

Reg. No.: .....



Name: .....

University of Kerala

U8947

Second Semester FYUGP Degree Examination, April 2025

Discipline Specific Core Course

MATHEMATICS

UK2DSCMAT104 - Integral Calculus 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      | Write the value of $\int_1^4 x^2 dx$                                                 | RE | 2  |
| 2      | Write the standard form of a first order linear differential equation.               | RE | 3  |
| 3      | Determine $\int_0^{100} 2 dx$ .                                                      | UN | 1  |
| 4      | Write an example of a first order linear homogeneous ordinary differential equation. | UN | 4  |
| 5      | Write the integrating Factor of the linear equation $\frac{dy}{dx} - 3y = 6$ .       | UN | 4  |
| 6      | Give an example of a Boundary-Value Problem.                                         | 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      | Evaluate $\int_0^{\frac{\pi}{8}} \sin^5 2x \cos 2x dx$ .                                                                                                                    | UN | 1  |
| 8      | Determine whether the functions $f_1(x) = x$ , $f_2(x) = x^2$ and $f_3(x) = 4x - 3x^2$ are linearly dependent or linearly independent on the interval $(-\infty, \infty)$ . | UN | 3  |

| Qn No. | Question                                                                                                                              | CL | CO |
|--------|---------------------------------------------------------------------------------------------------------------------------------------|----|----|
| 9      | Verify the functions $y_1 = e^{3x}$ , $y_2 = e^{-3x}$ are solutions of the homogeneous linear equation $\frac{d^2y}{dx^2} - 9y = 0$ . | AP | 4  |
| 10     | Evaluate $\int_0^1 \tan^{-1} x dx$                                                                                                    | AP | 2  |

**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     | <p>A)</p> <p>Evaluate <math>\int_0^4 3x\sqrt{(25-x^2)} dx</math>.</p> <p>OR</p> <p>B)</p> <ol style="list-style-type: none"> <li>1. Solve <math>\frac{dy}{dx} = y^2 - 4</math>.</li> <li>2. Solve <math>\frac{dy}{dx} - 3y = 6</math>.</li> <li>3. Solve <math>x \frac{dy}{dx} - 4y = x^6 e^x</math>.</li> </ol>                                                                                                                                                                                                   | AP | 1, 3 |
| 12     | <p>A)</p> <ol style="list-style-type: none"> <li>1. Solve the initial-value problem <math>\frac{dy}{dx} = \frac{xy^2 - \cos x \sin x}{y(1-x^2)}</math>, <math>y(0) = 2</math>.</li> <li>2. Solve <math>x \frac{dy}{dx} + y = x^2 y^2</math>.</li> </ol> <p>OR</p> <p>B)</p> <p>Find a function <math>f</math> such that the slope of the tangent line at a point <math>(x, y)</math> on the curve <math>y = f(x)</math> is <math>\sqrt{3x+1}</math> and the curve passes through the point <math>(0, 1)</math></p> | AN | 4, 2 |
| 13     | <p>A)</p> <ol style="list-style-type: none"> <li>1. Solve the BVP: <math>y'' + y = 0</math>, <math>y'(0) = 0</math>, <math>y'(\pi/2) = 0</math>.</li> <li>2. Solve the Initial-Value Problem <math>4y'' - 4y' - 3y = 0</math>, <math>y(0) = 1</math>, <math>y'(0) = 5</math>.</li> </ol> <p>OR</p> <p>B)</p>                                                                                                                                                                                                       | EV | 4, 1 |

| Qn No. | Question                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | CL | CO   |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|------|
|        | <p>(a) Evaluate the integral <math>\int_1^5 \frac{dx}{\sqrt{2x-1}}</math>.</p> <p>(b) Evaluate the integral by substitution method: <math>\int \frac{\sin(1/x)}{3x^2} dx</math>.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |      |
| 14     | <p>A)</p> <ol style="list-style-type: none"> <li>Solve the Differential Equation <math>y'' - 10y' + 25y = 0</math>.</li> <li>Solve the <math>4x^2 \frac{d^2y}{dx^2} + 8x \frac{dy}{dx} + y = 0</math>.</li> </ol> <p>OR</p> <p>B)</p> <ol style="list-style-type: none"> <li>Show that the solutions <math>y = e^x, y = e^2x, y = e^3x</math> satisfy the differential equation <math>\frac{d^3y}{dx^3} - 6 \frac{d^2y}{dx^2} + 11 \frac{dy}{dx} - 6y = 0</math>.</li> <li>Solve the Differential Equation <math>\frac{d^2y}{dx^2} - 3 \frac{dy}{dx} - 28y = 0</math>.</li> <li>Find the General Solution of <math>\frac{d^3y}{dx^3} - 3 \frac{d^2y}{dx^2} - 4y = 0</math>.</li> </ol> | CR | 4, 4 |