

Reg. No.:



Name:

University of Kerala

U9172

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	Define Bernoulli's differential equation	RE	1
2	What do you mean by linearly independent solutions of a differential equation	RE	1
3	Give an example of a function that has a critical point but no relative extrema at that point.	UN	1
4	Solve the differential equation $\frac{dy}{dx} = \frac{x}{y}$	UN	1
5	Determine whether the equation $(2x - 1)dx + (3y + 7)dy = 0$ is exact.	UN	4
6	Find the interval(s) on which the function $\tan^{-1} x$ is increasing.	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 fundamental set of solutions of the differential equation $\frac{d^2y}{dx^2} - y = 0$	UN	2
8	Solve $\frac{dy}{dx} = e^{3x+2y}$.	UN	4
9	Discuss the applicability of Rolle's theorem for the function $f(x) = \tan x$ in the interval $[0, \pi]$	AP	1
10	Find the absolute maximum and minimum values of $f(x) = (x - 2)^3$ on the closed interval $[1, 4]$, and state where those values occur.	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	A) (a) Use Euler's method to obtain a 2-decimal approximation of $y(1.2)$ using $h = 0.1$ for the differential equation $y' = 2x - 3y + 1$, $y(1) = 5$ (b) Solve $y'' - y' - 12y = 0$ OR B) A rectangular metal sheet of length 6 metres and width 2 metres is given. Four equal squares are removed from the corners. The sides of this sheet are turned up to form an open rectangular box. Find, approximately , the height of the box , such that volume of the box is maximum.	AP	3, 2

Qn No.	Question	CL	CO
12	<p>A) For the function , $f(x) = \sin x - \cos x$, find the regions in $[-\pi, \pi]$ where it is increasing, decreasing , concave up and concave down. OR</p> <p>B) Determine whether the function $f(x) = \frac{1}{x^2-1}$ has any absolute extrema on the interval (0, 1). If so, find them and state where they occur.</p>	AN	1, 3
13	<p>A)</p> <p>Solve $(e^{2y} - y \cos(xy))dx - (2xe^{2y} - x \cos(xy) + 2y)dy = 0$</p> <p>OR</p> <p>B)</p> <p>Solve the initial value problem $\cos x (e^{2y} - y) \frac{dy}{dx} = e^y \sin 2x, y(0) = 0$.</p>	EV	3, 3
14	<p>A)</p> <p>A 13 ft ladder is leaning against a wall.If the top of the ladder slips down the wall at a rate of 2 ft/s how fast will the foot be moving away from the wall when the top is 5 ft above the ground</p> <p>OR</p> <p>B)</p> <p>Solve $x \frac{dy}{dx} - 4y = x^6 e^x$</p>	CR	2, 4