ENGR 4411: Physical Acoustics
CRN: 34749
Spring 2026

Dr. William V. Slaton
Office: LSC 015 (Ph: 450-5905)
Email (preferred): wvslaton@uca.edu

If you are sick (or potentially sick), stay home.
Email me—don't come to campus.

COURSE DESCRIPTION

ENGR 4411 INTRODUCTION TO PHYSICAL ACOUSTICS An elective course for engineering or physics majors. This course covers fundamental acoustics topics such as vibrating strings, membranes, structures, acoustic wave generation, propagation and radiation, wave transmission and reflection phenomena, in addition to applications such as bioacoustics, architectural acoustics, and transducers. Prerequisite: Consent of instructor.

COURSE INFORMATION

Lecture: MW, 11:00–11:50 AM, CCCS 112, Lecture/Lab: Tues, 2:30–6:30 PM, CCCS 112.

Final Exam: 2:00 - 4:00PM, Monday, April 27, 2026

Office Hours: 1:30 - 3:00PM MW, 9:30 - 11:30AM T, or by appointment. Drop-ins at other times are welcome, but availability cannot be guaranteed. Email is preferred for appointments or other communication - I tend to not check my voice mail. I will respond within 24hrs during the week or by the next work day if on a weekend.

Textbook: *Understanding Acoustics - An Experimentalist's View of Sound and Vibration*, 2nd Edition, by S. Garrett, ISBN: 978-3-030-44786-1. The text is open access and available for download here: `https://link.springer.com/book/10.1007/978-3-030-44787-8` Other supplemental texts are in the library or online. Refer to your University Physics or OpenStax textbook(s) for a review of the basics (mass/springs, waves, circuits, etc).

Content Coverage / Objective: Chapter 1, parts of Chapters 2 & 3 then jumping to parts of Chapters 7, 8, 10, 11, & 13. Other topics covered as needed.

Supplies: Scientific calculator, writing utensils, ruler, protractor, and access to a computer. Python/Jupyter Notebooks will be used for computational problems, though other tools are acceptable. Lab safety glasses are required to be worn when in the lab as appropriate.

GRADING

This course uses a two-stage assessment model: open resource technical work followed by individual verification of understanding. Students are encouraged to use textbooks, notes, computational tools, and AI responsibly when developing solutions, but must also be able to independently explain, justify, and apply those solutions. A: 90–100%, B: 80–89%, C: 70–79%, etc. Grades will be based on the following:

Component	**Percentage**	**Format**
Professional engagement	10%	Daily sign-in sheet & active participation
Labs	10%	Hands-on experiments with formal reports
Homework	10%	Analytical, computational, and/or conceptual
Quizzes (weekly-ish)	20%	Analytical, computational, and/or conceptual
Exams (monthly-ish)	20%	Analytical, computational, and/or conceptual
Design Project	30%	End-of-semester design project
Total	100%	

Professional engagement: Regular attendance is expected and necessary for participation in discussions, in-class problem solving, and hands-on activities. Excused absences require advance notice for sanctioned events or documentation from the Student Health Center.

Labs: There will be weekly-ish hands-on experimental activities with formal reports. These activities are designed to reinforce theoretical concepts through measurement, modeling, and comparison with analytical or computational predictions.

Homework: Homework assignments may include derivations, conceptual questions, computational modeling, or problem solving. Homework is explicitly *open-resource*: collaboration, textbooks, online resources, and generative AI tools are permitted. Submitted work must be clearly written, logically explained, and technically correct. Computational work must include well-documented code and interpreted outputs. All submissions must be your own synthesis and understanding. Homework must be submitted as a PDF.

Quizzes: Weekly-ish quizzes will consist of two parts.

1. The first part is an open-resource assignment, similar in scope to homework, and must be completed and submitted prior to the in-class quiz. This portion emphasizes problem formulation, modeling, and solution development.

2. The second part is a short (10–15 minute) in-class assessment focused on individual understanding of the first part. Students may be asked to explain reasoning, complete a related calculation, or interpret results without external resources.

Exams: Exams follow the same two-stage structure as quizzes but at a larger scale. The open-resource portion will involve more complex or extended problems and must be completed in advance. The in-class portion will occupy the full class period and will assess individual understanding, interpretation, and application of the open-resource work.

Design Project: Students will complete an end-of-semester engineering design project that synthesizes course concepts. The project will involve modeling, analysis, and justification of design choices and may include analytical, computational, and experimental components. Expectations, milestones, and assessment criteria will be provided at a later date.

This grading structure reflects the realities of professional physics and engineering practice, where open resources and computational tools are routinely used, but individual understanding, judgment, and accountability are essential.

UNIVERSITY POLICIES

Academic Integrity: The University of Central Arkansas affirms its commitment to academic integrity and expects all members of the university community to accept shared responsibility for maintaining academic integrity. Students in this course are subject to the provisions of the university's Academic Integrity Policy, approved by the Board of Trustees as Board Policy No. 709 on February 10, 2010, and published in the Student Handbook. Penalties for academic misconduct in this course may include a failing grade on an assignment, a failing grade in the course, or any other course-related sanction the instructor determines to be appropriate. Continued enrollment in this course affirms a student's acceptance of this university policy.

Americans with Disabilities Act: The University of Central Arkansas adheres to the requirements of the Americans with Disabilities Act. If you need an accommodation under this Act due to a disability, please contact the Office of Accessibility Resources and Services (OARS), 450-3613.

Building Emergency Plan: An Emergency Procedures Summary (EPS) for the building in which this class is held will be discussed during the first week of this course. EPS and Building Emergency Plan (BEP) documents for most buildings on campus are available at `https://uca.edu/go/bep-library`. Every student should be familiar with emergency procedures for any campus building in which he/she spends time for classes or other purposes.

Title IX: In furtherance of its core values— academic vitality, integrity, and diversity—UCA is dedicated to promoting a campus community free from discrimination. Title IX of the Education Amendments Act of 1972 requires all educational institutions to address gender-based discrimination on campus, and UCA implements these Federal requirements through a fair, consistent, and appropriate process of investigation and adjudication. Please see UCA's Title IX website (`https://uca.edu/titleix/`) for the university's policy, relevant forms, training opportunities, and related information.

Student Handbook: It is advisable to refer to the Student Handbook for important policies not specifically detailed in the syllabus, for example: Sexual Harassment Policy and other Academic Policies.

Student Course Experience Survey: The Student Course Experience Survey is a crucial element in helping faculty achieve excellence in the classroom and the institution in demonstrating that students are gaining knowledge. Students may complete surveys for courses they are taking starting on Monday, April 6, 2026, through the Sunday after finals week by logging in to myUCA and clicking on the Course Evaluations task.

Code of Ethics: In addition to UCA's Academic Integrity policy we will also be mindful and knowledgeable of the IEEE Code of Ethics. A copy of the code can be found here: `https://www.ieee.org/about/corporate/governance/p7-8`

Disclaimer: The instructor reserves the right to modify course policies as necessary.

POLICY ON GENERATIVE AI

Generative AI tools are permitted and encouraged in this course as part of an *open-resource learning environment*. These tools should be used in the same manner as textbooks, symbolic algebra systems, numerical solvers, or online references: as aids to thinking, modeling, and communication; not as substitutes for understanding.

In this course, **what matters is not whether AI was used, but how it was used and whether the resulting work is technically sound, well-reasoned, and defensible**.

Appropriate Use of Generative AI in Physics & Engineering: When used responsibly, generative AI can support advanced technical work in the following ways:

1. **Conceptual Framing and Strategy Development:** AI may be used to explore solution strategies, compare modeling assumptions, or outline approaches to complex physical systems (e.g., boundary conditions, symmetries, or approximations).

2. **Mathematical and Computational Support:** AI can assist with algebraic manipulation,

checking intermediate steps, setting up numerical models, generating plots, or translating equations into code. All results must be independently verified.

3. **Code Development and Debugging:** AI may be used to draft, refactor, or debug code (e.g., Python, C++, LaTeX, etc). You are responsible for understanding, testing, and validating all code used in submitted work.

4. **Technical Writing and Documentation:** AI may assist with structuring reports, clarifying explanations, or improving technical clarity. The intellectual content, interpretation, and conclusions must be your own.

5. **Exploration and Iteration:** AI can support rapid prototyping of ideas, parameter studies, or alternative formulations. These exploratory uses are encouraged when accompanied by critical evaluation.

Professional and Ethical Responsibilities: Use of AI in this course must align with professional engineering and scientific standards:

1. **Accountability and Verification:** You are fully responsible for the correctness of all equations, code, plots, assumptions, and conclusions—regardless of whether AI was used.

2. **Transparency:** Clearly disclose meaningful AI assistance in reports, code comments, or project documentation. Transparency is required, not optional.

3. **Demonstration of Understanding:** Submitted work must reflect your ability to explain and defend the underlying physics, mathematics, and modeling choices. AI-generated output that you cannot justify will be treated as incorrect.

4. **Standards and Safety Awareness:** AI outputs might not account for engineering standards, safety factors, or real-world constraints. These considerations must be explicitly addressed by you.

Citing AI-Assisted Work: AI use must be cited when it contributes substantively to your work:

- **Technical Reports and Projects (IEEE Style):**

  [#] OpenAI, "ChatGPT response to <your prompt>," ChatGPT, [Online]. Available: <URL>. Accessed: <Date>.

- **Code and Algorithms:** Include comments noting AI assistance when applicable.

- **Design or Research Work:** Include an acknowledgment describing how AI was used (e.g., brainstorming, debugging, drafting).

Limitations of Generative AI in Physics & Engineering: Students should be aware of the following limitations, which are especially relevant in upper-division physics and engineering:

1. **Context Window Limitations:** AI models may lose track of assumptions, definitions, or notation in long or multi-stage conversations. Errors often emerge silently.

2. **Internal Inconsistency:** AI may change symbols, coordinate systems, gauges, or conventions without warning. Dimensional or physical inconsistencies are common.

3. **Shallow or Overgeneralized Reasoning:** AI often produces plausible-sounding but incomplete explanations, especially for advanced or specialized topics where it has limited training data.

4. **False Confidence:** Correct and incorrect results are frequently presented with high confidence and polished language.

5. **Lack of Physical Judgment:** AI does not understand experimental feasibility, noise sources, safety margins, or engineering tradeoffs.

6. **Skill Atrophy Through Overreliance:** Effective physicists and engineers develop intuition through struggle and iteration. AI should accelerate this process, not replace it.

Bottom Line: Generative AI is treated in this course as a **powerful but fallible engineering tool**. Its use is permitted, expected, and professionally appropriate—**provided that all work you submit reflects your own understanding, judgment, and responsibility as an emerging physicist or engineer**.