Winter 2007

CEG 416-01: Matrix Computations

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CEG/MTH 416/616 Matrix Computations

Section 1 - Winter 2007 Tu Th 6:05-7:20 p.m., University Hall Room 060
Last Updated: December 20, 2006

Description: This course is a survey of numerical methods in linear algebra for application to problems in engineering and the sciences. Emphasis is on using modern software tools on high performance computing systems. This course covers the mathematics of linear equations, eigenvalue problems, singular value decomposition, and least squares. Material covered will be relevant to applications areas such as structural analysis, heat transfer, neural networks, mechanical vibrations, and image processing in biomedical engineering. A familiarity with MATLAB is useful, and the ability to program in languages such as C/C++ or Fortran is very important. A basic knowledge of matrix algebra is required. Four credit hours.

Prerequisites: MTH 253 or 355; and CS 142 or 241.

Instructor: Dr. Ronald F. Taylor, RC 356, 775-5122, ronald.taylor@wright.edu, 1:30 – 2:30 p.m. Monday through Thursday (other times by appointment).

Required Textbook: Numerical Linear Algebra, Lloyd N. Trefethen and Bavid Bau, SIAM, 1997, ISBN 0-8971-361-7.

Recommended Textbook: Matrix Operations, Richard Bronson, Schaum's Outline, McGraw-Hill, 1998, ISBN 0-07-007978-1.

Course Home Page and WebCT: http://www.cs.wright.edu/people/faculty/rtaylor/ceg416 available by the start of second week of class. We will also be using WebCT for posting of grades and submittal of some assignments or portions of assignments. Students should familiarize themselves with accessing WebCT: http://wisdom.wright.edu/. Students are also responsible for accessing the Course Home Page or WebCT for printing copies of resource materials. Some handouts will be given in class.

Programming: Writing and using numerical programs is an important part of this course. Programming assignments (in order of language preference): MATLAB (strongly preferred), C/C++, Fortran , or Java. MATLAB is available on a number of Wright State systems as is Fortran, C/C++, Java and Mathematica. Many times numerical work can be done on a scientific or programmable calculator. MATLAB is very useful, and you may want to consider purchasing the Student Edition if you have a PC that can support it. The Symbolic Math Toolbox which comes with the Student Edition will be discussed in lecture and maybe useful for some assignments. It is expected that students will spend a minimum of 2 hours per week working in a computer lab or equivalent environment enhancing their programming skills and completing programming assignments for this course. If you need to use a language other than MATLAB, please meet with the Instructor and discuss.

Computers and Computing Accounts: You must be able to access the Web and have a WSU Student Login to Wings, e-mail, and WebCT. Check your WSU e-mail on a regular basis for any course announcements from the instructor. Get familiar with the use of the PCs in Russ Center 152C to access MATLAB if you do not have it on your own PC. Needed computing topics be covered in class and handouts or web citations given as appropriate. Check the University computing information at http://www.wright.edu/cats/help/guides/students/index.html as well as that for the College of Engineering and Computer Science at: http://www.cs.wright.edu/help/services.shtml

Grading Policy: Mid-term exam and quizzes – 35% . One comprehensive final – 40%. Homework/Project assignments – 25%. Quizzes may be in class or take-home: points included with mid-term score. Students registered at the graduate level (i.e. CEG 416 or MTH 416) will be required to complete extra problems, programs and/or special projects as part of the Homework/Project component of this course. Expect about six major Homework/Project assignments. Some problems assigned will be considered "practice" and may not be graded. In general, one week will be given to prepare these assignments. Smaller homework problems/investigations may be due the next class period. Follow the "Homework Standards" posted on the course website.

Course Grade Based on Course Average: **A:** 100-90, **B**: less than 90-80, **C:** less than 80-70, **D:** less than 70-60, **F:** less than 60-0.

Class Policies: No late or early exams unless verifiable emergency. No make-up quizzes: quizzes may be unannounced. Attendance at lecture is not a component of your grade. However, students are expected to attend all lectures and to

participate in class discussion. Attendance may be taken in the course to better get to know students. In cases of infrequent attendance, lower homework and exam grades will inevitably result since a significant portion of lecture material is not covered in the text. All Homework/Project assignments are due at the start of class and/or in WebCT on the date and time specified. Grades on late assignments will be reduced by 10%. Submittals more than one day late will not be graded - "zero" grade assigned. Exceptions to the above policies may be made unusual circumstances when documentation is provided in writing -- otherwise expect strict enforcement of the policies. All work submitted must be your own unless group assignments are explicitly made by the instructor; sharing of program code or copying problem solutions/codes from any source will result in at least a homework grade of "zero" for all involved and possibly a grade of "F" for the course. University procedures for plagiarism will be strictly followed. Sharing ideas and general mathematical and computer skills with others outside of class is encouraged. Students are expected to read, understand and follow the University Academic Integrity Policy at:

http://www.wright.edu/students/judicial/integrity.html

Supplemental Class Information and Homework Standards: A document: "Supplemental Information" is given on the course website which clarifies and details how the above class and grading policies are to be implemented. Also carefully study and follow the "Homework Standards" document on the course website. Students are responsible for understanding these documents referring to them during the quarter as needed. Please ask for clarification if you have questions on either of these two important documents.

Schedule: NLA = Numerical Linear Algebra (Required Textbook) and MO = Matrix Operations (Recommended Textbook). Topics may vary: an alternate topical syllabus may be provided after the first week. We may just follow the chapters in order in NLA and assign supplemental problems and readings from MO. **Exams dates and times** are firm.

Week	Topic/Tests etc.	Readings/Reference
1	Introduction to Matrix Computations, Applications, Software, MATLAB	NLA Chapter 9 MO Chapter 1
2	Fundamentals: Operations, Norms, SVD	NLA Chapters 1, 2, 3, 4 MO Chapters 6, 12
3	Solving Linear Equations by Direct Methods with Applications	NLA Chapters 21, 22, 23, 24 MO Chapter 2, 4
4	Solving Linear Equations by Iteration with Applications	Notes
4	Linear Equations: Software and Applications	Notes
5	Introduction to Eigenvalue Problems **(Mid-Term Exam – Thursday February 1)**	NLA Chapters 24, 25, 26, 27 MO Chapters 8, 19, 20
6	Eigenvalue Problems: Software and Applications	Notes
7	The Unsymmetrical and Generalized Eigenvalue Problem	NLA Chapters 28, 29, 30 Notes
8	Singular Value Decomposition and Applications	NLA Chapter 31
9	Orthogonalization and Least Squares	NLA Chapters 8, 10, 11
10	Special Topics and Parallel Computations	Notes
Finals	**Comprehensive Final – Thursday March 15, 8:00-10:00 p.m.**	