



Department of Physics and Engineering

## **EGR/PHY 3083 Electricity, Magnetism, and Waves II**

3 Units

*Spring 2026*

**MWF | 11:00 AM – 11:55 AM**

**Meeting location Rohr Science Hall (RS) 395**

**Final Exam: 05/06 10:30 AM – 1:00 PM**

**Instructor Title and Name:** Dr. José Manjarrés

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**Office Location and Office Hours:** RS 276 | M 9:30-10:30 AM; T 10:00 AM-12:00 PM; W 1:30-3:00 PM; R 10:30 AM – 12:00 PM; F 9:00-10:30 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 Department of Physics & Engineering provides strong programs of study that aid in ensuring our students are well prepared for both graduate studies and careers in a variety of scientific and engineering fields. We emphasize a collaborative learning environment that allows students to thrive academically, build personal confidence, and develop interpersonal skills, while providing a Christian setting for students to learn values and judgment and pursue integration of modern scientific knowledge and Christian faith.

## Course Description

Electrodynamics with an emphasis on application of Maxwell's equations particularly to electromagnetic radiation. Also offered as PHY 3083.

**Prerequisite(s): EGR 3063 or PHY 3063**

## Program and Course Learning Outcomes

Program Outcomes:

- 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 acquire and apply new knowledge as needed, using appropriate learning strategies. (LO7)

Course Learning Outcomes:

- Master the fundamental principles of electromagnetic wave propagation, including Maxwell's Equations and their physical interpretations.
- Explain the fundamental principles of electromagnetic wave propagation using wave equations.
- Understand the behavior of EM waves at dielectric and conductor interfaces, including concepts like Snell's Law, reflection, transmission coefficients, and Brewster's Angle.
- Outline the principles of transmission lines, including impedance matching and Smith Chart.
- Describe key antenna concepts such as radiation patterns and directivity.
- Synthesize and apply comprehensive knowledge of the electromagnetic waves to a specific technological application.

## 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.

- D. Elliot. *Electromagnetic Fields for Engineers*, 1st edition. Cambridge: Cambridge University Press, 2024. ISBN 9781009309448.

## 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-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 112.5 total hours meeting the course learning outcomes. The time estimations are provided in the Canvas modules.

## Assessment and Grading

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

1. Entry tickets: Handwritten summaries of the topics addressed in the pre-class readings, including questions that guide the in-class discussions. These assignments are graded based on legibility, content quality, and depth of the questions.
2. Case study presentations: Short group presentations addressing technical applications and their connections to class material.
3. Technical application presentation: A comprehensive individual presentation where each student presents a technical application of their choice, making several significant connections between class material and key aspects of the application.
4. Audience summaries: While students are in the audience of the technical application presentations, they are expected to craft a short handwritten summary of their main takeaways from the presentation.
5. Poster presentation: As a follow-up to the technical topic presentation, each student will design and print a poster for a presentation session open to the public. This is an opportunity for students to share the results of their research on their selected technical application with a wide range of audiences.

The table below outlines the assessment criteria for this course.

Activity	Points per Activity	Quantity	Total Points
Entry Tickets	20	18	360
Case Study Presentations	50	8	400
Technical Application Presentation	200	1	200
Audience Summaries	10	8	80
Poster Presentation	100	1	100
			<b>1140</b>

Grades will be based on the following:

### Sample Standard Grade Scale Based on Percentages

A	B	C	D	F
A [92.5-100]	B+ [87.5-90]	C+ [77.5-80]	D+ [67.5-70]	F [0-60]
A- [90-92.5]	B [82.5-87.5]	C [72.5-77.5]	D [62.5-67.5]	
	B- [80-82.5]	C- [70-72.5]	D- [60-62.5]	

#### 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 [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 the beginning of the class session 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.

#### Class Attendance and Punctuality 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.

#### Artificial Intelligence (AI) Policy

You are allowed to use Artificial Intelligence (AI) tools (e.g., ChatGPT, Gemini Pro 1.5, GrammarlyGo, Perplexity, etc) to generate ideas, but you are not allowed to use AI tools to generate content (text, video, audio, images) that will end up in any work submitted to be graded for this course. If you have any doubts about using AI, please gain permission from the instructor.

#### 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](mailto:EAC@pointloma.edu) or 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 allowed 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 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 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 materials.*

For more information about **LomaBooks**, please go: [HERE](#)

### **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/11BgAANLOJ9tjt837d24EZ181ukM2qzHF/edit>

### **Semester Schedule Outline**

<b>Date</b>	<b>Session</b>	<b>Topic</b>
<b>12-ene</b>	<b>0</b>	Welcome
<b>14-ene</b>	<b>1</b>	Gauss Law
<b>16-ene</b>	<b>2</b>	Case Studies (TN 1.6, 1.8, 1.9)
<b>19-ene</b>		MLK Day
<b>21-ene</b>	<b>3</b>	Magnetic Fields and Ampère's Law
<b>23-ene</b>	<b>4</b>	Case Studies (TN 4.10, 4.11, 4.12)
<b>26-ene</b>	<b>5</b>	Faraday's Law

<b>28-ene</b>	<b>6</b>	Case Studies (TN 5.1, 5.5, DC Motors)
<b>30-ene</b>	<b>7</b>	Case Studies (TN 6.7, 6.8, 6.10)
<b>2-feb</b>	<b>8</b>	Maxwell's Equations
<b>4-feb</b>	<b>9</b>	The Wave Equation
<b>6-feb</b>	<b>10</b>	Examples of Wave Propagation
<b>9-feb</b>	<b>11</b>	Uniform Plane Wave
<b>11-feb</b>	<b>12</b>	Case Studies (TN 8.5, 8.6, 8.7)
<b>13-feb</b>	<b>13</b>	Plane Waves in Lossy Media
<b>16-feb</b>	<b>14</b>	Power Flow
<b>18-feb</b>	<b>15</b>	Reflection of Uniform Plane Waves, Normal Incidence
<b>20-feb</b>	<b>16</b>	Reflection of Uniform Plane Waves, Oblique Incidence
<b>23-feb</b>	<b>17</b>	Case Studies (Optical Fiber, TN 8.19, 8.21)
<b>25-feb</b>	<b>18</b>	Standing Waves
<b>27-feb</b>	<b>19</b>	Lossless and Lossy Transmission Lines
<b>2-mar</b>	<b>20</b>	Standing Waves and Reflections at a Load
<b>4-mar</b>	<b>21</b>	Impedance Matching
<b>6-mar</b>	<b>22</b>	Case Studies (Problems 9-24, 9-27, 9-29)
<b>9-mar</b>		Spring Break
<b>11-mar</b>		Spring Break
<b>13-mar</b>		Spring Break
<b>16-mar</b>	<b>23</b>	The Smith Chart
<b>18-mar</b>	<b>24</b>	Reflection Coefficients with the Smith Chart
<b>20-mar</b>	<b>25</b>	Input Impedance with the Smith Chart
<b>23-mar</b>	<b>26</b>	Impedance Matching with the Smith Chart
<b>25-mar</b>	<b>27</b>	Basics of Waveguides
<b>27-mar</b>	<b>28</b>	Elemental Dipole Antenna
<b>30-mar</b>	<b>29</b>	Long Antennas and Antenna Arrays
<b>1-abr</b>	<b>30</b>	Case Studies (11.2, 11.3, 11.5)
<b>3-abr</b>		Easter Break
<b>6-abr</b>		Easter Break
<b>8-abr</b>	<b>31</b>	Free
<b>10-abr</b>	<b>32</b>	Presentation 1
<b>13-abr</b>	<b>33</b>	Presentation 2
<b>15-abr</b>	<b>34</b>	Presentation 3
<b>17-abr</b>	<b>35</b>	Presentation 4
<b>20-abr</b>	<b>36</b>	Presentation 5
<b>22-abr</b>	<b>37</b>	Presentation 6
<b>24-abr</b>	<b>38</b>	Presentation 7
<b>27-abr</b>	<b>39</b>	Presentation 8
<b>29-abr</b>	<b>40</b>	Presentation 9
<b>1-may</b>	<b>41</b>	Poster Session
<b>6-may</b>		Final