Math 451: Numerical Analysis I

Winter 2022

Instructor:	Dr. Stathis Charalampidis	**Office:**	25-319 (Faculty Offices East)
Email:	echarala@calpoly.edu	**Phone:**	(805) 756-2465

Course Web Page: https://www.egcharalampidis.com/teaching/451_W22/math_451_W22/

Class Meetings:

- Section 1 (MTRF): 08:10-09:00am (38-218)

Office Hours: T 12:00-1:15pm and R 9:15-10:30am, or by appointment.

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, and an introductory college-level programming language (see, next!).

Programming Prerequisites: In this course, the programming language and numeric computing environment **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 (the PDF files can be found on Canvas too).

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 in-class exam** and **one cumulative final**. For their schedule, see below the "Important Dates" section of this document. Before **the midterm and final exams**, I will hold outside the regular class time review sessions according to:

Review session for midterm	Friday, February 4 (TBA)
Review session for final	Friday, March 11 (TBA)

In these review sessions, we will be solving practice problems and past exams. Of course, I would be more than happy to answer any questions you might have!

Note that no makeup midterms will be given. In addition, further details about the policies of the final exam can be found by visiting the link:

https://academicprograms.calpoly.edu/content/academicpolicies/final-exams

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 17
(Monday schedule is followed on Tuesday, January 18)	
Midterm	Friday, February 11
Washington's Birthday	Monday, February 21
Last day of classes	Friday, March 12
Final Exam	Friday, March 18, 7:10-10:00am

Exams and Class Policies:

- All exams will be closed-book. Exams are primarily based on the material we cover in class and the homework.
- Absolutely no formula sheets and class notes will be allowed during midterm and final exams.
- Please go through the cheating and plagiarism procedures by clicking here.
- You are respectfully asked for turning off your cell phones during class time and 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/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.

COVID-19 Compliance, Classroom, and Campus Safety:

Cal Poly is committed to protecting the health and safety of the campus community. Taking preventative steps, as well as monitoring your health and staying home if you are feeling unwell, will help protect the entire Cal Poly community.

By participating in this course, you agree to abide by all campus safety protocols. Please note that safety protocols may change throughout the quarter. You must follow all protocols as outlined in the most recent campus updates including:

- **Vaccination**: All students, faculty, and staff who access campus, or any CSU facilities, are required either to be fully vaccinated or to qualify for a medical or religious exemption.
- **Face Coverings**: Per Cal Poly policy, you must always properly wear a face covering in the classroom, regardless of vaccination status. If you are seen in class **without** a face covering or are wearing it improperly, you will be invited to put one on or be reminded to wear it properly. Acceptable face coverings must:
  - Completely cover the nose and mouth.
  - Fit snugly against the side of the face with secured ties/ear loops.
  - Allow breathing without restriction.
  - Be clean and undamaged. Wash your hands before putting on a face covering.

If you do not have a face covering with you, you will be asked to visit the nearest sanitation station to get one and then return to class. If you refuse to wear a face covering in the classroom, you will be asked to leave. Students not in compliance with face covering requirements also may be reported to the Office of Student Rights and Responsibilities (https://osrr.calpoly.edu/). While campus policy states, "Individuals do not need to wear a face covering while alone in their residence or personal/private office, or while eating or drinking," eating and drinking will not be permitted in the classroom. More information on face covering requirements is available on the Face Coverings webpage (https://coronavirus.calpoly.edu/face-coverings).

Testing and Compliance

Unvaccinated students must participate in ongoing COVID-19 testing and reporting as required by the University. Check the COVID-19 Info tab on your portal daily to determine your testing requirement and compliance status. If you are required to participate in ongoing testing, be reminded that **it is your responsibility to do so**. More details are available on the COVID-19 Testing webpage (https://coronavirus.calpoly.edu/covid-19-testing).

Failure to comply with testing requirements may result in restrictions from campus services, spaces, and applications, including access to the Cal Poly Portal, Canvas, and Zoom. You will receive several notifications before restrictions occur; please heed those notifications and alert me in advance of restrictions from campus applications. Be reminded that University policy:

https://www.catalog.calpoly.edu/universitypolicies/#emailanofficialmeansofcommunicationtostudents

states, "campus email is an official method of campus communication to students and may be used as the sole method of communication for some campus matters." Campus policy will be followed, and communications will be initiated through Cal Poly email. An absence, including any late or missed work, due to testing non-compliance restrictions may be considered unexcused and is subject to the course attendance and make-up work policies.

Daily Symptoms Screening

You must complete the **daily health screening by noon (12 p.m.) or before arriving on campus, whichever comes first**, to receive a campus pass, regardless of vaccination status. Upon completion of the daily health screening, you will receive a daily campus pass. Note that having a blue pass does not fall within the University's attendance guidelines for excused absences. Absences due to a blue pass are therefore subject to course attendance and make-up work policies. Please visit the COVID-19 Daily Self-Screening webpage:

https://coronavirus.calpoly.edu/covid-19-self-screening

for more information on the campus pass.

Please follow current health and safety guidelines, monitor yourselves for COVID-19 symptoms, stay home if you have any COVID-19 symptoms, and get tested if you are symptomatic or learn that a close contact has been infected. Learn more about protecting your health and well-being while on campus by visiting the university Coronavirus Information webpage:

https://coronavirus.calpoly.edu/