MATH 131
NUMERICAL ANALYSIS
SPRING 2024 SYLLABUS

Lecture time:	Tuesday/Thursday 1:30-2:45
Lecture room:	SSB 160
Instructor:	Juan C. Meza
E-mail address:	jcmeza@ucmerced.edu
Office:	ACS 372
Office hours:	Tuesday 3:00-4:00 or by appointment: https://calendly.com/profmeza/office-hours

COURSE GOAL AND TOPICS

Numerical analysis has a long history that goes back beyond the modern electronic computing era. With the advent of computers, the field has grown even more rapidly and is now used in virtually all scientific areas. But what is numerical analysis? One popular definition of numerical analysis "is the study of algorithms for the problems of continuous mathematics" (Trefethen 2022). In practice, numerical analysis is a balancing act of several goals when solving mathematical problems on a computer. From this viewpoint, numerical analysis is the fine art of balancing accuracy, efficiency, and robustness of numerical algorithms for mathematical problems. In this course you will learn the concepts underlying these ideas and how to apply them. Any numerical method today will also entail computational implementations of algorithms. As such, we will discuss and implement some of the more important numerical algorithms on a computer and learn the consequences of working with finite precision.

COURSE LEARNING OUTCOMES

Upon completion of this course, students should be able to:

1. assess and articulate what type of numerical methods are appropriate for a given problem;
2. construct a numerical algorithm for solving a given problem and analyze its properties, such as convergence, accuracy, efficiency, and robustness;
3. implement, test, and validate codes to solve a given problem numerically;
4. analyze the results of numerical simulations.
5. present mathematical ideas clearly in writing.

COURSE MATERIALS

Textbook. The textbook for the course is *Numerical Analysis,* Richard L. Burden and J. Douglas Faires (Chapters 1-6). However, lectures may depart from the textbook or present material using alternative approaches. Unless indicated otherwise for a particular topic, you will be responsible for *all the material covered in the lectures* on the exams.

Course webpage. Math 131 website is part of the CatCourses course management system. All course materials will be posted under the course website.

Grade determination. Your grade in this class will be determined by the following combination:

40% Homeworks
25% Midterm exam
25% Final exam (or second mid-term)
10% Class participation (includes discussion sections)

Homework assignments will be comprised of both analytical and computational problems and will be graded for correctness of content, ***clarity of technical writing***, and overall presentation.

Late Policy:

- All students will be allowed a one-time token for a 24 hour extension to any assignment without any penalty. However, you must submit a request in writing no less than 24 hours prior to the deadline.
- Otherwise, late assignments will generally not be accepted unless there are extenuating circumstances (along with proper documentation), please contact me as soon as you are aware of the situation and an extension may be granted. A 20% penalty will normally be assessed on late homeworks.
- In all cases there will be ***no extensions without prior approval***.

ADDITIONAL COURSE INFORMATION

Please make sure to check the Resources & Policy section of the CatCourses website:
https://catcourses.ucmerced.edu/courses/25827/external_tools/1282

The Resource & Policy section will contain important information on many of the UCM course policies and resources available to all students. This will include topics such as:

- Principles of Community
- Course Add/Drop/Withdrawal Information
- Accommodations for Students
- Academic Honesty Policy
- etc.

CLASS SCHEDULE

(Subject to Change Depending on Class Discussions)

Week	Lecture	Topic
Week 1 Jan. 16	1-2	Introduction to Numerical Analysis; Foundations (Taylor Polynomials)
Week 2 Jan. 23	3-4	Sources of Error/Roundoff Error; Floating Pt Systems
Week 3 Jan. 30	5-6	IEEE Floating Point Standard; Computer Arithmetic
Week 4 Feb. 6	7-8	Algorithms/Conditioning
Week 5 Feb. 13	9-10	Nonlinear Equations/Bisection/Newton/Secant
Week 6 Feb. 20	11-12	Nonlinear Equations/Fixed Point Methods
Week 7 Feb. 27	13-14	Interpolation/Approximation
Week 8 Mar. 5	15	Interpolation/Approximation
Mar. 7	16	**Midterm 1 – March 7, 1:30-2:45**
Week 9 Mar. 12	17-18	Linear Systems/Least Squares
Week 10 Mar. 19	19-20	Linear Systems/Least Squares
Week 11	Spring Break	**Spring Break**
Week 12 Apr. 2	21-22	Numerical Differentiation
Week 13 Apr. 9	23-24	Numerical Integration
Week 14 Apr. 16	25-26	Initial Value Problems – Euler
Week 15 Apr. 23	27-28	Initial Value Problems – Higher Order
Week 16 Apr. 30	29	Initial Value Problems – Multi-Step
May 2	30	**Midterm 2, May 2, 1:30-2:45**