ENVIRON/ENERGY 590.05: Economics of Modern Power Systems - Fall 2022

Course Overview

Class Hours

M-W 10:15 to 11:30 LSRC (Grainger Hall 2102)

To join class on Zoom click here.

Passcode: F2022

Instructor

Luana Medeiros Marangon Lima

Office: Gross Hall - 101B

E-mail: luana.marangon.lima@duke.edu

Office hours: Wed 11:45-12:45pm (Gross Hall 101B or Luana's Zoom), or by appointment.

Teaching Assistant

Jeff Fromuth

email: jeffrey.fromuth@duke.edu

Office hour: TBD

Communication

We will use Slack for communication. I will add all students to the slack workspace I've created for the class. Using slack will assure I never miss an email from you and will also keep us one text message away! You may use slack on your computer and/or phone.

Click here to join our slack workspace.

Course Description

The electric power grid is undergoing a major transformation. On the generation side we see an increase in renewable energy penetration driven by the need to reduce CO_2 emissions. On the demand side we face new consumption profiles such as plug-in vehicles, smart homes and smart buildings. The course will focus on the economics of modern power grids to facilitate the integration of these new agents.

Students will learn about the additional strains placed on the existing grids to balance electricity supply and demand. We will discuss energy storage to handle intermittent and fluctuating energy availability from renewable energy sources.

Since most of the transformation is happening at the distribution level we will also talk about distribution network pricing (access charges and rate structure). The pricing mechanism is the key to ensure the success

of the new Smart Grid environment and has an important role in sending economic signals to network users. Yet there is no established practice or common pricing principle that can best serve the industry in the coming period of great change. Upon completion of this course students will understand how information and communication technology will be incorporated into every aspect of electricity generation, delivery and consumption to minimize environmental impact and improve reliability and efficiency.

Course Format and Grading

The course consists of in-person lectures and discussions based on the readings. There will be a set of assignments, a journal and a final project. Grades will be based on:

Percentage

Assignments

50%

Journal Entries

30%

Final Project

20%

You will work on assignments and journal in groups of two to ensure you are getting to know each other and also getting experience working as a team. There will be 5 assignments. The assignments involve reading and applying concepts and tools learned in class to an specific data set or problem. For the assignment you can choose your own group. But for the journal you will be rotating pairs. Two students should not work together for more than one week. More information to come later once I have the final number of enrolled students.

Course Schedule and Topics

Please check our detailed proposed schedule at our class website.

Class Etiquette

You should take responsibility for your education. I expect students to attend every class and get to class on time. If you must enter the class late, please do so quietly. Retain from using phones and tablets for social media during class. Some classes will involve coding on your laptop. I expect you to focus on the assignment and refrain from any web browsing that may disrupt the progress of your work.

Your classmates deserve your respect and support. We will likely have students from many different backgrounds and countries in this class and you should all feel comfortable and make each other comfortable while participating.

Nicholas School Honor Code

All activities of Nicholas School students, including those in this course, are governed by the Duke Community Standard, which states:

"Duke University is a community dedicated to scholarship, leadership, and service and to the principles of honesty, fairness, respect, and accountability. Citizens of this community commit to reflect upon and uphold these principles in all academic and nonacademic endeavors, and to protect and promote a culture of integrity. To uphold the Duke Community Standard:

- I will not lie, cheat, or steal in my academic endeavors;

- I will conduct myself honorably in all my endeavors; and
- I will act if the Standard is compromised."

Please add the following affirmation to the end of all assignments, and sign your name beside it: "I have adhered to the Duke Community Standard in completing this assignment."

Land Acknowledgment

"What is now Durham was originally the territory of several Native nations, including Tutelo (TOO-tee-lo) and Saponi (suh-POE-nee) - speaking peoples. Many of their communities were displaced or killed through war, disease, and colonial expansion. Today, the Triangle is surrounded by contemporary Native nations, the descendants of Tutelo, Saponi, and other Indigenous peoples who survived early colonization. These nations include the Haliwa-Saponi (HALL-i-wa suh-POE-nee), Sappony (suh-POE-nee), and Occaneechi (oh-kuh-NEE-chee) Band of Saponi. North Carolina's Research Triangle is also home to a thriving urban Native American community who represent Native nations from across the United States. Together, these Indigenous nations and communities contribute to North Carolina's ranking as the state with the largest Native American population east of Oklahoma."