CBCS SCHEME

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BMATE201

Second Semester B.E./B.Tech. Degree 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 directional derivatives of $\phi = x^2yz + 4xz^2$, at (1, 2, -1) along $2i - j - 2k$.	7	L3	CO1
	b.	Find $\text{div}\vec{F}$ and $\text{curl}\vec{F}$, where $\vec{F} = \text{grad}(x^3 + y^3 + z^3 - 3xyz)$.	7	L3	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	L2	CO1
		OR			
Q.2	a.	Find the work done in moving a particle in the Force field $F = 3x^2\hat{i} + (2xz - y)\hat{j} + z\hat{k}$ along the straight line from (0, 0, 0) to (2, 1, 3).	7	L3	CO1
	b.	Using Green's theorem, evaluate $\oint(xy + y^2)dx + x^2dy$ over the region bounded by the curves $y = x$ and $y = x^2$.	7	L3	CO1
	c.	Using modern mathematical tools, write a code to find the divergence and curl of the vector $x^2yz\,\hat{i} + y^2zx\,\hat{j} + z^2xy\hat{k}$.	6	L2	CO5
		Module – 2			
Q.3	a.	Define a 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 : (2, 2, 1), (1, 3, 7), (1, 2, 2) form a basis of R^3.	7	L2	CO2
	c.	Show that $T: R^2 \to R^3$ given by $T(x,y) = (x + y, x - y, y)$ is a linear transformation.	6	L2	CO2
		OR			
Q.4	a.	Define linearly independent set of vectors and linearly dependent set of vectors. Show that the vectors (1, 4, 9), (3, 1, 4), (9, 3, 12) are linearly dependent.	7	L2	CO2
	b.	Verify the Rank-Nullity theorem for $T: R^3 \to R^3$ 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 represent the reflection transformation $T: R^2 \to R^2$ and to find the image of vector (10, 0) when it is reflected about the y – axis.	6	L2	CO5
		Module – 3			
Q.5	a.	Find the Laplace Transform of, (i) $e^{-3t}(2\cos 5t - 3\sin 5t)$ (ii) $\dfrac{\cos at - \cos bt}{t}$	7	L2	CO3

	b.	Find the Laplace transform of the triangular wave function, $f(t)=\begin{cases} t, & \text{if } 0\le t\le a \\ 2a-t, & \text{if } a\le t\le 2a\end{cases}$	7	L2	CO3
	c.	Express $f(t)=\begin{cases} t^2, & 1<t\le 2 \\ 4t, & t>2\end{cases}$ interms of Heaviside unit step function and hence find $L(f(t))$.	6	L3	CO3
		OR			
Q.6	**a.**	Find $L^{-1}\left[\dfrac{2s^2-6s+5}{s^3-6s^2+11s-6}\right]$.	7	L2	CO3
	b.	Find $L^{-1}\left[\dfrac{1}{s(s^2+a^2)}\right]$ using convolution theorem.	7	L2	CO3
	c.	Solve the differential equation by using Laplace Transform method. $y''+6y'+9y=12t^2e^{-3t}$, $y(0)=y'(0)=0$	6	L3	CO3
		Module – 4			
Q.7	**a.**	By Newton-Raphson method, find the root of $x\sin x+\cos x=0$, near $x=\pi$. Carryout the iteration upto four decimal places of accuracy.	7	L2	CO4
	b.	Using Lagrange's interpolation formula, find y at x = 2, using the points (0, -12), (1, 0), (3, 6), (4, 12)	7	L2	CO4
	c.	Using Simpson's $\left(\frac{1}{3}\right)^{rd}$ rule, evaluate $\int_0^{0.6} e^{-x^2}$ by taking seven ordinates.	6	L3	CO4
		OR			
Q.8	**a.**	Find a real root of the equation $x^3-4x-9=0$ correct to three decimal places by the method of False position in (2, 3)	7	L2	CO4
	b.	Construct Newton's forward interpolation polynomial for the data : x: 0, 1, 2, 3 f(x): 1, 2, 1, 10	7	L2	CO4
	c.	Evaluate $\int_0^1 \dfrac{dx}{(1+x)^2}$ by using Simpson's $\left(\frac{3}{8}\right)^{th}$ rule, by taking 6 equal intervals.	6	L3	CO4
		Module – 5			
Q.9	**a.**	Use Taylor series method to find y(0.2) from $\dfrac{dy}{dx}=2y+3e^x$, with $y(0)=0$.	7	L3	CO5
	b.	Using R-K method of order 4, solve $\dfrac{dy}{dx}=\dfrac{y^2-x^2}{y^2+x^2}$ with $y(0)=1$ at $x=0.2$.	7	L3	CO5
	c.	Applying Milne's Predictor-Corrector method, find y(0.4), from $\dfrac{dy}{dx}=2e^x-y$, given that, $y(0)=2$, $y(0.1)=2.010$, $y(0.2)=2.040$, $y(0.3)=2.090$	6	L3	CO5
		OR			

Q.10	a.	Solve by using modified Euler's method, $y' = 1 + \frac{y}{x}$, $y(1) = 2$ at x = 1.2 and x = 1.4.	7	L3	CO5
	b.	Using the Runge-Kutta method of fourth order find y(1.1), given $\frac{dy}{dx} = xy^{\frac{1}{3}}$, taking h = 0.1, y(1) = 1.	7	L3	CO5
	c.	Using modern mathematical tools, write a code to find y(1.4), given $\frac{dy}{dx} = x^2 + \frac{y}{2}$, y(1) = 2, y(1.1) = 2.2156, y(1.2) = 2.4649, y(1.3) = 2.7514, by Milne's Predictor and Corrector method.	6	L3	CO5

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