Engineering Acoustics
Fall 2019

EE 363N (16530), ME 379N (18170)
MWF 11–12n, ETC 4.150
Prof. Preston S. Wilson (pswilson@mail.utexas.edu)

TEXT: *Fundamentals of Acoustics* (4th ed.), Kinsler et al. (Wiley, 2000)
SUPPLEMENTAL MATERIAL: Reading materials and videos provided on CANVAS. MATLAB (or equivalent software) will be required to complete some assignments.
PREREQUISITES: M 427K with a grade of C or better
OFFICE HOURS: TH 12:30–2p, F 3–4p, or by appointment; ETC 4.152A

IMPORTANT DATES: Last day to drop or withdraw (with dean's approval)—OCT 31
Tour of campus anechoic chamber: 18 SEPT; Laser Vibrometer Demo: 4 DEC (both start in class)
Exam 1: ≈9 OCT; Exam 2: ≈20 NOV
Final exam review and course/instructor evaluations—last class day
Final Exam: 16 DEC, 2–5p

OBJECTIVE: The goal of this course is to introduce the foundations of acoustics that are necessary for applying the science of sound in engineering.

TOPICS (in order, and with corresponding textbook sections):

Introduction (in class)
examples from real life that illustrate why we study acoustics

Oscillations (Secs. 1.1-1.5, 1.14, A2)
simple harmonic motion, complex numbers, Fourier series

Wave Equation and Simple Solutions (Secs. 5.1-5.12, 13.1, 13.2)
wave equation, speed of sound, plane waves, standing waves, normal modes, energy and intensity, acoustic impedance, spherical waves, decibels, sound levels, frequency analysis

Radiation (Secs. 7.1, 7.3-7.6)
Point, spherical, and line sources, arrays, circular pistons, focused sources

Transducers (Sec. 1.12; Chap. 14, selected topics)
Electrical circuit analogies, moving coil loudspeakers and enclosures, electrostatic speakers and microphones

Reflection and Transmission (Secs. 6.1, 6.2, 6.4, 6.7)
normal incidence, refraction, absorption coefficient, transmission through walls, mass law, coincidence effect, double walls, acoustical filters, mufflers, Helmholtz resonators

Architectural Acoustics (Secs. 9.2, 12.1-12.8)
room resonances and modal density, energy density, transient response of rooms, reverberant field, reverberation time, absorption, design criteria, coupled rooms, cocktail party effect

Miscellaneous Topics (throughout the course, and as time permits)
medical ultrasound, sonar/underwater acoustics, nondestructive testing and evaluation, bubbles

GRADING: Two mid-term exams (30% + 30%); homework (10%); final exam (30%)
Homework is intended to help you learn the concepts and to learn problem solving. It will be graded on a per problem, credit/no credit basis. The two mid-term exams are take home exams, quantitatively graded. The final exam is during the University-prescribed exam time and is quantitatively graded. Unreadable writing and disorganized solutions cannot be accurately graded therefore, solutions must be neatly written or typeset and well organized.

Numerical to letter grade conversions: The formula given above will yield a numerical score that converts to the letter grades below:

Grade	Cutoff
A	92%
A–	90%
B+	88%
B	82%
B–	80%
C+	78%
C	72%
C–	70%
D	60%
F	<60%

CLASSROOM EXPECTATIONS

Attendance: Attendance will not be recorded. However, most course material is presented in lecture, and the lectures are intended to be the primary means for delivery of information, with the text and the supplemental reading material used as secondary support. In the past, regular student attendance has correlated with positive outcomes. There will be some in-class activities, demonstrations, and a couple of out-of-classroom activities conducted during the class time. These will be hard to replicate if missed and will be announced ahead of time. I also understand that some students may have travel related to interviews, senior design projects, or other reasons to miss class. Please try to minimize absences, and notify me ahead of time, so I can help you plan a make-up effort, if required. Instead of following a rigorous calendar schedule of topics, the course is paced as needed, with sufficient time give to each topic and to allow for sufficient questions and discussion.

Participation: I encourage active questions and discussion during lecture, and expect group activities to be undertaken by all students in the class. Note-taking on computer or tablet is allowed, but clandestine texting, or other non-class-related device use is strongly discouraged. It is distracting to me and the other students.

Late work: Due dates for homework assignments and exams will be given at the time they are released and they are expected to be followed. Under certain circumstances, late home work may be accepted, but students must inform me ahead of time.

Student Rights & Responsibilities

- You have a right to a learning environment that supports mental and physical wellness.
- You have a right to respect.
- You have a right to be assessed and graded fairly.
- You have a right to freedom of opinion and expression.
- You have a right to privacy and confidentiality.
- You have a right to meaningful and equal participation, to self-organize groups to improve your learning environment.
- You have a right to learn in an environment that is welcoming to all people. No student shall be isolated, excluded or diminished in any way.

With these rights come responsibilities:

- You are responsible for taking care of yourself, managing your time, and communicating with the professor and with others if things start to feel out of control or overwhelming.
- You are responsible for acting in a way that is worthy of respect and always respectful of others.
- Your experience with this course is directly related to the quality of the energy that you bring to it, and your energy shapes the quality of your peers' experiences.
- You are responsible for creating an inclusive environment and for speaking up when someone is excluded.
- You are responsible for holding yourself accountable to these standards, holding each other to these standards, and holding the teaching team accountable as well.

UNIVERSITY POLICIES:

Academic Integrity

Each student in the course is expected to abide by the University of Texas Honor Code: "As a student of The University of Texas at Austin, I shall abide by the core values of the University and uphold academic integrity." You are responsible for understanding UT's Academic Honesty and the University Honor Code, which can be found at the following web address:
http://deanofstudents.utexas.edu/conduct/standardsofconduct.php

Q Drop Policy

If you want to drop a class after the 12th class day, you'll need to execute a Q drop before the Q-drop deadline, which typically occurs near the middle of the semester. Under Texas law, you are only allowed six Q drops while you are in college at any public Texas institution. For more information, see: https://ugs.utexas.edu/vick/academic/adddrop/qdrop

University Resources for Students

Your success in this class is important to me. We will all need accommodations because we all learn differently. If there are aspects of this course that prevent you from learning or exclude you, please let me know as soon as possible. Together we'll develop strategies to meet both your needs and the requirements of the course. There are also a range of resources on campus:

Services for Students with Disabilities

This class respects and welcomes students of all backgrounds, identities, and abilities. If there are circumstances that make our learning environment and activities difficult, if you have medical information that you need to share with me, or if you need specific arrangements in case the building needs to be evacuated, please let me know. I am committed to creating an effective learning environment for all students, but I can only do so if you discuss your needs with me as early as possible. I promise to maintain the confidentiality of these discussions. If appropriate, also contact
Services for Students with Disabilities, 512-471-6259 (voice) or 1-866-329- 3986 (video phone).
http://diversity.utexas.edu/disability/about/

Counseling and Mental Health Center
Do your best to maintain a healthy lifestyle this semester by eating well, exercising, avoiding drugs and alcohol, getting enough sleep and taking some time to relax. This will help you achieve your goals and cope with stress.

All of us benefit from support during times of struggle. You are not alone. There are many helpful resources available on campus and an important part of the college experience is learning how to ask for help. Asking for support sooner rather than later is often helpful.

If you or anyone you know experiences any academic stress, difficult life events, or feelings like anxiety or depression, we strongly encourage you to seek support.
https://www.cmhc.utexas.edu/individualcounseling.html

The Sanger Learning Center
Did you know that more than one-third of UT undergraduate students use the Sanger Learning Center each year to improve their academic performance? All students are welcome to take advantage of Sanger Center's classes and workshops, private learning specialist appointments, peer academic coaching, and tutoring for more than 70 courses in 15 different subject areas. For more information, please visit https://ugs.utexas.edu/slc or call 512-471-3614 (JES A332).

Undergraduate Writing Center: http://uwc.utexas.edu/
Libraries: https://www.lib.utexas.edu/
ITS: https://its.utexas.edu
Student Emergency Services: http://deanofstudents.utexas.edu/emergency/

Important Safety Information:
If you have concerns about the safety or behavior of fellow students, TAs or Professors, call BCAL (the Behavior Concerns Advice Line): 512-232-5050. Your call can be anonymous. You can also submit a concern online:
https://utexas-advocate.symplicity.com/care_report/index.php/pid437932?
If something doesn't feel right – it probably isn't. Trust your instincts and share your concerns.

The following recommendations regarding emergency evacuation from the Office of Campus Safety and Security, 512-471-5767, https://financials.utexas.edu/avp-campus-safety
Occupants of buildings on The University of Texas at Austin campus are required to evacuate buildings when a fire alarm is activated. Alarm activation or announcement requires exiting and assembling outside.

- Familiarize yourself with all exit doors of each classroom and building you may occupy. Remember that the nearest exit door may not be the one you used when entering the building.
- Students requiring assistance in evacuation shall inform their instructor in writing during the first week of class.
- In the event of an evacuation, follow the instruction of faculty or class instructors. Do not re-enter a building unless given instructions by the following: Austin Fire Department, The University of Texas at Austin Police Department, or Fire Prevention Services office.
  Link to information regarding emergency evacuation routes and emergency procedures can be found at:
  https://emergency.utexas.edu