PH 331 Syllabus
Winter 2019

Instructor: Tom Giebultowicz ("Dr. Tom")
Office: Weniger 424 **Phone:** 737-1707
email: *giebultt@science.oregonstate.edu*
Office Hours: Tuesday, 12:00-12:50; WNGR 200
(note: to see me at my OHs, please do not come to my office at WNGR 424, but to Room 200 at Weniger).

Class meeting hours: TR 13:00 – 13:50, WNGR 149.
Labs meet in Wngr 200. There are three lab sections:
T 10:00-11:50; T 14:00-15:50; T 16:00-17:50;
Lab TA: Tom Giebultowicz (yes, the same person as the Course instructor).

Website: http://www.science.oregonstate.edu/~giebultt/COURSES/ph331/
(please note that the word COURSES **must be** in capitals – while all other characters in *lower case* – in other words, the page address is "case-sensitive" (it's not Dr. Tom's idea, it's a rule established for all Department of Physics courses by the Department leaders).

FINAL EXAM: Tuesday, March 19th, 2019 from 18:00 pm to 19:40, WNGR 149

Principal Objectives

The PH331 "Sound, Hearing and Music" is one of the Oregon State University's Baccalaureate Core (Bacc Core) Courses. Their principal objective is to instill in students the abilities to:

1. **Analyze relationships among science, technology, and society using critical perspectives or examples from historical, political, or economic disciplines.**
2. **Analyze the role of science and technology in shaping diverse fields of study over time.**
3. **Articulate in writing a critical perspective on issues involving science, technology, and society using evidence as support.**

Specific aims in the Ph331 Course are given below in the Section "Specific aims".

SPECIFIC AIMS AND GENERAL INFORMATION FOR PH 331

Baccalaureate Core:
This course is part of the baccalaureate core and fulfills the synthesis requirement for study related to science, technology and society. This course will require students to analyze relationships among science, technology, and society using critical perspectives or examples from historical, political, or economic disciplines, analyze the role of science and technology in shaping diverse fields of study over time, and articulate in writing a critical perspective on issues involving science, technology, and society using evidence as support.

Student learning outcomes:

After completing the course, the students will be able to define sound, hearing, music, velocity or speed, mass, force, pressure, density, periodic motion, simple harmonic motion (SHM), linear restoring force, amplitude, period, frequency, phase angle, resonance, damping, the speed of sound in air, The Principle of Superposition, constructive and destructive interference, diffraction, refraction, reflection, beats, The Doppler Effect, ultrasound, infrasound, Mersenne's Laws, standing waves on strings and in air columns, nodes and anti-nodes, fundamental frequency, harmonics, bowing, action, edge tones, reed tones, register key, Fourier Theorem, Fourier Analysis, Fourier Synthesis, waveform, spectrum, timbre, envelopes, inharmonics, formants, Faraday's Law of Induction, Lorentz Force, analog vs. digital, microphones, transducers, analog and digital storage, numbering systems, bits, sampling rate, Nyquist Theorem, resolution, speakers, frequency range of hearing, frequency just noticeable difference (JND), limit of frequency discrimination (LFD), sound intensity, sound intensity level, change in sound intensity level, thresholds, loudness level, Fletcher-Munson Curves, reverberation time, focusing and dispersal, absorption, absorption coefficient, Pythagoras, Pythagorean Theorem, diatonic scale, Music of the Spheres, Pythagorean Intervals, open vs. closed temperaments, Pythagorean temperament (open) and equal temperament (closed); solve numerical and symbolic problems which involve frequency and period; speed, frequency and wavelength; amplitude; sine, square and triangle waves; average frequency and beat frequency; length, linear mass density, tension, fundamental and harmonics of stringed instruments; fundamental and harmonics of wind instruments; graphical superposition of two waves; waveform and spectral analysis; converting numbers from base ten to base two and vice versa; sampling rate and the Nyquist Theorem; digital resolution; sound intensity, sound intensity level and change in sound intensity level; reverberation time, total absorption and absorption coefficients; Pythagorean and equal temperaments.

Prerequisites: None. However, a basic understanding of algebra, logarithms, functions, exponents and trigonometry is necessary.

Required Texts: None. Lecture notes in a book-like form, or a sequence of Power Point slides, will be posted ahead of the lectures. Such a method is in agreement with the current tendency at OSU to provide the students with the material in a "textbook-lie form", so that they do not need to pay $100 or more for a text book for each individual course. But if a student badly wants to use a regular printed textbook, the recommended one is *The Physics of Sound* (3rd edition) by Berg and Stork (Prentice-Hall, 2005). But it's not necessary to buy one – three copies will be available in the Lab, for reading at the site, or for short-term loans.

Physics 331 Laboratory Manual will be posted at the Course Web page, there is no need to buy anyting.

Laboratory: Original work is required. **Read the lab instructions before coming to lab.** Lab reports are due by the end of lab, unless the lab TA indicates otherwise.

Help Room: Physics TAs will hold their office hours in the Help Room, Weniger 145. A schedule is posted on the door of the room. You are also welcome to stop by the instructors office at any time.

Exams: There will be a midterm and a final. The final will be comprehensive, i.e. it will cover the entire course. The midterm will be given on Thursday, February 7, in WNGR 149 at 13:00 (the same site and time as for the regular class hour meetings). The final will be given at the date and time shown in the Schedule of Final Examinatins for the winter term – onTuesday, March 19, at 18:00 (6:00 pm), venue TBA. Exams are closed book and closed notes. A formula sheet will be provided by the instructor for each exam, so you do not need to memorize any formulas. **Please arrive to the exam room five to ten minutes early and bring a calculator that has trigonometric (sine, cosine and tangent), logarithm and exponential function keys.**

Term Paper: You will write a three-to-five page paper (typed, double-spaced) on one of the following topics (or a different one approved by the instructor): **Music of the Spheres, Sound Recording, Sound Reproduction, Architectural Acoustics, Whispering Rooms, Noise Pollution, Synthesized Music, Acoustics in Medicine, Echolocation, Cavitation, Sonoluminescence, Seismic Waves, Midi Technology, Digital Distortion, Theremin, Pythagorean Scale.** You will submit a rough draft two weeks before the final draft is due. The instructor will read it and provide useful feedback. It's important for you to submit a rough draft for feedback before writing the final version of your paper.

Academic Integrity: All students are expected to uphold the highest standards of honesty and integrity in their academic work. **All graded work is to be done on an individual basis.** Any incidence of academic dishonesty will be dealt with in accordance with OSU policies.

Students with Disabilities: Students with **documented** disabilities who need special accommodations are kine adly requested to schedule (by e-mail) an individual appointment with the instructor as soon as possible to discus, in privacy, the accommodations and any other relevant issues.

Final Grades: Your final grade will be computed as follows: Midterm 20%, Final 35%, Term Paper 20% and Lab Reports 25%. The grading scale is the following:

90 - 100% = A	85 - 89% = A-	82 - 84% = B+	78 - 81% = B
75 - 77% = B-	72 - 74% = C+	68 - 71% = C	65 - 67% = C-
62 - 64% = D+	58 - 61% = D	55 - 57% = D-	0 - 54% = F