ESC 350: Linear Algebra for Engineers
Spring 2021
MWF 10:15 AM – 11:05 AM (Remote Synchronous over zoom)

Catalog Description: ESC 350 Linear Algebra for Engineers
Prerequisites: Prerequisites: MTH 182, and ESC 151 or ESC 152 or CIS 260 or equivalent computer programming language.
Content: Vectors and vector operations, matrices and determinants, eigenvalues and eigenvectors, systems of linear and non-linear equations. Linear Algebra applications in Engineering. Introduction to related numerical methods for Engineering applications. MATLAB for linear algebra applications.
Textbook: Kolman, B. and Hill, D.R. "Elementary Linear Algebra with Applications", 9th Ed., Prentice-Hall, Upper Saddle River, NJ (2008).

Recommended: MatLab license for students: http://www.mathworks.com/academia/student_version

Instructor: Dr. Raghavan Gopalakrishnan
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                        Office Hours: virtual, by appointment only

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Course Objectives: This course is designed to:
1. Provide sophomore-level students with the fundamentals of vector and matrix algebra.
2. Demonstrate the application of linear algebra in the formulation and solution of engineering problems.
3. Develop skills necessary to select and use appropriate algorithms for the numerical solution of common engineering problems.
4. Emphasize accuracy and efficiency concepts and their relation to the algorithm selection process.
5. Extend programming tools learnt in introductory programming course (ESC 151) to solve realistic Engineering problems.

Expected Outcomes: Upon completion of this course, students should be able to:
1. Formulate and manipulate vector/matrix notation problems.
2. Formulate and analyze specific Engineering problems using vector/matrix algebra.
3. Select an appropriate algorithm for the solution of linear and non-linear Engineering problems.
4. Understand the implications of algorithm selection on the efficiency and accuracy of the solution.
5. Write and modify computer programs for the solution of specific Engineering problems using vector/matrix algebra.

Fulfills Program Outcomes:
a) Ability to apply Mathematics, Science, and Engineering knowledge.
e) Identification, formulation, and solution of Engineering problems.
j) Use techniques, skills, and modern engineering tools necessary for Engineering practice.

Prerequisites by Topic:
Computer programming, calculus, differential and integral calculus, differential equations.

Topics and Schedule (tentative and subject to change):

Introduction to linear algebra	1 week
General properties of matrices	1 week
Elementary matrix operations	1 week
Linear systems of equations	2 weeks
Matrix inverse	1 week
Determinants	1 week
Ill-conditioned systems	1 week
Midterm-1	TBD
Vectors	1 week
Linear transformations	1 week
Least square fits	1 week
Eigenvalues, eigenvectors	1 week
Root finding	1 week
Midterm-2	TBD
Non-linear equations and numerical methods	1 week
Finals	TBD

Laboratory Projects:
The course consists of lectures in the classroom and practical exercises in the computer lab using MATLAB. In addition, there will be at least two computer projects for which teamwork is encouraged. The schedules for those course components will be determined as the course proceeds.

Organization:
For successful completion of this course attendance and note-taking are required. The textbook is used as supplemental instructional material and will not be the only resource employed in this course. Due to time constraints and the prerequisite of successful completion of a computer language course, the student is expected to familiarize him/herself with MATLAB as an independent study (Chapter 9 of the textbook).

If a class is missed, the *student* is responsible for the missed material.

The student is requested to read and understand the rules of the computer lab. After computer lab hours, the student is required to exit the MATLAB package. If a student finds, that some package is running before starting work, that package must be exited first.

Homework problems will be assigned on an irregular basis and will be collected one week after assignment. Some homework may take on the form of a project. In such cases, the instructor will allow for additional time.

There will be two mid-term examinations after approximately one third and two thirds of the course. The final examination is comprehensive. All exams are open-book, and must be taken when scheduled.

By default, the overall grade will be determined by:

Homework/Projects:	25%
Exam 1:	20%
Exam 2:	20%
Final:	35%