CVEN 302-501
Computer Applications in Engineering and Construction
Spring 2004, MWF 8:00-8:50, Zachry 127B

Instructor : Dr. Scott A. Socolofsky
Office : Weisenbaker 235H
Office hours : MTW 4:00-5:00 p.m.
Telephone : (979) 845-4517
E-mail : socolofs@tamu.edu

TA : Tirtharaj Bhaumik
Office : HYDRO 102
Office hours : MW 9:00-10:00 a.m.
Telephone : (979) 845-8049
E-mail : tirtharaj@neo.tamu.edu

TAs will also be in the Computer Lab (CE 215) from 7:00–8:30 p.m. MTWR.

Computer Applications in Engineering and Construction. (3-0). Credit 3. I, II, S
Application of computers to solution of civil engineering problems using various numerical
methods; mathematical modeling and error analysis; solution of algebraic and differential equations;
numerical differentiation and integration; curve-fitting. Prerequisites: ENGR 112; MATH 308 or
registration therein.

The objective of this course is to develop efficient, computer-oriented solutions to civil engi-
neering problems through learning:

• To implement common solution methods to problems in engineering
• To determine the performance of numerical solutions and numerical error
• To design, implement, and test computer programs
• To analyze and present numerical results

This course also contributes to the following ABET-identified outcomes of the civil and ocean
engineering curricula:

• Ability to apply knowledge of basic mathematics, science, and engineering
• Ability to formulate and solve civil/ocean engineering problems
• Ability to use techniques, skills, and modern tools necessary for civil/ocean engineering prac-
tice
• Ability to use computers to solve civil/ocean engineering problems.

Together, these objectives are important to professional engineers as preparation for engineering
practice.

There are two required textbooks: Chapra & Canale (2002), Numerical Methods for Engineers,
Fourth edn. (the primary text book), and Palm III (2001), Introduction to Matlab 6 for Engineers
(used as a Matlab reference). There will also be lecture note handouts. To access the online course
material (downloads of assignments, course handouts, and to email grades), please see the course
web pages at:
1 Tentative course calendar

The following table presents a tentative course calendar. Readings are assigned from Chapra & Canale (2002). Palm III (2001) should be used for reference as needed to answers questions in the assignments.

<table>
<thead>
<tr>
<th>Date</th>
<th>Lec.</th>
<th>Topic</th>
<th>Reading</th>
<th>HW Due</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/21</td>
<td>1</td>
<td>Organization, review of prerequisites, and introduction</td>
<td>PT1, Ch1</td>
<td></td>
</tr>
<tr>
<td>1/23</td>
<td>2</td>
<td>Introduction to Matlab and computer programming</td>
<td>Ch2</td>
<td></td>
</tr>
<tr>
<td>1/26</td>
<td>3</td>
<td>Computer programming control structures</td>
<td>Ap. B</td>
<td></td>
</tr>
<tr>
<td>1/28</td>
<td>4</td>
<td>Programming example</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/30</td>
<td>5</td>
<td>Programming with Matlab</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2/2</td>
<td>6</td>
<td>Round-off error and error analysis</td>
<td>Ch3</td>
<td></td>
</tr>
<tr>
<td>2/4</td>
<td>7</td>
<td>Taylor series expansion</td>
<td>Ch4</td>
<td></td>
</tr>
<tr>
<td>2/6</td>
<td>8</td>
<td>Root finding, bisection method</td>
<td>PT2, 5.1-5.2</td>
<td></td>
</tr>
<tr>
<td>2/9</td>
<td>9</td>
<td>False-position and Newton-Raphson methods</td>
<td>5.3-6.2</td>
<td></td>
</tr>
<tr>
<td>2/11</td>
<td>10</td>
<td>Secant method</td>
<td>6.3</td>
<td></td>
</tr>
<tr>
<td>2/13</td>
<td>11</td>
<td>Polynomial methods and root polishing</td>
<td>7.1-7.4, 8.2</td>
<td></td>
</tr>
<tr>
<td>2/16</td>
<td>12</td>
<td>Linear Algebraic Equations</td>
<td>PT3</td>
<td></td>
</tr>
<tr>
<td>2/18</td>
<td>13</td>
<td>Gauss elimination</td>
<td>9.1-9.6</td>
<td></td>
</tr>
<tr>
<td>2/20</td>
<td>14</td>
<td>LU decomposition</td>
<td>10.1</td>
<td></td>
</tr>
<tr>
<td>2/23</td>
<td>15</td>
<td>Matrix inverse</td>
<td>10.2-10.3</td>
<td></td>
</tr>
<tr>
<td>2/25</td>
<td>16</td>
<td>Iterative methods: Gauss-Seidel</td>
<td>11.2-12.2</td>
<td></td>
</tr>
<tr>
<td>2/27</td>
<td>—</td>
<td>Exam 1: Programming, root finding, and linear algebra</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3/1</td>
<td>17</td>
<td>Curve fitting</td>
<td>PT5, 17.1</td>
<td></td>
</tr>
<tr>
<td>3/3</td>
<td>18</td>
<td>General least squares</td>
<td>17.1</td>
<td></td>
</tr>
<tr>
<td>3/5</td>
<td>19</td>
<td>Matrix equations for least squares</td>
<td>Handout</td>
<td></td>
</tr>
<tr>
<td>3/8</td>
<td>20</td>
<td>Nonlinear regression (Gauss-Newton iteration)</td>
<td>17.3-17.5</td>
<td></td>
</tr>
<tr>
<td>3/10</td>
<td>21</td>
<td>Regression examples</td>
<td>17.5</td>
<td></td>
</tr>
<tr>
<td>3/12</td>
<td>22</td>
<td>Polynomial interpolation</td>
<td>18.1-18.2</td>
<td></td>
</tr>
<tr>
<td>3/22</td>
<td>23</td>
<td>Interpolation examples</td>
<td>20.2</td>
<td></td>
</tr>
<tr>
<td>3/24</td>
<td>24</td>
<td>Numerical calculus, Simpson’s rules</td>
<td>PT6, 21.1-21.2</td>
<td></td>
</tr>
<tr>
<td>3/26</td>
<td>25</td>
<td>Newton-Cotes algorithms</td>
<td>22.1-22.2</td>
<td></td>
</tr>
<tr>
<td>3/29</td>
<td>26</td>
<td>Romberg iteration and Gauss quadrature</td>
<td>22.3-22.4</td>
<td></td>
</tr>
<tr>
<td>3/31</td>
<td>27</td>
<td>Numerical differentiation</td>
<td>23.1-23.2, 24.2</td>
<td></td>
</tr>
<tr>
<td>4/2</td>
<td>—</td>
<td>Exam 2: Matrices, curve fitting, and numerical calculus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4/5</td>
<td>28</td>
<td>Ordinary differential equations, Euler’s method</td>
<td>PT7, 25.1</td>
<td></td>
</tr>
<tr>
<td>4/7</td>
<td>29</td>
<td>Improved Euler’s method</td>
<td>25.2</td>
<td></td>
</tr>
<tr>
<td>4/12</td>
<td>30</td>
<td>Runge-Kutta methods</td>
<td>25.3-25.4</td>
<td></td>
</tr>
</tbody>
</table>

(continued)
2 Grading

Your final grade is broken down as follows:

Homework : 20 %  
Group project : 10 %  
Midterm 1 : 20 %  
Midterm 2 : 20 %  
Final exam : 30 %

Letter grades will be assigned from your total course score according to $90\% \leq A \leq 100\%$, $80\% \leq B < 90\%$, $70\% \leq C < 80\%$, $60\% \leq D < 70\%$, and $F < 60\%$. Please note that homework and the group project are 30% of your total grade.

3 Class participation and quizzes

There will be an occasional sign-in sheet to evaluate class participation. Pop quizzes may be given during any lecture. The purpose of a pop quiz is to motivate you to keep up with the material and to give you practice working potential exam problems. Class participation and quizzes are 25% of the total homework grade. Reading assignments should be done before coming to class.

4 Homework policy

Homework will be assigned periodically and the due date announced. You may ask others for help at places where you have made diligent attempts and have become stumped. You may ask others for confirmation of results at significant milestones in the problem. However, homework submissions are to be as individuals; please do not copy (see Plagiarism below).

Homework problems must be answered clearly, showing all your work and should be easy to follow. Where applicable, the solution to each problem should contain:
1. A brief statement of the problem
2. The general form of the equations used to solve the problem
3. An equation with the plugged-in numbers and the highlighted solution

Failure to include one of these elements will result in lost credit for the problem. Not all homework or homework problems may be graded. Partial credit will be given for wrong answers that demonstrate some of the correct solution method.

Homework is due by 5:00 p.m. on the assigned day and should be turned in either in class or in my mailbox in Weisenbaker 235. Unless you have a university excuse (see Absences below), late assignments will not be accepted for full credit. Please do not ask me for exceptions.

5 Group project

There will be one group project, handed out March 24, 2004, and due on May 4, 2004. The project will be a programming assignment and will include a report write-up. You will work in groups of four students each. Grading of the group project will make use of the evaluation form attached at the end of this syllabus.

6 Exams

Two, 50-minute midterms and a two-hour final examination are scheduled (see the course calendar given above). The two midterms will be cumulative and the final exam is comprehensive. Unexcused absences will result in a grade of zero for missed examinations.

The exams are closed book but you may prepare crypt-sheets as follows. You may prepare notes on the front and back of one page of 8 1/2 x 11 paper for each exam. You may prepare one new sheet for each exam and you may bring the sheet from the previous exams to the later exams. For example, in the final, you may have one sheet of notes each from the two midterms and a third sheet of notes for the final. You will need a hand-held calculator for each exam. It is your responsibility to ensure that your calculator is working and will perform in the examination.

7 Plagiarism and Cheating

Please read Section 20 of the Texas A&M University Student Rules at

- [http://student-rules.tamu.edu/rule20.htm](http://student-rules.tamu.edu/rule20.htm)

No form of scholastic dishonesty (cheating, plagiarism, etc.) will be tolerated. As commonly defined, plagiarism consists of passing off as one’s own the ideas, words, writings, etc., which belong to another. In accordance with this definition, you are committing plagiarism if you copy the work of another person and turn it in as your own, even if you should have permission of that person. Since the homework grade for this course is a high percentage of your total grade, no plagiarism or cheating will be permitted in the homework. This includes programming assignments.
8 Absences

Please read Section 7 of the Texas A&M University Student Rules at


Please contact me as soon as you know you will miss a class or an exam so that a reasonable alternative can be accommodated. Unexcused absences will result in a grade of zero for the missed work.

9 Americans with Disabilities Act (ADA)

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact the Department of Student Life, Services for Students with Disabilities in Room 126 of the Koldus Building, or call 845-1637. If you require accommodation for activities related to this course, please contact me as soon as possible.

10 ABET

You may be asked to allow copies of your assignments and exams to be submitted to the Accreditation Board for Engineering and Technology (ABET) review panel. The purpose of this is to demonstrate to ABET that our stated mission and objectives are being effectively implemented. Your grade will not be affected by participation.

11 External Resources

You may find the following external resources useful:

- http://www.nr.com/
- http://www.mathworks.com/

References


CVEN 302-501 PROJECTS
INDIVIDUAL EFFORT RATING FOR TEAM MEMBERS

Please print the complete names of all of your team members **INCLUDING YOURSELF**, and rate the degree to which each member fulfilled his/her responsibilities in completing the project. The final grade on the project will be equal to $0.5 \times (\text{Project Grade} + \text{Project Grade} \times \text{Factor})$ where the factor equals the sum of your weighted grades divided by the average of the sum of the weighted grades for everyone in your group. Weighting factors are given below. Sign your name and fill in the class the rating at the bottom. The possible ratings are as follows:

- **Excellent**  Consistently went above and beyond, tutored teammates, carried more than his/her share of the load. Factor = 1.0
- **Very Good** Consistently did what he/she was supposed to do, very well prepared and cooperative. Factor = 0.9
- **Satisfactory** Did what he/she was supposed to do, acceptably prepared and cooperative. Factor = 0.8
- **Ordinary** Mostly did what he/she was supposed to do, minimally prepared and cooperative. Factor = 0.7
- **Marginal** Sometimes failed to show up or complete assignments, rarely prepared. Factor = 0.6
- **Deficient** Often failed to show up or complete assignments, rarely prepared. Factor = 0.5
- **Unsatisfactory** Consistently failed to show up or complete assignments, unprepared. Factor = 0.4
- **Superficial** Practically no participation. Factor = 0.3
- **No Show** No participation at all. Factor = 0.2

These ratings should reflect each individual’s level of participation and effort and sense of responsibility, not his or her academic ability.

<table>
<thead>
<tr>
<th>Name of team member</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Your signature: ________________________ Date: ________________________

Print your name: ________________________ Team: ____________