ECE 2040 Linear Electric Circuits
Syllabus (July 16, 2020)
Fall 2020
T Th 2:00pm – 3:15pm & 3:30pm – 4:45pm (Van Leer C241) &
Office Hours: T Th 1pm-2pm, 4:45pm-6:00pm (location TBD)

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Course website: http://hasler.ece.gatech.edu/Courses/ECE2040/index.html
Updated Course Syllabus as on-line information at this website.

Most information for the course is openly available at this website. Canvas website is primarily for aspects of the course that are not for public release (documents, grades, etc.).

Objectives:

- To introduce the principles of circuit design using linear components,
- To reinforce the concepts of differential equations, linear algebra, and signals learned in previous courses
- To provide a background for further coursework.

Text: Introduction to Electric Circuits, 9th Ed., R.C. Dorf and J.A. Svoboda, John Wiley & Sons, Inc., New York, 2014.

Prerequisite: Physics II, Differential Equations (Co-Req), Fluency in Spoken English

Attendance: Typically, students are responsible for all material covered in class, including changes in project schedules announced in class. All on-line lecture material should be considered at this same level. The easiest way to do poorly in my class is to skip class or not pay attention while in class; conversely, paying attention to class material strongly correlates with higher grades. Further, I will not take up class time to review information that students have missed because of being excessively late. Prompt arrival to class is required.

And yet, in this Covid-19 environment, this course will have some flexibility because of its hybrid format, and not every student can be expected to be at every class session. I will make a strong effort to capture what is discussed in class for those who can only participate on-line for that session.

Class sessions in this Hybrid environment will focus on interactive question and answer sessions on questions in the course material as well as questions in the experimental laboratory measurements.

Could have question / answer sessions. Will want to have things pulled together after the class session for something that would be recorded, etc. Need the TA to help create these materials and have information figured out in these cases.

Grading: Your course grade will be based on your performance on projects that include experimental measured data, three exams, homework, and an optional final exam.

Academic Honesty: Although students are encouraged strongly to work together to learn the course material, all students are expected to complete projects (in the respective groups) individually, following all instructions. You may discuss project questions in large groups, but each group must

independently perform and write-up the required work for each project. Cheating on tests is strictly forbidden and any cases will be treated with the utmost seriousness. You should expect at least getting a 0 on any assignment that you are cheating. Any suspected cases of academic dishonesty will be reported to the Dean of Students for further action. All conduct in this course will be governed by the Georgia Tech honor code. Additionally, it is expected that students will respect their peers and the instructor such that no one takes unfair advantage of anyone else associated with the course.

No Photography / Recording during Class: No cameras or other recording devices are allowed to be used in class for any reason other than what I have approved beforehand. I want to be careful for the range of students involved and not hinder those from participating. I will take pictures of all whiteboards and post them as well as do my best to capture what is covered in a given session.

Course Grading Policy: This class has an *optional final exam*. Students who have clearly demonstrated their understanding of this material (A, B, C, etc.) may use the evaluation and grading scale determined before the final exam for your grade in the course. On the other hand, the final exam gives students one additional chance to demonstrate your ability of this material. All grades will be finalized by the beginning of class on Dec 1, and every student will have their opportunity to choose whether they will take the final or not. The choice will be settled, individually and one-by-one, by the end of this class period. Students choosing not to be in class that day without a valid institute excuse will have the choice made for them.

Your grade evaluation will be determined using the following metrics:

Three exams	50%
Four experimental projects	43%
Homework / Short Quizes	7%

If you take the final exam, the grades above will be worth 75% of your grade, and the final exam grade will be worth 25% of your grade. No further details on the final exam will be given until decisions are made on (or before) Nov 24. If your grade will not improve by taking the final exam, you will not be allowed to take the final exam (e.g. if your grade is an A before the final exam, you don't get to take the final exam).

Grades will be assigned on a curve; however, I will guarantee the following grades if you reach the following percentages: 89% for an A, 79% for a B, 60% for a C, and 50% for a D. Rarely does the line for a C or D move as a result of a curve; the curve for an A and B vary significantly between classes.

Examinations: Relevant information for exams

- There will be three, closed book midterm examinations each of 75 minute duration
- Rules of exam: 1 sheet of handwritten notes, last exam's sheet of notes, and the on-line scientific calculator on Honorlock system. As you are taking the exam remotely, your sheet of hand written notes needs to be sent to me 15 minutes before the exam. All other resources are closed.
- Each exam is basically cumulative: Every unit builds on all the previous units.
- Expect the unexpected: The exam will be over material covered in lectures (primarily), handouts, and in the textbook, but I reserve the right to make any / all problems not look like

homework problems. I expect that you get the intuition of the key concepts from the homework; in the exam, I want to see if you can apply these concepts to slightly different problems.

- All grades become final one week after they are returned in class.

Exam Dates:

- Exam 1: Thursday, Sept. 10
- Exam 2: Thursday, Oct. 8
- Exam 3: Tuesday, Nov. 3

On-line examination will happen through the Honorlock proctoring software connected through Canvas. For this class, you will need a laptop system and resulting network connection to support Honorlock proctoring. You will need to have Chrome working on your laptop (not in a virtual machine). Apparently Chrome on Linux has trouble with the Honorlock software. A student will need a webcam and microphone. Students must have a secure private location to take an exam and will be asked to provide a picture ID as part of the exam process. When taking your exam, your video and audio will be recorded. More information on Honorlock: https://honorlock.kb.help. For the entire class community, I need to protect the integrity of the exam for everyone in the class, and therefore all exams will either be fully digitally proctored, or handled in person by the appropriate GT office in the case there are special needs, during class time on the same day.

I am planning to make a practice quiz available to test the technical aspects of the Honorlock proctoring system. It will be optional (and open to everyone) and will be worth bonus points on the first exam.

In the case of pending changes to our school (e.g. moving to entirely virtual teaching without proctored exams), I reserve the right to either move these dates to an earlier time or eliminate an exam and adjust the percentages accordingly. There will not be any unproctored exams for this course as most students expect a safe and secure experience in this course.

Instructions from Honorlock: Honorlock will proctor your exams this semester. Honorlock is an online proctoring service that allows you to take your exam from the comfort of your home. You **DO NOT** need to create an account, download software or schedule an appointment in advance. Honorlock is available 24/7 and all that is needed is a computer, a working webcam, and a stable Internet connection.

To get started, you will need Google Chrome and to download the Honorlock Chrome Extension. You can download the extension at ***www.honorlock.com/extension/install.***

When you are ready to test, log into the LMS, go to your course, and click on your exam. Clicking **Launch Proctoring** will begin the Honorlock authentication process, where you will take a picture of yourself, show your ID, and complete a scan of your room. Honorlock will be recording your exam session by webcam as well as recording your screen. Honorlock also has an integrity algorithm that can detect search-engine use, so please do not attempt to search for answers, even if it's on a secondary device.

Honorlock support is available 24/7/365. If you encounter any issues, you may contact Honorlock by live chat, phone (**844-243-2500**), and/or email (***support@honorlock.com***).

Some useful resources for Honorlock:

- Honorlock Student Guide (the same guide that is in Canvas when they start the test)
- Honorlock Video for your Students (good video on how to take an exam)
- Proper Room Scan (shows your students how to do a proper room scan)
- honorlock.com/support (students can test their system here and contact support)

Projects: Information on the Experimental Projects

Each unit we will have one experimental project. The point of the experimental projects is to develop intuition about linear circuits, as well as develop confidence in experimentally building these circuits. Circuit concepts are directly tied to actual physical structures, and nothing quite connects the depth of the concepts like actually seeing things work. Therefore, the course will go through four experimental projects tied to our unit material. These labs will use your existing laptop. Remember every student is required to have a laptop of particular hardware capabilities.

Items you need to obtain: To do the labs you need obtain two items:

- A kit of passive components. Sometimes you can buy the components from sparkfun, at the link: https://www.sparkfun.com/products/13953?custom_code=GTECE2040 (when ECE puts up the link).
- A data acquisition device. I would suggest one of two possibilities that roughly run $250 for a device.
    - Data acquisition device from Analog Discovery. I personally use this device, and is the device I support. The code base works for MAC, Windows, Ubuntu (Linux) that I've personally seen work, and is fairly straightforward to use. It is also the most advanced device available anywhere near its price point. If you plan to have a data acquisition device available for future use in projects, which I highly recommend, then this is the device you want to own. One link on obtaining this device: https://store.digilentinc.com/analog-discovery-2-100msps-usb-oscilloscope-logic-analyzer-and-variable-power-supply/

    - Data acquisition from National Instruments using the myDAQ device. The device has the advantage that it might get used in another ECE course (although the Analog Discovery device would also work well in other classes), as well as others around GT might have a device they used that they want to get off their hands. It works fairly well in Windows, but not really MAC or Linux, so one is required to have a dual boot to operate this software. One link to find more on this device: www.ni.com/en-us/landing/low-cost-daq.html . If you want to use NI DAC with Matlab, it is in theory possible, and might be easier if you want to use a MAC, although I've not tried these approaches. One link to start considering things is https://www.mathworks.com/help/daq/examples/acquire-data-using-ni-devices.html

  If you have a third option, I am open to that discussion, but you should talk with me *before* committing to that option.

The labs and resulting reports will *be done in groups of two* unless I make an exception for a particular group ahead of time. *One report will be submitted per group*, particularly for a group of two. You may self organize for your groups of two.

You will have one writeup, which must be word-processed, with data figures integrated into the text. No data figures added to the end of the writeup. You will submit the writeup as a .pdf file. You should integrate data and analysis together on your submitted plots. For example, if you perform a curve fit, I expect the curve fit and the data to be on the same graph, where the data points would be in point markers (e.g. "o"), and the curve fit would be a straight line. The plots need to be MATLAB style plots (MATLAB, scilab, python MATLAB), and not other non-technical forms (e.g. Excel). Do not submit your MATLAB code to generate the plot.

The experimental projects will be fairly subjective in nature, in contrast to the exams that are more objective in nature. The starting point for the labs are labs that have been used for ECE 2040 and ECE 3710 previously. On the other hand, these labs tend to be very objective, and my experience teaching IC labs in classes show labs are a better place to get subjective understanding. I will use similar items, but will have some different requirements of what will be completed and submitted. I will make these previous lab versions available since they might be useful for circuit setup. You will see that I will use similar structures, etc, but the requirements will be different. For example, I will want you to give me plots of data (MATLAB / Scilab plots; don't do excel) and discuss the plot, rather than just a couple of data values.

For all three of the labs, we will have one dedicated day of class to work through lab aspects. You will personally obtain all of the materials you need for the lab, and therefore, you can do the lab at any time. My *strong* suggestion is that your group of two starts the lab before our class lab day and get as far as you can, noting questions along the way. In this case, when you get to our lab class, you can have questions directly answered.

Homework: We will have roughly weekly homework assignments. These will be problems assigned in the book, a set of problems per week. The homework will be submitted into Canvas electronically. Good scans of clear hand written solutions are acceptable.

The homework is effectively checked that you have made a clear and full attempt to completely solve the problem. I understand as it is your first time through some questions you may not get everything right, and you won't have points taken off. An honest attempt to completely work through the problems is essential. Homework is required by the beginning of class the day it is due.

My plan is to make the homework solutions available on-line, and hopefully that will be successful.

This course is based on three tightly coupled units:

Unit	Topic Summary	Project Due	Exam Date
Unit 1	Basic elements, Resistive Circuits, One-Port, Two-Port Networks, Op-Amps	Sept 3	Sept 10
Unit 2	Step Response, Single Time-Constant Circuits, Laplace Transform methods	Oct 6	Oct 8
Unit 3	Fourier Transform, Frequency Response, Phasors, Power	Oct 29	Nov 3
Unit 4	Advanced Circuit Topics	Nov 19	

The first exam will cover the Unit 1 material, the second exam will cover material through Unit 2, and the third exam will cover material through Unit 3. The fourth project will involve building advanced circuits building on knowledge learned in the first three units.

Labor Day: Sept. 7
Last day of regular classes: Nov 19. Class during "dead days" before final exams: Nov 24.