

# CBCS SCHEME

BMATE101



**First Semester B.E./B.Tech. Degree Examination, June/July 2023**  
**Mathematics-I for EEE Stream**

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 notations prove that $\tan \phi = r \frac{d\theta}{dr}$ .	6	L1	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 Cardioid $r = a(1 + \cos \theta)$ .	7	L2	CO1
OR					
Q.2	a.	If p be the perpendicular from the pole on to 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	L1	CO1
	b.	Find the pedal equation of the curve $r^n = a^n \cos n\theta$ .	7	L2	CO1
	c.	Using modern mathematical tool, write a program/code to plot the curve $r = 2(\cos 2\theta)$ .	7	L3	CO5
Module - 2					
Q.3	a.	Expand $f(x) = \sin x + \cos x$ by MaClaurin's series upto the terms containing $x^4$ .	6	L3	CO1
	b.	If $u = f(2x - 3y, 3y - 4z, 4z - 2x)$ , show that $6u_x + 4u_y + 3u_z = 0$ .	7	L2	CO1
	c.	If $u = \frac{yz}{x}$ , $v = \frac{zx}{y}$ , $w = \frac{xy}{z}$ show that $\frac{\partial(u, v, w)}{\partial(x, y, z)} = 4$ .	7	L2	CO1
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	CO1
	b.	Show that the function $f(x, y) = x^3 + y^3 - 3xy + 1$ is minimum at the point (1, 1).	7	L2	CO1
	c.	Using modern mathematical tool, write a program/code to show that $u_{xx} + u_{yy} = 0$ , given $u = e^x(x \cos y - y \sin y)$ .	7	L3	CO5

Module – 3					
Q.5	a.	Solve $\frac{dy}{dx} + y \tan x = y^3 \sec x$ .	6	L2	CO2
	b.	Prove that the system of parabola's $y^2 = 4a(x + a)$ is self orthogonal.	7	L2	CO2
	c.	Solve $xyp^2 - (x^2 + y^2)p + xy = 0$ .	7	L2	CO2
OR					
Q.6	a.	Solve $(x^2 + y^2 + x)dx + xydy = 0$ .	6	L2	CO2
	b.	When a resistance R ohms connected in series with an inductance L henries with an emf of E volts, the current i amperes at time t is given by $L \frac{di}{dt} + Ri = E$ . If $E = 100 \sin t$ 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
Module – 4					
Q.7	a.	Evaluate $\int_{-c-b-a}^c \int_b^a \int_a^c (x^2 + y^2 + z^2) dx dy dz$ .	6	L2	CO3
	b.	Evaluate $\int_0^1 \int_x^{\sqrt{x}} xy dy dx$ by changing the order of integration.	7	L2	CO3
	c.	Prove that $\int_0^{\pi/2} \sqrt{\sin \theta} d\theta \times \int_0^{\pi/2} \frac{d\theta}{\sqrt{\sin \theta}} = \pi$ .	7	L2	CO3
OR					
Q.8	a.	Evaluate $\int_0^1 \int_0^{\sqrt{1-y^2}} (x^2 + y^2) dx dy$ by changing into polar coordinates.	6	L2	CO3
	b.	Prove that relation between beta and gamma function $\beta(m, n) = \frac{\Gamma m \Gamma n}{\Gamma m + n}$ .	7	L3	CO3
	c.	Using double integration find the area between the parabolas $y^2 = 4ax$ and $x^2 = 4ay$ .	7	L3	CO3
Module – 5					
Q.9	a.	Find the rank of the matrix $A = \begin{bmatrix} 2 & -1 & -3 & -1 \\ 1 & 2 & 3 & -1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & -1 \end{bmatrix}$	6	L2	CO4

CMRIT LIBRARY  
RANGALORE - 560 037

	b.	Solve the system of equations by Jordan method. $2x + 5y + 7z = 52, \quad 2x + y - z = 0, \quad x + y + z = 9$	7	L2	CO4
	c.	Using Rayleigh's power method, find the largest eigen value and the corresponding eigen vector of $A = \begin{bmatrix} 2 & 0 & 1 \\ 0 & 2 & 0 \\ 1 & 0 & 2 \end{bmatrix}$ by taking $[1 \ 0 \ 0]^T$ as initial eigen vector. (Carry out 6 iterations)	7	L3	CO4
<b>OR</b>					
Q.10	a.	Solve the following system of equations by Gauss elimination method: $x + y + z = 9, \quad x - 2y + 3z = 8, \quad 2x + y - z = 3$	7	L2	CO4
	b.	For what values of $\lambda$ and $\mu$ the system of equations $x + y + z = 6, \quad x + 2y + 3z = 10, \quad x + 2y + \lambda z = \mu$ has (i) no solution (ii) unique solution (iii) many solutions.	8	L2	CO4
	c.	Using modern mathematical tool, write a program/code to find the largest eigen value of $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ by power method.	5	L3	CO5

CMRIT LIBRARY  
BANGALORE - 560 037

\*\*\*\*\*