POINT 1902 LOMA
NAZARENE UNIVERSITY

Department of Physics and Engineering

EGR3113 Measurement and Instrumentation

3 Units

Fall 2026

TR | 1:30 - 2:45 PM

Meeting location Rohr Science Hall (RS) 265

Final Exam: 12/17 1:30 PM - 4:00 PM

Instructor title and name:	Dr. José Manjarrés
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Office location and hours:	RS 276 | MWF 9:00 - 9:50 AM, 1:00 PM - 1:30 PM; T 10:30 - 11:30 AM Schedule office hours here

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

This course provides an in-depth analysis of a variety of commonly used instrumentation in industry and academic research settings. Example instrumentation include: lock-in amplifiers, waveform generators, low-noise preamplifiers, spin-coaters, tensile loading systems, and micromanipulator probe stations. Equipment will be used to carry out a variety of engineering experiments such as: electrical transport, temperature dependent resistivity, and stress-strain of materials.

Prerequisite(s): EGR 2024 with a grade of C- or higher.

Program and Course Learning Outcomes

Student Outcomes:

- Perform sensor calibration for a variety of sensor types.
- Develop virtual instruments that interact with physical measurement systems.
- Understand how to effectively sample sensor signals to avoid misrepresentation in the digital domain.
- Classify and characterize the performance of instruments using a consistent framework.
- Select appropriate sensors for a given measurement problem.
- Use benchtop instruments at a professional level.
- Quantify errors in a measurement system.

Program Outcomes:

- 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 (CC: OC) (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

- Alan S. Morris, Reza Langari. Measurement and Instrumentation: Theory and Application, 3rd Edition. Academic Press, 2020.

- John W. Dyer & Chad E. Davis. Measurement and Instrumentation: An Introduction to Concepts and Methods. Norman, OK, 2020.

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.

Assessment and Grading

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

1. Worksheets: In-class, group-based guided application of a session's pre-class reading.
2. Practical skills tests: One-hour hands-on group evaluations on a group of related topics.
3. Final Project: A comprehensive design problem encompassing topics from the beginning to the end of the course. It includes a report and three presentations: a proposal presentation, a progress presentation, and a final showcase 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
Worksheets	40	16	640
Practical Skills Tests	150	3	450
Project Proposal Presentation	50	1	50
Progress Presentation	50	1	50
Final Project	300	1	300
Total			**1490**

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	Pre-class Reading	Topic
1-sep		Welcome
3-sep	Morris Ch. 1	Fundamentals of Measurement Systems
8-sep	Morris Ch. 2 (2.1-2.3)	Instrument Types and Performance Characteristics
10-sep	Boylestad 5.6-5.10	Review of Voltage, Current, and Resistance

15-sep	Boylestad 5.11-5.12, 6.8-6.9	Practice of Electrical Measurements
17-sep	Morris Ch. 3 (3.1-3.4)	Error Analysis
22-sep	Morris Ch. 6 (6.1-6.2)	Resistance Measurement with the Wheatstone Bridge
24-sep		Final Project Proposal Presentations
29-sep		Practical Skills Test 1
1-oct	Download and Install LabVIEW Community Edition and finish LabVIEW Tutorial (Morris Ch. 9)	LabVIEW Basics
6-oct	Tutorial to connect Arduino to LabVIEW using VISA	Arduino + LabVIEW
8-oct	LDR Online Resource	Light Sensing with LDRs
13-oct	Calibration Online Resource	Sensor Calibration
15-oct	Morris Ch. 14	Thermocouples and Thermistors
20-oct	Arduino tutorial to connect AM1011A	Temperature and Humidity Sensing with AM1011A
22-oct		No class - Fall break
27-oct		Practical Skills Test 2
29-oct	Oscilloscope Survival Guide Video	Review of Oscilloscopes and Waveform Generators
3-nov	Dyer Ch. 3 (3.1, 3.3, 3.4, 3.5.1)	Introduction to OpAmps
5-nov	Dyer Ch. 3 (3.5.2-3.5.3), Pressure Sensor datasheet	Instrumentation Amplifiers
10-nov	Piezoelectric Sensors Online Resource	Vibration Sensing with Piezoelectric Sensors
12-nov	Tutorial on connecting ADXL345 and I2C	Accelerometers
17-nov	Tutorial on load cells and HX711	Load Cells
19-nov		Final Project Progress Presentations
24-nov		Practical Skills Test 3

26-nov		No class - Thanksgiving
1-dic	Dyer Ch. 2	ADC, Sampling, and Aliasing
3-dic	Dyer Ch. 3 (3.5.4)	Introduction to Active Filters
8-dic	ECG Tutorial	Cascading Active Filters
10-dic		Final Project Time
17-dic		Comprehensive Project Presentations