CBCS SCHEME

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BMATE101

First Semester B.E/B.Tech. Degree Examination, Dec.2023/Jan.2024
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
1	a.	With usual notations prove that $\tan\phi = r\dfrac{d\theta}{dr}$.	6	L2	CO1
	b.	Find the angle of intersection for the pair of curve $r = a(1 + \sin\theta)$, $r = b(1 - \sin\theta)$.	7	L2	CO1
	c.	Find the radius of curvature of the curve $x^3 + y^3 = 3xy$ at $\left(\dfrac{3}{2}, \dfrac{3}{2}\right)$.	7	L2	CO1
		OR			
2	a.	Prove that the pair of curves $r = a\sec^2\left(\dfrac{\theta}{2}\right)$, $r = b\operatorname{cosec}^2\left(\dfrac{\theta}{2}\right)$ intersect orthogronally.	8	L2	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 sine and cosine curves.	5	L3	CO5
		Module – 2			
3	a.	Expand $\log(\sec x)$ up to the term containing x^6 using Maclaurin's series.	6	L2	CO1
	b.	If $u = \tan^{-1}\left(\dfrac{y}{x}\right)$ where $x = e^t - e^{-t}$ and $y = e^t + e^{-t}$. Find $\dfrac{du}{dt}$.	7	L2	CO1
	c.	If: $u = x + 3y^2 - z^3$, $v = 4x^2yz$, $w = 2z^2 - xy$. Find $\dfrac{\partial(u,v,w)}{\partial(x,y,z)}$ at $(1,-1,0)$.	7	L3	CO1

			Marks	Level	CO
		OR			
4	a.	Evaluate : i) $\lim_{x\to 0}\left(\frac{a^x+b^x}{2}\right)^{1/x}$ ii) $\lim_{x\to 0}(\sin x)^{\tan x}$.	7	L2	CO1
	b.	If u=f(y – z, z – x, x – y) prove that $\frac{\partial u}{\partial x}+\frac{\partial u}{\partial y}+\frac{\partial u}{\partial z}=0$.	8	L2	CO1
	c.	Using modern mathematical tool write a program/ code to evaluate : $\lim_{x\to\infty}\left(1+\frac{1}{x}\right)^x$.	5	L3	CO5
		Module – 3			
5	a.	Solve : $\frac{dy}{dx}+2\frac{y}{x}=\frac{y^2\log x}{x}$.	6	L2	CO2
	b.	Find the orthogonal trajectories of the family of Asteroid $x^{2/3}+y^{2/3}=a^{2/3}$.	7	L3	CO2
	c.	Solve : $p^3+2xp^2-y^2p^2-2xy^2p=0$.	7	L2	CO2
		OR			
6	a.	Solve : $y(x+y+1)dx+x(x+3y+2)dy=0$.	6	L2	CO2
	b.	Show that a DE for the current i in an electric circuit containing an inductance L and resistance R in series and acted by an electromotive force E sin ωt satisfies the equation : $L\frac{di}{dt}+Ri=E\sin\omega t$. Find the value of the current at any time t, if initially there is no current in the circuit.	7	L3	CO2
	c.	Modify the equation into Clairaut's form. Hence find the general and singular solution of $xp^2-py+kp+a=0$.	7	L2	CO2
		Module – 4			
7	a.	Evaluate : $\int_{-1}^{1}\int_{0}^{z}\int_{x-z}^{x+z}(x+y+z)\,dy\,dx\,dz$.	6	L2	CO3
	b.	Evaluate by changing the order of integration : $\int_0^1\int_0^{\sqrt{1-x^2}} y^2\,dx\,dy$.	7	L2	CO3
	c.	Prove that $\beta(m,n)=\frac{\Gamma(m)\cdot\Gamma(n)}{\Gamma(m+n)}$.	7	L2	CO3

		OR			
8	a.	Evaluate : $\int_0^a \int_0^{\sqrt{a^2-y^2}} y\sqrt{x^2+y^2}\,dxdy$ by changing into polar form.	6	L2	CO3
	b.	Find the area bounded between the parabolas $y^2 = 4ax$ and $x^2 = 4ay$ using double integration.	7	L3	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
		Module – 5			
9	a.	Find the Rank of the Matrix : $\begin{bmatrix} 1 & 0 & 2 & -2 \\ 2 & -1 & 0 & -1 \\ 1 & 0 & 2 & -1 \\ 4 & -1 & 3 & -1 \end{bmatrix}$.	6	L2	CO4
	b.	Solve the system of equations by Gauss – Elimination method. $2x + y + z = 10$ $3x + 2y + 3z = 18$ $x + 4y + 9z = 16$.	7	L3	CO4
	c.	Using Gauss – Seidel iterative method to solve : $5x + 2y + z = 12$ $x + 4y + 2z = 15$ $x + 2y + 5z = 20$ Carryout 4 iterations, taking the initial approximation to the solution as (1, 0, 3).	7	L3	CO4
		OR			
10	a.	Find the Rank of the matrix : $\begin{bmatrix} 4 & 0 & 2 & 1 \\ 2 & 1 & 3 & 4 \\ 2 & 3 & 4 & 7 \\ 2 & 3 & 1 & 4 \end{bmatrix}$.	7	L2	CO4
	b.	Solve by Gauss – Jordan method : $2x + y + 3z = 1$ $4x + 4y + 7z = 1$ $2x + 5y + 9z = 3$.	7	L3	CO4
	c.	Using modern mathematical tool write a program/code to test the consistency of the equations : $x + 2y - z = 1$ $2x + y + 4z = 2$ $3x + 3y + 4z = 1$.	6	L3	CO5

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