

Helen and John Hartman Department of Electrical and Computer Engineering

ECE 449 - Power Systems Laboratory (2 credits, 3 contact hours):

Instructor: Hector Rivas	Office: FMH 317
Phone: (973) 596-3546	Email: hector.rivas@njit.edu
Office Hours: Monday 5:00-6:00 PM and Wednesday 5:00-5:30 PM or as available for drop in or by appointment.	

Class Schedule: Monday 6:00 - 9:05 pm Room FMH 109

Textbook: Manual of experiments on-line (ECElabs.njit.edu and moodle).

Course Description: Laboratory work in the design and synthesis of power systems, closely coordinated with the power systems elective. Prerequisites: ECE 494. Corequisite: ECE 442. Experiments will be coordinated with the lecture.

Expected Course Outcomes:

- a. To be able to measure and calculate: complex power, real and reactive power; lagging and leading power factor, apparent power (volt amps) and verify that the measurements are predictable from the theory.
- b. To be able to compensate Inductive loads with appropriate capacitances and to determine the effect on transmission losses,
- c. To observe on the scope the phase sequence of a three-phase supply and use experiments to verify the observed sequence.
- d. To understand the various three phase transformer connections and measure the
- e. various voltages
- f. To have hands-on experience on how electric energy is generated.
- g. To have hands-on experience on the control of voltage, frequency, and power of an AC generator.
- h. To have hands-on experience on paralleling of generators and connecting a generator to the grid.
- i. To have hands-on experience on the use and design of power systems software.

List of Topics and Approximate Schedule: Note that the large size of this class will necessitate that not all groups will be performing the same lab every week. It will be very important therefore that groups do not get behind. You will be expected to come to class prepared for the lab that you will be doing that day. You should have read the lab manual in advance and ensured that you understand it and are prepared.

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| Week 1: | Introduction & Calibrating an analog AC meter |
| Week 2: | Experiment 1 continued |
| Week 3: | Power Factor Compensation and Introduction to PowerWorld |
| Week 4: | Phase sequence measurements |
| Week 5: | Three-phase Transformers |
| Week 6: | Multi-phase power generation |
| Week 6: | The V-curves of a Synchronous Machine |
| Week 7: | Synchronizing an alternator and connecting it to the power system |
| Week 8: | Real and Reactive Power Control of an Alternator |
| Week 9 & 10: | Using Matlab to solve the load-flow problem. Verify results with PowerWorld. |
| Week 11: | Study the effect of load on voltage angles and voltage profile in the |

	14-bus system (PowerWorld)
Week 12& 13:	TBD
Week 14:	TBD

Grading: An important goal of a lab course is to impart hands-on experience. Although it may appear that the grade is given based on the submitted report only, it should be realized that an essential part of the lab experience is actually doing the experiment. No grade will be given for a lab session if the student did not attend the session. Lab reports are due the week after the lab is completed unless discussed with the instructor in advance. There a penalty of one point out of 10 points for each week the report is late. Each group will have one “free week” extension that can be used for one of the reports with notice to me by the group. This should be used only as necessary as additional extensions will be awarded only in extreme circumstances.

Grades will be determined with 30% of the grade from the prelab and class participation and 70% from the lab reports.

Another important goal of the lab experience is to reinforce the theory learned in lecture courses. Hence students are expected to review the write up of the experiment to be done and the relevant theory before coming to the lab to do the experiment.

Each student should include in his/her report a section titled “Discussion and Analysis of results.” This is an important part of the experiment and it is given 30% of the grade of the report.

The report should be readable by itself without referencing the lab manual, etc. It should be written using your own words. Cutting and pasting form the manual and other resources is not rewarded.

To summarize: There are 10 total points for each experiment: 4 points Data, 3 points for Discussion and Analysis of results: 3 points for other items including:

Title Sheet and Cover, Abstract or Synopsis, Procedure (not necessarily separate from the data reporting), Connection Diagram (s).

Clarifying, you must follow “The Formal Laboratory Report” format. This is a link from ECE 494 Lab Manual with instructions and cover report sample at the bottom, which it may be used for your report.

http://ecelabs.njit.edu/ece494/lab_report.php

The Honor Code

Students should be familiar with NJIT Honor Code. This code will be rigorously upheld, any violations will be brought to the immediate attention of the administration.