

AA/EE/ME 510
Mathematical Foundations of Systems Theory
Fall 2016; Syllabus¹

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Instructor Office Hours: Tuesdays: 2:15-5:15 pm

Teaching Assistant: TBD
TA Office Hours: TBD

Class website: (via) <http://faculty.washington.edu/mesbahi/>
Class Room: Loew 206
Class Time: M,W: 2:30-4:20 pm

Textbooks:

S. Axler, *Linear Algebra Done Right* (Third Edition), Springer, 2015.
D. G. Luenberger, *Optimization by Vector Space Methods*, Wiley, 1997.

Recommended References:

Y. Katznelson, and Y. Katznelson, *A (Terse) Introduction to Linear Algebra*, AMS, 2008.
A. W. Naylor and G. R. Sell, *Linear Operator Theory in Engineering and Science*, Springer 2000.
R. A. Horn and C. R. Johnson, *Matrix Analysis*, Cambridge, 2012.
P. Lax, *Linear Algebra and Its Applications*, Wiley, 2007.
D. S. Bernstein, *Matrix Mathematics: Theory, Facts, and Formulas*, Princeton 2009.
P. R. Halmos, *Finite-Dimensional Vector Spaces*, Springer, 1974.
A. N. Kolmogorov and S. V. Fomin, *Elements of the Theory of Functions and Functional Analysis*, Dover, 1999.

Theme: This course aims to provide a solid mathematical foundation for a number of disciplines in systems theory (communications, signal processing, control), optimization, machine learning, among others. Topics covered include finite dimensional vector spaces, matrix theory, norm and metric spaces, Hilbert spaces, and applications in systems sciences. Particular attention will be given to strengthening students ability to read and do formal mathematical reasoning as required for many graduate courses in systems, signal processing, communication, control, and optimization.

Topics: The topics to be covered include: vectors spaces, duality, norms, matrix decompositions, positive semi-definite and nonnegative matrices, metric and normed spaces, applications in systems sciences.

Website: The class website is a living document. **Check it regularly** as I plan to update it often. I will post homework, homework solutions, hints, thoughts, notes, references, etc., on it.

Handouts: I will provide hand-outs or post papers/notes on the class website on topics of interest during the quarter.

Homework: We will have weekly homework assignments, assigned every Wednesday; the homework is also due on every Wednesday. The contribution of homework toward the final grade is 20%.

Homework Clinic: We will have homework clinics on Tuesdays during the office hours.

Midterms: We will have two midterms approximately during the 4th and 8th weeks into the term. The midterms will contribute 30% each to the final grade.

Project: There is a project for the class, details of which will be discussed during the lecture. The project will contribute 20% to the final grade.

¹Rev. 0.1; September 28, 2016