ECE 5734/ ME 5584/ AOE 5734: Convex Optimization
Course Syllabus

Instructor: Mazen Farhood
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Meeting Time: Tuesdays and Thursdays, 12:30 to 1:45 PM

Meeting Place: 208 Randolph Hall

Office Hours: Tuesdays and Thursdays, 1:50 to 3:20 PM

Grader: TBA

Description: Recognizing and solving convex optimization problems. Convex sets, functions, and optimization problems. Least-squares, linear, and quadratic optimization. Geometric and semidefinite programming. Vector optimization. Duality theory. Convex relaxations. Approximation, fitting, and statistical estimation. Geometric problems. Control and trajectory planning.

Primary Text: Stephen Boyd and Lieven Vandenberghe, *Convex Optimization*, Cambridge University Press.

References:

A. Ben-Tal, A. Nemirovski, *Lectures on Modern Convex Optimization: Analysis, Algorithms, and Engineering Applications*, SIAM.

D. P. Bertsekas, A. Nedic, A. E. Ozdaglar, *Convex Analysis and Optimization,* Athena Scientific.

D. P. Bertsekas, *Nonlinear Programming*, Athena Scientific.

Y. Nesterov, *Introductory Lectures on Convex Optimization: A Basic Course*, Springer.

J. Borwein and A. S. Lewis, *Convex Analysis and Nonlinear Optimization: Theory and Examples,* Springer**.**

Grade:

	20%	Homework
	40%	Midterm (24-hour take-home exam)
	40%	Final (24-hour take-home exam)

Course Topics:

		Percent of Course
1.	**Convex Sets and Functions.** Basic properties and examples; operations that preserve convexity; convexity with respect to generalized inequalities; quasiconvex and log-concave functions.	20%
2.	**Convex Optimization Problems.** Linear, quadratic, and geometric programs; generalized inequalities; semidefinite programming; vector optimization and Pareto optimal points.	20%
3.	**Optimality Conditions and Duality theory.** Lagrange dual problem; weak and strong duality; geometric interpretation; Karush-Kuhn-Tucker conditions; perturbation and sensitivity analysis.	15%
4.	**Approximation and Fitting.** Norm approximation; least-norm problems; regularized approximation; robust approximation.	15%
5.	**Statistical Estimation.** Maximum likelihood estimation; optimal detector design; experiment design.	15%
6.	**Geometric problems.** Extremal volume ellipsoids; centering; classification; facility location.	15%
		100%