



Physics and Engineering
School of STEM

EGR 3123/3123L – Mechanical Engineering Applications and Lab

Number of Units: 2+1

Spring 2026

Meeting days/times
(Lecture: MW 11:00 am – 11:55 am)
(Lab: F 1:30pm – 4:20pm)

Meeting location (Rohr Science (RS) 365)

Final Exam: (Wednesday, 5/6, 10:30am – 1:00 pm)

Instructor Title and Name: Dr. Anthony Cortez

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Office Location and Office Hours: RS 282 By Appointment

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

PHE: 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

EGR 3123 – Mechanical Engineering Applications (2)

Analysis and application of engineering principles in project-oriented activities and labs. Measurement and analysis of error discussed. Topics include fluid flow, heat transfer, structural dynamics, thermodynamic systems, and electromechanical systems.

EGR 3123L – Mechanical Engineering Applications Lab (1)

A lab designed for hands on exploration of mechanical engineering applications. Meets three hours per week. Letter grade.

Prerequisite(s): [EGR 2014](#) with a grade of C- or higher.

Corequisite(s): [EGR 3123](#)

Program and Course Learning Outcomes

Through this course students develop skills so they will be able to:

1. Distinguish between the three fundamental modes of heat transfer—conduction, convection, and radiation—and solve steady-state and transient problems for various engineering applications.
2. Calculate heat transfer rates for linear and radial geometries and determine the thermal performance of systems under both free (natural) and forced convection conditions.
3. Operate a physical refrigeration unit to collect data, analyze the vapor-compression refrigeration cycle, and evaluate the Coefficient of Performance (COP).
4. Utilize Solidworks Simulation to model thermal systems, applying appropriate boundary conditions to validate theoretical heat transfer models with numerical results.
5. Operate a cryostat to gain hands on experience needed for quantum engineering fields

STUDENT OUTCOMES ADDRESSED

Students will have:

1. 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)
2. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions. (LO6)
3. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies. (LO7)

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.

1. *A Heat Transfer Textbook 6e* by John H. Lienhard V and John H. Lienhard IV
2. *Access to Solidworks with Simulation*

Assessment and Grading

Grades will be based on the following:

- **Homework/Assignments:** There will be assigned Homework/Assignments to keep you on track with the Mini Projects. Some of these will be submitted as a team and some will be submitted individually.
- **Labs:** Labs will provide hands-on applications of the topics we are learning in lecture. Lab deliverables will include oral reports, written reports, completed worksheets, and supplemental submissions on Canvas.
- **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. 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.

Grades will be based on the following:

Sample Standard Grade Scale Based on Percentages

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	

Grading Distribution	Percent
Exams	30
Final Exam	30
Homework	15
Labs	25
Total	100

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 will receive a score of zero.

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 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](#)

Tentative Schedule (Subject to Updates)

Week	Session	Topic	Text Reference
1	1	Intro: Conduction, Convection, & Radiation	Ch. 1
	2	Fourier's Law & The Heat Conduction Equation	Ch. 2
2	3	MLK - No Class	
	4	Steady 1D Conduction: Thermal Resistance	Ch. 2
3	5	Conduction with Internal Heat Generation	Ch. 2
	6	Fins I: The Governing Equation & Boundary Conditions	Ch. 4
4	7	Fins II: Fin Efficiency & Surface Effectiveness	Ch. 4
	8	Transient Conduction: Lumped Capacity Method	Ch. 1 & 5
5	9	Transient Conduction: Analytical 1D Solutions	Ch. 5
	10	MIDTERM EXAM 1 (Conduction & Transient)	Ch. 1–5
6	11	Heisler Charts & Semi-Infinite Solids	Ch. 5
	12	Convection: Velocity & Thermal Boundary Layers	Ch. 6
7	13	Dimensional Analysis: Re, Pr, and Nu Numbers	Ch. 6

	14	Laminar vs. Turbulent Flow over Flat Plates	Ch. 6
8	15	External Forced Convection: Cylinders & Spheres	Ch. 7
	16	Internal Forced Convection: Entry Length & Fully Developed	Ch. 7
9	17	Internal Forced Convection: Correlations for Pipe Flow	Ch. 7
	18	Natural Convection: Gr and Ra Numbers	Ch. 8
10	19	Natural Convection: Vertical & Horizontal Geometries	Ch. 8
	20	MIDTERM EXAM 2 (Convection)	Ch. 6–8
11	21	Radiation Physics: Blackbody & Planck's Law	Ch. 10
	22	Easter - No class	
12	23	Easter - No class	
	24	Radiative Properties: Emissivity & Absorptivity	Ch. 10
13	25	Refrigeration Overview	
	26	Refrigeration Enthalpy Curves	
14	27	Quantum Engineering - Overview	

	28	Quantum Engineering - Device Fabrication	
15	29	Quantum Engineering - Cryogenic Requirements	
	30	FINAL EXAM Review	Comprehensive

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>