Department of Mathematics, UAB
Introduction to Differential Equations
MA252-1A Fall 2024

Instructor: Professor Ian Knowles, Room 4024, University Hall.
Email: iknowles@uab.edu
Class Meeting Times and Location: MWF: 8:00am – 8:50am, HHB221.
Office Hours. After class; you may also email for an office or Zoom appointment.
Textbook. None: we use my lecture notes; download these from Canvas.
Prerequisite Course. Calculus II (MA126), or permission of instructor.
Term Dates. First day of classes: Monday August 26, 2024. Labor Day Holiday: September 02, 2024. Fall Break: November 25–December 01. Last day of classes: Friday December 06, 2024.

Maple Software. Access to Maple software is required for this course. A Maple 2024 12-month student license may be purchased for $75 directly from Maplesoft by going to the "live link"

`https://store.maplesoft.com/products/usd-maple-student/`

and scroll down and click on the yellow Redeem Instructor Code box and enter the code **UAB-M2024-0509** and click on the blue Submit box. You should see

Maple: Student Edition - 12 month Term

You can click on the blue Add to Cart box and pay your $75 by credit card.

Grading. There will be approximately one written modeling project per week; these collectively will constitute 50% of the course grade. There will be two in-class tests, around the end of September and November; each counts 25% of the course grade. There is no final examination in this course. 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 File Submission. For each homework assignment you are required to submit a **single pdf file** in Canvas 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 can be scanned to a single pdf file using a mobile scanning app such as Adobe Scan, for example.

Syllabus. This is a first course in ordinary differential equations from a modern perspective. A hundred 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. More recently, 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. Each assignment must be written as a report in your own words, adhering to the guidelines listed below. Points may be deducted for sufficiently gross transgressions of these rules. As explained in class, you can add commentary to a Maple worksheet using the Maple "text" facility, or leave space for the later insertion of hand-written material using your iPad or other tablet device. The sample assignment `ass0.pdf` on Canvas may be consulted as a guide to the correct application of these rules.

(1) Your **name**, **class** (MA252-2A), **semester** (Fall 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.**
(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. Your report should be a logically ordered 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 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, Medicine 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.

Class Schedule.

Week	**Monday**	**Wednesday**	**Friday**
08/26 – 08/30	First Class		
09/02 – 09/06		Assignment 1 due in Canvas	
09/09 – 09/13		Assignment 2 due in Canvas	
09/16 – 09/20		Assignment 3 due in Canvas	
09/23 – 09/27		Assignment 4 due in Canvas	
09/30 – 10/04	Review for Test 1	Test 1	
10/07 – 10/11			
10/14 – 10/18		Assignment 5 due in Canvas	
10/21 – 10/25		Assignment 6 due in Canvas	
10/28 – 11/01		Assignment 7 due in Canvas	
11/04 – 11/08		Assignment 8 due in Canvas	
11/11 – 11/15		Assignment 9 due in Canvas	
11/18 – 11/22		Assignment 10 due in Canvas	
11/25 – 11/29	Thanksgiving Break		
12/02 – 12/06	Review for Test 2	Test 2	Last Class
12/09 – 12/13	No Final Exam in this course		

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; you can acquire copies second-hand via Amazon for a moderate expenditure, or by other means.

Likewise, there is no text for the modeling component of the course, which we will do as an in-class/homework activity. Regular class attendance is highly recommended for this reason. I will provide, via Canvas, files for the assignments and Maple work, and review problem files for the tests.