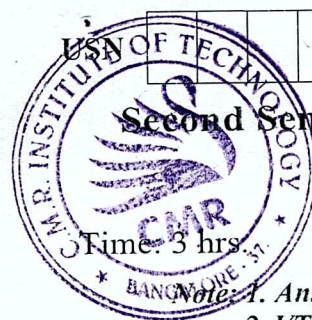




Second Semester B.E./B.Tech. Degree Examination, June/July 2025
Mathematics-II for CSE Stream

BMATS201

Max. Marks: 100

Time: 3 hrs

- Notes:**
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.	Change the order of integration and hence evaluate $\int_0^1 \int_{\sqrt{y}}^1 dx dy$		07	L2	CO1
	b.	Evaluate $\int_{-1}^1 \int_0^z \int_{x-z}^{x+z} (x+y+z) dy dx dz$		07	L2	CO1
	c.	Prove that $\beta(m,n) = \frac{m \cdot n}{m+n}$		06	L2	CO1
OR						
Q.2	a.	Evaluate $\int_0^a \int_0^{\sqrt{a^2-x^2}} y^2 \cdot \sqrt{x^2+y^2} dy dx$ by transforming in to polar coordinates.		07	L2	CO1
	b.	Evaluate $\int_{-c}^c \int_{-b}^b \int_{-a}^a (x^2+y^2+z^2) dz dy dx$		07	L2	CO1
	c.	Using Mathematical Tools, write the code to find the area of the Ellipse by double integration. $\text{Area} = A = 4 \int_0^a \int_0^{\frac{b\sqrt{a^2-x^2}}{a}} dy dx$		06	L3	CO5
Module – 2						
Q.3	a.	Find the angle between the surfaces $x^2+y^2+z^2=9$ and $z=x^2+y^2-3$ at the point (2, -1, 2).		07	L3	CO2
	b.	If $\vec{F} = (3x^2y-z)\vec{i} + (xz^3+y^4)\vec{j} - 2x^3z^2\vec{k}$, find $\text{grad}(\text{div } \vec{F})$ at (2, -1, 0).		07	L2	CO2
	c.	Show that the spherical polar coordinates system is orthogonal.		06	L3	CO2
OR						
Q.4	a.	Find the directional derivative of $\phi = \frac{xz}{x^2+y^2}$ at (1, -1, 1) in the direction of $\vec{A} = \vec{i} - 2\vec{j} + \vec{k}$.		07	L2	CO2
	b.	Express the vector $\vec{A} = z\vec{i} - 2x\vec{j} + y\vec{k}$ in cylindrical coordinates.		07	L2	CO2
	c.	Using Mathematical Tools, write a code to find the curl of $\vec{F} = xy^2\vec{i} + 2x^2yz\vec{j} - 3yz^2\vec{k}$		06	L3	CO5

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Module – 3																		
Q.5	a.	Express the matrix $A = \begin{pmatrix} 3 & -1 \\ 1 & -2 \end{pmatrix}$ in the vector space of 2×2 matrices as a linear combination of $B = \begin{pmatrix} 1 & 1 \\ 0 & -1 \end{pmatrix}$, $C = \begin{pmatrix} 1 & 1 \\ -1 & 0 \end{pmatrix}$ and $D = \begin{pmatrix} 1 & -1 \\ 0 & 0 \end{pmatrix}$	07	L2	CO3													
	b.	Define subspace of a vector space. Determine whether the subset $w = \{(x, y, z) : 2x - 7y + z = 0\}$ of a vector space R^3 is a subspace.	07	L3	CO3													
	c.	Define Linear Transformation. Show that the function $T : R^2 \rightarrow R^3$ given by $T(x, y) = (x + y, x - y, y)$ is a linear transformation.	06	L2	CO3													
OR																		
Q.6	a.	Determine whether or not each of the following forms a basis $x_1 = (2, 2, 1)$, $x_2 = (1, 3, 7)$, $x_3 = (1, 2, 2)$ in R^3 .	07	L2	CO3													
	b.	Verify the Rank-Nullity Theorem for $T : R^3 \rightarrow R^3$ defined by $T(x, y, z) = (x + 2y - z, y + z, x + y - 2z)$	07	L2	CO3													
	c.	Define (i) Inner Product Space (ii) Orthogonality Show that functions $f(x) = 3x - 2$ and $g(x) = x$ are orthogonal in P_n with inner product $\langle f, g \rangle = \int_0^1 f(x) \cdot g(x) dx$	06	L2	CO3													
Module – 4																		
Q.7	a.	Using Regula - Falsi method find the real root of the equation $x \cdot \log_{10} x - 1.2 = 0$ in 3 steps.	07	L2	CO4													
	b.	The area A of a circle corresponding to diameter (D) is given below: <table border="1"><tr><td>D</td><td>80</td><td>85</td><td>90</td><td>95</td><td>100</td></tr><tr><td>A</td><td>5026</td><td>5674</td><td>6362</td><td>7088</td><td>7854</td></tr></table> Find the Area of a circle whose diameter is 105 using appropriate interpolation formula.	D	80	85	90	95	100	A	5026	5674	6362	7088	7854	07	L3	CO4	
	D	80	85	90	95	100												
A	5026	5674	6362	7088	7854													
c.	Evaluate $\int_0^{\pi/2} \sqrt{\cos \theta} \cdot d\theta$ by Simpson's $(1/3)^{rd}$ rule by dividing the interval $(0, \pi/2)$ into 6 equal parts.	06	L2	CO4														
OR																		
Q.8	a.	Using Newton-Raphson Method find the real root of $3x = \cos x + 1$ corrected to 3 decimal places.	07	L2	CO4													
	b.	Using Newton's divided difference formula, evaluate $f(9)$ from the following data: <table border="1"><tr><td>x</td><td>5</td><td>7</td><td>11</td><td>13</td><td>17</td></tr><tr><td>f(x)</td><td>150</td><td>392</td><td>1452</td><td>2366</td><td>5202</td></tr></table>	x	5	7	11	13	17	f(x)	150	392	1452	2366	5202	07	L2	CO4	
	x	5	7	11	13	17												
f(x)	150	392	1452	2366	5202													
c.	Evaluate $\int_0^{0.6} e^{-x^2} \cdot dx$ by taking 7 ordinates using Simpson's $(3/8)^{th}$ rule.	06	L3	CO4														

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Module – 5

Q.9	a.	Using Taylor's series method find $y(0.1)$ given that $\frac{dy}{dx} = x - y^2$ with $y(0) = 1$ considering upto fourth degree term.	07	L2	CO4
	b.	Using RK method of 4 th order find $y(0.1)$ given that $\frac{dy}{dx} = 3e^x + 2y$ with $y(0) = 0$.	07	L2	CO4
	c.	Applying Milne's predictor and corrector formula compute $y(1.4)$ given $\frac{dy}{dx} = x^2 + \frac{y}{2}$ and the data is $y(1) = 2$, $y(1.1) = 2.2156$, $y(1.2) = 2.4649$, $y(1.3) = 2.7514$.	06	L2	CO4
OR					
Q.10	a.	Given $y' - \sqrt{xy} = 2$, $y(1) = 1$ find $y(1.25)$ using Modified Euler's Method.	07	L2	CO4
	b.	Using RK method of fourth order solve $(x+y) \cdot \frac{dy}{dx} = 1$ $y(0.4) = 1$ at $x = 0.5$ corrected to 4 decimal places. CMRIT LIBRARY BANGALORE - 560 037	07	L2	CO4
	c.	Using Mathematical Tools, write a code to find the solution of $\frac{dy}{dx} = 1 + (y/x)$ at $y(2)$ by taking $h = 0.2$ given that $y(1) = 2$ by RK method of fourth order.	06	L3	CO5
