MATH 331

The University of Massachusetts at Amherst
Department of Mathematics & Statistics
SPRING, 2023

Instructor:	<PROF_FULL_NAME>	**Course Chair:**	<PROF_FULL_NAME>
Email:	<PROF_EMAIL>	**TAs:**	Available
Class Day/Time:	MoWeFr 9:05AM - 9:55AM (Sect 06)	**Class Room:**	Room 51
Class Day/Time:	MoWeFr 10:10AM - 11:00AM (Sect 01)	**Class Room:**	Room 51
Class Day/Time:	MoWeFr 1:25PM - 2:15PM (Sect 08)	**Class Room:**	Room 151
Term:	2023 Spring	**Class Location:**	Goessmann Lab. Addition
Office Hours:	MoWeFr 12:00PM - 1:00PM & By appointment	**Office Location:**	LGRT 1030

COURSE DESCRIPTION

Introduction to ordinary differential equations and their applications to the natural and engineering sciences. Specific topics include first order differential equations, linear differential equations with constant coefficients, Laplace transforms, and systems of linear equations.

PREREQUISITE(S)

MATH 132

LEARNING OUTCOMES

- identify an ordinary differential equation and classify it by order and linearity.
- determine whether or not a unique solution to a first-order initial-value problem exists.
- recognize and solve linear, separable and exact first-order differential equations.
- recognize and solve autonomous first-order differential equations, analyze trajectories, and determine the stability of critical points.
- use the Euler method to approximate solutions to first-order differential equations.
- model and solve application problems using linear and non-linear first-order differential equations, including topics such as: growth and decay, series circuits, Newton's law of cooling, mixtures, logistic growth, chemical reactions, particle dynamics.
- use the Wronskian to determine whether or not a set of solutions to a differential equation are linearly dependent or independent.
- solve homogeneous linear equations with constant coefficients.
- solve nonhomogeneous linear differential equations
- determine the Laplace transforms for basic functions, derivatives, integrals and periodic functions and their inverse transforms.
- use the Laplace transform and the Dirac delta function to determine the impulse response of a linear differential equation.
- determine eigenvalues and eigenvectors of a real-valued matrix.
- solve systems of homogeneous first-order linear differential equations using matrix methods.

COURSE TOPICS

1. Separable 1st order DEs
2. Higher-order linear DEs with constant coefficients
   - i& homogeneous - real distinct roots, complex roots, repeated real roots.
   - i& non-homogeneous - overlapping and non-overlapping with the homogeneous solutions.
3. Laplace Transforms
   - i& Introduction to Laplace as an integral transformation, change in domain from t to s.
   - i& Forward and backwards Laplace transforms of functions using table of transforms. New functions: piecewise/step functions.
   - i& Forward and backwards transformation of DEs using Laplace transforms
4. Systems of differential equations
   - i& Background/review - row reduction, computing eigenvalues and eigenvectors of matrices.
   - i& Transforming systems of 1st order DEs into matrix form.
   - i& Building vector solutions to matrix form using eigenvectors and eigenvalues.

MOODLE, TEXTBOOK AND WEBASSIGN

This course uses Moodle/Moonami as a Learning Management System (LMS). Additional resources and some material will be posted on Moodle, but homework will be available through WebAssign (use WileyPLUS for online homework + eBook). Students must access their Moodle (integrated WebAssign) and UMass Gmail accounts.

TEXTBOOK: *Elementary Differential Equations, 11th Edition (2017) by William E. Boyce, Richard C. DiPrima, Douglas B. Meade*

An electronic copy of the textbook is integrated in the homework system Wiley-Plus that we will use for the class. When setting-up your account with Wiley plus there will be an option to purchase a hard copy of the book for a (small) extra-fee. Please follow the instructions in the WileyPLUS Registration link in Moodle to register for WileyPLUS at UMass's discounted price.

GRADING POLICY

Letter Grades for all Math 331 sections will be determined as follows:

Course Component	Grade weightings
Mid-term Exam (will be held on 3/30/2023 from 7pm-9pm and will cover sections 1.1 - 3.4)	30%
Final Exam (will be held on 5/23/2023 from 3:30PM - 5:30PM at Totman Phys. Ed. Bldg. Gym)	30%
Homework (30% + 10% = 40%) Homework will be made up of Online HW via WileyPLUS (30%) Written Homework (10%)	40%

After being determined by the above algorithm, the following scale will then determine the letter grade (Note: There is no numerical rounding in the conversion to a letter grade. i.e. a numerical grade of 89.9% would result in a letter grade of A-)

Letter Grade	A	A_	B+	B	B-	C+	C	C-	D+	D-	F
	90	87	83	79	75	71	67	63	59	55	< 55

Homework: Two styles of homework throughout the semester (WileyPLUS for online homework + eBook, and written homework sets). Students will submit their written homework via Gradescope.

Late Homework Policy: You are strongly encouraged to keep up with the deadlines on WileyPLUS, though they **may be completed after the due date for full credit until the day of the Final at 12:00 pm (noon) EST**.
No credit will be given for WileyPLUS submissions after this deadline. Extensions for Written HW will be at the instructor's discretion, but will not be granted after the release of the solutions.

Final Exam : The Final will cover Chapters 3 (emphasis after the midterm cutoff), 6, and 7. The date and time of the final exam will be scheduled by the university. The final will only be given at that time, and not at any other time for any reason. In particular, arrange your travel plans for Final Exam week accordingly.

EXAM POLICIES

Please be aware of the exam rules:

- Please arrive 10 minutes early. You will not be admitted to the exam more than 30 minutes late.
- Do not bring any cheat sheets, formula sheets, and class notes to the Midterm exams and final exam.
- Bring your student ID to the exam.
- Calculator policy: Calculators are not allowed during Exams.
- Make-up exam policy: Make-up exams are given for University approved reasons. Make-up exams MUST be requested (by providing documentation) no later than 2 weeks before the exam at 5 pm for all reasons that can be anticipated prior to the exam. For unexpected requests (illness, etc), you must contact your instructor within 48 hours of the exam (unless there are circumstances preventing this) and provide documentation supporting your University approved absence as soon as you return to campus.

INCOMPLETE COURSE GRADE

Students must complete all assignments (Homework) and exams by their due dates. Students who cannot meet course requirements within the allotted time because of severe medical or personal problems may request a grade of Incomplete from the course instructor. Incomplete grades are warranted only if a student passes the course at the time of the request and if the course requirements can be completed by the end of the following semester. If you are entitled to an "incomplete" in the course, you must complete an Incomplete Grade Form - you can get this form from the Academic Dean. All incomplete course assignments must be completed within a timeframe agreed between the instructor and student. An incomplete count as an "F" until you complete the work and a grade is submitted. You only have one semester to complete the work, or the "INC" becomes an "F".
Incomplete Grade Form *http : //www.umass.edu/dean_students/codeofconduct/acadhonesty/*

ACADEMIC DISHONESTY

Since the integrity of the academic enterprise of any institution of higher education requires honesty in scholarship and research, academic honesty is required of all students at the University of Massachusetts Amherst. Academic dishonesty is prohibited in all programs of the University. Academic dishonesty

includes but is not limited to: cheating, fabrication, plagiarism, and facilitating dishonesty. Appropriate sanctions may be imposed on any student who has committed an act of academic dishonesty. Instructors should take reasonable steps to address academic misconduct. Any person with reason to believe that a student has committed academic dishonesty should bring such information to the attention of the appropriate course instructor as soon as possible. Instances of academic dishonesty not related to a specific course should be brought to the attention of the appropriate department Head or Chair. Since students are expected to be familiar with this policy and the commonly accepted standards of academic integrity, ignorance of such standards is not normally sufficient evidence of lack of intent (*http : //www.umass.edu/dean students/codeofconduct/acadhonesty/*).

DISABILITY SERVICES - ACCOMMODATIONS

The University of Massachusetts is committed to providing equal educational opportunities for all students. A student with a documented physical, psychological, or learning disability on file with Disability Services may be eligible for reasonable accommodations to succeed in this course. This semester, students receiving accommodations will take their exams through the Disability Services Center (DSC). Such students should obtain documentation from the Office of Disability Services and inform instructors at least two weeks before the exams or assignments for which the accommodation is required. Accommodations can be scheduled through *https : //www.umass.edu/disability/students*. After your accommodations are scheduled, your instructor will receive a letter of accommodations from the Disability Services office.
Please get in touch with your instructor if any special arrangements should be made.

LECTURE SCHEDULE

Week	Lecture	Events	Memo
2/6	1.1, 1.2, 1.3	First day of classes (2/6/2023)	
2/13	2.1, 2.2	Last day (2/13/2023) to add or drop any class with no record	
2/20	2.3, 2.5	Holiday - Presidents' Day (2/20/2023) Monday class schedule will be followed	
2/27	2.4, 2.6, 2.7, 2.8		
3/6	3.1, 3.2		
3/13		Spring recess begins (3/12/2023) classes resume (3/20/2023)	
3/20	3.3, 3.4		
!3/27	3.5		Midterm Exam on 3/30/2023 form 7 - 9 pm
4/3	3.5, 3.7, 3.8	Last day (4/10/2023) to Drop with 'W' and select 'P/F'	
4/10	6.1, 6.2		
4/17	6.3, 6.4	Classes resume on 4/19/2023	
4/24	6.5, 7.1		
5/1	7.2, 7.3, 7.4		
5/8	7.5, 7.6		
4/15	Review and catch up	Last day of classes (5/17/2023)	
4/22			Final Exam on 5/23/2023 3:30 - 5:30pm