CBCS SCHEME - Summer Semester

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BMATE201

Second Semester B.E/B.Tech. Degree Examination, June/July 2025
Mathematics – II 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 Hand Book is permitted.

		Module – 1	**M**	**L**	**C**
1	a.	Find the angle between the surfaces $x^2+y^2+z^2=9$ and $z=x^2+y^2-3$ at (2, -1, 2).	7	L2	CO1
	b.	If $\vec{F}=\nabla(xy^3z^2)$, find the div $\vec{F}$ and curl $\vec{F}$ at the point (1, -1, 1).	7	L2	CO1
	c.	Find the directional derivative of $\phi=x^2yz+4xz^2$ along the direction of the vector $(2\hat{i}-\hat{j}-2\hat{k})$ at (1, -2, -1).	6	L2	CO1
		OR			
2	a.	Find the work done in moving the particle in the force field $\vec{F}=3x^2\hat{i}+(2xz-y)\hat{j}+z\hat{k}$ along the straight line from (0, 0, 0) to (2, 1, 3)	7	L2	CO1
	b.	Using Green's theorem, evaluate $\int_C [(x^2+xy)dx+(x^2+y^2)dy]$ where C is the square formed by the lines $x=\pm1$ and $y=\pm1$	7	L3	CO1
	c.	Using Modern mathematical tools, write the code to find the gradient of $\phi=xy^2+yz^3$.	6	L3	CO5
		Module – 2			
3	a.	Define subspace. Show that the intersection of two subspaces of a vector space V is also a subspace of V.	7	L2	CO2
	b.	Define a basis for a vector space. Determine whether or not the vectors form a basis of R^3 (2, 2, 1), (1, 3, 7), (1, 2, 2)	7	L2	CO2
	c.	Prove that $T:R^2\to R^3$ defined by $T(x,y)=(x+y, x-y, y)$ is a linear transformation.	6	L2	CO2
		OR			
4	a.	Define linearly independent set of vector. Show that the vectors $v_1=(1,2,3)$, $v_2=(3,1,7)$ and $v_3=(2,5,8)$ are linearly independent.	7	L2	CO2
	b.	Verify the Rank-nullity theorem for the linear transformation, $T:R^3\to R^3$ defined by, T(x, y, z) = (x+ 2y-z, y+z, x+y-2z)	7	L2	CO2
	c.	Using the modern mathematical tool, write the code to find the basis and dimension of a vector space.	6	L3	CO5

		Module – 3			
5	a.	Find the Laplace transform of, (i) $e^{-t}\cos^2 3t$ (ii) $\frac{1-e^{-at}}{t}$	7	L2	CO3
	b.	Find the Laplace transform of the periodic function defined by $f(t)=E\sin\omega t$; $0<t<\frac{\pi}{\omega}$.	7	L2	CO3
	c.	Express the following in terms of unit step function and hence find its Laplace transform of $f(t)=\begin{cases}1 ; & 0<t\le1\\ t ; & 1<t\le2\\ t^2 ; & t>2\end{cases}$	6	L3	CO3
		OR			
6	a.	Find the inverse Laplace transform of, (i) $\frac{(s+2)^3}{s^6}$ (ii) $\frac{s+5}{s^2-6s+13}$	7	L2	CO3
	b.	Using the convolution theorem, find the inverse Laplace transform of, $\frac{1}{(s-1)(s^2+1)}$.	7	L3	CO3
	c.	Solve the differential equation by using the Laplace transform method, $\frac{d^2y}{dt^2}+4\frac{dy}{dt}+4y=e^{-t}$, $y(0)=0,\ y'(0)=0$	6	L3	CO3
		Module – 4			
7	a.	By Newton-Raphson method, find the root of $xe^x=2$ which is near 1 correct to 3 decimal places.	7	L2	CO4
	b.	Using Lagrange's interpolation formula, find y at x = 5, given x : 1, 3, 4, 6 y : -3, 9, 30, 132	7	L3	CO4
	c.	Evaluate $\int_4^{5.2}\log_e x\,dx$ using Simpson's $\frac{1}{3}$rd rule by taking seven ordinates.	6	L2	CO4
		OR			
8	a.	Find the real root of the equation $x\log_{10}x=1.2$ by Regulai falsi method, correct to three decimal places in [2, 3]	7	L2	CO4
	b.	From the following table find the number of students who obtained marks between 40 and 45. Marks : 30 – 40, 40 – 50, 50 – 60, 60 – 70, 70 – 80 No. of students : 31, 42, 51, 35, 31	7	L2	CO4
	c.	Evaluate f(9) using Newton's divided difference formula : x : 5, 7, 11, 13, 17 f(x) : 150, 392, 1452, 2366, 5202	6	L2	CO4

		Module – 5			
9	a.	Use Taylor's series to find y(0.1) from $\frac{dy}{dx} = x - y^2$; y(0) = 1.	7	L2	CO4
	b.	Using Runge-Kutta method of order 4, find y at x = 0.2 given $\frac{dy}{dx} = \frac{y-x}{y+x}$, y(0) = 1, take h = 0.2	7	L2	CO4
	c.	Apply Milne's method to find y(0.8) given, $\frac{dy}{dx} = x - y^2$; y(0) = 0, y(0.2) = 0.02, y(0.4) = 0.0795, y(0.6) = 0.1762.	6	L2	CO4
		OR			
10	a.	Using Modified Euler's method find y(20.2) and (20.4) given $\frac{dy}{dx} = \log_{10}\left(\frac{x}{y}\right)$ with y(20) = 5, h = 0.2	7	L3	CO4
	b.	Use Taylor's series to find y(0.1) and y(0.2) given $\frac{dy}{dx} = 2y + 3e^x$; y(0) = 0	7	L3	CO4
	c.	Using Modern mathematical tools, write the code to find the solution of $\frac{dy}{dx} = 3x + \frac{y}{2}$ at y(0.2) given y(0) = 1 taking h = 0.2	6	L3	CO5

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