

Physics 105 - **Sound and Music** - Syllabus

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Book: **The Science of Sound, 3rd Ed**, by Rossing, Moore & Wheeler

Overview: Physics is a science in which we describe and predict the behavior of the natural world – physical phenomena such as gravity, forces, friction...and waves. Waves make up a great deal of physical phenomena, whether it concerns a water wave, or light treated as a wave, or as in this course, sound waves. In this course we are going to consider the various aspects of sound, the production of sound, our hearing of sound, and the mathematical nature of music. We will start by considering the simplest of waveforms and then add the complexity present in the production of sound. We will consider the techniques with which sound is produced by various instruments and the effects on the complexity of the sound waves. Likewise, we will consider the physical and psycho-physical nature of hearing. We will explore the mathematical nature of musical scales.

Topics:

- 1. Vibrations, Waves and Sound.** This section will involve examining simple waves, wavelength and frequency of the wave behavior including superposition and beat tones. It will also involve introductory sound waves. The concept of resonance will be introduced.
- 2. Perception and Measurement of Sound.** Concepts related to human hearing including the mechanics of the inner ear., Sound pressure, power, intensity (loudness). Pitch and timbre of a musical note. Combining tones and harmony, musical scales and temperament.
- 3. Musical Instruments.** We will examine the production of musical sounds by various types of instruments. The construction of these instruments and the physical concepts that make them operate properly to produce efficient musical sounds.. These will start with production of sounds using air columns and then stringed instruments and proceed to keyboard instruments. Complex vibrations will be discussed, as will the effects of resonance on the sounds produced by instruments.

4. The Human Voice . We will examine speech construction and the use of the voice as a singing instrument.

Procedure: The order of the above subject material may be augmented or rearranged from that given above. Assignments will be made as we proceed. Some topics may be investigated to different lengths depending on the overall interest of the class (or instructor). We will attempt to provide hands on labs or homework projects demonstrating various subjects.

We will probably have short quizzes intermittently.

In lieu of a final exam we will have a final project. The preferred project is the construction of a working musical instrument making use of physical principles developed in this course. Examples of successful projects from previous classes will be placed on the class home page. If you prefer not to tackle a construction project an alternate is to do a short (10 -15 p) term paper covering the physics of some instrument or group of instruments. Such a paper should be researched properly and include a proper bibliography. Though use of the internet is useful, plagiarism of such sources is not acceptable.

A home page with specific links for this course will be maintained on the internet: The address is:

<http://users.ipfw.edu/miers/phys105/>

Sound and Music is a General Education Area II course. As such, there are specific outcomes:

1. To be familiar with the important modes of human thought that are the foundations of science, philosophy, art and social behavior.
2. To possess effective foundation skills:
 - a. Read, write, and speak with comprehension, clarity, and precision.
 - b. Identify substantive knowledge and disciplinary methods.
 - c. Develop information literacy skills.
 - d. Reason quantitatively (as means of gaining and creating knowledge and drawing reliable conclusions)
3. To demonstrate the ability to think critically and to solve problems using the foundation skills:
 - a. Evaluate their ideas and the ideas of others based upon disciplined reasoning.
 - b. Understand the traditions that have formed one's own and other cultures.
 - c. Be able to articulate their ideas in appropriate media.