

**Point Loma Nazarene University**  
**Department of Physics and Engineering**  
**PHY1034/1034L The Physics of Sound and Music and Lab (3 +1 Units)**  
**MWF 1:30-2:25 RS 265**  
**Fall 2022: August 30 - December 9**

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Instructor: Dr. Paul D. Schmelzenbach

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Office hours: MTWRF 6:15-7:20 (RS258) / Appointment as needed (also via zoom)

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### **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.

### **Foundational Explorations 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 in appropriate problems, and assess the reasonableness of calculated answers
4. comprehend relevant physical concepts and apply them to the analysis of sound and instruments create and interpret graphical and visual representations of physical quantities (such as interpreting waveforms and how they relate to perceived sounds)
5. recognize the instrument groups and to understand how they function
6. understand how the ideas and techniques of physics are used to analyze sound, operation of instruments and the propagation of musical sound
7. apply inquiry and laboratory techniques in the pursuit of knowledge of the technical aspects of music and its production.

### **Foundational Explorations 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 FELO 1e. Quantitative Reasoning: Students will be able to solve problems that are quantitative in nature.

### **Required texts and Recommended Study Resources**

Readings will be provided for this course. You will need 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 4 unit class delivered over 15 weeks. Specific details about how the class meets the credit hour requirements can be provided upon request.

### **Assessment and Grading**

Graded Components:

- (20%) Lab provides you the opportunity for a hands-on experience of topics from class

meetings, developing lab technique, understanding of basic equipment from the nuclear lab, and data analysis. Labs will be performed in small groups, but each individual is responsible for submitting their own documents unless otherwise specified. Depending on covid regulations at the time of the meetings, there may be more emphasis placed on data analysis.

- (25%) Homework is exceedingly important for developing an understanding of the course material, not to mention building skills in problem solving. I encourage you to work together on the homework sets, but you must participate in the process of obtaining the solution to each problem. The guideline is that you should have no trouble explaining or repeating work that you turn in.
- (5%) Preclass questions are submitted before each lecture section
- (30%) Three quizzes will be given through the semester which will included problems and questions read in the reading and handouts, as well as material presented in class
- (20%) Final Project

Final Grades will be based on the following:

<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>F</b>
A 92-100	B+ 87-89	C+ 77-79	D+ 67-69	F Less than 59
A- 90-91	B 83-86	C 73-76	D 63-66	
	B- 80-82	C- 70-72	D- 60-62	

### **Spiritual Care**

PLNU strives to be a place where students grow as whole persons. To this end, we provide resources for our students to encounter God and grow in their Christian faith.

If you have questions, a desire to meet with the chaplain, or if you have prayer requests, you can contact the [Office of Student Life and Formation](#).

### **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.

### **Final Exam**

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.

### **Late Assignments and Exam Policy**

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.

Homework and Lab assignments that are submitted late without prior consent will have an automatic deduction of 20 percent per day late. Preclass assignments submitted late will not earn points.

### **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.

### **Incompletes**

Incompletes will only be assigned in extremely unusual circumstances.

### **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 [Academic Policies](#), 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](mailto: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.

### **Sexual Misconduct and Discrimination**

Point Loma Nazarene University faculty are committed to helping create a safe learning environment for all students. If you (or someone you know) have experienced any form of sexual discrimination or misconduct, including sexual assault, dating or domestic violence, or stalking, know that help and support are available through the Title IX Office at [pointloma.edu/Title-IX](http://pointloma.edu/Title-IX). Please be aware that under Title IX of the Education Amendments of 1972, it is required to disclose information about such misconduct to the Title IX Office.

If you wish to speak to a confidential employee who does not have this reporting responsibility, you can contact Counseling Services at [counselingservices@pointloma.edu](mailto:counselingservices@pointloma.edu) or find a list of campus pastors at [pointloma.edu/title-ix](http://pointloma.edu/title-ix)

### **PLNU Attendance and Participation Policy**

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.

### **Course Calendar**

			<b>Hmk</b>	
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<b>Date</b>	<b>Topic</b>	<b>Reading</b>	<b>Due</b>	<b>Week's Lab</b>
8/30	Introductions			
8/31	Science and Sound	1.1-1.5		
9/02	Periodic Motion and Frequency	2.1-2.3	Hmk 1	Lab 1: Periodic Motion
9/07	Simple Harmonic Motion; Damped Oscillations	2.4-2.6		
9/09	Transverse and Longitudinal Waves	3.1-3.5; 4.1	Hmk 2	Lab 2: Sound and Oscillations
9/12	Wave interactions: Reflection, Bending, and Interference	5.1-5.5; 7.1		
9/14	Standing Waves and Resonance	3.5; 4.2-4.3		
9/16	Tubes of Air and Helmholtz Resonators	6.1-6.2; 12.1-12.3	Hmk 3	
9/19	Beats, Interference and Doppler	6.5-6.6		Standing Waves
9/21	Wrap up and review			
9/23	Quiz 1		Hmk 4	
9/26	Display and Analysis of Sound 1	Notes		
9/28	Display and Analysis of Sound 2	Notes		
9/30	Basic Generation of Sound	Notes	Hmk 5	Analysis of Tubes of Air
10/03	Sound Intensity 1	9.1-9.5		
10/05	Sound Intensity 2	9.5; 10.1- 10.3		
10/07	Sound and Hearing	10.4-10.5; 15.3; 15.5	Hmk 6	dB
10/10	Acoustics 1	26.6-26.7;		

10/10	Acoustics 1	27.1-27.5		
10/12	Acoustics 2	26.5		
10/14	Wrap-up and Review		Hmk 7	Accoustics
10/17	Quiz 2			
10/19	Musical Temperament 1	14.1-14.4		Musical Straws
10/24	Musical Temperament 2	14.5-14.8		
10/26	Musical Temperament 3	14.9-14.12		
10/28	Analog and Digital	Notes	Hmk 8	
10/31	Sound Generation Part 2	Notes		
11/02	Instruments: Woodwinds	18.1-18.3		Digital Music
11/04	Instruments: Woodwinds	18.4-18.6	Hmk 9	
11/07	Instruments: Brass	19.1-19.4		
11/09	Instruments: Percussion	13.1-13.3; 20.3-20.4		Woodwinds and Brass
11/11	Instruments: Percussion	13.4, 13.6; 20.8-20.11	Hmk 10	
11/14	Instrument: Speech and Voice 1			
11/16	Instrument: Speech and Voice 1			Metal Bars
11/18	Wrap up and review		Hmk 11	
11/21	Quiz 3			
11/28	Sound and Music Topics			
11/30	Sound and Music Topics			
12/03	Build and Analyze and Instrument		Hmk	Speech and

12/02	1		12	Voice
12/05	Build and Analyze and Instrument 2			
12/07	Build and Analyze and Instrument 3			
12/09	Build and Analyze and Instrument 4			Build an Instrument
12/16	Final Project Presentations			