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

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

Section 1 – Spring 2005 Tu & Th 6:05 - 7:20 p.m., Russ Engineering Center Room 150

Last Updated: March 29, 2005 at 12:54 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, 1:00-3:30 p.m. on M & W and 1:00 - 2:00 p.m. Tu & Th (other times by appointment).

Required Textbook:

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

References:

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

Course Home Page: <http://www.cs.wright.edu/people/faculty/rtaylor/cs316> available by the start of second week of class. Students are responsible for accessing the home page and 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.

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: Two exams - 30% each. Homework/Project assignments - 35%. Quizzes - 5%. Quizzes may be in class or take-home. 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 the course web site unless otherwise stated. We will be using WebCT for posting of grades and other information. 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/>.

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 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.

Week	Topic	C&K Reading
1	Introduction, Review of Calculus and Programming	Chap 1, App A, 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, Exam (5th week) – April 28	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, Gaussian Quadrature.	Chap 5 and Notes
10	Integration (concluded): Multiple Integrals, Review Exam (10th week) - June 2	Chap 6 and Notes
Finals	(no final exam will be given in finals week for this course)	

Supplemental Information: Class/Grading Policy Implementation CS/MTH 316/516 Numerical Methods for Digital Computers - I

Last Updated: March 29, 2005 at 2:37 p.m.

This document is considered part of the syllabus. Please read fully and carefully. Ask questions if needed.

1. As your instructor, I am glad that you have registered for this course. I hope that you will be able to expand your knowledge and skills to learn how to solve new and interesting problems relevant to engineering, science, and applied mathematics.
2. However, this course may not be the right level for everyone registered. There are other numerical mathematics courses available at Wright State which may work better in your case: either at a lower level or a higher level. See me if you have questions or concerns after the first lecture. You should also talk to your academic advisor if this is a required course and you want a suggestion for an alternative. **Make any needed schedule changes early.** If you need to drop/withdraw, pay attention to deadlines and make sure you get the change in registration processed. Just stopping attendance will likely get you a grade of "X" which is basically equivalent to an "F".
3. Note that this is an undergraduate and a graduate course. It is listed under Computer Science and Mathematics . It contains significant programming and mathematical content. Students registered at the graduate level need to put forth additional efforts especially on homework.
4. **Take the course prerequisites seriously.** A good programming background is very important. You will need good mathematics skills to be successful in this course. Basic physics and an interest in engineering applications are also important in this course. Don't be surprised if you need to review calculus and matrix algebra on your own. I'm quite willing to help you if you are having mathematical or programming difficulties.
5. This course requires considerable outside of class preparation and study. This includes preparing for class in addition to homework. Study the text and your lecture notes before you come to class.
6. **I strongly urge you to get your own copy of the Required Textbook. I do not loan out books.** Some students find the book to be difficult while others find it to be elementary. Work examples in the book. Understand the theory and the applications. You can learn a lot about programming by studying the pseudo-codes in the text. Do not use the codes from other textbooks or codes downloaded from the internet for submitted homework unless so directed.
7. If my office hours don't correspond to your availability, please make an appointment with me at another time. I am quite willing to work with you. I usually respond quickly to e-mail.
8. Please note the grading scale equalities and inequalities. Examples of course averages: 90.0 is an A, 89.9 is a B, 80.0 is a B etc. If exam grades are uniformly low, at my option I can uniformly add a fixed number of points to all exam scores.
9. I do not drop low exam, quizzes or homework grades.
10. Always bring a scientific calculator and textbook with you to class. You will need your calculator on quizzes and to work on problems presented in lecture. Be willing to volunteer to help with calculations.
11. Quizzes may occur unannounced at the beginning, middle, or end of any lecture. Quizzes may be closed-book and closed-notes. Some Quizzes may be take-home and due the next class period. There are no makeup Quizzes.
12. You will be allowed to one or two pages of notes for use during the Exams. Study Sheets will be provided for these exams.

13. There are no extra credit assignments.
14. Homework Standards must be followed. This document will be posted on the class web site. Points off if you do not follow standards.
15. I do not recommend that you put homework under my door. It can get lost. Hand it to me in person or take it to the Computer Science Department Office: Room 303 Russ Center. The office is open from 8:30 a.m. to 5:00 p.m. Monday through Friday. They will date and time stamp your homework and put it in my office mailbox.
16. I do give partial credit for homework. Make sure you turn in something to avoid getting a "zero." Your goal should be to turn in all work on time and to have it complete with the expectation of getting 100% as a grade. If you are uncertain about how to work a problem -- ask me.
17. I will not change exam dates. If you miss an exam then it is assumed that you had an unexpected emergency and written documentation will be required. Homework more than one day late will also require acceptable written documentation of an emergency.
18. **Take the Academic Integrity policy very seriously.** Two violations of Academic Integrity can result in expulsion from the University and permanent notations on your transcript. Official University policy will be strictly followed. I will not tolerate any misconduct during exams. Keep your eyes on your own exam paper. Any student copying during an exam or using unauthorized materials or electronic devices will receive a "zero" for the exam and an "F" for the course.
19. On homework, your **submittal must be your own work.** Copying solutions or using computer codes from any source is prohibited. "Zero" grade on homework and course grade of "F" are probable penalties. If you give homework code or solutions to another student any time during the course, then you have violated the Academic Integrity policy even if they do not use your code or solutions. You both are subject to the penalties noted above. It is never appropriate or necessary to ask another student for solutions. If you need to see a solution for valid study purposes -- ask me.
20. I do encourage the interchange of ideas and sharing of mathematical and computing skills among students. You may study in groups -- that is encouraged. You may ask questions on approaches to problems or programs of other students. If you are uncertain as to what is permitted, please ask me.
21. Ask questions in class. Please speak up if you are confused on procedures or would like more examples. I am glad to answer questions on any homework or lecture topics covered.
22. Be on time to class. We usually give important information at the beginning relating to due dates of homework and other information. I expect you to be attentive and respectful of others during lectures. Excessive talking is disruptive. If you are ill or in great need of sleep, it would be best if you left the class and return when you are feeling better and can be more attentive.