**Acoustical Physics**

**Physics 118 Online**

**Department of Physics and Astronomy**

**Name: Office:**

**Email: Office Hours:**

**Phone:**

**Class meeting time and place:**

**Course Description**

Topics covered include waves, resonance, frequency, pitch, waveform, hearing, intervals, scales, strings, air columns, rods, plates, vocal apparatus, instruments. Computation of lecture and laboratory grades into one grade; same grade recorded for both lecture and laboratory. Corequisite: PHY 118 laboratory.

**Program Learning Outcomes**

This is a general education core curriculum course and no specific program learning outcomes for this major are addressed in this course.

**General Education Core Curriculum Objectives/Outcomes**

**CO1 - Critical Thinking Skills** - including creative thinking, innovation, inquiry, and analysis, evaluation and synthesis of information

**CO2 - Communication Skills** - including effective development, interpretation and expression of ideas through written, oral and visual communication

**CO3 - Empirical and Quantitative Skills** - including the manipulation and analysis of numerical data or observable facts resulting in informed conclusions

**CO4 - Teamwork -** including the ability to consider different points of view and to work effectively with others to support a shared purpose or goal

**Student Learning Outcomes**

The overall objectives of this course are that the learner will:

**SLO1** - Demonstrate basic familiarity with the physics of vibrating systems.

**SLO2** - Describe the concepts of auditory perception.

**SLO3** - Describe the basics of room acoustics.

**SLO4 -** Demonstrate skills developed in critical thinking, communication (written and visual), empirical and quantitative analysis, and teamwork, (SLO 4. Includes COs 1, 2, 3, 4)

**Text and Materials**

The text is *Fundamentals of Musical Acoutics*, second, revised edition by Arthur H. Benade. The readings indicated in the Course Calendar correspond to chapters from this text. PHY 118L.020, the Acoustical Physics Laboratory is a corequisite and a new edition of the lab manual is available in the bookstore.

**Course Calendar**

Each exam section of the course is 25% of class time. Introduction of the core objectives will be by readings and YouTube video segments (See the Course Calendar for times). Power point slides will also help to introduce the objectives during the labs called Human Hearing Response and Complex Waves, where the objectives are assessed. SLO 1 is a major aim of the course and is addressed throughout, but especially in section one of the course.

**Lecture Calendar**

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| |  |  |  |  | | --- | --- | --- | --- | | Week | Title | SLO | Text  Chapter | | 1 | Preliminaries to a Study of Acoustics  **Lecture and assigned readings on CO 1** | SLO 1 | **1** | | 1 | Impulsive Sounds, Alone and in Sequence **Lecture and assigned readings on CO 2** | SLO 1 | **2** | | 2 | Simple Relations of Sounds and Motions **Lecture and assigned readings on CO 3** | SLO 1 | **3** | | 2 | Characteristic Frequencies and the Decay of Composite Sounds  **Lecture and assigned readings on CO 4** | SLO 1 | **4** | | 3 | Pitch: The Simplest Implication of Characteristic Oscillations | SLO 1 | **5** | | 4 | The Modes of Oscillation of Simple and Composite Systems | SLO 1 | **6** | | **4** | **Exam 1** |  | **Date 1** | | 5 | Introduction to Vibrational Recipes | SLO 2 | **7** | | 6 | Broad and Soft Hammers and the Stiffness of Strings | SLO 2 | **8** | | 7 | The Vibrations of 2-D Surfaces | SLO 1 | **9** | | **7** | **Exam 2** |  | **Date 2** | | 8 | Sinusoidally Driven Oscillations | SLO 1 | **10** | | 9 | Room Acoustics 1 | SLO 3 | **11** | | 10 | Room Acoustics 2 | SLO 3 | **12** | | **11** | **Exam 3** |  | **Date 3** | | 11 | The Loudness of Single and Combined Sounds | SLO 2 | **13** | | 12 | The Acoustical Phenomena Governing Pitch | SLO 2 | **14** | | 13 | Successive Tones and Musical Scales | SLO 2 | **15** | | 14 | Temperaments | SLO 2 | **16** | | **15** | **Exam 4** |  | **Date 4** | |

**Lab Calendar**

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| **Week** | **Experiment** | **Due Date** |
| 2 | Simple Harmonic Motion |  |
| 3 | The Speed of Sound |  |
| 4 | Exam 1 |  |
| 5 | Standing Waves on Vibrating Strings |  |
| 6 | The Organ Pipe |  |
| 7 | Exam 2 |  |
| 7-8 | Make Your Own Wind Chimes |  |
| 9-10 | The Plumber's Pipe |  |
| 11 | Exam 3 |  |
| 12 | Human Hearing Response\*\* |  |
| 13-14 | Complex Waveforms\* |  |
| 15 | Exam 4 |  |

\* The **Complex Waves Experiment** will allow students to demonstrate their mastery of skills in **critical thinking, communications, and teamwork**. Students commonly work in teams of 4-5 in the laboratory (CO 4) and monitoring by the instructor ensures that the teams work together. Students will have read the assigned readings and have watched a YouTube video segment on **teaming, communications, and critical thinking** before the lab. The introductory Power Point presentation will include slides on the elements of **critical thinking, communications, and teaming**. The laboratory exercise examines Fourier Analysis and is in two parts: part one requires the student to understand beat frequencies as they decode the touch tone keypad of a telephone; part two requires the student to find the relative amplitudes of the first six harmonics of an tone produced by an instrument chosen by the instructor for each team. The teams will experiment with a spreadsheet written by the instructor to analyze the harmonic content of sound. At first this is probably trial-and-error, but experience soon guides the work. The students will draw conclusions based on this experience and communicate (CO 2) findings in a written report. Questions for this lab will bring the students through the steps in critical thinking required to successfully predict the harmonic frequencies (CO 1).

\*\*The **Human Hearing Response Lab** will allow students to demonstrate their mastery of their **empirical and quantitative skills**. This lab measures the hearing response of the student. Students will have read the assigned readings and have watched a YouTube video segment on **empirical and quantitative skills** before the lab. The introductory Power Point presentation will include slides on the elements of **empirical and quantitative skills**. The data collected is amplitude required to produce tones of equal loudness as frequency is changed. The student is then required to work through several calculations in order to (CO 3) in order to finally graph the results and compare to typical results.

**Course Requirements**

**Exams**

There will be four major tests each covering a limited amount of material. The exams are scheduled during the lab period since that period is already committed in the student’s schedule.

**Grading Policy**

Each major exam will be graded on a 100-point scale. No grade curving is done on any grade in this course. The lecture (75%) and lab (25%) grades will be combined into the course grade and the same grade will be recorded for both lecture and lab.

The grading scale is…

**A 90 – 100 B 80 – 89 C 70 – 79 D 60 – 69 F < 60**

**Academic Integrity (A-9.1)**

Abiding by university policy on academic integrity is a responsibility of all university faculty and students. Faculty members must promote the components of academic integrity in their instruction, and course syllabi are required to provide information about penalties for cheating and plagiarism as well as the appeal process. (Much of this information will be provided through internet links.)

**Definition of Academic Dishonesty**

Academic dishonesty includes both cheating and plagiarism. Cheating includes, but is not limited to: (1) using or attempting to use unauthorized materials to aid in achieving a better grade on a component of a class; (2) falsification or invention of any information, including citations, on an assignment; and/or (3) helping or attempting to help another in an act of cheating or plagiarism. Plagiarism is presenting the words or ideas of another person as if they were your own. Examples of plagiarism include, but are not limited to: (1) submitting an assignment as if it were one's own work when, in fact, it is at least partly the work of another; (2) submitting a work that has been purchased or otherwise obtained from the Internet or another source; and (3) incorporating the words or ideas of an author into one's paper or presentation without giving the author due credit.

Please read the complete policy and the appeals process at

<http://www.sfasu.edu/policies/academic_integrity.asp> and

<http://www.sfasu.edu/policies/academic_appeals_students.asp>

**Withheld Grades Semester Grades Policy (A-54)**

At the discretion of the instructor of record and with the approval of the academic chair/director, a grade of WH will be assigned only if the student cannot complete the course work because of unavoidable circumstances. Students must complete the work within one calendar year from the end of the semester in which they receive a WH, or the grade automatically becomes an F. If students register for the same course in future semesters, the WH will automatically become an F and will be counted as a repeated course for the purpose of computing the grade point average.

**Students with Disabilities**

To obtain disability related accommodations, alternate formats and/or auxiliary aids, students with disabilities must contact the Office of Disability Services (ODS), Human Services Building, and Room 325, 468-3004 / 468-1004 (TDD) as early as possible in the semester. Once verified, ODS will notify the course instructor and outline the accommodation and/or auxiliary aids to be provided. Failure to request services in a timely manner may delay your accommodations. This syllabus and other course materials can be made available in other formats. This course meets certain objectives of the ExCET/TEKS. A copy of the objectives and course correlations is available in the ExCET Advisor's office.

**F-1 Visa Holders**

There are important federal regulations pertaining to distance education activity for   
F-1 Visa holders. All students with an F-1 Visa should follow the instructions at the following link to make sure they are in compliance.

<http://www.oit.sfasu.edu/disted/facsup/f1visa.html>