CBCS SCHEME - Summer Semester

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BMATS201

Second Semester B.E./B.Tech. Degree Examination, June/July 2025
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.	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 $\beta(m,n) = \frac{\lceil m \cdot \lceil n}{\lceil m+n}$	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. Area = $A = 4\int_0^a \int_0^{\frac{b}{a}\sqrt{a^2-x^2}} dy\,dx$	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 $\vec{F} = (3x^2y-z)i+(xz^3+y^4)j-2x^3z^2k$, find grad(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 $\overline{A} = i-2j+k$.	07	L2	CO2
	b.	Express the vector $\overline{A} = zi-2xj+yk$ in cylindrical coordinates.	07	L2	CO2
	c.	Using Mathematical Tools, write a code to find the curl of $\overline{F} = xy^2i+2x^2yzj-3yz^2k$	06	L3	CO5

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 $T : R^2 \to R^3$ 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 $T : R^3 \to R^3$ 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: D: 80, 85, 90, 95, 100 A: 5026, 5674, 6362, 7088, 7854 Find the Area of a circle whose diameter is 105 using appropriate interpolation formula.	07	L3	CO4
	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: x: 5, 7, 11, 13, 17 f(x): 150, 392, 1452, 2366, 5202	07	L2	CO4
	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

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 4th 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.	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

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