

## MA 341 Applied Differential Equations I

### Lecture details

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Office Hours:	MWF 10:35 am-11:30 am	Office Hours:
	or by appointment	
Moodle page:	<a href="http://wolfware.ncsu.edu/">http://wolfware.ncsu.edu/</a>	
Class Webpage:	<a href="http://www4.ncsu.edu/~lakurtz/">http://www4.ncsu.edu/~lakurtz/</a>	

### 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 in-class term tests. Students are required to turn in 4 blue examination

booklets by February 1 (This does not apply to students who take their tests with DRO). Those who fail to do so will lose 5 points on Test 1. After Test 1, students who haven't brought blue books will continue to lose 5 points on each test/exam until blue books are brought in. Blue books can be purchased in the bookstore. Do not write anything on them.

### **Final Exam 35%**

The final exam is mandatory, cumulative and will be held in the usual classroom. Check the Final Exam Calendar on <http://registrar.ncsu.edu/calendars/academic/> for the exact date/time of the final exam. 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. The link to the login page is:

<http://webwork.math.ncsu.edu/webwork2/>

also found on the Moodle page. For your username enter the NCSU unity id and your NCSU email password. If you are unable to get into WeBWorK for any reason, email me. You can find more information about submitting your assignments in WeBWorK on the course webpage.

### **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!

### **Test Make-Up Policy**

All *anticipated absences* must be excused in advance of the test date. These include university duties or trips (certified by an appropriate faculty or staff member), required court attendance (certified by the Clerk of Court), or religious observances (certified by the Department of Parent and Family Services 515-2441). *Emergency absences* must be reported as soon as possible once returning to class and must be appropriately documented (illness by an attending physician or family emergencies by Parent and Family Services). If you are sick on a test day and decide not to come to class, go to the health center or other medical facility. Students who miss a test and have a university-approved excuse must submit appropriate documentation. No other make-ups will be given.

**Attendance** will be recorded daily. You are expected to arrive on time to class. Any student who is not an active class participant the full class period (e.g., doing other work in class, socializing, texting, coming late, leaving early). will be recorded as absent. If you miss no more than 3 days AND attend every test, your lowest test grade will be replaced with your final exam grade (assuming it is higher). Please note: If you get a zero on a test because of cheating, your test will NOT be replaced. If you miss class or are late, you are still responsible for all material covered and assignments due.

**The Math Multimedia Center** is a tutorial center for undergraduate students that need help in their mathematics courses (100- through 300-level), and is staffed by math graduate students familiar with the material taught in these courses.

Location: SAS Hall 2103/2105

Hours: Monday - Friday 8:00 am - 5:00 pm

You can also get help with your courses (not only math) at the NCSU Undergraduate Tutorial Center.

### **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>

**MA341 Course Content and Tentative Week-by-Week Schedule**

Week	Sections	Topics
Jan 7–11	1.1–1.2 1.3	Solutions & Initial Value Problems Direction Fields & Phase Line Supplement
Jan 14–18	2.2 2.3 3.2	Separable Equations Linear First Order Equations Mixing Problems
Jan 21 Jan 22–25	3.2 3.3 2.4	<b>Martin Luther King Day</b> - no class Mixing Problems cont. Newton's Law of Heating, More Separable Applications Exact Equations (time permitting)
Jan 28–Feb.1	4.2 4.3 4.5	Homogeneous Linear Eqs. Constant Coefficients: Real Roots (review MA241) Homogeneous Linear Eqs. Constant Coefficients: Complex Roots (review MA241) Undetermined Coefficients
Feb 4–7 Feb 8	4.5 4.6	Undetermined Coefficients and Superposition Variation of Parameters, Review <b>Test 1</b>
Feb 11–15	4.9 4.10 7.2	Free Mechanical Vibrations Forced Mechanical Vibrations Definition of Laplace Transform
Feb 18–22	7.2-7.3 7.4	Laplace transform: definition and properties. Inverse Laplace Transform
Feb 25–Mar 1	7.4 7.5 7.6	Inverse Laplace continued Solving IVPs with Laplace transforms Transforms of Discontinuous Functions
Mar 4–7 Mar 8	7.6 9.1-9.3	Extra day with Laplace transforms if necessary Systems of Differential Equations and Linear Algebra, Review <b>Test 2</b>
Mar 11–15		<b>Spring Break</b> - no class
Mar 18–Mar 22	9.1-9.3 9.4 9.5	Cont. Linear Systems in Normal Form Linear Systems of Diff. Eq. with Constant Coefficients: Real Eigenvalues
Mar 25–29	9.5 9.6	Cont. Linear Systems of Diff. Eq. with Constant Coefficients: Complex Eigenvalues
Apr 1–5	9.7 9.7 9.5-9.7	Nonhomogeneous Linear Systems: Undetermined Coefficients Nonhomogeneous Linear Systems: Variation of Parameters Applications: Interconnected Tanks
Apr 8–11 Apr 12	5.6	Coupled Mass-Spring Systems (time permitting). Review <b>Test 3</b>
Apr 16–18 Apr 19	5.4	Phase Plane <b>Spring Holiday</b> - no class
Apr 22 –26	12.2 12.3	Linear Systems in the plane Almost Linear Systems (time permitting) Review
Apr 29–May 7		Final Exams

**Good Luck!**