EE141L Applied Linear Algebra for Engineering

Course Syllabus[1]

Term: Fall 2019

Goals:

- Linear algebra concepts are fundamental to many areas in Engineering and beyond. Examples include, among many others Communications, Control and Signal Processing, Machine Learning, Computer Vision, Computer Graphics.
- The main goal of this class is to master the basic tools and intuitions in Linear Algebra, both from theoretical/abstract and practical/programming perspectives. The emphasis will be on learning the language of linear algebra, and using it for problem solving.
- Towards this goal, throughout the semester, and for each of the topics to be covered, the goals will be to:
  - Introduce basic linear algebra concepts
  - Learn how to prove basic facts using these concepts
  - Discuss specific real world problems to understand how linear algebra tools can be applied
  - Learn basic Matlab programming in order to apply these tools to solve concrete problems

Instructor:

Prof. Antonio Ortega,
Department of Electrical and Computer Engineering, EEB 436
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Lecture: Monday and Wednesday, 2:00-3:50pm, SOS B46

Discussion/Lab: Friday, 10:00-11:50am, THH 102

Important Note: On specific weeks, Labs will be on Monday or Wednesday. On those weeks the Friday time will be used for Lecture. This will be announced in class and the schedule (see link below) will be updated accordingly.

Office Hours: Monday, Wednesday, 4-5:30pm, or by appointment, EEB 436.

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[1] This syllabus is subject to change and will be updated. Last edit 8/19/19.

Teaching Assistants and Office Hours (Note: F 10am-noon correspond to discussion/lab):

Pratyusha Das (G), daspraty@usc.edu Tue 11am-1pm, *F 10am-noon*
Norton Kishi (UG), nkishi@usc.edu Tue 8-9pm, Thu 8-9pm, *F 10am-noon*, 1-2pm
Emily Kuo (UG), ekuo@usc.edu Tue 2-3:50pm
Yubin Lin (UG), yubinlin@usc.edu Tue 10am-noon
Yawen Liu (UG), yawenliu@usc.edu Mon 5:30-6:30pm, *F 10-11am*
Joshua Solomon (UG), jdsolomo@usc.edu Mon 12-1pm, Thu 1-3pm
Alexander Vilesov (UG), avilesov@usc.edu Wed 9-11am, F 12-1pm
Bin Wang (G), wang699@usc.edu Thu 3-5pm, *F 10am-noon*
Kevin Zhou (UG), zhouk@usc.edu Thu 5-6pm, *F 11am-noon*

The following link will have an up to date class calendar with weekly lectures, labs, discussions and office hours listed: EE 141L Calendar

Grading: Labs/Homework (25%) Midterm 1 (20%) Midterm 2 (25%) Final Exam (30%).

Exam dates:
Midterm 1: TBD
Midterm 2: TBD
Final Exam: 12/6 2-4pm.

Communication:

- **Blackboard** will be used to post assignments, handouts and grades:
  https://blackboard.usc.edu
- **Piazza** can be used to post any questions you may have (anonymous posting is allowed). For most class related questions Piazza is the best way to ask, since it allows others to see the question and answers. Of course for specific questions related to your own schedule or to make an appointment, you can use email.
  http://piazza.com/usc/fall2019/ee141l

Textbook:
Richard C. Penney, "Linear Algebra: Ideas and Applications" 4th Edition (Wiley, 2016).

Up to date schedule: Class schedule

Google Calendar: EE 141L Calendar

- Lecture topics
  - Introduction
  - Vectors, Matrices and Linear dependence, vector spaces
  - Systems of Equations and Rank

- ○ Gaussian elimination
- ○ Column Space and Nullity
- ○ Test for linear independence
- ○ Basis
- ○ Dimension
- ○ Rank Nullity Theorem
- ○ Matrix representation theorem
- ○ Matrix multiplication
- ○ Linear systems -- composition
- ○ Inverses -- Linear transformations
- ○ Inversion
- ○ Determinants
- ○ Cramer's rule
- ○ Scalar products, Distance
- ○ Projection and Approximation
- ○ Fourier Series, Orthogonal Matrices, Least Squares
- ○ Eigenvectors and eigenvalues
- ○ Quadratic forms, SVD
- ○ Complex eigenvectors
- ○ Generalized eigenvectors
- ○ Numerical techniques
- ● Labs:
  - ○ Intro to Matlab
  - ○ Simple image processing
  - ○ Traffic flow
  - ○ Page Rank
  - ○ Point clouds
  - ○ Image transforms and JPEG
  - ○ Linear regression
  - ○ Netflix challenge

Statement for Students with Disabilities:
Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. Website and contact information for DSP:

http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html,

(213) 740-0776 (Phone), (213) 740-6948 (TDD only), (213) 740-8216 (FAX) ability@usc.edu.

Statement on Academic Integrity:
USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. SCampus, the Student Guidebook, (www.usc.edu/scampus or http://scampus.usc.edu) contains the University Student Conduct Code (see University Governance, Section 11.00), while the recommended sanctions are located in Appendix A.

Emergency Preparedness/Course Continuity in a Crisis:
In case of a declared emergency if travel to campus is not feasible, USC executive leadership will announce an electronic way for instructors to teach students in their residence halls or homes using a combination of Blackboard, teleconferencing, and other technologies.