

# **MATH 3650 Section 4: Fall 2015**

## **Numerical Methods for Engineers**

**Instructor:** Timo Heister ([heister@clemson.edu](mailto:heister@clemson.edu)), (864) 656-0411

**Homepage:** <http://www.math.clemson.edu/~heister/>

**Office:** Martin O-14

**Office Hours:** (see my homepage)

### **Course Description:**

This course is designed to introduce students to the appropriate scientific methods for numerically approximating the solution to engineering related problems.

### **Topical Outline:**

1. Computer representation of number and floating point arithmetic,
2. Solution of linear algebraic equations,
3. Solution of non-linear equations,
4. Interpolation and curve fitting,
5. Least-squares solution to equations,
6. Numerical integration and differentiation,
7. Numerical approximation of Initial Value Problems,
8. Numerical approximation of Eigenvalue Problems.

### **Learning outcomes:**

Upon successful completion of this course, a student will be able to:

1. Understand round-off error and its consequences in computing
2. Master algorithms for solving scalar nonlinear equations
3. Solve square linear systems with Gaussian elimination method with partial pivoting
4. Use the power method to find the largest eigenvalue of a matrix, and know when it will work and when it might not
5. Interpolate functions with polynomials and piecewise polynomials
6. Approximate derivatives with finite difference methods, and quantify the error
7. Approximate definite integrals with numerical methods, and quantify the error
8. Solve ordinary differential equations with timestepping method such as forward and backward Euler, and quantify the error.
9. Be proficient at basic Matlab programming

### **Attendance**

- Class meets TTH 2:00-3:15 in Martin M103

- Students are allowed two unexcused absences during the semester. More than two unexcused absences may result in a student being dropped from the course.
- Attendance at scheduled class tests and the final exam is MANDATORY, unless prior consent has been given by the instructor. No makeup tests will be given. In the event of an "excused absence" from a test that proportion of the students final grade will be added to that of the students final exam.
- Late Policy: If the Instructor is more than 15 minutes late, the class will be considered canceled.

### **Textbook:**

Required textbook:

Scientific Computing for Scientists and Engineers, T. Heister and L. Rebholz, ISBN: 978-3-11-035940-4

see <http://www.math.clemson.edu/~heister/scicompbook/> for details.

### **Course Assessment**

Assessment for the class will be based upon class tests, homework assignments/quizzes, and a final exam.

First and second Midterm exam: 45%

Take-Home Final exam: 20%

- more details will be announced in class

Homework/assignments/quizzes: 35%

- Homework is due at the beginning of class.
- Late homework assignments will not be accepted! An assignment will be considered late if it is not handed in at the beginning of class on the due date. If your HW is late for a university approved absence, that assignment will not count for or against you.
- Partial Credit: The instructor reserves the right to assign negative partial credit to unrelated or extraneous answers.

### **Grading Scale**

A = 90% - 100%, B = 80% - 89%, C = 70% - 79%,

D = 60% - 69%, F = Below 59%.

### **Course Etiquette**

- All course related interactions, including in the classroom and office meetings, will be conducted in a professional manner.
- Any e-mail correspondence with the instructor must adhere to proper professional standards.
- At least 24 hours notice is required for "by appt" office hours.

## **Academic Integrity**

"As members of the Clemson University community, we have inherited Thomas Green Clemson's vision of this institution as a 'high seminary of learning.' Fundamental to this vision is a mutual commitment to truthfulness, honor, and responsibility, without which we cannot earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a Clemson degree. Therefore, we shall not tolerate lying, cheating, or stealing in any form. In instances where academic standards may have been compromised, Clemson University has a responsibility to respond appropriately to charges of violations of academic integrity."

Integrity Policy:

<http://gradspace.editme.com/AcademicGrievancePolicyandProcedures#integritypolicy>

## **Disability Access Statement**

"It is University policy to provide, on a flexible and individualized basis, reasonable accommodations to students who have disabilities. Students with disabilities requesting accommodations should make an appointment with Dr. Arlene Stewart (656-6848), Director of Disability Services, to discuss specific needs within the first month of classes. Students should present a Faculty Accommodation Letter from Student Disability Services when they meet with instructors. Accommodations are not retroactive and new Faculty Accommodation Letters must be presented each semester. Students are encouraged to contact Student Disability Services to discuss their individual needs for accommodation."

## **Title IX**

"Clemson University is committed to a policy of equal opportunity for all persons and does not discriminate on the basis of race, color, religion, sex, sexual orientation, gender, pregnancy, national origin, age, disability, veteran's status, genetic information or protected activity (e.g., opposition to prohibited discrimination or participation in any complaint process, etc.) in employment, educational programs and activities, admissions and financial aid. This includes a prohibition against sexual harassment and sexual violence as mandated by Title IX of the Education Amendments of 1972. This policy is located at <http://www.clemson.edu/campus-life/campus-services/access/title-ix/>"