CBCS SCHEME

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BMATE101

First Semester B.E./B.Tech. Degree 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 notation, prove that $\rho = \frac{(r^2 + r_1^2)^{\frac{3}{2}}}{r^2 + 2r_1^2 - rr_2}$.	6	L1	CO1
	b.	Find the angle between the curves $r = a\log\theta$ and $r = \frac{a}{\log\theta}$.	7	L2	CO1
	c.	Find the Pedal equation of the curve $r^n = a^n \cos n\theta$.	7	L1	CO1
		OR			
Q.2	a.	With usual notation, prove that $\frac{1}{p^2} = \frac{1}{r^2} + \frac{1}{r^4}\left(\frac{dr}{d\theta}\right)^2$	8	L1	CO1
	b.	Show that the radius of curvature of $x = a\cos^3\theta$ and $y = a\sin^3\theta$.	7	L3	CO1
	c.	Using modern mathematical tool, write a programe / code to plot the curve $r = 2\|\cos 2\theta\|$.	5	L3	CO5
		Module – 2			
Q.3	a.	Evaluate : (i) $\underset{x\to\frac{\pi}{2}}{\text{Lt}} (\sin x)^{\tan x}$ (ii) $\underset{x\to 1}{\text{Lt}} (1 - x^2)^{\frac{1}{\log(1-x)}}$.	6	L2	CO2
	b.	Calculate the $J\left(\frac{u, v, w}{x, y, z}\right)$, if $U = x + 2y + z$, $V = x + 2y + 3z$, $W = 2x + 3y + 5z$	7	L3	CO2
	c.	Find the extreme values of $\sin A + \sin B + \sin(A + B)$.	7	L3	CO2
		OR			
Q.4	a.	Expand $\sqrt{1 - \sin 2x}$ by Maclaurin's series upto the term containing x^4.	8	L2	CO2
	b.	If z is a function of x and y where $x = e^u + e^{-v}$ and $y = e^{-u} - e^v$ show that $z_u - z_v = xz_x - yz_y$.	7	L2	CO2
	c.	Using Modern mathematical tool. Write a programme/code to show that $u_{xx} + u_{yy} = 0$ given $u = e^x(x\cos y - y\sin y)$	5	L2	CO5
		Module – 3			
Q.5	a.	Solve : $\frac{dy}{dx} + \frac{y}{x} = y^2 x$.	6	L2	CO3
	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	CO3
	c.	Solve : $xyp^2 - (x^2 + y^2)p + xy = 0$.	7	L1	CO3

		OR			
Q.6	**a.**	Solve : $[2xy + y - \tan y]dx + [x^2 - x\tan^2 y + \sec^2 y]\, dy = 0$.	6	L2	CO3
	b.	A series circuit with resistance R, inductance L with electromotive force E, the current i and time t is given by $L\frac{di}{dt} + iR = E$. Find the current at any time t when initial current i = 0.	7	L3	CO3
	c.	Solve the equation $(px - y)(py + x) = 2p$ by reducing into Clairaut's form, taking the substitution $X = x^2,\ Y = y^2$.	7	L2	CO3
		Module – 4			
Q.7	**a.**	Evaluate : $\int_0^{2\pi}\int_0^{\pi}\int_0^{a} r^4(\sin\phi)\,dr\,d\phi\,d\theta$.	6	L2	CO4
	b.	Evaluate : $\int_0^{1}\int_{\sqrt{y}}^{2-y} x^2\,dx\,dy$.	7	L2	CO4
	c.	Define Beta and Gama function and show that $\beta(m,n) = 2\int_0^{\frac{\pi}{2}}(\sin^{2m-1}\theta)(\cos^{2n-1}\theta)\,d\theta$.	7	L2	CO4
		OR			
Q.8	**a.**	Evaluate by changing the order of integration $\int_0^{a}\int_y^{a}\frac{x}{x^2+y^2}\,dy\,dx$.	6	L2	CO4
	b.	Find the volume bounded by the cylinder $x^2 + y^2 = 4$ and the planes $y + z = 4$ and $z = 0$.	7	L2	CO4
	c.	Evaluate $\int_0^{1} x^{\frac{3}{2}}(1-x)^{\frac{1}{2}}dx$, by expressing in terms of Gamma and Beta function.	7	L2	CO4
		Module – 5			
Q.9	**a.**	Using Gauss-Jordan method, solve : $x + 3y - 2z = 7$; $x + 2y - 3z = 10$; $2x - y + z = 5$.	6	L3	CO5
	b.	Solve by Gauss-Seidal iteration method, $8x - y + z = 18$; $2x + 5y - 2z = 3$; $x + y - 3z = -16$; taking (0, 0, 0) as an initial approximate. (Carry out 4 iterations).	7	L3	CO5
	c.	Find the value of λ and μ the system of equations $x + y + z = 6$; $x + 2y + 3z = 10$; $x + 2y + \lambda z = \mu$ has (i) No solution (ii) Unique solution (iii) Infinite solution.	7	L3	CO5
		OR			
Q.10	**a.**	Find the rank of matrix $\begin{bmatrix} 1 & 4 & 9 & 16 \\ 4 & 9 & 16 & 25 \\ 9 & 16 & 25 & 36 \\ 16 & 25 & 36 & 49 \end{bmatrix}$.	8	L2	CO5

	b.	Test for consistency and solve : $x+2y+2z=1$; $2x+y+z=2$; $3x+2y+2z=3$; $y+z=0$	7	L3	CO5
	c.	Using modern mathematical tool write a programme/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

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