Department of Physics and Engineering

EGR2024/L Electrical Circuit Analysis and Lab

4 Units

Fall 2026

MWF | 1:30 - 2:25 PM
R | 10:30 AM - 1:20 PM (Labs)

Meeting location Rohr Science Hall (RS) 265

Final Exam: 12/14 1:30 - 4:00 PM

Instructor Title and Name: Dr. José Manjarrés
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Office Location and Office Hours: RS 276 | MWF 9:00 - 9:50 AM, 1:00 PM - 1:30 PM; T 10:30 - 11:30 AM

PLNU Mission

To Teach ~ To Shape ~ To Send

Point Loma Nazarene University exists to provide higher education in a vital Christian community where minds are engaged and challenged, character is modeled and formed, and service is an expression of faith. Being of Wesleyan heritage, we strive to be a learning community where grace is foundational, truth is pursued, and holiness is a way of life.

Department Mission

The Physics and Engineering Department at PLNU provides strong programs of study in the fields of Physics and Engineering. Our students are well prepared for graduate studies and careers in scientific and engineering fields. We emphasize a collaborative learning environment which allows students to thrive academically, build personal confidence, and develop interpersonal skills. We provide a Christian environment for students to learn values and judgment, and pursue integration of modern scientific knowledge and Christian faith.

Course Description

Theory and analysis of electrical circuits. Topics include basic circuit elements, laws of circuit analysis, Kirchoff's laws, loop and nodal analysis, differential equations for modeling electronic circuits, AC and DC analysis, transient analysis, complex impedance and steady-state analysis, Laplace Transforms, and frequency domain analysis.

Prerequisite(s): PHY 2054
Corequisite(s): EGR2024L

Program and Course Learning Outcomes

Student Outcomes:

- Apply circuit reduction planning to effectively solve electrical circuit analysis problems.
- Use circuit analysis techniques to find relevant information in electrical circuits as part of contextualized problem-solving.
- Understand power balancing as a transversal tool to interpret the role and performance of devices in a circuit.
- Employ Thévenin's theorem to analyze the effects a load can have in an electrical system.
- Interpret realistic scenarios using alternating-current power analysis.
- Interpret basic circuit schematics that translate into simulated and mounted circuits on a breadboard.
- Utilize computational tools to solve equation systems that describe direct-current or alternating-current circuits.
- Design and implement a model of a microgrid with distributed generation.
- Reflect on the ethical implications of the implementation of the designed microgrid.

Program Outcomes:

- An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. (LO1)
- An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. (LO2)
- An ability to communicate effectively with a range of audiences. (LO3)
- An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts (LO4)

- An ability to function effectively in a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. (LO5)

Required Texts and Recommended Study Resources

Students are responsible for having the required course textbooks prior to the first day of class.

All supplemental materials posted on this course site (including articles, book excerpts, or other documents) are provided for your personal academic use. These materials may be protected by copyright law and should not be duplicated or distributed without permission of the copyright owner.

Required Texts:

- Alexander, C., Sadiku, M. Fundamentals of Electric Circuits, 2026 Release. McGraw-Hill. ISBN: 9781264143993.

Course Credit Hour Information

In the interest of providing sufficient time to accomplish the stated Course Learning Outcomes, this class meets the PLNU credit hour policy for a 4-unit class delivered over 14 weeks. It is anticipated that students will spend a minimum of 37.5 participation hours per credit hour on their coursework. For this course, students will spend an estimated 150 total hours meeting the course learning outcomes. The time estimations are provided in the Canvas modules.

Assessment and Grading

This course will have four ways to assess knowledge and learning, described as follows.

1. Pre-class readings: Short quiz related to a pre-session reading to be completed before the class session.
2. Interactive Activities: Application-based problems solved through the e-textbook platform.
3. Lab reports: Technical document summarizing an experiment set and a brief result analysis.
4. Lab completions: Lab activities designed to be completed within the allotted lab time.
5. Tests: 50-minute evaluations on a group of related topics.
6. Final Project: A comprehensive design problem encompassing several topics from the course. It includes a report and a presentation to the general public during the time designated for the final exam.
7. Vocation and ethics assignments: Personal reflection assignments on the student's vocation and calling, and the impact that their proposed final project could have on the community of interest from an engineering ethics perspective.

The table below outlines the assessment criteria for this course.

Activity	Points Per Activity	Qty.	Total
Pre-class Readings	10	33	330
Interactive Activities	10	5	50
Lab Reports	50	5	250
Lab Completions	30	4	120
Tests	100	5	500
Final Project Proposal	50	1	50
Final Project Progress Presentation	50	1	50
Final Project	200	1	200
Vocation and Ethics Assignments	10, 20	3	50
Total			**1600**

Grades will be based on the following:

Sample Standard Grade Scale Based on Percentages

A	B	C	D	F
A 93-100	B+ 87-89	C+ 77-79	D+ 67-69	F Less than 59
A- 90-92	B 83-86	C 73-76	D 63-66	
	B- 80-82	C- 70-72	D- 60-62	

Final Examination Policy

Successful completion of this class requires taking the final examination (final project) on its scheduled day. The final examination schedule is posted on the Traditional Undergraduate Records: Final Exam Schedules site. If you find yourself scheduled for three (3) or more final examinations on the same day, you are authorized to contact each professor to arrange a different time for one of those exams. However, unless you have three (3) or more exams on the same day, no requests for alternative final examinations will be granted.

Incompletes and Late Assignments

All assignments are to be submitted/turned in by when they are due—including assignments posted in Canvas. Late assignments, if allowed, are deducted 20% of its grade. Incompletes will only be assigned in extremely unusual circumstances.

Artificial Intelligence (AI) Policy

You are allowed to use Generative Artificial Intelligence (GAI) tools (e.g., ChatGPT, Claude, Gemini, etc.) in this course as a study support tool. You may not use GAI to write content for any kind of evaluation; if you do so, it'll be considered a case of academic dishonesty and prompt disciplinary action.

PLNU Academic Accommodations Policy

PLNU is committed to providing equal opportunity for participation in all its programs, services, and activities in accordance with the Americans with Disabilities Act (ADA). Students with disabilities may request course-related accommodations by contacting the Educational Access Center (EAC), located in the Bond Academic Center, by email or phone at 619-849-2533. Once a student's eligibility for an accommodation has been determined, the EAC will work with the student to create an Accommodation Plan (AP) that outlines approved accommodations. Professors are able to view a student's approved accommodations through Accommodate.

PLNU highly recommends that students speak with their professors during the first two weeks of each semester/term about the implementation of their approved accommodations in that particular course. Accommodations are not retroactive; as such, clarifying with the professor at the outset is one of the best ways to promote positive academic outcomes.

Students who need accommodations for a disability-related need should contact the EAC as early as possible (i.e., ideally before the beginning of the semester) to assure appropriate accommodations can be provided. In accordance with ADA, accommodations cannot constitute a fundamental alteration to course outcomes; therefore, planning ahead is vital in establishing appropriate accommodations for equal access to this course. It is the student's responsibility to make the first contact with the EAC. Students cannot assume that because they had accommodations in the past, their eligibility at PLNU is automatic. All determinations at PLNU must go through the EAC eligibility process. This is to protect the privacy of students with disabilities who may not want to disclose this information and are not asking for any accommodations.

LomaBooks Instructions for Students

This course is part of our course material delivery program, LomaBooks. The bookstore will provide each student with a convenient package containing all required physical materials; all digitally delivered materials will be integrated into Canvas.

You should have received an email from the bookstore confirming the list of materials that will be provided for each of your courses and asking you to select how you would like to receive any printed components (in-store pick up or home delivery). If you have not done so already, please confirm your fulfillment preference so the bookstore can prepare your LomaBooks materials.

Additional Course Information

Additional PLNU policies and practices that apply to this course can be found at the following link: https://docs.google.com/document/d/1SoL5YMfCv_5cobhBwrDjbcZJzNKKTCfM/edit?usp=sharing&ouid=104297418648613020764&rtpof=true&sd=true

Semester Schedule Outline

Date	Reading (before)	Topic
31-Aug		Welcome
2-Sep	1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.8	Prefixes and Basic Concepts
3-Sep	Breadboard & LTSpice Tutorial	First DC Circuit Lab (Multimeter, Breadboard, DC Power Supply)
4-Sep	1.5, 1.6, 1.7.2	Energy Bills
7-Sep		Labor Day - No classes
9-Sep	2.1, 2.2	I-V Curves and Resistance
10-Sep	Solar panel videos	Solar Panels Lab
11-Sep	2.3, 2.4, 2.5, 2.6	Voltage and Current Division
14-Sep	2.3, 2.4, 2.5, 2.6 & Practice Problems	Circuit Reduction Planning
16-Sep	Practice Problems	Practice: Reduction in Resistive Circuits
17-Sep		Voltage and Current Dividers
18-Sep		Test 1
21-Sep	Vocation Text	Vocation Activity
23-Sep	B.1, B.2	Complex Number Operations
24-Sep	9.1, 9.2 & Oscilloscope Video	Sinusoids Lab
25-Sep	B.3, 9.1, 9.2	Introduction to Phasors
28-Sep	9.3,	Phasors Practice
30-Sep	6.1, 6.2, 6.7, 9.4, 9.5	Impedance and Admittance
1-Oct		Final Project Proposal Presentations
2-Oct	9.6, 9.7	Impedance Combinations
5-Oct	Practice Problems	Practice: Impedance Combinations
7-Oct	Practice Problems	Practice: Reduction in AC Circuits
8-Oct	AC Simulation Tutorial on LTSpice	Intro to AC Circuit Simulation and Implementation
9-Oct		Test 2
12-Oct	A.1, A.2, 3.1, 3.2	Nodal Analysis
14-Oct	3.2, 3.3	Nodal Analysis with Voltage Sources
15-Oct	Linear Equation Systems video	Intro to Linear Equations & MATLAB Tutorial to Solve Equation Systems
16-Oct	Practice Problems	Practice: Nodal Analysis
19-Oct	10.2,	Nodal Analysis in AC
21-Oct	Practice Problems	Practice: Nodal Analysis in AC

22-Oct		Fall Break - No classes
23-Oct		Fall Break - No classes
26-Oct	3.4,	Mesh Analysis
28-Oct	3.5, 3.6, 3.7	Mesh Analysis with Current Sources
29-Oct		Final Project Progress Presentations
30-Oct	Practice Problems	Practice: Mesh Analysis
2-Nov	10.3,	Mesh Analysis in AC
4-Nov	Practice Problems	Practice: Mesh Analysis in AC
5-Nov		Applied Analysis Lab
6-Nov		Test 3
9-Nov	4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7	Thévenin's Theorem
11-Nov	Practice Problems	Practice: Thévenin Theorem
12-Nov		Thévenin's Theorem Lab
13-Nov	4.5, 4.8	Maximum Power Transfer
16-Nov	10.6,	Thévenin's Theorem in AC
18-Nov	Practice Problems	Practice: Thévenin's Theorem in AC
19-Nov		Thévenin's Theorem in AC Lab
20-Nov		Test 4
23-Nov	11.1, 11.2, 11.3	Maximum Power Transfer in AC
25-Nov		Thanksgiving Break - No classes
26-Nov		Thanksgiving Break - No classes
27-Nov		Thanksgiving Break - No classes
30-Nov	Practice Problems	Practice: Maximum Power Transfer in AC
2-Dec	11.4, 11.5	Apparent Power and Power Factor
3-Dec		Complex Power Lab
4-Dec	11.6, 11.7, 11.8, 11.9	Complex Power and Power Factor Correction
7-Dec	Practice Problems	Practice: Complex Power
9-Dec	Practice Problems	Practice: Complex Power
10-Dec		Final Project Time
11-Dec		Test 5
14-Dec		Final Project Presentations