ECE4320 Course Syllabus

ECE4320

Power System Analysis & Control (3-0-0-3)

CMPE Degree
This course is Elective for the CMPE degree.

EE Degree
This course is Elective for the EE degree.

Lab Hours
0 supervised lab hours and 0 unsupervised lab hours

Course Coordinator
Meliopoulos,A P

Prerequisites
ECE 3072

Corequisites
None

Catalog Description
Introduces basic concepts in electric power generation, distribution,system control and economic operation.

Textbook(s)
Bergen & Vittal, *Power System Analysis* (2nd edition), Prentice Hall, 2000. ISBN 0136919901, ISBN 9780136919902 (required)

Bergen and Vitta, *Power System Analysis & Control* (2nd edition), Prentice Hall Eds., 2000. (optional)

Course Outcomes
Upon successful completion of this course, students should be able to:

1. identify, formulate, and solve power flow problems in electric energy delivery systems.
2. assess the impact of the various controls in the operation of the power system and explain the fundamental principles involved in the operation and control of electric energy power systems
3. model complex control structures of power equipment such as generators, transformers, and exercise these controls for voltage and frequency control of the power system.
4. identify the cost model of power systems, formulate, and solve the economic dispatch problem.
5. identify operating constraints, model and solve optimization problems that minimize the cost subject to constraints and apply this knowledge to the optimal power flow problem.

6. identify operating constraints, model and solve optimization problems that minimize the cost subject to constraints and apply this knowledge to the optimal power flow problem.

Student Outcomes

In the parentheses for each Student Outcome:
"P" for primary indicates the outcome is a major focus of the entire course.
“M” for moderate indicates the outcome is the focus of at least one component of the course, but not majority of course material.
“LN” for “little to none” indicates that the course does not contribute significantly to this outcome.

1. (P) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. (LN) 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. (LN) An ability to communicate effectively with a range of audiences
4. (LN) 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. (LN) 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. (LN) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. (LN) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Topical Outline

```
Background
Historical perspective
Power system structure
Economic factors
The Smart Grid
Integration of Renewables

Fundamentals
Steady state AC circuit analysis
Three phase systems
Symmetrical components
Power System Modeling
Transmission Lines
Transformers, passive, regulating
Generators, control models

Power Flow Analysis
Formulation
Solution methods
Large scale systems

Power Flow Applications
Power transfer capability
Transmission losses
```

Voltage stability
Available Transfer Capability
Security Assessment

Operating State Estimation

Economic Operation of Power Systems
Economic Characteristics
Economic Dispatch
Controls ? The Optimal Power Flow
Operation in a Deregulated environment
Power System Markets
Financial Transmission Rights

Power System ControlsLoad-Frequency ControlVoltage Control
Ancillary Services from Renewables