Engineering Faculty Document No. 46-94
May 24, 1995

TO: The Engineering Faculty

FROM: The Faculty of the School of Electrical Engineering

RE: Change in EE 580

The Faculty of the School of Electrical Engineering has approved the following course changes in EE 580. This action is now submitted to the Engineering Faculty with a recommendation for approval.

FROM:

EE 580. OPTIMIZATION METHODS FOR SYSTEMS AND CONTROL
Sem. 2, class 3, credits 3.
Prerequisite: Elements of linear algebra and calculus; basic knowledge of linear systems (in particular, some familiarity with state variables); some experience in programming.

Introduction to various methods of obtaining the extremum of a non-dynamic or a dynamic system and their use in control system design. Linear programming, various search methods, nonlinear programming and dynamic programming. Various real-life applications are discussed and appropriate case studies are investigated.

Text: David G. Luenberger, *Introduction to Linear and Nonlinear Programming*, Addison-Wesley. (0-201-15794-2)

Outline:

	Weeks
Introduction Motivating examples; mathematical preliminaries	1
Linear programming; linear programs, the simplex method	2
Nonlinear programming Unconstrained problems; first and second order conditions	2
Computational methods of nonlinear optimization Descent methods Conjugate direction methods Quasi-Newton methods Constrained minimization; first and second order conditions least squares theory	4

APPROVED FOR THE FACULTY
OF THE SCHOOLS OF ENGINEERING
BY THE COMMITTEE ON
FACULTY RELATIONS

CFR MINUTES #846

DAT 11/15/95

R. Neal Houze

CHAIRMAN CFR

Optimization of functionals Calculus of variations	2
Practical aspects of optimization	1
Continuous optimal control Maximum principle Time-optimal problems Linear quadratic problem	1
Discrete optimal control Dynamic programming	1
Exams	1

TO:

EE 580. OPTIMIZATION METHODS FOR SYSTEMS AND CONTROL
Sem. 2, class 3, credits 3.
Prerequisite: Elements of linear algebra and calculus of several variables; some experience with MATLAB helpful.

Introduction to optimization theory and methods, with applications in systems and control. Nonlinear unconstrained optimization, linear programming, nonlinear constrained optimization, various algorithms and search methods for optimization, and their analysis. Examples from various engineering applications are given.

Text: E. K. P. Chong and S. H. Zak, *An Introduction to Optimization*, New York, NY, John Wiley & Sons, Inc., 1995, ISBN 0471-08949-4. (Expected to be available in September 1995)

Outline:

	Weeks
Introduction Motivating examples; Mathematical preliminaries (Chapters 1-5)	1
Unconstrained optimization First and second order conditions (Chapter 6)	1.5
Algorithms for unconstrained optimization One dimensional search methods (Chapter 7) Gradient methods (Chapter 8) Newton methods (Chapter 9) Conjugate direction methods (Chapter 10)	4

Quasi-Newton methods (Chapter 11)	
Least squares analysis Examples; basic properties, recursive least squares algorithm (Chapter 12)	1
Linear programming Examples; basic properties; simplex method; duality (Chapters 15-17)	2.5
Nonlinear constrained optimization Equality and inequality constraints; Lagrange conditions; Karush-Kuhn-Tucker conditions; Second order conditions (Chapters 19-20)	3
Convex optimization Convexity; Optimality conditions (Chapter 21)	1
Exams	1

REASON: The proposed changes more accurately reflect the way the course is presently taught.

Richard J. Schwartz
Professor and Head