POINT 1902 LOMA
NAZARENE UNIVERSITY

Department of Physics and Engineering

EGR2024/L Electrical Circuit Analysis and Lab

4 Units

Fall 2024

MWF | 2:55 - 3:50 PM
T | 1:30 - 4:20 PM (Labs)

Meeting location Rohr Science Hall (RS) 265

Final Exam: 12/16 2:30 - 5:00 PM

Instructor title and name:	Dr. José Manjarrés
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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:

- Master the fundamental principles of electrical circuits.
- Interpret basic circuit schematics that translate into simulated and mounted circuits on a breadboard.
- Analyze DC and AC circuits using appropriate mathematical tools.
- Utilize computational tools to solve equation systems that describe DC or AC circuits.
- Understand the significance of every component in complex power.
- Describe the behavior of passive filters based on their frequency response.
- Design and implement a model of a microgrid with distributed generation.

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 function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. (LO5)
- An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions. (LO6)

Required Texts and Recommended Study Resources

- Nilsson, J., Riedel, S. Electric Circuits, 12th ed. Pearson. ISBN: 9780137648375.

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 15 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.

Assessment and Grading

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

1. Homework Checks: Short 5-minute quiz related to a pre-session reading.
2. Lab Reports: Technical document summarizing an experiment set and a brief result analysis.
3. Quizzes: One-hour evaluations on a group of related topics.
4. Final Project: A comprehensive design problem encompassing topics from the beginning to the end of the course. It includes a report and a presentation to the general public during the time designated for the final exam.

The table below outlines the assessment criteria for this course.

Activity	Points Per Activity	Quantity	Total Points
Homework Checks	10	26	260
Lab Reports	50	5	250

Quizzes	50	7	350
Final Project	200	1	200
Total			**1060**

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 on its scheduled day. The final examination schedule is posted on the Class 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 are deducted 20% of its grade. Incompletes will only be assigned in extremely unusual circumstances.

Missed Exams

No examination shall be missed without prior consent or a well-documented emergency beyond the student's control. A score of zero will be assigned for an examination that is missed without prior consent or a well-documented emergency beyond the student's control. If a student misses an online test, any attempt to complete it outside of the classroom will be considered an act of academic dishonesty and will nullify the test score as well as disciplinary actions.

Class Enrollment

It is the student's responsibility to maintain his/her class schedule. Should the need arise to drop this course (personal emergencies, poor performance, etc.), the student has the responsibility to follow through (provided the drop date meets the stated calendar deadline established by the university), not the instructor. Simply ceasing to attend this course or failing to follow through to arrange for a change of registration (drop/add) may easily result in a grade of F on the official transcript.

PLNU Attendance and Participation Policy

Regular and punctual attendance at all class sessions is considered essential to optimum academic achievement. Unjustified absences or late attendance (i.e., more than 10 minutes) are penalized with a 1% deduction on the overall grade. If the student is absent for more than 10 percent of class sessions, the faculty member will issue a written warning of de-enrollment. If the absences exceed 20 percent, the student may be de-enrolled without notice until the university withdrawal date or, after that date, receive an "F" grade.

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 Copyright Policy

Point Loma Nazarene University, as a non-profit educational institution, is entitled by law to use materials protected by the US Copyright Act for classroom education. Any use of those materials outside the class may violate the law.

PLNU Recording Notification

In order to enhance the learning experience, please be advised that this course may be recorded by the professor for educational purposes, and access to these recordings will be limited to enrolled students and authorized personnel.

Note that all recordings are subject to copyright protection. Any unauthorized distribution or publication of these recordings without written approval from the University (refer to the Dean) is strictly rohibited.

PLNU Academic Honesty Policy

Students should demonstrate academic honesty by doing original work and by giving appropriate credit to the ideas of others. Academic dishonesty is the act of presenting information, ideas, and/or concepts as one's own when in reality they are the results of another person's creativity and effort. A faculty member who believes a situation involving academic dishonesty has been detected may assign a failing grade for that assignment or examination, or, depending on the seriousness of the offense, for the course. For all student appeals, faculty and students should follow the procedures outlined in the

University Catalog. See Academic Policies for definitions of kinds of academic dishonesty and for further policy information.

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 (EAC@pointloma.edu or 619-849-2486). 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 allowed accommodations. The EAC makes accommodations available to professors at the student's request.

PLNU highly recommends that students speak with their professors during the first two weeks of each semester/term about the implementation of their AP in that particular course. Accommodations are not retroactive so 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 should contact the EAC as early as possible (i.e., ideally before the beginning of the semester) to assure appropriate accommodations can be provided. 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 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 special accommodations.

State Authorization

State authorization is a formal determination by a state that Point Loma Nazarene University is approved to conduct activities regulated by that state. In certain states outside California, Point Loma Nazarene University is not authorized to enroll online (distance education) students. If a student moves to another state after admission to the program and/or enrollment in an online course, continuation within the program and/or course will depend on whether Point Loma Nazarene University is authorized to offer distance education courses in that state. It is the student's responsibility to notify the institution of any change in his or her physical location. Refer to the map on State Authorization to view which states allow online (distance education) outside of California.

Semester Schedule Outline

Date	Topic
3-Sep	Welcome
4-Sep	Units and Prefixes
6-Sep	Voltage and Current
9-Sep	Power, Energy, and Electricity Bills

10-Sep	First DC Circuit Lab (Multimeter, Breadboard, DC Power Supply)
11-Sep	Voltage and Current Sources
13-Sep	Ohm's Law
16-Sep	Resistor Color Code Competition
17-Sep	Circuit Design, Simulation, and Implementation (One design problem)
18-Sep	Resistors in Series and Parallel
20-Sep	Practice: Reduction in Resistive Circuits
23-Sep	Voltage Division
24-Sep	Solar Panels
25-Sep	Quiz 1
27-Sep	Survey of Renewable Energy Sources
30-Sep	Batteries
1-Oct	Final Project Proposal Presentations
2-Oct	Intro to Complex Numbers
4-Oct	Complex Number Operations
7-Oct	Capacitors and Inductors
8-Oct	LED Fading Circuit with Capacitor
9-Oct	Intro to Phasors and Impedance
11-Oct	Practice: Converting to phasor domain
14-Oct	Series and Parallel Impedance
15-Oct	Intro to AC Circuit Simulation and Implementation
16-Oct	Practice: Reduction in AC Circuits
18-Oct	Quiz 2
21-Oct	Kirchhoff's Laws

22-Oct	Intro to Linear Equations & MATLAB Tutorial to Solve Equation Systems
23-Oct	Intro to Node-Voltage Analysis
25-Oct	No class - Fall break
28-Oct	Supernodes
29-Oct	Solving Node-Voltage Analysis using MATLAB
30-Oct	Practice: Node-Voltage Analysis in AC
1-Nov	Quiz 3
4-Nov	Intro to Mesh-Current Analysis
5-Nov	Solving Mesh-Current Analysis using MATLAB
6-Nov	Practice: Mesh-Current Analysis in AC
8-Nov	Quiz 4
11-Nov	Thévenin Theorem
12-Nov	Final Project Progress Presentations
13-Nov	Practice: Thévenin Theorem
15-Nov	Thévenin Theorem in AC
18-Nov	Maximum Power Transfer
19-Nov	Thévenin Theorem Lab
20-Nov	Quiz 5
22-Nov	Average, Reactive, and RMS Power
25-Nov	Complex Power and Maximum Power Transfer in AC
26-Nov	Final Project Time
27-Nov	No class - Thanksgiving
29-Nov	No class - Thanksgiving
2-Dec	Quiz 6
3-Dec	Final Project Time
4-Dec	RL Circuits
6-Dec	RC Circuits
9-Dec	Step Response
10-Dec	Passive Filters Lab

11-Dec	Bandpass Filters
13-Dec	Practice: Passive Filters
16-Dec	Quiz 7; Final Projects