MATH 4499/5599 Numerical Linear Algebra **Fall 2017**
TR 9:30-10:45am **Room: PS 324**

Instructor: Dr. Yunrong Zhu **Office**: PS 328B **Phone**: 282-3819 E-Mail: zhuyunr@isu.edu

Course Website: MOODLE **Office Hours:** TR 11:00am-12:00pm, or by appointment

References:

- LLoyd N. Trefethen and David Bau, III, *Numerical Linear Algebra*, SIAM, 1997.
- David S. Watkins, *Fundamentals of Matrix Computations*, 3rd Edition, Wiley, 2010.
- Gene H. Golub and Charles F. Van Loan, *Matrix Computations*, 4th Edition, Johns Hopkins University Press, 2013.

Prerequisites: MATH 2240 Linear Algebra (Passed with C- or better), and some experience in programming (preferable Matlab).

Course Description: Numerical linear algebra is of great practical importance in scientific computation and is routinely used in mathematics, natural sciences, computer science, social science and data science. Even nonlinear problems usually involve linear algebra in their solution. This course is an introduction to numerical solution techniques of the classical problems in linear algebra, including solving linear systems, least squares, eigenvalue problems and their applications. The topics include direct and iterative methods for solving linear systems, singular value decomposition, least squares problems, and eigenvalue problems. Matlab will be used as the programming tool for the computer assignments/projects and computing is an essential component of this course.

Learning Objectives: After completing the course, students will develop facility with the classical numerical techniques for linear algebra problems, e.g., various factorizations, iterative methods, and their analysis. A student successfully meeting all the learning objectives of this course will be able to:

- Select or design a method or approach for solving a problem in numerical linear algebra
- Evaluate a method for its accuracy, stability, and computational cost
- Discuss efficiency implications in a computer implementation of a method
- Use Matlab and other numerical software appropriately, i.e., understand when to use certain methods and their limitations

Homework: The homework assignments and due dates will be announced in class, and posted on MOODLE. Show all work and include complete, clear explanations and justifications. Please staple your homework together to avoid missing pages. Each assignment will consist of both mathematical analysis problems and algorithm implementation (preferable MATLAB) for problem solving. It is encouraged to discuss with your classmates to get more insights on the problems, but you should write your own solutions.

Final Project: At the end of the semester, each student is expected to finish a final project. The project should have the form of a scientific paper (typed in LaTex). It should be well structured, self-contained, with introduction (motivations and background information), well stated claims (theorems), arguments to support the claims (proofs, heuristic arguments, experimental results, whatever is required), well chosen numerical experiments, interpretations and discussions, conclusions, references. It is essential for your project to cite any and all reference material used in the project, including material from the Web. A failure to cite work by someone else that you use in your project will be considered plagiarism. A supplement containing your code that was used for the computations should be provided.

For the topic of the project, each student can select one project from the given list of topics, or pick his/her own topic with my advance approval. Each student must arrange an individual meeting with me to discuss his/her project before starting serious work on it.

Grading: Students course grade will be based EXCLUSIVELY on HW, one take-home exam, and one final project. There will be NO "extra credit" work. The weights are distributed as follows:

40% HW+ 25% Middle Term Exam + 35% Final.

A+	93% and above	C	73%–76%
A-	90%–92%	C-	70%–72%
B+	87%–89%	D+	67%–69%
B	83%–86%	D	63%–66%
B-	80%–82%	D-	60%–62%
C+	77%–79%	F	59% and below

Academic Integrity and Dishonesty: Academic integrity is expected of all students. Academic dishonesty, including cheating or plagiarism, is unacceptable. The Idaho State University academic dishonesty policy allows an instructor to impose one of several penalties for cheating that range from a warning up to assigning a failing grade for the course or dismissal from the University. ANY use of an electronic device or other form of unauthorized materials during an exam or other assessment will be considered cheating. For more information, see the ISU Policies and Procedures Policy 5000 (Student Conduct Code) located at: http://www.isu.edu/policy/5000/5000-Student-Conduct-System.pdf.

Extra Help: Do not hesitate to come to my office during office hours or by appointment to discuss a homework problem or any aspect of the course. Free tutoring is available from the Math Center in the Student Success Center, Rendezvous 327 in Pocatello and CHE Room 220 in Idaho Falls. Information is available at http://www.isu.edu/success/math/index.shtml.

ADA Policy: Idaho State University is committed to providing equal opportunity in education for all students. If you have a diagnosed disability or if you believe you have a disability (physical, learning, hearing, vision, psychiatric) that might require reasonable accommodation in this course, please contact the Disability Services Center, Rendezvous Building, Room 125 (282-3599) http://www.isu.edu/disabilityservices as early as possible.