Department of Mathematics, UAB
Introduction to Differential Equations
MA252-2A Spring 2021 Remote

Instructor: Professor Ian Knowles, Room 4024, University Hall.
Email: iknowles@uab.edu
Class Meeting Times: TR: 8:00am – 9:15am, on Zoom.
Class Management via Canvas: Files for homework assignments, Maple codes, tests, test review sheets, and other materials will be posted in the Files Course Navigation Link in Canvas. Homework assignments and tests will only be collected via uploading into the Assignments Link in Canvas.
Office Hours. After class on Zoom; you may also email for a private Zoom.
Textbook. We use my lecture notes; download these from Canvas.
Prerequisite Course. Calculus 2 (MA126), or permission of instructor.
Archiving of Class Lectures. It is my intention to record each of our Zoom meetings and make them available on Canvas.
Term Dates. First day of classes: Tuesday January 19, 2021. Last day of classes: Friday April 23, 2021.

Maple Software. Access to the software Maple is required. Maple student edition may be purchased at a 25% discount from Maplesoft

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Syllabus. This is a first course in ordinary differential equations from a more modern perspective. Fifty years ago it was important for engineers and scientists to be familiar with a myriad of clever mathematical tricks aimed at producing closed-form solutions for differential equations (DEs). More recently this process has been both extended and simplified by the ready availability of powerful software, such as Maple, for computations and computer algebra applications. It is the aim of this course to provide both the theoretical background needed to understand how DEs work, and familiarity with the various software tools needed to facilitate their use in modeling.

We cover first order differential equations (separable, linear, exact, and additional non-linear examples using Maple), modeling with first order DEs, examples of systems of first order DEs, theory of higher order linear DEs (homogeneous and non-homogeneous, superposition of solutions, linear independence (via Wronskians) and general solutions, initial and boundary value

problems), solution of constant coefficient homogeneous linear equations, non-homogeneous linear equations by variation of parameters and Green's functions, with complicated cases done using Maple, and the theory and application of Laplace transforms. Modeling projects in the course will emphasize the use of Maple to do the heavy lifting.

Grading. There will be approximately one graded homework assignment per week; these collectively will constitute 50% of the course grade. There will be two Zoom tests: the first is on Thursday February 25, and the second is on Tuesday April 20; each counts 25% of the course grade. There is no final examination. Your final grade is determined from your course grade according to the following table:

Course Grade:	88-100	75-87	62-74	50-61	below 50
Final Grade:	A	B	C	D	F

Homework and Test File Submission For each homework assignment and test you are required to upload in Canvas a **single pdf file** on or before the due time. You should note that files larger than 15MB may cause problems in Canvas. For assignments that use Maple you can use the "save as pdf" printing option inside Maple. If you prefer to use paper, homework sheets and printed test files can be scanned to a single pdf file using a mobile scanning app such as Adobe Scan, for example. One can also combine scans by including them as graphics components in a word processor, as long as you output a pdf file at the end, and observe the following assignment rules.

Assignment Rules. All assignments must be your own work; do not copy the work of others or allow your work to be copied. Each assignment must be written as a report in your own words, adhering to the guidelines listed below. Points may be deducted for transgressions of these rules. You can add commentary to a Maple worksheet using the Maple "text" facility, or leave space for the later insertion of hand-written material; see the sample assignment `Files/Assignments/ass0.pdf` on Canvas.

1. Your **name**, **class** (MA252-2A), **semester** (Spring 2021), and **assignment number** appears at the beginning of your report.

2. Each question and part of question must be clearly numbered; **the questions (and parts thereof) must appear in INCREASING order in your report;** infractions will incur an "out of order" penalty.

3. Add text commentary explaining each Maple step (or group of steps).

4. Use the Maple text editor to interleave text and Maple material. You can mix Maple and hand-written text by leaving a space in your Maple file for later insertion of your hand-written material. **No "Maple appendices"[1] are permitted; your report needs to be a logical and continuous blend of explanatory text and Maple output.**

5. Clearly label your answers and/or conclusions.

Aims of the Course Upon successful completion of the course a student should

- be familiar with the standard types of ordinary differential equations and their methods of solution;
- understand that differential equations provide a precise quantitative connection between the laws of Physics and modeling applications in Science and Engineering;
- be able to use computer algebra software (such as Maple) to facilitate the computations that arise in practical modeling projects.

Reference Books. As mentioned above, there is no prescribed textbook for this course. Many books, such as *A First Course in Differential Equations with Modeling Applications*, Dennis G Zill, Brooks/Cole, any edition, or *Elementary Differential Equations and Boundary Value Problems*, William E. Boyce and Richard C. DiPrima, Wiley, any edition, cover well the theoretical material in the course. Likewise, there is no text for the modeling component of the course, which we do as an zoom-class/homework activity. Regular Zoom attendance is highly recommended for this reason. I will provide files for the assignments and Maple work, and review problem files for the tests.

[1] i.e. all of the Maple output glomped together at the end of the report

Class Schedule.

Week	Tuesday	Thursday
01/19 – 01/22	First Class	
01/25 – 01/29	Assignment 1 due in Canvas	
02/01 – 02/05	Assignment 2 due in Canvas	
02/08 – 02/12	Assignment 3 due in Canvas	
02/15 – 02/19	Assignment 4 due in Canvas	
02/22 – 02/26	Review for Test 1	Test 1 on Zoom
03/01 – 03/05		
03/08 – 03/12	Assignment 5 due in Canvas	
03/15 – 03/19	Assignment 6 due in Canvas	
03/22 – 03/26	Assignment 7 due in Canvas	
03/29 – 04/02	Assignment 8 due in Canvas	
04/05 – 04/09	Assignment 9 due in Canvas	
04/12 – 04/16	Assignment 10 due in Canvas	Review for Test 2
04/19 – 04/23	Test 2 on Zoom	Last Class
04/26 – 04/30	No Final Exam in this course	

UAB DSS Accessibility Statement. The University of Alabama at Birmingham is committed to providing an accessible learning experience for all students. If you are a student with a disability that qualifies under Americans with Disabilities Act (ADA) and Section 504 of the Rehabilitation Act, and you require accommodations, please contact Disability Support Services for information on accommodations, registration and procedures. Requests for reasonable accommodations involve an interactive process and consist of a collaborative effort among the student, DSS, faculty and staff. If you are registered with Disability Support Services, please contact DSS to discuss accommodations that may be necessary in this course. If you have a disability but have not contacted Disability Support Services, please call (205) 934-4205, visit their website, or their office located in Hill Student Center Suite 409.

UAB Title IX Statement. The University of Alabama at Birmingham is committed to providing an environment that is free from sexual misconduct, which includes gender-based assault, harassment, exploitation, dating and domestic violence, stalking, as well as discrimination based on sex, sexual orientation, gender identity, and gender expression. If you have experienced

any of the aforementioned conduct we encourage you to report the incident. UAB provides several avenues for reporting. For more information about Title IX, policy, reporting, protections, resources and supports, please visit UAB Title IX web page for UAB's Title IX, UAB's Equal Opportunity, Anti-Harassment, Duty to Report, and Non-Retaliation policies.
