

	Department/School Name: Physics and Engineering Course Number and Name: EGR 2024/2024L – Circuits Analysis Number of Units: 3 + 1
Fall 2022	

Meeting Days: (Lecture) MWF (Lab) R	Professor: Dr. Anthony Cortez
Meeting Times: (Lecture) 11:00 am - 11:55 am (Lab) 10:00 am – 11:45 am	Phone: (619) 849-2439
Meeting Location: Rohr Science 295	Email: AnthonyCortez@pointloma.edu
Final Exam: Wed. 14-Dec 10:30am	Office hours: MWF 8:45am-9:45am Thur. 2:30pm-3:30pm By Appointment via Google Calendars Location: Rohr Science 282

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

EGR 2024 – Circuit Analysis (3)

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): EGR 2024L

EGR 2024L – Circuit Analysis Lab (1)

A lab course designed for a hands-on exploration of Circuit Analysis. Meets two hours per week.

Prerequisite(s): PHY 2054 with a grade of C- or higher.

Corequisite(s): EGR 2024

COURSE LEARNING OUTCOMES

1. Explain and apply basic electrical principles to analyze linear DC and AC circuits, including KVL, KCL and various circuit topologies.
2. Apply circuit theorems to find voltage, current, and power in linear DC & AC circuits, including voltage and current division, mesh and node analysis, superposition, and Thevenin and Norton equivalencies.
3. Describe basic waveforms, define, measure and calculate key parameters such as period, frequency, phase of periodic signals.
4. Calculate the transient response of linear DC RC, RL & RLC circuits, including time constants, initial and final conditions, and response in switched DC circuits.
5. Analyze the sinusoidal steady-state response of linear AC circuits using phasors.
6. Analyze the full response of linear AC circuits using Laplace Transforms and assess implications across the frequency domain.
7. Understand, build and test linear circuits from discrete components and utilize basic electrical test equipment, signal generators and power supplies.
8. Learn fundamental skills for group collaboration, as well as lab and project execution/documentation/demonstrations.

STUDENT OUTCOMES ADDRESSED

- 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)

REQUIRED TEXTS AND RECOMMENDED STUDY RESOURCES

Analysis and Design of Linear Circuits by Roland E. Thomas, Albert J. Rosa, and Gregory J. Toussaint– 8th Edition

NOTE: Students are responsible to have the required textbooks prior to the first day of class. Students are also encouraged to begin reading the books in preparation for the class as soon as possible.

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. 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.

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 3+1 unit class delivered over fifteen 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.

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.

ASSESSMENT AND GRADING

Graded Components

- **Homework:** Homework will be assigned weekly and a hard copy is due at the start of class the following week.
- **Labs:** Labs will provide hands on applications of circuit analysis techniques we are learning in lecture. You will be assigned a group to work with for the duration of the semester. Each lab you will complete a lab report that is due at the end of the scheduled

lab time. Lab reports will be submitted ONLY in Word, Excel, or .pdf format in Canvas (pictures of equations, circuit diagrams, set up, measurements, graphs, etc. may be embedded as long as legible). Up to 10% extra credit will be awarded for work done on the "If you have time" problems at the end of the lab, which may be turned in later (but before the next lab). A single grade will be given to each assigned group (for all who participate). In addition, there will be a lab final demonstrating an application of a reasonable technical implementation learned in the semester for each individual which will count as 30% towards the individual's lab grade. The labs are designed to enhance your understanding of the course material with hands on equipment, communicate your understanding in writing, and efficiently work in small teams.

- **Pre-Class Reading Questions:** There will be assigned reading prior to the start of select lectures. It is expected that you read the assigned section prior to the start of class. One quiz will be given each week at the start of a selected day.
- **Examinations and the Final Examination.** Examinations and the Final Examination will include problems and questions over material assigned in the text, readings and handouts, as well as material presented in class. No examination shall be missed without prior consent or a well-documented emergency beyond your control. A score of zero will be assigned for an examination that is missed without prior consent or a well-documented emergency beyond your control. Only your two highest exam scores (not including the final) will be included in the calculation of your grade. You must take all three exams in order to drop the lowest score, otherwise all three exams will be used in the calculation of your grade. The final exam date and time is set by the university at the beginning of the semester and may not be changed by the instructor. This schedule can be found on the university website and in the course calendar. No requests for early examinations will be approved. Only in the case that a student is required to take three exams during the same day of finals week, is an instructor authorized to consider changing the exam date and time for that particular student.

Grading Distribution	Percent
Exams (Lowest Score Dropped)	30
Final Exam	25
Homework	20
Labs	20
Pre-Class Reading Questions	5
Total	100

Grading Scale

Grades are based on the number of points accumulated throughout the course with the following exception. Approximate minimal percentages required to obtain a given grade are:

Standard Grade Scale Based on Percentages					
	A	B	C	D	F
+		87.5- 89.5	77.5-79.5	67.5-69.5	
	91 -100	81-87.5	71-77.5	61 -67.5	0-57
-	89.5-91	79.5-81	69.5-71	57-61	

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.

LATE ASSIGNMENTS

All assignments are to be submitted by the due dates. Assignments will be considered late if posted after the due date and time using Pacific Standard Time. Late assignments will receive a grade of 0.

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 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. Faculty should follow and students may appeal using the procedure in the university Catalog. See [ADC Academic and General Policies](#)[Links to an external site.](#) 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. 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 issue an academic accommodation plan ("AP") to all faculty who teach courses in which the student is enrolled each semester.

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 and/or if they do not wish to utilize some or all of the elements of their AP in that course.

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.

PLNU SPIRITUAL CARE

Please be aware PLNU strives to be a place where you grow as whole persons. To this end, we provide resources for our students to encounter God and grow in their Christian faith. If students have questions, a desire to meet with the chaplain or have prayer requests you can contact the [Office of Spiritual Development](#) [Links to an external site.](#)

PLNU ATTENDANCE AND PARTICIPATION POLICY

Attendance is expected at each class session. In the event of an absence, you are responsible for the material covered in class and the assignments given that day. Regular and punctual attendance at all class sessions is considered essential to optimum academic achievement. 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 drop date or, after that date, receive the appropriate grade for their work and participation.

PLNU USE OF TECHNOLOGY

In order to be successful in the online environment, students need to meet the minimum technology and system requirements; please refer to the [Technology and System Requirements](#) [Links to an external site.](#) information. If a student is in need of technological resources please contact student-tech-request@pointloma.edu

Problems with technology do not relieve students of the responsibility of participating, turning in assignments, or completing class work.

TENTATIVE SCHEDULE (Subject to Updates)

Date	Topic	Reading	HW Due
30-Aug (WEEK 1)	Intro	1-1 to 1-4	
31-Aug	Intro to Devices (Element Constraints)	1-3	
2-Sep	Kirchhoff's Laws	2-2, 2-3	
5-Sep (WEEK 2)	Labor Day – No Class		
7-Sep	Equivalent Circuits	2-4	
9-Sep	Voltage and Current Dividers	2-5	HW 1
12-Sep (WEEK 3)	Circuit Reduction	2-6	
14-Sep	Computer-Aided Analysis	2-7	
16-Sep	Node Voltage Analysis	3-1, 3-2	HW 2
19-Sep (WEEK 4)	Mesh Current Analysis	3-1, 3-2	
21-Sep	Linearity (Proportionality and Superposition)	3-3	
23-Sep	Catch up/Review		HW 3
26-Sep (WEEK 5)	Exam 1		
28-Sep	Thévenin/Norton Theorems	3-4	
30-Sep	Signal Transfer and Interface Design	3-5, 3-6	HW 4
3-Oct (WEEK 6)	Comparison of Analysis Techniques	3-1 thru 3-6	
5-Oct	Dependent Sources I (Intro)	4-1, 4-2	
7-Oct	Dependent Sources II (Feedback)	4-2	HW 5
10-Oct (WEEK 7)	Op-Amps (Intro)	4-3	

12-Oct	Signals I (Singularity and Exponential Functions)	5-1 thru 5-3	
14-Oct	Signals II (Sinusoids and Partial Descriptors)	5-4 and 5-6	HW 6
17-Oct (WEEK 8)	Catchup/Review		
19-Oct	Exam 2		HW 7
21-Oct	Fall Break Day – No Class		
24-Oct (WEEK 9)	Capacitors and Inductors I (Fundamentals)	6-1 and 6-2	
26-Oct	Capacitors and Inductors II (Combining, Integrators, Differentiators)	6-3 and 6-4	
28-Oct	RL and RC Circuits (Natural Response)	7-1	
31-Oct (WEEK 10)	RL and RC Circuits (Step Response	7-2 and 7-3	
2-Nov	RL and RC Circuits (Exponential and Sinusoidal Transient Responses)	7-4	
4-Nov	RLC Series and Parallel Circuits (Natural Response)	7-5, 7-6	HW 8
7-Nov (WEEK 11)	RLC Step Response	7-7	
9-Nov	AC Circuit Analysis I (Basics)	8-1, 8-2	
11-Nov	AC Circuit Analysis II (Theorems)	8-2, 8-3	HW 9
14-Nov (WEEK 12)	AC Circuit Analysis and Design III	8-3, 8-4	
16-Nov	AC Circuit Analysis IV (Node Voltage/Mesh Current, Power)	8-5, 8-6	
18-Nov	Catch up/Review		HW 10
21-Nov (WEEK 13)	Exam 3		
23-25-Nov	Thanksgiving Break – No Class		
28-Nov (WEEK 14)	Intro to Laplace Transforms and the Complex Frequency Domain	9-1, 9-2	
30-Nov	Laplace II: Pole-Zero Diagrams and the Inverse Laplace	9-3, 9-4	

2-Dec	Laplace III: Circuit Response and Initial and Final Value Theorems	9-5, 9-6	HW 11
5-Dec (WEEK 15)	Laplace IV: Transformed Circuits	10-1, 10-2	
7-Dec	Flex Day		
9-Dec	Review		HW 12
14-Dec	Final Exam		