ECE-201 Circuits and Systems I
Fall 2018

Instructor: Peng Zhang
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Schedule: **Section 3:** M W F, 3:00 PM - 3:50 PM, 2250 Engineering Building

Office Hours: M W F: 4-5pm, or by appointment (arranged by email)

Co-Req: Math 234

Course Website: D2L https://d2l.msu.edu/

Course Objectives:

At the completion of this course, each student should be able to do the following:

1. Understand and describe the properties of basic circuit elements including resistors, capacitors, inductors, controlled sources and op-amps.
2. Apply element constraints, connection constraints, and network theorems for circuit analysis.
3. Apply network theorems for circuit analysis
4. Analyze DC circuits.
5. Analyze first order RL and RC circuits, and second order RLC circuits. Calculate the transient response of first and second order circuits.
6. Enter netlists of basic circuits into Spice software and obtain simulation results.
7. Understand electrical safety.

On-Line Lectures: https://www.youtube.com/user/ECE201msu

Textbook: G.M. Wierzba, ECE 201: Electric Circuits and Systems I Class notes for Fall 2019, available at (free download by Nov. 25, 2019)
https://www.egr.msu.edu/~wierzba/ECE201_Fall_2019.pdf

Thomas, Rosa & Toussaint, *The Analysis and Design of Linear Circuits*, Wiley, 2016 (8th Edition) – on reserve in the Central Library

Grading:

Grading is assigned using the straight scale shown below.

Score	90-100%	85-89%	80-84%	75-79%	70-74%	65-69%	60-64%	<60%
Grade	4.0	3.5	3.0	2.5	2.0	1.5	1.0	0.0

Points are distributed as follows.

Homework	Classroom Activities	Exam 1	Exam 2	Exam 3	Final Exam
15%	15%	15% each			25%

Attendance Policy: Classroom attendance is expected. Classroom activities will be graded. It is the student's responsibility to obtain notes for any missed classes.

Homework Policy: Homework will be due one week after it is assigned. Homework is due at the start of class. Points will be deducted for late homework as follows:

Homework received 15 minutes after the start of class => 10 points deducted
Homework received after the end of class => 30 points deducted
Homework received one hour or more after class => homework not accepted (score of zero entered)

Homework is to be done on 8.5" x 11" paper using only one side. It **must** be stapled. You are expected to work independently. Identical assignments are **not** acceptable and will all receive a grade of **zero**.

You must obtain a passing grade in Homework to pass the course.

Exam Policy: There are **NO MAKEUP EXAMS**.

You must obtain a passing grade in Final Exam to pass the course.

Students who do not take the final exam will receive a score of 0.0 in the class. Students who request a rescheduled ECE 201 Final Exam based on the MSU "3-exam in 1 day policy" must request rescheduling by sending an email to the instructor. The request must be made prior to the last regularly scheduled class day and approval of the request is based on confirmation of enrollment in the classes having concurrent exams, and consistency of the final exam schedules as listed at: https://reg.msu.edu/ROInfo/Calendar/FinalExam.aspx

Calculators for Exams: Unless stated otherwise, bring a calculator to the exams. You may use any scientific or graphing calculator, unless it has features described on the "Prohibited" list.

Prohibited:

- Pocket organizers;
- Handheld or laptop computers;
- Electronic writing pads or pen-input devices;
- Calculators built into cell phones or other electronic communication devices;
- Calculators with a typewriter keyboard (keys in QWERTY format). Calculators with letter keys not in QWERTY format are permitted.

Exam Schedule: The 50-minute exams are held in the classroom during the regularly scheduled class time. Exams are closed book and notes. There are NO formula sheets, NO crib sheets for the exams. The exam dates are (Tentative for Exams 1-3. Changes will be informed two weeks before the exams if any):

Exam 1: Wednesday, September 25, 2019
Exam 2: Monday, October 21, 2019
Exam 3: Monday, November 18, 2019
Final Exam: The Final Exam will be in the classroom and will be

comprehensive (chapters 1 – 7).
Monday, Dec 9 2019 3:00pm - 5:00pm in 2250 EB

Help Room: TBD

Graders: Firas Kaafarani, kaafara3@msu.edu

Important Dates: MSU Academic Calendar
https://reg.msu.edu/roinfo/calendar/academic.aspx

Spartan Code of Honor Academic Pledge: "As a Spartan, I will strive to uphold values of the highest ethical standard. I will practice honesty in my work, foster honesty in my peers, and take pride in knowing that honor is worth more than grades. I will carry these values beyond my time as a student at Michigan State University, continuing the endeavor to build personal integrity in all that I do."

Detailed Topics

Chapter 1: Introduction

- 1.1 About This Book
- 1.2 Symbols and Units
  - Prefixes, Engineering Notation
- 1.3 Circuit Variables
  - Current, Voltage, Power, Passive Sign Convention, Ground, Conservation of Energy, Conservation of Power

Chapter 2: Basic Circuit Analysis

- 2.1 Element Constraints
  - Electrical Network, Circuit, Resistance, Ohm's Law, V-I Characteristics, Conductance, Power, Resistor, Color Code, Precision Resistors, Ratings, Open and Short Circuits, Switches, Independent Voltage Sources, Independent Current Sources
- 2.2 Connection Constraints
  - Kirchhoff's Current Law, Kirchhoff's Voltage Law
- 2.3 Combined Constraints
  - Assigning Reference Marks
- 2.4 Equivalent Circuits
  - Series Resistance, Parallel Resistance, Special Cases, Approximations, Equivalent Voltage Sources, Equivalent Current Sources, Source Transformations, Delta-to-Wye and Wye-to-Delta Transformations, Redundant Elements
- 2.5 Voltage and Current Division
  - Voltage Divider Rule, Special Cases, Potentiometers, Current Divider Rule, Special Cases, Meter Movements, Wheatstone Bridge

Chapter 3: Circuit Analysis Techniques

- 3.1 Node-Voltage Analysis
  - Element Inspection Rule, Writing Node Equations by Inspection, Cramer's Rule, Evaluating Determinants, Node Analysis with Voltage Sources, Supernode
- 3.2 Mesh-Current Analysis
  - Element Inspection Rule, Writing Mesh Equations by Inspection, Mesh Analysis with Current Sources, Supermesh
- 3.3 Linearity Properties
  - Superposition Principle, Proportionality Property, Transfer Function, Unit Output Method
- 3.4 Thevenin and Norton Equivalent Circuits
  - Thevenin's Theorem, Norton's Theorem, Relationships
- 3.5 Maximum Signal Transfer
  - Second Derivative Test, Maximum Power Transfer Theorem, Maximum Efficiency Theorem, Computer-Aided Circuit Analysis

2.7 Computer-Aided Circuit Analysis
SPICE, MATLAB

Chapter 4: Active Circuits

4.1 Linear Dependent Sources
Voltage Controlled Sources, Current Controlled Sources, SPICE Models

4.2 Analysis of Circuits with Dependent Sources
Node-Voltage Analysis, Mesh-Current Analysis, Thevenin and Norton Equivalent Circuits

4.4 The Operational Amplifier
Notation, Ideal and Commercial Op-Amps, Non-inverting Amplifier, Zero Volt - Zero Current Property, Modeling a Non-inverting Amplifier, Limitations Due to the Power Supply, Voltage Follower, Inverting Amplifier and Model, Differential Amplifier and Model, Op-Amp Circuit Analysis, Bridge-T Amplifier

Chapter 6: Capacitance and Inductance

6.1 The Capacitor
V-I Relationship of Capacitance, Plotting Power and Energy with SPICE, Capacitor, Modeling a Capacitor with Ideal Elements

6.2 The Inductor
V-I Relationship of Inductance, Plotting Power and Energy with SPICE, Inductor, Modeling an Inductor with Ideal Elements

6.4 Equivalent Capacitance and Inductance
Series and Parallel Combinations of Capacitance, Series and Parallel Combinations of Inductance

Chapter 7: First- and Second-Order Circuits

7.2 First-Order Circuit
Step Response Step Response of an RC Circuit, Algorithm for any One Capacitance Circuit, Time Constant, Interpretation of the Time Constant, Step Response of an RL Circuit, Algorithm for any One Inductance Circuit, Time Constant, Sequential Switching, Algorithm for Sequential Switching, PSpice Simulation with Switches

7.4 First-Order Circuit Sinusoidal Response
Natural and Forced Response, RC Circuits

7.5 The Series RLC Circuit
Natural Response, Characteristic Equation, Overdamped, Critically Damped and Underdamped Response, SPICE

7.6 The Parallel RLC Circuit
Natural Response, Characteristic Equation, Overdamped, Critically Damped and Underdamped Response, SPICE

7.7 Second-Order Circuit Step Response
Complete Response of a Series RLC Circuit with a Step Input, SPICE

Schedule for Fall 2019

Week	Date	Day	Classes	Pages Covered	Videos	Supplement Problems & Solutions	Videos
1	Aug 28	W	Introduction, 1	Ch. 1 pp. 1-7	Ch01_001 Ch01_002	S1.1 S1.2	Sp01_001 Sp01_002
	Aug 30	F	2	Ch. 1 pp. 7-15	Ch01_003 Ch01_004 Ch01_005	S1.3 S1.4	Sp01_003 Sp01_004
2	Sep 2	M	No class	Labor day			
	Sep 4	W	3	Ch. 2 pp. 1-8	Ch02_001 Ch02_002	S2.1 S2.2 S2.3 S2.4	Sp02_001 Sp02_002 Sp02_003 Sp02_004
	Sep 6	F	4	Ch. 2 pp. 9-17	Ch02_003 Ch02_004 Ch02_005	S2.5 S2.6, S2.7 S2.8	Sp02_005 Sp02_006 Sp02_007 Sp02_008
3	Sep 9	M	5	Ch. 2 pp.18-25	Ch02_006 Ch02_007	S2.9 S2.10 S2.11 S2.12 S2.13	Sp02_009 Sp02_010 Sp02_011 Sp02_012 Sp02_013
	Sep 11	W	6	Ch. 2 pp.25-35	Ch02_008 Ch02_009 Ch02_010	S2.14 S2.15 S2.16 S2.17	Sp02_014 Sp02_015 Sp02_016 Sp02_017
	Sep 13	F	7	Ch. 2 pp.36-43	Ch02_011	S2.18	Sp02_018
4	Sep 16	M	8	Ch. 2 pp. 43-50	Ch02_012 Ch02_013	S2.19 S2.20 S2.21	Sp02_019 Sp02_020 Sp02_021
	Sep 18	W	9	Ch. 2 pp. 51-58	Ch02_014 Ch02_015 Ch02_016	S2.22 S2.23 S2.24	Sp02_022 Sp02_023 Sp02_024
	Sep 20	F	Self Review	Chapters 1-2			
5	Sep 23	M	Review	Chapters 1-2	Sample Exam 1		Solution of Sample Exam 1
	Sep 25	W	**Exam 1**	Covers Chapters 1-2			
	Sep 27	F	10	Ch. 3 pp. 1-18	Ch03_001 Ch03_002 Ch03_003	S3.1	Sp03_001
6	Sep 30	M	11	Ch. 3 pp.19-26	Ch03_004 Ch03_005	S3.2	Sp03_002
	Oct 2	W	12	Ch. 3 pp.27-37	Ch03_006 Ch03_007	S3.3	Sp03_003
	Oct 4	F	13	Ch. 3 pp.38-47	Ch03_008	S3.4	Sp03_004

					Ch03_009		
7	Oct 7	M	14	Ch. 3 pp.48-58	Ch03_010 Ch03_011 Ch03_012	S3.5 S3.6 S3.7	Sp03_005 Sp03_006 Sp03_007
	Oct 9	W	15	Ch. 3 pp.59-66	Ch03_013 Ch03_014	S3.8 S3.9 S3.10	Sp03_008 Sp03_009 Sp03_010
	Oct 11	F	16	Ch. 3 pp.67-77	Ch03_015 Ch03_016	S3.11 S3.12 S3.13 S3.14	Sp03_011 Sp03_012 Sp03_013 Sp03_014
8	Oct 14	M	17	Chapter 3	Matlab, PSpice		
	Oct 16	W	Self Review	Chapter 3			
	Oct 18	F	Review	Chapter 3	Sample Exam 2		Solution of Sample Exam 2
9	Oct 21	M	**Exam 2**	Covers Chapter 3			
	Oct 23	W	18	Ch. 4 pp.1-6	Ch04_001 Ch04_002	S4.1 S4.2 S4.3	Sp04_001 Sp04_002 Sp04_003
	Oct 25	F	19	Ch. 4 pp.7-14	Ch04_003 Ch04_004	S4.4 S4.5	Sp04_004 Sp04_005
10	Oct 28	M	20	Ch. 4 pp.15-22	Ch04_005 Ch04_006	S4.6 S4.7	Sp04_006 Sp04_007
	Oct 30	W	21	Ch. 4 pp.23-29	Ch04_007 Ch04_008	S4.8 S4.9 S4.10 S4.11 S4.12	Sp04_008 Sp04_009 Sp04_010 Sp04_011 Sp04_012
	Nov 1	F	22	Ch. 4 pp.30-35	Ch04_009 Ch04_010	S4.13 S4.14 S4.15	Sp04_013 Sp04_014 Sp04_015
11	Nov 4	M	23	Ch. 6 pp. 1-8	Ch06_001 Ch06_002	S6.1 S6.2 S6.3	Sp06_001 Sp06_002 Sp06_003
	Nov 6	W	24	Ch. 6 pp. 9-18	Ch06_003 Ch06_004 Ch06_005		
	Nov 8	F	25	Ch. 6 pp. 18-21	Ch06_006 Ch06_007	S6.4 S6.5 S6.6	Sp06_004 Sp06_005 Sp06_006
12	Nov 11	M	26	Ch. 7 pp. 1-11	Ch07_001 Ch07_002 Ch07_003	S7.1 S7.2 S7.3	Sp07_001 Sp07_002 Sp07_003
	Nov 13	W	Review	Chs. 4 and 6	Sample Exam 3		Solution of Sample Exam 3
	Nov 15	F	Self Review	Chs. 4 and 6			

13	Nov 18	M	**Exam 3**	Covers Chs. 4 and 6			
	Nov 20	W	27	Ch. 7 pp. 12-18	Ch07_004 Ch07_005 Ch07_006	S7.4 S7.5 S7.6 S7.7	Sp07_004 Sp07_005 Sp07_006 Sp07_007
	Nov 22	F	28	Ch. 7 pp.19-32	Ch07_007 Ch07_008 Ch07_009		
14	Nov 25	M	29	Ch. 7 pp.33 -50	Ch07_010 Ch07_011 Ch07_012 Ch07_013		
	Nov 27	W	30	Ch. 7 pp.51-58	Ch07_014 Ch07_015		
	Nov 29	F	No class	Thanksgiving			
15	Dec 2	M	Review	Chs. 1-7	Sample of Final Exam		Solution of Sample Exam
	Dec 4	W	Honor's Option Presentations	Course Evaluation			
	Dec 6	F	No class/ Design day	Class End			
16	Dec 9	M	**Final Exam**	Covers Chs. 1-7	3:00pm - 5:00pm	2250 EB	

(Changes to the schedule will be informed two weeks earlier if any.)