Spring 2011

CS/MTH 317/517: Applications of Numerical Methods for Computational Science

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CS/MTH 317/517 Applications of Numerical Methods for Computational Science

Section 1 – Spring 2011 M F 2:15-3:30, Russ Center Room 346
Last Updated: March 29, 2011

Description: Applications of computing for solving scientific and engineering problems. Numerical solution of initial value and boundary value problems for ordinary and partial differential equations are covered. Applications involving numerical optimization methods are included. Special topics presented as schedule permits. Four hour lecture.

Prerequisites: Mathematics courses recommended: MTH 231 and (MTH 235 or MTH 253). Programming course prerequisites: EGR 153 or CEG 220 or CS 241 or CS 142.

Instructor: Dr. Ronald F. Taylor, RC 340, 775-5122, ronald.taylor@wright.edu. , Tuesday 2-4 p.m.; Wednesday and Friday 9-11 a.m.; other times by appointment.

Required Textbook:

Numerical Computing with MATLAB, Cleve B. Moler, Society for Industrial and Applied Mathematics (SIAM), 2004, ISBN 978-0-898716-60-3. Free online copy and software at: http://www.mathworks.com/moler/index_ncm.html

Suggested Resources:

Numerical Mathematics and Computing, Sixth Edition, W. Cheney and D. Kincaid, Thomson Brooks/Cole, 2008, ISBN 13: 978-0-495-11475-8.
Scientific Computing with Case Studies, Dianne P. O'Leary, Society for Industrial and Applied Mathematics (SIAM), 2009, ISBN 978-0-898716-66-5.

Course Home Page and Pilot: http://www.cs.wright.edu/people/faculty/rtaylor/cs317sp11 available by the start of second week of class. We may be using Pilot for posting of grades and submittal of some assignments or portions of assignments. Students should familiarize themselves with accessing Pilot . Students are also responsible for accessing the Course Home Page or Pilot for printing copies of resource materials as needed. Some handouts may be given in class.

Programming: MATLAB Student Edition http://www.mathworks.com/academia/student_version/ from MathWorks (about $100). Wright State University's College of Engineering and Computer Science provides a special licensing program for the MathWorks MATLAB software. More information at http://www.wright.edu/software/mathworks/ . Students may also use Octave which is free http://www.gnu.org/software/octave/download.html . When we refer to "MATLAB" students may also substitute "Octave". If you decide to use Octave instead of MATLAB, please inform the instructor. 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. 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 may also use the C programming language for some class demonstrations. Some assignments may involve using or adapting some given C programs.

Computers and Computing Accounts: You must be able to access the Web and have a WSU Student Login to Wings, e-mail, and Pilot. 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/studentzone .

Grading Policy: Three exams with content quizzes – 75% . No comprehensive final during finals week. Homework/Project assignments with homework quizzes – 25%. Content quizzes may be in class or take-home: points included with mid-term score. Students registered at the graduate level (i.e. CS 517 or MTH 517) will be required to complete extra problems, programs and/or special projects as part of the Homework/Project component of this course. Homework/Projects will be spot checked for organization, completeness, and accuracy. Homework quizzes may be given on the day of Homework/Project submittal. Students are expected to be able to answer questions regarding these submittals. Students will be allowed to use only their own Homework/Project submittal and a calculator during the homework quizzes. Points for Homework/Projects and homework quizzes will be given when each assignment is made. In general, about one

week will be given to prepare larger assignments. Smaller homework problems/investigations may be due the next class period. Follow the "Homework Standards" posted on the course website.

Special Note on Homework/Projects: A significant portion of the formal Topics below may be included in a "Computational Science" module. This module may take three to four weeks to cover: it will involve study of a specific application of computational tools to a "real world" problem. Group work may be involved. Class participation and weekly reports may be assigned in lieu of homework problems from the text. Details will be discussed the first week of the course. The points for this project will be included in the 25% of the Homework/Project grade.

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

Week	Topics	Reference (Moler Chapter)
1	Introduction, Review of Numerical Methods I, Mathematics and Programming	Notes
2	Linear Systems of Equations and Eigenproblems for Differential Equations	Chap 2 and 11
3	Applications of Ordinary Differential Equations (ODEs)	Chap 7 and 11
4	Initial Value Problems for ODEs: Single step methods **(Exam 1: Friday April 22nd – one hour)**	Chap 7 and Notes
5	Initial Value Problems for ODEs: Multistep methods	Chap 7 and Notes
6	Boundary Value Problems for ODEs and applications	Chap 7 and Notes
7	Partial Differential Equations (PDEs) and applications **(Exam 2: Friday May 13th – one hour)**	Chap 11 and Notes
8	PDEs and applications (concluded)	Chapt 11 and Notes
9	Fourier Analysis	Chap 8
10	Introduction to Simulation and Optimization (as time permits) **(Exam 3: Friday June 3rd)**	Chap 9 and Notes