ECE4325 Course Syllabus

ECE4325

Electric Power Quality (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

Prerequisites
ECE 3072

Corequisites
None

Catalog Description
Transients and harmonics in power systems, analysis methods and mitigation practices. Causes of power quality problems and relationship to equipment susceptibility.

Textbook(s)
A. P. Meliopoulos & George Cokkinides, *Electric Power Quality: An Introduction*. (required)

Jerry Heydt, *Electric Power Quality*, Stars in a Circle, 1991.(optional)

A. Greenwood, *Electrical Transients in Power Systems*, Wiley-Interscience, 1992.(optional)

Course Outcomes
Upon successful completion of this course, students should be able to:
1. Identify all harmonic sources in a power grid
2. Solve harmonic power flow problems in electric energy systems
3. Identify and analyze harmonic resonances and assess their impact,
4. Explain transients in electric power systems and their effect on power quality,
5. Explain and analyze the impact of grounding design on power quality
6. Explain the basics in filter design to improve power quality.

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

Power Quality Concepts
Transients, Voltage Sags, Voltage swells
Power Electronic Based End Use Devices
Energy Resources with Conevrter-Based Interfaces
Waveform Distortion, Harmonics
Power concepts under waveform distortion
Equipment Susceptibility
Power Quality Problems - Classification
Modeling for Power Quality Analysis
Lumped Parameter Circuits
Distributed Parameter Circuits
Transmission lines, transformers, generators
Distorting loads
Grounding
Analysis Methods
Fourier Transforms
Laplace Transforms
Numerical Methods
Special Transforms (Wavelets, Hartley)
Voltage Sags and Swells
Fault Induced Sags and Swells
Transferred Voltages
Impact of grounding
Mitigation techniques (filters, active compensators, voltage restor
Harmonics
Generation mechanisms
Effects of harmonics (resonance, derating, vibrations, etc.)
Mitigation methods, Filters, UPS
Standards
Electrical Transients
Switching Transients (Energization, Cap Switching, In-Rush, Motor S
Lightning Induced Transients (Lightning Characteristics, Surges, Sh
Overvoltage Protection (Technology, Surge Protection Devices, Coord
Distributed Generation and Power Quality
Distributed Generation Technologies (Wind, Fuel Cells, Microturbine
Integration and MicroGrids
Protection and Control of Microgrids