# Math 212 Differential Equations Fall 2004

**Instructor:** Linda Smolka
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**Office:** 369 Olin **Phone:** 577-3563
**Office Hours:** M 3 - 5 p.m., F 11:00 a.m. - noon, and by appointment
**Class Meeting:** 102 Rooke Chemistry
**Class Times:** Section 1: MWF 9:00 - 9:52 a.m., T 8:00-9:22 a.m.
Section 2: MWF 10:00 - 10:52 a.m., T 8:00-9:22 a.m.
**Course Webpage:** www.unix.bucknell.edu/∼lsmolka/Math212
**Text:** Elementary Differential Equations with Boundary Value Problems by Edwards & Penney, 5 edition, ISBN: 0-13-145774-8

**Course Description:** Basic methods of solving ordinary differential equations, systems of linear differential equations, Laplace transforms, numerical methods, nonlinear systems and Fourier series.

**Tests:** There will be three midterm exams (on 9/21, 10/19 and 11/16) and a cumulative final exam (scheduled between 12/9 and 12/16, make your travel plans accordingly). You must secure my approval to postpone an exam ahead of time. Make-up exams are given with no penalty if you have a valid excuse, otherwise seven points will be deducted from your exam grade.

**Quizzes:** Given each Tuesday except for exam dates. Your lowest quiz grade will be dropped. There are no make-ups, unless you miss class due to participation in a University sanctioned event.

**Homework:** Assignments will be posted on the course webpage and are due on Tuesdays; they can be turned in at class or in my mailbox at 380 Olin by **5 p.m.**. Late homework will be accepted with penalty (minus three pts.); no homework grades will be dropped. The assignments will be graded according to completeness, correctness and clarity. Though only a selected portion of the problems will be graded, you are responsible for all assigned problems. *Assignments should be stapled and written in pencil.*

**Grading Policy:**
45% Three Midterm Exams (15%/exam)
30% Final Exam
15% Quizzes
10% Homework

**Academic Honesty:**
From the Bucknell catalog, "Bucknell students are responsible to the academic community for the preparation and presentation of work representing their own individual efforts. Acceptance of this responsibility is essential to the educational process and must be considered as an expression of mutual trust, the foundation upon which creative scholarship rests. Students are directed to use great care when preparing all written work and to acknowledge fully the source of all ideas and language other than their own." If you have questions about this, ask first.

**Advice and Comments:**
1. Engage yourself in the lectures and ask questions. The more you understand in class, the less backtracking you'll need to do outside of class.
2. Attendance is expected and will be used to determine final grades.
3. You are responsible for reading the material in the text not covered in class unless otherwise specified.
4. I will ask questions to get you to think so be ready.
5. Start the assignments early. You'll find the problems take some time to solve.
6. Calculators (graphing or scientific) may not be used on exams or quizzes.
7. You will be evaluated on the supporting work you provide to a problem. Answer only → no credit.
7. Please be on time to class.

# Syllabus

**Chapter 1: First-Order Differential Equations**

1.1 Differential Equations and Mathematical Models
1.2 Integrals as General and Particular Solutions
1.3 Slope Fields and Solution Curves
1.4 Separable Equations and Applications
1.5 Linear First-Order Equations
1.6 Substitution Methods and Exact Equations
1.7 Population Models
1.8 Acceleration-Velocity Models

**Chapter 2: Linear Equations of Higher Order**

2.1 Introduction: Second-Order Linear Equations
2.2 General Solutions of Linear Equations
2.3 Homogeneous Equations with Constant Coefficients
2.4 Mechanical Vibrations
2.5 Nonhomogeneous Equations and Undetermined Coefficients
2.6 Forced Oscillations and Resonance
2.7 Electrical Circuits
2.8 Endpoint Problems and Eigenvalues

**Chapter 4: Laplace Transform Methods**

4.1 Laplace Transforms and Inverse Transforms
4.2 Transformation of Initial Value Problems
4.3 Translation and Partial Fractions
4.4 Derivatives, Integrals and Products of Transforms
4.5 Periodic and Piecewise Continuous Input Functions
4.6 Impulses and Delta Functions

**Chapter 5: Linear Systems of Differential Equations**

5.1 First-Order Systems and Applications
5.2 The Method of Elimination
5.3 Matrices and Linear Systems
5.4 The Eigenvalue Method for Homogeneous Systems
5.5 Second-Order Systems and Mechanical Applications

**Chapter 6: Numerical Methods**

6.1 Numerical Approximation: Euler's Method
6.2 A Closer Look at the Euler Method
6.3 The Runge-Kutta Method

**Chapter 7: Nonlinear Systems and Phenomena**

7.1 Equilibrium Solutions and Stability
7.2 Stability and the Phase Plane
7.3 Linear and Almost Linear Systems
7.4 Ecological Models: Predators and Competitors
7.5 Nonlinear Mechanical Systems

**Chapter 8: Fourier Series Methods**

8.1 Periodic Functions and Trigonometric Series
8.2 General Fourier Series and Convergence
8.3 Fourier Sine and Cosine Series
8.5 Heat Conduction and Separation of Variables

(These topics may be subject to change.)