AUBURN UNIVERSITY
SAMUEL GINN
COLLEGE OF ENGINEERING
AEROSPACE

Fundamentals of Aeroacoustics

AERO 4970/7970 **Course Outline** **Spring Semester 2014**

Lecturer: Joseph C. (Joe) Majdalani, Ph.D.
Lecture Location: Davis 215
Lecture Times: 11:00am-12:15pm TR
Office Hours: 10-11am, TR, Davis 211

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Grader: TBD
Textbook: Notes

References:

1. Temkin, Samuel, *Elements of Acoustics*, Wiley, 1981.
2. Pierce, Allan D., *Acoustics: An Introduction to its Physical Principles and Applications*, McGraw, 1981.
3. Lord, H., Gatley, W. S. and Evensen, H.A., *Noise Control for Engineers*, McGraw, 1980.
4. Diehl, G. M., *Machinery Acoustics*, Wiley, 1973.

Objectives: The purpose of this course is to provide a broad coverage of the fundamentals of the theory and measurement of acoustics and noise control encompassing the production of sound from vibrations and waves, acoustical devices, sound in enclosed spaces, architectural/room acoustics, etc.

Grading and Exams:

Homework	40%
Two 1-hour examinations	30%
One 2-hour final examination*	30%
Total	100%

Topics: One dimensional wave equation: modal solution (separation of variables) and traveling wave solutions (D'Alembert's solution). Concepts of work, power, energy density and intensity for harmonic plane and spherical waves; acoustical impedance in near and far fields. Introduction to aeroacoustics: monopoles, dipoles, quadropoles, subsonic and supersonic flows, doppler effect, pressure, velocity and intensity fields; Lighthill's theory. Frequency spectra: periodicity, Fourier series, Fourier integrals and the discrete Fourier transform. Acoustics of enclosures: absorption, reflection and transmission of sound; sound levels in rooms, reverberation rooms and anechoic chambers.

* A higher score on the final exam replaces one of the two 1-hour exams.

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Unit	Subject
1	Introduction
2	Math - Complex numbers
3	Wave equation
4	Plane waves
5	Plane waves
6	Fourier analysis
7	Fourier analysis
8	Acoustic energy
9	Decibel Scales
10	The ear and human hearing
11	Reflection
12	Reflection
13	Transmission
14	Transmission
15	Variable area
16	Exam I
17	Spherical waves
18	Spherical waves
19	Simple sources
20	Simple sources
21	Other sources
22	Piston sources
23	Forces and dipoles
24	Quadrupoles
25	Room acoustics
26	Room acoustics
27	Room acoustics
28	Room acoustics
29	Semireverberant fields
30	Semireverberant fields
31	Noise control approaches
32	Exam II
33	Noise standards
34	Community noise
35	Aircraft noise
36	Traffic noise
37	Indoor noise
38	Materials
39	Review
40	Final Exam: To be determined in May