# Engineering Linear Algebra

IE-15570, Spring 2020

Engineering Building TBA, Mon/Wed 15:00–16:15

## Instructor

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Office: Engineering Building 207–10527
Office Hours: 10:30–11:30am (M/W); 16:30–17:30pm (M/W); or by appointment. (No afternoon office hours on the first Monday of each month).

## Textbook

공학 선형대수학 (저자: 김상일, 김준교, 김현민, 윤지훈, 이동희, 이창익, 정일효, 천정수, 허찬, 히라사카). (주)교문사(청문각). 제1판 1쇄 (2019). ISBN 978-89-363-1832-1

## Web Page

https://AppliedStat.GitHub.io/teaching

## Software

*R Language* (http://www.r-project.org).

## Prerequisite

The expectation is that you have already been exposed to the basic high-school-level algebra.

## Policy

- Attendance Policy: Class attendance is mandatory. If you miss a class for some reason, it is your responsibility to get notes, etc. from someone in class. I will not repeat lectures during my office hours.
- Tardy Professor Policy: If the instructor has not arrived within 15 minutes of the scheduled class time, you may assume that class has been canceled.
- All drop/add procedures are your responsibility.

## Description and Learning Objectives

- Engineering Linear Algebra will focus on basic concepts and theories of linear algebra with engineering applications.
- Basic topics covered in this class include basic vector and matrix representations, determinant, solution of a system of linear equations, independence/dependence concepts, vector space/subspace, etc.
- In addition, we will also study various applied topics such as linear transformation, eigen-value/eigen-vector, diagonalization, inner product space, Gram-Schmidt orthogonalization, least squares problems, etc.
- The popular R statistical language will be handled in this class.

Upon successful completion of this course, a student will be able to:

- Understand basic concepts on vector and matrix representation.
- Solve a system of linear equations using the linear algebra.
- Diagonalize a matrix.
- Decompose a matrix with a diagonal matrix and eigen-vectors.
- Incorporate the linear algebra technique into various engineering problems.

## Grading

For the regular face-to-face class, the final grade will be curved and calculated as follows. For the online class, we did not decide the rule yet.

| | |
|---|---|
| Homework: | 5% |
| Attendance: | 5% (will be checked at random and count 3 points) |
| Midterms 1, 2: | 60% (30+30) |
| Final: | 30% |

– ~~The lowest one of your mid-term exam grades can be replaced by the final exam if the final grade is better.~~ For the in-class exam, the lowest one of your mid-term exam grades can be replaced by the final exam if the final grade is better.

ROUGH GRADING GUIDE:

- A+: 95 ∼ 100   A: 90 ∼ 95-
- B+: 85 ∼ 90-   B: 80 ∼ 85-
- C+: 70 ∼ 80-   C: 60 ∼ 70-
- D+: 50 ∼ 60-   D: 40 ∼ 50-
- F : below 40.

## Exams

| | | |
|---|---|---|
| MIDTERM 1: | T.B.A. | In class |
| MIDTERM 2: | T.B.A. | In class |
| FINAL: | T.B.A. | |

– All in-class the exams will be closed-book. (Other instructions will be provided for the online exam.)

– For the final exam, you are allowed to bring in *one* A4-size formula sheet made up by yourself. But, the formula sheet should be submitted after the exam.

– The final exam will be comprehensive.

– During the exams, a basic calculator will be permitted but cannot be shared with others.

– Calculators in smart phones, tablet PC and laptops are prohibited.

– No early or late exams will be allowed without a written and legitimate excuse.

## Homework

– The students can collaborate on their homework problems, but they should submit their homeworks separately.

– Late homeworks will **not** be accepted.

– Up to 1 ∼ 3 problems, selected at random, will be graded in detail, on a scale of 0–5 each.

– To get full credit, you must show all work on the homework problems, which must be handed in in the same order as they are assigned.

## Tentative Schedules

1 Matrix and a system of linear equations.
2 Gauss elimination and inverse matrix.
3 LU decomposition.
4 Basics on Determinants.
5 Applications of Determinants.
6 Basics on Vectors and vector space.
7 Subspace, basis, and dimension.
8 Row space and column space.
9 Linear transformation.
10 Matrix representation of linear transformation.
11 Eigen-value/eigen-vector, diagonalization.
12 Inner product space.
13 Normed space.
14 Orthogonal set and Gram-Schmidt orthogonalization.
15 Least squares problems, etc.
16 Final Exam.