SYLLABUS

MTH 365/465 - Numerical Linear Algebra

Spring 2016

Instructor: Sofya Chepushtanova (http://chepusht.mathcs.wilkes.edu/)

- Email: sofya.chepushtanova@wilkes.edu
- Office: Stark Learning Center (SLC) 410. Phone: (570) 408-4868

Class Meetings:

- MWF 12:00-12:50am, room SLC 403

Office Hours: SLC 410, MW 1:00-3:00pm, F 1:00-2:00pm or by appointment.

Course Description and Objectives: This course provides an introduction to numerical linear algebra, the study of algorithms for finding numerical solutions of linear algebra problems. Topics include direct and iterative methods for the solution of systems of linear equations, matrix decompositions, computation of eigenvalues and eigenvectors, and relaxation techniques; the theoretical basis for error analysis, including vector and matrix norms; applications such as least squares and finite difference methods.

Students completing this course should:

- Be able to understand the basics concepts of stability and conditioning of a linear system.
- Be able to perform certain matrix factorizations.
- Be able to solve small size linear systems by hand, and larger size ones by using certain computer software.
- Understand the iterative techniques such as Jacobi and Gauss-Seidel methods.
- Solve eigenvelue problems.
- Solve least square problems.
- Be able to use finite difference method to solve two-point boundary value problem.

Prerequisites: An elementary course in linear algebra (MTH 214 equivalence) and programming experience (CS 125 equivalence).

Text: *Numerical Methods: Design, Analysis, and Computer Implementation of Algorithms* by Anne Greebaum and Timothy Chartier, Princeton University Press, 2012. (more details are here: http://press.princeton.edu/titles/9763.html).

Other Useful References:

1. Gilbert Strang, *Linear Algebra and Its Applications*, third edition, International Thompson Publishing.

2. Carl D. Meyer, *Matrix Analysis and Applied Linear Algebra*, SIAM, Philadelphia, 2000.

3. Gene H. Golub and V. Van Loan, *Matrix Computations*, third edition, John Hopkins U. Press, Baltimore, 1996.

4. James W. Demmel, *Applied Numerical Linear Algebra*, SIAM, Philadelphia, 1997.

5. Biswa Nath Datta, *Numerical Linear Algebra and Applications*, second edition, SIAM, 2010.

Attendance: You are expected to attend classes regularly. If you miss a class, it is your responsibility to obtain notes from a classmate, find out any announcements made during the class, and make sure your homework turned in on time.

Homework: Homework problems will be assigned for each topic covered. Start working on assigned problems as soon as the sections are covered. Not all of the assignments will be collected and graded, but you may be asked to present your work in class. Access to Matlab is required to do computational homework assignments.

Exams and Grade Distribution: There will be three in-class exams and a comprehensive take-home final exam. Your final score in this course will be calculated as follows:
100% = Homework 25% + 3 Exams (45%) + Final Exam (30%), and your final grade will be computed from the total points you earn as follows:

$A = 4.0$	$90 - 100\%$
$B+ = 3.5$	$85 - 89\%$
$B = 3.0$	$80 - 84\%$
$C+ = 2.5$	$75 - 79\%$
$C = 2.0$	$70 - 74\%$
$C- = 1.5$	$65 - 69\%$
$D = 1.0$	$60 - 64\%$
$F = 0.0$	59% and lower

Drop Policy: If you wish to drop from the course, I will give my permission during the first ten weeks of the semester. Thereafter you will need the permission of the Dean. Be aware that poor performance in the course will not be a sufficient reason for the Dean's permission to be granted.

Academic Honesty: By handing in homework, quizzes, and exams you certify that this is your own work. You are encouraged to discuss homework solution strategies with fellow students but the final write-up must be your own. A violation will result in a grade of zero on

that particular assignment; serious or repeated infractions of the Academic Honesty policy will result in failure of the course.

Cell Phones are not permitted in class. Please switch them to silent mode or turn them off, and put out of sight.

Tentative Class Schedule Spring 2016 (Dates are Subject to Change)

1. Week of 1/18: Review of important concepts in linear algebra.
2. Week of 1/25: Introduction to Matlab. Linear systems of equations. Gaussian elimination and its variants.
3. Week of 2/1: Other direct methods for solving linear systems, matrix factorization.
4. Week of 2/8: More on matrix factorization.
5. Week of 2/15: Review for Exam I, Exam I.
6. Week of 2/22: Conditioning of problems, stability of algorithms.
7. Week of 2/29: Vector and matrix norms, sensitivity of solutions of linear systems.
8. Week of 3/7: *No classes - Spring Recess.*
9. Week of 3/14: Iterative techniques in matrix algebra, Jacobi and Gauss-Seidel methods.
10. Week of 3/21: Relaxation techniques for solving linear systems. *No class on Friday - Holiday Recess.*
11. Week of 3/28: Review for Exam II, Exam II. *No class on Monday - Holiday Recess.*
12. Week of 4/4: Continue on iterative methods. Least squares problems.
13. Week of 4/11: The normal equations, QR decomposition, fitting polynomial to data.
14. Week of 4/18: Eigenvalues and eigenvectors.
15. Week of 4/25: The power method. Review for Exam III, Exam III.
16. Week of 5/2: MTH 465 students present lecture on topics of finite difference method for the two-boundary value problem. *Wednesday (last day of class) follows Friday schedule.* Final Exams begin on Thursday, 5/5.
17. Week of 5/9: Take-home final exam, due time and date: TBD.