ECE 5043 (Proposed): Power Systems - Analysis and Operation

Course Description

Power systems analysis and operations, including steady-state analysis, state estimation, and economic operation.

Transcript Abbreviation: Pow Sys Anal & Op
Grading Plan: Letter Grade
Course Deliveries: Classroom
Course Levels: Undergrad, Graduate
Student Ranks: Junior, Senior, Masters, Doctoral
Course Offerings: Spring
Flex Scheduled Course: Never
Course Frequency: Every Year
Course Length: 14 Week
Credits: 3.0
Repeatable: No
Time Distribution: 3.0 hr Lec
Expected out-of-class hours per week: 6.0
Graded Component: Lecture
Credit by Examination: No
Admission Condition: No
Off Campus: Never
Campus Locations: Columbus
Prerequisites and Co-requisites: ECE major and ECE 3040 or ISE major and senior standing, and MATH 2568; or graduate standing in Engineering or Biological, Mathematical, and Physical Sciences (BMPS).
Exclusions:
Cross-Listings: ISE 5043

Course Rationale: Provides a much needed course in power systems for both ISE and ECE students.

The course is required for this unit's degrees, majors, and/or minors: No
The course is a GEC: No
The course is an elective (for this or other units) or is a service course for other units: Yes

Subject/CIP Code: 14.1001
Subsidy Level: Doctoral Course

Programs

Abbreviation	Description
CpE	Computer Engineering
EE	Electrical Engineering

Course Goals

Students learn how power systems operation in steady-state (solving systems of nonlinear equations)
Students learn how to estimate the state of a power system (solving unconstrained optimization problems)
Students learn how to perform a security analysis of a power system (slogan a large number of interrelated systems of linear equations)
Students learn how electricity markets operate (solving linear optimization problems)

Students learn how generating units are scheduled for production (solving mixed-integer linear optimization problems)

Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Introduction: Power systems and how they work	3.0							
Power system steady-state analysis: power flow equations, Newton solution, DC power flow	12.0							
Power system state estimation: observability, estimation, bad data detection and identification	12.0							
Power system security: contingency analysis, optimal power flow, security-constained optimal power flow	12.0							
Power system economic operation: market clearing, unit commitment	9.0							

Representative Assignments

Computational homework on steady-state analysis
Computational homework on state estimation
Computational homework on security
Computational homework on economic operation

Grades

Aspect	Percent
Homework	50%
Midterm exam	20%
Final exam	30%

Representative Textbooks and Other Course Materials

Title	Author
Electric Energy Systems: Analysis and Operation	A. Gomez Exposito, A. J. Conejo, C. Canizares
Modern Power System Analysis	D. P. Kothari, I. J. Nagrath

ABET-EAC Criterion 3 Outcomes

Course Contribution		College Outcome
***	a	An ability to apply knowledge of mathematics, science, and engineering.
***	b	An ability to design and conduct experiments, as well as to analyze and interpret data.
*	c	An ability to design a system, component, or process to meet desired needs.
**	d	An ability to function on multi-disciplinary teams.
***	e	An ability to identify, formulate, and solve engineering problems.
*	f	An understanding of professional and ethical responsibility.
*	g	An ability to communicate effectively.
**	h	The broad education necessary to understand the impact of engineering solutions in a global and societal context.
	i	A recognition of the need for, and an ability to engage in life-long learning.

Course Contribution		College Outcome
**	j	A knowledge of contemporary issues.
**	k	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Additional Notes or Comments

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to be cross-listed with ISE
"recommended" texts. 2/5/15. ced.
edited text info, 5/10/17, CED
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