MA 436 – Numerical Analysis (preliminary)
Fall 2022; 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://math436.straub.link`

Office. MSPB 313

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

Office hours. TR 12:15-3:15pm, or by appointment

Class schedule. TR, 11:00-12:15pm, 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. To understand how to do mathematics using computers as well as how computers do mathematics: this includes discussing how numbers and functions are represented in practice, leading to polynomial interpolation, splines, power series, Fourier series or orthogonal polynomials.

    To learn how to perform basic computations, such as derivatives and integrals, numerically.

    To learn how to solve differential equations numerically via discretization.

    To implement and analyze the discussed numerical methods in Python. No prior programming skills are needed.

    These methods and approaches are fundamental to scientific computation in virtually all branches of applied sciences including engineering, biology, physics, or computer science.

Textbook. Lecture sketches will be posted after each class.

Course format. Web-enhanced

Pre-requisite. C or better in MA 227 (Calculus III) and MA 238 (Differential Equations); MA 238 can be taken concurrently with this course.

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: Thursday, September 29
- Midterm Exam 2: Thursday, November 10
- Final Exam: Tuesday, December 6 — 10:30-12:30pm

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, python assignments, and the final exam.

- Midterm Exams: 40% in total
- Homework: 20%
- Python assignments: 15%
- Final Exam: 25%

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

$[90, 100]$: A, $\qquad$ $[80, 90)$: B, $\qquad$ $[70, 80)$: C, $\qquad$ $[60, 70)$: D, $\qquad$ $[0, 60)$: 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, October 28. 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.

Python assignments. In addition to regular homework problems, there will be occasional Python assignments asking you to write short Python code. No previous exposure to Python is expected and students will be introduced to Replit (`https://replit.com`), which offers a free cloud service for running Python code (from within a web browser and without the need to install any software) and which will be used for submitting the assignments. For these assignments, I will provide a way to test your code before submission so that you can get in touch with me in case your code is not working as intended.

(Students who are already familiar with Python are free to use their favorite environment, such as Spyder, for writing Python code. The final code then needs to be submitted via Replit.)

Attendance. Attendance of all lectures is mandatory and roll will be taken. 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 $X \leqslant 3$, 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 not acceptable during lecture and is reserved for emergencies.

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.