

# CS537: Numerical Analysis

## Fall 2008 (TTh: 2:00pm – 3:15pm) White Hall 238-CB

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**Office:** 763F Anderson Tower.

**Office Hours:** TTh: 1:00pm – 2:00pm, and by appointment.

**Web Page:** <http://www.cs.uky.edu/~jzhang/CS537/cs537.html>.

**Learning Outcomes:** Students will gain sound understanding of major concepts and problems in numerical analysis; be able to use already existing or design their own algorithms; fully understand floating-point errors and how to cope with them; gain a firm understanding of numerical methods for scientific problems. Specifically students will be able to:

1. Estimate computation errors;
2. Analyze sensitivity of the problem to be solved;
3. Select/propose numerically stable methods;
4. Understand important properties for a number of basic methods (e.g., Gaussian elimination, Hermite and spline interpolation, basic and composite rules, uniform and least-square approximation techniques, iterative methods for non-linear equations and fixed points);
5. Modify problems (to increase their smoothness and/or reduce condition numbers) for better algorithm performance;
6. Analyze results computed in fl-arithmetic.

**Prerequisites:** Students need to have good mathematical background (Calc. 3 and Linear Algebra) knowledge of material covered in CS/MA321, knowledge of a high-level programming language (e.g., C, Fortran).

**Text Book:** *Numerical Mathematics and Computing*, by Ward Cheney and David Kincaid. (A recent version is OK).

**Topical outline** (tentative):

- Number representation and errors,
- Locating roots of equations,
- Interpolation and numerical differentiation,
- Numerical integration,
- Numerical solution of systems of linear equations,
- Approximation by spline functions,
- Numerical solution of ordinary differential equations,
- Smoothing of data and least squares (time permits).

**Grading:** Programming projects and homeworks (40%); Midterm (October 16, Thursday) (30%); Final (December 12, Thursday, 10:30AM) (30%). Final grade: A: 100 - 86, B: 85 - 75, C: 74 - 60, E: below 60.

**Cheating:** Students have to do the work by themselves. They can help each other with general concepts; however, direct assistance with a particular solution will be considered as cheating. Please refer to *Student Rights and Responsibilities* for more details concerning cheating; let me only remind that the minimum penalty for cheating is an E-grade.

**Makeup exams:** Makeup tests will be given only under exceptional circumstances, such as accidents, illnesses or (serious) family emergencies. You must inform the instructor as soon as possible regarding the situation. Be definition an emergency is not planned, so please refrain from asking *in advance* whether you can take a makeup exam. Documented proof will be needed before you are granted a makeup test. If you would like to observe any holidays other than the public holidays, please inform the instructor in the first week of the class.

**Homework and Exam Policy:** In preparing your homeworks, whether programming labs or exercises, you may seek general help from the instructor, your fellow students, or any other reference material, provided you *do not copy* any of the other person's work. You are encouraged to discuss the material in groups as this helps in understanding and learning. However, you must turn in your own individual homeworks. The exams are not group efforts and will be closed book. All exam responses must be your own.

**Due Dates:** Due dates will be very strictly enforced, unless an extension is granted to all students. All assignments must be turned in at the beginning of the lecture in which they are due. Any homework/lab turned in after this time will not be accepted. If you become sick or a family emergency arises and you are unable to turn in your assignments on time, please inform the instructor as soon as possible and an extension may be given to you. However, documented proof will be needed for such excuses. Make sure that your homework/lab is stapled together and your name is printed on every pages. Please also make sure your assignment/lab is written legibly or typed. You may loose points for poor presentation. *It is highly recommended* to start working on an assignment soon after it is given. Information on what is due next and PDF versions of the assignments will be available on the class web pages.

**Grading:** If you have a question on a grade you received, please see the instructor. *You have one week from when a homework/exam is handed back to get your scored changed.* Regraded score may go up or down.