ENGR 4411 - CRN: 34749

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Introduction to Physical Acoustics
Spring 2025

IF YOU ARE SICK (OR POTENTIALLY SICK) – STAY HOME! EMAIL ME – DON'T COME TO CAMPUS.

LECTURE & LAB: Monday & Wednesday 12:00 – 2:40PM, CCCS 112

FINAL EXAM: Wednesday, April 30th, 2025 from 11:00-1:00 PM, CCCS 112

OFFICE HOURS (LSC 015): Tentatively 9:25 – 10:40AM Tues & Thurs & 1:00-2:00 PM Friday. Drop-ins at other times are welcome but I can't guarantee that I will have a lot of time due to other commitments, etc. Email me to set up an appointment if these times do not work with your schedule and we can find a mutually agreeable time to meet. I'll use your cub email addresses and/or Blackboard for important class announcements, assignments, and other information – pay attention to it!

GRADES: A's are 90-100%, B's are 80-89%, C's are 70-79%, etc.

Grades will be based on the following:

Component	Percentage	Format
Lab Reports & Presentations	50%	Typed in format given
Assignments / Homework	10%	Neatly written or typed
Attendance	10%	Sign-in sheet
Exams	10%	Take-home and/or lab-based exams
Design Project	20%	Details to be given.
Total	100%	

Class Schedule: (tentative)

Date	Activity	Notes
January 13 – 17:	Introduction and Applied Fundamentals – Chap 2	
January 20 - 24:	Introduction and Applied Fundamentals – Chap 2 cont.	No Class Monday, MLK Holiday
January 27 - 31:	Vibration and Damping	
February 3 - 7:	Nondissipative Lumped Elements – Chap 8	
February 10 - 14:	Nondissipative Lumped Elements – Chap 8 cont.	
February 17 - 21:	Waves in Fluids – Chap10 & 11	
February 24 – 28:	Waves in Fluids – Chap10 & 11	
March 3 - 7:	Waves in Fluids – Chap10 & 11	
March 10 - 14:	Signal Processing	
March 17 - 21:	Signal Processing	
March 24 - 28:	**SPRING BREAK!**	No Class
March 31 – April 4:	Signal Processing	
April 7 - 11:	Special Topics	
April 14 - 18:	Special Topics & Student Projects	
April 21 - 25:	Special Topics & Student Projects	
April 28 – May 2:	**FINALS WEEK**	Project Presentation (Finals Week)

TEXT: 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).

SUPPLIES: Scientific calculator and writing utensils. You will need access to a computer lab or your own laptop to solve some problems computationally. Lab safety glasses are required to be worn when in the lab as appropriate.

ENGR 4411 – PHYSICAL ACOUSTICS: An elective course for physics or engineering 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: PHYS 3341 or consent of instructor.

ATTENDANCE: I expect you to attend all classes and labs (it is part of the course grade); by now you know you cannot fully understand a technical discipline like physics without being present, on-time, and mentally alert in every class and lab. If you are sick, have a family emergency, or university sanctioned event please let me know in advance via email. Documentation for an absence will be necessary. Students who have informed me about an excused absence can make up a course work at my convenience. Late work is not accepted unless for an excused absence.

SOFTWARE: I will be using and demonstrating computational solutions using the Python programming language and Jupyter notebooks. You are free to use whatever programming language you prefer for homework or labs as needed.

HOMEWORK & EXAMS: The homework portion of the course will come from the textbook as well as computational assignments as given. ***Neatly*** handwritten written homework on non-jagged-edge paper is to be turned in for a grade or typeset using LaTeX or some other typesetting program like MS WORD. To have mastered a concept you need to be able to apply it to some seen-before, similar, and never-seen-before problems to give me an assessment of your understanding. Please follow the format requested in the specific assignment and be mindful of the policy on generative AI (such as ChatGPT) below.

PROJECT: Students will work in teams or individually depending on enrollment to complete an engineering design project. Details of the project will be given later in the semester.

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 documents for most buildings on campus are available at http://uca.edu/mysafety/bep. 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 DISCLOSURE: If a student discloses an act of sexual harassment, discrimination, assault, or other sexual misconduct to a faculty member (as it relates to "student-on-student" or "employee-on-student"), the faculty member cannot maintain complete confidentiality and is required to report the act and may be required to reveal the names of the parties involved. Any allegations made by a student may or may not trigger an investigation. Each situation differs and the obligation to conduct an investigation will depend on those specific set of circumstances. The determination to conduct an investigation will be made by the Title IX Coordinator. For further information, please visit: https://uca.edu/titleix. **Disclosure of sexual misconduct by a third party who is not a student and/or employee is also required if the misconduct occurs when the third party is a participant in a university-sponsored program, event, or activity.*

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 (page 37). 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. Be sure to refer to the policy on generative AI (such as ChatGPT) below as regards to academic integrity.

CODE OF ETHICS: In addition to UCA's Academic Integrity policy we will also be mindful and knowledgeable of the National Society of Professional Engineers Code of Ethics. A copy of the code can be found here: https://www.nspe.org/resources/ethics/code-ethics

STUDENT EVALUATIONS: Student evaluations of a course and its professor are a crucial element in helping faculty achieve excellence in the classroom and the institution in demonstrating that students are gaining knowledge. Students may evaluate full term courses they are taking starting on April 7th, 2025 through May 4th, 2025 by logging in to myUCA and clicking on the Course Evaluations task.

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 UCA Disability Resource Center, 450-3613.

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.

DISCLAIMER: All standard disclaimers apply. The instructor reserves the right to modify the course policies, assignments, due dates, etc. as necessary or appropriate for meeting the goals of the course. Hot glass looks like cold glass. Do not look into laser with remaining eye. If you mess up, 'fess up. Don't be a d^3x/dt^3.

POLICY ON GENERATIVE AI (ChatGPT, etc):
We will use generative AI (such as ChatGPT) in this course. Some assignments will require it (one check mark), some assignments may allow the use of AI in limited ways (two check marks), and some assignments may prohibit the use of AI entirely (three check marks). Assignments will be clearly labeled as to the level of assistance AI may provide. Any assignment that does not specifically denote a level can be assumed to prohibit the use of AI entirely. Failure to use AI appropriately for an assignment or to cite it properly could result in a violation of UCA's academic integrity policy. We will learn how to use it appropriately and ethically since using AI is an emerging skill. In the spirit of transparency, I used ChatGPT to help me write the following sections on the use of AI in the course.

Use of Generative AI Tools in Engineering
In this course, we will explore the use of generative AI tools like ChatGPT as part of your learning. In the context of engineering, these tools offer several benefits:

1. **Technical Problem-Solving and Brainstorming**: AI can assist in generating ideas for project design, coding solutions, and even early-stage problem analysis. It can suggest approaches to tackle engineering challenges or help you explore different strategies for solving technical problems.
2. **Supplementary Learning and Clarifications**: AI tools can help you quickly review concepts in math, physics, and engineering principles. For topics like calculus, mechanics, or circuit design, AI can provide step-by-step explanations and alternative perspectives on solving complex equations or understanding core concepts.
3. **Code Generation and Debugging**: Generative AI can be used to draft code snippets, troubleshoot common programming issues, or even explore different approaches to coding tasks. While it's no replacement for understanding programming languages, it can speed up the process and offer learning insights.
4. **Technical Writing Assistance**: AI can help you structure technical reports, lab documentation, or design proposals. It can provide guidance on clarity, grammar, and technical language while helping you develop concise and effective communication for engineering contexts.
5. **Skill Development**: Engaging with AI encourages critical thinking and analytical skills, especially as you learn to evaluate AI-generated outputs for accuracy and relevance in engineering applications.
6. **Prototyping and Innovation**: For creative design projects, AI can be used to simulate ideas, propose new designs, or suggest optimizations. Integrating AI as part of your prototyping process can enhance innovation and improve iterative design.

Ethical Use of Generative AI in Engineering
When using AI tools in an engineering context, follow these ethical guidelines:

1. **Transparency in AI Assistance**: Clearly disclose when and how AI contributed to your projects, reports, or problem-solving processes. Whether generating design ideas, writing code, or clarifying concepts, it's important to attribute AI's role honestly.
2. **Academic Integrity and Learning**: Ensure your work reflects your understanding and effort. AI can assist with problem-solving, but it's crucial that you develop and demonstrate the core engineering skills you're learning in this course.
3. **Safety and Accuracy in Technical Work**: AI-generated outputs are not always reliable, especially when it comes to technical calculations, design parameters, or safety-critical applications. Verify all AI-generated content against trusted engineering sources or industry standards.
4. **Bias and Ethical Engineering Design**: AI models can introduce biases into design or problem-solving suggestions. It's important to critically evaluate these outputs, particularly in engineering applications that impact diverse populations or involve ethical considerations.
5. **Respecting University and Industry Standards**: Adhere to both academic guidelines and professional engineering standards when using AI. Unauthorized or unacknowledged use of AI in technical reports, design projects, or exams can result in academic penalties.

Citing AI-Generated Content in Engineering Work
If you use AI-generated content, whether for reports, code, or problem-solving, be sure to cite it properly:

- **Technical Reports and Projects**: When using AI-generated text or design suggestions in your reports or presentations, cite the tool used. To comply with IEEE standards, use the format:

  [<#>] <Brand Name>, "<AI Name> Response to <Your Question>," <AI Name>, [Online]. Available: <URL>. Accessed on: <Date>.

  For example:

[1] OpenAI, "ChatGPT Response to How do I cite chatgpt's response following IEEE's standards?," ChatGPT, [Online]. Available: https:/chatgpt.com/share/007f83e5-4426-41ae-88c6-c53343228e44. Accessed on: Aug. 19, 2024.

- **Code and Algorithms**: If AI contributed to a code snippet or algorithm in your work, include a comment noting its origin and a citation if required by the course or project guidelines.
- **Acknowledgment in Design or Research**: When AI plays a role in idea generation or refining your designs, include an acknowledgment in your report or project documentation explaining how it was used.

Limits of Generative AI in Engineering

While AI tools can be valuable, they have limitations that are particularly important in engineering contexts:

1. **Inaccurate Technical Information**: AI can generate technically incorrect calculations, flawed code, or invalid engineering solutions. Always verify any technical output with reliable sources, reference materials, or calculations.
2. **Limited Understanding of Complex Engineering Problems**: Generative AI may lack the ability to fully grasp the intricacies of advanced engineering concepts, making it less effective for complex analysis or specialized design problems.
3. **Insufficient Depth in Analysis and Design**: While AI can offer general ideas or starting points, engineering solutions require in-depth analysis, modeling, and verification that AI is not capable of providing.
4. **Ethical and Safety Considerations**: In engineering, designs and decisions can have real-world consequences. AI does not account for safety protocols, ethical considerations, or human factors, so always apply your judgment and ensure your work meets safety and ethical standards.
5. **Over-reliance and Skill Development**: Developing foundational engineering skills—like coding, circuit analysis, or problem-solving—requires practice. Overusing AI can prevent you from building the competencies necessary for professional growth and success.
6. **Context-Specific Issues**: Engineering problems are often context-dependent, requiring an understanding of specific conditions, constraints, and requirements. AI lacks the ability to fully integrate such contextual details, which are crucial for robust solutions.