University of Michigan
Department of Electrical Engineering & Computer Science
EECS 598: Power System Markets & Optimization
Winter 2016

Course Syllabus

Summary: This course covers the fundamentals of electric power system markets, and the optimization methods required to solve planning and operational problems including economic dispatch, optimal power flow, and unit commitment. The course will highlight recent advances including convex relaxations of the optimal power flow problem, and formulations/solutions to stochastic dispatch problems. Problems will be placed in the context of actual electricity markets, and new issues, such as incorporation of renewable resources and demand response into markets, will be covered. All students will conduct an individual research project.

Prerequisites: EECS 463 (Power System Design & Operation, or equivalent) or Permission of Instructor; Proficiency with MATLAB and basic linear algebra and optimization

Instructor: Prof. Johanna Mathieu
4231 EECS Building
jlmath@umich.edu
Office hours: Tuesdays 11:00 am – 12:00 pm, Wednesdays 4:00 – 5:00 pm. If you have a conflict and need to chat, email me to set up another time.

Schedule: Tuesdays & Thursdays, 9:10-10:30 am

Location: 1690 Beyster

Units: 3


Additional materials to be posted on the course website.

Website: I will use Canvas to post announcements, assignments, resources, etc.

Assessment: Assignments (20%)
Midterm 1 (20%)
Midterm 2 (20%)
Project 1 (10%)
Project 2 (30%)

Assignments: Homework assignments will be assigned/due approximately every other week. In addition to completing quantitative problems, you will also be asked to read academic reports/papers and write analyses.

You may discuss problems and solution approaches with your peers, but you must write-up and/or code your solutions by yourself.
**Exams:** There will be two midterm exams, one the week of Feb 22 and one the week of April 4. Exact dates/details will be announced later in the semester. There is no final exam.

**Projects:** There will be two projects assigned. The first will be a group project to investigate a specific electricity market. The second will be an individual research project on a topic related to the course of your own choosing. Deliverables include a project proposal, project presentation, and final project report.

**Policy on electronic devices** (laptops, smart phones, etc.): Electronic devices should not be used in class with the exception of laptops used for note taking.

**Policy on late assignments:** Late assignments will not be accepted. Exceptions may be granted if you speak with me more than 5 days in advance of the deadline.

**Policy on re-grades:** If you believe there is an error in the grading of your assignment/exam, explain the issue in writing and resubmit the assignment/exam with the explanation attached. I will re-grade the entire assignment/exam (which means you could end up with a higher or lower grade than before).

**Honor code:** The College of Engineering has an honor code: [http://honorcode.engin.umich.edu/](http://honorcode.engin.umich.edu/). Please familiarize yourself with it.

In particular, please read the UM Library’s website on plagiarism: [http://guides.lib.umich.edu/c.php?g=283392&p=1887232](http://guides.lib.umich.edu/c.php?g=283392&p=1887232)

Any plagiarism found in an assignment or project will result a score of zero. Repeated offenses will be referred to the honor council.

**Students with disabilities:** If you need accommodation for any disability that affects your participation in this class, please contact me.

**Course Topics:**
- Basic principles of electricity markets, supply/demand balancing, price elasticity, market power
- Types of markets: capacity, energy, ancillary services, financial transmission rights, bilateral trading
- Economic dispatch, locational marginal prices, solution methods
- Optimal power flow (OPF), non-convex solution methods, convex relaxations, convex solution methods
- Unit commitment, mixed integer programming
- Comparison of actual markets (MISO, PJM, CAISO, ERCOT, etc.), co-optimization of energy and ancillary services
- Robust and stochastic optimal power flow/unit commitment
- Incorporating renewable resources and demand response into markets
- Optimal infrastructure planning