Georgia Institute of Technology
G. W. Woodruff School of Mechanical Engineering
At Georgia Tech Europe
Fall term, 2025
Syllabus date 2025-06-04
ME6760/AE6760 Acoustics I

1. **Instructor:** **Prof. Dr. Nico F. DECLERCQ**
   Email: Declercq@gatech.edu

   Availability: After class + Open door policy (it may be useful to make an appointment by email however, Office: GTE 224).

2. **Course objectives:** The goal of this course is to expose students to an in-depth understanding of the fundamental principles governing the generation, propagation, reflection, and transmission of sound waves in fluids.

3. Textbooks with adequate information (Certainly useful for the final project, class notes however are sufficient to study for quizzes and exams):
-L. Kinsler, A. Frey, A. Coppens, and J. Sanders, Fundamentals of Acoustics, 4th edition, Wiley, New York, 2000.
-David T. Blackstock, Fundamentals of Physical Acoustics, Wiley, New York, 2000.
- Often work is included from other sources. All information will appear on the white board however.

Other useful references:

Allan D. Pierce, *Acoustics: Introduction to Physical Principles and Applications*, 1st Edition, Springer-Verlag, 1989 (an Acoustical Society publication).

Lord Rayleigh, (J. W. Strutt), The Theory of Sound, Vol. 1 and Vol. 2., Dover Collection, New York, 1945. *[The ultimate reference book in Acoustics!]*

P. M. Morse, Vibration and Sound, published by the American Institute of Physics for the Acoustical Society of America, 1976. [Original edition 1936].

Acoustical Society of America: http://asa.aip.org/
See information about books, education, fellowships, membership, meetings, etc…

3. **Contents:**

- Fundamentals
- Governing equations
- Sound speed
- Energy, intensity
- Coherent and incoherent sound sources
- Acoustic power

- Plane, inhomogeneous, spherical sound waves
- Spectral analysis, decibels, frequency weighting
- Reflection and Transmission of sound waves
- Acoustic impedance
- Reflection/transmission between two fluids
- Reflection at an impedance boundary
- Standing wave tube
- Radiation from a vibrating infinite plate
- Transmission through a wall, a layer
- Ideal sources
- Pulsating sphere, translating sphere
- Monopoles, dipoles, quadrupoles, multipole expansions

This list is subject to changes during the semester, which is why you will regularly receive a list of covered topics, which will help you to study this course.

4. **REQUIRED SILENCE IN CLASS** : Class participation (being present, paying attention, asking questions, …) is perfect. What is not OK is "noise." You all pay tuition and should not be disturbed by others. Therefore, be quiet so that your classmates can listen to their teacher without being distracted.

5. **GT Academic Honor Code**

Students are required to follow the Georgia Tech honor code which may be found at: http://osi.gatech.edu/content/honor-code
Students are allowed to collaborate on out of class assignments but must include specific attribution to any help they received. Work turned in must be your own work not copied from anywhere else (including solution manuals) and you must state what type of assistance you received while completing the assignment.

6. **CANVAS**

Your instructor uses CANVAS to send you messages and your results of homeworks and quizzes. Note: if canvas estimates your final mark you need to ignore it because to calculate the final mark you need to use the proper weights as given in this syllabus

7. **Attendance** at lectures is required.

8. **Tasks and Grading weights:**

There will be no final exam. Instead, there will be three quizzes and a final homework. Each quiz is a closed book and closed notes task. (quizzes are mentioned in the 'weights' section below)

Final Project and Presentation: 10% (deliverable: professional report, not later than seven days after our last class)
The report must be made professionally. The length indication is five pages per student (word document, 5 A4 pages (single space, letter size 12 - This may include figures but not more than necessary and not larger than needed) per student, written in your own words and not directly copied from anywhere else). If you

work in a group with n-students, the total length is n*5 pages. Groups should not be larger than five students.
Task: study a topic related to this course and write a report (text and images as appropriate) at our peers' level.
TOPIC: the topic must be substantially related to this class and may cover chapters of textbooks or other material you can find in journals, scientific books, or other sources, or a subject that you find interesting in the field of acoustics. A list of examples will be distributed on Canvas during the semester; the list will not be limited. Therefore, you may propose other topics by email.

Presentation: per group, 10 minutes per student. Given the short amount of time, just define your project and select the most interesting facts. The extended description will be read (by your teacher) in your report. (7 students per class time slot)

Homework: 10% (deliverable : professional reports with matlab files if applicable). For each homework problem you receive full marks when solved 100% correctly, 50% when solved incorrectly and 0% when not solved.

Only online submissions are allowed
All tasks will be submitted on canvas, except exams. If you have a handwritten task, you can take photos an submit them via canvas.

WEIGHTS:

-**Quiz 1** : covers all the material studied between the first class and the class day prior to quiz 1.
Weight of quiz 1: 20%

-**Quiz 2** : covers all the material studied between the first class and the class day prior to quiz 2.
Weight of quiz 2: 25%

-**Quiz 3** : covers all the material studied between the day after quiz 1 and the class day prior to quiz 3.
Weight of quiz 3: 30%

-Take-Home-**Quiz 4** (i.e. a Final Homework): covers materials touched after quiz 3.
Weight: 5% (submission on the last GTE class day of the semester)

-Homework: 10%. Deliverable : professional reports with matlab files if applicable.

-Final Project: 10% (deliverable : professional report, not later than 7 days after our last class. A presentation of 10 mins per student is also required, to be scheduled later)

9. CALENDAR:

We follow the GT Lorraine Calendar.
The exact dates of the quizzes will be defined and communicated at least one week before each quiz.
QUIZ 1: around September 17

10. Grading policy:

For each task, you will receive a numerical grade on CANVAS. These numbers must be interpreted as :
90%-100% : A
80%-89.99%: B
70%-79.99%: C
60%-69.99%: D
below 60% : F

My CUT-OFF for an A is 90%, for B is 80%, for C is 70% etc.

11. AI Usage Policy in This Class

Students are permitted to use AI as a supplementary tool for learning, alongside lectures and course literature. AI is considered as an artificial colleague that you may discuss with. In other words, you may consider AI as a peer with whom you can engage in intellectual discussions, keeping in mind that its responses may not always be accurate, and part of the learning experience lies in critically evaluating the information.

However, AI must not be used to generate code, complete assignments, produce reports, or perform any other similar creative tasks related to coursework in this class. These activities must be carried out independently to ensure genuine understanding and skill development.

IMPORTANT: if canvas estimates your final mark you need to ignore it because to calculate the final mark you need to use the proper weights as given earlier in this syllabus. Canvas does not take this into account automatically!

END OF SYLLABUS