ENG ME 520 Introduction to Acoustics

2008-2009 Catalog Data:

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: Two 2 hour lectures per week

Status in the Curriculum: Elective

Textbook(s) and/or Other Required Material: A.D. Pierce, "Acoustics: An Introduction 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:

- 1. Fluid Mechanics
- 2. Energy and Thermodynamics
- 3. Engineering Math

Goals:

1. Achieve a fundamental understanding of propagation of acoustic waves through onedimension 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:

i. Understand propagation of one-dimensional waves.

ii. Express sound waves in terms of quantitative metrics

iii. Derive the wave equation from basic fluid dynamics.

iv. Understand the transmission and reflection of sound waves from planar interfaces and layered media

v. Calculate normal modes for wave in Cartesian co-ordinate (strings, membranes and rooms)

vi. Understand sound propagation in stratified media (ocean and the atmosphere)

vii. Understand how absorption and dispersion impact sound propagation in 1D.

Program:	Α	В	С	D	Е	F	G	Н	Ι	J	K	L	М	Ν
Course:	i, iii, iv-vii	vi	ii,i v v		i,iii,iv -vii	ii	i- vii		ii,vii		iv,v, vi vii			
Emphasis:	5	2	2	1	5	2	2	1	2	1	5	1	1	1

Course Learning Outcomes mapped to Program Outcomes:

Topics (time spent in weeks):

- 1. Wave Equation Derivation (1)
- 2. D'Alembert's Solution (1)
- 3. Measurement Metrics (1)
- 4. Transmission and Reflection: Normal Incidence (2)
- 5. Transmission and Reflection: Oblique Incidence (1.5)
- 6. Normal Modes (2)
- 7. Sound sources and Horns (1.5)
- 8. Propagation in Stratified Media (1.5)
- 9. Absorption and Dispersion (1.5)
- 10. In-class tests (1)

Contribution of Course to Meeting the Professional Component:

Engineering topics: 100%

Status of Continuous Improvement Review of this Course:

Prepared by: Robin Cleveland Date: 3/30/2009