ENGR 597: Dynamic Optimization for System Operation Under Uncertainty

Syllabus
Fall Semester, 2019

Professor:	Dr. James Cale	Email:	jcale@colostate.edu
Office Hours:	By appointment	Phone:	(970) 412–0494

Course Description: This independent study course will provide a survey of analytical and numerical methods for solving multi-stage decision problems which include uncertainty, with the goal of operating systems to minimize an undesirable outcome (e.g., economic cost, risk) over a number of stages. The course will introduce the dynamic programming framework and illustrate its use in solving multi-stage operational decision problems with applications in areas such as energy, finance, and operations research. Finite horizon and infinite horizon problems will be discussed. This course will include individual reading and literature review assignments to survey existing research and application of concepts through coding and numerical simulation.

Prerequisites[1]

- Students *must* have taken a previous course in undergraduate probability theory and preferably graduate coursework in probability and/or stochastic processes.
- Undergraduate engineering mathematics (calculus, differential equations, matrices).
- Proficiency in one or more of the following languages: MATLAB, Python, R.
- Recommended: previous coursework in undergraduate or graduate control theory.

Textbooks & Other Resources

-*Dynamic Programing and Optimal Control (Vol. 1), 4th ed.*, D. Bertsekas. Belmont, MA: Athena Scientific. 2017.

-*Dynamic Optimization: The Calculus of Variations and Optimal Control in Economics and Management*, M. Kamien and N. Schwartz. New York, N.Y.: Elsevier. 1991.

-Research articles and whitepapers (to be distributed in class)

Meeting Location and Time

Engineering Building Room 202, Systems Engineering Conference Room, Fort Collins campus, Tuesday evenings, 4:30-7:15 PM (MST)

Course Grading Weights

Class participation (10%), short projects/homework (20%), mid-term exam (30%), final project (40%).

[1] Contact the instructor (jcale@colostate.edu) with questions and/or requests for waivers for the prerequisites.

Class Participation

A grade for class participation will be based on (a) attendance in class, (b) active participation during class (e.g., answers to questions during lectures), and (c) presentation and/or discussion during class about assigned sections in the book (teaching your peers) or literature reviews.

Projects/Homework

Homework projects will be graded and will typically be due two weeks after distribution (dates/times will be listed on the assignment). No late homework will be accepted.

Mid-term Exam

The mid-term exam will be an individual, take-home exam; you will have several days to complete it. It will consist of problems to work and will likely include coding and initial work towards your final project. No late mid-term exams will be accepted.

Project Reports & Presentations

This course will culminate in a final report and presentation from each student on their chosen project. You will have several weeks to complete it. Exam deliverables will consist of your code, presentation of your project via a slide deck, and presentation to class. During the last session (Session 14) students will present their projects. No late presentations or edits to your presentation will be accepted after the due date.