Course Syllabus

ELC 333 - Electrical Engineering Lab I

Spring Semester

2010-2016 Catalog Data:

ELC 333/Electrical Engineering Lab I

.5 course unit
Corequisite: ELC 251

A practical laboratory experience designing, simulating, breadboarding, and testing electronic circuits to complement the theory in ELC 251.

Textbook:

Microelectronic Circuits, 7th Edition by Abel S. Sedra and Kenneth C. Smith, Wiley 2003

Instructor: Prof Joe Jesson, jessonj@tcnj.edu, Direct 203-613-3344, 144 Armstrong Hall,
Mo 02:00PM- 04:40PM, Jan 25, 2016 – May 6, 2016

Course Objectives*:

Objective 1: To develop the student's ability to collect, analyze, and interpret laboratory data involving electronic devices and related circuits [a,b,c,d,e,g,k].

Objective 2: To introduce students to basic principles of electronic devices and the analysis, design, and testing of circuits containing electronic devices [a,b,c,e,k,l].

Objective 3: To give students the ability to identify, formulate and solve engineering problems involving electronic devices [a,b,c,d,e,g,k,l].

Topics Covered:

1. Basic Operational Amplifier and Applications
2. Active Filter Basics
3. Semiconductor Diode Characteristics and Circuit Applications
4. Bipolar Junction Transistor (BJT) Characteristics and Circuit Applications
5. Field-Effect Transistor (FET) Characteristics and Circuit Applications
6. Small Signal Amplifiers
7. Frequency Selective and Tuned Amplifiers
8. Utilization of PSpice and other simulation packages for circuit analysis

Evaluation:

1. Laboratory Reports
2. Oral Presentation
3. Performance in Laboratory

Performance Criteria:**

Objective 1

- Students will demonstrate the ability to collect, analyze, interpret and report experimental

  data involving the operation of electronic devices in the laboratory. [A,B,C]

Objective 2:

- Students will demonstrate an understanding of the basic applications of electronic devices by designing, building, and testing active circuits. [A,B,C]

- Students will demonstrate an understanding of the characteristics and basic applications

  of operational amplifiers. [A,B,C]

- Students will demonstrate an understanding of the biasing of electronic devices. [A,B,C]

2.4 Students will demonstrate an understanding of the change in characteristics with frequency of electronics devices when applied in electronic circuits. [A,B,C]

Objective 3

Students will demonstrate the ability to solve circuit problems involving diodes, BJT and FET devices. [A,B,C]

- Students will demonstrate the ability to solve circuit problems employing operational amplifiers. [A,B,C]
- Students will demonstrate the ability to solve problems involving the design basic electronic devices, including device biasing, and small and large signal operation. [A,B,C]
- Students will demonstrate the ability to analyze and solve electronic device problems using the computer and PSPICE techniques. [A,B,C]
- Students will demonstrate they can work in a team on the solution of electronic circuit design problems. [A,B,C]

Contribution of course to meeting the professional component:

Engineering Science: 70%

Engineering Design: 30%

Educational Objectives:

The School of Engineering at The College of New Jersey seeks to prepare its graduates:

- To contribute to the economic development of New Jersey and the nation through the ethical practice of engineering;
- To become successful in their chosen career path, whether it is in the practice of engineering, in advanced studies in engineering or science, or in other complementary disciplines;
- To assume leadership roles in industry or public service through engineering ability, communication skills, teamwork, understanding of contemporary global and socio-economic issues, and use of modern engineering tools;
- To maintain career skills through life-long learning and be on the way towards achieving professional licensure.

Electrical and Computer Engineering Program Student Outcomes

(What TCNJ Electrical and Computer Engineering students are expected to know and be able to do at graduation. What knowledge, abilities, tools and skills the program gives the graduates to enable them to accomplish the Educational Objectives)

The Student Outcomes listed below are expected of all graduates of the Electrical or Computer Engineering Program.

ECE graduates will have:

- an ability to apply knowledge of mathematics, science and engineering;
- an ability to design and conduct experiments, as well as to analyze and interpret data;
- an ability to design a system, component, or process to meet desired needs;
- an ability to function in multidisciplinary teams;
- an ability to identify, formulate and solve engineering problems;
- an understanding of professional and ethical responsibility;
- an ability to communicate effectively;

- the broad education necessary to understand the impact of engineering solutions in a global and societal context;
- a recognition of the need for and an ability to engage in life-long learning;
- a knowledge of contemporary issues;
- an ability to use the techniques, skills and modern engineering tools necessary for engineering practice;
- an ability to analyze and design complex electrical and electronic devices;
- an ability to analyze and design software and systems containing hardware and software components.
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Lab Rules

Execution of lab work in a safe manner is even more important than performing accurate electronic measurements and construction neat circuits The first step is always to become familiar with the lab itself. You should know where the fire extinguishers and the emergency exits are located. Equally as important is the location of nearest phone to call for help. You should also know all equipments and substances that are used in the Lab to take the necessary precautions. The ever-present hazard in an electronics Lab is the electric shock. Most people equate the severity of electric shock with the voltage, i.e., a 1,000-V shock is deadlier than a 100-V shock. This is not true. The real measure of a shock is the amount of current that flows through the body. Obviously, the larger the resistance, the smaller would be the current.

Therefore, in order to minimize the electric shock hazard:

1. Always power down the electrical equipment, disconnect the power cord, and wait for a few seconds before touching exposed wires. Remember that circuit breakers are usually set for much larger currents (e.g., household breakers are at 15 A and higher) than the current that kill a person (200-300 mA). Do not assume that because your circuit is powered with 5 V, it is not dangerous. In some circuits, capacitors can be charged to a much higher voltage and give you a nasty surprise. Death by electrocution has been reported at a voltage as low as 42 V (DC).

2. Do not wear rings, watches, necklace, and any any other loose metallic objects. Rings and watches are specially dangerous as the skin beneath them is wet by sweat, making the resistance of skin much lower.

3. Make sure that your hand are dry. Resistance of wet skin can be as low as 1 kOhm as opposed to dry skin which is about 500 kOhm.

4. Make sure that your shoes are dry (specially in rainy days). Do not lean on metallic objects (like legs of the bench tables) as you are providing a very large contact area for the current to flow out of your body to ground.

In case of electric shock, cut the power and/or remove the victim as quickly as possible without endangering yourself. If the power switch is not readily available (remember the Lab Emergency Shut-Off Power switch near the door), use an insulting material such as dry wood, rope, belt, etc. The resistance of body decreases during a shock so action should not be delayed. Send someone to call for help immediately.

If the victim is unconscious and has stopped breathing, start artificial respiration at once. Do not stop until a medical authority has arrived and taken over. Do not stop even if the victim does not have a pulse.

Safety Rules

1. Each group is responsible for the their Lab bench. After the Lab exercise is over, all equipment should be powered down and all probes, cords, etc. returned to their proper position. Do not cut and drop wires on the Lab bench. Lose cut wires have caused many short circuits. Your Lab grade will be affected if your bench is not tidy when you leave the Lab.

2. Always get instruction on how to use the tools and instruments. Use only the tool designed to do the job in hand. One tool that requires special attention is the soldering iron. Careless use can result in painful burns and fire. Always put the hot iron in its holder. Turn the iron one only when you need to use it and turn it off when you are done (even if you may need it in 5 minutes). The short warm-up time is a small price to pay for the prevention of potential fire and burn hazards.

3. Do not wear rings, watches, necklace, and any any other loose metallic objects (electric shock hazard). Do not wear lose clothing. They cause all sort on un-intentional accidents (from dropping equipment to being set on fire with a soldering iron).

4. No open drinks and/or food is allowed near the Lab benches. Spilled drinks have caused many accidents.

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*Lower case letters in brackets refer to the student outcomes of the Electrical/Computer Engineering Program

** Capital letters in brackets refer to evaluation methods used to assess student performance.