Syllabus for ENGR065-01: Circuit Theory

Fall 2021

Instructor:

- Ricardo de Castro,
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Catalog Description

The course has been designed to introduce fundamental principles of circuit theory commonly used in engineering research and science applications. Techniques and principles of electrical circuit analysis include basic concepts such as voltage, current, resistance, impedance, Ohm's and Kirchhoff's laws; basic electric circuit analysis; resistive circuits; transient and steady-state responses of RLC circuits; circuits with DC and sinusoidal sources; steady-state power; Laplace and Fourier transforms applications for solving circuit problems.

Text Books and Other Required Materials

- J. W. Nilsson and S. Riedel, "Electric Circuits", 11th Edition, 2018, Pearson-Prentice Hall
    - ISBN-13: 978-0-13-474696-8, ISBN-10: 0-13-474696-1

Course Objectives Student Learning Outcomes:

To develop problem-solving skills and understanding of circuit theory through the application of techniques and principles of electrical circuit analysis to common circuit problems.

Course Goals:

1. To develop an understanding of the fundamental laws and elements of electric circuits.
2. To learn the energy properties of electric elements and the techniques to measure voltage and current.
3. To understand transient, and steady-state responses of RLC circuits.
4. To develop the ability to apply circuit analysis to DC and AC circuits.
5. To understand advanced mathematical methods such as Laplace and Fourier transforms along with linear algebra and differential equations techniques for solving circuit problems.
6. To learn how to use fundamental electrical instruments, build circuits with solderless breadboards, analyze experimental data, and write experimental reports.

Learning Outcomes:

1. To be able to understand basic electrical properties.
2. To be able to analyze electrical circuits.
3. To be able to find circuit responses using Laplace transform.
4. To be able to understand signal superposition and Fourier transform.
5. To gain hands-on practice on how to use fundamental electrical instruments to measure and test electric circuits.
6. To be able to document and analyze the experimental data using appropriate tools.

Prerequisites by Topic

- Linear Algebra and Differential Equations (MATH 024 or equivalent)

- Introductory Physics (PHYS 9 / PHYS 19 or equivalent);

Topics:

CIRCUIT PARAMETERS AND FUNDAMENTAL LAWS I: Electric charge; Electric work; Potential; Potential difference; Electric current; Power; Energy; Resistance; Ohm's law; Kirchhoff's laws. Branch; Node; Mesh; Circuit elements in series; Circuit elements in parallel.

CIRCUIT PARAMETERS AND FUNDAMENTAL LAWS II: Ideal current source; Ideal voltage generator; Internal resistance; Mesh current method; Node voltage method; Thevenin's equivalent circuits; Norton's equivalent circuits; Superposition's theorem; Capacitors; Inductors; An electromagnetic flux.

OPERATIONAL AMPLIFIERS: Impedance mismatching issue; Ideal op-amp model; Voltage follower; Gain; Addition/subtraction; Integrator; Differentiator; Other useful operations; Active filters; CMRR and practical issues.

LAPLACE AND FOURIER TRANSFORM: The Laplace's transform; Fourier transform; Initial value theorem and final value theorem; Transient phenomena with the Laplace transform; Circuit analysis in the s domain; Resonance; Frequency response; Cutoff frequency; Pole; Zero; Low- pass filter; High-pass filter.

COMPLEX IMPEDANCE AND ADMITTANCE: Resistance; Capacitive and inductive reactance; Impedance; Conductance; Capacitive and inductive susceptance; Admittance; Series and parallel equivalent circuit.

CIRCUITS TRANSIENT AND STEADY-STATE RESPONSE: RC, RL and RLC circuits; Time constant; Step response; Transient response; Sinusoidal source; Frequency; Angular frequency; Phase angle; Root mean square; Time domain; Frequency domain; Passive circuits elements in frequency domain; Circuits analysis in frequency domain.

Class/Laboratory/Final Exam Schedule and Location:

CRN	Course #	Course Title	Units	Actv	Days	Time	Bldg/Rm	Start - End	Instructor
30265	ENGR-065-01	Circuit Theory Must Also Register for a Corresponding Lab	4	LECT EXAM	WF W	1:30-2:45pm 8:00-11:00am	COB2 110 COB2 110	25-AUG 10-DEC 15-DEC 15-DEC	Pinto de Castro, Ricardo
30717	ENGR-065-02L	Circuit Theory	0	LAB	W	9:00-11:50am	SRE 303	25-AUG 10-DEC	Ahmed, Muhammad Hassaan
30718	ENGR-065-03L	Circuit Theory	0	LAB	R	9:00-11:50am	SRE 303	25-AUG 10-DEC	Li, Haoyu
30818	ENGR-065-04L	Circuit Theory	0	LAB	T	12:00-2:50pm	SRE 303	25-AUG 10-DEC	Manzo, Cristian
33473	ENGR-065-05L	Circuit Theory	0	LAB	R	12:00-2:50pm	SRE 303	25-AUG 10-DEC	Manzo, Cristian
33729	ENGR-065-06L	Circuit Theory	0	LAB	F	9:00-11:50am	SRE 303	25-AUG 10-DEC	Leylaz Mehrabadi, Ghazaale
34030	ENGR-065-07L	Circuit Theory	0	LAB	M	12:00-2:50pm	SRE 303	25-AUG 10-DEC	Li, Haoyu
34606	ENGR-065-08L	Circuit Theory	0	LAB	W	3:00-5:50pm	SRE 303	25-AUG 10-DEC	Ahmed, Muhammad Hassaan
34607	ENGR-065-09L	Circuit Theory	0	LAB	F	3:00-5:50pm	SRE 303	25-AUG 10-DEC	Leylaz Mehrabadi, Ghazaale

Grading Scheme and Distribution

Grading Scheme	**Grade Distribution** **Grade Total Scores (%)**
Labs (20%) Homework (25%) Midterm exam (25%) Final exam (30%)	A+ 99+ A 95 - 99 A- 90 - 94 B+ 87 - 89 B 83 - 86 B- 80 - 82 C+ 77 - 79 C 73 - 76

	C- 70 - 72 D+ 67 - 69 D 63 - 66 D- 60 - 62 F < 60

Office Hours

Instructor/TA	Office Hours	Location
Ricardo de Castro rpintodecastro@ucmerced.edu	Wednesday, 3 to 5pm	See catcourse
Ghazaale Mehrabadi gleylaz@ucmerced.edu	Monday, 3 to 5pm	See catcourse
Cristian Manzo cmanzo4@ucmerced.edu	Tuesday, 3 to 5pm	See catcourse
Haoyu Li hli84@ucmerced.edu	Monday, 1 to 3pm	See catcourses
Muhammad Ahmed mahmed27@ucmerced.edu	Monday, 11am to 1pm	See catcourses

Catcourses

We will be using CatCourses for posting the syllabus, lecture notes, assignments, lab documents, announcements, and grades.

Course Policies:

1. NO CELL PHONES are allowed during lectures and labs.
2. Be on time to class and labs.
3. No late work will be accepted. Medical or family emergency will be considered on a case-by-case basis.
4. A zero score will be assigned to the missed quizzes or exams. No electronic devices other than a calculator will be allowed.
5. If you miss a class or lab due to a personal emergency or medical reasons, please be sure to inform us by e-mail.
6. Homework assignments are to be submitted to catcourses by the due date. You should keep a record of your homework and be ready to present it upon request. You may discuss homework problems with your classmates, but you are responsible for your own work.
7. You are recommended to read the sections in the textbooks related to the covered topics prior to the lecture as well as after.
8. After an assignment grade has been posted online, if you feel there is anything wrong with your grade and wish to discuss the assignment and your work, you must see the instructor within one week. University's rules on academic honesty concerning exams and individual assignments will

be strictly enforced. See UC Conduct Standards: http://studentlife.ucmerced.edu/what-we-do/student-judicial-affairs/uc- conduct-standards

Academic Integrity:

1. Each student in this course is expected to abide by the University of California, Merced's Academic Honesty Policy. Any work submitted by a student in this course for academic credit will be the student's own work.
2. You are encouraged to study together and to discuss information and concepts covered in lectures and the sections with other students. You can give "consulting" help to or receive "consulting" help from other students. However, this permissible cooperation should never involve one student having possession of a copy of all or part of work done by someone else, in the form of an email, an email attachment file, a diskette, or a hard copy. Should copying occur, both the student who copied work from another student and the student who gave material to be copied will both automatically receive a zero for the assignment. The penalty for violation of this Policy can also be extended to include failure of the course and University disciplinary action.
3. During examinations, you must do your own work. Talking or discussion is neither permitted during the examinations, nor compare papers, copy from others, or collaborate in any way. Any collaborative behavior during the examinations will result in failure of the exam and may lead to failure of the course and University disciplinary action.

Accommodations for Students with Disabilities:

Accommodations for Students with Disabilities: The University of California Merced is committed to ensuring equal academic opportunities and inclusion for students with disabilities based on the principles of independent living, accessible universal design, and diversity. Any student who feels he or she may need an accommodation based on the impact of a disability should contact me privately to discuss his or her specific needs. Also contact Disability Services at (209) 228-7884 as soon as possible to become registered and thereby ensure that such accommodations are implemented in a timely fashion.

Tentative Weekly Schedule

Week	Lecture Dates	Lecture	Reading	HW	Lab
1	Aug 25, 27	No Lectures*	Chap 1	1	No Labs
2	Sep 1, 3	Power Sources, Passive Sign Convention, Ohm's law, KCL, KVL	Chap 2	1	Lab 1 –introduction to lab, safety, and equipment
3	Sep 8, 10	Resistors in Series and in Parallel, Voltage and Current Dividers Node-Voltage Method	Chap 3	2	No labs
4	Sep 15, 17	Mesh-Current Method, Source Transformation,	Chap 4	3	Lab 2 – Electric Measurement, Ohm's Law
5	Sep 21, 23	Thévenin Equivalent, Norton Equivalent	Chap 4	4	Lab 3 – Resistors combination, KCL, KVL
6	Sep 29, Oct. 1	Maximum Power Transfer, Superposition	Chap 4	5	Lab 4 – Node Voltage Method
7	Oct 6, 8	Op Amps	Chap 5		Lab 5 – Thevenin Circuits
8	Oct 13, 15	Review, Mid Term Exam			No Lab, Midterm exam
9	Oct 20, 22	Inductors, Capacitors, Series-Parallel Combinations of Inductance and Capacitance.	Chap 6	6	Lab 6 – Superposition
10	Oct 27, 29	RL, RC, RLC Circuits	Chap 7, 8	7	Lab 7 – Intro to PSPICE
11	Nov 3, 5	Laplace Transform (I)	Chap 12	8	Lab 8 – Simulation, OpAmps
12	Nov 10, 12	Laplace Transform (II)	Chap 12	9	No labs
13	Nov 17, 19	Circuit Analysis with Laplace Transform (I)	Chap 13		Lab 9 – RL/RC Circuits
14	Nov 24, 26	Thanksgiving Holiday			No Labs
15	Dec 1, 3	Circuit Analysis with Laplace Transform (II)	Chap 13	10	Lab 10 – Simulation, RLC
16	Dec 8, 10	Review			No Labs
17	Dec. 15	Final Exam			No Labs

* During week 1, online assignments, readings and videos will be used to introduce the *Syllabus, Engineering Overview, SI units and Circuit Variables*. The in-person instruction (lectures and labs) will start on Week 2.