Math 450: Introduction to Numerical Analysis I, Fall 2023

Instructor:	Marc Fehling, Ph.D. Weber 208 marc.fehling@colostate.edu
Lectures:	Monday, Wednesday, Friday, 1:00pm–1:50pm Engineering, Room E 104 Lectures will be recorded on Echo360
Office hours:	Monday 2:00–3:00pm; or by appointment

About the Course. Numerical methods are employed to solve mathematical or engineering problems on computers. They are typically formulated as algorithms which are sequences of steps that can be implemented in various programming languages. Additionally, numerical analysis also deals with examining properties of numerical methods, e.g. their performance. This introductory course covers the following topics:

- Solution of nonlinear equations $f(x) = 0$

- Solution of systems of linear equations $Ax = b$

- Interpolation: fitting functions through a set of data points

- Approximation: fitting functions to approximate a set of data points

The solution of ordinary and partial differential equations as well as eigenvalue problems will be covered in the follow-up course Math 451: Introduction to Numerical Analysis II.

Suggested Textbook. I do not require you to get any textbook, and will not give homework problems that reference a certain book. The content of the course is oriented on the following book.

- D.R. Kincaid and E.W. Cheney, Numerical Analysis: Mathematics of Scientific Computing, American Mathematical Society

  - You can buy the book at AMS
    https://bookstore.ams.org/amstext-2

  - You can read an online version at the CSU library (free!)
    https://colostate.primo.exlibrisgroup.com/permalink/01COLSU_INST/via34g/alma9910
    31490091103361

Prerequisites. You require access to a computer for this class, for which you ideally use your personal notebook. Please get in touch with me if you do not have access to a computer.

- Programming: CS 150A or CS 150B or CS 152 or CS 163 or CS 164 or CS 156 or CS 253 or Math 151

- Advanced Calculus: Math 255 or Math 261

Programming languages. You will be assigned with programming tasks in your homework, and can choose your preferred programming language to complete them. If your choice is somewhat exotic, you will need to provide sufficient commentary to make your code understandable.

For this course, I recommend using the `python` language together with the `numpy`, `scipy`, and `matplotlib` packages and `Visual Studio Code` as your integrated development environment (IDE).

- `Visual Studio Code`
  https://code.visualstudio.com/docs/python/python-tutorial

- Interactive web tutorials for `python`
  https://www.learnpython.org/

- Documentation for `python` and packages `numpy`, `scipy`, and `matplotlib`
  https://docs.python.org/3/
  https://numpy.org/doc/stable/index.html
  https://docs.scipy.org/doc/scipy/
  https://matplotlib.org/stable/index.html

- `Python` programming and numerical methods: a guide for engineers and scientists
  https://pythonnumericalmethods.berkeley.edu/

- Numerical programming with `python`
  https://python-course.eu/numerical-programming/

- Differences between `numpy` and `matlab`
  https://numpy.org/doc/stable/user/numpy-for-matlab-users.html

Grade distribution. Final grades will be determined on the following components and cut-offs. Precise letter grade cut-offs will be determined at the end of the semester, but are expected to be no stricter than stated. Please be aware that the in-progress grades displayed on Canvas are not necessarily correct and may be misleading; it is best to keep track of your performance yourself.

Homework will be handed out every two weeks. The midterm exam will be held in the same room as the lectures. The poster presentation will take place at Lory Student Center.

• Homework	bi-weekly	40%	• Grade A	$\geq 90\%$
• Midterm exam	October 25, 1–1:50pm	25%	• Grade B	$\geq 80\%$
• Poster presentation	December 7, 8–11am	35%	• Grade C	$\geq 70\%$
			• Grade D	$\geq 60\%$

You must make arrangements in advance if you expect to miss an exam or quiz. Exam absences due to recognized University-related activities, religious holidays, verifiable illness, and family/medical emergencies will be dealt with on an individual basis. In all cases of absence from exams a written excuse is required. Ignorance of the time and place of an exam will not be accepted as an excuse for absence.

Late homework policy. Homework turned in late will lose points based on the following schedule:
- same day   no deduction
- 1 day late   20% deduction
- 2 days late   40% deduction
- > 2 days late no credit

Accommodations. If you require Student Disability Center Accommodations for exams, you must make arrangements with the Student Disability Center and provide formal documentation to the instructor at least one week in advance of every exam.
https://disabilitycenter.colostate.edu/

Life Circumstances. If you have a serious, unexpected life circumstance that is affecting your ability to participate in the course fully, the best thing to do would be to confer with the CSU Student Case Management, which deals with these situations in a safe, confidential and professional manner.
https://studentcasemanagement.colostate.edu/

Academic Integrity. Academic integrity is integral to the success of the University and to you as a learner. Academic integrity is conceptualized as doing and taking credit for one's own work. Academic dishonesty undermines the educational experience at Colorado State University. Examples of academic dishonesty include (but are not limited to) cheating, plagiarism, and falsification. Plagiarism includes the copying of language, structure, images, ideas or thoughts of others and is related only to work submitted for credit. Cheating or any form of academic dishonesty will not be tolerated. The use of material from improperly cited or credited sources will be considered plagiarism. You are encouraged to collaborate with your classmates, unless otherwise directed, but all work intended for a grade must clearly be your work as an individual. Ignorance of the rules does not exclude any member of the CSU community from the requirements or the processes meant to ensure academic integrity.
https://tilt.colostate.edu/integrity/

Syllabus Resources and Policies. The following web page provides policies relevant to your courses and resources to help with various challenges you may encounter.
https://tilt.colostate.edu/syllabus-resources-and-policies/