CBCS SCHEME

USN | | | | | | | | | | |

BMATE101

First Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025

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.
3. VTU Formula Handbook is permitted.

		Module – 1	M	L	C
Q.1	a.	With usual notations , prove that $\tan\phi = r.\ d\theta/dr$.	6	L2	CO1
	b.	Show that the curves $r = a(1 + \cos\theta)$ and $r = b(1 - \cos\theta)$ intersects orthogonally.	7	L2	CO1
	c.	Find the radius of curvature for the curve $x^3 + y^3 = 3axy$ at $\left(3a/2, 3a/2\right)$.	7	L3	CO1
		OR			
Q.2	a.	Find the angle of intersection between curves $r^n = a^n \cos n\theta$ and $r^n = b^n \sin n\theta$.	7	L2	CO1
	b.	Find the pedal equation of the curve $r^m = a^m (\cos m\theta + \sin m\theta)$.	8	L2	CO1
	c.	Using modern mathematical tool, write a program to plot the curve $r = 2\lvert\cos 2\theta\rvert$.	5	L3	CO1
		Module – 2			
Q.3	a.	Expand $\sqrt{1+\sin 2x}$ using Maclaurin's series expansion upto terms containing x^6.	6	L2	CO1
	b.	If $u = f\left(x/y, y/z, z/x\right)$ then prove that $x\dfrac{\partial u}{\partial x} + y\dfrac{\partial u}{\partial y} + z\dfrac{\partial u}{\partial z} = 0$.	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	CO1
		OR			
Q.4	a.	If $u = xy/z$, $v = yz/x$ and $w = xz/y$ then show that $J\left(\dfrac{u,v,w}{x,y,z}\right) = 4$.	7	L2	CO1
	b.	Find the extreme values of the function $f(x, y) = x^3 + y^3 - 3x - 12y + 20$.	8	L3	CO1
	c.	Using modern tool write a program to evaluate $\lim\limits_{x\to\infty}\left(1 + 1/x\right)^x$.	5	L3	CO5

		Module – 3			
Q.5	**a.**	Solve $x\dfrac{dy}{dx} + y = x^3y^6$.	6	L2	CO2
	b.	Find the orthogonal trajectories of a family of curves $2a/r = 1 - \cos\theta$.	7	L3	CO2
	c.	Solve $xy(p^2) - (x^2 + y^2)p + xy = 0$.	7	L2	CO2
		OR			
Q.6	**a.**	Solve $(x^2 + y^2 + x)dx + xy\,dy = 0$.	6	L2	CO2
	b.	A series circuit with resistance R, inductance L and electromotive force E is governed by the differential equation $L\,di/dt + Ri = E$, where L and R are constants and initially the current i is zero. Find the current at any time t.	7	L3	CO2
	c.	Solve $(px - y)(py + x) = a^2p$ by reducing into Clairaut's form using the substitution $X = x^2$ and $Y = y^2$.	7	L2	CO2
		Module – 4			
Q.7	**a.**	Evaluate $\int_{-1}^{+1}\int_{0}^{z}\int_{x-z}^{x+z}(x + y + z)\,dy\,dx\,dz$.	6	L2	CO3
	b.	Change the order of integration and evaluate $\int_{0}^{1}\int_{x}^{\sqrt{x}} xy\,dy\,dx$.	7	L2	CO3
	c.	Prove that $\beta(m, n) = \dfrac{\sqrt{m}.\sqrt{n}}{\sqrt{m+n}}$.	7	L2	CO3
		OR			
Q.8	**a.**	Evaluate $\int_{0}^{\infty}\int_{0}^{\infty} e^{-(x^2+y^2)}dxdy$ by changing into polar coordinates.	6	L2	CO3
	b.	Evaluate $\int_{0}^{\pi/2}\sqrt{\text{Cot}\theta}\,d\theta$ by expressing in terms of gamma functions.	7	L2	CO3
	c.	Using double integration find the area between the curves $y^2 = 4ax$ 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
	b.	Investigate the values of λ and μ such that the system of equations $x + y + z = 6$, $x + 2y + 3z = 10$ and $x + 2y + \lambda z = \mu$ may have i) Unique solution ii) Infinite solution iii) No solution.	7	L3	CO4
	c.	Using Rayleigh's power method find the largest eigen value and the corresponding eigen vector of the matrix $\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ by taking $[1, 1, 1]^T$ as initial eigen vector.	7	L3	CO4
		OR			
Q.10	a.	Solve by using Gauss – Jordan method $x + y + z = 9$, $x - 2y + 3z = 8$ and $2x + y - z = 3$.	7	L2	CO4
	b.	Solve by using Gauss – Siedel method $20x + y - 2z = 17$, $3x + 20y - z = -18$ and $2x - 3y + 20z = 25$.	8	L2	CO4
	c.	Using modern mathematical model, write a program to test the consistency of the equations $x + 2y - z = 1$, $2x + y + 4z = 2$ and $3x + 3y + 4z = 1$.	5	L3	CO5

* * * * *