CBCS SCHEME

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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.	Evaluate $$\int_{-1}^{1}\int_{0}^{z}\int_{x-z}^{x+z}(x+y+z)\,dy\,dx\,dz$$	07	L3	CO1
	b.	Evaluate $\displaystyle\int_{0}^{\infty}\int_{x}^{\infty}\frac{e^{-y}}{y}\,dy\,dx$ by changing the order of integration.	07	L3	CO1
	c.	Show that $$\beta(m,n)=\frac{\Gamma(m).\Gamma(n)}{\Gamma(m+n)}$$	06	L2	CO1
		OR			
Q.2	a.	Evaluate $\displaystyle\int_{0}^{1}\int_{0}^{\sqrt{1-y^2}}(x^2+y^2)\,dy\,dx$ by changing to polar coordinates.	07	L3	CO1
	b.	Using double integration find the area of a plate in the form of a quadrant of the ellipse $\dfrac{x^2}{a^2}+\dfrac{y^2}{b^2}=1$	07	L3	CO1
	c.	Using mathematical tools, write the code to find the volume of the tetrahedron bounded by the planes $x = 0$, $y = 0$, $z = 0$ and $6x + 3y + 2z = 6$.	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	L2	CO2
	b.	Evaluate $\text{div}\,\vec{F}$ and $\text{curl}\,\vec{F}$ at the point $(1, 2, 3)$, given $\vec{F} = \text{grad}(x^3y + y^3z + z^3x - x^2y^2z^2)$	07	L3	CO2
	c.	Express the vector $\vec{F} = 2x\,\hat{i} - 3y^2\,\hat{j} + zx\,\hat{k}$ in cylindrical form.	06	L3	CO2
		OR			
Q.4	a.	Find the directional derivative of $\phi(x, y, z) = x^2yz + yxz^2$ at $(1, -2, 1)$ in the direction of the vector $2\hat{i}-\hat{j}-2\hat{k}$.	07	L2	CO2
	b.	Show that the vector $$\vec{F}=\frac{x\,\hat{i}+y\,\hat{j}}{x^2+y^2}$$ is both solenoidal and irrotational.	07	L3	CO2
	c.	Using mathematical tool, write the code to find the gradient of $xy^3 + yz^3$.	06	L3	CO5

Module – 3

Q.5 a. Show that the set $W = \{(x, y, z) / x + y + 2z = 0\}$ of the vector space $V_3(R)$ is a subspace of $V_3(R)$. — 07 | L2 | CO3

b. Find the basis and dimension of the subspace spanned by the vectors $\{(1, -1, 0), (0, 3, 1), (1, 2, 1), (2, 4, 2)\}$ in R^3. — 07 | L3 | CO3

c. Find the matrix of the linear transformation $T : V_2(R) \to V_3(R)$ such that $T(-1, 1) = (-1, 0, 2)$ and $T(2, 1) = (1, 2, 1)$. — 06 | L2 | CO3

OR

Q.6 a. Determine whether the following set of vectors in 2×2 matrix space is linearly independent or linearly dependent: — 07 | L2 | CO3

$$S = \{v_1, v_2, v_3,\} \text{ where } v_1 = \begin{bmatrix} 2 & 1 \\ 0 & 1 \end{bmatrix}, \; v_2 = \begin{bmatrix} 3 & 0 \\ 2 & 1 \end{bmatrix} \text{ and } v_3 = \begin{bmatrix} 1 & 0 \\ 2 & 0 \end{bmatrix}$$

b. Prove that $T : R^3 \to R^2$ defined by $T(x, y, z) = (x + y, y + 2z)$ is a linear transformation. — 07 | L2 | CO3

c. Verify the Rank – nullity theorem for the linear transformation $T : R^3 \to R^2$ defined by $T(x, y, z) = (y - x, y - z)$. — 06 | L2 | CO3

Module – 4

Q.7 a. Find a real root of the equation $x \log_{10} x = 1.2$ by regula falsi method corrected to 4 decimal places between (2.5, 3). Carry out 4 iterations. — 07 | L2 | CO4

b. From the following table of half yearly premium for policies maturing at different ages, estimate the premium for the policies maturing at the age of 46. — 07 | L3 | CO4

Age :	45	50	55	60	65
Premium (in Rs.)	114.84	96.16	83.32	74.48	68.48

c. Use Trapezoidal rule to estimate the integration — 06 | L3 | CO4

$$\int_0^1 \frac{1}{1+x^2}\,dx \quad \text{by taking 10 equal intervals.}$$

OR

Q.8 a. Find by Newton's Raphson method, the root of the equation $\cos x = x e^x$ near to 0.5, corrected to 4 decimal places. — 07 | L2 | CO4

b. Using Newton's divided difference interpolation, find the interpolating polynomial of the given data: — 07 | L3 | CO4

x :	- 4	- 1	0	2	5
f(x) :	1245	33	5	9	+1335

c. Evaluate using Simpson's $(1/3)^{rd}$ rule, — 06 | L3 | CO4

$$\int_4^{5.2} \log x \, dx \quad \text{by dividing the range (4, 5.2) into seven ordinates.}$$

Module – 5

			Marks	Level	CO
Q.9	a.	Solve $y' = 3x + y^2$; $y(0) = 1$ using Taylor's series method at $x = 0.1$ and $x = 0.2$.	07	L3	CO4
	b.	Given $\frac{dy}{dx} = \frac{y-x}{y+x}$ with $y = 1$ when $x = 0$. Find an approximate y at $x = 0.1$ using Euler's modified method. (Use modified formula twice).	07	L3	CO4
	c.	From the data given below find y at $x = 1.4$ using Milne's method. Given $\frac{dy}{dx} = x^2 + \frac{y}{2}$.	06	L3	CO4

x :	1	1.1	1.2	1.3
y :	2	2.2156	2.4549	2.7514

OR

			Marks	Level	CO
Q.10	a.	Using Runge – Kutta method of order 4, find y at $x = 0.2$, given $\frac{dy}{dx} = \frac{x^2 + y^2}{10}$; $y(0) = 1$ taking $h = 0.1$.	07	L3	CO4
	b.	Using modified Euler's method solve $y' = 3x + \frac{y}{2}$ with $y(0) = 1$ taking $h = 0.2$ at $x = 0.2$. (Use modified Euler's formula twice).	07	L3	CO4
	c.	Using mathematical tools, write the code to solve $\frac{dy}{dx} = x^2y - 1$; $y(0) = 1$ by Taylor's series method at $x = 0.1\ (0.1)\ 0.3$	06	L3	CO5

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