

## Department of Industrial & Management Systems Engineering

### EIN 6936 Nonlinear & Dynamic Optimization

Spring 2008

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| <b>Time &amp; Place</b> | MW 11:00 am - 12:15 pm, room ENG 201.  |
| <b>Instructor</b>       | Dr. Alex Savachkin, ENC 2201, <a href="mailto:savachki@eng.usf.edu">savachki@eng.usf.edu</a> , 813-974-5577.   |
| <b>Office Hours</b>     | Tuesday 08:00 am - 10:00 am. <i>Feel free to stop by at any time.</i>  |
| <b>Textbook</b>         | A compilation of instructor's notes (30%) and the following references will be used.   |
| <b>References</b>       | <i>Linear and Nonlinear Programming</i> , D. G. Luenberger, 2003.<br><i>Nonlinear Programming: Theory and Algorithms</i> , M. S. Bazaraa, et al., 2006.<br><i>Convex Analysis</i> , R. T. Rockafellar, 1996.<br><i>Convex Optimization</i> , S. Boyd, L. Vandenberghe, 2004.<br><i>Dynamic Programming: Models and Applications</i> , E. V. Denardo, 2003.<br><i>Dynamic Programming</i> , R. Bellman, 2003. |

#### Course Objectives

Get exposed to the theory of nonlinear and discrete dynamic programming and build foundations for their applications.

#### Grading Policy

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| Quizzes     | - 25%  |
| Midterm I   | - 25%  |
| Midterm II  | - 25%  |
| Midterm III | - 25%. |

#### Miscellaneous Policies

If a test/quiz is missed, you must have a *written authorized* excuse to be able to have a make-up. Academic misconduct will not be tolerated; violations of academic honesty will be dispatched in accordance with the University policy.

#### Topics

##### Deterministic Dynamic Optimization

*Sequential decision making; backward recursion; optimal paths in finite acyclic directed networks; principle of optimality; myopic policies; notions of stage and state; asset replacement model; the poacher's strategy model; multi-stage production/inventory planning model; resource allocation models; investment model; solving LP problems using DP.*

##### Stochastic Dynamic Optimization

*Probabilistic state transitions and recursive equations; gambling model; game of chance model; hit-and-miss design model; multi-stage newsboy model; stock-option model; modular functions and monotone policies.*

##### Elements of Basic Topology

*Metric spaces; open and closed sets; compact sets; continuous functions; Weierstrass' theorem.*

##### Convex Analysis

*Convex sets; convex hulls; convex functions; preservation of convexity; convex optimization problems.*

##### Unconstrained Nonlinear Optimization

*Descent methods; gradient descent method; Newton's method; first/second order necessary conditions; one-dimensional search algorithms; unimodal functions.*

##### Constrained Nonlinear Optimization

*Linear equality constraints; Newton's method with equality constraints; inequality constraints; KKT conditions; penalty functions; interior-point methods.*