MAT 361 - Differential Equations

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Course Content:

**Required Text:** *A First Course in Differential Equations*, R. Herman, 2018.

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;

► Use a variety of techniques to solve homogeneous and non-homogeneous 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.
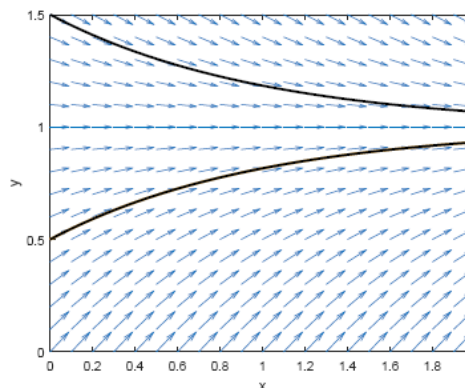
Course Philosophy

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 will be doing a computproject. 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
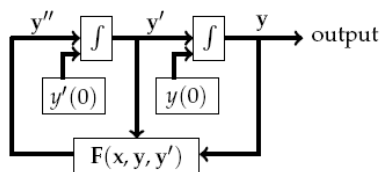
neatly organized. It should summarize your approach to the problem, present your results and conclusions, and be furnished with full explanations.

- ► 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 can will be posted on the internet. The website is located at

http://people.uncw.edu/hermanr/m361

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.

Due to Hurricane Florence, class times will be extended by five minutes and additional online resources will be provided to make up for lost class time. Homework assignments were adjusted, the scope of the last exam was changed, and select topics were removed from Chapters 4, 6 and 7, still meeting the course learning outcomes

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: 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 excercises 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% for each absence from your total grade.

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

Exam	New Coverage	Revised Dates
I	Chap 1-2	Oct 15
II	Chap 2-4	Nov 9
III	Chap 5	Nov 28
Final	Chap 1-6	Dec 11, 8:00 AM

Your final grade will be based on the following:

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

| 90-100	A
80-89.5	B
70-79.5	C
60-69.5	D

In some cases borderline grades may be modified by a plus, or a minus, if the instructor determines that such grades are earned.

Homework Assignments:

You are required to turn in all of the assigned problems for grading on the due date. All work is expected to be neat (in order, readable, no extraneous marks or scratch work), stapled, and with all work provided. [It helps to rewrite any scratch work in a neat and organized submission.]

Assignments are due by 5:00 PM of the due date, though homework due on exam days should be done before the exam. Late work will be graded, but there will be a late penalty. It is best to start problems as soon as possible. Sometimes, you may need to take time off from a problem to get a different focus on it. Of course, you can get hints from your instructor if you have spent 20 minutes on it and have not gotten anywhere. Do not spent more time than that without refocusing or getting help.

This syllabus is subject to change!

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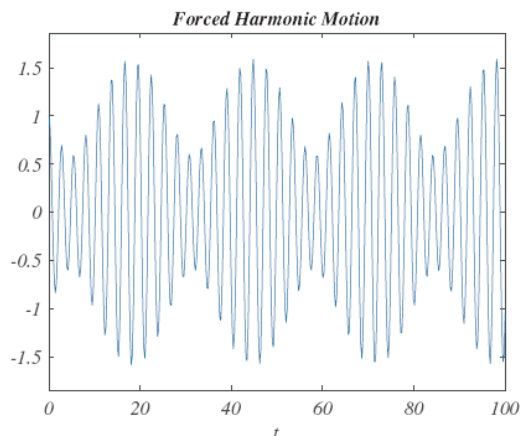
Advice for Success:

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.

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: http://uncw.edu/diversity/documents/ApprovedSeahawkRespect Compact8x10.08.09.pdf .