EE-4223

Power System Protection

Curricular Designation:  CpE: N/A  EE: Elective

Catalog Description: Real-time monitoring and protection of modern power systems. Secure and reliable operation of radial and grid systems. Protection of transmission lines, buses, generators, motors, transformers, and other equipment against disturbances. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Spring Offered alternate years beginning with the 2004-2005 academic year Pre-requisites: EE 4221 and EE 4222(C)

Textbook(s) and Other Required Materials:
Protective Relaying Principles and Applications, 2\textsuperscript{nd} Ed, J.L. Blackburn, © 1998.

Prerequisites by Topic:
1. Mastery of DC and AC circuit analysis.
2. Mastery of three-phase circuits, per phase, and per unit analysis.
3. Familiarity with basic electric machine and transformer theory.
4. Familiarity with power systems analysis including short-circuit and symmetrical components.

Course Objectives:
1. Become familiar with general concepts of zones of protection, types of protection, and coordination of protection schemes. Understand tradeoffs between reliability, simplicity, cost, security, selectivity, and speed.
2. Master the analysis of ideal and non-ideal performance of relay input sources.
4. Become familiar with grounding principles, and ground potential rise.
5. Master the fundamental design and analysis related to application of protection schemes listed the topics below.
4. Become familiar with commonly-used communications methods and system control/interfacing.
Topics Covered:

1. Review: system protection philosophies, system grounding, circuit breakers, fuses.
2. Relay input sources: VTs, CTs, CVTs, CCVTs, optical voltage and current transducers.
3. Fundamental protection concepts: time-inverse, differential, directional impedance, etc.
4. Generator protection (differential, negative sequence, loss of excitation, out of step, etc).
5. Motor protection (ground fault, locked rotor, undervoltage, phase rotation, etc).
7. Transformer protection (differential, sudden pressure, over temperature, low oil, etc).
8. Line protection (directional comparison, blocking, unblocking, transfer trip, etc).
10. Communications (pilot wire, power line carrier, microwave, fiber optics), SCADA, etc.

Relationship of Course to Program Objectives (See UPAC SOP, Tables 1 and 2):

- EE: Outcome: a, k, e via topics 1-6
- CpE: N/A

Contribution of Course to Meeting the Professional Component

- EE: Engineering Topics
- CpE: N/A

Class/Laboratory Schedule (note: 1 hour = 50 minutes):

Lecture: 45 hours = 3 hours/week for 15 weeks

Prepared by:

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