I. COURSE INFORMATION
   1. Meeting Time & Place: MWF 11:00 – 11:50 in ST 108
   2. Professor: Dr. Beate Zimmer
   3. Office Phone: 825-2682
   4. Office Address: CI 310
   5. e-mail Address: beate.zimmer@tamucc.edu
   6. Web Page Address: http://www.sci.tamucc.edu/~bzimmer
      Additions or changes to this syllabus, exam solutions etc. will be posted on the
      class web page. Be sure to regularly check the class web page.
   7. Office Hours:
      MW 12:00 – 2:00 PM
      F 12:00 – 1:00 PM
      Others by appointment

II. COURSE DESCRIPTION
    A continuation of 3311, Linear Algebra, with emphasis on numerical aspects. Topics
discussed include: Floating point arithmetic, Gauss Elimination, LU factorization,
Cholesky factorization, Overdetermined linear systems, iterative methods, eigenvalues
and eigenvectors by the power method and the QR algorithm, the singular value
decomposition. 3 credit hours.

III. PREREQUISITES FOR THE COURSE
    Math 3311 (Linear Algebra).

IV. COURSE PURPOSE
    This course provides essential mathematical background for students in the Masters
program in mathematics. Numerical linear algebra is crucial to scientific computing.
An understanding of Numerical Analysis methods and of the possible sources of errors
in large computations are a prerequisite for any research in applied mathematics.

V. TARGET AUDIENCE
    This course is a required course for the Masters program in Mathematics. Computer
Science graduate students may also be interested in the course.

VI. TEXTBOOK
    Numerical Linear Algebra and Applications by Biswa Nath Datta, Second Edition
SIAM, 2010. All class demonstrations will be done with MATLAB.

VII. STUDENT LEARNING OUTCOMES
    At the end of the course the student will be able to:
    • solve linear systems by direct methods such as LU factorization, or Gauss elimi-
      nation with partial or full pivoting
• use the QR factorization for linear problems or least squares problems
• decide when a numerical solution can be trusted
• compute and use the Cholesky factorization
• use iterative methods such as the Jacobi method, Gauss-Seidel, Successive Over-relaxation or the conjugate gradient method to solve linear systems
• calculate dominant eigenvalues by the Power method
• calculate all eigenvalues by the QR iteration
• compute the singular value decomposition (SVD) of a matrix
• use the information given by the SVD to infer the structure of the original matrix
• discuss the sources and types of errors arising in numerical computations
• decide which algorithm is appropriate for a given problem
• use existing MATLAB algorithms such as the ones in MATCOM that accompany the book
• generate their own codes for certain problems.

VIII. INSTRUCTIONAL METHODS AND ACTIVITIES
The class uses a lecture format encouraging student participation and discussion. The lecture introduces the concepts and algorithms, provides proofs of the theorems and gives examples of applications. The students will have the opportunity to use algorithms in the MATLAB environment. They will use teaching codes, as well as their own codes.

IX. EVALUATION AND GRADE ASSIGNMENT
The grade is calculated as follows:
Three exams 60%
Homework 15%
Final Exam 25%

Homework will be assigned weekly and is due at the start of the next week. Homework may consist of problems from the textbook, may ask students to implement algorithms from class in MATLAB for a given matrix or may ask students to use existing software such as the MATCOM library to perform calculations. In addition students will be asked to interpret the results found in their calculations in homework assignments. No late homework is accepted. The lowest homework grade gets dropped. Office hours are a great opportunity to ask questions about homework. Working with other students is fine, but be sure to turn in your own product in the end.

Grading Scale: Grades will be no stricter than
A = 90.00 – 100%
B = 80.00 – 89.99%
C = 70.00 – 79.99%
D = 60.00 – 69.99%
F = below 60%

X. AVAILABILITY OF LIBRARY/UNIVERSITY RESOURCES
The computers in the Center for Instruction have the MATLAB software on them. All of the books listed below are available in the Bell Library.

Recommended reading for the course:
XI. TENTATIVE COURSE SCHEDULE

<table>
<thead>
<tr>
<th>Class</th>
<th>Date</th>
<th>Sections</th>
<th>Topics</th>
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<tr>
<td>1</td>
<td>W 1/11</td>
<td>0.1, 0.2</td>
<td>Introduction</td>
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<tr>
<td>2</td>
<td>F 1/13</td>
<td>0.3</td>
<td>Determinants, Cramer’s Rule</td>
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<tr>
<td>3</td>
<td>W 1/18</td>
<td>1.1, 1.2</td>
<td>Linear Algebra Review: Vectors</td>
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<td>4</td>
<td>F 1/20</td>
<td>1.3, 1.4</td>
<td>Matrices and some special matrices</td>
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<td>5</td>
<td>M 1/23</td>
<td>1.5 – 1.7</td>
<td>Cayley-Hamilton Theorem, Singular Values, Vector and Matrix Norms</td>
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<tr>
<td>6</td>
<td>W 1/25</td>
<td>2.1 – 2.4</td>
<td>Floating Point Numbers and their Arithmetic</td>
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<tr>
<td>7</td>
<td>F 1/27</td>
<td>2.5 – 2.8</td>
<td>Floating Point calculations and errors</td>
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<tr>
<td>8</td>
<td>M 1/30</td>
<td>3.1 – 3.3</td>
<td>Some basic Algorithms, Stability, Conditioning</td>
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<td>9</td>
<td>W 2/2</td>
<td>5.1, 5.2</td>
<td>Gaussian Elimination, Partial Pivoting</td>
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<td>10</td>
<td>F 2/3</td>
<td>5.3</td>
<td>Gaussian Elimination with Complete Pivoting, Stability</td>
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<td>11</td>
<td>M 2/6</td>
<td>5.4</td>
<td>Householder Transformation, QR factorization</td>
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<td>12</td>
<td>W 2/8</td>
<td>5.5</td>
<td>Givens Matrices</td>
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<tr>
<td>13</td>
<td>F 2/10</td>
<td>6.1, 6.2</td>
<td>Linear Systems, Existence, Uniqueness and invariance of Solutions</td>
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<td>14</td>
<td>M 2/13</td>
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<td>Exam #1</td>
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<td>15</td>
<td>W 2/15</td>
<td>6.3</td>
<td>Applications giving rise to Linear Systems problems</td>
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<td>16</td>
<td>F 2/17</td>
<td>6.4</td>
<td>Direct Methods to solve Linear Systems</td>
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<tr>
<td>17</td>
<td>M 2/20</td>
<td>6.4</td>
<td>Direct Methods to solve Linear Systems</td>
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<tr>
<td>18</td>
<td>W 2/22</td>
<td>6.10</td>
<td>Iterative Methods: Jacobi, Gauss-Seidel</td>
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<td>19</td>
<td>F 2/24</td>
<td>6.10</td>
<td>Convergence of Iterative Methods, Successive Overrelaxation</td>
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<td>20</td>
<td>M 2/27</td>
<td>6.10</td>
<td>Conjugate Gradient Method</td>
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<tr>
<td>22</td>
<td>F 3/2</td>
<td>7.4, 7.5</td>
<td>Geometric Interpretation, Normal Equations, Polynomial Fitting</td>
</tr>
<tr>
<td>23</td>
<td>M 3/5</td>
<td>7.8</td>
<td>Solving Overdetermined Least-Squares Problems</td>
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</table>
XII. CLASS POLICIES

Class attendance and participation is considered for the course grade: for every missed class (without a documented acceptable excuse) your grade drops by 1%. Skipping class is not recommended. Tardiness is often disruptive to the whole class and is not appreciated. If you are delayed and arrive late for class please do so quietly. Extreme Tardiness may be counted as an absence.

Cell phones and such must be turned off before class. For each time your phone rings during class, your course grade goes down by one percent.

There will be no makeups for missed exams. If an exam is missed, its score will be replaced by the score on the final exam.

You are expected to conduct yourself in accordance with the highest standards of academic honesty. The Graduate Catalog outlines the procedures and possible consequences if you fail to abide by these standards. In turning in work (or MATLAB programs) for a grade you attest that the work is your own work. The policies about academic dishonesty outlined in the Graduate Catalog apply: academic dishonesty results in zero points on the test or assignment and the incident will be reported to the appropriate authorities, which may impose further sanctions.

Grade Appeal Process: As stated in University Rule 13.02.99.C2, Student Grade Ap-
peals, a student who believes that he or she has not been held to appropriate academic standards as outlined in the class syllabus, equitable evaluation procedures, or appropriate grading, may appeal the final grade given in the course. The burden of proof is upon the student to demonstrate the appropriateness of the appeal. A student with a complaint about a grade is encouraged to first discuss the matter with the instructor. For complete details, including the responsibilities of the parties involved in the process and the number of days allowed for completing the steps in the process, see University Rule 13.02.99.C2, Student Grade Appeals, and University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures. These documents are accessible through the University Rules Web site at http://www.tamucc.edu/provost/university_rules/index.html. For assistance and/or guidance in the grade appeal process, students may contact the Office of Student Affairs.

Additions or changes to this syllabus will be announced on the class web page http://www.sci.tamucc.edu/~bzimmer/MATH5333001FAL09.html.

XIII. ACADEMIC INTEGRITY/PLAGIARISM

University students are expected to conduct themselves in accordance with the highest standards of academic honesty. Academic misconduct for which a student is subject to penalty includes all forms of cheating, such as illicit possession of examinations or examination materials, falsification, forgery, complicity or plagiarism. (Plagiarism is the presentation of the work of another as one's own work.) In this class, academic misconduct or complicity in an act of academic misconduct on an assignment or test will result in a grade of zero for the assignment or test and will be reported to the appropriate authorities for further action.

XIV. DROPPING A CLASS

I hope that you never find it necessary to drop this or any other class. However, events can sometimes occur that make dropping a course necessary or wise. Please consult with me before you decide to drop to be sure it is the best thing to do. Should dropping the course be the best course of action, you must initiate the process to drop the course by going to the Student Services Center and filling out a course drop form. Just stopping attendance and participation WILL NOT automatically result in your being dropped from the class. Friday, March 30 is the last day to drop a class with an automatic grade of "W" this term.

XV. CLASSROOM/PROFESSIONAL BEHAVIOR

Texas A&M University-Corpus Christi, as an academic community, requires that each individual respect the needs of others to study and learn in a peaceful atmosphere. Under Article III of the Student Code of Conduct, classroom behavior that interferes with either (a) the instructor’s ability to conduct the class or (b) the ability of other students to profit from the instructional program may be considered a breach of the peace and is subject to disciplinary sanction outlined in article VII of the Student Code of Conduct. Students engaging in unacceptable behavior may be instructed to leave the classroom. This prohibition applies to all instructional forums, including classrooms, electronic classrooms, labs, discussion groups, field trips, etc.
XVI. GRADE APPEALS
As stated in University Rule 13.02.99.C2, Student Grade Appeals, a student who believes that he or she has not been held to appropriate academic standards as outlined in the class syllabus, equitable evaluation procedures, or appropriate grading, may appeal the final grade given in the course. The burden of proof is upon the student to demonstrate the appropriateness of the appeal. A student with a complaint about a grade is encouraged to first discuss the matter with the instructor. For complete details, including the responsibilities of the parties involved in the process and the number of days allowed for completing the steps in the process, see University Rule 13.02.99.C2, Student Grade Appeals, and University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures. These documents are accessible through the University Rules Web site at http://www.tamucc.edu/provost/university_rules/index.html. For assistance and/or guidance in the grade appeal process, students may contact the Office of Student Affairs.

XVII. DISABILITIES ACCOMMODATIONS
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 call or visit Disability Services at (361) 825-5816 in Corpus Christi Hall 116. If you are a returning veteran and are experiencing cognitive and/or physical access issues in the classroom or on campus, please contact the Disability Services office for assistance at (361) 825-5816.