

# Science of Musical Sounds

PHYS 0082, section 29503, Fall 2018

Meeting times: **Mon/Wed/Fri 10:00-10:50 am**  
Lecture room: **7th Floor Auditorium, Alumni Hall**  
Instructor: **Dr. Matteo Broccio**, mbroccio@pitt.edu  
Office hours: 217 Allen Hall, by email appointment

## Reference book

“The Physics and Psychophysics of Music” (4<sup>th</sup> edition) by Juan G. Roederer

## Course description and goals

This course explores the musical sound from a physics point of view. Topics include how musical instruments work; loudness, pitch, timbre; room acoustics; scales, intervals, and tunings; hearing and aural perception. Both communication and problem-solving skills are developed through assignments. Student activities include hands-on investigations of musical instruments.

By the end of this course, the successful student will be able to describe the human perception of musical sound, the production of sound by musical instruments (including human voice), the science basis of music theory, the propagation of sound, and the tools for music recording and playback. Students are expected to be minimally equipped with basic algebra and geometry. There are no formal music or physics prerequisites for this course, although a familiarity with music notation and direct experience with music will be very useful.

## Class meetings

Lectures will typically begin with demonstrations and continue with interactive discussions about processes, and the explanation of mathematical models used to describe them. Students will often be asked to collaborate in small groups under the supervision of the instructor. Participation in lecture is worth 4% of your grade. Please note that although attendance is not a significant source of points it is vital for adequately preparing for in-class assessments.

## Homework

Homework will be posted on Courseweb every other week by the instructor, and random portions of it will be graded based on correctness, the rest of the grade being given based on completion. Select homework problems will be discussed in class by the instructor to provide feedback on your learning. Homework is worth 18% of your end-of-term grade.

## Exams

There will be **three midterm exams**, each worth 21% of your grade, and a mandatory *final project* to be performed in a small group, which is worth 15% of your grade.

## Grading

Your numerical grade is broken down as shown below. As an initial assumption, you may expect that a 92% or more will be converted to an A and a 48% or less will be converted to an F.

Coursework component	Grading weight
In-class participation	4%
Homework assignments	18%
Midterm exams (all combined)	63%
Final project (required)	15%

## Tentative course schedule

Week	Monday	Wednesday	Friday
1: Aug 27	overview	vibrations	resonance
2: Sept 3	<i>Labor Day</i>	waves	sound propagation
3: Sept 10	superposition	sound spectrum	beats
4: Sept 17	auditory system	pitch perception	loudness perception
5: Sept 24	nonlinear effects	perceptual paradoxes	<b>Exam 1</b> (Sept 28)
6: Oct 1	plucked and bowed string	violin	other strings
7: Oct 8	pipes and reeds	woodwinds	brass
8: Oct 15	modern piano	percussions	human vocal system
9: Oct 22	human speech	singing voice	<b>Exam 2</b> (Oct 26)
10: Oct 29	intervals and scales	temperaments	pitch standards
11: Nov 5	acoustics effects	acoustical environment	spatial processing
12: Nov 12	energy transduction	microphones	loudspeakers
13: Nov 19	musical synthesis	electronic music	<b>Exam 3</b> (Nov 23)
14: Nov 26	(to be determined)	<i>Thanksgiving Break</i>	<i>Thanksgiving Break</i>
15: Dec 3	Final Projects	Final Projects	Final Projects

## Disability Resource Services

If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and the Office of Disability Resources and Services, 140 William Pitt Union, 412-648-7890, as early as possible in the term. Disability Resources and Services will verify your disability and determine reasonable accommodations for this course.

## **Academic Integrity**

Cheating/plagiarism will not be tolerated. Students suspected of violating the University of Pittsburgh Policy on Academic Integrity, noted below, will be required to participate in the outlined procedural process as initiated by the instructor. A minimum sanction of a zero score for the quiz, exam or paper will be imposed. (The full Academic Integrity policy may be found at [www.provost.pitt.edu/info/ai1.html](http://www.provost.pitt.edu/info/ai1.html).)

## **E-mail Communication Policy**

Each student is issued a University e-mail address (username@pitt.edu) upon admittance. This e-mail address may be used by the University for official communication with students. Students are expected to read e-mail sent to this account on a regular basis. (For the full E-mail Communication Policy, go to [www.bc.pitt.edu/policies/policy/09/09-10-01.html](http://www.bc.pitt.edu/policies/policy/09/09-10-01.html).)

## **Update policy**

Any updates to formats, policies, or schedule shown in this document will have to be announced by the instructor *both* in the classroom and and electronically on Courseweb to be in effect.