MATH 245: Numerical Methods and Mathematical Computing, Fall 2024

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1 Basic Information

Classes meet	Monday, Wednesday and Friday from 1 to 1:50 pm
Textbooks	There is no required text to purchase; the primary source is the instructor's OER web-based book Introduction to Numerical Methods and Analysis with Python[1], (also available in printable (PDF) form[2]), and a collection of interactive Jupyter notebooks.
Professor's Office Hours	To see me out of class, there are two options: • After any class, and • by appointment: arrange by email or by talking with me in-class.
Professor's Office	Room 344, Robert S. Small Building.
Professor's Email Address	lemesurierb@cofc.edu
Professor's Websites	http://lemesurierb.people.cofc.edu/ and http://blogs.cofc.edu/lemesurierb/, but once the course starts, most online communication will be through OAKS[3].
Prerequisites	MATH 203 and MATH 220, or permission of the instructor.

2 Course Objectives and Student Learning Outcomes

The main expectation of this course is that students learn methods for computing accurate numerical solutions to mathematical and scientific problems, and acquire an understanding of when and why particular methods work, and how reliable, accurate and efficient they are.

This will be done in conjunction with learning how to use computational software to implement algorithms for computing numerical solutions to mathematical problems, and to present results appropriately with graphs, tables and written discussions.

The core topics are:

- Numerically computing the zeros of functions.
- Solving systems of simultaneous linear equations.
- Approximating functions by polynomials.
- Approximating periodic functions by sinusouidal functions.

[1] lemesurierb.people.cofc.edu/introduction-to-numerical-methods-and-analysis-python/
[2] lemesurierb.people.cofc.edu/introduction-to-numerical-methods-and-analysis-python.pdf
[3] lms.cofc.edu/

- Fitting straight lines and simple curves to experimental data.
- Approximating derivatives and definite integrals.

We will assess the accuracy and speed of the various methods, and to help with this, we will review and use Taylor polynomials.

There are many possible optional topics for the final project mentioned below, including

- solving initial value problems for differential equations,
- solving boundary value problems for differential equations,
- finding the minimum of a function of several variables,
- computing eigenvalues and eigenvectors,
- or a more specific application arising in another course.

3 Undergraduate Mathematics Program Student Learning Outcomes

This course can be used to satisfy some requirements of the undergraduate mathematics degree program, for which there are also some standard goals. Students will:

1. Use algebra, geometry, calculus and other track-appropriate sub-disciplines of mathematics to model phenomena in mathematical terms.
2. Use algebra, geometry, calculus and other track-appropriate sub-disciplines of mathematics to derive correct answers to challenging questions by applying the models from the previous Learning Outcome.
3. Write complete, grammatically and logically correct arguments to prove their conclusions.

These outcomes will be assessed on the tests and projects.

4 Computers and Software

No familiarity with this software or computer programming is assumed; learning that is part of the course's objectives.

We will primarily use the programming language Python[1] together with some add-on packages for scientific computing, like Numpy[2] and SciPy[3] for numerical computing tools, Matplotlib[4] for graphics, along with the Jupyter interactive notebook system[5].

However, if a student is fluent in Matlab™, that can be used instead for programming work.

All of the Python tools are available as parts of the free software Anaconda[6], downloadable from https://www.anaconda.com/download/.

5 Graded Work: Assignments, Exams, and Projects

There will be

- assignments every few weeks, involving a mixture of written and programming work;
- two programming projects;
- two mid-terms exams,
- and a final exam.

[1] www.python.org
[2] www.numpy.org
[3] www.scipy.org
[4] matplotlib.org
[5] jupyter.org/
[6] www.anaconda.com/Anaconda

The exams will be partly or entirely take-home.

The second project will be one that you choose individually, with the option of customizing it to fit with topics from another course.

For all computer work, you will submit drafts for for my comments and then a final version, and we will discuss your work-in-progress to ensure that the final version is working well.

6 Grading Scheme

The total grade will be weighted

- 25% on the assignment total,
- 15% on each of the projects, and
- 15% on each of the three exams.

The aggregate score guarantees at least the following grades:

A	A^-	B^+	B	B^-	C^+	C	C^-	D^+	D	D^-
90–100	87–89	84–86	80–83	77–79	74–76	70–73	67–69	64–66	60–63	57–59

7 Reading Assignments and Question Time

I will usually set reading at the end of each class, and start each class with time for questions on the reading, current assignments and such.

8 Participation Requirements

I will not check attendance, but you are expected to attend and you are responsible for knowing what happens in each class including assignments, information about test and project topics, and due dates.

Thus if you miss a class, check for news, either from a classmate or from me; checking the course's section in OAKS[1] should help.

9 Accommodations for Students with Disabilities

If you have a documented disability, please contact me during the first two weeks of class or as soon as you have been approved to receive accommodations, so that reasonable accommodations can be arranged.

Approval for such accommodations is arranged through the Center for Disability Services: see http://disabilityservices.cofc.edu/accommodations/

10 College of Charleston Honor Code and Academic Integrity

Lying, cheating, attempted cheating, and plagiarism are violations of our Honor Code that, when identified, are investigated. Each incident will be examined to determine the degree of deception involved.

Cases of suspected academic dishonesty will be reported directly to the Dean of Students. A student found responsible by the Honor Board for academic dishonesty will receive a XXF in the course, indicating failure of the course due to academic dishonesty. This grade will appear on the student's transcript for two years after which the student may petition for the XX to be expunged. The F is permanent. The student may also be placed on disciplinary probation, suspended (temporary removal) or expelled (permanent removal) from the College by the Honor Board.

[1] lms.cofc.edu

Students should be aware that unauthorized collaboration or working together without permission is a form of cheating. Unless the instructor specifies that students can work together on an assignment, quiz and/or test, no collaboration during the completion of the assignment is permitted. Other forms of cheating include possessing or using an unauthorized study aid (which could include accessing information via a cell phone or computer), copying from others' exams, fabricating data, and giving unauthorized assistance.

Students can find the complete Honor Code in this page about the Honor System[1]; see also this page about the Student Handbook[2].

[1] deanofstudents.cofc.edu/honor-system/
[2] deanofstudents.cofc.edu/honor-system/studenthandbook/