Syllabus for PHYS 150
Physics of Sound and Music – Spring 2014

Class Times: MWF, 11:00-11:50 AM, RHSC 108

Instructor Information: Dr. Mike Larsen

Office Phone: 843-953-2128

Office Hours: Mondays, 8:00 - 9:00 AM; Mondays 2:00-3:00 PM; Tuesdays 10:30-11:30 AM; and Tuesdays 12:30-1:30 PM. Also available by appointment.

Office Locations: RHSC 310 (I also am sometimes elsewhere during my office hours, but I am fastidious about making sure my office door accurately describes where I am during my office hours; check the door of room 310 for my current location.)

Email address: LarsenML@cofc.edu

Course Webpage: http://larsenml.people.cofc.edu/phys150_spr14.html
(Please see course page for full description of course, rationale, and supplementary information).

Course Description

> An investigation of mechanical and electronic generation of sound; propagation of sound; perception of sound and music; the acoustics of vocal and instrumental music; musical elements such as pitch, loudness, and timbre; and musical constructs such as scales, temperament, and harmony.

Topics Discussed We will be very flexible about course content, adjusting to fit student interest and expertise. The text is divided into 8 parts. Parts of sections I (Vibrations, Waves and Sound), II (Perception and Measurement of Sound), and III (Musical Instruments) will definitely be discussed. Depending on time and student interest, subsections of all 8 parts of the text may be discussed. Given the flexible nature of the course content, no formal schedule of topics will be presented at this time.

Attendance Policy

Attendance is expected, and is part of your course grade. This class hinges on developing class discussion, and we can't do that if you aren't here. Therefore, come to class. I will.

Textbook and References

The textbook for this course is:

Rossing, T.D., F.R. Moore, and P.A. Wheeler (2002). *The Science of Sound* (3rd Ed.) Addison-Wesley.

We will be drawing our course content primarily from this text, though we by no means will discuss the entire book this semester – not even close. I chose this text for three main reasons: (1) It is commonly viewed as the most comprehensive introductory book on this topic, (2) it includes many details for demos and project ideas, and (3) it gives us a wide range of possible topics that we can cover depending on student interest.

Other texts introducing the material from this course include.

Backus, J. (1977). *The Acoustical Foundations of Music* (2nd Ed.) Norton.

Berg, R.E. and D.G. Stork (2005). *The Physics of Sound* (3rd Ed.) Pearson.

Fletcher, N.H. and T.D. Rossing (2010). *The Physics of Musical Instruments* (2nd Ed.) Springer.

Olson, H.F. (1967). *Music, Physics, and Engineering* (2nd Ed.) Dover.

Rayleigh, J.W.S. (1945). *The Theory of Sound* (2nd Ed., Vols 1-2). Dover.

Rigden, J.S. (1977). *Physics and the Sound of Music* (2nd Ed.) Wiley.

This is not a comprehensive list, but are decent books to check if your current text doesn't seem to explain an idea in a particularly clear way. These are at several different levels of mathematical sophistication, but most stick with an algebra-based approach.

Honor Code / Code of Conduct It is expected that you will adhere to the university's honor code and student code of conduct, as can be found in your student handbook.

Students with Disabilities The College will make reasonable accommodations for persons with documented disabilities. Students should apply at the Center for Disability Services/SNAP located on the first floor of the Lightsey Center, Suite 104. Students approved for accommodations are responsible for notifying your professor as soon as possible and subsequently contacting your professor again at least one week before any specific accommodation is needed.

Classroom Policies

This class is held in a science laboratory – a general rule for life is to not have food or beverage in a science lab if you plan on staying healthy. Please do not bring food or drink to lab.

Your professor also has a major pet-peeve about cell-phones in class. Please be considerate of your instructor, as well as your fellow classmates, and turn off your cell-phone ringers before class starts. Please also abstain from texting or other potentially disruptive activities during class.

If you are causing a disruption to the class, the professor may remove you from the class.

Grading Grading Scale: The formal numerical scale might move around a little bit depending on the class performance, but the final grading scale will be *no more stringent* than:

A	>90	C+	79
A-	90	C	71-78
B+	89	C-	70
B	81-88	D	60-69
B-	80	F	<60

This course is meant to be a fun, low-stress survey of Physics principles associated with the production, perception, and properties of sound. As such, graded work in this class will be based on four components that demonstrate understanding of these principles and associated problem-solving techniques.

- Component 1: Attendance and Participation (20%). This grade will be partly allocated to just showing up, and partly allocated to your contributions to in-class discussions.
- Component 2: Homework (30%). Homework will be periodically assigned out of the text and used to reinforce lecture topics. The plan is to give one homework per week through the semester. Often you will be required to read the text on your own to answer the questions; the actual content may or may not be discussed in class. I will drop your lowest homework grade for the semester.
- Components 3 and 4: Individualized options (25% each). Of the course of the semester, each student needs to select two options off the following list. Each of these options will be one of the four components of the final course grade:

Option A Write a 10-15 page paper describing, in detail, the properties of a particular acoustical system/device/instrument not discussed in detail in the course. Topics must be approved by the instructor. A grading rubric for this will be distributed under separate cover.
Relevant due dates for option A:

* Topic selected and approved by: Friday, February 14
* Rough draft of paper submitted by: Friday, March 14
* Final draft of paper submitted by: Friday, April 25

Option B Present/Teach the material from a chapter of your text to the class as a lecture/presentation. The presentation is expected to last at least 40 minutes and will take the place of the class's lecture during the semester. The presenter will need to be flexible and knowledgeable enough about the topic to address questions from classmates as well as the instructor during and after the lecture. Demos/applets are not only allowed, but encouraged. Topic selection must be from a chapter from your text not previously presented by your instructor, and are "first come, first served". A grading rubric for this will be distributed under separate cover.
Relevant due dates for option B:

* Topic selected and approved by: Friday, February 14
* Presentation date chosen by: Friday, February 21
* Presentation given: March 10, 12, 14, 17, 19, 21, 24, 26, 28, 31 or April 2, 4, 7, 9, 11

Option C Project. Conduct an experiment/investigation of some sort. This investigation can be done to verify one of the quantitative results given in the book, or can be original work. The key here is that you physically measure something meaningful and interpret the results. You will then present your work (conference presentation style) in class. You will have 20 minutes to present your work. You may use a formal slide presentation or do this in demonstration form, as needed. The presentation is expected to outline what you did, what you found out, and you are also expected to interpret your results in a broader context. Following your presentation, you will also be graded on your ability to answer questions from classmates and your instructor. A grading rubric for this will be distributed under separate cover.
Relevant due dates for option C:

* Project outlined and approved by: Friday, February 14
* Presentation date chosen by: Friday, February 21
* Presentation given: March 10, 12, 14, 17, 19, 21, 24, 26, 28, 31 or April 2, 4, 7, 9, 11

Option D Final Exam based on course content. (Final Exam Time Block: Monday, April 28 8-11 AM). NOTE: If you miss a deadline / presentation date for options A-C, you will automatically be reassigned to option D – unless you already were planning on using option D, in which case your other option will incur a late penalty.

Student Learning Objectives At the conclusion of the course, the successful student will be able to:

- summarize the basic physics principles associated with the production, perception, and properties of sound.
- use the basic physics principles associated with sound in order to answer applied questions associated with practical sound generation and recording tasks.
- successfully convey – via written and/or oral methods – ideas associated with the physics of sound and music.
- organize and conduct a demonstration of a sound phenomenon that can be explained via an appeal to standard physics principles.