MATH 310: Numerical Analysis

T Th 9:45 – 11:15
Bunnell 410
http://www.dms.uaf.edu/∼eallman/classes/310/310-2015.html

Instructor: Elizabeth S. Allman

Contact Details: Chapman 308B, e.allman@alaska.edu and 474-2479.

Office Hours: M 12:00, Tu 2:00, Th 11:30 and by appointment. (tentative)

Prerequisites: MATH 302 or 314 with a grade of C or better.

Textbook: *An Introduction to Numerical Methods and Analysis*, 2nd ed., by J. Epperson, Wiley

Midterm Dates: Thursday, October 8 and Thursday, November 12 (tentative)

Final Exam Date: Saturday, December 19, 8:00 – 10:00

Course Overview and Goals:

In Numerical Analysis we study numerical algorithms designed to compute mathematical quantities. For example, we learn and implement in software the bisection method, Newton's method, and the secant method for approximating zeros of non-linear functions.

Of course, numerical analysis is concerned not only with finding algorithms for computation, but also with understanding how quickly or slowly these algorithms work. We study at length the rate of convergence of each algorithm and evaluate the strengths and weaknesses of different algorithms designed for the same purpose. In addition, we learn about floating point arithmetic and computer storage of numbers, polynomial interpolation, numerical integration and differentiation, Gaussian elimination and other topics. A knowledge of programming, linear algebra (or possibly differential equations), and Calculus III is an essential prerequisite for this course.

Numerical analysis is quite an interesting and fun course. Many of the theorems you learned in Calculus that seemed only of theoretical value will be infused with new life; their utility will become apparent. For example, we will use the Intermediate Value Theorem and Taylor approximations on a regular basis.

We will use the software program MATLAB to code programs. MATLAB stands for matrix laboratory and is a powerful tool for scientific computing. It is in wide use in industry and for research today. You are free to use one of MATLAB's free equivalents like Octave as an alternative, but I will not be able to help with debugging. A student version of MATLAB is available for a reasonable price and MATLAB is on many campus computers.

Course Mechanics:

Class attendance is expected, although I will not formally take roll. If you miss a class, you should get notes from another student. Checking the course webpage for notifications and homework assignments is essential.

Homework will be assigned regularly and collected once a week, usually at 3 pm on Thursdays. There will rarely be time at the beginning of class for simple questions on homework, so you should expect to get your homework questions answered during office hours. Formatting of homework assignments is essential, and guidelines for homework papers and obtaining MATLAB will be given on the first days of class.

I encourage you to work with others on the homework, and to share ideas for solutions, but you must *write up and code solutions independently*. You will learn nothing from simply copying a solution.

Homework will be accepted on its due date, either at my office or in my mailbox in the math department office. I will not accept *any* late homework that has not been cleared ahead of time or is not due to a genuine emergency (e.g., a death in the family).

Missed examinations or homework papers that are not approved in advance will result in an 'F' on that work. No make-ups will be given except in extreme circumstances (e.g., family death, documented illness, etc.). Notifying me by email or a note that you will miss an exam is not sufficient for advance approval; you must speak with me to be excused.

Grades:

As should be clear from the above, the largest contribution to your final grade will be from your graded work on homework assignments and examinations. This is an elective class, and I expect students to work maturely and hard to implement numerical algorithms. This includes filling in gaps in background independently, when necessary. Grades will be assigned using the following weights:

Homework	35 %
Midterm 1	20 %
Midterm 2	20 %
Final Exam	25 %

Grade Bands: A, A- (90 - 100%); B+, B, B- (80 - 89%); C+, C, C- (70 - 79%); D+, D, D- (60 - F%); 69 (0 - 59%). On rare occasion, I may lower the thresholds. Also, in an effort to reward the student who makes significant improvement over the course of the term, marked improvement over the semester may overcome earlier deficiencies and result in a better final grade.

Other Policies:

Course accommodations: If you need course adaptations or accommodations because of a disability, please inform your instructor during the first week of the semester, after consulting with the Office of Disability Services, 203 Whitaker (474-7403).

University and Department Policies: Your work in this course is governed by the UAF Honor Code. The Department of Mathematics and Statistics has specific policies on incompletes, late withdrawals, and early final exams, some of which are listed below. A complete listing can be found at

`http://www.dms.uaf.edu/dms/Policies.html`.

Prerequisites: The prerequisite for MATH 310 is MATH 302 or 314 with a grade of C or better. Students not meeting this prerequisite are not eligible to take this course and will be dropped.

Late Withdrawal: This semester the last day for withdrawing with a 'W' appearing on your transcript is October 30. If, in my opinion, a student is not participating adequately in the class, I may elect to drop this student.

Graded Coursework: Please keep all graded work for MATH 310 until final grades have been assigned.

Academic Honesty: Academic dishonesty, including cheating and plagiarism, will not be tolerated. It is a violation of the Student Code of Conduct and will be punished according to UAF procedures.

Courtesies: As a courtesy to your instructor and fellow students, please arrive to class on time, turn your cell phones and iPods off during class, and pay attention in class.

Tentative Schedule:

Week #	M's date	Tuesday	Thursday
0	Aug 31		Introduction: First Examples Taylor's Theorem, etc
1	Sept 7	Introductory concepts Error Computer arithmetic	
2	Sept 14	Computer arithmetic Simple methods and tools	
3	Sept 21	Simple methods and tools Root finding	
4	Sept 28	Root finding	
5	Oct 5	Root Finding/Interpolation	Exam 1
6	Oct 12	Interpolation and approximation	
7	Oct 19	Interpolation and approximation	
8	Oct 26	Interpolation and approximation	
9	Nov 2	Numerical integration	
10	Nov 9	Numerical Integration	Exam 2
11	Nov 16	Numerical Linear Algebra	
12	Nov 23	Linear Algebra	No class
13	Nov 30	Numerical Linear Algebra	
14	Dec 7	Topics	

Exam Sat Dec 19 8:00 am