EE-4222

Power System Analysis 2

Curricular Designation:  
CpE: N/A  
EE: Elective

Catalog Description:  
Covers power flow, economic dispatch, power system operation, and power system stability. 
Credits: 3.0  
Lec-Rec-Lab: (0-3-0)  
Semesters Offered: Spring  
Prerequisites: EE4221

Textbook(s) and Other Required Materials:


Prerequisites by Topic:

1. Prerequisite topics of EE4221.
2. Mastery of 60 Hz models of transmission lines, loads, and transformers, particularly the per unit models.
3. Mastery of the power flow problem in power systems.

Course Objectives:

1. Mastery of balanced and unbalanced faults, including fault calculations using bus impedance matrices.
2. Familiarity with generation of positive, negative, and zero sequence bus impedance matrices.
3. Mastery of symmetrical component representation of power system components and their application to unbalanced faults.
4. Familiarity with overcurrent, differential, and ratio protection devices and their application in a coordinated protection scheme.
5. Familiarity with power system operation, including economic dispatch of generation, frequency, and voltage control.
6. Familiarity with stability problems and clearing of faults to mitigate these problems; the ability to calculate critical clearing times. System voltages and currents.
Topics Covered:

1. **Balanced short-circuits, including**: Series R-L circuit transients, Synchronous machine transient, sub-transient, and steady-state models, Inclusion of pre-fault currents by superposition.

2. **Unbalanced three-phase short-circuits, including**: Developing sequence networks for power systems, Developing sequence impedance matrices for power systems from the sequence networks, Applying sequence networks and sequence impedance matrices to determine the system, currents and voltages under the application of unbalanced faults, Selecting fuses and circuit breakers in power systems.

3. **Power system protection, including**: instrument transformers, CTs and VTs., overcurrent, directional, impedance, and differential relays; fuses and reclosers, coordination of overcurrent devices, protecting lines, buses, and transformers.

4. **Control of power system operation**: scheduling generation, including the statistical nature of load, generator-voltage control, turbine-governor control, economic dispatch, including losses.

5. **Power system stability**: the swing equation, equal-area criterion, solution of the swing equation, design methods for improving stability

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

- EE: outcome: a, e, k via topics 1-5
  - outcome: l via topic 4

- 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:**

Dennis Wiitanen, Professor, February 12, 2004