ME 424 COURSE PROFILE

DEGREE PROGRAM: Mechanical Engineering

COURSE NUMBER: ME 424	**COURSE TITLE:** Engineering Acoustics
REQUIRED COURSE OR ELECTIVE COURSE: Elective	**TERMS OFFERED:** Fall
TEXTBOOK / REQUIRED MATERIAL: Fundamentals of Acoustics by Kinsler & Frey, 4th ed.	**PRE / CO-REQUISITES:** Math 216, Physics 240. I (3 credits)
COGNIZANT FACULTY: K. Grosh **BULLETIN DESCRIPTION:** Vibrating systems; acoustic wave equation; plane and spherical waves in fluid media; reflection and transmission at interfaces; propagation in lossy media; radiation and reception of acoustic waves; pipes, cavities, and waveguides; resonators and filters; noise; selected topics in physiological, environmental, and architectural acoustics.	**COURSE TOPICS:** 1. One degree-of-freedom forced-damped oscillations 2. Acoustic wave equation 3. Decibels 4. Plane and spherical waves 5. Reflection and transmission at interfaces 6. Propagation in real fluids 7. Acoustic radiation from vibrating surfaces 8. Pipes, cavities, and wave guides 9. Resonators and filters
COURSE STRUCTURE/SCHEDULE: Lecture: 2 days per week at 1.5 hours	

COURSE OBJECTIVES: for each course objective, links to the Program Outcomes are identified in brackets.	1. To make students familiar with fundamental acoustic analysis tools and principles: complex exponentials, frequency, amplitude, phase, impedances, acoustic power, decibels [1, 2, 6] 2. To teach how the acoustic wave equation is obtained from established conservation laws [1, 2, 6] 3. To teach the use of the one-dimensional time-harmonic solutions of the wave equation [1, 2] 4. To present the phenomena of acoustic absorption [1, 2] 5. To teach how to analyze simple problems involving material interfaces [1, 2] 6. To introduce the fundamental relationships between acoustic sources and acoustic radiation [1, 2, 6] 7. To teach how enclosed sound waves behave in a variety of ducts and enclosures [1, 2] 8. To teach simple acoustic experimental techniques and the use of human hearing as an engineering tool [1, 4, 6]
COURSE OUTCOMES: for each course outcome, links to the Course Objectives are identified in brackets.	1. Recognize and use complex exponentials to describe acoustic waves [1, 2, 3] 2. Convert between engineering units and decibels [1, 2, 6] 3. Given the angle of incidence and material properties, determine acoustic transmission and reflection coefficients, and the transmission loss in dB [1, 2, 5, 6] 4. Given the acoustic absorption, intended propagation distance, and minimum dB level, determine the necessary sound power for an omnidirectional acoustic source operating in an absorbing fluid [2, 4, 6]. 5. Given a few simple sources, determine the far-field acoustic radiation [1, 2, 6] 6. Given the diaphragm size, acoustic frequency, and acoustical properties of the fluid, determine the far-field amplitude and phase of the sound radiated by a uniformly vibrating baffled circular piston [1, 2, 5] 7. Given the necessary impedance(s) and the geometry, determine the resonant frequencies of a pipe or a simple pipe system [1, 2] 8. Given the geometry, determine the Helmholtz frequency of a cavity [1,2,6, 7] 9. Use a sound pressure level meter to measure acoustical impedance, and hear the difference between frequencies and sound pressure levels. [1, 2, 6, 8]
ASSESSMENT TOOLS: for each assessment tool, links to the course outcomes are identified	1. Regular homework problems [1-9] 2. Exam(s) and/or project(s) [1-9]

PREPARED BY: K. Grosh
LAST UPDATED: 05/11/2023 – K. Oldham