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BMATS101

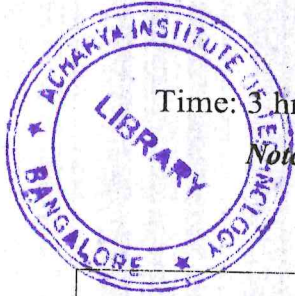
First Semester B.E./B.Tech. Degree Examination, June/July 2026

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 $\tan \phi = r \frac{d\theta}{dr}$.	06	L2	CO1	
	b.	Find the angle between the curves $r = 6\cos\theta$ and $r = 2(1 + \cos\theta)$.	07	L2	CO1	
	c.	Show that the radius of curvature at any point of the cycloid $x = a(\theta + \sin\theta)$, $y = a(1 - \cos\theta)$ is $4a \cos\left(\frac{\theta}{2}\right)$.	07	L2	CO1	
OR						
Q.2	a.	Show that the curves $r = a(1 + \cos\theta)$ and $r = b(1 - \cos\theta)$ cut each other orthogonally.	07	L2	CO1	
	b.	Find the pedal equation of the curve $r^n = a^n \cos n\theta$.	08	L2	CO1	
	c.	Using modern mathematical tool write a program / code to plot the curve $r = 2 \cos 2\theta $.	05	L3	CO5	
Module – 2						
Q.3	a.	Expand $e^{\sin x}$ as Maclaurin's series upto the terms containing x^4 .	06	L2	CO1	
	b.	If $u = f\left(\frac{x}{y}, \frac{y}{z}, \frac{z}{x}\right)$, prove that $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} + z \frac{\partial u}{\partial z} = 0$.	07	L2	CO1	
	c.	Find the extreme values of the function $f(x, y) = x^3 + y^3 - 3x - 12y + 20$.	07	L3	CO1	
OR						
Q.4	a.	Evaluate $\lim_{x \rightarrow 0} \left[\frac{a^x + b^x + c^x + d^x}{4} \right]^{1/x}$.	07	L2	CO1	
	b.	If $u = \frac{yz}{x}$, $v = \frac{zx}{y}$, $w = \frac{xy}{z}$, show that $\frac{\partial(u, v, w)}{\partial(x, y, z)} = 4$.	08	L2	CO1	
	c.	Using modern mathematical tool write a program/code to show that $u_{xx} + u_{yy} = 0$ given $u = e^x (x \cos(y) - y \sin(y))$.	05	L3	CO5	
Module – 3						
Q.5	a.	Solve: $\frac{dy}{dx} + \frac{y}{x} = y^2 x$.	06	L2	CO2	
	b.	Find the orthogonal trajectories of the family of parabolas $y^2 = 4ax$.	07	L3	CO2	
	c.	Solve: $y \left(\frac{dy}{dx} \right)^2 + (x - y) \frac{dy}{dx} - x = 0$.	07	L2	CO2	

OR

Q.6	a.	Solve : $\frac{dy}{dx} + \frac{y \cos x + \sin y + y}{\sin x + x \cos y + x} = 0$	06	L2	CO2
	b.	A series circuit with resistance R, inductance L and electromotive force E is governed by the differential equation $L \frac{di}{dt} + Ri = E$, where L and R are constants and initially the current i is zero. Find the current at any time t.	07	L3	CO2
	c.	Solve the equation $(px - y)(py + x) = 2p$ by reducing into Clairaut's form by taking substitution $X = x^2$ and $Y = y^2$.	07	L2	CO2

Module – 4

Q.7	a.	Find the least positive values of x such that i) $71 \equiv x \pmod{8}$ ii) $78 + x \equiv 3 \pmod{5}$ iii) $89 \equiv (x + 3) \pmod{4}$	06	L2	CO3
	b.	Find the remainder when $175 \times 113 \times 53$ is divided by 11.	07	L2	CO3
	c.	Solve : $7x + 3y \equiv 10 \pmod{16}$ and $2x + 5y \equiv 9 \pmod{16}$	07	L3	CO3

OR

Q.8	a.	Solve : $x \equiv 1 \pmod{4}$, $x \equiv 0 \pmod{3}$, $x \equiv 5 \pmod{7}$ by using remainder theorem.	06	L2	CO3
	b.	Find the general solutions of LDE $5x + 11y = 92$.	07	L3	CO3
	c.	Encrypt the message "Stop" using RSA with key (2537, 13) using prime numbers 43 and 59.	07	L2	CO3

Module – 5

Q.9	a.	Find the rank of the matrix $\begin{bmatrix} 2 & -1 & -3 & -1 \\ 1 & 2 & 3 & -1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & -1 \end{bmatrix}$	06	L2	CO4
	b.	Solve the system of equations by Gauss-Jordan Method. $x + y + z = 9$; $x - 2y + 3z = 8$; $2x + y - z = 3$	07	L3	CO4
	c.	Investigate the values of λ and μ such that the system of equations $x + y + z = 6$; $x + 2y + 3z = 10$; $x + 2y + \lambda z = \mu$ may have (i) Unique solution (ii) Infinite solution (iii) No solution.	07	L2	CO4

OR

Q.10	a.	Solve the following system of equations by Gauss-Seidel Method. $10x + y + z = 12$; $x + 10y + z = 12$; $x + y + 10z = 12$	08	L2	CO4
	b.	Solve the following system of equations by Gauss-Elimination Method. $2x + y + 4z = 12$; $4x + 11y - z = 33$; $8x - 3y + 2z = 20$	07	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.	05	L3	CO5
