Spring 2016 (41381)

1164-ELC373-L1

2014-2016 Course Description:

Design issues and modeling techniques in communication transmission systems. Experiments include linear, nonlinear, and digital modulation/demodulation and computer-aided design.

Textbook: ELC 373 Lab Manual, A. Katz, TCNJ

Instructor: Prof Joe Jesson, jessonj@tcnj.edu, Direct 203-613-3344, 144 Armstrong Hall, T 02:00PM- 04:50PM, Jan 25, 2016 – May 6, 2016

Week	Laboratory
1	Introduction (Lab Rules and Safety)
2	L-C Oscillator Design
3	L-C Oscillator Fabricate and Test
4	L-C Oscillator Concluded
5	Amplitude Modulation

6	IC Oscillator (Angle Modulation)
7	RLC Lumped Element Transmission Line
8	RLC Lumped Element Transmission Line Continued
9	Time Domain Reflectometry
10	Fiber Optic Link Plant Visit*
11	Vector Network Analyzer Measurements (loads & antenna)
12	Vector Network Analyzer Measurements – Design Project
13	Vector Network Analyzer Measurements - Design Project Cont'd.
14	Oral Project Presentations

Final Grad: Lab Grades 90%

Class/Lab Participation 10%

* Related library/research assignment

Course Objectives:

Objective 1: To develop the student's ability to collect, analyze, and interpret laboratory data in the area of communications and electromagnetic transmission systems.

Objective 2: To teach students the basic concepts of communications and electromagnetic transmission systems.

Objective 3: To introduce students to engineering design in the area of communications and applied electromagnetic systems.

Performance Criteria:

Objective 1

1.1 Students will demonstrate the ability to collect, analyze, interpret and report experimental data.

Objective 2:

2.1 Students will demonstrate an understanding of the structure of basic communications systems, the concepts of time, frequency and information in these systems.

- Students will demonstrate an understanding of time-spectrum analysis principles.
- Students will demonstrate an understanding of different methods of modulation and demodulation.
- Students will demonstrate an understanding of the different forms and effect of distortion.
- Students will demonstrate an understanding of the principles of operation and application of transmission lines and related components.

Objective 3

- Students will demonstrate they can work in a team on the solution of open-ended communications and electromagnetic transmission system design problems.
- Students will demonstrate the ability to research and solve communications and electromagnetic transmission system design problems.

3.3 Students will demonstrate the ability to design, fabricate, and test components of communications and related and electromagnetic transmission systems.

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.

Specific to this course

- an ability to apply knowledge of mathematics, science and engineering; by performing and documenting engineering laboratory projects.
- an ability to design and conduct experiments, as well as to analyze and interpret data; by performing and documenting engineering laboratory projects.
- an ability to design a system, component, or process to meet desired needs; by designing a sinusoidal oscillator and a cellular antenna or similar component to realistic system specifics.
- an ability to identify, formulate and solve engineering problems; by working as a group on the solution and documentation of four design related projects and at least three additional laboratory problems.
- an ability to communicate effectively; by documenting engineering laboratory projects in written reports and at least one aural presentation using Power Point.
- an ability to use the techniques, skills and modern engineering tools necessary for engineering practice; by using professional grade spectrum analyzers, network analyzers and software as PSpice, MATLab and Microwave Office to solve laboratory projects.
- an ability to analyze and design complex electrical and electronic devices; by designing and evaluating filters, modulators, amplifiers (both linear and non-linear), oscillators, transmission lines and an antenna.

DESCRIPTION OF DESIGN ACTIVITY

Design of filters, modulators, amplifiers, oscillators and an antenna are required..

Example: Design a 100 kHz sinusoidal oscillator with < 5% distortion, > 1 volt amplitude into a 1000 ohm load, with a 5% frequency stability over a temperature range from -10 to 60 degrees C.

REALISTIC CONSTRAINTS

Economic: Discuss relative costs and manufacturing considerations of different designs.

PROFESSIONAL ENGINEERING TOOLS

Professional grade spectrum analyzers and network analyzers are used in the course.

COMPUTER USAGE

Software as PSpice, MATLAB and Microwave Office are required to complete many of the laboratory projects.

FEEDBACK MECHANISM

The instructor meets with each lab group to review the grading of every laboratory report except the final report, which is aurally presented using Power Point by the students and discussed.

Selected TCNJ Policies

TCNJ's final examination policy is available on the web: http://www.tcnj.edu/~academic/policy/finalevaluations.htm (Links to an external site.)

Attendance

Every student is expected to participate in each of his/her courses through regular attendance at lecture and laboratory sessions. It is further expected that every student will be present, on time, and prepared to participate when scheduled class sessions begin. At the first class meeting of a semester, instructors are expected to distribute in writing the attendance policies which apply to their courses. While attendance itself is not used as a criterion for academic evaluations, grading is frequently based on participation in class discussion, laboratory work,

performance, studio practice, field experience, or other activities which may take place during class sessions. If these areas for evaluation make class attendance essential, the student may be penalized for failure to perform satisfactorily in the required activities. Students who must miss classes due to participation in a field trip, athletic event, or other official college function should arrange with their instructors for such class absences well in advance. The Office of Academic Affairs will verify, upon request, the dates of and participation in such college functions. In every instance, however, the student has the responsibility to initiate arrangements for make-up work.

Students are expected to attend class and complete assignments as scheduled, to avoid outside conflicts (if possible), and to enroll only in those classes that they can expect to attend on a regular basis. Absences from class are handled between students and instructors. The instructor may require documentation to substantiate the reason for the absence. The instructor should provide make-up opportunities for student absences caused by illness, injury, death in the family, observance of religious holidays, and similarly compelling personal reasons including physical disabilities. For lengthy absences, make-up opportunities might not be feasible and are at the discretion of the instructor. The Office of Academic Affairs will notify the faculty of the dates of religious holidays on which large numbers of students are likely to be absent and are, therefore, unsuitable for the scheduling of examinations. Students have the responsibility of notifying the instructors in advance of expected absences. In cases of absence for a week or more, students are to notify their instructors immediately. If they are unable to do so they may contact the Office of Records and Registration. The Office of Records and Registration will notify the instructor of the student's absence. The notification is not an excuse but simply a service provided by the Office of Records and Registration. Notifications cannot be acted upon if received after an absence. In every instance the student has the responsibility to initiate arrangements for make-up work.

TCNJ's attendance policy *is available on the web:*
http://www.tcnj.edu/~recreg/policies/attendance.html (Links to an external site.)

Academic Integrity Policy
Academic dishonesty is any attempt by the student to gain academic advantage through dishonest means, to submit, as his or her own, work which has not been done by him/her or to give improper aid to another student in the completion of an

assignment. Such dishonesty would include, but is not limited to: submitting as his/her own a project, paper, report, test, or speech copied from, partially copied, or paraphrased from the work of another (whether the source is printed, under copyright, or in manuscript form). Credit must be given for words quoted or paraphrased. The rules apply to any academic dishonesty, whether the work is graded or ungraded, group or individual, written or oral.

TCNJ's academic integrity policy *is available on the web:* http://www.tcnj.edu/~academic/policy/integrity.html (Links to an external site.).

Americans with Disabilities Act (ADA) Policy
Any student who has a documented disability and is in need of academic accommodations should notify the professor of this course and contact the Office of Differing Abilities Services (609-771-2571). Accommodations are individualized and in accordance with Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1992.

TCNJ's Americans with Disabilities Act (ADA) policy is available on the web: http://www.tcnj.edu/~affirm/ada.html (Links to an external site.) (Links to an external site.)

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 equipments 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.