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CBCS SCHEME

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BMATS201

Second Semester B.E./B.Tech. Degree Examination, June/July 2026
Mathematics – II for CSE Stream

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.
3. VTU Formula Hand Book is permitted.

		Module – 1	M	L	C
Q.1	**a.**	Evaluate $\int_{-c}^{c}\int_{-b}^{b}\int_{-a}^{a}(x^2+y^2+z^2)\,dx\,dy\,dz$	**7**	**L2**	**CO1**
	b.	Evaluate $\int_{0}^{\infty}\int_{0}^{\infty} e^{-(x^2+y^2)}\,dx\,dy$ by changing into polar coordinates.	**7**	**L3**	**CO1**
	c.	Show that $\beta(m,n)=\frac{\Gamma(m)\cdot\Gamma(n)}{\Gamma(m+n)}$.	**6**	**L2**	**CO1**
		OR			
Q.2	**a.**	Evaluate $\int_{0}^{a}\int_{y}^{a}\frac{x}{x^2+y^2}\,dx\,dy$ by changing the order of integration.	**7**	**L3**	**CO1**
	b.	Evaluate $\iint_R xy\,dx\,dy$ where R is the region bounded by the x – axis, ordinate x = 2a and the curve $x^2 = 4a\,y$.	**7**	**L3**	**CO1**
	c.	Using Mathematical tools, write the code to find the area of an ellipse by double integration $A = 4\int_{0}^{a}\int_{0}^{\frac{b}{a}\sqrt{a^2-x^2}} dxdy$	**6**	**L3**	**CO5**
		Module – 2			
Q.3	**a.**	Find the directional derivative of $\phi = x^2\,yz + 4xz^2$ at (1, -2, -1) in the direction of the vector $2i - j - 2k$.	**7**	**L2**	**CO2**
	b.	If $\vec{F} = \nabla(x^3+y^3+z^3-3xyz)$ find $\text{div}\,\vec{F}$ and $\text{curl}\,\vec{F}$.	**7**	**L2**	**CO2**
	c.	Express the vector $\vec{A} = z\vec{i} - 2x\vec{j} + y\vec{k}$ in cylindrical coordinates.	**6**	**L2**	**CO2**
		OR			

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Q.4	**a.**	Find the directional derivative of $\phi = 4xz^3 - 3x^2y^2z$ at (2, +1, +2) in the direction of the vector $2i - 3j + 6k$.	**7**	**L3**	**CO2**
	b.	Show that the vector $\vec{F} = \frac{xi + yj}{x^2 + y^2}$ is both solenoidal and irrotational.	**7**	**L2**	**CO2**
	c.	Using mathematical tools, write the code to find the curl of $\vec{F} = x\,y^2\,i + 2\,x^2\,yzj - 3yz^2\,k$.	**6**	**L3**	**CO5**
		Module – 3			
Q.5	**a.**	V is a vector space of polynomials over R. Find a basis and dimension of the subspace W of V, spanned by the polynomial $x_1 = t^3 - 2t^2 + 4t + 1$; $x_2 = 2t^3 - 3t^2 + 9t - 1$; $x_3 = t^3 + 6t - 5$; $x_4 = 2t^3 - 5t^2 + 7t + 5$.	**7**	**L3**	**CO3**
	b.	Write the vector V = (4, 2, 1) as a linear combination of the vectors $u_1 = (1, -3, 1)$, $u_2 = (0, 1, 2)$, $u_3 = (5, 1, 37)$.	**7**	**L2**	**CO3**
	c.	Define a Inner product space. Consider $f(t) = 3t - 5$ and $g(t) = t^2$, the inner product $< f.g > = \int_0^t f(t)g(t)\,dt$. Find $< f.g >$.	**6**	**L3**	**CO3**
		OR			
Q.6	**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**	**CO3**
	b.	Define a Subspace. Show that any plane passing through the origin is a subspace of R^3.	**7**	**L2**	**CO3**
	c.	Show that the function $f(x) = 3x - 2$ and $g(x) = x$ are orthogonal in Pn with inner product $< f.g > = \int_0^t f(x)g(x)\,dx$	**6**	**L2**	**CO3**
		Module – 4			
Q.7	**a.**	Find a real root of the equation $x^3 - 2x - 5 = 0$. Correct to three decimal places by the method of false position in (2, 3).	**7**	**L3**	**CO4**
	b.	Use Lagrange's interpolation formula to find y at x = 10, given x: 5, 6, 9, 11 y: 12, 13, 14, 16	**7**	**L2**	**CO4**
	c.	Use Simpson's $3/8^{th}$ rule to evaluate $\int_1^4 e^{1/x}dx$.	**6**	**L3**	**CO4**
		OR			
Q.8	**a.**	Find an approximate root of the equation $3x = \cos x + 1$, using the Newton Raphson method, correct to three decimal places near x = 0.6.	**7**	**L3**	**CO4**

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	b.	Given Sin 45° = 0.7071 , Sin 50° = 0.7660 , Sin 55° = 0.8192 , Sin 60° = 0.8660. Find Sin 57° using Newton's Backward interpolation formula.	7	L4	CO4
	c.	Evaluate $\int_0^1 \frac{dx}{1+x^2}$ by using Simpson's 1/3rd rule taking four equal strips.	6	L3	CO4
		Module – 5			
Q.9	a.	Use Taylor's series method to find y at x = 0.1, 0.2, 0.3 considering terms upto the third degree. Given that $\frac{dy}{dx} = x^2 + y^2$ and y(0) = 1.	7	L4	CO4
	b.	Using Runge – Kutta method of fourth order, find y(0.2) for the equation $\frac{dy}{dx} = \frac{y-x}{y+x}$, y(0) = 1 taking h = 0.2.	7	L3	CO4
	c.	If $\frac{dy}{dx} = 2e^x - y$, y(0) = 2 , y(0.1) = 2.010 , y(0.2) = 2.040 and y(0.3) = 2.090. Find y(0.4) , correct to four decimal places by using Milne's Predictor - Corrector method.	6	L3	CO4
		OR			
Q.10	a.	Using modified Euler's method find an approximate value of y when x = 0.1. Given that $\frac{dy}{dx} = x + y$ and y = 1 when x = 0. Apply three modification.	7	L2	CO4
	b.	Using the Runge – Kutta method of fourth order , find y(0.1) given that $dy = 3e^x + 2y$; y(0) = 0, taking h = 0.1.	7	L3	CO4
	c.	Using mathematical tool, write a 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.	6	L2	CO5

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