CBCS SCHEME

USN ☐☐☐☐☐☐☐☐☐☐ **BMATE201**

Second Semester B.E./B.Tech. Degree Supplementary Examination, June/July 2024

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 surfaces $xy^2y = 3x + z^2$ and $3x^2 - y^2 + 2z = 1$ at the point (1, -2, 1).	7	L2	CO1
	b.	If $\vec{F} = \nabla(x^3 + y^3 + z^3 - 3xyz)$, find div $\vec{F}$ and curl $\vec{F}$.	7	L2	CO1
	c.	Show that the vector $\vec{F} = \dfrac{x\hat{i} + y\hat{j}}{x^2 + y^2}$ is both solenoidal and irrotational.	6	L3	CO1
		OR			
Q.2	a.	Find the total work done by the force $\vec{F} = 3xy\hat{i} - 5z\hat{j} + 10x\hat{k}$ along the curve $x = t^2 + 1$; $y = 2t^2$, $z = t^3$ from $t = 1$ to $t = 2$.	7	L2	CO1
	b.	Using Green's theorem, evaluate $\int_c (xy + y^2)dx + x^2dy$ where 'c' is the closed curve of the region bounded by $y = x$ and $y = x^2$.	7	L3	CO1
	c.	Using modern mathematical tools, write the code to find the find the gradient of $\phi = x^2y + 2xz - 4$.	6	L2	CO5
		Module – 2			
Q.3	a.	Define a Subspace. Show that the intersection of two subspaces of a vector V is also a subspace of V.	7	L2	CO2
	b.	Show that $T : R^3 \rightarrow R^3$ defined by $T(x, y, z) = (x, y, -z)$ is linear transformation.	7	L3	CO2
	c.	If $u = [2, -5, -1]^T$, $V = [-7, -4, 6]^T$, compute : i) $<u, v>$ ii) $\|\| u\|\|^2$ iii) $\|\| v\|\|^2$ iv) $\|\| u + v\|\|^2$.	6	L2	CO2
		OR			
Q.4	a.	Define linearly independent and linearly dependent set of vectors. Test the vectors $v_1 = [3, 0, -6]^T$, $v_2 = [-4, 1, 7]^T$ and $v_3 = [-2, 1, 5]^T$ forms a basis.	7	L2	CO2
	b.	State Rank – Nullity Theorem. For the matrix $A = \begin{bmatrix} 1 & -4 & 9 & -7 \\ -1 & 2 & -4 & 1 \\ 5 & -6 & 10 & 7 \end{bmatrix}$, Find : i) Rank of A ii) Dim (Nul A) iii) Bases	7	L3	CO2

	c.	Using the modern mathematical tool, write the code to represent the reflection transformation $T : R^2 \rightarrow R^2$ and to find the image of vector (10, 0) when it is reflected about y – axis.	6	L2	CO5
		Module – 3			
Q.5	**a.**	Find the Laplace Transform of (i) $e^{-3t} \cos 2t$ ii) $\frac{\text{cosat - cosbt}}{t}$.	7	L2	CO3
	b.	Find the Laplace Transform of the square wave function of period Za, defined by $f(t) = \begin{cases} k & 0 < t < a \\ -k & a < t < 2a \end{cases}$.	7	L2	CO3
	c.	Explain $f(t) = \begin{cases} \cos t & 0 < t < \pi \\ \cos 2t & \pi < t < 2\pi \\ \cos 3t & t > 2\pi \end{cases}$ in term of the unit step function and hence find L[f(t)].	6	L3	CO3
		OR			
Q.6	**a.**	Find the inverse Laplace transformer of i) $\frac{2s-1}{s^2+4s+29}$ ii) $\frac{1}{(s-4)^2}$.	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 by the Laplace transforms $y'' + k^2y = 0$, given that $y(0) = 2$, $y'(0) = 0$.	6	L2	CO3
		Module – 4			
Q.7	**a.**	Find the real root of $x \log_{10} x = 1.2$ by Regula – Falsi method correct to 2 decimal places the root lies between (2, 3).	7	L2	CO4
	b.	Find interpolating polynomical by Newton's divided difference formula for the data f(1) = 4, f(3) = 32, f(4) = 55 and f(6) = 119.	7	L2	CO4
	c.	Evaluate using Simpson's $\frac{1}{3}^{rd}$ rule $\int_0^6 \frac{e^x}{1+x} dx$ by taking six equal parts.	6	L2	CO4
		OR			
Q.8	**a.**	Find the real root of the equation $\cos x = xe^x$, using Newton's – Raphson method, correct to 3 decimal places taking $x_0 = 0.5$.	7	L2	CO4
	b.	Use Newton's backward interpolation formula to compute the value of y when x = 6, given that $\begin{array}{cccccc} x & 1 & 2 & 3 & 4 & 5 \\ y & 1 & -1 & 1 & -1 & 1 \end{array}$	7	L3	CO4

	c.	Evaluate $\int_0^5 \frac{dx}{4x+5}$, by Trapezoidal rule, taking 6 ordinates.	**6**	**L2**	**CO4**
		Module – 5			
Q.9	**a.**	Employ Taylors series method to find y(0.2), given that $\frac{dy}{dx} = 2y + 3e^x$, y(0) = 0.	7	L3	CO4
	b.	Using Modified Euler's method, find y(0.1) correct to 4 decimal places, given that $y' = x - y^2$, y(0) = 1, h = 0.1, perform 2 iterations.	7	L2	CO4
	c.	Employ Milne's predictor – corrector method given that $y' = x^2(1 + y)$ y(1) = 1, y(1.1) = 1.233, y(1.2) = 1.548, y(1.3) = 1.979 to find y(1.4).	6	L3	CO4
		OR			
Q.10	**a.**	Solve $y' = \log_{10}(x + y)$, by modified Euler's method at x = 0.2 and x = 0.4 with h = 0.2, perform 2 iterations at each stage.	7	L2	CO4
	b.	Use 4th order Runge – Kutta method to solve (x + y) y′ = 1 with y(0.4) = 1, at x = 0.5 correct to 4 decimal places.	7	L2	CO4
	c.	Using modern mathematical tools, write a code to find y(0.1), given y′ = x – y, y(0) = 1 by Taylors series.	6	L3	CO5

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