Numerical Analysis

Math 446/OR 481, Sander, Fall, 2021

Lecturer: Dr. E. Sander (*esander@gmu.edu*)

LAs: Vincent Vu (*vvu22@gmu.edu*) and Swan Klein (*hklein2@gmu.edu*)

Lectures: Horizon Hall 3008 MW 9-10:15am

Prerequisite: MATH 203 and CS 112

Office hours: Both the lecturer and the LAs will have a mix of in person and online office hours for drop in no appointment needed. Hours, locations, and links are posted on Blackboard.

Discord: There is a Discord server for this course - link posted in Blackboard. Please join -- it's a nice way to have discussions with fellow students, as well as asking questions of the instructor and LAs.

Course description: Design and implementation of algorithms for the solution of scientific and engineering problems. Emphasis will be placed on the written and graphical presentation of solutions. The course will cover the following topics.

- Floating point arithmetic
- The solution of nonlinear equations in one variable
- The solution of systems of linear equations
- The solution of nonlinear systems
- Interpolation and polynomial approximation
- Curve-fitting; cubic and Bezier splines
- Least squares problems

Schedule: Here is a semester schedule.

Textbook: T. Sauer, *Numerical Analysis*, Pearson, 3rd Edition. Make sure to download the useful files, available from the textbook website including in particular the **Textbook Matlab Code**.

Required software:

- **Matlab** and **Matlab Grader:** Follow the instructions at https://its.gmu.edu/find-a-service/software-listing-matlab/
- **Blackboard:** Blackboard is the home for all class activities. Any updates, assignments, etc. will appear on Blackboard.
- **Gradescope:** The theoretical homework is available from Gradescope. There is a link in the Blackboard site.

Matlab: The software package Matlab will be required for analysis and presentation of data. Matlab is a computing environment with programming capability, good graphics, and powerful library functions. The university negotiated a new site license that gives much better access than ever before. To get access to Matlab, please go to the GMU Matlab Access Website.

I strongly suggest you sign up for a GMU Math Scientific Computing Workshop introducing Matlab. These courses are offered for no charge to all GMU Math students and are a handy way to get up and running quickly. Matlab tutorials can be found readily on the internet. There is a pretty good one at Mathworks, and another one in the textbook's appendix.

Grading:

- In Class Checkups (4 pts. each)
- Weekly Theoretical Homework (15 pts. each)
- Biweekly Prelabs (15 pts. each)
- Biweekly Labs (15 pts. each)
- Final Exam (70 pts.)

With the exception of the In Class Checkups, grades in the course will be based on your INDIVIDUAL effort on the exams and projects. Discussion of course topics with others is helpful and encouraged; however, all work toward the solution of homework projects submitted for credit, including computer code and written summaries, must be done SOLELY by you. A description of each portion of the class is given below.

Description of Course Work

- **Textbook Exercises:** The textbook exercises are listed on the schedule. They should be attempted before class, and completed before attempting the weekly theoretical homework.

- **In Class Checkups:** Before each lecture, the student is responsible for reading the assigned sections of the text and taking a look at the textbook exercises. During class, you will be working on problems in groups, and will be graded for a combination of attendance, participation, and accuracy.

- **Theoretical Homework** Weekly Theoretical Homework is assigned on Gradescope. Unless it is a multiple choice question, within each box, you will type a single number. For non-integer answers, the digits of accuracy of the number will be specified. There is a time limit of 2 hours on the theoretical homework. This should give you ample time to complete it, since in order to prepare for it, you will be doing similar problems in the book and during class.

- **Prelabs** Prelabs are done in Matlab Grader. It is an autograded coding assignment to make sure you have accurate working code before attempting the labs. You can submit the lab as many times as you want before the deadline. You will have immediate feedback as to whether you have gotten the correct answer, and for incorrect answers you will get suggestions as to where you went wrong.

- **Labs** Labs are coding assignments to be done in Matlab. Your writeup will demonstrate the ability to communicate technical ideas effectively, including answers, illustrative tables, graphs, and explanations of why you got the answer you did. In addition to correctness, a writeup will be graded for readability, formatting, and communication of ideas. This is a vital part of the what you will need when applying the materials you are learning. Start good habits now: A well prepared report is key skill in a professional workplace.

Dates

- All theoretical homework, labs, and prelabs are due Fridays at 11:59pm.
- Final Exam: 12/13 7:30am-10:15am (per official university schedule).

Honor Code: The University Honor Code is to be followed. Sharing information of any kind about exams, theoretical homework, or Matlab assignments will result in a grade of zero. Any violations will be submitted to the University Honor Committee.

Office of Disability Services: All academic accommodations must be arranged through the ODS. Please speak to me if this applies to you.

COVID Specific information: Everyone must fill out the Mason Covid Health Check Form every day before coming to class. Everyone is required to wear masks as per the university guidelines. Any student who is unable to come to class due to (any) health problem must contact the instructor immediately to make arrangements to make up the work.
