ENG ME 520 Introduction to Acoustics

ENG ME 520 Introduction to Acoustics Prereq: ENG ME 302, ENG ME 303, ENG ME 304, and ENG ME 400. Introduction to wave propagation and sound. General concepts such as quantitative measures of sound, plane waves, and acoustic energy density and intensity. Derivation of wave equation. Sound radiation from vibrating bodies. Basic ray-acoustic concepts: reflection, refraction, diffraction, and scattering of acoustic waves. Other topics may include flow-induced sound, Helmholtz resonators, sound transmission through ducts and mufflers, room acoustics, and absorption and attenuation of sound waves in fluids. 4 cr.

Class/Lab Schedule:
M/W 4-6pm

Status in the Curriculum: (List here Required or Elective)
Elective

Textbook(s) and/or Other Required Material:
A.D. Pierce, Acoustics:An Introdution to Its Physical Principle and Applications, (ASA-AIP, 1994).
D.T. Blackstock, Fundamentals of Physical Acoustics, (Wiley 2000).

Reference:
Kinsler, Frey, Coppens and Sanders, Fundamentals of Acoustics, (Wiley).

Coordinator: Robin Cleveland, Associate Professor, Mechanical Engineering

Prerequisites by topic:
ENG ME 303 (Fluid Mechanics), ENG ME 304 (Energy and Thermodynamics), and ENG ME 400 (Engineering Math)

Goals:
1.Achieve a fundamental understanding of propagation of acoustic waves through one-dimension analysis.
2. Calculate pressure levels for propagation in the presence of interfaces, stratified media and absorption.

Course Learning Outcomes:

As an outcome of completing this course, students will:

A/ Understand propagation of one-dimensional waves.
B/ Express sound waves in terms of quantitative metrics
C/ Derive the wave equation from basic fluid dynamics.

D/ Understand the transmission and reflection of sound waves from planar interfaces and layered media
E / Calculate normal modes for wave in Cartesian co-ordinate (strings, membranes and rooms)
F / Understand sound propagation in stratified media (ocean and the atmosphere)
G/ Understand how absorption and dispersion impact sound propagation in 1D.

Course Learning Outcomes mapped to Program Outcomes:

Program:	a	b	c	d	e	f	g	h	i	j	k
Course:	A, C, D,E,F,G	F	B,D,E		A,C,D,E,F,G	B	A-G		B,G		D,E,F,G
Emphasis:	5	2	2	1	5	2	2	1	2	1	5

Topics (time spent in weeks):

Wave Equation Derivation	1 week
D'Alembert's Solution	1 week
Measurement Metrics	1 week
Transmission and Reflection: Normal Incidence	2 weeks
Transmission and Reflection: Oblique Incidence	1.5 weeks
Normal Modes	2 weeks
Sound sources and Horns	1.5 weeks
Propagation in Stratified Media	1.5 weeks
Absorption and Dispersion	1.5 weeks
In-class tests	1 week