Course topics

- Overview of electricity demand and supply, industry structure, and renewable energy today. Fundamentals of energy and electric power; a survey of traditional and new energy resources

- Power markets today and tomorrow

- The Grid: What are the characteristics of transmission? How will grid operators of the future make use of newly available online measurements, and new resources such as a vast arsenal of relays and high voltage DC technologies?

- Control on many time-scales: Economic dispatch/unit commitment (scheduling), reserve management, and second by second regulation.

The course is intended for undergraduate and graduate students who have some background in control. Experience with Matlab is essential.

Office hours: Sean Meyn: Tuesdays after lecture, 2:00-3:00 p.m. in 455 NEB
I can be reached for questions by electronic mail at meyn@ece.ufl.edu (not via e-learning)
Neil Cammardella: Wednesdays, 1:00-2:30 p.m. in 484 NEB (ncammardella@ufl.edu)

Exams, homework, etc. Homework problems will be assigned on a ∼bi-weekly basis, to be handed in at the beginning of class on the date due. They will be graded and returned the following week. Late homework cannot be accepted.

There is no final exam! However, mark your calendars: there are two evening midterm exams, Oct 12 and Dec 7; 90 minutes each, starting at 7:20pm. You will be allowed one sheet of notes (8 1/2 × 11; both sides) in the first exam, and two in the second. Calculators are allowed. Otherwise, the exams are closed-book and closed-notes.

Graduate students will present material from a research paper of their choosing, and will also submit a report.

Evaluation Undergraduates: Mid-term exams 75%, homework 25%
Graduate students: Mid-term exams 70%, homework 15%, oral/written project 15%

I encourage collaboration on homework!
References – Textbooks


There is no perfect text for this course. Course notes and other supplementary material will be available at the course website, http://www.meyn.ece.ufl.edu/courses/sgcourse-2016

Other References


⊙ An essay on markets for a general audience may be found here: *Addressing misconceptions on the performance of the energy market in Texas*, Utility Dive, April 15, 2021, https://tinyurl.com/y58ecgg7

Course topics — a bit more detail

⊙ Generation: Dynamics and costs of traditional generators; characteristics of renewables.

⊙ “Lagrangian relaxations”. Basic optimization theory will be developed in lecture. This is a foundation of much of the remainder of the course.

⊙ Resource allocation problems and convex optimization.

⊙ Economics of Power. “Micro- and Macro-regulation” (WWS Ch. 2); why are power markets so volatile and hostile?


⊙ Power reserves. Some basic probability is needed. This will be developed in lecture.

⊙ Ancillary Services — Why they are needed, and how to use them.

⊙ Classification based on bandwidth. New FERC orders to incentivize them.

⊙ The Grid: Transmission, Distribution, Grid dynamics

⊙ Real and Reactive Power

⊙ DC and AC Power Flow (for details, take a power systems course)

⊙ Demand response: Prices to devices? Buildings as batteries and automated DR.