

MATH 365 – ORDINARY DIFFERENTIAL EQUATIONS – SYLLABUS

Department of Mathematics
Millersville University

Description

First-order differential equations; linear first- and second-order initial-value problems; power series solutions; applications. Also includes at least one of the following topics: special functions of mathematical physics, Laplace transforms, systems of first-order equations. (3 credits)

Prerequisites

C- or higher in MATH 311.

Course Objectives

Students will learn theory and techniques of ordinary differential equations of first and second order and applications. By the conclusion of this course the successful student will be able to:

- Solve first order differential equations using the techniques of separation of variables and integrating factors
- Analyze autonomous equations as applied to population dynamics applications
- Solve exact equations
- Understand and apply existence and uniqueness theory to differential equations
- Solve homogeneous second order differential equations with constant coefficients
- Apply the techniques of method of undetermined coefficients and variation of parameters to solve nonhomogeneous second order differential equations
- Use the techniques for solving second order differential equations to solve application problems
- Solve second order differential equations using series solutions

Assessment

Assessment of student achievement of the course objectives may vary from one instructor to another. Typical assessment will be made through work in class, homework, and examinations. Additional assessment may be made through the completion of projects and/or presentations.

Use of Technology

The use of technology will vary from one instructor to another. Students are required to have access to a graphing calculator or software for this course. The department currently supports the TI 83, 84, and 86. Additionally, Millersville University students have access to the mathematical software, *Mathematica*, which may be used at the instructor's discretion.

Calculators, and technology in general, should enhance learning, and students should learn to use them appropriately. Instructors may, at times, prohibit the use of calculators with symbolic math capabilities, such as the TI-89 or TI-92. Instructors may prohibit the use of calculators on exams, as they deem appropriate.

Topics – May include the following

1. First order differential equations
 - a. Linear equations with variable coefficients
 - b. Separable equations
 - c. Modeling with first order equations
 - d. Autonomous equations and population dynamics
 - e. Exact equations and integrating factors
 - f. Existence and uniqueness theory
2. Linear differential equations of second order
 - a. Homogeneous equations with constant coefficients
 - b. Fundamental solutions of linear homogeneous equations
 - c. Linear independence and the Wronskian
 - d. Complex roots of the characteristic equation
 - e. Repeated roots; reduction of order
 - f. Nonhomogeneous equations; method of undetermined coefficients
 - g. Variation of parameters
 - h. Mechanical and electrical vibrations
 - i. Forced vibrations
3. Series solutions of second order linear equations
 - a. Series solutions near an ordinary point
 - b. Regular singular points
 - c. Euler equations
 - d. Series solutions near a regular singular point
 - e. Bessel's equation
4. The Laplace transform
 - a. Definition of the Laplace transform
 - b. Solution of initial value problems
 - c. Step functions

- d. Differential equations with discontinuous forcing
 - e. Impulse functions
 - f. The convolution integral
5. Systems of first order linear equations
- a. Review of matrices
 - b. Systems of linear algebraic equation; linear independence, eigenvalues, eigenvectors
 - c. Basic theory of systems of first order linear equations
 - d. Homogeneous linear systems with constant coefficients
 - e. Complex eigenvalues
 - f. Fundamental matrices
 - g. Repeated eigenvalues