ELECTRIC CIRCUITS SYLLABUS - ECSE 2010

Basic Overview Section	1
Policy Section	5
Assignment Detail Section	7
Course Logistics Section	11

Basic Overview Section

INSTRUCTORS:

Prof. Alex Patterson, (prefer to be called, **Prof. Patterson** or **Dr. Patterson**, or **Patterson**) Office: JEC 6020 Contact Information: WebEx Teams (<u>personal room</u> for meetings) or email: <u>pattea5@rpi.edu</u> Office Hours: TBD in WebEx Teams personal room or by appointment outside office hours (<u>meeting</u> <u>scheduler</u>)

Acting as a Super TA: Prof. Shayla Sawyer, (prefer to be called, **Prof. Sawyer** or **Dr. Sawyer**, or **Sawyer**)

Location: CII 8225, Mercer Xlab, generally all over campus (find me online on WebEx Teams!) Contact information: WebEx Teams, sawyes@rpi.edu or sawyes@gmail.com Prof. Sawyer's Personal Room for video meetings Meeting link: https://rensselaer.webex.com/meet/sawyes

Office Hours: TBD WebEx Teams Office Hours Space

Or by appointment. Please use this link to schedule an appointment outside of office hours <u>https://calendly.com/sawyes/15min</u>

Monday, Thursday Lecture:	4:00 p.m. – 5:50 p.m. in Academy Auditorium (<i>if and only if entire class is forced to be Remote, Lecture Space WebEx Teams for live lecture will be available</i>)	
Wednesday Lab:	<u>IEC 4201</u>	
, , , , , , , , , , , , , , , , , , ,	Section 1 Wednesday 9:00 a.m11:50 a.m AND WebEx	
	Teams Sec 1 Space will be available	
	Section 2 Wednesday 2:00 p.m3:50 p.m AND WebEx	
	Teams Sec 2 Space will be available	
Tuesday Test block (in-person tests	Academy Auditorium <u>Tuesday 7:00 p.m 8:50 p.m.</u>	
only UNLESS Covid protocols	Accommodations for extra time student must be prearranged and	
require a remote exam)	initiated by official documentation	
Notes: Preliminary videos are provided for every lecture. You should view these before every lecture.		

CLASS/LAB TIME AND LOCATION:

- WebEx Live videos are prerecorded, full 2-hour lectures from previous semesters with a navigation menu by topic. They are optional and can be used if you are quarantined with COVID, are having ANY symptoms even if you suspect it is just a cold, (better to just stay home!), or just need to review a lecture.
- We provided dedicated spaces on WebEx teams to meet with teammates, teaching assistants, and student assistants. *You are free to schedule any day or time in the week to meet with your lab partners to meet your lab objectives.* Please be aware, TA, SA, and Professor help will likely not be immediately available to you outside of the scheduled times.

TAs and SAs:

Graduate TA: TBD

Undergraduate SA: TBD

Undergraduate SA: TBD

OVERVIEW:

Techniques for the analysis and simulation of linear electric circuits and measurements of their properties. Topics include resistive and energy-storage elements, controlled sources and operational amplifiers, systematic analysis methods, AC steady state, power and three-phase systems, magnetic coupling and transformers, transients, s-plane representation and analysis, frequency response, and Laplace transform and computer-aided methods. All content can be found in the Circuits X Topic Link: https://ecse.rpi.edu/~ssawyer/videos/CircuitsXTopic.htm

GOALS:

The table below is a summary of what we hope you leave with after full participation in this course.

Enduring Understanding (Learning Objectives)	Important to Know and Do (Core Competencies/Skills)	Worth Being Familiar With (Exposure, Not Mastered)
understanding basic circuit analysis tools and approaches to solving for voltage and current in a resistive network	an ability to analyze circuits using KCL, KVL, superposition, node and mesh analysis, and equivalent circuits	matrix algebra and its usefulness in analyzing complex circuits
understanding behavior of first order circuits and second order circuits	an ability to find the time domain response of circuits using Differential Equations	overall perception of tradeoffs rather than one right answer
understanding of impedance, complex power, and phasors	an ability to find the time domain response (and s-domain response in the process) of circuits using Laplace transforms	basic applications of fundamentals in real- world power systems
understanding the usefulness of analysis in the s-domain	an ability to convert convey circuit properties graphically in complex space	why and when to use math tools: different math, different perspective, different efficiency of solving for same circuit
understanding of AC State Responses	an ability to write transfer function and draw a bode plot	limitations of a passive filters in design. the existence of higher order filters
understanding the relationship between mathematical analysis, experiment, data, and simulation	an ability to self-regulate progress and approach troubleshooting	non-idealities are significant data sheets are important approaches to solving an open-ended question or problem

STUDENT LEARNING OUTCOMES:

The students who finish this course in a satisfactory manner will be able to demonstrate (i) an ability to analyze circuits using superposition, nodal and mesh analysis, and equivalent circuits; (ii) an ability to analyze circuits that contain dependent and independent sources; (iii) an ability to find the time domain response of circuits using Laplace transforms; (iv) an ability to find the AC steady-state response of circuits.

STUDENT ASSESSMENT MEASURES:

You will be assessed by 1) Exams 2) Team Assignments 3) Homework 4) Lab documentation 5) Proof of Skills

PREREQUISITES: MATH-2400 Introduction to Differential Equations

TEXT: Thomas and Rosa, The Analysis and Design of Linear Circuits (7th edition or later) (recommended)

ONLINE RESOURCES: The table below includes the online resources needed for this course. Please be sure that you are signed in to each resource. <u>If you cannot get access to any of the online resources</u>, please send an email to pattea5@rpi.edu or sawyes@rpi.edu as soon as possible. <u>Please do not hesitate to contact us if events occur that disrupt your access to the internet such as power outages</u>.

Online Tool	Purpose	Website link: access code
Course website	All course content	www.ecse.rpi.edu/~ssawyer/videos
Gradescope	Document submission and	www.gradescope.com
	grading	Entry Code: 7D7RDK
WebEx Teams	Course meeting spaces: Lecture, Lab, Open Hours, Office Hours	Download WebEx Teams App and then find and contact Prof. Patterson or Prof. Sawyer directly for access.
GatherTown (if needed)	An interactive online workspace to form lab groups and "walk around the lab/classroom" to talk to others. DOES NOT WORK WITH MOBILE DEVICES!	Only intentional use is during the first week of the semester or during large class activities You can use any timeor suggest uses anytime

Policy Section

FERPA STATEMENT:

The online tools in the table provide a service designed to assist schools, teachers and other educational partners to improve student learning outcomes. In some circumstances, these online tools may receive personally identifiable information about students ("Student Data") from the instructor in the course providing this service. For example, an instructor will provide a class roster, email addresses of all students in the class, as well as coursework data that may be linked to a particular student. All listed online resource companies used by the instructor consider Student Data to be strictly confidential and have physical, administrative, and technical security protections in place to protect such data. They do not use personally identifiable Student Data for any purpose other than to provide the services to the instructor, and they do not share personally identifiable Student Data with any third party except as authorized or required by the instructor. The online tools above may collect, analyze, and share anonymized or aggregated data or data derived from Student Data for certain purposes, but only if the disclosure of such data could not reasonably identify a specific individual or specific School. Collection and use of Student Data provided by the instructor is governed by Terms of Service for each platform and by the provisions of the Family Educational Rights and Privacy Act (FERPA). Student Data is provided and controlled by the instructor. If you have questions about reviewing, modifying, or deleting personal information, please contact Rama Hamarneh hamarr@rpi.edu and cc pattea5@rpi.edu and sawyes@rpi.edu.

Students will be asked to sign this statement to agree to the use of these online tools and to acknowledge understanding of their use to facilitate online content for the course.

COLLABORATION AND ACADEMIC DISHONESTY:

Intellectual integrity and credibility are the foundation of all academic work. A violation of Academic Integrity policy is, by definition, considered a flagrant offense to the educational process. It is taken seriously by students, faculty, and Rensselaer and will be addressed in an effective manner. If found responsible for committing academic dishonesty, a student may be subject to one or both types of penalties: an academic (grade) penalty administered by the professor and/or disciplinary action through the Rensselaer judicial process.

The Rensselaer Handbook of Student Rights and Responsibilities defines the full list of forms of Academic Dishonesty and you should make yourself familiar with these. In this class, all assignments that are turned in for a grade must represent the student's own work. In cases where help was received, or teamwork was allowed, a notation on the assignment should indicate your collaboration. If you have any questions concerning this policy before submitting an assignment, please ask for clarification.

Some assignments, like exams, have a clearly marked place on the front page that requires a signature confirming academic integrity. If you forget to sign the document before submitting it, a TA or Prof. will contact you directly to ask you to sign before grading your assignment. I expect that you'll take exams without speaking to other students via another communication channel. I expect you to use the crib sheet as you would in class. You cannot interact with Chegg.com or any other online/internet

assignment sharing system for any graded assignment. Interaction with it results in an automatic failure for the entire course. A result of the violation using online resources to assist in graded assignments will result in a formal report. As a warning, there are ways that I can easily detect your use of these online resources that compromise academic integrity.

EQUITY, INCLUSIVITY, AND ACCESSIBILITY STATEMENT

Rensselaer Polytechnic Institute strives to make all learning experiences as accessible as possible. I will strive to provide an environment that is equitable and conducive for learning for all students. Please contact us as soon as possible if you:

1) are sick with COVID, *or suspect you are sick with COVID* and may need accommodations for exams. Course material is available online at <u>www.ecse.rpi.edu/~ssawyer/videos</u> You may set up lab sessions with partners during times that best fit your schedule. For additional help, please be proactive about attending open hours and office hours.

2) have internet accessibility issues where you live at any time during the semester. Contact us directly if events cause disconnection for any important portion of the course. If you know this will be a consistent problem, please contact us early in the semester.

3) anticipate or experience academic barriers based on a disability, please let us know immediately so that we can discuss your options. To establish reasonable accommodations, please register with The Office of Disability Services for Students. After registration, make arrangements with us as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. To receive any academic accommodation, you must be appropriately registered with DSS.

DSS contact information: dss@rpi.edu ; 518-276-8197, 4226 Academy Hall.

4) have an experience of micro or macro aggression that has hindered your ability to participate in the learning community from instructor, student, or staff. Please know I see you and want you to thrive by bringing your full self to the learning space that we all share. Contact us for a conversation about further actions that we can take.

Flexibility, accountability, and communication is built into the Circuits community experience. Designated assignments including homework and labs have two submission deadlines. The first deadline is often 8:00 p.m. or 11:59 pm EST on the due date. The second, late deadline is at 11:59 p.m. EST on the due date or 8:00 a.m. the following day depending on the assignment. Some assignments have late deadlines many weeks after the assignment is first due. While submitting on the first due date ensures that you are on track and ready to learn additional material, the late deadline gives you some flexibility if events occur that prohibit your close of business submission. During Spring 2024, submitting at the late deadline will NOT be penalized. However, after this late deadline assignments will not be accepted unless an official excuse is provided. Please plan accordingly and communicate directly with us via email if serious circumstances prevent you from completing the assignments that keep you on track with the course. "Do. Not. Fall. Behind." Paraphrased quote by every student who met their goals in Electric Circuits.

Assignment Detail Section

ELECTRONIC SUBMISSIONS AND GRADING:

All team assignments, homework assignments, and lab reports will be submitted by you, the student, via Gradescope. See the following link for tips on how best to do so. Make sure before submitting any assignment that all of your work is legible and easy to read after scanning. Most submission can be scanned from your smart phone. <u>https://ecse.rpi.edu/~ssawyer/CircuitsS2016_all/gradescope_tips.pdf</u>

All Exams will be scanned after the test session by the student into Gradescope. There will be a period of time given (15-20 minutes) after the exam to allow you enough time to scan and place it there. Keep your exam until the exam is graded just in case. They will be graded and sent back to you electronically through Gradescope. A rubric of deductions on every problem that is consistent for every student will be available to you. Also, there is a chance to electronically submit a request for regrade (within a specified time frame for exams) if you have any valid concerns about grading. The requirements for regrading and the definition of valid will be explained during class after the first exam.

HOMEWORK:

Homework problems are due as indicated on the syllabus provided for each of the units. Homework is generally due every week. *This semester, the homework will be graded for completeness and worth 10 points. They are practice to ensure that you understand processes to do full calculations. Late homework <u>will not be accepted after</u> the late homework deadline <i>posted on Gradescope* unless you have an excused absence. While homework can be done with your partner(s) as a collaborative effort, **each student must submit their own work**. Blatantly copied homework assignments will result in 0 points and you are subject to severe corrective action as it a violation of the academic dishonesty policy. It is better to not do the homework than to copy or find solutions elsewhere. It is practice! You should check homework exam solutions to make sure you have done the homework correctly.

LABORATORY ASSIGNMENTS:

Proof of Skills! Every individual student will be required to demonstrate their BASIC skill level for simulations (LTSpice), Experimental Personal Instrumentation (M1K OR Analog Discovery Board 2, or M2K), and Analytical Calculations (TI-XX and MATLAB). A working document is provided to help guide students toward completing these skills. You are strongly encouraged to add comments and links to this document. A collaborative atmosphere will be

a large part of classes and laboratories throughout the course to ensure that EVERY student can be proficient at 100% of the skills!

You submit your Proof of Skills submissions at your own pace and to Gradescope using a pdf or word document or video. You must complete ESSENTIAL SKILLS by January 31st for review and they must be completed by earning all possible by February 29th. This evaluates your readiness for the rest of the class before the official drop deadline on March 1st. If you don't have them complete you may be asked to drop the course or come up with a completion plan while working alone on your labs simultaneously! If you fail to complete your Essential Skills by the end of the semester expect your grade to AUTOMATICALLY drop AT LEAST two full grade modifiers.

After Proof of Skills you will decide to participate in Alpha (traditional) labs or Omega (design) labs and pick up to 2 partners.

Please create a space for your specific Alpha or Omega Lab Group. Even though we are inperson, it may be convenient to have an online space to meet and converse. In addition, it ensures readiness if COVID prohibits the class from meeting. Add your last name, lab type, and section so you are easy to identify. Example: Westbrook | James | Davis | Omega | Sec 2

- 1. <u>To work together:</u> You can meet in-person in JEC 4201, or anywhere on campus, and use WebEx teams to continue your lab project. The regular lab time will be open in WebEx for anyone who would like to use that regular schedule. TAs will be available then. HOWEVER, it may be necessary to find another regular time to meet become of different time zones. Find your partner(s) and communicate!
- 2. Expectations for completion: Omega labs: you have a project plan, proof of concepts and project manual to complete. Alpha Labs: you have proof of concepts. These requirements remain the same. You are free to modify the lab within reason to prove your concept (i.e. if you do not have a 4k resistor for example but you do have a 520-ohm resistor you can change the lab! Please explain what you exchanged and discuss how it affected your results. Someone in your likely has the parts and the Analog Discovery Board. They will be the designated circuit builder. You should have all parts necessary to complete the goals of the lab. If you need parts, please get in touch with the Lab TAs via Piazza or WebEx Teams.
- 3. <u>Individual Check-Ins</u>: You are required to submit a 1-3 minute video of your individual lab contributions in your Lab Group space on WebEx Teams on the day of your Proof of Concept submissions. This is a total of 6 check-ins. The video is accompanied by on online assignment on Gradescope which you must fill out to complete it. Individual Check-Ins account for 40% of your lab grade. In addition, an undergraduate student assistant will be assigned to your lab group and will act as a mentor, if needed, based on these submissions.

You can choose Design Focused Labs known as Omega Labs, Procedural-based Labs known as Alpha Labs OR SWITCH them up throughout the course.

Omega Laboratories (Design-based labs)

Omega Laboratories are written to incorporate multiple concepts in the course and explore their purpose. To participate, you will need to obtain the Diligent Discovery Board Parts Kit. Creativity is encouraged. Online searches for ideas and additional information are not only encouraged but necessary. More information can be found here: <u>Alpha-Omega Labs</u>

There is an opportunity to opt out of your final exam by completing Omega Labs (see details in document above)! **Evaluations for your Milestone 1, Milestone 2, and Milestone 3 reports MUST receive a 80% for every document submitted for Milestone 3 and one other milestone to opt out of the final.** You have an opportunity to continue to optimize your written reports to meet this goal to a deadline at the end of the semester. Depending on your Exam 1-3 scores, you may decide that taking the final exam is advantageous and you are free to take the exam to improve your grade.

- 4. <u>Demonstration day:</u> Create a demonstration video (no longer than 10 minutes) describing your project as you would in the lab on demonstration day. You should be able to collaborate and record yourselves on WebEx teams. The grading TA and I will come to your Omega Lab space to ask questions during the normal lab time for any of your groupmates that can make that time. If one or more of your teammates cannot make it during normal class time due to time zone issues, let us know in your omega lab space. We hope to have one representative for questions.
 - a. <u>Recording in WebEx Teams</u> Please create a 10-minute video using WebEx and "Record to the cloud". Your video will show up in your teams messages and we can come by watch and download your video!
 - b. <u>Place LTSpice file in WebExTeams (.asc file.)</u> Also upload your .asc file in your message window. This is necessary for a thorough review of your work!
 - **c.** <u>Individual Check-In Video</u> post a 1-3 minute video of your individual contribution to the lab. The associated online Gradescope assignment will guide the content of your video submission. You will also be required to provide feedback to your group members contributions as a peer assessment.

Alpha Laboratories (Traditional labs)

In many of the laboratories, some preparation work can be done in advance. Please read the labs in full and schedule time accordingly. Simulations are now done in LTSpice. Alternative simulations programs like PSpice are also accepted. You will submit a Proof of Concepts report written for each lab by your lab group. The Concepts are highlighted in every lab write-up. They must include analytical calculation, simulation, and experimental data with discussion that includes answers to questions in the lab.

If you finish ahead of time, you are free to move on to future labs.

Laboratory reports **are to be turned by a pair of students (3 students at most)** and will be graded on a 10-point scale. There will be occasions where Alpha Lab and Omega Labs groups must team up to think through portions of the design process. (Design Applications section).

5. Proof of Concepts: You will compare analytical, simulation, and experiment as much as you can. Please be sure to write when you exchanged part values according to what you had available. Also let us know if you purchased any parts. You should have all the parts needed for all labs as sent to you by the ECSE department in our Circuits kit or alternative Analog Discovery Companion kit. As a note, you will not need to build the transformer part of Lab 3. You will need to simulate and calculate for comparison. I will consider this extra credit if you find a transformer and are able to demonstrate your concepts with it!

Grading is based on Standards Based Assessment found at the end of every lab document.

EXAMS:

Exams will be given on the days indicated on the course Syllabus pages (under each unit) - these are the only times that any late evening session will be utilized. Sample exams (with solutions) are posted on the website. In most cases of an *excused* (by the Dean of Students) absence, a make-up exam may be created. In special cases, where a make-up exam is not possible, the average of a student's exam grades will serve as the grade replacement for any *excused* (by the Dean of Students) absences (e.g. due to illness) with the exception of Exam 2. <u>You must take Exam 2 to receive a final grade</u>.

In-Person Circuits EXAMS: All exams will be given in-person at the designated room location (Academy Auditorium). The normal exam time, 7:00 p.m. – 9:00 p.m. will be the main exam. You are only allowed to use the provided <u>crib sheet</u>. Extra time students will start directly before the exam. *Follow the honor code or you will be subject to the consequences of an academic dishonesty violation!* You must sign the front page of exams to indicate that you will not communicate with other students and not access online resources. Submission will be done by you through Gradescope. You'll get an extra 15-20 minutes to upload.

Final Exam: TBD

MATERIALS:

NEW COVID ONLINE CONTENT includes recorded WebEx sessions and LEVELUP problems three levels of worked out problems when possible. If you are unable to make an online class, <u>this is here for you, now!</u> Course videos are counted toward participation points. The quizzes in the videos are not graded for points. If >70% of all videos are viewed by a student, this participation will be taken into consideration for any final grades on the borderline. Please report any issue with the quizzes. I will amend this policy if quizzes are disabled for any reason.

Course Logistics Section

GRADING:

The course grade weightings are as follows:

Team assignments	(15%)
Homework	(2%)
Laboratory	(15%)
NEW Proof of Skills	(3%)
Laboratory reports	(6%)
Lab Individual Check-Ins	(6%)
Exam I	(16%)
Exam II	(16%)
Exam III	(16%)
Final exam	(20%)
Total	(100%)

Use this spreadsheet <u>Grade Calculator link</u> to find your approximate grades throughout the class: Grade cutoffs in this calculator are estimated. Plan accordingly.

RE-GRADING:

If you want to submit an exam for re-grading (after checking the posted solution) please indicate this on Gradescope. A concise explanation is expected. This must be done <u>no later than</u> one week after the paper was returned. You may review your final exam. However, except for gross grading errors, final exams will not be re-graded since those who did the grading may not be available.

RE-WORKS:

You will have an opportunity to REWORK your lowest scoring problem on Exam 1 and Exam 2 to get some points back. Details will be provided after the Re-grading of these exams.

SOLUTIONS:

Homework and exam solutions will be posted or sent by email through the Gradescope email function.

PRACTICE:

You should do as many exercises as possible including those in the text or in class problems. You have solutions to most problems you make by slightly altering existing problems through simulation with LTSpice! Use this resource. Also be sure to look at back exams which are available on the course website. Please feel free to seek help if you have any difficulties understanding the way the problems are solved.

LTSPICE (and PSpice):

Many of the activities/homework involves the circuit simulation program LTSpice. You can obtain a copy (which is what we'll be using) of the simulation program from the class web site. *It is expected and encouraged that you check your homework and other assignments using LTSpice (or PSpice)!* It is also a great tool for verifying solutions to practice problems you find elsewhere.

LTSpice is the only viable option if you are doing Omega Labs. Students tend to use LTSpice because there is no part limit when creating large circuits (necessary for Omega Labs).

PARTNERS:

You will need to work with a partner(s) on the laboratory assignments. No more than groups of 3 are allowed. You will turn in one homework per person and one Laboratory write-up per team with both partners' names on each submission. Please print YOUR NAME, SECTION NUMBER, and ASSIGNMENT clearly on all papers so we can grade and return them to you efficiently. Team Assignments have a maximum of 6 people per team. It will include your lab partner(s) and another lab group. These team assignments are given at least once a week, to ensure you are learning the material AND as another touchpoint to keep you connected and engaged.

CLEAN-UP:

We want to keep the studio classroom sanitized. Please be sure to wipe down your area if you decide to come to lab to work on assignments. You are required to sit socially distanced from classmates as much as reasonable as you are doing labs. Rather than setting down a list of cleanup rules, we simply ask you to wipe down the area you work in and leave your work area in the condition you would like to find it! Please use WebEx Teams to discuss issues with Student Assistants and Teaching Assistants as much as possible even while on campus in the same. They will come over only for issues that require close physical presence <u>If protocols change, we will</u> <u>convey these new protocols clearly throughout the semester</u>

EXCUSES:

For absence from a graded class activity, give the TAs or instructor a copy of your excuse signed by the infirmary, dean of students, coach, etc. Note that the infirmary does not give excuses for simple visits, and only excuses authorized by RPI are allowed. Planned trips and other functions under your control do NOT qualify for an excused absence - and must be discussed with your instructor to complete assignments before they are due.

CONFLICTS:

In the case of an exam conflict, please notify the course instructor as soon as possible.

CALCULATORS FOR CIRCUITS:

An appropriate calculator can be a real time-saver because you will often need to carry out:

polar/rectangular conversions (w/TI calculator) solution of simultaneous equations operations with complex numbers

If your calculator cannot at least do polar/rectangular conversions and solve three simultaneous equations, then you should consider upgrading. In any case, it is your responsibility to learn how to use your calculator for the various operations needed in this course.