Point Loma Nazarene University
PHY113/113L: The Physics of Sound and Music (3+1 hr) Fall 2018

Department of Physics and Engineering

Instructor: Dr. Paul D. Schmelzenbach	Meeting: MWF 8:30-9:25 LA2 Lab: T 7:25-9:20 (LA2)
e-mail: PaulSchmelzenbach@pointloma.edu	Office Phone: 849-2933
Office Hours: 10:45-11:50 MWF, 9-11 R; by appt.	Office Location: Trailer 02 below Gym

---

Materials – *The Physics of Sound* by Berg and Stork, 3rd edition, and a calculator

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. PHY113L is the co-requisite lab course designed for a hands-on exploration of the physics of sound.

Learning Outcomes – 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 cultures.

This course is one of the components of the General Education Program at Point Loma Nazarene University, in support of the general education learning outcome: Quantitative Reasoning: Students will be able to solve problems that are quantitative in nature. The purpose of general education is to provide a common educational experience, to develop essential skills, and to provide a broad cultural background for personal and professional growth. Within these broader outcomes, in this course you will

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
5. create and interpret graphical and visual representations of physical quantities (such as interpreting waveforms and how they relate to perceived sounds)
6. recognize the instrument groups and to understand how they function
7. understand how the ideas and techniques of physics are used to analyze sound, operation of instruments and the propagation of musical sound
8. apply inquiry and laboratory techniques in the pursuit of knowledge of the technical aspects of music and its production.

Preclass– In preparation for each class meeting there is a reading assignment. To complete the reading assignment you must answer three questions and submit them electronically by 9 pm the evening before class. Late submissions will not be accepted. This electronic communication is so important because it is your voice in what material we emphasize during class meetings and provides me constant feedback of your understanding of the material. These submissions will be graded on the following scale: 2=demonstrates reading, 1=room for improvement, 0=unsatisfactory. These points are accumulated and are worth 5% of the final grade.

Lab– Lab meetings will provide you the opportunity for hands-on experience of topics from class meetings, improve lab technique, and data analysis. Labs will be preformed in small groups, but each individual is responsible for submitting his or her own results. Labs are worth 25% of your final grade. You must pass the lab portion of the class to pass the class. Important note: You earn the same letter grade in both PHY113 and PHY113L. The credit you earn in lab is one component of calculating this overall grade. Labs cannot be made up, unless discussed and arrangements made with the professor before the lab.

Homework– Most weeks there will be homework due. Homework is worth 20% of your final grade. Practicing working problems is critical to your success in the class. Late homework will not be accepted unless their is a documented emergency.

Exams– Three examinations will be given during the semester on Sept. 24, Oct. 17 and Nov. 19. The final examination is on Friday, Dec. 14 at 7:30 am. Exams will be closed book, but a sheet of formulas will be provided to you to use during your exam along with the use of your calculator. 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. For problems that call for a solution or explanation, no credit will be given for an answer alone; the method or reasoning must also be shown. Exams cannot be made up, unless under extreme circumstances discussed and arrangements made with the professor before the exam.

Final Grades – The grade you earn in this course is based on the scale shown to the right. The points you receive during the course are weighted accordingly:

- Preclass: 5%
- Homework/Activities: 20%
- Lab: 25%
- Tests (3): 30%
- Final Exam: 20%

A	100 - 91.0
A-	91.0 - 89.5
B+	89.5 - 87.5
B	87.5 - 81.0
B-	81.0 - 79.5
C+	79.5 - 77.5
C	77.5 - 71.0
C-	71.0 - 69.5
D+	69.5 - 67.5
D	67.0 - 61.0
D-	61.0 - 57.0

University Mission: 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.

Attendance– Attendance is expected at each class session. In the event of an absence you are responsible for the material covered in class and the assignments given that day. Regular and punctual attendance at all classes is considered essential to optimum academic achievement. If the student is absent from more than 10 percent of class meetings, the faculty member can file a written report which may result in 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. See

http://catalog.pointloma.edu/content.php?catoid=24&navoid=1581#Class Attendance in the Undergraduate Academic Catalog.

Academic Honesty – 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 http://catalog.pointloma.edu/content.php?catoid=24&navoid=1581#Academic Honesty for definitions of kinds of academic dishonesty and for further policy information.

Academic Accommodations –

While all students are expected to meet the minimum standards for completion of this course as established by the instructor, students with disabilities may require academic adjustments, modifications or auxiliary aids/services. At Point Loma Nazarene University (PLNU), these students are requested to register with the Disability Resource Center (DRC), located in the Bond Academic Center. (DRC@pointloma.edu or 619-849-2486). The DRCs policies and procedures for assisting such students in the development of an appropriate academic adjustment plan (AP) allows PLNU to comply with Section 504 of the Rehabilitation Act and the Americans with Disabilities Act. Section 504 (a) prohibits discrimination against students with special needs and guarantees all qualified students equal access to and benefits of PLNU programs and activities. After the student files the required documentation, the DRC, in conjunction with the student, will develop an AP to meet that student's specific learning needs. The DRC will thereafter email the student's AP to all faculty who teach courses in which the student is enrolled each semester. The AP must be implemented in all such courses.

If students do not wish to avail themselves of some or all of the elements of their AP in a particular course, it is the responsibility of those students to notify their professor in that course. PLNU highly recommends that DRC students speak with their professors during the first two weeks of each semester about the applicability of their AP in that particular course and/or if they do not desire to take advantage of some or all of the elements of their AP in that course.

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.

Credit Hour – 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 16 weeks. Specific details about how the class meets the credit hour requirements can be provided upon request.

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 th 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.

	Topics	Reading	Lab (Tuesdays)
8/28	Introductions		
8/29	Simple Harmonic Motion	1.1-1.2	
8/31	Application to Sound	1.2-1.3	
9/5	Oscillations	1.4-1.5	Lab 1: Resonance and Lissajou Figures
9/7	Waves and Sound I	2.1-2.2	
9/10	Waves and Sound II	2.3	Lab 2: Basics of Sound
9/12	Waves and Sound III	2.4-2.5	
9/14	Waves and Sound IV	2.6-2.9	
9/17	Standing Waves I	3.1-3.2	Lab 3: Standing Waves
9/19	Standing Waves II	3.3-3.4	
9/21	Standing Waves III	3.4-3.5	
9/24	Exam 1		Lab 4: Introduction to Fourier Analysis
9/26	Synthesis and Analysis of Waves I	4.1-4.2	
9/28	Synthesis and Analysis of Waves II	4.2-4.3	
10/1	Synthesis and Analysis of Waves III	4.4	Lab 5: Fourier Analysis II
10/3	Electronic Music I	5.1	
10/5	Electronic Music II	5.2-5.3	
10/8	Hearing I	6.1-6.3	Lab 6: Electronic Music
10/10	Hearing II	6.4	
10/12	The Voice I	6.5-6.11	
10/15	The Voice II	6.12-6.14	Lab 7: Speech
10/17	Exam 2		
10/19	Fall Break		
10/22	Electricity I	7.1-7.2	Lab 8: Speed of Sound
10/24	Speakers and Microphones	7.3-7.4	
10/26	Digital Music	7.9-7.10	
10/29	Room Acoustics I	8.1-8.2	Lab 9: Room Acoustics
10/31	Room Acoustics II	8.3-8.5	
11/2	Pitch and Temperament	9.1-9.3	
11/5	Temprements	9.4-9.6	Lab 10: Temperment
11/7	Temprements	9.7-9.8	
11/9	Woodwinds 1	10.1-10.3	
11/12	Woodwinds 2	10.4-10.7	Build an Instrument I
11/14	Woodwinds 3	10.8-10.9	
11/16	Wrap-Up and Review		
11/19	Exam 3		Build an Instrument II
11/21	Thanksgiving		
11/23	Thanksgiving		
11/26	Brass 1	11.1-11.3	Build an Instrument III
11/28	Brass 2	11.4-11.6	
11/30	String	12.1-12.4	
12/3	Piano	13.1-13.4	Musical Celebration
12/5	Percussion	14.1-14.4	
12/7	Wrap-Up and Review		
12/14	Final Exam		