

Computational and Applied 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* (6th ed.) by C. Henry Edwards and David E. Penney.

1. **First Order Differential Equations:** Elementary models, slope fields and solution curves, separable equations, linear equations, substitution methods and exact equations, applications.
2. **Linear Equations of Higher Order:** Second order linear equations, general solution of linear equations, homogeneous equations with constant coefficients, nonhomogeneous equations, the method of undetermined coefficients, variation of parameters, applications.
3. **Power Series Methods:** Review of power series, Series solutions near ordinary points, regular singular points, the method of Frobenius.
4. **Laplace Transform Methods:** Laplace transforms and inverse transforms, initial value problems, translations and partial fractions, miscellaneous topics.
5. **Additional topics (as time allows):** Bessel's equation, Euler's method, the Runge-Kutta method, systems of differential equations.