KANPUR INSTITUTE OF TECHNOLOGY

(An Autonomous Institute of AKTU, Lucknow)
A-1, UPSIDC Industrial Area, Rooma, Kanpur-208001 (U.P.) India

ODD SEM SUMMATIVE EXAM, AY: 2024-25	PROGRAM: B. TECH	ROLL NO: 2416501310O1
SUBJECT CODE: (AHI1010)	BRANCH: CS/AI/ML/IT/EC/EN/ME	SECTION: A/B/C/D
SUBJECT NAME: ENGINEERING MATHEMATICS-I	SEMESTER: I	FACULTY NAME: MR.

Time: 2hrs *Total Marks: 30*

Note: Attempt all Sections

Attempt any one set of questions for CO1.

✓		Attempt all questions	02 x 01=02	
1a.	Define symmetric Matrix.			1
1b.	Find A^2 if $A = \begin{bmatrix} 1 & 1 & 0 \\ 2 & 1 & 3 \\ 1 & 0 & 3 \end{bmatrix}$			1

		Attempt any one question	01x 04=04	
✓ 2a.	Find the Rank of the matrix A. $A = \begin{bmatrix} 2 & 1 & 1 \\ 2 & 3 & 4 \\ -1 & -1 & -2 \end{bmatrix}$			4
2b.	Test the consistency for the following system of equations and if system is consistent, solve them: $x + y + z = 6$, $x + 2y + 3z = 4$, $x + 4y + 7z = 10$			4

OR

		Attempt all questions	02 x 01=02	
1a.	Define Hermitian Matrix.			1
1b.	Find the Rank of the matrix. $A = \begin{bmatrix} 1 & 1 \\ 0 & 4 \end{bmatrix}$			1

		Attempt any one question	01x 04=04	
2a.	Find the value of β For which the vector $(1,-2,\beta),(2,-1,5),(3,-5,7\beta)$ are linearly dependent.			4
2b.	Find the Eigen values of the matrix A. $A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$			4

Attempt any one set of questions for CO2.

		Attempt all questions	02 x 01=02	
3a.	Define Rolle's Theorem.			1
3b.	Define Mean Value Theorem.			1

		Attempt any one question	01x 04=04	
4a.	Verify Rolle's theorem for $2 + (1+x)^{\frac{2}{3}}$ in $[0,2]$.			4
4b.	Show that the function $f(x) = x^2 + 2x$ is continuous at $x = 3$.			4

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OR

✓		Attempt all questions	02 x 01=02	
3a.	Define Cauchy Mean Value Theorem.			1
3b.	Find $\frac{\partial^2 z}{\partial x^2}$. If $z = x^3 + y^3 - 63(x+y) + 12xy$.			1

		Attempt any one question		
4a.	Verify Cauchy's mean value theorem for the following pair of function in [a, b]. if $f(x) = e^x, g(x) = e^{-x}$			4
✓ 4b.	If $y = cos^{-1}x$, prove that $(1-x^2)y_2 - xy_1 = 0$.			4

Attempt any one set of questions for CO3.

		Attempt all questions	02 x 01=02	
5a.	Write the formula of Lagrange's method of multiplier.			1
5b.	Expand $e^y \log(1+x)$ up-to one degree.			1

		Attempt any one question	01x 04=04	
6a.	Expand $e^x \sin y$ in powers of x and y as for as terms of the two degrees.			4
6b.	If $f(x) = x^3 + 8x^2 + 15x - 24$ calculate the value of $f\left(\frac{11}{10}\right)$ by the application of Taylor's series.			4

OR

✓		Attempt all questions	02 x 01=02	
5a.	Define Maclaurin theorems of one variable.			1
5b.	State Euler's Theorem on homogeneous functions.			1

		Attempt any one question		
6a.	What error in the common logarithm of a number will be produced by an error of 1% in the number?			4
✓ 6b.	Examine for extreme values $x^3 + y^3 - 63(x+y) + 12xy$.			4

Attempt any one set of questions for CO4

		Attempt all questions	02 x 01=02	
7a.	Define Dirichlet's Integral.			1
7b.	Write the standard form of Beta function.			1

		Attempt any one question	01x 04=04	
8a.	Use Dirichlet's integral to evaluate $\iiint xyz\, dx\, dy\, dz$ throughout the volume bounded by $x = 0, y = 0, z = 0, and\ x + y + z = 1$.			4
8b.	Find the volume of the region bounded by the surface $y = x^2, x = y^2$ and the planes $z = 0, z = 3$.			4

OR

	Attempt all questions	02 x 01=02
7a.	Write the standard form of Gamma function.	1
7b.	Write the formula of Liouville's extension of Dirichlet's Integral.	1

	Attempt any one question	
8a.	Determine the area of region bounded by curves $xy = 2, 4y = x^2, y = 4$.	4
8b.	Evaluate: $\int_0^\infty \frac{dx}{1+x^4}$	4

Attempt any one set of questions for CO5

✓	Attempt all questions	02 x 01=02
9a.	Write the Statement of Green's Theorem.	1
9b.	Define curl of a vector field.	1

	Attempt any one question	01x 04=04
10a.	Calculate the following integral by changing the order of integration: $\int_0^\infty \int_x^\infty \frac{e^{-y}}{y} dydx$.	4
✓ 10b.	If $\vec{r} = x\hat{i} + y\hat{j} + 2\hat{k}$, show that: (i) $div\ \vec{r} = 3$ (ii) $curl\ \vec{r} = \vec{0}$	4

OR

	Attempt all questions	02 x 01=02
9a.	Write the formula of Stoke's Theorem.	1
9b.	Define Divergence of a vector field.	1

	Attempt any one question	
10a.	Find the value of m, if $\vec{F} = mx\hat{i} - 5y\hat{j} + 2z\hat{k}$ is a solenoidal vector.	4
10b.	Find the curl of $\vec{F} = xy\hat{i} + y^2\hat{j} + zx\hat{k}$ at $(-2,4,1)$.	4