

ECE 494 Electrical Engineering Laboratory III Syllabus

3 credits, 3 contact hours.

Course Instructor: Ratna Raj

Phone: (973) 596-8289 **Office:** ECE 347

e-mail: ratna.raj@njit.edu

Textbook: Laboratory Manual for ECE 494 (on ECE laboratory website,
<http://centers.njit.edu/ecelab/manuals/index.php>)

Supplemental materials

Jasprit Singh, “Semiconductor Devices”, ISBN 0-471-36245-X

S. O. Kasap, “Principles of electronic materials and devices”, ISBN 0-07-295791-3

Turan Gönen, “Electrical Machines with MATLAB”, second edition, ISBN 978-1-4398-7799-9

Contents of this course

This senior laboratory addresses two main areas of electrical engineering:

Power (part A) and

Semiconductor Devices (part B).

In part A, students experiment with three phase power measurements, ac power losses, DC generators, three phase induction motors, and power transformers. Industrial scale components, power and voltage level are used.

Part B includes measurements of characteristics of semiconductor diodes, transistors using computer control of experiments, data acquisition, and the efficiency of solar cells using solar simulator radiation source.

Prerequisites: ECE 341, ECE 374, ECE 392

Course is required in EE program

Course Learning Outcomes (CLO). Students have skills (or are able) to:

1. Measure power in three phase circuits
2. Distinguish between the effects of Eddy current and hysteresis losses in magnetic materials
3. Measure performance characteristics of DC generators and three-phase induction motors.
4. Perform power transformer open and short circuit tests and determine the values of elements of the equivalent circuit.
5. Design experiments for measuring characteristics of different semiconductor diodes
6. Measure characteristics and efficiency of a solar cell
7. Extract model parameters of diodes and solar cell from measured I-V characteristics
8. Design experiments and measure characteristics of MOS and BJT transistors
9. Extract transistor model parameters from the measured characteristics
10. Write a professional quality laboratory report describing their work, results and analysis.

Relevant student outcomes (ABET criterion 3):

- (1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics (CLO 2,5, 6, 8, 9)
- (3) an ability to communicate effectively with a range of audiences. (CLO 10)
- (5) 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 (CLO 1-10 all labs and reports are team based)
- (6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions (CLO 1-9)

Topics to be covered, using 1 to 2 weeks per lab.

(Half will start with Topic 1 and half with topic 6)

1. Three Phase Power
2. Power Transformer Open and Short Circuit Tests
3. Eddy Current and Hysteresis Losses
4. Performance Characteristics of DC Generators
5. Load Tests on a Three-Phase Induction Motor
6. Measurements of characteristics of semiconductor diodes.
7. Computer control voltage and current source and data acquisition
8. Measurements of characteristics and efficiency of a solar cell
9. Measurements of characteristics of BJT transistors
10. Measurements of characteristics of MOS transistors

NJIT Honor Code will be upheld, and any violations will be brought to the immediate attention of the Dean of Students.

Grading:

The course grade is based on the average grade of all experiments. Each experiment grade consists of the following elements:

- Preparation for the experiments including *Prelab* assignment and attendance: 15 % **Due at the start of the lab**
- Laboratory Report 85% **Due one week after completion of the lab.**

(Instructor may permit extensions when requested.)

Late lab reports will be devalued by 10% per week

- Quality of presentation and format 15 %
- Experimental data 40 %
- Analysis simulations and discussion 30 %

The grades of individual students in the same team may be different, based on their attendance and participation in the laboratory.

The TA for Part B may modify the above as he or she sees fit.

Makeup : Can be done :

- In the evening session of ECE494 with my permission but the readings have to be signed and approved by the instructor of evening class
- With special time slots approved by Dr. Haas or me .