MATH 445: Numerical Analysis, Spring 2020

Class Meetings:	Monday and Wednesday 7:00–8:15 pm, in Maybank 200.
Prerequisites:	MATH 203, MATH 245 and MATH 323.
Text:	**Numerical Mathematics and Computing** (7th Ed.) by Ward Cheney and David Kincaid.
Instructor:	Brenton LeMesurier
Office:	Robert Scott Small Building, room 344
Phone:	953-5917
Email:	lemesurierb@cofc.edu
Web Site:	http://blogs.cofc.edu/lemesurierb/
Office Hours:	To be arranged; initially, before class and by appointment.

Note: some details, like test dates and assessment, are subject to revision after discussion with the class.

Course objectives, structure, and student learning outcomes

The main objective is to learn to devise, evaluate and use methods for computing accurate numerical solutions to a variety of numerical problems, with the numerical solution of differential equations used as an organizing theme for the study of other topics. The evaluation of numerical methods includes judging their accuracy and efficiency, including the effects of rounding in computer arithmetic and errors in input data.

Upon completion of the course, students will be able to

- apply numerical methods for solutions of differential equations, systems of linear and nonlinear equations, eigenvalue problems, and for the evaluation of definite integrals and approximation of functions by polynomials and sinusoidal functions;
- present results in reports that include descriptions of the problems to be solved, the methods used, implementation of those methods in a suitable programming language, numerical results, interpretation and explanation of those results, and evaluation of the methods used; and
- choose between several possible methods based on evaluations of criteria like accuracy, robustness and efficiency.

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 are expected to display a thorough understanding of the topics covered. In particular, upon completion of the course, students will be able to

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; and
3. write complete, grammatically and logically correct arguments to prove their conclusions.

These outcomes will be assessed on the tests and projects.

Computational work and tools

Computational work will typically be done with Python, but if you are experienced with an alternative like Matlab you may use that if you prefer to do so. (I do not recommend it though!) I will use Python version 3.6, with the packages NumPy, SciPy, and Matplotlib, along with the Jupyter interactive notebook system for examples in class and most course material distributed online; I recommend this collecion of software for advantages like being free, easy to install on your own computer, and widely used in the modern scientific and technical work. All this can be accessed most easily by installing the free Anaconda package:
see `https://www.anaconda.com/download/` for some installation options.

All needed software is available on the computers in MYBK 200, along with Matlab, R and Mathematica.

Assessment

Assignments There will be assignments every few weeks. As these assignments are intended largely as educational experiences, I will be happy to give help with both mathematical and programming problems. What is more, I expect some exercises to be challenging enough that they need to be discussed in class, so you definitely should start work on them at least a week in advance!

Tests There will be two mid-semester exams with an in-class part and a take-home part, and a final exam at **Saturday April 25 from 7:30 to 10:30 pm**.

Projects Computer based work will be done mostly in several projects rather than numerous shorter tasks.

I will emphasize that the first step of any computational work is a careful written discussion of the mathematical background and numerical algorithms to be used, and the final step is a presentation and discussion of any computed results, not just a collection of computer output files full of numerical values and graphs.

Attendance and participation

You are responsible for knowing what happens in each class such as handouts and announcements of assignment details and deadlines, so if you miss one, get notes and find out about such details; either from me or a classmate.

The primary measure of participation is working on assignments, projects and such: students will be dropped [WA] for missing more than two assessment tasks without explanation.

Grading system Subject to discussion, I propose that

- the assignments will count a total of 30%,
- the projects will count a total of 40%, and
- each test will count 15% for a total of 30%.

Final course grades will be determined by the scale

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

Accommodations for students with disabilities

If there is a student in this class who has a documented disability and has been approved to receive accommodations through the Center for Disability Services/SNAP (Students Needing Access Parity), please come and discuss this with me during my office hours.

See also http://disabilityservices.cofc.edu/accommodations/

Honor Code

Any violation of the College's Honor Code will be reported to the Honor Board. For more details, see http://studentaffairs.cofc.edu/honor-system/ and the Student Handbook at http://studentaffairs.cofc.edu/honor-system/studenthandbook/