Reg No.:

Name :

U8227

University of Kerala

First Semester Degree Examination, November 2024

Four Year Undergraduate Programme

Discipline Specific Course

Mathematics

UK1DSCMAT103, Differentiation & Linear System of Equations

Academic Level: 100-199

Time: 2 hours **Max. Marks: 56**

Part A. 6 Marks. Time:5 Minutes
Objective Type. 1 Mark Each. Answer all Questions
(Cognitive Level: Remember/Understand)

Qn. No.	Question	Cognitive Level	Course Outcome (CO)
1.	Find $\frac{dy}{dx}$ where $y = \tan(x^2 + 1)$	Remember	CO1
2.	The average rate of change of $y = x^2 + 1$ with respect to x over the interval $[3, 5]$ is	Remember	CO2
3.	The value of $\log_2 16$ is	Understand	CO2
4.	Find $\lim_{x \to 0} \frac{\sin x}{x}$	Understand	CO2
5.	Let A be a 5×4 matrix and B be a 5×4 matrix. The order of the matrix AB^T is	Remember	CO3
6.	What is an eigenvalue problem ?	Remember	CO4

Part B. 10 Marks. Time:20 Minutes
Two-Three sentences. 2 Marks Each. Answer all Questions
(Cognitive Level: Remember/Understand/Apply)

Qn. No.	Question	Cognitive Level	Course Outcome (CO)
7.	Find $\lim_{x\to+\infty} \frac{3x+5}{6x-8}$	Remember	CO2
8.	Determine whether $f(x) = \frac{x^2-4}{x-2}$ is continuous at $x = 2$	Remember	CO2
9.	Find an equation for the tangent line to the curve $y = 2/x$ at the point $(2, 1)$ on this curve.	Remember	CO2
10.	Find the rank of the matrix $\begin{bmatrix} 0 & 3 & 5 \\ 3 & 5 & 0 \\ 5 & 0 & 10 \end{bmatrix}$	Understand	CO3
11.	Find the eigenvalues of the matrix $\begin{bmatrix} -5 & 2 \\ 2 & -2 \end{bmatrix}$	Apply	CO4

Part C. 16 Marks. Time:35 Minutes
Short-Answer. 4 Marks Each. Answer all Questions, choosing among options within each question.
(Cognitive Level: Understand/Analyse/Apply)

Qn. No.	Question	Cognitive Level	Course Outcome (CO)
12.	(A) Find $\frac{dy}{dx}$ if $5y^2 + \sin y = x^2$ OR (B) Find $\frac{dy}{dx}$ if $y = \sin(\sqrt{1+\cos x})$	Understand	CO1
13.	(A) Find x such that $ln(x+1) = 5$ OR (B) Find the derivative of $ln\lvert\frac{1+x}{1-x}\rvert$	Understand	CO2.
14.	(A) Let $A = \begin{bmatrix} 5 & -8 & 1 \\ 4 & 0 & 0 \end{bmatrix}$. Find AA^T OR (B) Determine whether the vectors $(0, 1, 1)$, $(1, 1, 1)$, $(0, 0, 1)$ are linearly independent or not ?	Analyse	CO3

Qn. No.	Question	Cognitive Level	Course Outcome (CO)
15.	(A) Solve by Cramer's rule $3y - 4z = 166$ $2x - 5y + 7z = 27$ $-x - 9z = 9$ OR (B) Find the determinant of $\begin{bmatrix} a & b & c \\ c & a & b \\ b & c & a \end{bmatrix}$	Apply	CO4.

Part D. 24 Marks. Time:60 Minutes

Long-Answer. 6 Marks Each. Answer all 4 Questions, choosing among options within each question. (Cognitive Level: Understand/Analyse/ Apply)

Qn. No.	**Question**	**Cognitive Level**	**Course Outcome (CO)**
16.	A) Evaluate $\lim_{x\to+\infty} \frac{\sqrt{x^2+2}}{3x-6}$ OR B) Use implicit differentiation to find $\frac{dy}{dx}$ for the Folium of Descartes $x^3 + y^3 = 3xy$. Also Find an equation for the tangent line to the Folium of Descartes at the point $(\frac{3}{2}, \frac{3}{2})$	Analyse	CO1
17.	A) Solve $\frac{e^x - e^{-x}}{2} = 1$ for x OR B) Find $\lim_{x\to 0}(1+\sin x)^{1/x}$	Understand	CO2
Qn. No.	**Question**	**Cognitive Level**	**Course Outcome (CO)**
18.	A) Let $A = \begin{bmatrix} 4 & -2 & 3 \\ -2 & 1 & 6 \\ 1 & 2 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & -3 & 0 \\ -3 & 1 & 0 \\ 0 & 0 & -2 \end{bmatrix}$. Find (i) AB (ii) BA (iii) AB^T OR B) Find the inverse of the matrix $\begin{bmatrix} -1 & 3 & -4 \\ 2 & 4 & 1 \\ -4 & 2 & -9 \end{bmatrix}$	Understand	CO3
19.	A) Find the eigenvalues and eigenvectors of $\begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$ OR B) Diagonalise the matrix $\begin{bmatrix} 4 & 0 & 0 \\ 12 & -2 & 0 \\ 21 & -6 & 1 \end{bmatrix}$	Apply	CO4