CBCS SCHEME

USN ☐☐☐☐☐☐☐☐☐☐

BMATE201

Second Semester B.E./B.Tech. Degree Examination, June/July 2023

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. VTU Formula Hand Book is permitted.
3. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Find the angle between the direction to the normals to the surface $x^2yz=1$ at the point (-1, 1, 1) and (1, -1, -1).	7	L1	CO1
	b.	If $\vec{F}=\text{grad}(xy^3z^2)$ find div $\vec{F}$ and curl $\vec{F}$ at the point (1, -1, 1).	7	L2	CO1
	c.	Find the divergence and curl of the vector $\vec{V}=(xyz)\hat{i}+(3x^2y)\hat{j}+(xz^2-y^2z)\hat{k}$ at the point (2, -1, 1)	6	L1	CO1
		OR			
Q.2	a.	Using Green's theorem evaluate $\int_C (y-\sin x)dx+\cos x dy$ where C is the plane triangle enclosed by the lines $y=0$, $x=\frac{\pi}{2}$ and $y=\frac{2}{\pi}x$.	7	L3	CO1
	b.	Use stoke's theorem for vector $\vec{F}=(x^2+y^2)\hat{i}-2xy\hat{j}$ taken around the rectangle bounded by x = 0, x = a, y = 0, y = b.	7	L3	CO1
	c.	Using modern mathematical tools, write the code to find the gradient of $\phi=x^2y+2xz-4$.	6	L3	CO5
		Module – 2			
Q.3	a.	Define a subspace. Show that the intersection of any two subspaces of a vector space V is also a subspace of V.	7	L2	CO2
	b.	Show that the set B = {(1, 1, 0) (1, 0, 1) (0, 1, 1)} is a basis of the vector space $V_3(R)$.	7	L3	CO2
	c.	Prove that $T:R^2\rightarrow R^3$ be defined by T(a, b) = (a+b, a-b, b) is a linear transform.	6	L3	CO2
		OR			
Q.4	a.	Show that the set S = {(1, 0, 1) (1, 1, 0) (−1,0,−1) } is linearly dependent in $V_3(R)$.	7	L3	CO2
	b.	Let $T:R^3\rightarrow R^3$ defined by T(x, y, z) = (x+y, x-y, 2x+z). Find the rank and nullity of T and verify rank of T + nullity of T = $\dim(R^3)$.	7	L2	CO2
	c.	Using the modern mathematical tool, write the code to find the dimension of subspace spanned by the vectors (1, 2, 3) (2, 3, 1) and (3, 1, 2)	6	L3	CO5

Module – 3

Q.5	a.	Find the Laplace transform of, (i) $e^{-4t}(2\cos 6t - 3\sin 5t)$ (ii) $\dfrac{\cos 2t - \cos 3t}{t}$	7	L1	CO3
	b.	Find the Laplace transform of a square wave function, $f(t) = \begin{cases} E & 0 \le t \le \frac{T}{2} \\ -E & \frac{T}{2} \le t \le T \end{cases}$ Show that $L\{f(t)\} = \dfrac{E}{S}\tanh\left(\dfrac{ST}{4}\right)$.	7	L2	CO3
	c.	Express $f(t) = \begin{cases} \sin t & 0 < t < \pi \\ \sin 2t & \pi < t < 2\pi \\ \sin 3t & t \ge 2\pi \end{cases}$ in terms of unit step function and hence find $L\{f(t)\}$.	6	L3	CO3

OR

Q.6	a.	Find $L^{-1}\left[\dfrac{1}{s(s+1)(s+2)(s+3)}\right]$.	7	L1	CO3
	b.	Find $L^{-1}\left[\dfrac{s}{(s^2+a^2)^2}\right]$ using convolution theorem.	7	L3	CO3
	c.	Solve by Laplace transform method $y'' + 4y' + 4y = e^{-t}$ with $y(0) = y'(0) = 0$	6	L3	CO3

Module – 4

Q.7	a.	Find the real root of the equation $x \log_{10} x = 1.2$ by using the Regula-Falsi method between 2 and 3 (three iterations).	7	L1	CO4
	b.	Given $\sin 45^\circ = 0.7071$, $\sin 50^\circ = 0.7660$, $\sin 55^\circ = 0.8192$, $\sin 60^\circ = 0.8660$, find $\sin 52^\circ$ using Newton's forward interpolation formula.	7	L3	CO4
	c.	Using Lagrange's interpolation formulae to find f(5) from the following data: $\begin{array}{\|c\|c\|c\|c\|c\|c\|} \hline x & 1 & 3 & 4 & 6 & 9 \\ \hline f(x) & -3 & 9 & 30 & 132 & 156 \\ \hline \end{array}$	6	L3	CO4

OR

Q.8	a.	Find the real root of the equation, $x\tan x + 1 = 0$ which is near to $x = \pi$ by using Newton-Raphson method.	7	L2	CO4
	b.	Using Newton's divided difference formulae and find f(4) given the data : $\begin{array}{\|c\|c\|c\|c\|c\|} \hline x & 0 & 2 & 3 & 6 \\ \hline f(x) & -4 & 2 & 14 & 158 \\ \hline \end{array}$	7	L3	CO4
	c.	Evaluate $\int_0^{0.6} e^{-x^2}\,dx$ by using Simpson's $\left(\dfrac{1}{3}\right)^{rd}$ rule by taking seven ordinates.	6	L5	CO4

Module – 5

Q.9	**a.**	Solve $\frac{dy}{dx} = e^x - y$, $y(0) = 2$ by using Taylor's method upto 4th degree terms and find the value of $y(1.1)$.	7	L3	CO4
	b.	Using the Runge-Kutta method of order 4 find y at x = 0.1 given that $\frac{dy}{dx} = 3e^x + 2y$, $y(0) = 0$ and $h = 0.1$	7	L3	CO4
	c.	Apply Milne's predictor corrector method, find $y(0.4)$ from $\frac{dy}{dx} = 2e^x y$ $\begin{array}{ccccc} x & 0 & 0.1 & 0.2 & 0.3 \\ y & 2.4 & 2.473 & 3.129 & 4.059 \end{array}$	6	L2	CO4

OR

Q.10	**a.**	Solve by using modified Euler's method $\frac{dy}{dx} = 3x + \frac{y}{2}$, $y(0) = 1$ at $x = 0.2$.	7	L3	CO4
	b.	Using the Runge-Kutta method of 4th order find $y(0.2)$ given that $\frac{dy}{dx} = \frac{y-x}{y+x}$, $y(0) = 1$ taking $h = 0.2$.	7	L3	CO4
	c.	Using modern mathematical tools write the code to find the solution of $\frac{dy}{dx} = x - y^2$ at $y(0.1)$. Given that $y(0) = 1$ by Runge Kutta 4th order.	6	L2	CO5

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