

Reg. No.:



W7645

Name:

University of Kerala

First Semester FYUGP Degree Examination, December 2025

Discipline Specific Core Course

MATHEMATICS

UK1DSCMAT108 - Differential Calculus

Academic Level: 100-199

2024-Admission

Time: 2 Hours(120 Mins)

Max. Marks: 56

**Part A.6 Marks:Time 5 Minutes.(Cognitive Level :Remember(RE)/Understand(UN)) Objective Type.1 mark each,
Answer all questions**

Qn No.	Question	CL	CO
1	Write derivative of $\log_b x$.	RE	1
2	State mean vale theorem.	RE	3
3	Find $\lim_{x \rightarrow 0} \frac{\sin x}{x}$	UN	1
4	True or False : "If f is decreasing on $[0, 2]$, then $f(0) > f(1) > f(2)$ ".	UN	3
5	Write the domain of the derivative function $f'(x)$ of $f(x) = x $.	UN	1
6	Find the intervals on which $f(x) = x^2$ is increasing and the intervals on which it is decreasing.	UN	1

Part B.10 Marks.Time:20 Minutes (Cognitive Level:Understand(UN)/Apply(AP))Two-three sentences.2 marks each.Answer all questions

Qn No.	Question	CL	CO
7	Find $\lim_{x \rightarrow 0} \frac{\sin 3x}{\sin 5x}$.	UN	1
8	Use implicit differentiation to find $\frac{dy}{dx}$ if $4x^2 - 2y^2 = 9$.	UN	2
9	Find the derivative of $x^2 \sin x$.	AP	1
10	Evaluate $\lim_{x \rightarrow 0^+} x^{\sin x}$	AP	2
11	At what points, if any, does the graph of $y = x^3 - 3x + 4$ have a horizontal tangent line?	AP	1

Part C.16 Marks.Time:35 Minutes.(Cognitive Level :Apply(AP)/Analyse(AN))Short Answer.4 marks each, Answer all 4 questions,choosing among options * within each question

Qn No.	Question	CL	CO
12	A) Use second derivative test to find the relative extrema of $f(x) = 3x^5 - 5x^3$ OR B) Find the local linear approximation to $y = \frac{1}{x}$ at $x = 2$.	AP	2, 2
13	A) Find the area of the triangle formed from the coordinate axes and the tangent line to the curve $y = 5x^{-1} - \frac{1}{5}x$ at the point (5,0). OR B) Verify that the hypotheses of the Mean-Value Theorem $f(x) = x^2 - x$; on the interval $[-3, 5]$ find all values of c in that interval that satisfy the conclusion of the theorem.	AP	1, 2
14	A) Find the intervals on which $f(x) = x^2 - 4x + 3$ is increasing and the intervals on which it is decreasing. OR B) Assume that oil spilled from a ruptured tanker spreads in a circular pattern whose radius increases at a constant rate of 2 ft/s. How fast is the area of the spill increasing when the radius of the spill is 60 ft?	AN	4, 3
15	A) a) Find $\frac{d}{dx} \left[\ln \left(\frac{x^2 \sin x}{\sqrt{1+x}} \right) \right]$. b) Find $\frac{d}{dx} [\cos(e^x + 1)]$. OR B) Determine the interval in which the function $f(x) = x^3 - 3x^2 + 1$ is concave up and concave down. Also locate all inflection points.	AN	2, 3

Part D.24 Marks.Time: 60 Minutes.(Cognitive Level :Analyse(AN)/Evaluate(EV)/Create(CR)) Long Answer 6 Marks each.Answer all 4 questions choosing among options * within each question

Qn No.	Question	CL	CO
16	A) Draw the graph of x and show that x is continuous everywhere and differentiable except at $x = 0$. OR B) Find the slope of the tangent line to the curve $y = \frac{2}{x}$ at the point $(2, 1)$. Hence find the equation of the tangent line at $(2, 1)$.	AN	2, 2
17	A) (i) Using implicit differentiation compute $\frac{dy}{dx}$ at the point $(\frac{3}{2}, \frac{3}{2})$ using the function $x^3 + y^3 = 3xy$ (ii) Evaluate $\lim_{x \rightarrow 0^+} (\frac{1}{x} - \frac{1}{\sin x})$ OR B) a) Find $f''(\frac{\pi}{4})$ if $f(x) = \sec x$. b) Find $\frac{d}{dx}[(1 + x^5 \cot x)^{-8}]$.	EV	3, 2
18	A) (i) Use both the first derivative test to show that $f(x) = 3x^2 - 6x + 1$ has a relative minimum at $x = 1$. (ii) Find the open interval on which $f(x) = 5 + 12x^2 - x^3$ concave up and the open interval on which $f(x)$ is concave down. OR B) (i) Find the intervals on which $f(x) = x^2 - 6x + 5$ is increasing and the intervals on which it is decreasing. (ii) Verify that the function $f(x) = x^2 - 8x + 15$ satisfies the hypotheses of the Rolle's Theorem on the interval $[3, 5]$, and find all values of c in the interval that satisfy the conclusion of the theorem.	EV	3, 3
19	A)	CR	2, 2

Qn No.	Question	CL	CO
	Consider the function $f(x) = \frac{1}{x^2}$. Using definition, (i) find the average rate of change of $f(x)$ with respect to x over the interval $[1, 2]$ and (ii) find the instantaneous rate of change of $f(x)$ with respect to x when $x = 1$. OR B) A camera is mounted at a point 3000 ft from the base of a rocket launching pad. If the rocket is rising vertically at 880 ft/s when it is 4000 ft above the launching pad, how fast must the camera elevation angle change at that instant to keep the camera aimed at the rocket?		