Department of Mathematics, UAB
Introduction to Differential Equations
MA252-2A Fall 2020 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: Homework assignments, Maple codes, tests, test review sheets, and other materials will be posted in Canvas. Homework assignments and tests will only be collected via uploading in Canvas.
Office Hours. After class on Zoom; you may also email for a private Zoom appointment.
Textbook. We use my lecture notes; download these from Canvas.
Grading. There will be approximately one written modeling project per week; these collectively will constitute 50% of the course grade. There will be two Zoom tests: the first is on Thursday October 1, and the second is on Tuesday December 1; each counts 25% of the course grade. There is no final examination.
Maple Software. Access to the software Maple is required for this course. Maple student edition may be purchased at a 25% discount directly from Maplesoft
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. 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. It is also possible to combine scans by including them as graphics components in a word processor, as long as you output a pdf file at the end.
Prerequisite Course. Calculus 2 (MA126), or permission of instructor.
Term Dates. First day of classes: Monday August 24, 2020. Labor Day (UAB Holiday): Monday September 7, 2020. Last day of classes: Friday December 4, 2020.
Archiving of Class Lectures. It is my intention to record each of our Zoom meetings and make them available on Canvas as mp4 files.
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) of interest. In the last thirty years or so, this process has been both extended and simplified by the ready availability of powerful software, such as Maple, for numerical 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.

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 `ass0.pdf` on Canvas.

1. Your **name**, **class** (MA252-OQ), **semester** (Summer 2020), 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 should be a logical and continuous blend of explanatory text and Maple output.

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

5. Clearly label your answers and/or conclusions.

Class Schedule:

Week	**Tuesday**	**Thursday**
08/24 – 08/28	First Class	
08/31 – 09/04	Assignment 1 due in Canvas	
09/07 – 09/11	Assignment 2 due in Canvas	
09/14 – 09/18	Assignment 3 due in Canvas	
09/21 – 09/25	Assignment 4 due in Canvas	
09/28 – 10/02	Review for Test 1	Test 1 on Zoom
10/05 – 10/09		
10/12 – 10/16	Assignment 5 due in Canvas	
10/19 – 10/23	Assignment 6 due in Canvas	
10/26 – 10/30	Assignment 7 due in Canvas	
11/02 – 11/06	Assignment 8 due in Canvas	
11/09 – 11/13	Assignment 9 due in Canvas	
11/16 – 11/20	Assignment 10 due in Canvas	Review for Test 2
11/23 – 11/27	Thanksgiving Break	
11/30 – 12/04	Test 2 on Zoom	Last Class
12/07 – 12/11	No Final Exam in this course	

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

- be familiar with the standard types of ordinary differential equation 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 the context of 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.