



Introduction to Numerical Analysis

MAD 4401

Fall 2020

Instructor



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Office: 460 Little Hall



Office Hours:
■ TBD

Lecture



Mondays/Wednesdays/Fridays



Period 8 (3:00–3:50pm)



Held Synchronously via Zoom

Web Site



Canvas:
<https://elearning.ufl.edu/>

Course Description

This course is an introduction to the basic techniques of numerical analysis, the study of methods for solving mathematical problems with computers. We will focus on the mathematical theory behind the methods and algorithms used.

Topics to be covered:

- binary and floating point representation of numbers
- methods to solve algebraic equations
- methods to solve systems of equations
- interpolation
- numerical differentiation and integration
- solving ordinary differential equations

Prerequisites: Linear algebra (MAS 3114 or MAS 4105) with a minimum grade of C and experience with a scientific programming language.

Textbook/Perusall

Perusall: We will be using **Perusall**, a collaborative and social eBook platform, to access the textbook in this course.

To get access to the textbook and Perusall, visit our course web site on Canvas.

Textbook: *Numerical Analysis* (3rd edition) by Timothy Sauer

Textbook companion web site (contains MATLAB code, solutions to selected exercises, and additional examples): <https://bit.ly/2yN3AEX>

Software

MATLAB: Homework assignments will have some MATLAB programming using **MATLAB Grader** (<https://grader.mathworks.com>).

The full MATLAB software will be used for the course project, which is available on any computing device through **UApps** (<https://info.apps.ufl.edu>) and in computer labs (<https://labs.at.ufl.edu/computer-labs/>). An alternative option is GNU Octave (<https://www.gnu.org/software/octave/>).

There will be no MATLAB questions on exams.

Synchronous Remote Lectures

Our lectures will be audio-visually recorded for students in the class to refer back to and for enrolled students who are unable to attend live.

Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate verbally are agreeing to have their voices recorded.

Students are welcome to use the “chat” feature to type questions and comments live. The chat will not be recorded or shared.

As in all courses, unauthorized recording and unauthorized sharing of course materials is prohibited.

Communication

Course Announcements: Posted on **Canvas**. It is the student’s responsibility to make sure they receive notifications for this course.

Discussion Board: Homework/content questions should be posted on our class discussion board on **TBD by students**.

Personal Matters: Students may e-mail the instructor via **Canvas Inbox** or e-mail using their official UF e-mail address.

Grading Scheme

20%	Homework	30%	Midterm Exams (15% each)
15%	Project	30%	Final Exam
5%	Participation/Engagement		

Your final course grade will be no lower than the following:

A = [93,100]	B+ = [87,90]	C+ = [76,80]	D = [60,70]
A- = [90,93]	B = [83,87]	C = [70,76]	E = [0,60]
	B- = [80,83]		

Grades are based only on academic work and are calculated using the same criteria for all students. It is unethical to bring to your instructor's attention the possible impact of your mathematics grade on your future plans, including graduation, scholarships, jobs, etc.

More information on UF grading policies (including requests for withdrawal (W) or incomplete (I*/I) grades) may be found at: <https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/>

Homework

Homework assignments will be due weekly via electronic submission through Canvas and/or MATLAB Grader.

Late submissions will receive a point deduction of 10% per day late. Note that late days are counted in 24-hour periods. For example, if the cutoff for on-time submission is 11:59pm, submitting between 12:00am–11:59pm the next day is one day late, and so on. Every assignment has a hard deadline, usually 2 days past the original due date, and late submissions (penalty or not) are *not accepted after the hard deadline*.

The **two** lowest homework scores will be dropped at the end of the semester.

Project

During the second half of the semester, you will have the opportunity to work as part of a team on a project using MATLAB (or GNU Octave). Your team will submit a write-up and an audio and/or video summary due on the last day of class.

Exams

Midterm Exams

Friday, October 16

Friday, November 13

Final Exam (comprehensive)

Tuesday, December 15 from 12:30pm–2:30pm

In general, there will be *no make-up exams* in the course. However, in complex and unusual circumstances which are beyond your control, a make-up exam may be given on a case-by-case basis. This will require providing a detailed account of the situation and supporting documents. The instructor must be notified as soon as possible, preferably **before** the exam is given with as much advanced notice as possible.

There are no exam retakes or corrections, no lowest exam will be dropped, and there will be no extra credit assignments to erase the consequences of a bad exam score.

Participation/Engagement

Participation/engagement is expected regularly in this class, but how you participate is (in part) up to you. There is flexibility in the ways that you can participate in class, including:

- Perusall reading assignments
- Weekly check-in surveys
- Asking questions/giving answers on the class discussion board
- Reflections on readings or virtual field trips

Health and Wellness Resources

- U Matter, We Care
<https://umatter.ufl.edu>
- Counseling and Wellness Center
<https://counseling.ufl.edu>
- Student Health Care Center
<https://shcc.ufl.edu>
- University Police Department
<https://police.ufl.edu>
- UF Health Shands Emergency Room/Trauma Center
<https://ufhealth.org/emergency-room-trauma-center>
- Screen, Test, & Protect
<https://coronavirus.ufhealth.org/screen-test-protect/>

Academic Resources

- Teaching Center
(tutoring, study groups)
<https://teachingcenter.ufl.edu>
- Student Success
(tutoring, coaching)
<https://studentsuccess.ufl.edu>
- Computing Help Desk
<https://helpdesk.ufl.edu>
- Career Connections Center
<https://career.ufl.edu>
- Library Support
<https://cms.uflib.ufl.edu/ask>

Attendance

Attending lectures and other course events are vital to the learning process. Furthermore, a huge part of the transition into your professional careers is being where you are supposed to be when you are supposed to be there. As such, your attendance is expected at every lecture.

See <http://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/> for more information on UF attendance policies.

Classroom/Online Behavior

To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed.

Diversity, Inclusion, and Equity

I am committed to diversity and inclusion of all students in this course. I acknowledge, respect, and value the diverse nature, background and perspective of students and believe that it furthers academic achievements. It is my intent to present materials and activities that are respectful of diversity: race, color, creed, gender, gender identity, sexual orientation, age, religious status, national origin, ethnicity, disability, socioeconomic status, and any other distinguishing qualities.

Honesty Policy Regarding Cheating, Plagiarism, etc.

UF students are bound by *The Honor Pledge* (<http://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>) which states,

We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment."

The Student Conduct Code (<http://sccr.dso.ufl.edu/process/student-conduct-code/>) specifies a number of behaviors that are in violation of the honor code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please or consult with the instructor in this class.

Accessibility and Accommodations

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the Disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs as early as possible in the semester.

Online Course Evaluations

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <http://gatorevals.aa.ufl.edu/students/>.

Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <http://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <http://gatorevals.aa.ufl.edu/public-results/>.

Tentative Lecture Schedule

Monday	Wednesday	Friday
August 31st <i>First day of class</i>	September 2nd 0.1 Evaluating a Polynomial 0.2 Binary Numbers	4th <i>Last day to drop/add courses</i> 0.3 Floating Point Representations of Real Numbers
7th No Classes (Labor Day)	9th 0.4 Loss of Significance 0.5 Review of Calculus	11th 1.1 The Bisection Method
14th 1.2 Fixed-Point Iteration	16th 1.2 Fixed-Point Iteration	18th 1.3 Limits of Accuracy
21st 1.4 Newton's Method	23rd 1.5 Root-Finding without Derivatives	25th 2.1 Gaussian Elimination
28th 2.2 The LU Factorization	30th 2.3 Sources of Error	October 2nd 2.4 The PA=LU Factorization
5th 2.5 Iterative Methods	7th 2.5 Iterative Methods	9th 2.6 Methods for Symmetric Positive-Definite Matrices
12th 2.6 Methods for Symmetric Positive-Definite Matrices	14th 2.7 Nonlinear Systems of Equations	16th Exam #1
19th 3.1 Data and Interpolating Functions	21st 3.1 Data and Interpolating Functions	23rd 3.2 Interpolation Error
26th 3.3 Chebychev Interpolation	28th 3.4 Cubic Splines	30th 3.4 Cubic Splines 3.5 Bézier Curves
November 2nd 5.1 Numerical Differentiation	4th 5.2 Newton–Cotes Formulas for Numerical Integration	6th 5.2 Newton–Cotes Formulas for Numerical Integration 5.3 Romberg Integration
9th 5.4 Adaptive Quadrature 5.5 Gaussian Quadrature	11th No Classes (Veterans Day)	13th Exam #2
16th 6.1 Initial Value Problems	18th 6.1 Initial Value Problems	20th 6.2 Analysis of Initial Value Problem Solvers

Monday	Wednesday	Friday
23rd <i>Last day to withdraw from courses with W</i> 6.3 Systems of Ordinary Differential Equations	25th No Classes (Thanksgiving)	27th No Classes (Thanksgiving)
30th 6.3 Systems of Ordinary Differential Equations	December 2nd 6.4 Runge–Kutta Methods and Applications	4th 6.5 Variable Step-Size Methods
7th 6.6 Implicit Methods and Stiff Equations 6.7 Multistep Methods	9th <i>Last day of class</i> <i>Last day to petition to your college for late withdrawal</i> 6.7 Multistep Methods	11th

Tuesday, December 15: Final Exam 12:30pm–2:30pm

Important Note: Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.