

CBCS SCHEME

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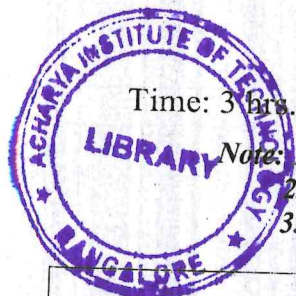
BMATM101

First Semester B.E./B.Tech. Degree Examination, June/July 2026 Mathematics – I for ME Stream

Time: 3 hrs.

Max. Marks: 100

- Notes:* 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 $\tan \phi = r \frac{d\theta}{dr}$	6	L2	CO1
	b.	Find the angle of intersection of the curves $r = \frac{a}{1 + \cos \theta}$ and $r = \frac{b}{1 - \cos \theta}$	7	L2	CO1
	c.	Find the pedal equation of $\frac{2a}{r} = 1 - \cos \theta$	7	L3	CO1

OR

Q.2	a.	Derive the radius of curvature for the Cartesian form.	6	L2	CO1
	b.	Find the angle of 'φ' for the polar curve $r = a(1 + \sin \theta)$. Hence determine the slope of the curve at $\theta = \pi/2$	7	L2	CO1
	c.	Using modern mathematical tool write a programme/code to plot sine and cosine curve.	7	L3	CO5

Module – 2

Q.3	a.	Expand $\log (1 + e^x)$ by using Maclaurin's series upto the term containing x^4 .	6	L2	CO2
	b.	If $u = f(2x - 3y, 3y - 4z, 4z - 2x)$ show 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	CO2
	c.	Examine the function $f(x, y) = 2(x^2 - y^2) - x^4 + y^4$ for extreme values.	7	L3	CO2

OR

Q.4	a.	Evaluate $\lim_{x \rightarrow 0} \left(\frac{a^x + b^x + c^x + d^x}{4} \right)^{1/x}$	6	L2	CO2
	b.	If $x = r \sin \theta \cos \phi$, $y = r \sin \theta \sin \phi$, $z = r \cos \theta$, show that $\frac{\partial(x, y, z)}{\partial(r, \theta, \phi)} = r^2 \sin \theta$	7	L2	CO2

	c.	Using modern mathematical tool write a programme to show that $u_{xx} + u_{yy} = 0$ where $u = e^x [x \cos y - y \sin y]$	7	L3	CO5
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Module – 3

Q.5	a.	Solve $\frac{dy}{dx} + y \tan x = y^2 \sec x$	6	L2	CO3
	b.	Find the orthogonal trajectories of the family of curves $\frac{x^2}{a^2} + \frac{y^2}{b^2 + \lambda} = 1$ where λ is a parameter.	7	L3	CO3
	c.	Solve $yp^2 + (x-y)p - x = 0$	7	L2	CO3

OR

Q.6	a.	Solve $(8xy - 9y^2) dx + 2(x^2 - 3xy) dy = 0$	6	L2	CO3
	b.	If the temperature of the air is 30°C and the substance cool from 100°C in 15 minutes. Find when the temperature reaches at 40°C .	7	L2	CO3
	c.	Find the general and singular solution of $(p-1)e^{3x} + p^3e^{2y} = 0$ by using the substitution $u = e^x$ and $v = e^y$.	7	L3	CO3

Module – 4

Q.7	a.	Solve $(\Delta^4 + 5D^3 + 6D^2 - 4D - 8)y = 0$	6	L2	CO3
	b.	Solve $\frac{d^3y}{dx^3} + 2\frac{d^2y}{dx^2} + \frac{dy}{dx} = e^{-x} + \sin 2x$	7	L2	CO3
	c.	Solve $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 9y = \frac{e^{3x}}{x^2}$ by the method of variation of parameters.	7	L3	CO3

OR

Q.8	a.	Solve $[D^4 + 2D^3 + 3D^2 + 2D + 1]Y = 0$	6	L2	CO3
	b.	Solve $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = 8(e^{2x} + \sin 2x + x^2)$	7	L2	CO3
	c.	Solve $x^3 \frac{d^3y}{dx^3} + 2x^2 \frac{d^2y}{dx^2} + 2y = 10(x + 1/x)$	7	L3	CO3

Module – 5

Q.9	a.	Find the rank of the matrix $A = \begin{bmatrix} 2 & 3 & -1 & -1 \\ 1 & -1 & -2 & -4 \\ 3 & 1 & 3 & -2 \\ 6 & 3 & 0 & -7 \end{bmatrix}$	6	L2	CO4
	b.	Solve the system of equations by Gauss-Jordan method $2x + 3y - z = 5, 4x + 4y - 3z = 3, 2x - 3y + 2z = 2$	7	L3	CO4
	c.	For what values of λ and μ the system of equations $2x + 3y + 5z = 9, 7x + 3y - 2z = 8, 2x + 3y + \lambda z = \mu$ may have i) unique solution ii) infinite solution iii) no solution.	7	L3	CO4
OR					
Q.10	a.	Solve the system of equations using Gauss seidal method by taking $(0, 0, 0)$ as an initial conditions $10x + y + z = 12, 2x + 10y + z = 13, 2x + 2y + 10z = 14$	6	L2	CO4
	b.	Using Rayleigh's power method find the dominant eigen value and the corresponding eigen vector of $\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ by taking $[1 \ 1 \ 1]^T$ as the initial eigen vector (carry out 5 iterations).	7	L2	CO4
	c.	Using modern mathematical tool write a programme / code to test the consistency of the equations $x + 2y - z = 1, 2x + y + 4z = 2, 3x + 3y + 4z = 1$.	7	L3	CO5
