CBCS SCHEME

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BMATE101

First Semester B.E./B.Tech. Degree Supplementary Examination, June/July 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
Q.1	a.	With usual notations prove that $\cot\phi = \frac{1}{r}\left(\frac{dr}{d\theta}\right)$	6	L2	CO1
	b.	Find the angle between the curves $r = 6\cos\theta$ and $r = 2(1+\cos\theta)$	7	L2	CO1
	c.	Find the radius of curvature of the curve $\sqrt{x}+\sqrt{y}=4$ at the point where it cuts the line passing through the origin making an angle 45° with the X-axis.	7	L3	CO1
		OR			
Q.2	a.	Find the Pedal equation of the curve $r^2 = a^2 \sec 2\theta$	7	L2	CO1
	b.	Show that for the curve $r = a(1+\cos\theta)$ is p^2/r = constant.	8	L3	CO1
	c.	Using modern mathematical tool, write a program/code to plot the sine and cosine curve.	5	L3	CO5
		Module – 2			
Q.3	a.	Expand log(sec x) up to the term containing x^4 using Maclaurin's series.	6	L2	CO1
	b.	If $u = f(x-y, y-z, z-x)$, show that $\frac{\partial u}{\partial x}+\frac{\partial u}{\partial y}+\frac{\partial u}{\partial z}=0$	7	L2	CO1
	c.	If $x = r\sin\theta\cos\phi$, $y = r\sin\theta\sin\phi$, $z = r\cos\theta$ find the value of $\frac{\partial(x,y,z)}{\partial(r,\theta,\phi)}$	7	L3	CO1
		OR			
Q.4	a.	If $z = e^{ax+by} f(ax-by)$, show that $b\frac{\partial z}{\partial x}+a\frac{\partial z}{\partial y}=2abz$	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 mathematical tool, write a program/code to evaluate $\lim_{x \to \infty}\left(1+\frac{1}{x}\right)^x$	5	L3	CO5
Module – 3					
Q.5	a.	Solve $\frac{dy}{dx}+\frac{y}{x}=y^2x$	6	L2	CO2
	b.	Find the orthogonal trajectories of the family of curves $\frac{x^2}{a^2}+\frac{y^2}{b^2+\alpha}=1$, where α is a parameter.	7	L3	CO2
	c.	Solve $xyp^2-(x^2+y^2)p+xy=0$.	7	L2	CO3
OR					
Q.6	a.	Solve $\frac{dy}{dx}+\frac{y\cos x+\sin y+y}{\sin x+x\cos y+x}=0$	6	L2	CO2
	b.	Show that a differential equation for the current i in an electrical circuit containing an inductance L and resistance R in series and acted on by an electromotive force E sin wt, satisfies the equation $L\frac{di}{dt}+Ri=E\sin wt$. Find the value of the current at any time t, if initially there is no current in the circuit.	7	L3	CO2
	c.	Solve the equation $(px-y)(py+x)=2p$ by reducing in to Clairaut's form, taking the substitution $X=x^2$, $Y=y^2$.	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.	Evaluate $\int_{-2}^{2}\int_{0}^{\sqrt{4-x^2}}(2-x)\,dy\,dx$ by changing the order of integration.	7	L2	CO3
	c.	Prove that $\int_0^{\pi/2}\frac{d\theta}{\sqrt{\sin\theta}}\times\int_0^{\pi/2}\sqrt{\sin\theta}\,d\theta=\pi$	7	L2	CO3
OR					
Q.8	a.	Evaluate $\int_0^{\infty}\int_0^{\infty}e^{-(x^2+y^2)}dx\,dy$ by changing into polar coordinates.	6	L2	CO3
	b.	Derive the relation between beta and gamma function.	7	L2	CO3
	c.	Find the volume bounded by the cylinder $x^2+y^2=4$ and the planes $y+z=4$, $z=0$.	7	L3	CO3

		Module – 5			
Q.9	a.	Find the rank of the matrix $\begin{bmatrix} 0 & 1 & -3 & -1 \\ 1 & 0 & 1 & 1 \\ 3 & 1 & 0 & 2 \\ 1 & 1 & -2 & 0 \end{bmatrix}$	6	L2	CO4
	b.	Solve the system of equations by Gauss elimination method $2x + y + 4z = 12$ $4x + 11y - z = 33$ $8x - 3y + 2z = 20$	7	L3	CO4
	c.	Solve the following system of equations by Gauss-Seidel method $20x + y - 2z = 17$ $3x + 20y - z = -18$ $2x - 3y + 20z = 25$	7	L3	CO4
		OR			
Q.10	a.	Using Gauss Jordan method, solve $2x + 5y + 7z = 52$, $2x + y - z = 0$, $x + y + z = 9$	7	L3	CO4
	b.	Using Rayleigh's power method find the dominant eigenvalue and the corresponding eigenvector of $\begin{bmatrix} 4 & 1 & -1 \\ 2 & 3 & -1 \\ -2 & 1 & 5 \end{bmatrix}$ by taking $[1, 0, 0]^T$ as initial eigen vector [carryout 5 iterations].	8	L3	CO5
	c.	Using modern mathematical tool. Write a program/code to test the consistency of equations: $x + 2y - z = 1$ $2x + y + 4z = 2$ $3x + 3y + 4z = 1$	5	L3	CO5

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