The Pennsylvania State University
Department of Mechanical Engineering
ME 597 - Engineering Acoustics

Instructor: Prof. Ryan L. Harne. Email: ryanharne@psu.edu. Office: 336 Reber Building.
Office Hours: Held by the Zoom feed: https://psu.zoom.us/my/ryanharne. Wed 10am to 12pm, or by appt.
Class Times: Students watch online videos before each lecture (see **Course Delivery**). The online videos for each lecture will typically be less than 30 minutes in total length. Lectures are MWF 2:30pm to 3:20pm. **In Spring 2021, the lecture components will be held in Zoom**.

Learning Objectives: By completing this course, students will be able to
1. Understand concepts of acoustic system analysis and design.
2. Understand sound wave propagation, including radiation, absorption, and transmission, and understand human perception of these behaviors.
3. Apply acoustics problem solving methods for diverse engineering applications.

Course Delivery:
This course is delivered through **online video** and **lecture** components. The lecture components are also recorded. **In Spring 2021, the lecture components will be held in Zoom**. Prior to viewing or participating in lecture components of the course, a sequence of short online videos should be viewed by all students. After watching the online videos, students are requested to send to the instructor via Canvas topical questions, problem or example recommendations, and general feedback to be addressed by the instructor during lecture components.

Online Videos: The online videos present course content and basic examples of technical principles.

Lectures: The lectures address student-submitted requests and feedback, provide detailed examples and problem solution methods, and elaborate on course subject matter.

Course Materials:
The course materials consist of **slides** and **course notes**, which are maintained on the course website.

Slides: The slides are completed during the online video portions of the course, filling in details of the essential technical principles. Slides will also be recorded from the lectures and provided shortly after each lecture on ther course website.

Course Notes: The Course Notes are a miniature textbook customized for this course. The Course Notes are help as a resource to complete homework, fulfill project activities, and to direct attention to additional references for acoustics subject matter.

Course Website:
The course website will be hosted on the university Canvas system. All course resources and materials will be maintained at the website. Student homework and project activity files will be submitted through the course website. A forum will be available on the course website to be utilized by the students and instructor to comment on homework solutions, application questions, and other acoustics subject matter.

Course Graded Elements and Grades:
The graded elements of the course include **Participation** (10%), **Homework** (15%), and **Projects** (75%).

Participation: The course website will contain a forum for discussion of course and subject matter. Student participation in forum conversations will be evaluated to encourage community engagement.

Homework: There will be 7 homework assignments over the course duration. Students will submit their homework submissions as a PDF document to the course website by the submission deadlines.

Projects: Three projects will be assigned pertaining to engineering noise control, medical ultrasonics, and architectural acoustics. The projects will involve data collection using phone-based apps, data post-processing, and/or model simulation to begin, followed by reporting and assessment via slides and a summary video.

Course Outline:
A tentative outline for the course is as follows.

Week	Topic	Submissions Due
1	Wave propagation phenomena. Fundamental audiology. Hearing loss.	
2	Wave equation introduction. Harmonic waves. Spherical waves. Sound levels.	Homework 1
3	Impedance. Wave types. Barriers. Acoustic instrumentation.	Homework 2
4	Frequency bands and weighting. Sound level meters. Source-path-receiver noise control.	
5	Acoustic sources, combinations, and characteristics.	Project 1
6	Acoustic arrays. Wave focusing. Geometric acoustics. Medical ultrasonics.	Homework 3
7	Method of images. Wave transmission through layers.	Homework 4
8	Oblique incidence transmission. Snell's law. Evanescent waves. Periodic media.	
9	Transient room acoustics. Sound transmission through partitions.	Project 2
10	Sound transmission through flexible structures. Transmission through panels.	Homework 5
11	STC, IIC, SIL, NC.	Homework 6
12	NIHL. Occupational noise and regulation. Environment noise risks. Hearing protection.	
13	Mechanisms of binaural hearing. Masking phenomena.	Project 3
14	Binaural recordings. Augmented reality.	Homework 7