Instructor: Niloufer Mackey(nil.mackey@wmich.edu)  
Office: 6618 Everett, 387-4594  
URL: http://homepages.wmich.edu/~mackey/Teaching/637/  

Office Hours: MF 11 – noon; TR 3 – 4pm.

Prerequisite: A graduate level course in linear algebra (Math 510), and programming experience in Fortran/C/C++. A first course in numerical analysis (Math 507) is also required. See the handout entitled “Notes to the Student” for a list of linear algebra concepts that you should be familiar with.

Text: L. N. Trefethen & D. Bau, Numerical Linear Algebra, (1997), published by the Society for Industrial and Applied Mathematics (SIAM). Available at discount prices to SIAM members. If you are not a member of SIAM, then become one by going to http://www.siam.org/students/. There is no charge for students, as WMU is an institutional member of SIAM.

References:


Course Rationale: As Trefethen and Bau point out, the field of numerical linear algebra is more beautiful, and more fundamental, than its rather dull name suggests. More beautiful, because it is full of powerful ideas that are quite unlike those emphasized in an abstract linear algebra course. And more fundamental because it is here that one finds the essential ideas that every mathematical scientist needs.
Syllabus: We plan to cover the following topics, found in Chapters 1 – 3, 5, 6 of Trefethen and Bau. Please bring the text to class, as we will refer to it frequently.

- **Fundamentals.** Matrix Norms, Condition Numbers, Stability.
- **Decompositions.** QR factorization, Schur Decomposition, Singular Value Decomposition.
- **Eigenproblem.** Reduction to Hessenberg form, Rayleigh quotients, Inverse Iteration, QR algorithm, QR with shifts, Jacobi Method.
- **Iterative Methods.** Arnoldi, Lanczos, Conjugate Gradients, Preconditioning (as time permits).

Homework: Problems covering both theoretical and numerical concepts will be regularly assigned. MATLAB will be used for numerical experiments.

Examinations: Midterm approximately on Thurs Feb 22, and a cumulative Final on Tues Apr 24, 10:15am - 12:15pm. Your grade will be calculated thusly:

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<th>Homework</th>
<th>Midterm</th>
<th>Final</th>
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Grading: Your grade will be determined by the scale:

- A 92 – 100
- B 81 – 86
- C 67 – 75
- D 55 – 59
- BA 87 – 91
- CB 76 – 80
- DC 60 – 66
- E < 55

Class participation will be used to boost border-line grades.

Academic Integrity: I encourage you to discuss problems with each other. The work you submit, however, must be your own. Copying each other’s work will have serious consequences. If you have received help/ideas from a fellow student or another source, it is important to cite them.

Here is the formal warning: You are responsible for understanding the policies and procedures in the Graduate Catalog (pp. 25-27) that pertain to Academic Integrity. These policies include cheating, fabrication, falsification and forgery, multiple submission, plagiarism, complicity and computer misuse. You should consult with me if you are uncertain about an issue of academic dishonesty prior to the submission of an assignment or test. Violations of the academic honesty policies can result in failing grades for the assignment and the course. Additional penalties can be imposed by the University.

Important Dates:
- MLK Day (no classes): Jan 16
- Sprirt Day, Spring Break: March 2 – 9
- Last day to drop with “W”: Mar 19
- Final Exam: Tues 24 Apr, 10:15am – 12:15pm.

Incompletes: A grade of Incomplete will be given only if you have completed most of the course work with a satisfactory grade, and circumstances beyond your control prevent you from completing the remainder of the course. Incompletes will not be given in case of a low or failing grade.