ECE4321 Course Syllabus

ECE4321

Power System Engineering (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
To introduce basic concepts of electric power system design, encompassing protection, stability and control.

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

Glover, Overbye & Sarma, *Power System Analysis and Design*, Cengage , 2017. (required)

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

1. Explain the failure modes in electric energy systems
2. Analyze electric power systems under various fault conditions.
3. Apply the basic principles of stability of dynamic systems to electric energy systems.
4. Apply the principles of power system protection, characteristics of protective relays and setting and coordinating protective relays.
5. Model and formulate the dynamics of electric energy systems.
6. Determine the stability properties of electric energy systems.
7. Apply fault detection methods to formulate specific protection functions for electric energy systems.

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

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Background (one lecture)
Power system design issuesPower system stability
Power system protection
Power system controlPower System Models (Chapter 3, five lectures)
Line Sequence Impedances
Generator Sequence Impedances
Transformer Impedances
Per Unit Parameters
Power System Grounding

Power System Electrical Transients (Chapter 4, six lectures)
Transients Characterization
Balanced Fault Analysis
Unbalanced Fault Analysis
Three Phase FaultsAsymmetric FaultsFault TransientsEffects of Groun
Interactive A&V of Electrical Transients

Electromechanical Transients / Stability (Chapter 14, eight lecture
Classification of Electromechanical TransientsTransient Stability
Numerical solution methods
The equal area criterion
Lyapunov direct method
System Stabilization

Protection Fundamentals (Chapter 5, eight lectures)
Protection PhilosophyZones of ProtectionProtective Equipment Overcu
Zone Distance Protection
Overvoltage / Undervoltage Protection
Underfrequency / Overfrequency Protection
Pilot Relaying
Substation Automation
Interactive A&V of Protective Relaying
Fault Monitoring and Recording
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