ACS 597: Noise Control Applications
Spring 2025 Syllabus

From Advising at Penn State: "Students are responsible for knowing the information provided on a syllabus. In essence, it is a contract between the instructor and the student."

Instructor

Tyler Dare, Ph. D., INCE Bd. Cert.
Associate Research Professor
tpd10@psu.edu

Learning objectives

At the end of this course students will be able to:

- Design muffler and silencer systems
- Design acoustic enclosures
- Design vibration isolation systems
- Develop and exercise models for mechanical and electrical machinery noise generation
- Develop strategies for assessing and mitigating noise from rotating machinery

Course format

The course is presented as five modules. Each module lasts approximately three weeks (five or six lectures). The modules may be changed based on the instructor and students' interests. Tentative modules are:

Ducts, mufflers, and silencers

This module will expand on knowledge of pipe and duct acoustics and introduce lumped element and 4-pole solution methods for pipe/duct systems with applications in exhaust and HVAC. These methods will be used to discuss muffler and silencer elements such as liners, plenums, diffusers, expansion chambers, perforated pipes, and other elements. In addition, concepts such as pressure drop, flow noise, break-in noise, and break-out noise will be discussed.

Acoustic enclosures

This module will discuss large and small acoustic enclosures and how to specify types and sizes of enclosures to meet acoustic specifications. Topics may include panel transmission loss, absorption vs. blocking, enclosure openings, and mounting.

Vibration control

This module will discuss advanced vibration transmission through structures and control techniques. Topics may include multi-stage base isolation, tuned mass dampers, free layer damping, constrained layer damping, shock isolation, rotating imbalance, and shaft balancing.

Acoustic sources

This module will focus on mechanical and electrical noise sources and discuss models for predicting frequencies and levels of sound emitted. Sources that may be discussed include fans and propellors, compressors, pumps, jets, fluid flow, valves, engines, generators, gears, bearings, belts, chain drives, electric motors, power supplies, and transformers.

Rotating machinery

This module will focus on methods assessing and mitigating noise from rotating machinery, with special emphasis on propellers, tires, and their associated power trains.

Schedule and attendance

211 Hallowell Bldg
Mondays and Wednesdays
1:00 PM – 2:15 PM

Resident students are expected to attend in-person unless approved in writing in advance. Distance Education students may join via Zoom or may watch class recordings asynchronously.

There will be class periods where I am unavailable due to work travel or weather cancellations. Those class periods may be substituted by asynchronous video lectures, synchronous online lectures, or in-person make-up lectures on Fridays.

Office hours

Office hours are 1:00 PM – 2:00 PM on Fridays via Zoom or by appointment. Evening appointments are available for Distance Education students.

Grading

Each module is self-contained, worth 20% of the semester grade (20 points). There is one homework assignment per module, due soon after the end of the module. Homework submissions will be assessed based on technical accuracy and presentation. There are no mid-semester or final exams.

All work should be individual work. Study groups are encouraged but each person must do their own work.

Homework submission format

Homework submissions should generally follow the format of a technical report, with steps typed neatly. Equations, tables, and figures should be numbered and referred to in the text. Imagine you are writing an official solution guide to these problems that will be published in a textbook.

- Submissions should be a single PDF document. Do not submit MATLAB live scripts or Jupyter notebooks.
- It is not necessary to re-produce the problem statements. Instead, briefly restate the problem in your own words as an introduction to your solution.
- Important equations shoudl be written out and referenced. Reference class notes by lecture and slide number.

- Important code should be included as an appendix, but it is not necessary to submit every line of code you used to produce the results.

Late homework submissions

Please make every effort to turn in homework on time. One assignment may be turned in up to one week late without penalty. Before the original due date, put a comment in the Canvas submission saying you are using your late submission for the semester. Any additional late submissions will receive a 10% per day (2 points) penalty. Submissions must be substantially complete (if not completely correct). Incomplete submissions are not allowed to be resubmitted for additional credit (see below).

Homework resubmission

After receiving your grade and feedback for an assignment, you have up to one week to correct any issues and resubmit for additional credit. You may recover up to half of the points lost. For example, if your originally submission scored 14 points, your maximum score upon resubmission is 17 points. To qualify for resubmission, your original submission must have been substantially complete. That is, you cannot turn in half of the assignment on the original due date and then the second half as a "resubmission."

Resubmissions for the final assignment of the semester may be due earlier to allow for timely submission of final grades by the instructor.

Course grades

Letter grades for the course will be assigned based on total points:

Grade	Points
A	93–100
A-	90–92
B+	87-89
B	83–86
B-	80–82
C+	77-79
C	70–76
D	60–69
F	0–59

Course materials

There are no required course materials. All necessary materials will be provided by the instructor. However, the following references are strongly encouraged for anyone with an

interest in noise control:

- Bies, Hansen, Howard, and Hansen, *Engineering Noise Control, Fifth or Sixth Edition.*
  - A comprehensive noise control textbook that blends theory and practice.
  - Available as a paperback for relatively little cost.
  - See www.causalsystems.com for errata and sample problems.
- Hansen and Hansen, *Noise Control From Concept to Application, Second Edition.*
  - A companion to the above textbook with many example problems and solutions.

Additional references may be recommended at the beginning of each module.

Prerequisites

This course does not have prerequisites, However, is intended to generally be taken after ACS 537, Noise Control Engineering. Students with industry or acoustical consulting backgrounds can be successful in this course if they have not taken ACS 537.

Course recordings

Video and audio recordings of class lectures will be part of the classroom activity. The video and audio recording is used for educational use/purposes and only may be made available to all students presently enrolled in the class. For purposes where the recordings will be used in future class session/lectures, any type of identifying information will be adequately removed.

Changes to the syllabus

This syllabus is subject to change by the instructor. Any changes will be provided in writing.

Academic integrity

Academic integrity is the pursuit of scholarly activity in an open, honest, and responsible manner. Academic integrity is a basic guiding principle for all academic activity at The Pennsylvania State University, and all members of the University community are expected to act in accordance with this principle.

According to Penn State policy G-9: Academic Integrity, an academic integrity violation is "an intentional, unintentional, or attempted violation of course or assessment policies to gain an academic advantage or to advantage or disadvantage another student academically." Unless your instructor tells you otherwise, you must complete all course work entirely on your own, using only sources that have been permitted by your instructor, and you may not assist other students with papers, quizzes, exams, or other assessments. If your instructor allows you to use ideas, images, or word phrases created by another person (e.g., from Course Hero or Chegg) or by generative technology, such as ChatGPT, you must identify their source. You may not submit false or fabricated information, use the same academic work for credit in multiple courses, or share instructional content. Please be aware that Turnitin may be utilized as a plagiarism detection tool in this course. Students with questions about academic integrity should ask their instructor before submitting work.

Students facing allegations of academic misconduct may not drop/withdraw from the affected course unless they are cleared of wrongdoing (see G-9: Academic Integrity). Attempted drops will be prevented or reversed, and students will be expected to complete course work and meet course deadlines. Students who are found responsible for academic integrity violations face academic outcomes, which can be severe, and put themselves at jeopardy for other outcomes which may include ineligibility for Dean's List, pass/fail elections, and grade forgiveness. Students may also face consequences from their home/major program and/or The Schreyer Honors College.

See also the Penn State academic integrity resources at https://integrity.psu.edu/academic-integrity.

Disability access

Penn State welcomes students with disabilities into the University's educational programs. Penn State values diversity and inclusion; we are committed to a climate of mutual respect and full participation. Our goal is to create environments that are usable, equitable, inclusive, and welcoming. Every Penn State campus has a Student Disability Resources (SDR) office. SDR at Penn State University Park is located in the 116 Boucke Building.

To receive consideration for academic accommodations, auxiliary aids, and/or services, please contact SDR. SDR will engage students in an individualized, interactive, and confidential process to review requests on a case-by-case basis. For more information, please

visit the SDR website at https://equity.psu.edu/offices/student-disability-resources or call 814-863-1807.

Counseling & psychological services

Success in college depends heavily on your personal health and wellbeing. Please recognize that some stress and anxiety is an expected part of life and the college experience, which can be compounded by unexpected setbacks or life changes outside the classroom. Penn State Harrisburg has a number of support options listed in this syllabus. If you are experiencing issues that feel unmanageable, you reach the point that you have difficulty concentrating and/or feeling motivated, or experience anxiety or depression that interferes with your ability to take care of yourself or your daily responsibilities, please consider talking with someone in our CAPS (Counseling and Psychological Services) office. CAPS provides a range of services to help you navigate issues that are impacting your ability to be healthy, well, and productive at college.

You can learn more about the confidential mental health services available on campus at CAPS by visiting the https://studentaffairs.psu.edu/counseling or by calling 814-863-0395 Monday through Friday 8:00 AM – 5:00 PM. You can speak to an available counselor 24/7/365 any time by calling 1-877-229-6400 or by texting "LIONS" to 741741.

Educational equity

Penn State takes great pride in fostering a diverse and inclusive environment for students, faculty, and staff. Acts of intolerance, discrimination, harassment, and/or incivility due to age, ancestry, color, disability, gender, national origin, race, religious belief, sexual orientation, or veteran status are not tolerated and can be reported through Educational Equity at the Report Bias site: https://equity.psu.edu/reportbias. Penn State's Code of Conduct can be found at the following link: https://studentaffairs.psu.edu/support-safety-conduct/student-conduct/code-conduct.

Direct all inquiries regarding the nondiscrimination policy to Student Diversity, Equity, and Inclusion at 717-948-6180.

Mandated reporting

Penn State is committed to equal access to programs, facilities, admission, and employment for all persons. It is the policy of the University to maintain an environment free of harassment and free of discrimination against any person because of age, race, color, ancestry, national origin, religion, creed, service in the uniformed services (as defined in state and federal law), veteran status, sex, sexual orientation, marital or family status, pregnancy, pregnancy-related conditions, or physical or mental disability, gender, perceived gender,

gender identity, gender expression, genetic information or political ideas. Discriminatory conduct and harassment, as well as sexual misconduct and relationship violence, violates the dignity of individuals, impedes the realization of the University's educational mission, and will not be tolerated. Gender-based and sexual harassment, including sexual violence, are forms of gender discrimination in that they deny or limit an individual's ability to participate in or benefit from University programs or activities. For reporting resources, and support, please visit Penn State's Title IX website.

Penn State strongly encourages all members of the campus community to take appropriate action by providing support and encouraging those impacted by such incidents to submit a report. If the University Title IX staff receives information about an incident, they will reach out to offer information about resources, rights, and procedural options available to you.