

Matrix and Numerical Methods in Systems Engineering

ESI3327C Section 5201

Class Periods: M Period 10 - 11 (5:10 pm - 7:05 pm), W Period 10 (5:10 pm – 6:00 pm)

Location: LAR0310

Academic Term: Spring 2025

Instructor:

Name: Yu Yang

Email Address: yu.yang@ise.ufl.edu

Office Phone Number: (352) 294-7727

Extra Office Hours: MW 4:00 pm to 5:00 pm, Weil Hall 401C/Zoom: <https://ufl.zoom.us/j/93018207618>

Grader:

Name: Brandon Mancilla

Email Address: brandon.mancilla@ufl.edu

Please contact him if you have any questions related to grading.

Course Description

This is a 3-credit course that covers the theory and application of vectors, matrices, and related numerical methods in systems engineering with a focus on the solution of linear systems and general equations. Additional topics, including error analysis, interpolation, and numerical integration, will also be briefly introduced. The lab sessions will be dedicated to numerical solutions using Python.

Course Pre-Requisites / Co-Requisites

MAC2313 and MAS3314 with minimum grades of C.

Course Objectives

- To understand the fundamental ideas underlying numerical methods presented in the course
- To understand computational complexity and modern developments in numerical methods
- To be able to solve small-sized problems analytically and solve general problems using Python.

To be successful in this class, you will need to invest a lot of your time and be ready to carry a lot of work. It will be rewarding because the techniques you learn can facilitate your understanding of other classes in the IE curriculum and enhance your problem-solving skills significantly.

Materials and Supply Fees

No fees.

Relation to Program Outcomes (ABET):

The table below is an example. Please consult with your department's ABET coordinator when filling this out.

Outcome	Coverage*
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	High
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	
3. An ability to communicate effectively with a range of audiences	

4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	Medium

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not covered or assessed in the course.

Recommended Textbooks

Title: *Numerical Methods and Optimization: An Introduction*

Authors: S. Butenko and P. Pardalos

Publisher: Chapman and Hall, 1st edition

ISBN: 9781466577770

Course Schedule

The course schedule, including the dates of the exams, is offered as a guide and is subject to change depending on the pace of the class. The instructor might choose to cover parts of the curriculum more extensively or extend deadlines.

Week	Date	Lecture	Topic
1	M 1/13	1	Course Introduction + Vectors, Matrices and Their Properties
	W 1/15	2	Vectors, Matrices, and Their Properties
2	M 1/20		MLK Day- No Class
	W 1/22	3	Vectors, Matrices, and Their Properties
3	M 1/27	4	Vectors, Matrices, and Their Properties
	W 1/29	5	Lab-1 Python Basics + Matrix Properties (HW1 Due, HW2 Out)
4	M 2/3	6	Numbers and Errors
	W 2/5	7	Numbers and Errors
5	M 2/10	8	Direct Methods for Solving Linear Systems
	W 2/12	9	Direct Methods for Solving Linear Systems (HW2 Due, HW3 Out)
6	M 2/17	10	Direct Methods for Solving Linear Systems
	W 2/19	11	Iterative Methods for Solving Linear Systems
7	M 2/24	12	Iterative Methods for Solving Linear Systems
	W 2/26	13	Lab-2 Solving Linear Systems
8	M 3/3	14	Stability
	W 3/5	15	Computing Eigenvalues and Eigenvectors
9	M 3/10	16	Midterm Review (HW3 Due, HW4 Out)
	W 3/12		Midterm
10	M 3/17		Spring Break - No class
	W 3/19		Spring Break - No class

11	M 3/24	17	Fixed Point + Bracketing Method
	W 3/26	18	Fixed Point + Bracketing Method
12	M 3/31	19	Newton's Method + Secant Method
	W 4/2	20	Lab-3 Power Method + Solving Equations (HW4 Due, HW5 Out)
13	M 4/7	21	Polynomial Interpolation
	W 4/9	22	Polynomial Interpolation
14	M 4/14	23	Numerical Integration
	W 4/16	24	Numerical Integration
15	M 4/21	25	Lab-4 Interpolation + Integration (HW5 Due)
	W 4/23	26	Final Review
16	W 4/30		

Attendance: Attendance is not required; however, it is strongly recommended. Random attendance will be taken and bonus points will be given (totaling 5%). **You are responsible for the announcements made in class.** Students are expected to know the material covered in the prerequisite courses. When necessary, they are expected to relearn material from these courses on their own.

Class Expectations: To ensure a classroom environment conducive to success for everyone, please turn off cell phones before class starts. Please make an effort to arrive at class on time. If you must enter the classroom late, be considerate and be as quiet as possible. Refrain from leaving early. If you need to do so, be as quiet as possible. Examples of a positive contribution to the class include asking questions that clarify any confusion you might be experiencing, constructively challenging the assumptions of a model, communicating your opinion about an open problem or sharing your personal experience.

Homework: You are allowed to discuss problems with other students in the class, and you may refer to online resources, but you cannot share complete answers with each other. If you use any external resources (ideas from classmates, the internet, etc.), you must properly mention them at the start of your solution to each problem. You will **NOT** lose any points for telling the truth.

Late Assignment Policy: All homework assignments should be submitted in class or via Canvas before 5:10 pm on the due date. Late submissions will be deducted 25% for each additional day. Submissions later than 5:10 pm on the same day will also be counted as late for one day, and there will be a 25% deduction. **Submissions that are four or more days late will receive 0 points.**

Make-Up Policy: Students needing a make-up exam due to schedule conflicts with another course exam must provide documentation and notify the instructor **at least two weeks** before the day the exam is scheduled for. If you miss any exam due to a justified emergency (evidence must be provided), you must contact the instructor immediately **within 24 hours** to schedule a make-up exam. Please note that employment interviews, employer events, weddings, vacations, etc. **are not excused absences.**

Regarding Request:

- Compare your solution to the solution posted on the website using the detailed grade breakdown you receive.
- **Within one week** after your grade has been posted, e-mail the grader requesting a grade breakdown or ask any question you may have.
- **Within the first week**, if you still have questions about your grade, meet the instructor during office hours.

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Homework Sets (5)	100 each	40%
Midterm Exam	100	30%
Final Exam	100	30%
Random Attendance Bonus	TBD	5%
Total		105%

Grading Policy (Subject to Change)

A grade of C is required to pass this class. A C- is NOT considered passing.

Percent	Grade	Grade Points
92.0 - 100	A	4.00
90.0 - 91.9	A-	3.67
86.0 - 89.9	B+	3.33
82.0 - 85.9	B	3.00
78.0 - 81.9	B-	2.67
74.0 - 77.9	C+	2.33
71.0 - 73.9	C	2.00
68.0 - 70.9	C-	1.67
65.0 - 67.9	D+	1.33
62.0 - 64.9	D	1.00
60.0 - 61.9	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at: <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Students Requiring 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.

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 <https://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 <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

In-Class Recording

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture

does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

University Honesty Policy

UF students are bound by The Honor Pledge 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 Honor Code (<https://sccr.dso.ufl.edu/process/student-conduct-code/>) specifies a number of behaviors that are in violation of this 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 consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values varied perspectives and lived experiences within our community and is committed to supporting the University’s core values, including the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of race, creed, color, religion, age, disability, sex, sexual orientation, gender identity and expression, marital status, national origin, political opinions or affiliations, genetic information, and veteran status.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- HWCoe Human Resources, 352-392-0904, student-support-hr@eng.ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html>

Campus Resources:

Health and Wellness

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: <https://counseling.ufl.edu>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. <https://lss.at.ufl.edu/help.shtml>.

Career Connections Center, Reitz Union, 392-1601. Career assistance and counseling; <https://career.ufl.edu>.

Library Support, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. <https://teachingcenter.ufl.edu/>.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. <https://writing.ufl.edu/writing-studio/>.

Student Complaints Campus: <https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>; <https://care.dso.ufl.edu>.

On-Line Students Complaints: <https://distance.ufl.edu/getting-help/>; <https://distance.ufl.edu/state-authorization-status/#student-complaint>.