ACOUSTICS FOR THE SPEECH AND HEARING SCIENCES
SPH 267       FALL 2003

Title of Course: ACOUSTICS FOR THE SPEECH AND HEARING SCIENCES
Room & Time: 205 SPH, MWF 11:00–11:50
Instructor: Brad Story, Ph.D.
Office: 330 SPH
Office Phone: 626-9528
Email: bstory@u.arizona.edu
Office Hours: TBA
TA: Carly Scott
Course Website: www.u.arizona.edu/~bstory/sph267.html

COURSE DESCRIPTION

This course will cover the basic principles of acoustics, especially with regard to speech and hearing science. The target audience is undergraduates majoring in Speech and Hearing Science. The course may also be of interest to students in Music, Linguistics, and Engineering. The mathematical demands of the course will be at the level of freshman algebra. The first part of the course will address descriptions of sound, simple harmonic motion, pressure waves, decibels, complex waves, resonance, and sound transmission.

The second part will focus on the acoustics of speech production, the relationship between articulation and acoustics, prosodics, and, some speech technology. In addition, the International Phonetic Alphabet (IPA) will be introduced throughout this section of the course so that the standard symbolic representation of speech sounds is linked to the physical systems that produce those sounds.

The third section of the course will address phonetic transcription. Students will use the IPA to transcribe audio samples of speech. The initial emphasis will be on broad transcription, but use of diacritics for narrow transcriptions will be introduced. Students will participate in several in-class phonetic transcription exercises.

REQUIRED TEXTBOOK

Available at the UA Bookstore.


COURSE WEBSITE

At the instructor’s discretion, some of the lecture notes and handouts will be made available on the course website (listed above). In addition, this website may also be used for messages related to the course.


**Useful References**


**Course Requirements**

- **Attendance:** Students are expected to attend class regularly. Attendance will be taken periodically. Anyone who is *chronically* absent may have their grade lowered or be dropped from the class.
- **Reading & Homework Assignments:** All students are expected to read and study the textbook/course notes and any other material provided by the instructor. In addition, homework will be assigned to coincide with some of the lectures. These assignments will be collected and are given 1 point if *completed*. At the end of the semester, total homework scores will be normalized to 50 points, regardless of the number of assignments given.
- **Exams:** There will be four 1 hour exams (50 pts each) given during the semester and a final exam (100 points).

**Grades**

Course grades will be based on the sum of three sets of scores (maximum pts = 350):

- Four(1) hour examinations (50 points, each) = 200 points
- Homework = 50 points
- Final examination = 100 points

There is no pre-set grading curve for the class. Generally, a point accumulation of 90% of the maximum number of points (330) will earn an “A”, 80% = “B”, and so forth. The instructor reserves the right to assign a failing grade to anyone who scores less than 50% on the final exam.
**Course Outline**

1. Description of Sounds and Notation & Information carried by sound
   - Why study acoustics?
   - Everyday sounds, listening
   - Descriptions: musical, phonetic, physical
   - Sound events, sound objects
   - Physics of sound producing events

2. Basic Acoustics
   - Nature of sound
     - Wave propagation
     - Simple Harmonic Motion
     - Logarithms, Decibels
     - Sound Intensity, Sound pressure

3. Speech Acoustics
   - Vibration of biomaterials - phonation
   - International phonetic alphabet
   - Source–filter theory: vowels, fricatives, affricates, liquids, nasals
   - Phonetics & the source–filter theory
   - Prosodics: fundamental frequency and intensity
   - Spectrographic analysis
   - Speech synthesis

4. Phonetic Transcription
   - Broad and narrow transcription.
Notice

Any student who does not understand or accept the contents and terms of this syllabus or who has a disability or condition that compromises her/his ability to complete the course requirements must notify the instructor in writing within 2 days of receiving this syllabus. A synopsis of the University of Arizona Code of Academic Integrity is attached. All credit will be forfeited for any academic work completed for this class that violates the code.

Code of Academic Integrity

Note: This is a synopsis. The full version can be found at the website, [w3.arizona.edu/~studpubs/policies/cacaint.htm], or at the Dean of Students office, Rm. 203 Old Main.

Integrity is expected of every student in all academic work. The guiding principle of academic integrity is that a student’s submitted work must be the student’s own. Students engaging in academic dishonesty diminish their education and bring discredit to the academic community. Students shall not violate the Code of Academic Integrity and shall avoid situations likely to compromise academic integrity. Students shall observe the generally applicable provisions of this Code whether or not faculty members establish special rules of academic integrity for particular classes. Failure of faculty to prevent cheating does not excuse students from compliance with the Code.

Conduct prohibited by the Code consists of all forms of academic dishonesty, including, but not limited to: cheating, fabrication, facilitating academic dishonesty, and plagiarism as set out and defined in the Code of Conduct, modifying any academic work to obtain additional credit in the same class unless approved in advance by the faculty member; failure to observe rules of academic integrity established by a faculty member for a particular course; and attempting to commit any act prohibited by this Code. Any attempt to commit an act prohibited by these rules shall be subject to sanctions to the same extent as completed acts. The procedures for reviewing a suspected violation follow:

- Faculty–Student Conference – The faculty member must confer with the student within 15 working days of receiving evidence of a suspected violation.

- Appeal to Department Head – Students may appeal the findings made and the sanctions imposed by a faculty member to the Head of the Department in which the course was offered or the Associate/Assistant Dean in colleges with no departments. A student must deliver the written appeal to the Department Head within ten working days of the date on which he/she receives notice of the findings and sanction(s). The Department Head shall render a decision within 15 working days.

- University Hearing Board – If the student wishes to further pursue the matter, or if the Department Head fails to act within the 15 day period, the student may, within ten working days, appeal to a University Hearing Board by providing written notice of appeal to the Dean of Students office. The board shall convene within 30 working days of the time the student files the appeal.
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<tr>
<th>Learner Outcomes</th>
<th>Assessment Method</th>
<th>A</th>
<th>B</th>
<th>C</th>
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<tbody>
<tr>
<td>1. State three standard descriptions, of sound and describe the material properties and forces responsible for production of sound.</td>
<td>in-class exam, homework</td>
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<td>2. Plot waveforms of acoustic and vibrational quantities.</td>
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<td>3. Calculate the period, frequency, and wavelength of a sound wave.</td>
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<td>4. Describe different forms of wave propagation.</td>
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<td>6. Compute a waveform from a mathematical representation of simple harmonic motion.</td>
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<td>7. Define three characteristics of a sine wave.</td>
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<td>8. Explain how RMS pressure is calculated.</td>
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<td>9. Explain why dB IL and dB SPL are the same and calculate dB for a variety of situations</td>
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<td>10. Explain the relation between a waveform and spectral/spectrographic representations.</td>
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<td>11. Give examples of periodic and nonperiodic sounds and describe their expected spectral representations.</td>
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<td>12. Give examples of periodic and nonperiodic sounds and describe their expected spectral representations.</td>
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<td>13. Explain and calculate conditions of resonance in waveguides.</td>
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<td>14. Graphically, show the output of low-pass, high-pass, and band-pass filters.</td>
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<td>15. Apply knowledge of filters, vibration, resonance, and spectra to explain the the source-filter theory of speech.</td>
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<td>16. Generate broad IPA transcriptions, of text and audio representations of words short phrases. Demonstrate knowledge of narrow transcription notation.</td>
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