

Mathematics 3335 -- Differential Equations

Student Learning Outcomes

1. **Students will demonstrate factual knowledge of mathematical notation and terminology used in this course.** Students will demonstrate the ability to read, interpret, and use the vocabulary, symbolism, and basic definitions that arise in the study of ordinary differential equations.
2. **Students will be able to describe the fundamental principles involved in the study of differential equations.** Students will demonstrate familiarity with the theorems about and the characteristics of various types of differential equations. For example, students will understand the concepts of existence and uniqueness of solutions, classifications of differential equations, and a variety of related solution methods.
3. **Students will develop specific skills, competencies, and thought processes sufficient to support further work in this or related fields.** Students will acquire a level of proficiency in the concepts and applications necessary for work in occupational fields requiring a background in Differential Equations. These fields might include computer science, engineering, the physical and natural sciences as well as mathematics.
4. **Students will be able to apply techniques and procedures covered in this course to solve problems.** Students will be able to analyze differential equation models in fields such as physics, biology, and engineering, and will be able to apply analytical techniques to solve 1st and 2nd order differential equations or obtain solutions using computer software or approximation techniques.

Course Content

Textbook: *Elementary Differential Equations* (8th ed.) by William E. Boyce and Richard C. DiPrima

1. **Preliminaries:** Direction fields and solutions to differential equations, classification of differential equations.
2. **First Order Differential Equations:** Linear equations, integrating factors, separable equations, differences between linear and nonlinear equations, autonomous equations and population dynamics, exact equations and integrating factors, Euler's method, the existence and uniqueness theorem.
3. **Linear Second Order Differential Equations:** Homogeneous equations with constant coefficients, fundamental solutions, linear independence and the Wronskian, complex roots of the characteristic equation, repeated roots, reduction of order, nonhomogeneous equations and undetermined coefficients, variation of parameters, applications.
4. **Higher Order Differential Equations:** General n th order linear equations, homogeneous equations with constant coefficients, undetermined coefficients, and variation of parameters.
5. **Series Solutions of Second Order Linear Equations:** Review of power series, Series solutions near an ordinary point, regular singular points, Euler equations, special functions.
6. **The Laplace Transform:** Definition and properties, solution of initial value problems, step functions, discontinuous forcing functions, impulse functions.
7. **Additional topics (as time allows):** systems of differential equations, nonlinear equations.