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BMATE201

Second Semester B.E./B.Tech. Degree Examination, June/July 2026
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 $x^2+y^2+z^2=9$ and $z=x^2+y^2-3$ at (2, -1, 2).	07	L2	CO1
	b.	Evaluate curl(curl $\vec{F}$) and div(curl $\vec{F}$) if $\vec{F}=x^2y\,\hat{i}+y^2z\,\hat{j}+z^2x\,\hat{k}$	07	L3	CO1
	c.	Show that $\vec{F}=\frac{x\,\hat{i}+y\,\hat{j}}{x^2+y^2}$ is both Solenoidal and Irrotational.	06	L3	CO1
		OR			
Q.2	a.	Find the total work done by the force represented by $\vec{F}=3xy\,\hat{i}-y\,\hat{j}+2zx\,\hat{k}$ in moving a particle around the circle $x^2+y^2=4$.	07	L2	CO1
	b.	Using Green's theorem evaluate $\oint(xy+y^2)dx+x^2dy$ over the region bounded by the curves $y=x$ and $y=x^2$	07	L3	CO1
	c.	Using modern mathematical tools, write the code to find gradient of $\phi=x^2y+2xz-4$.	06	L3	CO5
		Module – 2			
Q.3	a.	Define Vector Space. Determine whether the vectors (1, 2, 3) (3, 1, 7) and (2, 5, 8) are linearly independent or not.	07	L2	CO2
	b.	Find the rank and nullity of the linear transformation, $T: V \to W$ defined by $T(x, y, z) = (x + 2y - z, y + z, x + y - 2z)$	07	L3	CO2
	c.	Define an Inner Product Space. Consider $f(t)=1$, $g(t)=2t-1$ and $h(t)=12t^2$, the inner product $<f,g>=\int_0^1 f(t).g(t).dt$, $<g,h>=\int_0^1 g(t).h(t).dt$ Find (i) <f, g> (ii) <g, h>	06	L3	CO2
		OR			
Q.4	a.	Determine whether or not the following vectors forms a basis in R^3: (2, 2, 1) (1, 3, 7) and (1, 2, 2)	07	L2	CO2
	b.	Find the matrix of the linear transformation $T: R^2 \to R^3$ defined by $T(x, y) = (3x - y, 2x + 4y, 5x - 6y)$ with respect to the standard bases R^2 and R^3.	07	L3	CO2

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Q.4	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	06	L3	CO5
		Module – 3			
Q.5	a.	Find the Laplace Transform of, (i) $e^{-2t}(2\cos 5t - \sin 5t)$ (ii) $\frac{\cos at - \cos bt}{t}$	07	L2	CO3
	b.	Find the Laplace transform of the triangular wave function, $f(t) = \begin{cases} t & \text{if } 0 \le t \le a \\ 2a - t & \text{if } a \le t \le 2a \end{cases}$ and hence show that $L[f(t)] = \frac{1}{s^2}\tanh\left(\frac{as}{2}\right)$	07	L3	CO3
	c.	Express the following function in terms of unit step function and hence find the Laplace transform of $f(t) = \begin{cases} \sin t & 0 \le t < \pi \\ \sin 2t & \pi \le t \le 2\pi \\ \sin 3t & t > 2\pi \end{cases}$	06	L3	CO3
		OR			
Q.6	a.	Find the inverse Laplace transform of $\frac{2s^2 + 5s - 4}{s^3 + s^2 - 2s}$	07	L2	CO3
	b.	Using convolution theorem, find the inverse Laplace transform of $\frac{s}{(s^2 + a^2)^2}$.	07	L3	CO3
	c.	Solve by differential equation $y'' + 4y' + 3y = e^{-t}$ with $y(0) = 1 = y'(0)$ using Laplace transforms.	06	L3	CO3
		Module – 4			
Q.7	a.	Find the real root of the equation $xe^x - 2 = 0$ correct to three decimal places using Newton-Raphson method.	07	L2	CO4
	b.	Using Newton's forward difference formula, find y(38), given that x: 40, 50, 60, 70, 80, 90 y: 184, 204, 226, 250, 276, 304	07	L2	CO4
	c.	Evaluate using Simpson's $\frac{1}{3}^{rd}$ rule to find $\int_0^{0.6} e^{-x^2} dx$ by taking seven ordinates.	06	L3	CO4

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OR

Q.8	**a.**	Find the real root of $x\log_{10}x - 1.2 = 0$, by using Regula-Falsi method (Carry out three iterations) where root lies between (2, 3).	**07**	**L2**	**CO4**
	b.	Use Lagrange's interpolation formula to find f(4), given x: 0, 2, 3, 6 f(x): -4, 2, 14, 158	**07**	**L2**	**CO4**
	c.	Using Simpson's $\frac{3}{8}^{th}$ rule evaluate $\int_0^3 \frac{x\,dx}{\cos x}$ correct to four decimal place by taking seven ordinates.	**06**	**L3**	**CO4**
		Module – 5			
Q.9	**a.**	Use Taylor's series method to find y(0.2) by considering the terms upto 4th degree , given $\frac{dy}{dx} = 3e^x + 2y$ and $y(0) = 0$.	**07**	**L2**	**CO4**
	b.	Given $\frac{dy}{dx} = 3x + \frac{y}{2}$, $y(0) = 1$. Compute y(0.2) by taking h = 0.2, using Runge-Kutta method of fourth order.	**07**	**L3**	**CO4**
	c.	Apply Milne's method to find y(0.8) given that $\frac{dy}{dx} = x - y^2$ and x: 0, 0.2, 0.4, 0.6 y: 0, 0.02, 0.0795, 0.1762	**06**	**L3**	**CO4**
		OR			
Q.10	**a.**	Using modified Euler's method find y(0.2) given that $\frac{dy}{dx} = x + y$, $y(0) = 1$.	**07**	**L2**	**CO4**
	b.	Apply Milne's method to find y(0.4) given that $\frac{dy}{dx} = x^2 + y^2$ and x: 0, 0.1, 0.2, 0.3 y: 1, 1.1113, 1.2507, 1.426	**07**	**L3**	**CO4**
	c.	Using modern mathematical tools, write the code to find the solution of $\frac{dy}{dx} = 1 + \frac{y}{x}$ at y(2) taking h = 0.2. Given that y(1) = 2 by Runge-Kutta 4th order method.	**06**	**L3**	**CO5**

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