

Course Title: Ordinary Differential Equations

Course Code: MATH-202

Course Type: Major Math

Prerequisites: Single Variable Calculus

Credit Hours: 3 (3 + 0)

Course Objectives: After the completion of the course, students will be able to:

- Understand formulation, classification of differential equations, existence and uniqueness of solutions.
- Provide skill in solving initial value and boundary value problems.
- Analyze mathematical models using linear differential equations to solve application problems.

Course Contents:

Preliminaries: Historical background and motivation, Basic mathematical models, Directional fields, Classification of differential equations, Existence and uniqueness of solutions, Introduction of initial value and boundary value problems.

First Order Ordinary Differential Equations: Basic concepts, Formation and solution of differential equations, Separable variables, Exact equations, Homogeneous equations, Linear equations, Integrating factors, Modeling with first-order ODEs, Differences between linear and nonlinear equations.

Second Order Linear Differential Equations: Initial value and boundary value problems, Homogeneous and non-homogeneous equations, Homogeneous equations with constant coefficients, Fundamental solutions of linear homogeneous equations, Linear independence and the Wronskian, Method of undetermined coefficients, Variation of parameters, Cauchy-Euler equation.

Higher- Order Linear Differential Equations: General theory of n th order linear equations, Homogeneous equations with constant coefficients, The methods of undetermined coefficients, Method of variation of parameters.

Series Solutions: Power series, Ordinary and singular points, Existence of power series solutions, Power series solutions, Types of singular points, Legendre equation, Bessel equation.

Recommended Books:

1. Boyce, W.E., *Elementary Differential Equations*, John Wiley & Sons Inc., 9th edition, 2008.
2. Bronson, R., *Schaum's Outline of Differential Equations*, McGraw Hill, 4th edition, 2014.
3. Ross, S. L., *Differential Equations*, John Wiley & Sons, 3rd edition, 1984.
4. Victor, H., Belozeroва, T. and Khennner, M., *Ordinary and Partial Differential Equations*, A K Peters/CRC Press, 1st edition, 2013.

5. Zill, D. G., *Differential Equation with Boundary Value Problems*, Cengage Learning, 9th edition, 2017.
