ECE 420 – Analytical Methods for Power System Economics and Cybersecurity

Credits: 3, **Contact Hours:** Two 75 minute lecture sessions per week.

Coordinator: Zuyi Li, Professor of ECE

Textbook: Class notes and handouts.

2019 Catalog Data: ECE 100: Analytical Methods for Power System Economics and Cybersecurity. Credit 3. Analytical methods for the economic operation of power systems with consideration of transmission losses. Analytical methods for the optimal scheduling of power generation including real power and reactive power. Analytical methods for the estimation of power system state. Analytical methods for the modeling of smart grid cybersecurity. Lecture: 3 Lab: 0 Credits: 3

Prerequisites or co-requisites by topic: ECE 319 or Electrical Circuit Analysis/Power System Analysis

Enrollment: Elective course for CPE and EE majors

Specific outcomes of instruction:

After completing this course, the student should be able to do the following:

1. Understand the concept of economic dispatch and solve economic dispatch problems with and without transmission losses.
2. Understand the concept of unit commitment and solve unit commitment problems using priority list method and dynamic programming method.
3. Understand the concept of optimal power flow, solve real power optimization problems using linear programming, and solve reactive power optimization problems using linear programming.
4. Understand the concept of state estimation and solve state estimation problems using linear programming method.
5. Understand the cybersecurity issues related to state estimation and model state estimation cybersecurity problems.
6. Apply mathematical programming methods (linear programming, dynamic programming) to solve power system problems.

Relationship of ECE 420 specific outcomes of instruction to student outcomes:

	Student Outcomes	**Course Goals**
1	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	1,2,3,4,5,6
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	
3	An ability to communicate effectively with a range of audiences	
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	
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	
6	An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	
7	An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	

Topics:

- Economic dispatch (1.5 weeks)
- Unit commitment (1.5 weeks)
- Linear programming (1.5 weeks)
- Power systems optimal power flow (3.5 weeks)
- Power systems state estimation (2 weeks)
- Smart grid cybersecurity (3 weeks)

Laboratory topics:

None

Prepared by: Zuyi Li **Date:** February 28, 2020