CBCS SCHEME

USN

BMATS201

Second Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.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. VTU Formula Hand Book is permitted.
3. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Evaluate $\int_{-1}^{1}\int_{0}^{z}\int_{x-z}^{x+z}(x+y+z)\,dy\,dx\,dz$	07	L2	CO1
	b.	Evaluate $\int_{0}^{1}\int_{x=0}^{\sqrt{1-y^2}}(x^2+y^2)\,dx\,dy$ by changing into polar coordinates.	07	L3	CO1
	c.	Prove that $\beta(m,n)=\dfrac{\gamma(m)\cdot\gamma(n)}{\gamma(m+n)}$	06	L2	CO1
		OR			
Q.2	a.	Evaluate $\int_{0}^{\infty}\int_{x}^{\infty}\dfrac{e^{-y}}{y}\,dy\,dx$ by changing the order of integration.	07	L3	CO1
	b.	Find the area of the ellipse $\dfrac{x^2}{a^2}+\dfrac{y^2}{b^2}=1$ by double integration.	07	L3	CO1
	c.	Using the mathematical tools, write the code to evaluate the integral, $\int_{0}^{3}\int_{0}^{3-x}\int_{0}^{3-x-y}(xyz)\,dz\,dy\,dx$.	06	L3	CO5
		Module – 2			
Q.3	a.	Find the directional derivative of $\phi = 4xz^3 - 3x^2y^2z$ at (2, –1, 2) along $2i-3j+6k$.	07	L2	CO2
	b.	Find $curl(curl A)$, given that $\vec{A}=x^2yi-2xzj+2yzk$ at (1, 0, 2)	07	L2	CO2
	c.	Prove that the Spherical coordinate system is orthogonal.	06	L3	CO2
		OR			
Q.4	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	CO2
	b.	Show that, $\vec{F}=(y^2-z^2+3yz-2x)i+(3xz+2xy)j+(3xy-2xz+2z)k$ is both Solenoidal and irrotational.	07	L2	CO2
	c.	Using Mathematical tools, write the code to find the curl of $\vec{F}=x^2yzi+y^2zxj+z^2xyk$.	06	L3	CO5

		Module – 3			
Q.5	**a.**	Prove that $w = \{(x, 2y, 3z) \mid x, y, z \in R\}$ is a subspace of the vector space $V_3(R)$.	07	L2	CO3
	b.	Determine whether the matrix $\begin{bmatrix} 3 & -1 \\ 1 & -2 \end{bmatrix}$ in the vector space of 2×2 matrices is a linear combination of $x_1 = \begin{pmatrix} 1 & 1 \\ 0 & -1 \end{pmatrix}$, $x_2 = \begin{pmatrix} 1 & 1 \\ -1 & 0 \end{pmatrix}$, $x_3 = \begin{pmatrix} 1 & -1 \\ 0 & 0 \end{pmatrix}$	07	L2	CO3
	c.	Prove that the transformation T : $V_3(R) \rightarrow V_2(R)$ defined by, T(x, y, z) = (x+y, y+z) is a linear transformation.	06	L2	CO3
		OR			
Q.6	**a.**	Find the dimension and basis of the subspace spanned by the vectors, $\{(1,-3,4),(6,2,-1),(2,-2,3),(-4,-8,9)\}$ in $V_3(R)$.	07	L2	CO3
	b.	Find the matrix of the linear transformation, $T: V_2(R) \rightarrow V_3(R)$ defined by, T(x, y) = (x+y, x, 3x-y) with respect to basis, $B_1 = \{(1,1)(3,1)\}$, $B_2 = \{(1,1,1)(1,1,0)(1,0,0)\}$.	07	L2	CO3
	c.	Verify Rank-nullity theorem for the linear transformation $T: V_3(R) \rightarrow V_2(R)$ defined by T(x,y,z) = (y-x, y-z)	06	L3	CO3
		Module – 4			
Q.7	**a.**	Find the real root of $x \log_{10} x - 1.2 = 0$ using Regular Falsi method.	07	L2	CO4
	b.	Using Newton's divided difference formula, evaluate f(4), given that x: 0, 2, 3, 6 y: -4, 2, 14, 158	07	L2	CO4
	c.	Evaluate $\int_0^6 \frac{dx}{1+x^2}$ by using Trapezoidal rule, taking 6 divisions.	06	L3	CO4
		OR			
Q.8	**a.**	Find a real root of $xe^x - 2 = 0$. Correct to three decimal places using Newton-Raphson method.	07	L2	CO4
	b.	The area of a circle (A) corresponding to diameter (D) is given below. Find the area corresponding to diameter 105 using appropriate interpolation formula. x: 80, 85, 90, 95, 100 y: 5026, 5674, 6362, 7088, 7854	07	L2	CO4
	c.	Evaluate $\int_0^1 \frac{x^2}{1+x^3}dx$ by applying Simpson's $\frac{1}{3}^{rd}$ rule with 7 ordinates.	06	L3	CO4

		Module – 5			
Q.9	**a.**	Using Taylor's series method, find the value of y at x = 0.1 and x = 0.2, given that $\frac{dy}{dx} = 2y + 3e^x$, y(0) = 0.	**07**	**L2**	**CO4**
	b.	Using Runge Kutta method of fourth order, find y(0.2) given that $\frac{dy}{dx} = 3x + \frac{y}{2}$, y(0) = 1 taking h = 0.2.	**07**	**L2**	**CO4**
	c.	Given that $\frac{dy}{dx} = x^2 + y^2$, y(0) = 1, y(0.1) = 1.1113, y(0.2) = 1.2507, y(0.3) = 1.426. Find y(0.4) by applying Milne's method.	**06**	**L2**	**CO4**
		OR			
Q.10	**a.**	Using Modified Euler's method find y(0.2). Correct to three decimal places, given that $\frac{dy}{dx} = x - y^2$; y(0) = 1, taking h = 0.1. (Perform 2 modifications in each stage)	**07**	**L2**	**CO4**
	b.	Using Runge-Kutta method of fourth order, find y(0.5), given that $\frac{dy}{dx} = \frac{1}{x+y}$, y(0.4) = 1 taking h = 0.1	**07**	**L2**	**CO4**
	c.	Using 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 method of fourth order.	**06**	**L3**	**CO5**

* * * * *