CS 6210: Advanced Scientific Computing I  
Course Syllabus  
Instructor: Prof. Mike Kirby 

Course Information 

Meeting Time: Monday/Wednesday, 11:50am - 1:10pm  
Classroom: WEB L122  
Textbook: Introduction to Scientific Computing and Data Analysis by Mark H. Holmes  
Web page: www.eng.utah.edu/~cs6210  
Office Hours: Wednesdays 3-5pm (exception: third Wed. of each month - no office hours) or by appointment.  
Contact Information:  
  Office: WEB 3602  
  Phone: 585-3421  
  Email: kirby [at] cs.utah.edu  

Teaching Mentor: Vidhi Zala (vidhi.zala [at] utah.edu)  
Office Hours: Tuesdays 9-10am, WEB 2626 

Course Description 

This course is a graduate breadth course to give students exposure to the algorithms and implementations often used in scientific and data computing. It is assumed that students have had some previous experience to numerical methods (such as in an introductory numerical analysis or scientific computing course) or in a numerical ODEs course; however, for the diligent student, very little previous knowledge is required (other than basic calculus, linear algebra and ODEs). This course will be followed by an advanced graduate course that focuses on the numerical solution of partial differential equations (CS 6220: Advanced Scientific Computing II). 

This course is designed to expose students to simulation and data science. In this semester, we will use two application areas to help motivate the various topics we will engage. The first of these topics in computational finance (specifically modeling of options trading), and the second of these topics is simulation of structures for 3D printing (i.e. topological optimization). Approximately half the semester will be dedicated to each of these topics, with various scientific computing and data science topics being explored to help us build up our understanding of these areas. Specifically, in this course, we will touch on the following topics: 

• Nonlinear equations in one variable  
• Computational linear algebra (direct and iterative methods)  
• Eigenvalues and singular values  
• Nonlinear systems and optimization  
• Interpolation and approximation  
• Numerical differentiation and integration.
Course Grading

This course will be assessed by three general areas: attendance and participation in the practicums, assignments, and the final project. There will be no midterm of final exam. Every homework assignment will contain a listing of problems from the text that relate to issues we are discussing in class. The practicum days of the class are dedicated to reviewing the practicum problems of the assignment. Students are expected to attend class and to actively participate in the problem discussion. It is advised that students do the practicum problems before class so that they can answer questions and/or present solution strategies. Successful participation in the practicums account for 10% of your grade. In addition, each assignment will have a collection of problems to be done individually by a student. The number of problems to be done will be marked on the assignment sheet. Assignment and submission details are below. The final project will consist of some collection of problems that tie together one or both of the areas we discussed in class.

Attendance and Participation: 10%
Assignment 1: 12%
Assignment 2: 12%
Assignment 3: 12%
Assignment 4: 12%
Assignment 5: 12%
Final Project: 30%

Assignment Policies:

- All assignments will be take home and are to be done individually. Discussing topics is allowed; however, copying of each others work is considered cheating and will result in a failing grade. If a student is suspected of cheating, they may be asked to answer randomly selected homework questions in a public session to verify that they have actually mastered the material as claimed.

- Assignments are due by 5pm MT on the day in which they are to be submitted. Submissions will be done via Canvas. Ten points per 24-hour period as of the day and time for which the call went out (counting Saturday and Sunday) will be deducted for late assignments.

- Assignments will be submitted in electronic format and must be typeset. We recommend you use \texttt{\LaTeX} to typeset your assignments. While there is a bit of a learning curve, it is worth learning. If not, consider using \texttt{Lyx}, a front-end to \texttt{\LaTeX}. If neither of those work, feel free to use Word or Writer to type up your assignments. The deadline will be indicated on the class webpage. You will also submit any code you generate to solve the homework. The principle language of our textbook is Matlab. We will use Matlab for in-class demonstrations also. Students may use Matlab, Python, or other languages as they see fit as long as they are consistent as as long as they make sure that we can execute/run your code. Please also make sure to comment your code well so that we know what you are doing.