Engineering 37: Introduction to Circuit Analysis

Physical Sciences, Mathematics & Engineering (PSME) Division

CRN 10154, Section 037.61, Summer 2018

Instructor:	Raji Lukkoor
Class Days/Time:	MTWR: 6:30 PM – 8:45 PM
Location:	S42
Office Hours:	TR 6:00 PM – 6:30 PM
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Course Description

Introduction to Circuit Analysis is designed to allow students to explore the major methods and techniques of circuit analysis using Ohm's Law; Kirchhoffs's voltage and current laws (*KVL*/*KCL*); Loop/Mesh Current and Node Voltage analysis; Thevenin and Norton's theorems; Superposition and Linearity; Source conversions and Maximum Power Transfer theorem; basic Op-amp circuit analysis; natural and forced/step responses relating to *RC*, *RL*, and *RLC* circuits; circuits with more than one energy storage element; phasors; and alternate voltage and current.

Pre-requisites

Math 1D and Physics 4B (may be taken concurrently).

Texts Used

Principles of Electric Circuits – conventional current version by Thomas L. Floyd, 9th Edition. Prentice Hall, an imprint of Pearson. 2010. (Required)

Fundamentals of Electric Circuits by Charles K. Alexander and Matthew N.O. Sadiku, 6th Edition. McGrawHill Education. 2017.

Course Objectives

Specific objectives of the course include:

1. Use Ohm's Law, *KVL* and *KCL* to calculate voltages and currents in a *DC* circuit consisting of resistors, current sources, voltage sources, op amps and dependent sources.
2. Use Thevenin and Norton theorems to calculate the equivalent circuit of a *DC* circuit and find the maximum power output of a *DC* circuit.
3. Use Mesh Current and Node Analysis to find unknown quantities in a circuit.
4. Determine the *DC* gain of an op-amp circuit.
5. Determine the natural and forced/step response of a 1st order circuit consisting of *RC* and *RL* components, and of a 2nd order circuit consisting of *RLC* components.
6. Use Ohm's Law, *KVL* and *KCL* to calculate voltages, currents, impedance and admittance in an *AC* circuit consisting of resistors, capacitors and inductors.
7. Determine the *AC* power delivered and absorbed by an element in *RC*, *RL* and *RLC* circuits.

Materials

Scientific Calculator (TI-89 recommended)

Attendance

Attendance is mandatory. Ensure that vacations, doctor's appointments, social engagements, etc. do not interfere with attendance. Active class participation, including the completion of all class exercises, is key to achieving educational success. Class activities cannot be made up if the class is missed. If you are absent from class, the onus of checking on announcements made while you were absent is on YOU.

Classroom Protocol

Arrive to class on time. If you happen to arrive late, please enter and take your seat quietly. Expected classroom courtesies include: no text messaging, no emailing, no checking emails, no gaming, no video watching. Likewise, no recording of lectures, no in-class picture taking of lecture slides, no making/receiving phone calls. No copying or sharing of instructional material, including videos, PowerPoint slides, notes, handouts, problems, solutions, quizzes, tests, simulations, etc. The state of California makes it a crime to record or eavesdrop on any confidential communication, including conversations in a classroom, without the consent of all parties to the conversation. http://www.dmlp.org/legal-guide/california-recording-law

CELL PHONES must be turned **OFF** during all classes and exams. Cell phones may not be used to audio or video record in the classroom. Cell phones may not be used as calculators during exams or quizzes.

Note that any inappropriate or disruptive behaviors, including offensive/vulgar expressions, disrespecting others' viewpoints or disrespecting the instructor could lead to removal from the classroom and/or disciplinary action, as warranted. De Anza College will enforce all policies and procedures set forth in the Standards of Student Conduct at http://www.deanza.edu/publications/catalog/.

Communication

Email communication is most appropriate for administrative matters (notification of illness, scheduling appointments, clarification of homework problems, etc.). With all communication, please maintain a high degree of respect and professionalism. Homework problems or other course materials are best discussed in person during scheduled office hours and not by email.

Academic Integrity

De Anza College is committed to the highest standards of academic integrity and honesty. Students are required to comply with all rules and regulations as outlined in the student handbook at http://www.deanza.edu/studenthandbook/index.html. Dishonesty is unacceptable and will not be tolerated. If you are caught cheating or plagiarizing, a process is begun which may result in severe consequences, including receiving a failing grade on the test, paper or exam in question, receiving a grade of *F* in the course, being placed on disciplinary probation, and/or suspension. You are expected to abide with the ideals of academic integrity and accept personal responsibility for your work. Also, during exams, protect your work. Any infringement will disqualify both parties.

Dropping and Adding Class

Students are responsible for understanding the policies and procedures about adding and dropping courses. Add/drop deadlines can be found at http://www.deanza.edu/calendar/winterdates.html. Be sure to note all current deadlines and penalties for dropping classes. After the deadline, neither you nor your instructor can drop you.

Note: An 'incomplete' grade is only appropriate for verifiable unforeseen illness/injury or other unforeseen emergency situations. An *I* grade does not apply to doctor's appointments you forgot you had and did not reschedule, jury duty you could have requested to do after the quarter is over, or because you forgot to drop the class in time.

Coursework Expectation

Lecture presentations will be posted to *Canvas* at the start of each week. The *Circuit Analysis Course Schedule & Calendar* is attached. Each student is responsible to check the calendar on a regular basis to see if there is a change in the schedule.

Note: All work submitted past the due date will be docked 50%.

Homework:

Relevant homework problems will be assigned throughout the quarter. The various assignments and partial solutions/answers for each problem, will be posted to *Canvas*. The homework will not be collected, but its timely completion and understanding is essential for learning the material and performing well on the exams.

Note that problems/assignments might be added or deleted from the list as the quarter progresses.

Weekly Reading:

Specific topics from the required text will be assigned for reading during every class. Refer to the attached *Circuit Analysis Course Schedule & Calendar*. Reading the assigned topics is a required component of the curriculum. The sections highlighted in yellow are for you to complete on your own.

Note that weekly reading assignments might be added or deleted from the list as the quarter progresses.

Multisim Live Online Circuit Simulation:

Multisim Live is a free, online circuit simulator that includes SPICE software, which lets you create, learn and share circuits and electronics online. The *Multisim* interface, component library and interactive features allow you to capture and test the behavior of a circuit. Each student is required to open an account on http://www.multisimlive.com/ and re-create specific in-class circuit schematics on the online simulator.

Canvas Discussion Forum Videos:

You will watch 4 content-related videos and submit a written evaluation/summary for each, worth 10% of your course grade. The aim here is to help you develop your critical thinking skills throughout the quarter.

The list of the Discussion Forum videos is attached.

Note: Videos might be added or deleted from the list as the quarter progresses.

Group Project, Presentation & Demo:

During this course, as teams of two students, you will work on an electronics/electric circuit design project, which must include the following components: resistor, capacitor, switch, and power source. The design of the project must include an end application. A list of resources is attached for your reference. The cost of the project is on you.

The group project proposal, presentation & demo constitute 20% of your course grade.

Note: Participation on the group project, presentation & demo is mandatory, and you must complete it in order to pass this class.

Note: Unless there is a documented, serious explanation for missing the demo and presentation, make-up sessions will not be allowed.

The following are specific deliverables for the group project:

- Proposal (2%): During the 6th class meeting (on July 10), each project team will write and submit a project proposal that outlines the project description and objectives. The proposal must also include project circuit designs (created using *Multisim Live*), a list of tasks, and a schedule for completing those tasks
- Group Presentation & Demo (13%): At the end of the quarter, each project team will deliver (and submit) a PowerPoint presentation, and demonstrate your project in class, following which each team will conduct peer evaluations by providing constructive feedback on peer presentations
- Individual Presentation Delivery (3%) & Teammate Evaluation (2%): To help ensure that all members contributed to the project in an equitable manner, you will evaluate your teammate's performance (in a single paragraph consisting of no more than 4-5 sentences)

  Note: Submit teammate evaluations directly to me via *Canvas* mail.

  Note: Failure to submit an evaluation on your teammate will result in a loss of points on your grade.

Midterm Exam:

One Closed-Book and Closed-Notes midterm examination will be held on the date indicated in the attached *Circuit Analysis Course Schedule & Calendar*. The midterm exam is worth 30% of your course grade.

In lieu of notes, a sheet of formulae will be allowed for each exam. A non-programmable calculator will be allowed on the exam, but phones and other electronic devices must be switched off and put away under the desks. Instructor permission is required to leave the classroom for bathroom visits.

Note: Unless there is a documented, serious explanation for missing the midterm exam, make-up exams will not be allowed.

Note: You must complete the midterm exam in order to complete the course and pass this class.

Final Exam:

The final exam will be Closed-Book, Closed-Notes, and worth 40% of your course grade. In lieu of notes, a two-page (front and back) formula sheet will be allowed for the final exam. A non-programmable calculator will be allowed on the exam, but phones and other electronic devices must be switched off and put away under the desks. Instructor permission is required to leave the classroom for bathroom visits.

Note: Unless there is a documented, serious explanation for missing the final exam, make-up exams will not be allowed.

Note: You must complete the Final Exam in order to complete the course and pass this class.

Evaluation & Grading

Coursework will be weighted as follows:

Discussion Forums	10%
Group Project Proposal, Presentation & Demo	20%
Midterm	30%
Final Exam	40%

Note: The above weighting is subject to change, with fair notice given in class.

The final course grades will be assigned according to the following grading scale, with standard decimal rounding (i.e. 0.5 and greater rounded up):

A+ = 100-98%	A = 97-93%	A- = 92-90%
B+ = 89-87%	B = 86-83%	B- = 82-80%
C+ = 79-76%	C = 75-70%	
D+ = 69-66%	D = 65-60%	
F = 59-0%		

Note: The above grading rubric is subject to change, with fair notice given in class.

Study Tips and Strategies for Success

Regular attendance, completing homework in a timely manner, watching assigned videos, good note-taking skills, in-class participation, completing the hands-on project, and a positive, can-do attitude will greatly increase the likelihood of success in this course. Plan on spending at least 6-10 hours weekly, outside of class time, for homework, project and study.

- To stay on track throughout the quarter, begin each week by consulting the *Circuit Analysis Course Schedule & Calendar*, which presents an overview of the weekly lecture topics and indicates due dates for taking the midterm and the final exam.
- Regularly check *Canvas* Announcements for lecture updates, homework problems & solutions, and any changes in the *Circuit Analysis Course Schedule & Calendar*.
- Form and work in study groups.
- Complete each reading assignment prior to the relevant class lecture. Schedule and complete each HW assignment in a timely manner.
- Attend class regularly and participate in in-class exercises and discussions.
- For full credit, complete discussion forums in a timely manner.
- Collaborate with your teammate to work on your Group Project and submit all project deliverables by the assigned due dates.
- Register for a tutor. Free tutoring is available in the Tutorial Center, S41.

Circuit Analysis Course Schedule & Calendar

* Note that the schedule below is subject to change with fair notice given in class.*

Week	Date	Lecture Topic [Chapter Reading]	Deliverable
1	Jul 02	*First Day of Instruction* Review Chapters 1 – 6 *Multisim Live* practice Class Project Discussion / Project Team Formation	
	Jul 03	Chp 7: Series-Parallel Circuits [7-1 to 7-6] [8-8] [7-7] Project Team Formation / Project Selection & Approval	
	Jul 04	~ ***Holiday*** ~	
	Jul 05	Chp 8: Circuit Theorems and Conversions [8-1 to 8-3] Lecture on Project Proposal Project Selection & Approval	**Discussion Forum 1**
2	Jul 09	Chp 8: Circuit Theorems and Conversions [8-4]	
	Jul 10	Chp 8: Circuit Theorems and Conversions [8-5]	**Group Project Proposal**
	Jul 11	Chp 8: Circuit Theorems and Conversions [8-6 to 8-7]	
	Jul 12	Chp 9: Branch, Loop and Node Analysis [9-1] [9-3]	**Discussion Forum 2**
3	Jul 16	Chp 9: Branch, Loop and Node Analysis [9-3]	
	Jul 17	Chp 9: Branch, Loop and Node Analysis [9-4]	
	Jul 18	Chp 9: Branch, Loop and Node Analysis [9-4]	
	Jul 19		**MIDTERM**
4	Jul 23	Operational Amplifiers: Ideal, Non-ideal	
	Jul 24	Operational Amplifiers: Summing, Difference, Cascade	
	Jul 25	Chp 12: Capacitors [12-1 to 12-4] [12-5] [12-7]	
	Jul 26	Chp 13: Inductors [13.1 to 13-3] [13-4] [13-6]	**Discussion Forum 3**
5	Jul 30	Chp 11: Introduction to Alternating Current and Voltage [11-1 to 11-6] [11-9] Lecture on Presentation Guidelines	
	Jul 31	Chp 15: *RC* Circuits [12-6] [15-1 to 15-8] [15-9 to 15-10]	
	Aug 01	Chp 16: *RL* Circuits [13-5] [16-1 to 16-7] [16-8 to 16-9]	
	Aug 02	Chp 17: *RLC* Circuits [17-1 to 17-6]	**Discussion Forum 4**
6	Aug 06		**Group Project Presentation & Demo**
	Aug 07	Chp 18: Filters *Last Day of Instruction*	

	Aug 08	6:15 PM – 8:30 PM Check http://www.deanza.edu/calendar/finalexams.html	**FINAL EXAM**

Canvas Discussion Forum Videos and Due-dates:

1. *How Batteries Work*
   Available: July 02 Due: July 05
2. *Electrical Circuit*
   Available: July 06 Due: July 12
3. *Transistors – The Invention that Changed the World*
   Available: July 20 Due: July 26
4. *Sound as Sine Wave*
   Available: July 27 Due: August 02

Group Project Resources:

https://circuitdigest.com/electronic-circuits
http://www.electronicshub.org/electronics-mini-project-circuits/
https://www.elprocus.com/top-10-simple-electronic-projects-for-beginners-in-2014/
http://circuiteasy.com/
http://www.techlib.com/electronics/
http://www.circuitstoday.com/tag/simple-electronics-projects
http://www.circuitstoday.com/simple-electronics-projects-and-circuits
http://www.eleccircuit.com/easy-electronic-projects/
http://electronicsforu.com/category/electronics-projects/hardware-diy
http://sewelectric.org/diy-projects/

Student Learning Outcome(s):

*The student will be able to analyze circuits containing resistive, capacitive, inductive passive elements, along with op-amps interconnected to voltage and current sources.
*The student will be able to use circuit laws and network theorems to solve DC steady state circuits, RC, RL, and RLC DC circuit transients and sinusoidal AC steady state circuits.