Math 245: Numerical Methods and Mathematical Computing

Dr. Brenton LeMesurier

Fall 2015

Classes meet: Monday, Wednesday and Friday, 1-1:50 pm in Maybank 200
Text: **Numerical Analysis** (2nd ed.) by Timothy Sauer
Office: Robert Scott Small Building, room 200
Phone: 953-5917, messages 953-5730 (but email is better for messages)
Email: lemesurierb@cofc.edu
Web Site: http://blogs.cofc.edu/lemesurierb/
Office Hours: To be arranged: for now I am available immediately after each class.

There is a site for this course in the College's Learning Management System OAKS at http://lms.cofc.edu, also accessible via MyCharleston at http://my.cofc.edu.

Course Objectives and Expected Student 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.

The first main topic is a review of Taylor polynomials, which are a basic tool in numerical computation because they allow the approximation of many functions by polynomials, which are easy to work with.

Then we consider general issues of how to describe and measure the accuracy of numerical solutions, and sources of inaccuracy such as rounding in arithmetic.

We will see methods for numerically solving problems such as nonlinear equations, systems of simultaneous equations, approximating functions by polynomials, fitting straight lines and simple curves to experimental data, and approximating derivatives and definite integrals: mainly from Chapters 1 to 5 of the textbook, but not all sections of each chapter. We will also look briefly at solving differential equations (Chapter 10), to preview an important topic that you are likely to see in later courses.

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.

Computers and Software

We will use the programming language Python 3 together with some add-on packages for scientific computing: Numpy and SciPy for numerical computing tools, and Matplotlib for graphics. We will also use the iPython/Jupyter interactive notebook system occasionally in this course (and more often in Math 246). No familiarity with this software or computer programming is assumed; that can be learnt in the co-requisite course Math 246: *Numerical Computing and Programming Laboratory*.

This software is most easily accessed through the integrated development environment Anaconda, which is available in the computer classroom Maybank 200, and can be easily downloaded and installed on any Windows, Mac OS, or Linux computer. This will be discussed more in MATH 246.

Graded Work: Assignments, Tests and Projects

There will be assignments every few weeks, involving a mixture of written and programming work; two programming projects; and two tests.

The last 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 right.

Grading Scheme

The total grade will be weighted an equal 20% on the assignment total, each project, and each test. The aggregate score guarantees at least the following letter grades:

$$\geq 90\% : \text{A} \qquad \geq 80\% : \text{B} \qquad \geq 70\% : \text{C} \qquad \geq 60\% : \text{D}.$$

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.

Class Attendance Policy

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 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 at `https://lms.cofc.edu` should help.

Missing a test or or project or more than two assignments without adequate explanation may lead to a W/A: withdrawal due to absence. So if you miss any of these, you should contact me promptly to explain why.

Some important dates and times

Monday August 31	Last day to drop/add courses.
Monday September 7	Labor day — classes do meet.
Friday October 2	Test 1, proposed date.
October 19 & 20	Fall break.
Thursday October 29	Last day to withdraw with a grade of "W".
Tuesday November 3	Election day — classes do meet.
Friday November 13	Test 2, proposed date.
Wed. November 25 – Fri. November 27	Thanksgiving break — no classes.
Monday December 7	Last day of classes.