

MAT 361 Differential Equations

Course Guide

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Instructor

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Course Description

Theory, methods of solution, and applications of ordinary differential equations with emphasis on first and second order (linear and nonlinear) equations, and systems of first order equations. Methods used include Laplace transforms, matrices, eigenvalues and eigenvectors. Additional topics from power series solutions and numerical methods.

Course Content

Required Texts: *A First Course in Differential Equations for Scientists and Engineers*, R. Herman, 2018.

Goals

In this course we will investigate analytical, graphical, and approximate solutions of differential equations. We will study the theory, methods of solution and applications of ordinary differential equations. This will include common methods of finding solutions, such as using Laplace transform and power series methods.

You should also be prepared to review your calculus, especially if you have been away from it for a while. In particular, you should know how to differentiate and integrate all elementary functions, including hyperbolic functions. You should review your methods of integration as the need arises, including methods of substitution and integration by parts. For the most part, you will just need material from Calculus I and II. See the appendix of the text.

Student Learning Outcomes

Upon successful completion of this course, students will be able to:

- Solve simple first order Ordinary Differential Equations (ODEs);
- Use a variety of techniques to solve homogeneous and nonhomogeneous second order linear ODEs;
- Use power series to find approximate solutions of variable coefficient ODEs;
- Use Laplace transform techniques to solve ODEs;
- Use linear algebra techniques to solve systems of linear ODEs;
- Use numerical methods to find approximate solutions to ODEs;
- Use computer applications to solve ODEs;
- Identify, analyze, and solve real world problem whose behavior can be described by ordinary differential equations.

Course Philosophy

You have just come out of calculus knowing about derivatives and integrals. Hopefully, you have even seen some applications of calculus in your study. You are now about to embark on what you may think is an entirely different subject - differential equations - however, it is not different. In some cases, this is why calculus was developed. This might be why your department requires you to take so much mathematics. In fact, you have already seen some of the basic methods of solutions of differential equations in your second course in calculus.

As you will observe from the web materials we will not just study formal solutions of differential equations. In this course we will also be interested in understanding the origins of the equations, their qualitative and quantitative solutions, and the interpretation of these solutions.

You will be guided through various analytical, graphical, numerical and descriptive methods of studying differential equations. We will see that differential equations are a natural tool for numerous investigations in science, mathematics and engineering. We will use technology to explore and visualize solutions behaviors and solution methods. In this way we hope that we can learn to think,

experiment and comprehend the role that this subject plays in your chosen majors. Further applications will be found on the course webpage.

Group Work

In this course you may be doing a group project. You will be working with other students to complete a task. For many of you group work will be a new experience. In order to make this experience both productive and enjoyable, we offer the following suggestions:

- Start the assignment as soon as it is assigned. Do not put it off until the last minute. Some of the assignments will take time and working in a group may require more time due to scheduling difficulties.
- Read over the entire lab, or homework assignment, carefully before discussing or completing any part of it.
- Initially, you may have no idea as to how to get started. Don't panic! Discuss the lab with the group and generate some ideas.
- Lab work is not always as straightforward as standard homework assignments. You may need to make some assumptions and later justify these assumptions, indicating how they affect your results.
- The final report should be thoughtful, well-written and neatly organized. It should summarize your approach to the problem, present your results and conclusions, and be furnished with full explanations.
- If you have investigated the lab work as far as possible and still have questions, or there is a need for clarification of some point, then discuss them with your instructor before writing the report.

Web Pages/Email

This syllabus as well as a variety of other relevant information for this class is posted on the internet. The website is located at

<http://people.uncw.edu/hermanr/mat361/>

You are encouraged to log onto this page often to check the homework assignments, read text material, listen to videos and read about related topics and further examples. You can email me for hints to homework questions, after working on them, or any other concerns with the topics we are covering.

You will need to continually watch for additions, changes, and announcements for the class. So, make it a daily habit to go to the web site and read something different.

Course Requirements

Homework: Homework assignments will be collected on a regular basis and you will be told when the work is due. There will be a penalty of 10% for each class that it is late. As doing homework is very important for learning the material in this course, it will count as 35% of your grade.

Labs/Projects: At times the computations can become tedious or may not be doable by hand. Therefore, we will sometimes use Maple or MATLAB to solve problems. You may also have the opportunity to carry out physical experiments highlighting some of the standard applications in the class.

You will be expected to carry out in depth group projects or be assigned group computer labs. Due to the nature of some problems and the applicability of this course to your major, you will work on a project, which will extend over several days of the course. These will count for 10% of your total grade.

Attendance: YOU ARE EXPECTED TO ATTEND ALL OF THE CLASSES! After two excused absences there will be a penalty of 2

Exams and Grades: There will be three one hour exams and a final for this course. These exams will cover the basic material from the lectures and homework. There will be no makeup exams without prior permission. The tentative dates of the exams covered are

Exams	Date
Exam I	Sep 18
Exam II	Oct 21
Exam III	Nov 20
Presentations	Dec 4, 11:30 AM

Your final grade will be based on the following distribution

Hour Exams	30%
Homework	35%
Labs/Projects	10%
Final	20%

and grade scale

90-100	A
80-89.5	B
70-79.5	C
60-69.5	D
0-59.5	F

Plus-minus grading may be used in special cases.

This syllabus is subject to change!

Advice for Success

In order to learn the material in this course and earn a good grade, you need to put in some effort. Do not put off assignments or reading. If you do not understand something, ask the instructor. Come to office hours, use email, ask knowledgeable students, or go to the library/internet and find supplementary material. The instructor can only cover the basics in class. You are not expected to know the material by only listening to the lectures. You need to work problems and think about what you are doing.

Artificial Intelligence Use Policy

Core Principles

Learning to use AI responsibly is an essential skill. You are encouraged to explore AI tools for brainstorming, idea generation, and research assistance while maintaining academic integrity and developing critical thinking skills.

Permitted Uses

- **Small assignments:** AI may be used for brainstorming, drafting, and iterative improvement
- **Research projects:** AI may assist with literature review, organizing ideas, and refining arguments.
- **All uses:** Must be properly disclosed and attributed.

Requirements and Responsibilities

Attribution: All AI use must be acknowledged at the end of your submission. Include:

- Which AI tool(s) you used and how key prompts generated useful content.
- A brief description of how AI-generated material was incorporated or modified.

Verification: You are responsible for fact-checking all AI outputs. AI systems frequently generate inaccurate information and fake citations. Cross-reference all claims with reliable sources.

Quality Control: Effective AI use requires skillful prompting and critical evaluation. Minimum-effort prompts produce low-quality results that may harm your work.

Prohibited Practices

- Submitting AI-generated work as your own without attribution.
- Using AI-generated citations without verification.
- Relying on AI for factual claims without independent confirmation.

Academic Integrity Failure to properly attribute AI use violates university honor code policies. While AI can enhance your work, it cannot replace your critical thinking, analysis, and original contribution to the assignment.

Academic Honor Code: All members of UNCW's community are expected to follow the academic Honor Code. Please read the UNCW Honor Code carefully (as covered in the UNCW Student Handbook). Academic dishonesty in any form will not be tolerated in this class. Please be especially familiar with UNC-W's position on plagiarism as outlined in the UNCW Student Handbook. Plagiarism is a form of academic dishonesty in which you take someone else's ideas and represent them as your own.

Student Disabilities: UNCW Disability Services supplies information about disability law, documentation procedures and accommodations that can be found at www.uncw.edu/disability. To obtain accommodations the student should first contact Disability Services and present their documentation to the coordinator for review and verification.

Campus Respect Compact. UNCW has recently instituted a Respect Compact to affirm our commitment to a civil community, characterized by mutual respect. That Compact will soon be affixed to the wall of each classroom and can be accessed at: <https://uncw.edu/about/know-us/respect-compact>.
