University Of California, Berkeley
Department of Mechanical Engineering

ME 173 - Fundamentals of Acoustics [3 units]

Elective Course

Syllabus

CATALOG DESCRIPTION

Plane and spherical sound waves. Sound intensity. Propagation in tubes and horns. Resonators. Standing waves. Radiation from oscillating surface. Reciprocity. Reverberation and diffusion. Electro-acoustic loud speaker and microphone problems. Environmental and architectural acoustics. Noise measurement and control. Effects on man.

COURSE PREREQUISITES

ME 104.

TEXTBOOK(S) AND/OR OTHER REQUIRED MATERIAL

Fundamentals of Acoustics, 4th Edition, by L.E. Kinsler, A.R. Frey, A.B. Coppens and J.V. Sanders, Wiley, 2000.

COURSE OBJECTIVES

This course provides an introduction to the physics and applications of acoustics. Students should be able to express solutions to the wave equation in one dimension (linear and spherical), be able to solve basic reflection and refraction problems of wave incident on a planar interface, understand the function of the simple source as a method of describing the field produced by a dipole or finite source, and be able to analyze simple resonant acoustical systems. Students should appreciate the basic elements of psychological and architectural acoustics, and the role of musical instruments as acoustical sources.

DESIRED COURSE OUTCOMES

Students should be able to: Solve the linear wave equation in one dimension. Solve reflection and refraction problems associated with plane waves hitting a planar interface. Analyze simple resonant systems such as pipes and Helmholtz resonators. Use a simple point source to synthesize a more complex source. Recognize the essential elements of architectural acoustics in terms of reverberation time, direct echoes and acoustical amplification. Understand the spectral differences between sounds generated by different musical instruments.

TOPICS COVERED

Wave propagation in 1-dimension. Spherical wave propagation. Time and frequency domain representations of complex waveforms. Reflection and transmission through a plane interface. Cavities, resonators and waveguides. Simple and finite sources, including dipole, line and plane-piston sources. Noise, signal detection, hearing and speech. Architectural acoustics. Environmental acoustics. Musical Acoustics.

CLASS/LABORATORY SCHEDULE

Three hours of lecture per week.

CONTRIBUTION OF THE COURSE TO MEETING THE PROFESSIONAL COMPONENT

This course is primarily one in the engineering sciences, focusing on the physical aspects of acoustics and mathematical solutions of the wave equation. Students are asked to address perform a final project on an acoustical problem of their choice.

RELATIONSHIP OF THE COURSE TO ABET PROGRAM OUTCOMES

Students completing this course should have: an ability to apply knowledge of mathematics, science, and engineering; an ability to identify, formulate, and solve engineering problems; recognition of the need for, and an ability to engage in life-long learning; an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

ASSESSMENT OF STUDENT PROGRESS TOWARD COURSE OBJECTIVES

Homework. Midterm Exam. Project Report. Final Exam.

PERSON(S) WHO PREPARED THIS DESCRIPTION: **George C. Johnson** March 23, 2006