

Course Number and Title: Math 651-600, Optimization (I)—Fall 2011

Texts: Optimization by Vector Space Methods, by D. G. Luenberger

Meeting Time and Place: TR 9:35-10:50 am at BLOC 624

Instructor: Dr. Jianxin ZHOU, **Office:** Blocker 641J, **E-mail:** jzhou@math.tamu.edu

Office Hours: MW 1:00-2:00pm, or by Appointment

Description: A two semester course to study a rather unified theory for Optimization in Infinite Dimensional Spaces

Prerequisite: Linear algebra, calculus and analytic geometry, Math 410 or approval of instructor

Backbone of Approach: Applied functional analysis (convex analysis, calculus of variation,...)

Grading Policy: homeworks 80% and final exam or presentation 20%

Topics Covered in the First Semester:

Chapt.1 Introduction

Chapt.2 Linear Spaces: convexity, linear independence, compactness normed spaces

Chapt.3 Hilbert Space: approximation, projection theorem, Gram-Schmidt procedure, Fourier series, dual approximation

Chapt.4 Hilbert space of random variables, the least squares estimate, minimum-variance (unbiased) estimate, recursive estimate

Chapt.5 Dual Spaces: alignment and orthogonal complements, hyperplane, duality in minimum norm problems

Chapt.6 Linear Operators and Adjoints: duality relations for convex cones, the normal equations, the dual problems, Pseudoinverse operators

Topics Covered in the Second Semester:

Chapt.7 Optimization of Functionals: Gateaux and Frechet differentials, derivatives, Euler-Lagrange Equations, convex functionals, conjugate functionals, dual optimization problems, min-max theorem of game theory

Chapt.8 Global Theory of Constrained Optimization: positive cone, Lagrange multipliers, sensitivity analysis, duality

Chapt.9 Local Theory of Constrained Optimization: Inverse function theorem, equality constraints, inequality constraints, Kuhn-Tucker theorem, Pontryagin maximum principle

Chapt.10 Iterative Methods of Optimization: successive approximation, Newton's method, descent methods, conjugate direction methods, projection methods, the primal-dual method, penalty function methods

Other Topics: Optimization in Equilibrium Theory.

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