

**PHYS102**  
**Physics of Sound and Music**  
**Fall 2019**

**Dr. Matt Severson**

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PHY 1330 - Toll Phys Bldg

*Tentative Office hours*

M 2:00-3:00, Th 2-4, or by appt

*Lecture*

TTh 9:30 - 10:45 PHY 1410

*NOTE: Details in this syllabus should be taken as tentative. I will notify you when changes are made.*

### **Course Description**

This course (and the accompanying lab) are designed to provide a fundamental physical understanding of the nature of sound, hearing, and music. After introducing the basic physics of waves and oscillation, we will begin to explore increasingly intricate aspects of how simple waves are combine in extremely precise ways to create the complex sounds we experience in every day life, with a focus on how our perception of these sounds works, how the phenomenon of music arises, how certain instruments create their own unique versions of it, and how music is recorded and/or presented to an audience.

**Prerequisite:** at least MATH107 (or equivalent)

### **Textbook:**

Recommended: **Musical Acoustics**, 3rd ed., Donald Hall (Brooks/Cole, 2002).

Supplemental/reference: **The Physics of Sound**, 3rd ed., R. Berg and D. Stork (Pearson, 2005).

### **Assignments**

**Homework:** I will assign homework roughly every other week; the homework will be designed to increase the depth of your understanding and intuition for the ideas discussed in lecture. Homework will usually be submitted “the old fashioned” way on paper in class, but some exceptions may occur.

A late assignment may incur a penalty, depending on the extent and circumstances. I will drop your lowest assignment score before computing your average.

**Participation:** Starting after a short buffer period, I will regularly incorporate basic or interesting questions or other interactive activities during the lecture to quiz you on recent material and improve both your comprehension of the concepts and also my perception of that comprehension. These exercises will be submitted using the University "Clicker" system, although **I strongly recommend using the app** unless you already own the device.

Registration will take place in ELMS and more info is forthcoming.

*I will drop up to 4 of these submissions* in the end to accommodate ordinary absences and/or persistent technical difficulties. **No exceptions will be made beyond that except under extreme circumstances** (hospitalization etc).

**If you believe your response to an exercise failed despite proper registration, please take a picture or screenshot to document your participation, and then contact me **\*\*ASAP\*\***** Incidents more than a week old will be ignored!!

**Musical Instrument Project:** There will be one minor project after the halfway point of the semester in which you will present the details of the structure and function of one musical instrument. Due to an unexpected significant increase in enrollment, the specifics of this project (paper vs presentation etc) are still pending.

**Exams:** You will also have 3 exams, consisting of multiple choice and short-answer questions. Because the course material consistently builds on what we've already covered, exams will be pseudo-cumulative, but they will not explicitly test on material covered in previous exams.

## Grading Scheme

Homework	28%
Participation	20%
Instrument Project	7%
Exams (3)	45%

## ELMS Posts and Communicating with Me

I will clearly post all announcements, assignments, due dates, and other important information on the course ELMS page. I will also use ELMS to send course-wide emails when necessary. *It is **your responsibility** to find such information on ELMS.* Please check the page regularly for updates. I will be rather inflexible in dealing with problems that arise due to your failure to know things that have been said on ELMS.

That said, I will be happy to answer any other questions about course material, trouble with assignments, etc as they arise. Please feel free to send me email at any time for such reasons.

### **Attendance, Religious Observances, and University Closures**

The use of clicker questions will monitor attendance in the course, and again you will have 4 excused omissions/absences there to accommodate the usual illnesses or minor emergencies that arise.

*If you need to miss a hw deadline or an exam for a religious observance or other legitimate reason, please notify me in advance, and preferably ASAP.* If you miss an exam due to illness or emergency, *please get in touch ASAP* after the fact. In all cases, a makeup exam will be arranged accordingly.

If the university is closed due to inclement weather or some emergency situation on or near an exam day or other important date, I will contact you on ELMS with further instructions.

### **Academic Integrity**

The abstract nature of any physics often leads to difficulty in its study; often students find it beneficial to work with a partner on solving homework questions and problems. This sort of behavior is encouraged, although you should avoid larger groups to discourage stragglers.

That said, it is crucial that all students create and submit *their own* assignments. It will usually be easy to tell your assignments apart, and so also easy to see if you have copied someone else's work. You will be monitored during exams to ensure no cooperation among individuals. If detected, such behavior will not be tolerated and may result in an XF grade for the course and/or further action taken by the Student Honor Council.

### **Students with Disabilities**

Accommodations will be provided to enable students with disabilities to participate fully in the course. Please discuss any needs with me at the beginning of the semester, so that appropriate arrangements can be made. Students who are registered with ADS and plan to take exams at their facilities should provide the pertinent authorization forms (electronic format is fine) prior to each exam date, and note that the **office requires scheduling 3 days in advance.**

**PHYS 102**  
**Tentative Schedule Outline**  
**Fall 2019**

<i>Wk</i>	<i>Week of</i>	<i>Berg</i>	<i>Hall</i>	<i>Content</i>
1	Aug 27	1	2.4	Intro, simple harmonic oscillation
2	Sep 4	2	1,2	oscillation and traveling waves
3	Sep 10	2	4	wave properties, superposition, longitudinal waves
4	Sep 17	3, 6.4	5,6	sound perception, intensity, loudness decibel level
5	Sep 24	4, App A	7,8,18	intro to music, harmonic series
6	Oct 1	3	10.1,12.1	standing waves <b>Exam 1 - Tue, Oct 1</b>
7	Oct 8	3	8	overtones for strings and pipes
8	Oct 15	4	8	Fourier synthesis and spectra
9	Oct 22	4	8	spectra of instruments, inharmonics
10	Oct 29	6	6,14,17	details of hearing and speech
11	Nov 5	9	Box 7.1, 18.4-5	musical temperament <b>Exam 2 - Tue, Nov 5</b>
12	Nov 12	10,11	3.4,12,13	woodwinds, brass
13	Nov 19	12	11,10.1-2	strings <i>No class Thu - Thanksgiving</i>
14	Nov 26	13,14,6	10.3-4,9,14	piano, percussion, singing
15	Dec 3	7,8	15,16	acoustics, sound recording and production
16	Dec 10			<b>Exam 3 - Thu, Dec 12, 8:00am</b>