Engineering Analysis for Mechanical Engineers
MEEN/MATH 3310.001
Department of Mathematics and Statistics
Spring 2015

A. COURSE INFORMATION

Course number/section: MATH – 3310.001
Class meeting time: TR 11:00 - 12:15 PM
Class location: CS 115
Course Website: https://bb9.tamucc.edu

B. INSTRUCTOR INFORMATION

Instructor: Dr. D. Palaniappan (Dr. Pal)
Office location: EN 211
Office hours: MW 10:00 – 11:30 AM
TR 9:30 – 10:30 AM
Telephone: 825-2221
e-mail: devanayagam.palaniappan@tamucc.edu
Appointments: e-mail

C. COURSE DESCRIPTION

Catalog Course Description
Matrix operations, determinants, solutions of linear systems, vector spaces, subspaces, important examples, linear independence, linear dependence, basis, dimension, inner products, Gram-Schmidt process, least squares, linear transformations, eigenvalues, eigenvectors, and diagonalization are studied in this course.

Extended Course Description
The course also covers topics from multivariable calculus including gradient, divergence, curl operators, integral calculus, Green's Theorem, Divergence Theorem, Stokes's Theorem.

This course utilizes linear algebra, calculus and MATLAB tools to solve system of equations arising in mechanical and other engineering disciplines.

D. PREREQUISITES AND COREQUISITES

Prerequisites
MATH 3315 (Differential Equations) or Instructor’s Consent. A strong background in MATLAB (and its applications) is essential.
Co-requisites
None

E. REQUIRED TEXTBOOK(S), READINGS AND SUPPLIES
Required Textbook(s)
Linear Algebra with Applications by Steven J. Leon 8th edition.

Optional Textbook(s) or Other References
Introduction to Linear Algebra (3rd edition) by Gilbert Strang and Vector Calculus (3rd edition) by Susan J. Cooley are recommended. Additional material will be provided as needed.

Supplies
None

F. STUDENT LEARNING OUTCOMES AND ASSESSMENT
Assessment is a process used by instructors to help improve learning. Assessment is essential for effective learning because it provides feedback to both students and instructors. A critical step in this process is making clear the course’s student learning outcomes that describe what students are expected to learn to be successful in the course. The student learning outcomes for this course are listed below. By collecting data and sharing it with students on how well they are accomplishing these learning outcomes students can more efficiently and effectively focus their learning efforts. This information can also help instructors identify challenging areas for students and adjust their teaching approach to facilitate learning.

At the end of the course the student should be able to:

1. Use matrix theory to
   • Calculate sums and products of matrices.
   • Compute the inverse of a square matrix.
   • Find left and right inverses of a matrix.
   • Use Gauss-Jordan elimination method for matrices.
   • Solve system of algebraic equations using matrix methods.
   • Obtain solutions of problems in engineering applications.

2. Give examples of vector spaces and subspaces.
   • Use the ideas of linear dependence and linear independence, inner products and projections in practical situations.
   • Define a basis and properties of bases and find a rank of a matrix.
   • Apply Gram-Schmidt process and least squares method for systems

3. Utilize the concepts of linear transformations.
   • Find eigenvalues and eigenvectors of a matrix and understand their applications.
4. Evaluate double integrals using Green’s theorem
   - Compute surface and triple integrals using Stokes and Divergence theorems.
   - Apply integral calculus to problems in mechanical engineering.

5. Use numerical techniques and computer technology to solve linear systems.
   - Apply numerical methods to obtain solutions of ordinary differential equations arising in the field of engineering.

G. INSTRUCTIONAL METHODS AND ACTIVITIES

A variety of instructional methods may be used depending on content area. These include but are not limited to: lecture, multimedia, cooperative/collaborative learning, projects and presentations, performances, and learning experiences outside the classroom. Methodology will be selected to best meet student needs.

H. MAJOR COURSE REQUIREMENTS AND GRADING

Homework will be assigned in class along with the due date. No credit for late homework. Quizzes will be given in class. At the end of the semester the lowest homework/quiz grade gets dropped.

Project: Each student will select a topic to describe a physical problem from mechanical engineering. The problem should be such that its mathematical model use the concepts of this course. Project paper (report) should include the following:
   a. Statement of the problem
   b. Its Mathematical Model
   c. Analytical/numerical results of the model
   d. Interpretation of the results in engineering

Grades will be calculated based on the following

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>% of FINAL GRADE</th>
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<tbody>
<tr>
<td>Exams</td>
<td>48%</td>
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<tr>
<td>Quizzes</td>
<td>10%</td>
</tr>
<tr>
<td>Homework</td>
<td>10%</td>
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<tr>
<td>Project Report</td>
<td>7%</td>
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<tr>
<td>Final Exam</td>
<td>25%</td>
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Grading scale:
A = 90% – 100%
B = 80% - 89%
C = 70% - 79%
D = 60% - 69%
F = Below 60%

I. COURSE CONTENT/SCHEDULE

<table>
<thead>
<tr>
<th>Week of</th>
<th>Topic</th>
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<tbody>
<tr>
<td>Jan 19</td>
<td>Linear Algebra: Matrices and operations, Solutions of systems of equations</td>
</tr>
<tr>
<td>Jan 26</td>
<td>Gauss-Jordan method, inverse of matrices</td>
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<tr>
<td>Feb 02</td>
<td>Determinants and properties</td>
</tr>
<tr>
<td>Feb 09</td>
<td>Applications, vector spaces</td>
</tr>
<tr>
<td>Feb 16</td>
<td>Subspaces, examples, linear independence and linear dependence</td>
</tr>
<tr>
<td>Feb 23</td>
<td>Basis and dimension, inner products, Gram-Schmidt process, least squares</td>
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<tr>
<td>Mar 02</td>
<td>Test # 1, Linear transformations, eigenvalues and eigenvectors,</td>
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<tr>
<td>Mar 09</td>
<td>Diagonalization of matrices and applications</td>
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<tr>
<td>Mar 23</td>
<td>Vector analysis: Scalar and vector values functions</td>
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<tr>
<td>Mar 30</td>
<td>Gradient, divergence, curl operators, line integrals</td>
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<tr>
<td>April 06</td>
<td>Evaluation of integrals, Green’s theorem, Stokes’s and Divergence theorems</td>
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<tr>
<td>April 13</td>
<td>Numerical solutions of linear systems and ordinary differential equations</td>
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<td>April 20</td>
<td>Test # 2, Computer programming</td>
</tr>
<tr>
<td>April 27</td>
<td>Fourier Series</td>
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<tr>
<td>May 04</td>
<td>Series solutions, Bessel functions</td>
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<td></td>
<td>FINAL EXAM: Tuesday, May. 12, 11:00-1:30PM</td>
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Note: Changes in this course schedule may be necessary and will be announced to the class by the Instructor. The assignments and exams shown are directly related to the Student Learning Outcomes described in Section F.

J. COURSE POLICIES

Attendance/Tardiness
Attendance will be taken each class. Attending class is a faster way of learning the material than trying to catch up on missed material solely from the book. Tardiness is often disruptive to the whole class and is not appreciated.

Late Work and Make-up Exams
Missed homework assignments cannot be made up. At most one make-up exam will be scheduled for each exam. Make-up exams tend to be harder than the original exam.
Extra Credit
There is no extra credit in this class.

Cell Phone Use
Cell phones and such must be turned off before class. Each time your phone rings during class, your course grade goes down by 1%.

Laptop Use
You may use a laptop to take notes during lecture. Distracting other students by surfing the web is not acceptable behavior.

Food in Class
No food in class (except during the final, where non-noisy foods are OK).

Missed Exam
If you have to miss an exam, it is your responsibility to contact me no later than the day of the exam. Failure to contact me on or before the exam day results in a grade of zero points for the exam. This also applies to the final exam. For missed final exams due to an acceptable excuse the university rules about I (Incomplete) grades apply and the make-up is at the instructor's convenience early in the next long semester. Only extreme emergencies or official university business are acceptable reasons to miss exams and documentation will be required. Car trouble, routine doctor's appointments, family reunions or graduations of siblings etc. are not valid reasons to miss exams. If your reason to miss the exam is not a valid one, your exam score is 0 points. Be sure to check before missing an exam whether your reason is acceptable.

Participation
Participation is not part of the grade, but you learn more by interacting, than by watching passively.

J. COLLEGE AND UNIVERSITY POLICIES

• Academic Integrity (University)
  It is expected that university students will demonstrate a high level of maturity, self-direction, and ability to manage their own affairs. Students are viewed as individuals who possess the qualities of worth, dignity, and the capacity for self-direction in personal behavior.
  See Full University Policy at http://catalog.tamucc.edu/content.php?catoid=10&navoid=313#Academic_Integrity

• 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 prohibition applies to all instructional forums, including classrooms, electronic classrooms, labs, discussion groups, field trips, etc.

- **Deadline for Dropping a Course with a Grade of W (University)**
The grade of W will be assigned to any student officially dropping a course by Friday, April 10, 2015. No student is eligible to receive a W without completing the official drop process by this deadline. Visit the Office of the University Registrar for the Course Drop Form that must be submitted. After April 10, 2015 a student will not be allowed to drop a course.

- **Grade Appeals (College of Science and Engineering)**
As stated in University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures, 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 Procedure 13.02.99.C2.01, Student Grade Appeal Procedures. These documents are accessible through the University Rules website at [http://www.tamucc.edu/provost/university_rules/index.html](http://www.tamucc.edu/provost/university_rules/index.html), and the College of Science and Engineering Grade Appeals webpage at [http://sci.tamucc.edu/students/GradeAppeal.html](http://sci.tamucc.edu/students/GradeAppeal.html). For assistance and/or guidance in the grade appeal process, students may contact the chair or director of the appropriate department or school, the Office of the College of Science and Engineering Dean, or the Office of the Provost.

- **Disability Services**
Disability Services (DS) is the hub for coordinating services and accommodations to ensure accessibility and utilization of all programs for all Texas A&M University-Corpus Christi students with disabilities. Our services are designed to meet the unique educational needs of enrolled students with documented permanent or temporary disabilities. DS provides intake and consultation services to students seeking to register with our office. DS reviews an individual’s documentation of disability and assesses eligibility for services and the determination of reasonable accommodations. For more information visit the Disability Services Office at 116 Corpus Christi Hall or go to [http://disabilityservices.tamucc.edu/](http://disabilityservices.tamucc.edu/)
GENERAL DISCLAIMER

I reserve the right to modify the information, schedule, assignments, deadlines, and course policies in this syllabus if and when necessary. I will announce such changes in a timely manner during regularly scheduled lecture periods.