

The University of Maine
Department of Electrical and Computer Engineering
ECE 209 – Fundamentals of Electric Circuits

Fall 2020

Fundamentals of Electric Circuits

Course Number: ECE 209.

Prerequisites: MAT 127 – Calculus II, and PHY 122 – Physics for Engineers II.

Credits: 3.

Virtual Lectures: posted on the course website each week.

Virtual Class Recitation Sessions: 8:00 - 9:15 am, Tuesday and Thursday.

Virtual Class Recitation Link: <https://maine.zoom.us/j/95768844512>. (Password required.)

Course Website: <https://ece209.davidkotecki.com>.

Brightspace: <https://courses.maine.edu> is used to submit homework and exams.

Instructor

Dr. David E. Kotecki

Virtual Office: <https://maine.zoom.us/my/davidkotecki> (Password required.)

e-mail: kotecki@maine.edu

Mobile: 207.356.0168

Virtual Office Hours

1:00 - 2:00 pm Monday, Tuesday, Wednesday, and Thursday. You are encouraged to drop by my virtual office to ask questions and discuss homework problems related to this course. If you are unable to meet with me during these times, e-mail me to set up an appointment.

Virtual Lectures and Class Recitation Sessions

Lectures will be delivered asynchronously and posted weekly to the course website. You are welcome to attend the virtual class recitation sessions and ask questions. Alternatively, you can e-mail questions to me, and I will answer them during the recitation sessions. These sessions will be used to review homework problems and answer questions as they arise. These recitation sessions will be recorded and made available for later viewing. Note: the three preliminary exams will take place during scheduled virtual class recitation sessions.

Text Book

Title: [Electric Circuits \(11th edition\)](#)

Authors: James W. Nilsson and Susan A. Riedel

Publisher: Prentice Hall (2018)

ISBN: 978-0134746968

Electronic Text: <https://www.vitalsource.com/products/electric-circuits-james-w-nilsson-susan-riedel-v9780134747224>

Calculators

It is strongly recommended that you have a calculator capable of solving simultaneous linear equations with complex variables. Calculators may be used when solving homework problems and taking exams. The most popular calculators are the TI-89, TI-89 Titanium, and the TI Nspire CX CAS.

Goals

This is a foundation course in circuit analysis. You will acquire the fundamental tools to analyze linear circuits. You will learn how to analyze and solve circuit problems containing basic circuit elements including wires, resistors, capacitors, inductors, transformers, independent and dependent voltage and current sources, and operational amplifiers. Both time-independent (DC), transient, and steady-state analysis will be introduced. This course will prepare you for more advanced courses in circuit analysis, signals and systems, and electronics. This course should help you pass the PE exam.

Homework

The homework problems are located at the end of each chapter of the textbook. All of the assigned problems are listed **Page 5** of this syllabus. Once the homework is completed, take photographs of your work and upload your solutions to Brightspace. Homework must be submitted no later than 6:00 pm on the due date. Late homework is not normally accepted.

Not all homework problems will be graded; a selected number of problems from each assignment will be corrected and used to determine your homework grade. The homework score will be based on the correct method and the correct answer. Circle your final answers! Presentation will not be separately graded, but poor presentation of your work will lower your grade – be neat! Homework will be graded by the homework grader. Please contact the grader by e-mail if you have questions about your homework grade.

You may work on the homework problems individually or with others in the class. You are encouraged to work together and discuss your solution to the problem with other students in the class. Each student is required to submit their own homework solutions.

Homework Graders

Teaching Assistant 1: Ally DiFilippo, e-mail: alessandra.difilippo@maine.edu

Teaching Assistant 2: Caleb Marston, e-mail: caleb.marston@maine.edu

Exams

There are three preliminary exams and one final exam. The exams will be held from 8:00-9:15 am during regularly scheduled recitation sessions, and delivered over Brightspace. The exams are open book. Only hand held calculators (no tablets, phones, or laptops) may be used. At the end of the examination period, photograph your work and upload your solutions to Brightspace.

The exam grade will be based on both the method used to solve the problem and the answer. Answers to problems not supported by a correct method will not earn credit. Presentation will not

be separately graded and I will do my best to figure out what you meant to do on a problem, but if the work is poorly laid out or just a mess, your grade will suffer.

The exams are designed to test your knowledge of fundamental concepts and your ability to apply those concepts to solve problems. It is important to learn and master the key concepts rather than memorize how to do individual problems. Problems on the exams will be similar to but different from the problems in the homework. However all exam problems can be solved using the same concepts and techniques used to solve the homework problems.

Examination Dates

| | |
|-------------|----------------------------------|
| Exam #1: | 1 October 2020 |
| Exam #2: | 29 October 2020 |
| Exam #3: | 24 November 2020 |
| Final Exam: | 15 December 2020 (12:15-2:15 pm) |

Anyone who is unable to attend one of the scheduled examination dates must notify the instructor prior to the exam. If you are excused from the exam for cause, a make-up exam will be offered during the last week of classes.

If you have an accommodation letter from Student Accessibility Services, please send a copy to me as soon as possible.

Grading

| | |
|--------------|-------------|
| Exams 1 – 3 | 20% each |
| Homework | 20% |
| Final Exam | 20% |
| Total | <u>100%</u> |

Letter Grade Assignment Floor

| | |
|-------------|-----|
| $\geq 90\%$ | A |
| 88% – 90% | B + |
| 80% – 88% | B |
| 78% – 80% | C + |
| 70% – 78% | C |
| 68% – 70% | D + |
| 60% – 67% | D |
| < 60% | F |

Tentative Class Schedule

| Class | Date | Topics | Sections |
|-------|--------------|---|---------------------------------|
| 1 | 1 Sep. 2020 | Course Overview; Systems of Units; Power & Energy | Chapter 1, all sections |
| 2 | 3 Sep. 2020 | Voltage, Current, and Resistance | Chapter 2, Sections 1 – 3 |
| 3 | 8 Sep. 2020 | Kirchhoff's Laws | Chapter 2, Sections 4 and 5 |
| 4 | 10 Sep. 2020 | Series and Parallel Resistance; Y and Delta Configuration | Chapter 3, Sections 1, 2, and 7 |
| 5 | 15 Sep. 2020 | Measuring Voltage, Current and Resistance; Voltage and Current Division | Chapter 3, Sections 3 – 6 |
| 6 | 17 Sep. 2020 | Nodal Analysis, Nodes and Dependent Sources | Chapter 4, Sections 1 – 4 |
| 7 | 22 Sep. 2020 | Mesh Analysis | Chapter 4, Section 5 |
| 8 | 24 Sep. 2020 | Loops and Dependent Sources | Chapter 4, Sections 6 – 8 |
| 9 | 29 Sep. 2020 | Source Transformations, Thévenin and Norton Equivalent Circuits | Chapter 4, Sections 9 – 11 |
| 10 | 1 Oct. 2020 | Exam #1 | — |
| 11 | 6 Oct. 2020 | Superposition | Chapter 4, Sections 12 and 13 |
| 12 | 8 Oct. 2020 | Operational Amplifiers | Chapter 5, Sections 1 – 4 |
| 13 | 15 Oct. 2020 | Op Amp Circuits | Chapter 5, Sections 5 – 6 |
| 14 | 20 Oct. 2020 | The Inductor and Capacitor | Chapter 6, Sections 1 – 3 |
| 15 | 22 Oct. 2020 | Mutual Inductance | Chapter 6, Sections 4 and 5 |
| 16 | 27 Oct. 2020 | Natural Response RL and RC Circuits | Chapter 7, Sections 1 and 2 |
| 17 | 29 Oct. 2020 | Exam #2 | — |
| 18 | 3 Nov. 2020 | Forced Response RL and RC Circuits | Chapter 7, Sections 3 |
| 19 | 5 Nov. 2020 | General Solution to Step Response | Chapter 7, Section 4 |
| 20 | 10 Nov. 2020 | The Sinusoid | Chapter 9, Sections 1 and 2 |
| 21 | 12 Nov. 2020 | The Phasor and Passive Elements | Chapter 9, Sections 3 and 4 |
| 22 | 17 Nov. 2020 | Kirchhoff's Law | Chapter 9, Sections 4 and 6 |
| 23 | 19 Nov. 2020 | Thévenin and Norton Equivalents; Nodal and Mesh Analysis | Chapter 9, Sections 7 – 9 |
| 24 | 24 Nov. 2020 | Exam #3 | — |
| 25 | 1 Dec. 2020 | Transformer | Chapter 9, Sections 10 and 11 |
| 26 | 3 Dec. 2020 | Instantaneous, Average and Reactive Power | Chapter 10, Sections 1 – 3 |
| 27 | 8 Dec. 2020 | Complex Power and Power Transfer | Chapter 10, Sections 4 – 6 |
| 28 | 10 Dec. 2020 | Review of Entire Course | — |
| 29 | 15 Dec. 2020 | Final Exam (12:15 - 2:15 pm) | — |

Homework Assignments

| Homework | Due Date | Problems |
|----------|--------------|--|
| #1 | 11 Sep. 2020 | 1.4, 1.7, 1.8, 1.10, 1.11, 1.18, 1.25, 2.5, 2.7, 2.9, 2.12, 2.15, 2.17, 2.23, 2.32, 2.33 |
| #2 | 18 Sep. 2020 | 3.3, 3.5, 3.9, 3.11, 3.16, 3.18, 3.20, 3.24, 3.31, 3.39, 3.52, 3.57, 3.60 |
| #3 | 25 Sep. 2020 | 4.3, 4.6, 4.7, 4.8, 4.12, 4.15, 4.17, 4.18, 4.23, 4.25, 4.29, 4.30, 4.39 |
| #4 | 9 Oct. 2020 | 4.45, 4.51, 4.55, 4.57, 4.58, 4.60, 4.64, 4.68, 4.74, 4.78, 4.82, 4.87, 4.97 |
| #5 | 16 Oct. 2020 | 5.1, 5.3, 5.5, 5.6, 5.8, 5.10, 5.16, 5.21, 5.23, 5.27 |
| #6 | 23 Oct. 2020 | 5.31, 5.36, 5.38, 6.5, 6.6, 6.10, 6.12, 6.17, 6.19, 6.20, 6.23, 6.28, 6.35 |
| #7 | 10 Nov. 2020 | 6.39, 6.45, 7.4, 7.6, 7.10, 7.20, 7.25, 7.18, 7.29, 7.31 |
| #8 | 13 Nov. 2020 | 7.36, 7.37, 7.41, 7.46, 7.57, 7.68, 7.69, 7.70, 7.71 |
| #9 | 20 Nov. 2020 | 9.2, 9.4, 9.7, 9.11, 9.18, 9.22, 9.23, 9.24, 9.25, 9.30, 9.33, 9.36, 9.37, 9.39 |
| #10 | 11 Dec. 2020 | 9.43, 9.49, 9.53, 9.58, 9.67, 9.74, 9.76, 9.80, 10.1, 10.3, 10.8, 10.22, 10.28, 10.41 |

Academic Honesty Statement

Academic honesty is very important. It is dishonest to cheat on exams, to copy term papers, to submit papers written by another person, to fake experimental results, or to copy or reword parts of books or articles into your own papers without appropriately citing the source. Students committing or aiding in any of these violations may be given failing grades for an assignment or for an entire course, at the discretion of the instructor. In addition to any academic action taken by an instructor, these violations are also subject to action under the University of Maine Student Conduct Code. The maximum possible sanction under the student conduct code is dismissal from the University.

Students with Disabilities Statement

If you have a disability for which you may be requesting an accommodation, contact Student Accessibility Services, 121 East Annex, 581.2319, as early as possible. Students who have already been approved for accommodations by SAS and have a current accommodation letter should provide a copy of the letter to me as soon as possible.

Course Schedule Disclaimer (Disruption Clause)

In the event of an extended disruption of normal classroom activities, the format for this course may be modified to enable its completion within its programmed time frame. In that event, you will be provided an addendum to the syllabus that will supersede this version.

Sexual Violence Policy: Sexual Discrimination Reporting

The University of Maine is committed to making campus a safe place for students. Because of this commitment, if you tell a teacher about an experience of sexual assault, sexual harassment, stalking, relationship abuse (dating violence and domestic violence), sexual misconduct or any form of gender discrimination involving members of the campus, your teacher is required to report this information to the campus Office of Sexual Assault & Violence Prevention or the Office of Equal Opportunity.

If you want to talk in confidence to someone about an experience of sexual discrimination, please contact these resources:

For confidential resources on campus: Counseling Center: 207-581-1392 or Cutler Health Center: at 207-581-4000.

For confidential resources off campus: Rape Response Services: 1-800-310-0000 or Spruce Run: 1-800-863-9909.

Other resources: The resources listed below can offer support but may have to report the incident to others who can help: For support services on campus: Office of Sexual Assault & Violence Prevention: 207-581-1406, Office of Community Standards: 207-581-1409, University of Maine Police: 207-581-4040 or 911. Or see the OSVP website for a complete list of services at <http://www.umaine.edu/osavp/>

COVID-19 Statement

COVID-19 is an infectious disease caused by the coronavirus SARS-CoV-2. The virus is transmitted person-to-person through respiratory droplets that are expelled when breathing, talking, eating, coughing, or sneezing. Additionally, the virus is stable on surfaces and can be transmitted when someone touches a contaminated surface and transfers the virus to their nose or mouth. When someone becomes infected with COVID-19 they may either have no symptoms or symptoms that range from mild to severe and can even be fatal. During this global pandemic, it is imperative that all students, faculty, and staff abide by the safety protocols and guidelines set forth by the University to ensure the safety of our campus. All students are encouraged to make the Black Bear Cares Pact to protect the health of themselves, the health of others, and the College of Our Hearts Always.

Black Bears Care Pact: <https://umaine.edu/return/black-bears-care/>

Symptom checking: The symptoms of COVID-19 can range from mild to severe, and even people with mild symptoms may transmit the virus to others. Students are encouraged to use the symptom checking app each day before attending class or moving about campus and follow the recommendation prompted within the app. Students should monitor for the following symptoms daily: fever (temperature >100.4F/38.0C) or chills, new cough, loss of taste or smell, shortness of breath/difficult breathing, sore throat, diarrhea, nausea, or vomiting, or the onset of new, otherwise unexplained symptoms such as headache, muscle or body aches, fatigue, or congestion/runny nose.

Physical distancing: Students need to make every effort to maintain physical distancing (6 feet or more) indoors and outdoors including within classrooms. The University classrooms and physical spaces have been arranged to maximize physical distancing. Follow the traffic patterns outlined in each building and outdoor space to avoid crowding. If students are in an academic setting (i.e. clinical or lab class) that requires them to reduce physical distancing, they should follow the instructor's guidelines.

Face coverings: Students must wear appropriate face coverings in the classroom. Face coverings must be worn in indoor and outdoor spaces on campus unless people are alone in a room with a door closed or when they are properly physically distanced and do not expect someone to approach them. When face coverings are removed people are placing themselves and those surrounding them at increased risk for COVID-19.

Eating and drinking in classrooms: Students may not eat or drink in the classrooms and are encouraged to take their food or drink into areas designated for these purposes where they can maintain 6 feet physical distance from others.

Hand hygiene: Proper hand hygiene is an effective measure to prevent the spread of COVID-19. Students should wash their hands often with soap and water or use a hand sanitizer with at least 60

Contingency plans: Classes will be held in various formats to offer flexibility, compassion, and empathy during these unprecedented times. Under certain circumstances, students or instructors

may need to miss classes or in-person classes may be disrupted. Students are expected to notify their instructor if they are unable to attend an in-person or online class but will not be penalized for missing class due to illness or the need to care for a family member affected by COVID-19. If a disruption occurs, your instructor will provide communication and contingency plans.

What to do if you have or suspect you have COVID-19: If you have symptoms of COVID-19 or have been possibly exposed to someone with COVID-19, you should stay home, not interact with others, and contact your health care provider immediately to be tested for COVID-19. You may not attend in-person classes and should suspend interactions with others until you are tested. Prior to receiving test results you should quarantine in your living area according to the Maine CDC guidelines below. Please follow the guidance of your health care professional regarding testing, quarantine, and isolation during the testing process and potential illness period.

What to do if someone you know has or may have COVID-19: If someone you know or that you have had close contact with (defined by the ME CDC as 15 mins or more within 6 feet or less) has tested positive for COVID-19, you should stay home and quarantine according to the guidance of the ME CDC, contact your health care provider, and continue to monitor for symptoms. You may be required to quarantine and/or be tested for COVID-19 under these circumstances. You may also have been exposed to COVID-19 by someone you do not know, and it is possible that you could be contacted through contact tracing to determine if you were exposed. Everyone should respond to these confidential questions to ensure the safety of themselves and those around them.

Maine CDC guidelines: <https://www.maine.gov/dhhs/mecdc/infectious-disease/epi/airborne/coronavirus/general-information.shtml>

If you have questions or would like additional information related to the University of Maine COVID-19-specific policies or procedures please use the following sources:

University Webpages: umaine.edu/return and together.maine.edu

COVID-19 Information line: 207.581.2681

Emergency Operations Center Email Contact: umaine.alerts@maine.edu

What is Circuit or Electric Circuit? Types of Electric Circuits Electrical Network Series-Parallel Circuits Linear & Non Linear, Short Circuit, Open Circuit. What is an Electric Circuit? Types of Circuits, Network & Parts Of Circuit. Electrical Technology. 9 4 minutes read. Electric Circuit, Network, Complex Circuits and other Types of Circuits. Table of Contents. What is an Electrical Network? Complex Networks. What is a Circuit or Electric Circuit? Types of Electric Circuits. Series Circuit. Parallel Circuit. Electronic Circuit Monday, October 26, 2020. Schematic diagram of a Power Amplifier TDA7294. Symmetrical Power Supply. The DC to DC converter circuit, the PWM IC uses TL494, the mosfet uses 6 N-channel Mosfets. For the transformer can use ferrite EE or Toroid. with the number of turns as shown. The primary wire size must be larger than the secondary by a 3: 1 ratio. 12VDC CT for opamp circuit or subwoofer preamp. and this 5V to supply to pin MODE TDA8954. An electric circuit is a path through which electric current flows. An electric circuit can also be a closed path (in which the ends are joined), thereby making it a loop. The flow of electric current is possible because of the closed circuit. An electric circuit can also be an open circuit in which the flow of electrons is cut because the circuit is broken. Electric current doesn't flow in an open circuit. It is important to know about the basic parts of an electric circuit.

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