



Reg. No.:

Name:

University of Kerala

First Semester FYUGP Degree Examination, December 2025

Discipline Specific Core Course

MATHEMATICS

UK1DSCMAT101 - Differential Calculus and Linear Algebra

Academic Level: 100-199

2025-Admission onwards

Time: 1 Hour 30 Minutes(90 Mins.)

Max. Marks: 42

Part A. 6 Marks.Time:6 Minutes.(Cognitive Level:Remember(RE)/Understand(UN)) Objective Type. 1 Mark
Each.Answer all questions

Qn No.	Question	CL	CO
1	Define monotonic increasing function.	RE	2
2	Suppose that $f(x)$ twice differentiable at the point x_0 . If $f'(x) = 0$ and $f''(x_0) < 0$, then $f(x)$ has a relative at x_0 .	RE	1
3	The rank of an $n \times n$ identity matrix is	UN	3
4	A - "Every continuous function is differentiable". B - "Every differentiable function is continuous". Which of the following is true ? 1) Both A and B are True 2) Both A and B are False 3) Only A is True but not B 4) Only B is True but not A	UN	1
5	Find all critical points of $f(x) = x^3 - 3x + 1$	UN	2
6	Find $\frac{dy}{dx}$ for the function $y = x^2 \sin \frac{1}{x}$	UN	1

Part B.8 Marks.Time:24 Minutes.(Cognitive Level:Understand(UN)/Apply(AP))Short Answer. 2 marks each.Answer all questions

Qn No.	Question	CL	CO
7	Find the intervals on which $f(x) = x^3$ is increasing.	UN	1
8	Find the eigenvalues and corresponding eigenvectors for the matrix $A =$	UN	2

Qn No.	Question	CL	CO
	$\begin{bmatrix} 0 & 4 \\ -4 & 0 \end{bmatrix}$		
9	Find the eigenvector corresponding to the largest eigenvalue of the matrix $\begin{bmatrix} 1 & 3 \\ 0 & 4 \end{bmatrix}$	AP	4
10	Check the concavity of the function $h(x) = x^3 - 6x$ on the interval $(-\infty, 0)$	AP	1

Part C. 28 Marks. Time: 60 Minutes (Cognitive Level: Apply(AP)/Analyse(AN)/Evaluate(EV)/Create(CR)) Long Answer: 7 marks each. Answer all 4 Questions choosing among options * within each question

Qn No.	Question	CL	CO
11	<p>A)</p> <p>Find a point on the curve $y = x^2$ that is closest to the point $(18, 0)$.</p> <p>OR</p> <p>B)</p> <p>(a) Using implicit differentiation compute $\frac{dy}{dx}$ at the point $(\frac{3}{2}, \frac{3}{2})$ using the function $x^3 + y^3 = 3xy$</p> <p>(b) Find the derivative of $f(x) = \ln x$.</p>	AP	2, 2
12	<p>A)</p> <p>Diagonalize the matrix</p> $\begin{bmatrix} 2 & 0 & 0 \\ 1 & 2 & 1 \\ -1 & 0 & 1 \end{bmatrix}$ <p>OR</p> <p>B)</p> <p>(i) Find the eigenvalues and eigenvectors of</p> $A = \begin{bmatrix} 3 & 5 & 3 \\ 0 & 4 & 6 \\ 0 & 0 & 1 \end{bmatrix}$ <p>(i) find the Algebraic and Geometric multiplicity of eigen values of A.</p>	AN	3, 3
13	A)	EV	3, 4

Qn No.	Question	CL	CO
	<p>Let $A = \begin{bmatrix} 4 & -6 & 0 \\ -6 & 0 & 1 \\ 0 & 1 & 4 \end{bmatrix}$</p> <p>i) Find Rank of A.</p> <p>ii) Find the basis for Row space.</p> <p>iii) Find the basis for column space.</p> <p>OR</p> <p>B)</p> <p>Define inconsistent system of equations. Determine whether the system of equations is consistent or not. $x - 3y + z = 4$, $-x + 2y - 5z = 3$, $5x - 13y + 13z = 8$</p>		
14	<p>A)</p> <p>An open box is to be made from a 16-inch by 30-inch piece of card-board by cutting out squares of equal size from the four corners and bending up the sides. What size should the squares be to obtain a box with the largest volume?</p> <p>OR</p> <p>B)</p> <p>Find the relative extrema for $f(x) = 3x^2 - 5x^3$.</p>	CR	2, 2