MATH/CSCI-4800  
Numerical Computing

Instructor: J. W. Banks (banksj3@rpi.edu, 276-6412)  
Office Hours (AE 421): Wednesday 1:30pm-3:00pm, Friday 9:30am-11:00am  
Website: http://homepages.rpi.edu/~banksj3  
Required Text: Numerical Analysis, by Timothy Sauer  
Prerequisite: CSCI 1100 and MATH 2010 or ENGR 1100

Tentative schedule

1. Introduction (Chapter 0)  
   (a) MATLAB basics  
   (b) Calculus review (Section 0.5)  
   (c) Approximations and errors (Section 0.3.1-0.3.2)  
   (d) Computer arithmetic (Sections 0.3.3-0.4)

2. Linear equations (Chapter 2)  
   (a) Gaussian Elimination and LU factorization (Sections 2.1 - 2.2)  
   (b) Error analysis and accuracy (Section 2.3)  
   (c) Special types of linear systems (Section 2.6)

3. Nonlinear equations (Chapter 1)  
   (a) Introduction (Section 1.1)  
   (b) Fixed point iterations (Section 1.2)  
   (c) Iterative methods for scalar equations (Sections 1.4-1.5)  
   (d) Nonlinear systems of equations (Section 2.7)

4. Function approximation (Chapters 3, 5, 10)  
   (a) Introduction to interpolation (Section 3.1)  
   (b) Interpolation error (Section 3.2)  
   (c) Piecewise polynomial interpolation (Section 3.4)  
   (d) Least squares approximation (Sections 4.1 and 4.3)  
   (e) Trigonometric approximation (given time, Section 10.2)

5. Numerical differentiation and integration (Chapter 5)  
   (a) Numerical quadrature (Sections 5.2, 5.5, and 5.5)  
   (b) Numerical differentiation (Section 5.1)

6. Numerical solutions of ODE's (Chapter 6)  
   (a) Introduction and Euler's method (Section 6.1)  
   (b) Accuracy and stability (Section 6.2)  
   (c) Implicit methods and stiff equations (Section 6.6)  
   (d) Kunge-Kutta and Taylor methods (Section 6.4 and 6.7)
Grading
Homework assignments - 30%
Exam 1 - 20%
Exam 2 - 20%
Final exam - 30%

Homework:
Homework will be assigned regularly and constitutes a significant portion of your grade. Written solutions are expected to be neat, preferably typed, and comprehensive. This means that you should turn in any computer code you wrote and any results which were generated.

Late homework policy:
No late homework will be accepted. If you are unable to submit a homework assignment on time you must make arrangements with me before the assignment is considered late. For example, if you are sick or have a family emergency please discuss with me. Note that excessive work load will not constitute a valid reason for an extension.

Exams:
There will be three exams throughout the semester, two in-class exams and one final. The two in-class exams will primarily cover topics discussed since the last exam. However, because the material builds throughout the semester there will necessarily be some carryover. The final will cover all topics discussed in the course.

Appealing grades:
If you would like clarification on a grade or wish to appeal a grading decision simply stop by my office during office hours and we can discuss it. Such appeals must be performed within one week after receiving the graded homework or exam. After that time we can still discuss the issue but there will be no changes to the grade.

Academic integrity:
The relationship between a student and instructor is built on mutual respect and trust. For example, the student should treat the instructor with common courtesy and respect, and trust that the instructor has made appropriate decisions about the structure and content of the course. The instructor, on the other hand, should be courteous and respectful to every student, and trust that the students are working diligently and honestly on the assigned material. Acts which violate this mutual respect and trust undermine the education process.

The Rensselaer Handbook of Student Rights and Responsibilities defines various forms of Academic Dishonesty and you should familiarize yourself with these. In the case of homework assignments, collaboration between students is encouraged. However, each student must write their own solution and submit their own work. Copying assignments or computer codes is not permitted. If violations of this policy are suspected, then an explanation will be requested. If the explanation is not satisfactory, then a grade of zero will be given and a report made to the Dean of Students.

In the case of exams there is no collaboration of any kind. If cheating is suspected, then an explanation will be requested. If the explanation is not satisfactory, then an exam grade of zero will be given and a report made to the Dean of Students.