
AMATH 351 (SLN: 1055, 3 Credits)

INTRODUCTION TO DIFFERENTIAL EQUATIONS AND APPLICATIONS

Time	M W F 1:10 - 2:10 pm
Location	EE1 031
Website	http://www.amath.washington.edu/courses/351-summer-2006/
	USERNAME : amath351 PASSWORD : _____
Instructor	Justine Gunog Seo
Office	Condon 810 D
Email	justine@amath.washington.edu
Office Hours	Wed : 2:30 - 3:30 (MSCC) Thur : 12 - 2 (OFFICE)

Course Description

Introductory survey of ordinary differential equations. Linear and nonlinear equations. Laplace transforms. Emphasis on formulation, solution, and interpretation of results. Examples from physical and biological sciences and engineering.

Textbook

W. E. Boyce & R. C. DiPrima, *ELEMENTARY DIFFERENTIAL EQUATIONS AND BOUNDARY VALUE PROBLEMS* (8th Edition), John Wiley & Sons, 2004.
(Available at the University Bookstore)

Learning Objectives and Instructor Expectations

By the end of the class you will be able to:

- (1) Identify the class of ODEs you have to solve
- (2) Identify the solution strategy; Find a suitable reference
- (3) Interpret the results and compare with physical intuition

The contents of the course are themselves demanding, this means you will have to invest a significant amount of time in this course. Thus, class participation, independent reading from the textbook and working out homework problems is essential.

Outline

1. **First Order Differential Equations.** Solution techniques for linear, separable equations and exact equations. Modeling of problems in mechanics. Remarks on existence and uniqueness of solutions.
2. **Second Order Differential Equations.** Analytic techniques for homogeneous equations with constant coefficients. Linear independence and characteristic equation. Nonhomogeneous equations and variation of parameters. Euler equations. Problems in mechanical vibrations and electric circuits.
3. **The Laplace Transform.** Definition of Laplace transform and application to initial value problem. Step functions, discontinuities, and impulse functions.
4. **Systems of First Order Linear Equations.** Brief review of matrices and system formulation. Eigenvalues and linear dependence. Interpretation of eigenvalues in physical systems.
5. **Series Solutions of Second Order Linear Equations.** Series solutions near ordinary and singular points. Euler equations. Bessel's equation.
6. **Nonlinear Differential Equations and Stability.** Introduction to phase-plane analysis techniques and critical points. Applications to nonlinear systems such as the predator-prey model. Periodic solutions, limit cycles. Solution of 2×2 systems by the exponential matrix; Lyapunov Stability.

Grading

Your course grade will be calculated by weighing your HOMEWORK, MIDTERM, and FINAL grades in the proportions 40%, 20%, and 40%, respectively.

EXAMS

These exams will test your basic understanding of the material covered in class, as well as your ability to use it for solving problems, like those you have done for the homework.

BEFORE EXAM.

Some practice problems will be provided with solutions.

DURING EXAM.

- No calculators will be allowed on exams.
- You will be allowed one 8.5×11 (letter-size, two-sided) hand-written note sheet and you will have to turn in your note sheet with your exam.

MIDTERM (20%) : Wednesday, July 19, 2006

There will be one fifty-minute-long exam, constituting 20% of your grade.

FINAL (40%) : Friday, August 18, 2006

The final exam will last 110-minutes. It will be a comprehensive exam, but it will mainly test the material we covered in sections after the midterm.

HOMEWORK (40%)

- Homework problem sets will be assigned weekly.
- Homework due date: Friday in class.
- Late homework will not be accepted.
- Homework should be presented in a clear, professional, and precise manner.

Here is a sample of Homework:

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AMATH 351
HOMEWORK #1
YOUR NAME
STUDENT NUMBER
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1. Short Descriptions of the problem

(soln)

- Solve the problem in a clear, professional, and precise manner.
- Box your final answer.
- Mark the end of your solution with ■.

2.

- *Plots.* If problems ask you to plot solution curves or something else, you can use your graphic calculator, MATLAB, Maple, Mathematica, and so on. Some Math softwares are installed on the PC's in the MSCC. Also, I put some websites having graphing tools in class web-page.