Model Question Paper-II with effect from 2022 (CBCS Scheme)

USN | | | | | | | | | | |

Second Semester B.E Degree Examination

Mathematics-II for ELECTRICAL &ELECTRONICS ENGINEERING Stream-BMATE201

TIME: 03 Hours **Max. Marks: 100**

Note:
1. Answer any **FIVE** full questions, choosing at least **ONE** 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.01	a	Find the angle between the surfaces $xy^2z = 3x + z^2$ and $3x^2 - y^2 + 2z = 1$ at the point $(1, -2, 1)$	**7**	L3	**CO1**
	b	Find $div\,\vec{F}$ and $curl\,\vec{F}$ at (1,2,3), if $\vec{F} = 3x^2\hat{\imath} + 5xy^2\hat{\jmath} + 5xyz^3\hat{k}$	**7**	L2	**CO1**
	c	Show that $\vec{A} = (y^2 - z^2 + 3yz - 2x)\hat{\imath} + (3xz + 2xy)\hat{\jmath} + (3xy - 2xz + 2z)\hat{k}$ is both solenoidal and irrotational	**6**	L2	**CO1**
		OR			
Q.02	a	Find the work done in moving a particle in the force field $\vec{F} = 3x^2\hat{\imath} + (2xz - y)\hat{\jmath} + z\hat{k}$ along the straight line from $(0, 0, 0)$ *to* $(2, 1, 3)$	**7**	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* $y = x^2$	**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. 03	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: $(1, 1, 2), (1, 2, 5), (5, 3, 4)$ form a basis of R^3.	**7**	L2	**CO2**
	c	Prove that $T: R^3 \to R^3$ be defined by $T(a, b, c) = (3a, a - b, 2a + b + c)$ is a linear transformation.	**6**	L2	**CO2**
		OR			
Q.04	a	Define linearly independent set of vectors and linearly dependent set of vectors. Are the vectors $V_1 = (2, 5, 3)$, $V_2 = (1, 1, 1)$, and $V_3 = (4, -2, 0)$ linearly independent? Justify your answer.	**7**	L2	**CO2**

	b	State the rank-Nullity theorem and verify the 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 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**	L3	**CO5**
		Module-3			
Q. 05	a	Find the Laplace transform of (i) $e^{-3t}(2\cos 5t - 3\sin 5t)$ (ii) $\frac{\cos at - \cos bt}{t}$	**7**	L2	**CO3**
	b	Find the Laplace transform of the triangular wave function $f(t) = \begin{cases} t & if\ 0 \le t \le a \\ 2a - t & if\ a \le t \le 2a \end{cases}$	**7**	L2	**CO3**
	c	Express the following function in terms of unit step function and hence find its Laplace transform of $f(t) = \begin{cases} t^2, & 0 < t < 2 \\ 4t, & 2 < t < 4 \\ 8, & t > 4 \end{cases}$	**6**	L3	**CO3**
		OR			
Q. 06	a	Find the inverse Laplace transform of (i) $\frac{s}{s^2+2s+3}$ (ii) $\frac{1}{(s+2)^2}$	**7**	L2	**CO3**
	b	Using the convolution theorem, find the inverse Laplace transform of $\frac{s}{(s^2 + a^2)^2}$	**7**	L3	**CO3**
	c	Solve the differential equation by using the Laplace transform method $\frac{d^2y}{dt^2} + y = \sin 2t,\ \ y(0) = 0, y'(0) = 0$	**6**	L3	**CO3**
		Module-4			
Q. 07	a	By Newton-Raphson method, find the root of $x \tan x + 1 = 0$ which is near to $x = \pi$	**7**	L2	**CO4**
	b	Using Lagrange's interpolation formula, fit a polynomial which passes through the points (−1, 0), (1, 2), (2, 9) and (3, 8) and hence estimate the value of y when x = 2.2	**7**	L2	**CO4**
	c	Evaluate $\int_0^6 \frac{e^x}{1+x}\, dx$ using Simpson's $\left(\frac{1}{3}\right)^{rd}$ rule by taking 7 ordinates	**6**	L3	**CO4**
		OR			
Q. 08	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: 4, 6, 8, 10 $f(x)$: 1, 3, 8, 16	**7**	L2	**CO4**
	c	Evaluate $\int_0^3 \frac{x}{\cos x} dx$ by using Simpson's $\left(\frac{3}{8}\right)^{th}$ rule, by taking 6 equal intervals. (x is in radians)	**6**	L2	**CO4**
		Module-5			
Q. 09	a	Use Taylor series method to find $y(0.1)$ from $\frac{dy}{dx} = e^x - y^2, with\ \ y(0) = 1$	**7**	L2	**CO4**
	b	Using the Runge-Kutta method of order 4, find y at x = 0.6, given that $\frac{dy}{dx} = \sqrt{x+y},\quad y(0.4) = 0.41$ taking $h = 0.2$	**7**	L2	**CO4**
	c	Applying Milne's Predictor-Corrector method, find y(0.8), from $\frac{dy}{dx} = x^3 + y$, given that $y(0) = 2$, $y(0.2) = 2.073$, $y(0.4) = 2.452$, $y(0.6) = 3.023$	**6**	L2	**CO4**
		OR			
Q. 10	a	Solve by Using Modified Euler's method, $\mathrm{y}' = \log_{10}(\mathrm{x}+\mathrm{y}),\ \mathrm{y}(0) = 2$ at $\mathrm{x} = 0.2$ and $\mathrm{x} = 0.4$	**7**	L3	**CO4**
	b	Using the Runge-Kutta method of fourth order find y(0.1) given that $\frac{\mathrm{dy}}{\mathrm{dx}} = 3\mathrm{e}^{\mathrm{x}} + 2\mathrm{y},\ \mathrm{y}(0) = 0$, taking $\mathrm{h} = 0.1$	**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 4^{th} order method.	**6**	L3	**CO5**

Bloom's Taxonomy Levels	**Lower-order thinking skills**		
	Remembering (knowledge): L_1	Understanding (Comprehension): L_2	Applying (Application): L_3
	Higher-order thinking skills		
	Analyzing (Analysis): L_4	Valuating (Evaluation): L_5	Creating (Synthesis): L_6

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Second Semester B.E Degree Examination
Mathematics-II for Electrical & Electronics Engineering-BMATE201

TIME: 03 Hours **Max. Marks: 100**

Note:
1. Answer any **FIVE** full questions, choosing at least **ONE** 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.01	a	Find the directional derivatives of $\emptyset = x^2yz + 4xz^2$ at (1, 2, -1) along $2i - j - 2k$.	**7**	L2	**CO1**
	b	Evaluate $Curl(Curl\vec{F})$ and $Div(Curl\vec{F})$, if $\vec{F} = x^2y\,\hat{\imath} + y^2z\,\hat{\jmath} + z^2x\,\hat{k}$.	**7**	L2	**CO1**
	c	Show that the vector $\vec{F} = \frac{x\hat{\imath}+y\hat{\jmath}}{x^2+y^2}$ is both solenoidal and irrotational.	**6**	L3	**CO1**
		OR			
Q.02	a	Find the total work done by the force $F = 3xy\boldsymbol{I} - y\boldsymbol{J} + 2zx\boldsymbol{K}$ in moving a particle around the circle $x^2 + y^2 = 4$.	**7**	L3	**CO1**
	b	Verify Stoke's theorem for the vector field $\boldsymbol{F} = (2x - y)\boldsymbol{I} - yz^2\boldsymbol{J} - y^2z\boldsymbol{K}$ over the upper half surface of $x^2 + y^2 + z^2 = 1$, bounded by its projection on the xy- plane.	**7**	L2	**CO1**
	c	Using modern mathematical tools, write a code to find the divergence and curl of the vector $2x^2i - 3yzj + xz^2k$	**6**	L3	**CO5**
		Module-2			
Q. 03	a	Prove that in $V_3(R)$, the vectors {(1, 2, 1), (2, 1, 0), (1, -1, 2)} are linearly independent.	**7**	L2	**CO2**
	b	If W is the set of all points in R^3 satisfying the equation $lx + my + nz = 0$, then prove that W is a subspace of R^3.	**7**	L2	**CO2**
	c	Define an Inner product space. Consider $f(t) = 3t - 5$ and $g(t) = t^2$, the inner product $< f, g > = \int_0^1 f(t)g(t)dt$. Find $< f, g >$.	**6**	L2	**CO2**
		OR			
Q.04	a	Express the vector (3, 5, 2) as a linear combination of the vectors (1, 1, 0), (2, 3, 0), (0, 0, 1) of $V_3(R)$.	**7**	L2	**CO2**
	b	Find the dimension and basis of the subspace spanned by the vectors (2, 4, 2), (1, -1, 0), (1, 2, 1), and (0, 3, 1) in $V_3(R)$.	**7**	L2	**CO2**
	c	Let $T: V \to W$ be a linear transformation defined by $T(x, y, z) = (x + y, x - y, 2x + z)$. Find the range, null space, rank, nullity and hence verify the rank-nullity theorem.	**6**	L2	**CO2**

Module-3					
Q. 05	a	Find the Laplace transform of (i) $te^{-t}sin4t$ (ii) $\frac{1-cosat}{t}$	7	L2	CO3
	b	Find the Laplace transform of the square wave function of period 2a, defined by $f(t)=\begin{cases} k, & 0<t<a \\ -k, & a<t<2a \end{cases}$.	7	L3	CO3
	c	Express $f(t)=\begin{cases} cost, & 0<t<\pi \\ cos2t, & \pi<t<2\pi \\ cos3t, & t>2\pi \end{cases}$ in terms of the Heaviside unit step function and hence find $L\{f(t)\}$.	6	L3	CO3
OR					
Q. 06	a	Find $L^{-1}\left\{\frac{2s^2-6s+5}{s^3-6s^2+11s-6}\right\}$	7	L2	CO3
	b	Find $L^{-1}\left\{\frac{1}{s^3(s^2+1)}\right\}$ Using the convolution theorem.	7	L2	CO3
	c	Solve by Laplace transform method: $y''+4y'+3y=e^{-t}$, given $y(0)=y'(0)=1$.	6	L3	CO3
Module-4					
Q. 07	a	Find the real root of the equation $x\log_{10}x=1.2$ by the Regula-Falsi method between 2 and 3 (Three iterations).	7	L2	CO4
	b	Using Newton's forward difference formula, find $f(38)$ <table><tr><td>x</td><td>40</td><td>50</td><td>60</td><td>70</td><td>80</td><td>90</td></tr><tr><td>y</td><td>184</td><td>204</td><td>226</td><td>250</td><td>276</td><td>304</td></tr></table>	7	L3	CO4
	c	The following table gives the values of x and y <table><tr><td>x :</td><td>2.8</td><td>4.1</td><td>4.9</td><td>6.2</td></tr><tr><td>y :</td><td>9.8</td><td>13.4</td><td>15.5</td><td>19.6</td></tr></table>Find y when x = 8 using Lagrange's interpolation formula.	6	L2	CO4
OR					
Q. 08	a	Using Newton-Raphson Method find the real root of $tanx=x$ near x = 4.5 correct to four decimal places.	7	L3	C04
	b	Find the interpolating polynomial using Newton's divided difference formula for the following data <table><tr><td>x</td><td>0</td><td>1</td><td>2</td><td>5</td></tr><tr><td>y</td><td>2</td><td>3</td><td>12</td><td>147</td></tr></table>	7	L2	CO4

			Marks	Level	CO
	c	Evaluate $\int_{4}^{5.2} \log x \, dx$ using Simpson's $\left(\frac{3}{8}\right)^{th}$ rule , taking h = 0.2	**6**	L3	**CO4**
		Module-5			
Q. 09	a	Use Taylor series method to find $y(0.2)$ by considering the terms up to 4th degree, given $\frac{dy}{dx} - 2y = 3e^x$ & $y(0) = 0$.	**7**	L3	**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.	**7**	L2	**CO4**
	c	Apply Milne's method to find $y(0.8)$ given $\frac{dy}{dx} + xy^2 = 0$ x: 0, 0.2, 0.4, 0.6 y: 2, 1.9231, 1.7214, 1.4706	**6**	L2	**CO4**
		OR			
Q. 10	a	Using Modified Euler's method to find y at $x = 0.2$ given $\frac{dy}{dx} = x - y^2$ & $y(0) = 1$ by taking step size h = 0.1	**7**	L3	**CO4**
	b	Find $y(2)$ by using Milne's Predictor and Corrector method, given $\frac{dy}{dx} = \frac{x+y}{2}$ and x: 0, 0.5, 1, 1.5 y: 2, 2.636, 3.595, 4.968	**7**	L2	**CO4**
	c	Using modern mathematical tools, write a code to find $y(0.1)$, given $\frac{dy}{dx} = x - y, y(0) = 1$ by Taylor's Series.	**6**	L3	**CO5**

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