Point Loma Nazarene University

Department of Physics and Engineering

PHY 1034/L The Physics of Sound and Music (3 + 1 units) Spring 2026

Class Meetings: Ryan Learning 103, MWF 11:00 - 11:55 am
Lab Meetings: Rohr Science 365 R 10:30 am - 1:00 pm

Instructor: Dr. Paul D. Schmelzenbach
Phone: (619) 849-2933
Email: paulschmelzenbach@pointloma.edu
Office Hours: TBA, Rohr Science 258

Final Exam: Wednesday, May 6 at 10:30-1:00 pm

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.

General Education Mission

PLNU provides a foundational course of study in the liberal arts informed by the life, death, and resurrection of Jesus Christ. In keeping with the Wesleyan tradition, the curriculum equips students with a broad range of knowledge and skills within and across disciplines to enrich major study, lifelong learning, and vocational service as Christ-like participants in the world's diverse societies and culture.

Course Description

An introduction to the science of sound, hearing and music. The course will focus on concepts of sound production, propagation, and perception including topics such as musical scales, instruments, and acoustics. PHY1034L is the co-requisite lab course designed for a hands-on exploration of the physics of sound.

Course Learning Outcomes

After completing this course, students can:

1. Translate the description of physics problems into the mathematical equations required to solve them using relevant physical principles.
2. Calculate solutions to physics problems once appropriate equations or techniques are identified.
3. Predict reasonable answers to appropriate problems and assess the reasonableness of calculated answers.
4. Explain relevant physical concepts and apply them to the analysis of sound and the functioning of musical instruments.
5. Create and interpret graphical and visual representations of physical quantities, such as interpreting waveforms and understanding how they relate to perceived sounds.
6. Recognize different instrument groups and understand how they function.
7. Understand how the ideas and techniques of physics are used to analyze sound, the operation of instruments, and the propagation of musical sound.
8. Gather and interpret data in a lab setting.

General Education Learning Outcomes

This course is one of the components of the Foundational Experience program at Point Loma Nazarene University, through which students will acquire knowledge of human cultures and the physical and natural world while developing skills and habits that foster life-long learning. Specifically, this course supports this broader context in developing GELO 1e. Quantitative Reasoning: Students will be able to solve problems that are quantitative in nature. Assessment of this learning outcome will be demonstrated on the final exam embedded in questions typical of introductory physics.

Required Texts and Materials

"Physics and Music: The Science of Musical Sound" (Dover Books on Physics) by White and White, a clicker, and a calculator.

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 plus 1 unit lab delivered over 15

weeks. Specific details about how the class meets the credit hour requirements can be provided upon request.

Assessment and Grading

The grade you earn in this course is based on the scale below. The points you receive during the course are weighted accordingly:

- **(3%) Preclass:** In preparation for each class meeting, there is a reading assignment. Class meetings are not a standard lecture format, making these reading assignments especially important. To complete the reading assignment, you must answer 2-3 short questions and submit them electronically by 9 am before class. Late submissions will not earn points.
- **(25%) Lab:** Hands-on experience with topics from class meetings. Labs will be performed in small groups, but everyone is responsible for submitting their own results.
- **(22%) Homework:** Approximately weekly problem sets will allow you to apply and explore various aspects of the science of sound. Practicing your knowledge is extremely important to building your understanding and your success in the class.
- **(30%) Exams:** Three exams will be given during the semester. Exams will include both multiple-choice or short answer conceptual questions, and problems to solve. Exams will be closed book, but a sheet of formulas will be provided. Partial credit will be given for correct reasoning at any step of a problem, but only if it is communicated clearly enough for me to understand.
- **(20%) Final exam:** The final examination will be comprehensive, and you will have the use of a handwritten page of notes along with a provided sheet of formulas.

Grading Scale

A	B	C	D	F
92–100 (A)	**87–89** (B+)	**77–79** (C+)	**67–69** (D+)	< 59
90–91 (A–)	**83–86** (B)	**73–76** (C)	**63–66** (D)	
	80–82 (B–)	**70–72** (C–)	**60–62** (D–)	

Exams

Examinations, including the final examination, will cover topics explored in the text, lecture and through homework. The specific learning outcomes distributed for each section will serve as a valuable study guide.

Late Assignments

Preclass assignments earn half points if submitted late but still before the start of class, after this they receive not credit. Homework problems not submitted on time will receive a late penalty if submitted before the next homework set, otherwise they will not receive any points. Typically labs will be submitted at the end of the lab period.

Exams and Missing Exam Policy

Examinations and the Final Examination will include problems and questions over material assigned in the text, explored in homework, as well as material presented in class. Distributed specific learning outcomes for the section, or for the entire class will provide a good means of study. A score of zero will be assigned for an examination that is missed without prior consent or a well-documented emergency beyond your control. If such an event arises, please ensure that you communicate with the professor as soon as possible so other arrangements can be made.

Final Exam

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.

Incomplete Grade Assignment

A grade of incomplete will only be assigned in extremely unusual circumstances. If you believe that your particular circumstances qualify be in clear communication with the professor as soon as you are able.

Artificial Intelligence (AI) Policy

You are allowed to use Large Language Models (like ChatGPT, NotebookLM, Claude, etc.) as a study tool, but not on any exams. Work that utilizes AI-based tools should be identified as such including the tool used. Specific use cases will be clarified in class.

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.

Additional Course Information

Additional PLNU policies and practices that apply to this course can be found here https://docs.google.com/document/d/11BgAANLOJ9tjt837d24EZ181ukM2qzHF/edit .

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.

Course Schedule:

Course Schedule for Section I

Date	Topic	Reading	Homework	Lab (Tuesday Meetings)

1/12	Introductions			Lab 1: Speed of Sound
1/14	Building Toolkits of Understanding	1.1-1.6		
1/16	Periodic Motion and Frequency	2.1-2.3	Hmk 1	
1/21	Simple Harmonic Motion and Damped Motion	2.4-2.6		Lab 2: Periodic Motion
1/23	Transverse and Longitudinal Waves	3.1-3.4; 4.1	Hmk 2	
1/26	Standing Waves on Strings	3.5; 11.1-11.4		Lab 3: Standing Waves I
1/28	Standing Waves in Air	12.1-12.3		
1/30	Sound as a Wave I	5.1-5.2	Hmk 3	
2/02	Sound as a Wave II	5.3-5.6		Lab 4: Standing Waves II
2/04	Wrap-up and Review			
2/06	Exam 1		Hmk 4	
2/09	Wave Synthesis & Analysis I	Notes		Lab 5: Wave analysis
2/11	Wave Synthesis & Analysis II	Notes		
2/13	Resonance; Helmholtz Resonators	6.1-6.4	Hmk 5	
2/16	Beats, Interference, Doppler Effect	6.5-6.6		Lab 6: Helmholtz Resonator
2/18	Diffraction and Interference	7.1-7.4		
2/20	Sound and Hearing I	9.1-9.5	Hmk 6	
2/23	Sound and Hearing II	9.5; 10.1-10.3		Lab 7: dB
2/25	Sound and Hearning III	10.3-10.6		
2/27	Acoustics I	26.6-26.7; 27.1-27.5	Hmk 7	
3/02	Acoustics II	26.5		Lab 8: Room Acoustics
3/04	Wrap-up and Review			
3/06	Exam 2		Hmk 8	
3/16	Musical Temperament I	14.1-14.4		Lab 9: Musical Temperament
3/18	Musical Temperament II	14.5-14.8		
3/20	Musical Temperament III	14.9-14.12	Hmk 9	

3/23	Analog & Digital	Notes		Lab 10: Digital Music
3/25	Analog & Digital (Cont.)	Notes		
3/27	Instruments: Strings	16.1-9	Hmk 10	
3/30	Instruments: Woodwinds I	12.5-12.6; 18.1-18.3		No Lab meeting
4/01	Instruments: Woodwinds II	18.4-18.8		
4/08	Instruments: Percussion I	13.1-13.3; 20.3-20.4		Lab 11: Instruments 1
4/10	Instruments: Percussion II	13.4, 13.6; 20.8-20.11	Hmk 11	
4/13	Instruments: Brass and Voice	19.1-19.10		Lab 12: Speech and Voice
4/15	Instruments: Brass and Voice II	19.11-19.14		
4/17	Wrap-up and Review		Hmk 12	
4/20	Exam 3			Lab 13: Exploration
4/22	Sound and the Brain	Notes		
4/24	Synthesized Sound	Notes	Hmk 13	
4/27	Sound Design	Notes		Lab 14: Exploration
4/29	AI and Sound	Notes		
5/01	Wrap-up and Review		Hmk 14	
5/06	Final W 10:30-1			