Reg. No.: .....

Name: .....

University of Kerala

U8948

Second Semester FYUGP Degree Examination, April 2025

Discipline Specific Core Course

MATHEMATICS

UK2DSCMAT105 - Applications of Differentiation and Ordinary Differential Equations

Academic Level: 100-199

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	State Mean Value theorem.	RE	2
2	If $f''(a)$ exists and f has an inflection point at $x = a$, then $f''(a)$ --------.	RE	1
3	Find the critical points of $y = x^3 - 3x - 7$.	UN	1
4	Find the absolute minimum of the function $f(x) = \|x\| + 1$ in the interval $[-1, 1]$.	UN	1
5	Solve $\frac{dy}{dx} = 5y$.	UN	4
6	Solve $y'' + 4y' + 3y = 0$.	UN	2

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	Locate the inflection points of the function $f(x) = x + 2\sin x$	UN	1
8	Check whether the differential equation $(2xy^2 - 3)dx + (2x^2y + 4)dy = 0$ is exact	UN	3
9	Find the two x-intercepts of the function $f(x) = x^2 - 5x + 4$ and confirm that $f'(c) = 0$ at some point c between those intercepts.	AP	2
10	Solve $2y'' - 5y' - 3y = 0$.	AP	4

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	A) (a) Two roots of a cubic auxiliary equation with real co-efficient are $m_1 = \frac{-1}{2}$ and $m_2 = 3 + i$. What is the corresponding homogeneous differential equation(b) Solve the initial value problem $y'' - y = 0$, $y(0) = 1$, $y'(1) = 0$ OR B) Find the relative extrema of $f(x) = 3x^5 - 5x^3$.	AP	4, 1
12	A) Solve $xydx + (2x^2 + 3y^2 - 20)dy = 0$. OR B) (a) Solve the differential equation $\frac{dy}{dx} = y^2 - 4$. (b) Solve $x\frac{dy}{dx} - 4y = x^5e^x$.	AN	4, 4
13	A) If $f(x) = x^4 - 5x^3 + 9x^2$ then find: (a) the intervals on which f is increasing, (b) the intervals on which f is decreasing, (c) the open intervals on which f is concave up, (d) the open intervals on which f is concave down. OR B) (a) Solve the initial value problem $\frac{dy}{dx} = (-4x + y)^2 + 8$, $y(0) = 0$ (b) Solve $2y'' - 3y' + 4y = 0$	EV	2, 2
14	A) (a) Solve the initial-value problem $4y'' + 4y' + 17y = 0$, $y(0) = -1$, $y'(0) = 2$. (b) Solve $\frac{d^4y}{dx^4} + 2\frac{d^2y}{dx^2} + y = 0$. OR B)	CR	4, 2

Qn No.	Question	CL	CO
	(a) The minute hand of a certain clock is 4 in long. Starting from the moment when the hand is pointing straight up, how fast is the area of the sector that is swept out by the hand increasing at any instant during the next revolution of the hand? (b) Show that among all rectangles with perimeter p, the square has the maximum area.		