Catalogue Description:
This lab course includes nine experiments to study various aspects of power systems: measurement of the characteristics data of a transmission line and an assessment of its voltage drop and losses; synchronization and steady state operation of a generator connected to an infinite bus system; load characteristics of a synchronous motor and effect of field excitation on reactive power load; effect of voltage levels on power transmission and effects of various load types on power plants; load flow data preparation and system study; system analysis of symmetrical and unsymmetrical faults; Transient stability data preparation and system study.

Credit hours: 1 credits

Required or elective: Elective for ECE and CCE students

Prerequisites: By course: EECE 471, By topic: Basic understanding of power systems modeling methods

Textbook(s) and/or required materials: Experiment Manuals - Provided by the instructor

Course Objectives
The objectives of the course are to:
1. To allow students to practically verify several concepts and procedures learned in power system modeling and analysis.
2. To develop hands-on experience of how certain procedures of power system operation are carried out
3. To carry out system studies using state of the art power systems analysis software to assess system operation in steady state and under faulted conditions.
4. To promote teamwork among students and effective communication skills.

Course Topics
1. The Characteristic Data of a Transmission Line
2. Transmission Line Model and voltage drop evaluation
3. Load Characteristics of a Synchronous Motor
4. Load Effect on Power Plants
5. Load Flow Data Preparation and Entry into IPSA
6. Load Flow System Study using IPSA
7. Data Extension for Short Circuit studies.
8. Short Circuit Analysis for Symmetrical and Unsymmetrical Faults
9. Data Extension for Stability Studies
10. System Stability Studies using IPSA.

Course Learning Outcomes
1. Understand how to measure electrical parameters characteristics of a 3-phase transmission line.
2. Understand the effect of active and reactive loading on the voltage drop and the power handling capability of a transmission line.
3. Understand the significance of the “torque angle” and its relation to synchronous motor loading and investigate the effect of field excitation on the reactive loading of the motor.
4. Understand the effect of voltage level on power transmission and the effect that different types of loads (capacitive, inductive) have on power plant loading.
5. Practically know the procedure used in preparing transmission line, load and generator data for a load flow system study.
6. Understand the procedure and steps needed to implement a load flow system study and interpret the results provided by the software.
7. Understand the significance of extra data requirement needed for short circuit calculations and are able to prepare such data for a practical short circuit system study.
8. Know how to carry out a short circuit analysis study for symmetrical and unsymmetrical faults and are able to interpret the results of the analysis.
9. Understand the significance of extra data requirement needed for system stability studies and are able to prepare such data for practical system studies.
10. Know how to carry out a transient analysis study for faults of various durations on the system and are able to determine critical clearing times for various faults.

Class/laboratory schedule: One 150-minute lab session per week

Resources of the course: Lab Experiments and Moodle

Evaluation methods
1- Drop quizzes (10%)
2- Experimental results and Lab Reports (40%)
3- Final (open book/notes) (50%)

Professional Components
Engineering topics: 80%
General education: 10%
Mathematics and basic sciences: 10%

Person(s) who prepared this description and date of preparation
Prepared by Dr. Karaki, April 2009

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