CBCS SCHEME

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

BMATE101

First Semester B.E./B.Tech. Degree Examination, June/July 2023
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. 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 Cardiod $r = a(1+\cos\theta)$.	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 $\lim_{x\to 0}\left(\frac{a^x + b^x + c^x + d^x}{4}\right)^{1/x}$.	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 $\int_{-c}^{c}\int_{-b}^{b}\int_{-a}^{a}(x^2+y^2+z^2)dxdydz$.	6	L2	CO3
	b.	Evaluate $\int_0^1\int_x^{\sqrt{x}} xydydx$ 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 $\int_0^1\int_0^{\sqrt{1-y^2}}(x^2+y^2)dxdy$ by changing into polar coordinates.	6	L2	CO3
	b.	Prove that relation between beta and gamma function $\beta(m,n) = \frac{\Gamma m \Gamma n}{\Gamma m + m}$.	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

			Marks	Level	CO
	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
		OR			
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 λ and μ 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

* * * * *