Numerical Analysis

Syllabus for MATH 315

Term: Fall 2016
Time: TuTh 11:30 a.m. -12:45 p.m.
Room: White Hall 207

Instructor: Bree Ettinger
E-mail: betting@emory.edu
Office: MSC W404

Office Hours: 2:00-3:45 Th, 9:30-11:30 F or by appointment

Text: *Introduction to Scientific Computing using Matlab* by I. Gladwell, J. G. Nagy and W. E. Ferguson, Jr.

Course Description: Solution of linear and nonlinear systems of equations, interpolation, least-squares approximation, numerical integration, and differentiation.

Evaluation: The overall course grade is determined as follows:

Cody Coursework: 10%	Bottle Project: 20%
Tests [best 4 out of 5]: 40%	Final exam: 30%

The final examination will be on

Tuesday 13 December 3:00 p.m.- 5:30p.m.

The final exam will cover all of the course material. The time of the final exam cannot be changed. The **in-class** tests will be given during the first 30 to 45 minutes of class on

Tuesday 6 September, **Tuesday 27 September**, **Tuesday 25 October**, **Tuesday 8 November**, and **Tuesday 1 December**.

The times will be confirmed in class well in advance of the exam dates. No make-up tests will be given.

Homework and Cody Coursework: Suggested homework problems for each chapter will be posted but not graded. These problems are assigned to help you study for the 5 tests. Five or six Cody Coursework assignments will be linked to on Canvas. You will complete the Cody Coursework projects for a grade. You are encouraged to work together to find solutions, however, each student must submit their own work. There is no collaboration of any kind allowed on the tests or the final exam. Write legibly; if an answer is not readable, you will receive no credit.

Show all of your work on all assignments, tests and the final exam, supplying all necessary *reasoning* and calculations. No work = no credit! If a graph is part of a solution, axes must be labelled, units marked off, functions labelled.

Labs: After each in-class test, we will complete a *Lab project*. Please **bring your computer or tablet** for the lab projects. Labs will be submitted in-class though Gradescope.

Students with Disabilities: If you have a disability and would like to request accommodations, please see me to discuss arrangements.

Calculators, Laptops, Tablets, Phones: You may use a calculator such as a TI-83 Plus for doing calculations on the homework. However, calculators are not allowed on tests nor the Final Exam. All cellphones, PDAs, laptops, and any other devices with internet, phone or messaging capabilities **must be turned off and put away at the beginning of each class**.

The Honor Code: The Emory College Honor Code applies to all work in this class, including homework, labs, tests and the final examination. See

http://catalog.college.emory.edu/academic/policies-regulations/honor-code.html

Missed Exams: Please see the section *Incompletes and Absences* at:

http://catalog.college.emory.edu/academic/policies-regulations/incomplete-absence.html

The in-class exams during the term are "required midterm examinations" so are subject to the rule described there. If you know that you will have to miss an exam in advance, due to illness or a university-sanctioned off-campus commitment, **you must contact the course instructor before the exam**. Excuses such as travel for other reasons, non-Emory exams, etc., are not valid reasons for missing exams.

Matlab: Matlab is a matrix-vector based system for scientific computation and graphics. Matlab is a product of The MathWorks Inc. You can use Matlab on any campus computers – including the ones in the computer lab, Mathematics and Science Center, E308.

Matlab for Windows, Mac, and Linux is available as a download directly from the MathWorks website. To get started, you must first have a MathWorks account created. Please follow the instructions here:

http://it.emory.edu/software/matlab_access.html

Email requests must come from your emory.edu email account. Once this is done, you will receive an email within 2-3 business days with instructions to access your Matlab account.

Schedule: Below is a week-by-week listing of the topics to be covered in class. **Please note that this schedule is tentative**. It may be necessary to make changes to the topics and to the test dates. The sections refer to the text *Introduction to Scientific Computing using Matlab*. Additional materials are may be given out in class when needed.

25 Aug: Floating Point Numbers and Quality of Approximations [§2.1-2.2]

30 Aug/ 1 Sept: Propogation of Errors, Examples, and Matlab Notes [§2.3-2.4]

6 Sept: *Test 1:* Chapter 2 - *Lab 1:* Introduction to the Bottle Project

8 Sept: Linear Systems and Simply Solved Linear Systems [§3.1-3.2]

13/15 Sept: Forward Substitution, Backwards Substitution, FLOPS, Gaussian Elimination with Partial Pivoting [§3.2-3.3]

20/22 Sept: Gaussian Elimination and Matrix Factorizations, Accuracy of Computer Solutions, MATLAB Notes [§3.4-3.6]

27 Sept: *Test 2:* Chapter 3 - *Lab 2:* Bottle Design

29 Sept: Polynomial Interpolation: Power Series and Newton Forms, Nested Multiplication [§4.1]

4/6 Oct: Polynomial Interpolation: Newton Form, Lagrange Form, Chebyshev Polynomials, Error in Polynomial Interpolations, Linear Polynomial Splines [§4.1-4.3]

11/13 Oct: *Fall Break* / Errors of Linear Polynomial Splines, Higher Order Splines [§4.3]

18/20 Oct: Least Squares Fitting, Normal Equations, Curve Fitting, Approximating Data, MATLAB Notes [§4.3 4.5]

25 Oct: *Test 3:* Chapter 4 - *Lab 3:* Meeting Specifications

27 Oct: Differentiation: Finite Difference Approximations [§5.1]

1/3 Nov: Quadrature, MATLAB Notes [§5.2-5.3]

8 Nov: *Test 4:* Chapter 5 - *Lab 4:* Optimal Bottle Design

10 Nov: Root Finding: Fixed Points, Fixed Point iteration [§6.1-6.2]

15/17 Nov: Root Finding Methods, MATLAB Notes [§6.3-6.6]

22/24 Nov: Golden Section Search and Quadratic Interpolation Search [§7.2] / *Thanksgiving*

29 Nov: Cubic Interpolation Search and MATLAB Notes [§7.3-7.4]

1 Dec: *Test 5:* Chapters 6 & 7 - *Lab 5:* Set up Exhibit

6 Dec: Review

Final Examination : Tuesday 13 December 3 : 00 p.m. – 5 : 30 p.m.