ECE 3231: Introduction to Modern Power Systems

Credits and contact hours: 3 Credits (Two 75-minute lectures per week)

Instructor: Peng Zhang

Textbook: Ned Mohan, Electric Power Systems-A First Course, Wiley, 2012.

a. *Other supplemental materials* : none

***Specific course information*:**

a. *Catalog Description*: Fundamentals of power system modeling, planning, operation, and management. Power generation, transmission and distribution. Sustainable energy sources such as photovoltaics array, wind farms, and their grid integration. Power system load flow, control, and transient stability analysis using computer tools.

b. *Prerequisite*: ECE 2001

c. *Required, elective, or selected elective:* Selected elective (EE)

***Specific goals for the course*:**

a. *Specific outcomes of instruction*: The students will be able to describe the operation of transmission lines, machines, transformers, renewable resources, and other power system components. They will be able to use network theory, stability simulation, and power flow analysis for power system operation, planning, and grid integration of renewable resources.

b. *ABET Criterion 3 Student Outcomes addressed by the course*:

(1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
Students learn to apply techniques of algebra, calculus, circuit laws, and numerical methods such as Newton's method to solve power engineering problems.

(2) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
Students learn basic techniques for designing a resilient, intelligent, and sustainable power grid that satisfies social, environmental, & business development requirements.

(3) an ability to communicate effectively with a range of audiences
Students learn the engineering language used in power industry and are able to better communicate with power & energy industry professionals.

(4) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

n/a

(5) an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
n/a

(6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
n/a

(7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.
Students start to get familiar with industrial simulation tools (e.g. PSS/E) for the analysis of power systems and for solving power system planning and operation problems. This course also helps students learn about the use of information resources such as IEEE Power and Energy Magazine, IEEE journals and other good references for power engineers.

Topics covered:

- Introduction
- Review of basic concepts: Three phase power, reactive power, power factor correction. per phase analysis.
- Electric energy sources and the environment
- Power generation, transmission, distribution and utilization
- Transmission lines and underground cables
- Transformers
- Power flow in power systems and numerical solutions
- Equal area criterion and transient stability analysis of power system
- Grid integration of photovoltaic power systems and wind farms
- Introduction to smart grid technologies