

CBCS SCHEME

USN

--	--	--	--	--	--	--	--	--	--

BMATE101

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



Time: 3 hrs.

Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks, L: Bloom's level, C: Course outcomes.

Module – 1			M	L	C
1	a.	With usual notations prove that $\tan \phi = r \frac{d\theta}{dr}$.	6	L2	CO1
	b.	Find the angle between the curves $r = a(1 + \cos \theta)$ and $r = b(1 - \cos \theta)$.	7	L2	CO1
	c.	Find the radius of curvature for the cardioids $r = a(1 + \cos \theta)$	7	L3	CO1

OR

2	a.	If p be the perpendicular from the pole on the tangent, then show that : $\frac{1}{p^2} = \frac{1}{r^2} + \frac{1}{r^4} \left(\frac{dr}{d\theta} \right)^2$.	6	L2	CO1
	b.	Find the radius of curvature of the curve $x^3 + y^3 = 3axy$ at $\left(\frac{3a}{2}, \frac{3a}{2} \right)$.	7	L2	CO1
	c.	Using modern mathematical tool, write a program to plot the curve $r = 2 \cos 2\theta $.	7	L3	CO5

Module – 2

3	a.	Expand $\sqrt{1 + \sin 2x}$ using Maclaurin's series expansion upto term containing x^4 .	6	L2	CO1
	b.	If $u = f(2x - 3y, 3y - 4z, 4z - 2x)$ show that $6 \frac{\partial u}{\partial x} + 4 \frac{\partial u}{\partial y} + 3 \frac{\partial u}{\partial z} = 0$.	7	L2	CO1
	c.	Show that the function $f(x, y) = x^3 + y^3 - 3xy + 1$ is minimum at the point (1, 1).	7	L3	CO2

OR

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 $u = \frac{xy}{z}$, $v = \frac{yz}{x}$ and $w = \frac{xz}{y}$ then show that $J \left(\frac{u, v, w}{x, y, z} \right) = 4$.	7	L2	CO2
	c.	Using modern mathematical tool write a program to evaluate : $\lim_{x \rightarrow \infty} \left(1 + \frac{1}{x} \right)^x$	7	L3	CO5

Module – 3

5	a.	Solve $\frac{dy}{dx} + y \tan x = y^3 \sec x$.	6	L2	CO2
	b.	Find the orthogonal trajectories of a family of curves $\frac{2a}{r} = 1 - \cos \theta$.	7	L3	CO2
	c.	Solve : $xyp^2 - (x^2 + y^2)p + xy = 0$.	7	L2	CO2

OR

6	a.	Solve $(x^2 + y^2 + x)dx + xy dy = 0$.	6	L2	CO2
	b.	When a resistance R ohms connected in series with an inductance Harries with an emf of E volts, the current i amperes at time t is given by $L \frac{di}{dt} + Ri = E$. If $E = 10 \sin t$ volts and $i = 0$ when $t = 0$. Find i as a function of t.	7	L3	CO2
	c.	Find the general solution of the equation $(px - y)(py + x) = a^2p$ by reducing into Clairaut's form, taking the substitution $X = x^2$, $Y = y^2$.	7	L2	CO2

OR					
Q.8	a.	Solve $(D^2 + 5D + 4)y = 3 - 2x$.	6	L2	CO3
	b.	Solve by method of variation of parameters $\frac{d^2y}{dx^2} + y = \frac{1}{1 + \sin x}$	7	L3	CO3
	c.	Solve $x^2 \frac{d^2y}{dx^2} - x \frac{dy}{dx} + y = \log x$.	7	L2	CO4
Module – 5					
Q.9	a.	Find the rank of the matrix $\begin{bmatrix} 4 & 0 & 2 & 1 \\ 2 & 1 & 3 & 4 \\ 2 & 3 & 4 & 7 \\ 2 & 3 & 1 & 4 \end{bmatrix}$	6	L2	CO4
	b.	Solve the system of equations by Gauss – Jordan method $x + y + z = 9, x - 2y + 3z = 8, 2x + y - z = 3$.	7	L2	CO4
	c.	Using power method, find the largest eigen value and the corresponding eigen vectors of $\begin{bmatrix} 1 & -3 & 2 \\ 1 & 4 & -1 \\ 6 & 3 & 5 \end{bmatrix}$ by taking $(1, 0, 0)^T$ as initial eigen vector.	7	L3	CO4
OR					
Q.10	a.	Solve the system of equations $2x - 3y + 20z = 25, 20x + y + z = 17, 3x + 20y - z = -18$, using Gauss – seidel method, taking $(0, 0, 0)$ as an initial approximation carryout 4 iterations.	7	L2	CO4
	b.	For what values of λ and μ the system of equations $2x + 3y + 5z = 9, 7x + 3y - 2z = 8, 2x + 3y + \lambda z = \mu$ has i) no solution ii) a unique solution iii) infinite number of solutions.	8	L2	CO4
	c.	Using Modern mathematical tool write a program/code to find the largest eigen value of $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$	5	L3	CO5