MATH 562 Numerical Analysis II, Spring 2016
Class information

Instructor: Dr. Songting Luo
Office: 430 Carver Hall
Contact: email: luos@iastate.edu; phone: (515) 294-8140.
Class Page: http://orion.math.iastate.edu/luos/Teaching/MATH562_16SS/MATH562_16SS.html

Textbook:
Numerical Linear Algebra, L.N. Trefethen and D. Bau, SIAM Books, 1997.
References:
Introduction to Numerical Analysis, J. Stoer and R. Bulirsch, Springer, 3rd edition, 2002.
Numerical Analysis, R. L. Burden and J. D. Faires, 7th-10th edition.
Numerical Methods for Unconstrained Optimization and Nonlinear Equations, J.E. Dennis and R.B. Schnabel, SIAM Books, 1987.
Lectures: Time: **TR**, **12:40-2:00pm**; Room: **0290 Carver Hall**
Office hours: 2:00–3:30pm **TR**, or by appointment.

Official Mathematics Department Policies
For departmental policies on Academic Misconduct, Disability Accommodation, Make up Examinations, Dead Week, Student Behavior in Class, Harassment and Discrimination, Religious Accommodation, etc., please refer to ISU Dept. of Mathematics Class Syllabus and Class Policies in the following link:
http://www.math.iastate.edu/Faculty/ClassPolicies.html

Course Description and Objectives
Catalog Entry:

MATH 562. Numerical Analysis II.
(3-0) Cr. 3. S. Prereq: MATH 317
Numerical linear algebra including eigenvalue problems; numerical solution of nonlinear equations.

Math 562 is a one-semester survey course of standard topics that covers numerical linear algebra, numerical solution of nonlinear equations and optimization. A companion course Math 561 covers numerical analysis. These two courses can be taken in either order.
Math 561 and 562 together will also prepare Math graduate students for the Numerical Analysis Qualifying Exam.
The successful student will be able to derive, apply, and analyze elementary numerical algorithms. After completion of this course, students will be prepared for more advanced courses or research in other parts of numerical analysis. A good portion of this course will be concerned with the standard theorems of numerical algebra, linear and nonlinear. To

prove these results we will employ basic tools from linear algebra and differential and integral calculus, including matrix factorizations (LU, SVD, QR, etc.), the Mean Value theorem, Taylor's theorem, the Intermediate Value theorem, etc.. Familiarity with these tools will be largely assumed. A course in computer programming is not required, but some familiarity with programming tools like Matlab will be helpful.

The course objectives are taken from the list of topics for the Numerical Analysis Qualifying Exam:

- Computer and linear algebra basics: matrix-vector operations, positive definite matrices.
- Solution of linear systems: Gaussian elimination, LU factorization, elementary matrices, pivoting, Cholesky factorization, Householder transforms, QR factorization.
- Solution of eigenvalue problems for square matrices: Gershgorin Theorem, diagonal dominant matrices, power method, inverse power method, reduction to Hessenberg form, QR method.
- Solution of systems of nonlinear equations: rate of convergence for iterative methods, bisection method and secant method for scalar equations, fixed-point method, Newton's method.
- Iterative methods for systems of linear equations and their convergence: Jacobi method, Gauss-Seidel method, SOR method, steepest descent method, conjugate gradient method.

Homework and Exam Policy
Homework sets will be assigned according to the progress of the class and can be downloaded as pdf files that will be posted online (class page). No late homework will be accepted. Most likely the homeworks will not all be exactly the same length. I will just add all the points at the end, and convert it to a percentage. This will count for 3/4 of your grade. I encourage group participation in the solution of exercises.

There will be a final exam, which counts for 1/4 of the grade. Time and Room will be announced when available. There will be no make-up exams unless legitimate excuses are provided as listed in ISU Dept. of Mathematics Class Policies on Make up Examinations:
`http://www.math.iastate.edu/Faculty/ClassPolicies.html`

Programming Exercises
There may be Matlab programming exercises assigned during the semester. Familiarity with Matlab will be assumed.

Matlab Resources:

Matlab Primer of Professor Sigmon of the University of Florida:
`http://www.math.pitt.edu/~swigon/Matlab/primer.pdf`

Matlab documentation:
`http://www.mathworks.com/access/helpdesk/help/techdoc/matlab.html`

Assigning Course Grades
The final grade (as a percentage of the total points) will be computed using the following weights: Homeworks 75%, and Final Exam 25%. Letter grades will be assigned according to the following tentative scale:

- $\geq 89\%$ grade is at least $A-$
- $\geq 78\%$ grade is at least $B-$
- $\geq 67\%$ grade is at least $C-$
- $\geq 56\%$ grade is at least $D-$
- $< 56\%$ grade is likely F

I reserve the right to change this scale, provided the change benefits all students.

Attendance
Students are required to attend all class meetings. Note that any changes of the class will be only announced during class. If you must miss a class, it is your responsibility to get all the material missed from the class.

Departmental Student Disability Accommodation Policy
If you have a disability and require accommodations, please contact the instructor early in the semester so that your learning needs may be appropriately met. You will need to provide documentation of your disability to the Student Disability Resources (SDR) office, located on the main floor of the Student Services Building, Room 1076, 515-294-6624.

Melanie Erickson is the Disability Liaison for the Mathematics Department. She is in 396E Carver. You can reach her at `merick@iastate.edu` or at 294-0393.

The Mathematics Departmental Student Disability Accommodation Policy can also be found in the following link:
`http://www.math.iastate.edu/Undergrad/AccommodationPol.html`

Academic honesty
Students must be familiar with the academic standards of conduct, please refer to Academic Dishonesty
`http://catalog.iastate.edu/academiclife/regulations/#academicdishonestytext`

NOTE: I reserve the right to change the policy. Any changes of the syllabus and class information will be announced in class.