Circuits & Signals I
Fall, 2021
Lecture: on M W F, 9:50 – 10:40 in Speare 117

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Course Description: Principles of electrical circuit analysis. Kirchhoff's laws, equivalent circuits, dependent sources, node and mesh analyses, signals, RLC components. Introductory circuits and operational amplifier circuits as examples.

Mode of Instruction: Face-to-face lectures on M W F, 9:50 - 10:40 in Speare 117.

Pre-requisites: *MATH 1520* (Calculus and Analytic Geometry II)

Place in Curriculum: This course is normally offered in Fall semester. It is a requirement for the Electrical Engineering major.

Course Learning Outcomes:
After completion of this course, students are expected to be able to:

- Analyze circuits with basic elements using Ohm's law, KCL, and KVL.
- Calculate instantaneous power absorbed or supplied by elements.
- Apply nodal or mesh analysis to form system of linear equations and solve it.
- Understand the principles of op-amp, non-ideal source, and superpositions.
- Leverage Thevenin's Theorem and Norton's Theorem to evaluate the load conditions.
- Analyze circuits with energy-storage elements, e.g., capacitors and inductors.
- Resolve the integrodifferential equations with non-zero initial conditions and inputs.

Program Learning Outcomes: https://www.nmt.edu/academics/eleceng/undergrad/index.php

Course Requirements:
Textbook: *Elementary Linear Circuit Analysis (Second Edition). Leonard S. Bobrow, Oxford University Press 1987.*

Course schedule

Date	Chapter	Topic
Aug. 16		Syllabus and Canvas Navigation
Aug. 18, 20, 23, 25, 27	Chap. 1	Sources, Ohm's Law, KCL, KVL, Instantaneous Power
Aug. 30, Sep. 1, 3	Chap. 2	Nodal Analysis
Sep. 6	Holiday	
Sep. 8, 10	Chap. 2	Mesh Analysis
Sep. 13, 15, 17	Chap. 3	Op-Amp, Non-Ideal Sources, Thevenin's Theorem
Sep. 20		Midterm 1 Review
Sep. 22		Midterm 1 (Until Chap. 2)
Sep. 24, 27	Chap. 3	Norton's Theorem, Superposition
Sep. 29, Oct. 1, 4, 6, 8, 11	Chap. 4	Inductor, Capacitor, Input Functions, Integrodifferential Equations, Initial Conditions
Oct. 13	Chap. 5	Zero-Input and Zero-State Response
Oct. 15	Holiday	
Oct. 18, 20, 22, 25	Chap. 5	Linearity and Superposition, Non-Zero Initial Conditions
Oct. 27, 29	Chap. 6	RLC Circuits, Overdamp, Underdamp, Critically-damp
Nov. 1		Midterm 2 Review
Nov. 3		Midterm 2 (Until Chap. 4)
Nov. 5, 8, 10	Chap. 6	Non-Zero Inputs and Initial Conditions
Nov. 12, 15, 17, 19	Chap. 8	Complex Number, Time/Frequency Domain Analysis
Nov. 22, 24, 26	Holiday	
Nov. 29, Dec. 1, 3		Final Term Review

Grading:

- Homework: 40%
- 2 Midterm: 20% each
- Final term: 20%

A	90-100	C	70-72
A-	86-89	C-	66-69
B+	83-85	D+	63-65
B	80-82	D	60-62
B-	76-79	F	<60
C+	73-75		

Homework and exams: There will be 8 assignments (7 homework + 1 IEEE Code of Ethics), 2 midterm exams and 1 final exam. Homework will be available by the date when the needed materials have been covered in the courses. Homework will be due by one week after the available date, e.g., if HW 1 is available on Aug. 27, it is due by 11:59 pm on Sep. 2. Submission of homework will be done via Canvas online assignment portal. Exams will be done in the classroom on the scheduled dates. Students may work together on homework but must turn in individual assignments that CANNOT BE IDENTICAL. Late homework will not be accepted unless requested via email before the due date with a valid reason. There will be no make-up exams except in the case of extraordinary circumstances.

In-class open discussion: For review purpose, the 10 minutes from the beginning of the class will sometimes be reserved for an interactive in-class open discussion. The goal of this discussion is to encourage students to regularly review the course contents and practice technical presentation and communication. During this time, students may raise a topic to discuss (e.g., why are the differences between nodal analysis and mesh analysis), or ask questions about course examples, homework, or share some personal discovery and knowledge with the classmates. The instructor may also lead the open discussion with a general topic or a specific problem. *The in-class open discussion does NOT have any impact on the course final grade.*

Some important notes:

1. How to raise a question. Do NOT simply send me the photocopy of your homework and ask me if you did it correctly or not. I cannot "grade" your homework before you hand in. Explain your thoughts on how to solve the problem step by step.
2. Notation and indexing. You need to mark i1, i2, v1, v2 … in your circuit for me to understand how your derivation works in the equations.
3. Solver for system of equations. You can use programming tool (e.g., MATLAB) or online solver (e.g., https://www.symbolab.com/solver/system-of-equations-calculator/) to resolve the system of equations in your homework or exams.
4. Grading for homework and exams. Homework grade is more effort-based while exams require you to complete the problems correctly.