Course Syllabus for ME4760/ AE4760, **Engineering Acoustics and Noise Control**, Fall 2025

Instructor: Costas Arvanitis
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Office and Office Hours: 4100Q MoSE Building; Wednesday: 4-5 pm. I will also be available on Zoom (the link can be found on CANVAS:)

Meeting times: Tuesday and Thursday, 3:30 pm - 4:45 pm, Skiles 270.

Course Overview: The goal of this course is to introduce to the students the fundamental principles governing the generation, propagation, reflection, and transmission of sound waves in fluids. The course will also explore concepts related to noise and its control, instrumentation, data processing, room acoustics, noise control, and hearing. The course will support the students to apply these concepts to solve a range of problems of acoustics in engineering.

Course Outcomes: Outcome 1: The students will acquire expertise in fundamental principles of Acoustics along with key concepts related to noise and its control.

Outcome 2: The students will be able to identify and formulate advanced problems in Acoustics and apply knowledge of mathematics and science to solve problems of acoustics in engineering.

Outcome 3: The students will be able to communicate effectively, both orally and in written form, the fundamental principles governing the generation, propagation, reflection, and transmission of sound waves in fluids.

Prerequisites: Math (complex numbers, linear differential equations), Physics (traveling waves).

Textbooks:
1. Randall F. Barron, Industrial Noise Control and Acoustics, CRC Press, 2003
2. Kinsler et al., Fundamentals of Acoustics 4^{th} Ed., Wiley, New York, 2000

Topics covered: We will cover the following topics in the order listed (Textbook 1 chapters)

- Introduction to acoustics and noise control (Ch. 1)
- 1D wave equation and plane waves (Ch. 2)
- Calculation of acoustic quantities (Ch. 3)
- Transmission and Reflection of plane waves (Ch. 4)
- Noise control in ducts and pipes (Ch. 8)
- 3D wave equation and spherical waves (Ch. 4)
- Dissipation and attenuation of waves (Ch. 4)
- Acoustics of cavities and rooms (Ch. 7)
- Human hearing (Ch. 6)
- Frequency analysis, noise metrics, and acoustic measurements (Ch. 6)

Course Schedule: The following table lists all the topics covered in ME/AE4760 along with a tentative schedule of the classes, problem-solving studios (PSS), assignments (Ass.), midterm exams, and project.

Week	Date	Class	Topic	Assignments
1	8/19	Lecture 01	Course Overview	
	8/21	Lecture 02	1D wave equation, Harmonic solutions	
2	8/26	Lecture 03	Particle velocity, Impedance, Speed of Sound	A1 posted
	8/28	Lecture 04	Intensity, dB scale	
3	9/2	PSS 01	Problems on Wave Equation, Particle Velocity, etc.	
	9/4	Lecture 05	Reflection and Transmission (fluid - fluid)	A1 due
4	9/9	Lecture 06	Transmission and Reflection in Oblique Angle	A2 posted
	9/11	Lecture 07	Fluid layer special cases, change in cross-section area	
5	9/16	PSS 02	Problems on Rx/Tx	
	9/18	No Class	Instructor out of town	
6	9/23	No Class	Instructor out of town	A2 due
	9/25	Lecture 08	Expansion chamber muffler and Helmholtz Resonator	A3 posted
7	09/30	Lecture 09	Noise control and Review Midterm Exam 1	
	10/2	**Exam**	**Midterm Exam 1** (to be held in the classroom)	
8	10/7	No Class	Fall break	A3 due
	10/9	Lecture 10	3D wave equation, spherical wave solution	A4 posted
9	10/14	Lecture 11	Spherical waves intensity, power, and directivity	
	10/16	Lecture 12	Scattering from sphere	
10	10/21	PSS 03	Problems on point sources	A4 due
	10/23	Lecture 13	Wave eq. with dissipation, attenuation coefficient	A5 posted
11	10/28	Lecture 14	Standing wave in tube	
	10/30	PSS 04	Standing wave in rectangular cavities	
12	11/4	Lecture 15	Problems on waveguides and cavities	A5 due
	11/6	Lecture 16	Reverberation	
13	11/11	**Exam**	**Midterm Exam 2** (to be held in the classroom)	Project post.
	11/13	Lecture 17	Transmission through solid walls	
14	11/18	Lecture 18	Human hearing: physiology and anatomy	
	11/20	Lecture 19	Human hearing: impairment, diagnosis and protection	
15	11/25	Lecture 21	Acoustic Measurements	Project is due
	11/27	No class	Thanksgiving	
16	12/2	Lecture 20	Frequency analysis	

Important dates:

Tuesday, Aug 19: First day of class.

Tuesday, Sept 2: Deadline for Verification of Participation.

Oct 15 and 16: Fall Break (No classes, assignments, or assessments).

Saturday, Oct 25: Deadline to Withdraw from Individual Courses with 'W'.

Nov 27-29: Thanksgiving Break, Official School Holiday.

Dec 2: Final Instructional Day.

Course Website: Available to class participants: https://gatech.instructure.com/courses/468266. The instructor will upload assignments, solutions, and other material on CANVAS, and will regularly post announcements. Please check the site frequently for updated information.

Tools: We will be using Turning Point Technology for quizzes during the class (log in using your GaTech email; Session ID: **a6760**).

We will also use Piazza for class discussions. The system will be highly catered to getting help fast and efficiently from classmates and the instructor. Rather than emailing questions to the teaching staff, I encourage you to post your questions on Piazza. I also encourage you to respond to the questions of other students. When students help each other, piazza becomes very efficient and useful.

PSS: There will be 3-4 Problem-Solving Studios (PSS) with problems to facilitate deeper understanding of the "big ideas" of the course. This is a group activity that will also provide opportunities for peer-to-peer learning, work collaboratively, and interaction with the instructor. Depending on the final enrolment for the class each group will be composed of 2-3 students. Each team will have at least one student from the ME and one from the AE programs. By the end of the day (not class) the students must grade the effort of their teammates and answer the question(s) posted at the last page of the PSS.

Assignments: There will be 5-6 Assignments. You should expect one assignment every 2-3 weeks; it will be related to topics discussed in the class.

Final Project: The objective of the Final Project is to help you develop critical reading and quantitative analysis skills and help you to assess the concept, theory, and data presented in a scientific article in the field of Acoustics. To help you develop these skills as well as understand what is needed on the final project, a smaller project with the same structure will be provided in the form of an assignment during the term.

Grading: Failure is not part of your grades; in fact, the class is designed for you to fail and most importantly bounce back after receiving feedback from everybody in the class. However, lack of effort and engagement will most likely find its way to your grades. The points associated with each graded event are shown below. Consider the following numbers as a plan subject to change if necessary.

PSS (4%)	This grade will be based on peer evaluation at the end of the class. PSS: Problem Solving Studios
Assignments (26%)	Assigned every other week, 5 assignments.
Midterm 1 (35%)	Date: Monday October 2 (tentative); during normal lecture time.
Midterm 2 (35%)	Date: Monday November 11 (tentative); during normal lecture time.
Final Project (35%)	Due online by Friday. Nov. 25th

Your final grade will be assigned according to the accumulated score, using the best grade out of the following two: Midterm 1, 2 and final project.

A ("Excellent"):	≥ 90%
B ("Good"):	≥ 80%
C ("Satisfactory"):	≥ 70%
D ("Passing"):	≥ 60%
F ("Fail"):	< 60%

Course Policies:

- **Exams and Exam materials:** Make-up exams will not be given. Written re-grading requests are accepted up to a week after exams are returned. Exam materials include textbook, dictionary, calculator, class notes, and electronic notes.
- **Assignment Submission:** Assignments will be due at the time and date specified on CANVAS. Each student is allowed five late days. These can be used singularly or in any combination. For example, all five assignments can be handed in one day late each, or one assignment can be handed in five days late, or any other combination. After that point, the normal late penalty is 30% of the assigned points per day late after the due date. After 2 days, the homework will no longer be accepted, and you will receive 0. For extenuating circumstances (e.g., hospitalization), please contact me as soon as possible to coordinate late submission. In this case, upon approval, you will not incur a late penalty.
- **Extra credit:** No extra credit will be provided. The ability to use the best grade out of the two: Midterm 1, 2 and final project should allow you to make up for missed assignments or poor performance on exams.
- **Notes**: The Lecture slides will be posted on CANVAS the day before the class. Lecture notes will not be provided to individual students but may be provided to the entire class at the discretion of the instructor.
- **Collaboration:** Intellectual collaboration on the Assignments is encouraged and will be cultivated through PSS. Outright copying is not. The honor code will be in effect for this course.

Student-Faculty Expectations: At Georgia Tech we believe that it is important to continually strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. See https://catalog.gatech.edu/rules/21/ for an articulation of some basic expectations – that you can have of us, and that we have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech, while in this class.

Artificial Intelligence: The students may not use GenAI for class activities. See also Georgia Tech's guidance for use of AI in this link.

Individuals with Special Needs: If you are a student with learning needs that require special accommodation, contact the Office of Disability Services (often referred to as ADAPTS) at (404)894-2563 or http://disabilityservices.gatech.edu/, as soon as possible, to make an appointment to discuss your special needs and to obtain an accommodations letter. Also, please e-mail me as soon as possible to set up a time to discuss your learning needs.

Mental Health Care & Resources: The Center for Mental Health Care and Resources (CMHCR) is the best place to engage with mental health care at GT. They are found in the Smithgall Student Services Building and can also be reached at **404-894-2575**. Their normal hours of operation are 8am to 5pm Monday through Friday. CMHCR can connect you with services including individual or group counseling, academic or personal support services, assessment and testing for learning disabilities, and other mental health providers. They can help you find the right resources for a crisis, an acute issue, or a longer-term concern.

Crisis Services: If you require immediate support for mental health difficulties you have several options: During business hours (8 a.m.-5 p.m.). Call **404-894-2575** or go to Suite 238 in the Smithgall Student Services Building. Outside of business hours, call **404-894-2575** and select the option for the after-hours counselor. In an emergency, call Georgia Tech Campus Police at **404-894-2500** on campus or **911**.