# MA 341 Applied Differential Equations I

**Lecture details**

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|---|---|
| Section 603 | Course lectures are available to watch at http://wolfware.ncsu.edu |
| Instructor: | Leslie Kurtz |
| Office: | SAS 3240 |
| Email: | lakurtz@ncsu.edu |
| Phone: | 919.513.2111 |
| Zoom Office Hours: | MWF 10:40am-11:40pm or by appointment |
| Moodle page: | https://wolfware.ncsu.edu |
| WeBWorK: | https://wolfware.ncsu.edu |

**Course text**

*Fundamentals of Differential Equations and Boundary Value Problems*, by Nagle, Saff, and Snider, 7th Edition, Addison-Wesley.

**Catalog Description**

Prerequisite: MA 242 or (MA 132 and MA 231)
Differential equations and systems of differential equations. Methods for solving ordinary differential equations including Laplace transforms, phase plane analysis, and numerical methods. Matrix techniques for systems of linear ordinary differential equations. Credit is not allowed for both MA 301 and MA 341.

**Learning Objectives**

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

- Determine if a given function is a solution to a particular differential equation; apply the theorems for existence and uniqueness of solutions to differential equations appropriately;
- Distinguish between
  (a) linear and non-linear differential equations;
  (b) ordinary and partial differential equations;
  (c) homogeneous and non-homogeneous differential equations;
- Solve ordinary differential equations and systems of differential equations using:
  (a) Direct integration
  (b) Separation of variables
  (c) Methods of undetermined coefficients and variation of parameters
  (d) Laplace transform methods
- Determine particular solutions to differential equations with given initial conditions.
- Analyze real-world problems such as motion of a falling body, compartmental analysis, free and forced vibrations, etc.; use analytic technique to develop a mathematical model, solve the mathematical model and interpret the mathematical results back into the context of the original problem.
- Apply matrix techniques to solve systems of linear ordinary differential equations with constant coefficients.
- Find the general solution for a first order, linear, constant coefficient, homogeneous system of differential equations; sketch and interpret phase plane diagrams for systems of differential equations.

**Grading Policy**

The grading will be assigned on a 10-point scale: **A: 90 − 100, B: 80 − 89, C: 70 − 79, D: 60 − 69, F:** $\leq 60$

The cutoffs for the +/- grades are determined at the end of the semester. Your final grade in this course will be determined by marks earned on the final exam, three term tests, online homework assignments, and in-class quizzes. The weighting of these components are as follows:

Homework = 15 %
Three term tests = 50 %
Final Exam = 35 %

**Term Tests** 50%

There will be three closed book, closed notes tests that are administered over Zoom. Calculators of any kind are not permitted on tests or on the final exam. You will be allowed a single (double-sided) piece of paper with formulas,

examples, etc. If you are ill on a test day, you will need to present a doctor's note to reschedule.

**Test 1:** February 19
**Test 2:** March 26
**Test 3:** April 19

Attendance will be measured by your successful completion of the lecture videos. You will need to watch them the week they are assigned. If you take all the tests and have missed no more than 3 videos, your lowest test grade will be replaced with your final exam grade assuming it is higher.

**Final Exam** 35%
The final exam is mandatory and cumulative. You can take it on Friday May 7 . The only way to take the final exam at another time is to request a change through the Department of Registration and Records, 1000 Harris Hall.

**Homework Assignments** will be completed on-line using an Internet-based homework service called WeBWorK. I will send out reminders when you have upcoming assignments.

**Corrections to the grading**
The responsibility for grading tests resides with the Teaching Assistant for this section. After the tests are returned, you have 3 days to look them over and compare them to the solutions online. If you believe an error has been made in grading on a test, you need to notify me within those 3 days. Grade changes will not occur outside of this timeframe. Do not alter the original work!

**Students with disabilities**
Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, students must register with Disability Services: https://dro.dasa.ncsu.edu Please let me know how I can better accommodate you.

**Academic Integrity Statement and Academic Dishonesty**
I assume that anything turned in with your name on it is your own work. Each time you submit a test, homework, quiz, or WebWork assignment, you affirm the honor pledge, "I have neither received unauthorized aid nor given aid on this assignment." The minimum penalty for cheating is a grade of zero on the assignment; violators will be reported to the Academic Integrity Board, which can impose additional sanctions. The code of student conduct can be found at: https://policies.ncsu.edu/policy/pol-11-35-01

**Non-Discrimination Policy**
NC State prohibits discrimination, harassment, and retaliation that are based upon a person's race, color, religion, sex, national origin, age, disability, gender identity, sexual orientation, or veteran status. If you feel that you have been the subject of prohibited discrimination, harassment, or retaliation, you should contact the Office for Institutional Equity and Diversity (OIED) at 919-515-3148.

NC State's policies and regulations covering discrimination, harassment, and retaliation may be accessed at http://policies.ncsu.edu/policy/pol-04-25-05 or http://oied.ncsu.edu/divweb.

**COVID ADDENDUM:**

Due to the Coronavirus pandemic, public health measures have been implemented across campus. Students should stay current with these practices and expectations through the Protect the Pack website (https://www.ncsu.edu/coronavirus/). The sections below provide expectations and conduct related to COVID-19 issues.

**Health and Participation in Class:**
We are most concerned about your health and the health of your classmates and instructors. If you test positive for COVID-19, or are told by a healthcare provider that you are presumed positive for the virus, please work with your instructor on health accommodations and follow other university guidelines, including self-reporting (Coronavirus Self Reporting): Self-reporting is not only to help provide support to you, but also to assist in contact tracing for containing the spread of the virus.

**MA341 Pacing Guide**

| Week | Sections | Topics |
|---|---|---|
| Jan. 19–22 | 1.1–1.2 | Solutions & Initial Value Problems (Video 1) |
| Jan. 25–29 | 1.3<br>2.2<br>2.3 | Direction Fields and Phase Line Supplement (Video 2)<br>Separable Equations (Video 2)<br>Linear First Order Equations (Video 3) |
| Feb. 1–5 | 3.2,3.3<br>2.4<br>4.1–4.2 | Applications (Video 4)<br>Exact Equations (Video 5)<br>Introduction, Second Order Linear Equations (Video 5) |
| Feb. 8–12 | 4.2<br>4.3<br>4.4 | Homogeneous Linear Eqs. Constant Coefficients: Real Roots (Video 6)<br>Homogeneous Linear Eqs. Constant Coefficients: Complex Roots (Video 6)<br>Undetermined Coefficients (Video 7) |
| Feb. 15–19 | 4.5<br>4.6 | Superposition Principle (Video 8)<br>Variation of Parameters (Video 9)<br>**Friday February 19: Test 1 over Zoom** |
| Feb. 22–26 | 4.9<br>4.10<br>7.2-7.3 | Free Mechanical Vibrations (Video 10)<br>Forced Mechanical Vibrations (Video 10)<br>Laplace transform: definition and properties (Videos 10 and 11) |
| Mar. 1–5 | 7.4 | Inverse Laplace Transform (Video 12)<br>**Friday March 5: Wellness Day (no class)** |
| Mar. 8–12 | 7.5<br>7.6 | Solving IVPs with Laplace transforms (Video 13)<br>Transforms of Discontinuous Functions (Video 14) |
| Mar. 15–19 | 9.1-9.3 | Systems of Differential Equations and Linear Algebra (Video 15) |
| Mar. 22–26 | 9.4 | Linear Systems in Normal Form (Video 16)<br>**Wednesday March 24: Wellness Day (no class)**<br>**Friday March 26: Test 2 over Zoom** |
| Mar. 29–Apr. 2 | 9.5<br>9.6 | Linear Systems with Constant Coefficients: Real Eigenvalues (Video 17)<br>Linear Systems of Diff. Eq. with Constant Coefficients: Complex Eigenvalues (Video 18) |
| Apr. 5–9 | 9.7<br>9.7 | Nonhomogeneous Linear Systems (Video 19)<br>Applications: Interconnected Tanks (Video 19) |
| Apr. 12–16 | 5.6 | Coupled Mass-Spring Systems (Video 20)<br>Phase Plane (Video 21) |
| Apr. 19–23 | 5.4<br>12.2 | **Monday April 19: Test 3 over Zoom**<br>Linear Systems in the plane (Video 21) |
| Apr. 26–30 | 12.3 | Almost Linear Systems (Video 22)<br>Review (Video 23) |
| Friday May 7 | | **Final Exam 12-2:30pm over Zoom** |

## Good Luck!