Math 104B: Introduction to Numerical Analysis Winter 2015

INSTRUCTOR Paul J. Atzberger
http://atzberger.org/#Teaching
Office: 6712 South Hall
Office Hours: TR 2:00pm – 3:30pm

CLASS TIMES TR 3:30pm – 4:45pm.
PHELP 1425.

DESCRIPTION Computational approaches play an important role in many fields ranging from basic scientific research to the design of financial products. This class will discuss both the mathematical foundations and the practical implementation of modern numerical methods. Examples will also be discussed from applications areas. More information is on the website.

PREREQUISITES Calculus, Linear Algebra, Differential Equations, and experience programming.

TEXTBOOKS *Numerical Analysis 9th Edition* by R. L. Burden and J. D. Faires.

GRADING

Homework	30%
Midterm	30%
Take-home Final Exam	40%

POLICIES Assignments will be assigned in class and posted on the course website. Prompt submission of homeworks will be required. While no late homework will be accepted, one missed homework will be allowed without penalty. While it is permissible for you to discuss materials with classmates, the submitted homework must be your own work.

EXAMS A midterm exam will be on Thursday, February 19th.
Final exam/project will be at the end of the quarter.

TOPICS Differentiation and Integration:

- Finite Difference Approximation.
- Numerical Quadrature and Integration.
- Common Formulas: Simpsons Rule, Newton-Cotes.
- Gaussian Quadrature.
- Precision, Order of Accuracy.
- Composite Integration.
- Adaptive Methods.

Initial-Value Problems for Ordinary Differential Equations

- Well-posedness of initial-value problems.
- Euler's Method of Approximation.
- Taylor Methods for Higher-order Approximation.
- Runge-Kutta Methods.
- Multistep Methods.
- Convergence Analysis.

- Order of Accuracy and Stability.
- Stiff Differential Equations.

Solving Linear Systems and Matrix Algebra

- Linear Equations.
- Linear Algebra Review.
- Eigenvalues and Eigenvectors.
- Direct Methods.
- Gaussian Elimination.
- Role of Round-off Errors.
- Pivoting Methods.
- Matrix Inversion.
- LU Factorization.
- Iterative Methods.
- Jacobi, Gauss-Siedel, SOR.
- Conjugate Gradient.

WEBSITE http://atzberger.org/#Teaching