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Fall 2005

## CS/MTH 316/516: Numerical Methods for Digital Computers

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# CS/MTH 316/516 Numerical Methods for Digital Computers - I

Section 1 – Fall 2005 Tu & Th 6:05 - 7:20 p.m., Biological Sciences Room 103  
Last Updated: September 4, 2005 at 8:48 p.m.

**Description:** Introduction to numerical methods used in the sciences. Methods of interpolation, data smoothing, functional approximation, numerical differentiation and integration. Solution techniques for linear and nonlinear equations. Discussion of sources of error in numerical methods. Applications of interest to engineering, science, and applied mathematics students are an integral part of the course. Special topics presented as schedule permits. 4 credit hours. Prerequisites: CS 142 or EGR 153 or CEG 220 or CS 241, MTH 231, MTH 253 or 255.

**Instructor:** Dr. Ronald F. Taylor, RC 356, 775-5122, [ronald.taylor@wright.edu](mailto:ronald.taylor@wright.edu), 10:00-Noon Tu & Th (other times by appointment).

## Required Textbook:

(1)	<u>Numerical Mathematics and Computing</u> , Fifth Edition, W. Cheney and D. Kincaid, Brooks/Cole, 2004, ISBN 0-534-38993-7, referred to as "C&K" below.
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## References:

(2)	<u>Numerical Analysis: Mathematics of Scientific Computing</u> , 3rd Ed., D. Kincaid and W. Cheney, Brooks/Cole, 2002, ISBN 0-534-38905-8, referred to as "K&C" in lecture.
(2)	<u>Numerical Computation in Science and Engineering</u> , C. Pozrikidis, Oxford University Press, 1998, ISBN 0-19-511253-9.
	<u>Numerical Computing with MATLAB</u> , C. Moler, MathWorks, 2004. Printable version of complete text at: <a href="http://www.mathworks.com/moler">http://www.mathworks.com/moler</a>
	<u>MATLAB Primer</u> , Third Edition, Kermit Sigmon, University of Florida. Tutorial & primer at <a href="http://www.mines.utah.edu/gg_computer_seminar/matlab/matlab.html">http://www.mines.utah.edu/gg_computer_seminar/matlab/matlab.html</a>
	<u>Programming with C</u> , 2 <sup>nd</sup> Ed., Byron Gottfried, Schaum's Outline, McGraw-Hill, 1996, ISBN 0-07-24035-3.
	<u>Mathematica</u> , Eugene Don, Schaum's Outline, McGraw-Hill, 2001, ISBN 0-07-135719-X.
(3)	<u>Matrix Operations</u> , Richard Bronson, Schaum's Outline, McGraw-Hill, 1998, ISBN 0-07-007978-1.
	<u>Numerical Analysis</u> , 2 <sup>nd</sup> Ed., Francis Scheid, Schaum's Outline, McGraw-Hill, 1988, ISBN 0-07-055221-5.

(1) Available in WSU Bookstore under CS 316/516 or MTH 316/516. (2) On Reserve in Dunbar Library after second week. (3) Available as e-book through **netLibrary** - check Dunbar Library web site.

**Course Home Page and WebCT:** <http://www.cs.wright.edu/people/faculty/rtaylor/cs316> available by the start of second week of class. We will also be using WebCT for posting of grades and course materials. Students should familiarize themselves with accessing WebCT – go to the WSU home page <http://www.wright.edu/> and then click on link to WebCT (under Current Students). You may also go directly to the WebCT Entry Page with: <http://wisdom.wright.edu/>. Students are responsible for accessing the Course Home Page and WebCT for printing copies of resource materials. **This is very important since class handouts may be very limited -- you will be responsible for material posted which is discussed in lecture.**

**Programming:** Writing and using numerical programs is an important part of this course. Programming assignments (in order of language preference): MATLAB (strongly preferred), C, Fortran, C++, 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 use may also be made of

Mathematica. Microsoft C/C++ may possibly be obtained at the Dunbar Library for installation on a home PC. 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 first and explain why you need to do this.**

**Computers and Computing Accounts:** You must have a WSU Student Campus Computing Account, e-mail, and be able to access the Web. Get familiar with the use of the PCs in Russ Center 152C or the Library Annex. You should be able to use TELNET and FTP. It is useful to have an elementary understanding of UNIX commands plus be able to use a simple UNIX editor such as Pico. These topics may be covered in class and handouts given as needed. Be sure to review 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. 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. Some problems assigned will be considered "practice" and will not be graded in depth. At least 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 WebCT.

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 on the date 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 must be your own unless group assignments are explicitly made by the instructor; sharing of program code or copying problem solutions will result in at least a homework grade of "zero" for all involved and probably 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>

**Class/Grading Policy Implementation:** A document: "Supplemental Class Information" is given on the web site which clarifies and details how the above class and grading policies are to be implemented. That is considered part of this syllabus.

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

<b>Week</b>	<b>Topic</b>	<b>C&amp;K Reading</b>
1	Introduction, Review of Calculus and Programming	Chap 1, App A, and Notes
2	Software, Number Representation and Error	Chap 2, App B and C
3	Solving a Nonlinear Equation in One Unknown	Chap 3 and Notes
4	Introduction to Linear Equations and Gaussian Elimination	Chap 7 and App D
5	Factorizations, Special Systems, and Iterative Solution of Linear Equations: Jacobi, Gauss-Seidel, SOR, <b>Mid-Term Exam (end of 5<sup>th</sup> week) – Thu October 6, 2006</b>	Sect 8.1, 8.2 and Notes
6	Eigenvalues and Eigenvectors: Basic Properties and Power and Jacobi Methods	Sect 8.3, 8.4, and Notes
7	Curve Fitting: Polynomial and Spline Interpolation. Least Squares Approx.	Sect 4.0-4.2 and Notes
8	Numerical Differentiation, Finite Differences, and ODEs	Chap 4 and Notes
9	Finite Differences (concluded) and Integration: Trapezoid, Simpson, Romberg.	Chap 5 and Notes
10	Integration (concluded): Gaussian Quadrature, Multiple Integrals, Review	Chap 6 and Notes
Finals	<b>Comprehensive Final Exam - Thu November 17, 2005, 8:00-10:00 p.m.</b>	