ISC 4933-??/5935-?? - Mathematical Tools for Scientific Computing
Fall 2014

Instructor:	Professor Janet Peterson email: `jpeterson@fsu.edu` office: 444 DSL phone: 850-644-1979
Website:	http://www.sc.fsu.edu/∼jpeterson
Office Hours:	T 11-12, R 3:30-4:00, other times by appointment
TA:	Michelle Perry, `meperry@fsu.edu`, 481A DSL
TA Office Hours:	???
Class:	TR 2-3:15, 152 DSL
Prerequisites:	MAC 2311, MAC 2312 (corequisite)
Text:	Notes from website

Course Description: This course surveys the mathematical ideas and techniques that are a fundamental part of computational science. For some students, this may serve as a review course that brings these ideas together with a new focus; for students with a non-mathematical background, the course will be a rapid overview that ensures that the student has had a chance to see, understand, practice and master the mathematical concepts that will be repeatedly called upon in later courses.
While this course is open to both undergraduate and graduate students, graduate students will be assigned additional work as appropriate.

Course Objectives: Students completing the course will be able to:

- identify the standard tools;
- explain the use and properties of the standard tools;
- combine the standard tools to create algorithms for specific problems;
- write, debug, and verify computer codes that implement these algorithms.

Grading: The student's grade for the course will be based upon homework, lab assignments, a midterm and a final exam, weighted as follows:

- Homework - 30%
- Labs - 30%
- Midterm Exam - 20%
- Final Exam - 20%

Homework/Lab Submission: Homework and lab assignments must be submitted as `pdf` documents in a single `tar` or `zip` file via email to the teaching assistant, with a copy to the instructor.

University Attendance Policy: Excused absences include documented illness, deaths in the family and other documented crises, call to active military duty or jury duty, religious holy days, and official University activities. These

absences will be accommodated in a way that does not arbitrarily penalize students who have a valid excuse. Consideration will also be given to students whose dependent children experience serious illness.

Academic Honor Policy: The Florida State University Academic Honor Policy outlines the University's expectations for the integrity of student's academic work, the procedures for resolving alleged violations of those expectations, and the rights and responsibilities of students and faculty members throughout the process. Students are responsible for reading the Academic Honor Policy and for living up to their pledge to . . . be honest and truthful and . . . [to] strive for personal and institutional integrity at Florida State University. (Florida State University Academic Honor Policy, found at http://academichonor.fsu.edu/policy/policy.html.)

Americans with Disabilities Act Students with disabilities needing academic accommodation should:

- register with and provide documentation to the Student Disability Resource Center; and
- bring a letter to the instructor indicating the need for accommodation and what type. This should be done during the first week of class.

This syllabus and other class materials are available in alternative format upon request. For more information about services available to FSU students with disabilities, contact the Student Disability Resource Center, sdrc@admin.fsu.edu, web page: http://www.disabilitycenter.fsu.edu/.

Syllabus Change Policy Except for changes that substantially affect implementation of the evaluation (grading) statement, this syllabus is a guide for the course and is subject to change with advance notice.

Week	**Topics**
1.	Introduction to the class; Overview of Linear Algebra; Linear equations; Gauss elimination;
2.	Vectors and Matrices; Scalar multiplication, dot products, orthogonality; Identity, diagonal, triangular, transpose matrices; Matrix-vector and matrix-matrix multiplication; matrix inverse; The matrix form of Gauss elimination;
3.	LU factorization; Cholesky factorization; Operation counts; Vector norms;

Week	Topics
4.	Matrix norms, matrix conditioning; Vector spaces, linear independence, bases; The null space and range of a matrix;
5	Column, row, and null space of a matrix or its transpose; Matrix rank; The fundamental theorem of linear algebra; Orthogonal spaces;
6	The linear least squares problem; Orthonormal vectors; The QR factorization;
7	The eigenvalue problem; The Rayleigh quotient; Similarity transformations;
8	Numerical methods for finding an eigenvalue; The matrix 2-norm and the spectral radius; The Gershgorin circle theorem; The power method; the inverse power method;
9	The singular value decomposition;
10	The initial value problem; Linear ordinary differential equations; The method of separation of variables; Integrating factors;
11	General first order ODE's; The forward Euler method for solving initial value problems; Local and global truncation error; Stability of an ODE solution method;
12	Runge-Kutta methods for ODE's; Multistep methods; Predictor-Corrector methods;
13	The two point boundary value problem; Functions of several variables; The Jacobian matrix, and Newton's method; The Hessian matrix;
14	Taylor series for a function of two variables; Integration in higher dimensions;
15	Line integrals; Green's theorem; Introduction to partial differential equations.