

MA 238 – Differential Equations I

Fall 2024; Section 101

Instructor. Dr. Armin Straub

Email. straub@southalabama.edu

Email is the best way to get in touch with me. I strive to reply as soon as possible and definitely within 24 hours; if you don't hear back within 24 hours, please check the email address and contact me again (most likely, something went wrong).

Course website. <http://math238.straub.link>

Office. MSPB 313

Office phone. (251) 460-7262 (please use e-mail whenever possible)

Office hours. MWF 10:00-11:00am, 12:15-1:15pm, or by appointment

Class schedule. MWF, 9:05-9:55am, in MSPB 235

Overview. Topics include methods of numerical solutions of nonlinear equations in one variable, fixed points, contraction mapping and functional iteration methods, interpolation and approximation methods, numerical differentiation and integration, numerical solution of ordinary differential equations, analysis of error of various numerical procedures. Implementation in Python of all numerical methods discussed in class is an essential part of the course.

Learning objectives. Upon the successful completion of the course a student will:

- Understand the introductory concepts such as distinguishing ODEs from PDEs, the definition of an ODE, the meaning of a solution of an ODE, the mathematical modelling process.
- Characterize and solve first-order ODEs: separable equations, linear first-order ODEs, ODEs reducible to separable or linear form through substitution.
- Understand existence and uniqueness of solutions theorem for first-order ODEs.
- Solve applications involving first-order ODEs such as population models, heating and cooling of objects and buildings, acceleration-velocity models, motion in a resisting medium, mixing problems, modeling electric circuits.
- Solve higher-order linear constant coefficient ODEs: homogeneous equations with constant coefficients (general solutions), non-homogeneous equations (particular solutions using methods undetermined coefficients and variation of parameters).
- Solve applications involving higher-order linear ODEs: spring-mass oscillators, equations of motion.
- Solve simple first-order linear systems of ODEs using elimination.
- Use the Laplace transform (use of transform tables) to solve ODEs.

Textbook. *Fundamentals of Differential Equations and Boundary Value Problems*, by R. Kent Nagle, Edward B. Saff, Arthur David Snider (Pearson, 7th Ed., 2018)

The textbook is a nice additional resource but is not required for the course. You will have access to the online textbook automatically on Canvas through the JagPack Program (<https://www.southalabama.edu/programs/jagpack/>) unless you opted out.

Course format. Web-enhanced

Pre-requisite. D or better in MA 227 (Calculus III); or concurrent enrollment in MA 227

Grading

Exams. There will be two in-class midterm exams and a comprehensive final exam. Notes, books, calculators or computers are not allowed during any of the exam.

Our **tentative** exam schedule is:

- Midterm Exam 1: Wednesday, October 2
- Midterm Exam 2: Wednesday, November 13
- Final Exam: Wednesday, December 11 — 8:00-10:00am

Homework. Regular homework is assigned and needs to be submitted online. You have an unlimited number of attempts (a 15% penalty applies if homework is submitted after the posted due date, unless an extension has been granted due to special circumstances). Only the best score is used for your grade. Most problems have a random component (which allows you to continue practicing throughout the semester without putting your scores at risk).

(The homework system is written by myself in the hope that you find it beneficial. Please help make it as useful as possible by letting me know about any issues!)

Grades. Your grade will be based on the total sum of your scores on the midterm exams, homework, and the final exam.

- Midterm Exams: 50% in total
- Homework: 20%
- Final Exam: 30%

The resulting numerical score is then translated to your semester grade as follows:

[90, 100]: A, [80, 90): B, [70, 80): C, [60, 70): D, [0, 60): F.

Bonuses. You can earn bonus points by finding mathematical typos in the lecture notes, or by reporting mistakes in the homework. Each bonus point is worth 1% towards a midterm exam.

Make-up policy. There will be no make-ups for missed midterm exams. If an exam is missed and appropriate documentation (e.g. a doctor's note) is presented in a timely manner, then the corresponding exam score will be replaced with the final exam score. Otherwise, the score for the missed exam will be recorded as zero.

Online grades. Homework scores are available on our course website. Exam grades will be posted to USAonline: <https://usaonline.southalabama.edu>

Dropping. The final drop date is Friday, November 1. Please speak with me (and/or your advisor) before making a final decision to drop. Ideally, talk to me as soon as you are getting behind, so I can help you complete the course successfully.

Course organization

Online material. This syllabus as well as relevant information and material for this course can be found at our course website. In particular, homework and sketches of each lecture will be posted there.

Attendance. Attendance of all lectures is mandatory and roll will be taken. If you are unable to attend a class because you don't feel well, or because of any other reason, please let me know by email so that the absence can count as excused. You are responsible for finding out what you missed on days when you were unable to attend.

Let X be the number of times you miss class without excuse throughout the semester.

- If $X \leq 3$, then your lowest exam score is replaced with the final exam (if beneficial).
- If $X > 6$, then your overall semester grade will be decreased by a full letter grade.

Students are expected to be on time in class. Frequent late arrivals of a student to the classroom will be considered a disruption and a penalty may be applied in this circumstance.

Cell phones and other electronic devices. The use of cell phones and other electronic devices, such as laptops, is generally not acceptable during lecture due to its potential for distraction, and is reserved for emergencies. If use of an electronic device is helpful to your learning (for instance, for note-taking) please speak with me beforehand.

Changes. Not all classes progress at the same rate. Thus course requirements and policies might have to be modified as circumstances dictate. You will be given notice if the course policies need to be changed.

Additional Academic Course Policies. Information on Student Disability Services, Academic Disruption Policy and Class Demeanor, Student Academic Conduct Policy, Operational Disruptions, and other university policies are posted on USAonline.

Welcome!

...please ask anytime if you have questions.