

Reg. No.:



Y8675

Name:

University of Kerala

Second Semester FYUGP Degree Examination, June 2026

Discipline Specific Core Course

MATHEMATICS**UK2DSCMAT105 - Applications of Differentiation and Ordinary Differential Equations**

Academic Level: 100-199

2024 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	What do you mean by linearly independent solutions of a differential equation	RE	1
2	State Extreme Value Theorem.	RE	2
3	Find the degree of the homogeneous function $f(x, y) = x^2 - xy$	UN	2
4	Suppose that $f(x)$ has second derivative $f''(x) = (x - 4)(3x - 4)$. Determine the interval(s) on which f is concave down.	UN	1
5	Solve $\frac{dy}{dx} = xy$.	UN	4
6	Write an integrating factor that makes the differential equation $xydx + (2x^2 + 3y^2 - 20)dy = 0$ exact.	UN	4

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	A 10-foot ladder stands on a horizontal floor and leans against a vertical wall. Use x to denote the distance along the floor from the wall to the foot of the ladder, and use y to denote the distance along the wall from the floor to the top of the ladder. If the foot of the ladder is dragged away from the wall, find an equation that relates rates of change of x and y with respect to time?	UN	2
8	Use both the first and second derivative tests to show that $f(x) = x^3 - 3x + 3$ has a relative minimum at $x = 1$ and a relative maximum at $x = -1$.	UN	2
9	For what value of k the initial value problem $x \frac{dy}{dx} - 4y = 0$, $y(0) = k$ has no solution	AP	4
10	Find the general solution of the differential equation: $y'' - y' - 6y = 0$.	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) Solve the initial-value problem: $y'' + y' + 2y = 0$, $y(0) = 0$, $y'(0) = 0$. OR B) (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 $y'' - y = 0$, $y(0) = 1$, $y'(1) = 0$	AP	4, 4
12	A) Show that the function $f(x) = \frac{1}{4}x^3 + 1$ satisfies the hypotheses of the Mean-Value Theorem over the interval $[0, 2]$, and find all values of c in the interval $(0, 2)$ at which the tangent line to the graph of f is parallel to the secant line joining the points $(0, f(0))$ and $(2, f(2))$. OR B) An open box is to be made from a 16 inch by 30 inch piece of cardboard 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?	AN	2, 2

Qn No.	Question	CL	CO
13	A) Solve $xydx + (2x^2 + 3y^2 - 20)dy = 0$ by checking exact, if not use an integrating factor OR B) (a) Check the exactness and solve the differential equation $2xydx + (x^2 - 1)dy = 0$ (b) Solve $\frac{dy}{dx} + y = f(x)$, where $f(x) = \begin{cases} 1 & \text{if } 0 \leq x \leq 1 \\ 0 & \text{if } x > 1 \end{cases}$	EV	3, 3
14	A) A rocket is rising vertically, tracked by a radar station that is on the ground 5 miles from the launchpad. How fast is the rocket rising when it is 4 miles high and its distance from the radar station is increasing at a rate of 2000 miles/hour ? OR B) Sand pouring from a chute at the rate of $8 \text{ ft}^3/\text{min}$ forms a conical pile whose height is always twice its radius. How fast is the height of the pile increasing at the instant when the pile is 6 ft high?	CR	3, 3