

MATH 527
Numerical Analysis
Spring 2012

Meeting times: TTh 9:30 - 10:45 AM at LeConte ([LC](#)) 303B.

Instructor: Dr. Peter G. Binev

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Office hours: TTh 11:00 - 12:00 AM at [LeConte](#) 425 or by appointment.

Text: [Numerical Mathematics and Computing](#) by Ward Cheney and David Kincaid, *Sixth Edition*, Brooks/Cole: Cengage Learning 2008 (<http://rene.ma.utexas.edu/CNA/NMC6/>). The course will cover the material considered in chapters 1-6 and 9-14.

Description: Interpolation and approximation of functions; solution of algebraic equations; numerical differentiation and integration; numerical solutions of ordinary differential equations and boundary value problems; computer implementation of algorithms.

Credits: 3

Cross-listed Course: CSCE 561

Prerequisites: MATH 242 or MATH 520

Learning Outcomes: Upon the successful completion of this course students will be able to:

- read, interpret, and use vocabulary, symbolism, and basic definitions from Numerical Analysis;
- use facts, formulas, and techniques learned in this course to apply algorithms and theorems to find numerical solutions and bounds on their errors to various types of problems including root finding, polynomial and spline approximation, numerical differentiation and integration, numerical solutions of ODEs.

Outline: Numerical Analysis studies the algorithms for the problems of continuous mathematics. The course will give an introduction to general ideas in Numerical Analysis and will discuss different aspects of the performance of the numerical procedures involved. In addition to the theoretical material, some numerical implementations in MATLAB will be considered on an elementary level. Topics include:

- number representations and loss of significance;
- locating roots of equations;
- polynomial interpolation;
- numerical differentiation;
- numerical integration;
- spline functions;
- method of least squares;
- numerical methods for ordinary differential equations;
- Monte Carlo methods.

Attendance: Regular class attendance is important. A grade penalty will be applied to any student missing five or more classes (10%) during the semester. The "10 percent rule" stated above applies to both excused and unexcused absences. Students who anticipate potential excessive absences due to participation in permissible events as described in the USC Academic Bulletins (http://www.sc.edu/bulletin/ugrad/acadregs.html#class_atten.) should receive prior approval from the instructor to potentially avoid such penalty.

Cell Phones: All cell phones *must be turned off* during the class.

Homework and Quizzes: A few homework problems will be assigned each class. Be sure to solve and write these problems before the next class. The homework will be discussed in class. Some solutions will be collected and graded. There will be a few quizzes (announced in advance) on problems similar to ones from the homework. The homework grade will be based on student's participation in the discussions and the grades on the quizzes and the collected homework problems.

Projects: Every student has to choose a project motivated by the computational or theoretical problems discussed in the course. The projects should be submitted on or before **April 17, 2012**. The instructor will suggest several possible themes for the projects in the length of the course. The projects for the undergraduate students should prepare a 2-page description of a numerical method with a presentation one of the following subjects:

- computational realization of the method in Matlab or other programming language;
- theoretical considerations of the error estimation and the stability of the method;
- analysis of the computational flow of the algorithm and discussion of a realization on a multiprocessor platform.

The graduate students should submit a 5-page research paper that addresses all three issues about the method in consideration.

Midterm Exams: There will be a midterm exam in a form of a test. The tentative dates of the exam are **February 9** and **March 20**. The problems on the test will be similar to the ones from the homework and the discussions in class.

Final Exam: The final exam in a form of a test will take place on **Saturday, April 28 at 2:00 PM**.

Graduate Students: The graduate students attending the class will be given some additional problems on the exams. They should also prepare a 10-minute oral presentation based on their projects during the class on **April 19, 2012**.

Grading for Undergraduates: The final grade will be determined from the homework grade (30%), the midterm exams (15%+15%=30%), the project (10%), and the final (30%).

Grading for Graduate Students: The final grade will be determined from the homework grade (20%), the midterm exams (15%+15%=30%), the project (20%), and the final (30%).

Academic Dishonesty: Cheating and plagiarism will not be allowed. The University of South Carolina has clearly articulated its policy governing academic integrity and students are encouraged to carefully review the policy (<http://www.housing.sc.edu/academicintegrity/policy.html>) on the Honor Code in the Carolina Community.

ADA: If you have special needs as addressed by the Americans with Disabilities Act and need any assistance, please notify the instructor immediately.

Web Materials: The authors of the textbook maintain a webpage <http://rene.ma.utexas.edu/CNA/NMC6/>. In particular, they make available free software codes on the variety of programming languages under the link *Sample Codes*.

Important Dates:

January 13 – Last day to drop without **W**
February 9 – Midterm Exam 1
February 27 – Last day to drop without **WF**
March 4-11 – Spring Break
March 20 – Midterm Exam 2
April 17 – Deadline to submit the projects
April 19 – Graduate students' presentations
April 28 – Final Exam at 2:00 PM