

Mathematics 545: Numerical Analysis I

Class Meetings: Tuesday and Thursday 4:00–5:15 pm, in Maybank 200
Text: **Numerical Mathematics and Computing** (preferably the 7th ed.)
by Ward Cheney and David Kincaid
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Office Hours: Monday 2–3 pm, Tuesday 3–3:50 pm, Wednesday 2–3 pm,
Thursday 11am–noon, 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 and efficiency.

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 3.5, with the packages NumPy, SciPy, and Matplotlib for examples in class, and recommend it for advantages like being free and easy to install on your own computer. All this can be accessed most easily by installing Spyder from <https://github.com/spyder-ide/spyder/releases/> All needed software is available on the computers in MYBK 200, along with Matlab, R and Mathematica.

Assessment

Assignments There will be assignments about every two 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! *Graduate students will answer some additional questions on assignments.*

Tests There will be two tests: a mid-semester with an in-class part on **Thursday February 25** and a take-home part due on **Tuesday March 1**; and a final at the scheduled exam time of **noon to 3 pm, Thursday April 28**. *Graduate students will answer some additional questions on tests.*

Projects Computer based work will be done mostly in several projects rather than numerous shorter tasks. *Projects will have some additional requirements for graduate students.*

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

Regular, punctual attendance is important, especially due to the “hands-on” computational work that will be done at times. Students will be dropped [WA] for missing more than two assessment tasks without explanation.

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.

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	B ⁺	B	C ⁺	C
91–100	86–90	80–85	76–79	70–75

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/>