MAKE-UP EXAM

USN [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ] **BMATS201**

Second Semester B.E./B.Tech. Degree Examination, Nov./Dec. 2023
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 $\int_{-c}^{c}\int_{-b}^{b}\int_{-a}^{a}(x^2+y^2+z^2)\,dz\,dy\,dx$	7	L2	CO1
	b.	Evaluate $\int_0^{\infty}\int_0^{\infty} e^{-(x^2+y^2)}\,dx\,dy$ by changing into polar coordinates.	7	L2	CO1
	c.	Prove that $\beta(m,n) = \frac{\Gamma m - \Gamma n}{\Gamma m + n}$.	6	L2	CO1
		OR			
Q.2	a.	Evaluate $\int_0^1\int_x^{\sqrt{x}} xy\,dy\,dx$ by changing the order of integration.	7	L3	CO1
	b.	Prove that $\int_0^{\pi/2}\sqrt{\cot\theta}\,d\theta = \frac{\pi}{\sqrt{2}}$	7	L2	CO1
	c.	Using mathematical tools, write the code to find the area of an ellipse by double integration $A = 4\int_0^a \int_0^{\frac{b}{a}\sqrt{a^2-x^2}} dy\,dx$	6	L3	CO5
		Module – 2			
Q.3	a.	Find div $\vec{F}$ and curl $\vec{F}$, If $\vec{F} = \nabla(x^3+y^3+z^3-3xyz)$	7	L2	CO2
	b.	Find the directional derivative of $\phi = x^2yz + 4xz^2$ at (1, –2, –1) Along the direction of the vector (2i – j – 2K).	7	L2	CO2
	c.	Prove that the spherical coordinate system is orthogonal.	6	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 the point (2, –1, 2).	7	L3	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	7	L2	CO2
	c.	Using the mathematical tools, write the codes to find the divergence of $\vec{F} = x^2yi + yz^2j + x^2z\,K$.	6	L3	CO5

		Module – 3			
Q.5	**a.**	Prove that the subset $W = \{(x, y, z) / x - 3y + 4z = 0\}$ of the vector space R^3 is a subspace of R^3.	7	L3	CO3
	b.	Determine whether the matrix $A = \begin{bmatrix} 3 & -1 \\ 1 & -2 \end{bmatrix}$ is a linear combination of $B = \begin{bmatrix} 1 & 1 \\ 0 & -1 \end{bmatrix}$, $C = \begin{bmatrix} 1 & 1 \\ -1 & 0 \end{bmatrix}$ and $D = \begin{bmatrix} 1 & -1 \\ 0 & 0 \end{bmatrix}$ in the vector space M_{22} of 2×2 matrices.	7	L2	CO3
	c.	Find the linear transformation $T : V_2(R) \to V_3(R)$ such that $T(1, 1) = (0, 1, 2)$, $T(-1, 1) = (2, 1, 0)$.	6	L2	CO3
		OR			
Q.6	**a.**	Determine whether the vectors $V_1 = (1, 2, 3)$, $V_2 = (3, 1, 7)$ and $V_3 = (2, 5, 8)$ are linearly dependent or linearly independent.	7	L2	CO3
	b.	Find the dimension and basis of the subspace spanned by the vectors (2, 4, 2), (1, −1, 0), (1, 2, 1) and (0, 2, 1) in $V_3(R)$	7	L2	CO3
	c.	Verify the rank-nullity theorem for the linear transformation $T : V_3(R) \to V_3(R)$ defined by $T(x, y, z) = (x + 2y - z, y + z, x + y - 2z)$.	6	L2	CO3
		Module – 4			
Q.7	**a.**	Find the root of the equation $xe^x = 2$ that lies between 0 and 1. Using Regula- Falsi method. Carryout Four iterations. Correct to 3 – decimal places.	7	L2	CO4
	b.	Use Newton's divided difference formula. Find f(q), given the data : x : 5, 7, 11, 13, 17 f(x) : 150, 392, 1452, 2366, 5202	7	L3	CO4
	c.	Evaluate $\int_0^1 \frac{dx}{1+x^2}$ by using Simpson's $\frac{1}{3}^{rd}$ rule taking 4 equal parts.	6	L3	CO4
		OR			
Q.8	**a.**	Find the real root of the equation $3x - \cos x - 1 = 0$. Correct to 3-decimal places. Using Newton's Raphson method carryout 3 – iteration.	7	L2	CO4
	b.	Find Tan(0.26) given that Tan (0.10) = 0.1003 Tan (0.15) = 0.1511, Tan (0.20) = 0.2077, Tan (0.25) = 0.2553, Tan(0.30) = 0.3093. Using Newton's Backward interpolation formula.	7	L2	CO4
	c.	Evaluate $\int_4^{5.2} \log x \, dx$ taking 6 equal parts. Using Simpson's $3/8^{th}$ rule.	6	L2	CO4

Data for Q.7 b.:

x	:	5	7	11	13	17
f(x)	:	150	392	1452	2366	5202

		Module – 5			
Q.9	a.	Employ Taylor's series method find y at x = 0.1 and 0.2 given that $\frac{dy}{dx} = 2y + 3e^x$; y(0) = 0. Up to fourth degree terms.	7	L2	CO4
	b.	Using Runge Kutta a method of forth order to find an approximate value of y(0.2) given that $\frac{dy}{dx} = (x^2 + y)$ with y(0) = 1. Taking h = 0.2.	7	L2	CO4
	c.	Given $y' = (x - y^2)$ and the data y(0) = 0, y(0.2) = 0.02, y(0.4) = 0.0795, y(0.6)=0.1762. Compute y(0.8) by Milne's method.	6	L2	CO4
		OR			
Q.10	a.	Using modified Euler method find y(0.1) given that $\frac{dy}{dx} = (x + y)$, with y(0) = 1, Taking h = 0.1. Carryout 3-modification.	7	L2	CO4
	b.	Using Runge kutta method of fourth order, find the value of (0.2). Given that $\frac{dy}{dx} = \left(3x + \frac{y}{2}\right)$ with y(0) = 1. Taking h = 0.2.	7	L2	CO4
	c.	Using Mathematical tools, write the code solve the differential equation $\frac{dy}{dx} = 3e^x + 2y$ with y(0) = 0, using the Taylor's series method at x = 0.1 (0.1) 0.3.	6	L3	CO5

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