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## Courses

# MAD 6406: Numerical Linear Algebra (Fall 2024)

### Instructor

Instructor: Dr. Chunmei Wang

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Office: Little Hall 302

### Lecture

Mondays/Wednesdays/Fridays Period 5 (11:45am-12:35pm), Little Hall 205

Office hours: MWF Period 6

### Website

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

### Course Description

This course is designed for students in engineering, physical and mathematical sciences. The course covers most of materials in numerical linear algebra. We will address issues of algorithm development, implementation and applicability, the error analysis including effect of round off errors, available software packages, and parallel computing to some extent. Main topics include direct and iterative methods for solving system of linear equations, least squares solutions, eigenvalues problem, singular value decomposition, and non-linear system of equations.

### Topics to be covered

Introduction, round off errors & how to reduce them, vector and matrix norms, condition numbers.

Direct methods for linear systems, pivoting, LU, LL' decomposition, special matrices.

Iterative methods for linear systems, Jacobi, Gauss-Seidel, SOR, spectral radius, Krylov methods, CG and PCG, GMRES.

Iterative methods for non-linear systems, Newton method and variations, Broyden method.

Eigenvalue problems, eigenvalues estimation, Power and shifted Power method, orthogonal transformation, QR algorithm, least squares solution, SVD decomposition.

## Prerequisites

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

## Textbook

Numerical Linear Algebra, L. Trefethen and D. Bau, III. Published by SIAM: Society for Industrial and Applied Mathematics, 1997.

Numerical Mathematics, A. Quarteroni, R. Sacco, and F. Saleri

## Software

MATLAB is recommended. However, you can use Python, C, C++, Fortran, or other computer language and software packages as well. The full MATLAB software is available on any computing device through UF Apps (<https://info.apps.ufl.edu>) and in computer labs (<https://labs.at.ufl.edu/locations/>).

## Communication

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

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

## Attendance

Attending lectures 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. Furthermore, our focus is on the tasks at hand and not on extraneous activities such as chatting, texting, surfing the web/social media, etc. If you attend 90% of the class in the whole semester, you will be granted 4-point bonus. If you attend 80% of the class in the whole semester, you will be granted 2-point bonus.

## Homework

Homework will be assigned bi-weekly on Canvas and will be due in person in class.

## Exams

Midterm Exam (in Mid-October)

Final Exam (comprehensive)

## Grading Scheme

60% Homework

15% Midterm Exam

25% Final Exam

Your final course grade will be no lower than the following: A-=[90,93) A=[93,100] B-=[80,83) B=[83,87) B+=[87,90) C=[70,76) C+=[76,80) D=[60,70) E=[0,60)

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) grades) may be found at:

<https://catalog.ufl.edu/UGRD/academicregulations/grades-grading-policies/>

## Make-Up Policy for Homework/Exams

Make-up homework/exam work is allowed only when written evidence of an official University excused absence is provided

(<http://catalog.ufl.edu/UGRD/academicregulations/attendance-policies/>).

The instructor must be notified as soon as possible, preferably before the homework or exam due date with as much advanced notice as possible. A detailed account of the situation and supporting documents are required.

If you do not have an official University excused absence but are unable to complete homework on time for any reason, see the Late Policy below.

## Late Policy for Homework

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.

## Classroom 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.

The use of personal electronics such as laptops, tablets, and cell phones is distracting to the other students and the instructor. Their use can degrade the learning environment. Therefore, students are not permitted to use these devices during the class period (unless they are being used solely for note taking purposes).

## Accessibility

Accessibility and Accommodation

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/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.

## 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-conductcode/>) 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.

## Online Course Evaluation

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/publicresults/>.

**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.**

