Math 451: Numerical Analysis I

Winter 2021

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Course Web Page: https://www.egcharalampidis.com/teaching/451_W21/math_451_W21/

Class Virtual Meetings:

- Sections 1 and 2 (MTRF): 8:10-9:00am

Office Hours: T: 9:00-11:00am, R: 12:00-2:00pm, or by appointment.

Access to the course: Login into:

https://calpoly.zoom.us/

using your Cal Poly credentials. The Zoom ID numbers have already been sent to you in order to attend classes and office hours. In addition, meeting passwords are required and were sent to you as for an extra layer of security.

Required Textbook:

- *Elementary Numerical Analysis (3rd edition)*, Authors: Kendall Atkinson and Weimin Han, Publisher: John Wiley & Sons, 2004.

Additional References:

- *A First Course in Numerical Methods*, Authors: Uri M. Ascher and Chen Greif, Publisher: SIAM, 2011.
- *Numerical Linear Algebra*, Authors: Lloyd N. Trefethen and David Bau, Publisher: SIAM, 1997.
- *Matrix Computations*, Authors: Gene H. Golub and Charles F. Van Loan, Publisher: The Johns Hopkins University Press, 2013.
- *Theoretical Numerical Analysis: A Functional Analysis Framework*, Authors: Kendall Atkinson and Weimin Han, Publisher: Springer, 2000.

Objectives: This course is the first part of the Numerical Analysis sequence (Math 451-Math 452-Math 453) offered at Cal Poly San Luis Obispo. It will introduce foundational numerical methods used for problems that arise in many scientific fields. In particular, properties such as accuracy of methods, their stability and efficiency will be considered in this course. We will gain practical programming experience in implementing the methods using MATLAB, which will be taught through increasingly complex codes over the quarter, with examples in class and homework assignments. From time to time we will also discuss practical considerations of implementing these methods on modern computer architectures using C, C++, or Fortran. A detailed course outline containing the learning objectives for this class may be found at

https://content-calpoly-edu.s3.amazonaws.com/math/1/documents/451.pdf

Class Material by Topic: During the quarter, we will cover the following topics from the main textbook:

- Taylor Polynomials, Finite Precision Arithmetic and Error Propagation (briefly)
- Root-finding methods and Fixed-Point Theory
- Interpolation and Approximation
- Numerical Integration and Differentiation
- Linear Equations (Direct and Iterative methods)
- Advanced Topics in Numerical Linear Algebra
- Introduction to Numerical methods for IVPs (if time permits)

A tentative schedule is posted on the course web page under "Syllabus and Tentative Schedule."

Course Prerequisites: Math 206 and Math 242, or Math 241 and Math 244, or equivalent.

Programming Prerequisites: Introductory college-level programming course. It should be noted that **MATLAB** will be used in class and for homework assignments. Of course you can use **any** programming language such as Julia, Python, Fortran, C/C++, and so on. There are a few PDF files and links for help with MATLAB on the course web page.

Homework and Exams: There will be (almost) weekly **written** homework assignments including **computational tasks**. For the latter, you will have to include/attach your codes in your homework. Please make sure you include as many **comments** as possible in your codes such that they could be read and easily understood. For a complete list of all homework assigned to date, please visit the Canvas page for the course. Each assignment will consist of a group of problems and your task will be to write up solutions for each one and develop codes when the question is asking for doing so. **No late homework will be accepted.** Please keep in mind that you will be rewarded not only for getting a correct answer but most importantly for the structure and presentation of your work. Finally, struggling through a question in the homework and most particularly in a computational/programming task is not something unusual. Please make sure you start developing your codes way in advance in order you to check and debug your programs.

There will be **one take home exam** and **one cumulative final**. For their schedule, see below the "Important Dates" section of this document.

Grading Policy and Exams: Your final grade in this course is computed according to:

Homework	35%
Midterm	25%
Final Exam	40%

Important Dates and Academic Holidays:

Martin Luther King	Monday, January 18
(Monday schedule is followed on Tuesday, January 19)	
Midterm	TBA
Washington's Birthday	Monday, February 15
Last day of classes	Friday, March 12
Final Exam	Saturday, March 13

Class Policies:

- All exams are **take-home** exams.
- **Attendance is mandatory**. However, an **excused absence** can be allowed only if the reason for your absence falls into any of the categories listed in the following page:

  https://academicprograms.calpoly.edu/content/academicpolicies/class-attendance

  Please inform me as soon as possible if you are seeking to make up missed work pursuant to the excusable reasons listed in the url above.

Students with Disabilities: The University provides disability-related support services to qualified students through the Disabilities Resource Center (DRC). If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both me and the DRC (124-119) at (805) 756-1395, as early as possible in the term. In addition, and for your convenience, their website is https://drc.calpoly.edu/. Note that use of DRC services including testing accommodations requires prior authorization by the DRC and compliance with approved procedures. **Make sure you initiate any needed arrangements well in advance of an exam date**.

Diversity and Inclusion: I am fully committed to an academic environment that is free of bias against any group and I firmly believe in the value of diversity in people and ideas. My ultimate goal is to establish that this class is a welcoming environment to every-one regardless of gender identity, sexual orientation, race, ethnicity, or religious identity. The University and I do not tolerate discrimination. Please feel comfortable coming to me or an administration if at any point you ever feel uncomfortable for any reason.