Fall 2010

CS/MTH 316/516: Survey of Numerical Methods for Computational Science

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CS/MTH 316/516 Survey of Numerical Methods for Computational Science

Fall 2010 Tu Th 6:05 – 7:20 p.m., Russ Center 150
Last Update: August 27, 2010

Description: Introduction to numerical methods used in the sciences and engineering. Included will be methods for interpolation, data smoothing, integration, differentiation, and solution of systems of linear and nonlinear equations. Discussion of sources of error in numerical methods. Applications to science, engineering and applied mathematics are an integral part of the course. Special topics presented as schedule permits. Four hours lecture.

Prerequisites: (CS 142 or CS 241 or CEG 220) and MTH 231 and (MTH 235 or MTH 253 or MTH 255). Course descriptions at: http://www.wright.edu/academics/catalog/descriptions.html

Instructor: Dr. Ronald F. Taylor, RC 340, 775-5122, ronald.taylor@wright.edu, office hours: 3:00 – 4:00 p.m. on Tuesday and Thursday; 10:00a.m. – Noon on Wednesday (other times by appointment).

Required Textbook: Numerical Methods for Engineers and Scientists: An Introduction with Applications Using MATLAB, Second Edition, Amos Gilat and Vish Subramaniam, Wiley, 2011, ISBN 978-0-470-56515-5.

Reference Textbooks: MATLAB: An Introduction With Applications, Third Edition, Amos Gilat, Wiley, 2008, ISBN 978-0-470-10877-2.

Numerical Computing with MATLAB, Cleve B. Moler, Society for Industrial and Applied Mathematics (SIAM), ISBN 978-0-898716-60-3. Free online copy and software at: http://www.mathworks.com/moler/index_ncm.html

C Programming for Scientists and Engineers with Applications, R. N. Reddy and C. A. Ziegler, Jones and Barlett Publishers, 2010, ISBN13 978-0-7637-3952-2.

Course on WebCT: We will be using WebCT for posting of content, 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 printing copies of resource materials from WebCT as needed. Some handouts may be given in class.

Programming: MATLAB Student Edition http://www.mathworks.com/academia/student_version/ from MathWorks (about $100). Also Dev-C++ Version 4.9.9.2 for Windows http://www.bloodshed.net (free download – use C compiler). Writing and using numerical programs is an important part of this course. Programming assignments mostly will require MATLAB which is available on a number of Wright State systems. 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. 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. We will also use the C programming language for some class demonstrations. Some assignments may involve using or adapting some given C programs. Both MATLAB and C will be covered in lecture. The emphasis will be on MATLAB, however.

Use of E-Mail: All registered students have access to a Wright State e-mail account. The Instructor will use only that e-mail account to initiate communication with student. The Instructor will reply to other e-mail accounts. IMPORTANT: Please include in any communication with Instructor, a Subject which starts with "CS316" (or CS516, MTH316, MTH516). For example, a student with a question about HW 1, would use as a Subject: "CS316: Question on HW 1 Problem 2."

Grading Policy: Mid-term exam and quizzes – 35% . One comprehensive final – 40%. Homework/Project assignments – 25%. Quizzes may be in class, take-home, or in-office Q&A: points included with mid-term score. If more than four quizzes are given, the one with the lowest percentage grade will be dropped. Quiz point values may vary. Students registered at the graduate level (i.e. CS 516 or MTH 516) 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. A number of problems assigned may be considered "practice" and will 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. IMPORTANT: Submit any specified program files to be graded via WebCT only -- materials sent by e-mail will not be graded. Course Grade Based on 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 WebCT which clarifies and details how the above class and grading policies are to be implemented. Also carefully study and follow the "Homework Standards" document also on WebCT. Students are responsible for understanding these documents referring to them during the quarter as needed. Please ask for clarification if you have questions about either document.

Schedule: Topics may vary. **Exams dates and times** are firm. "Chapter" is the Required Textbook "Class Notes" are from lecture.

Week	Topics/Activity	Reference
1	Introduction, Review of Calculus and Programming	Class Notes, Chapter 2, Appendix A
2	Software, Number Representation and Types of Error, Algorithm Stability, and Programming Considerations.	Chapter 1, Appendix B, and Class Notes
3	Solving a Nonlinear Equation in One Unknown: Bisection, Fixed Point Iteration, Newton. Nonlinear Equations in Several Unknows: Newton-Raphson, Fixed Point Iteration.	Chapter 3 and Class Notes
4	Introduction to Linear Equations, Gaussian Elimination, and Factorization. Methods and Special Systems: Tridiagonal, Symmetric & Positive Definite.	Chapter 4 and Class Notes
5	Iterative Solution of Linear Equations: Jacobi and Gauss-Seidel Methods. Exam Review and **Mid-Term Exam: Th October 7, 2010 (full period) .**	Chapter 4 and Class Notes
6	Eigenvalues and Eigenvectors: Basic Properties and the Power Method with Extensions.	Chapter 4 and Class Notes
7	Curve Fitting: Polynomial and Spline Interpolation. Least Squares Approximation.	Chapter 5
8	Numerical Differentiation, Finite Differences, and Introduction to Ordinary Differential Equations: Initial Value and Boundary Value Problems.	Chapters 6, 8, 9 and Class Notes
9	Integration: Trapezoidal Rule, Simpson's Rule, Gaussian Quadrature. Introduction to Multiple Integrals, Singular Integrals, and Infinite Domain Integrals.	Chapter 7 and Class Notes
10	Evaluation of Instruction and Exam Review. **(No class Th November 11, 2010 – holiday)**	Class Notes
Finals Week	**Comprehensive Final Exam: Th November 18, 2010, 8:00 – 10:00 p.m.**	