Cover Sheet: Request 10489

EEL4558 Acoustics

Info

Process	Course|New|Ugrad/Pro
Status	Pending
Submitter	Edvardsson, Laurie laurie@ece.ufl.edu
Created	10/13/2015 2:09:44 PM
Updated	2/11/2016 3:21:28 PM
Description	New course which will be co-owned between ECE and MAE.

Actions

Step	Status	Group	User	Comment	Updated
Department	Approved	ENG - Electrical and Computer Engineering 011905000	Fox, Robert M		10/14/2015
No document changes					
College	Approved	ENG - College of Engineering	Caple, Elizabeth		1/21/2016
Replaced 4558 Acoustics - UCC1 syl.docx					11/17/2015
University Curriculum Committee	Comment	PV - University Curriculum Committee (UCC)	Case, Brandon	Added to February agenda	1/22/2016
No document changes					
University Curriculum Committee	Pending	PV - University Curriculum Committee (UCC)			1/22/2016
No document changes					
Statewide Course Numbering System					
No document changes					
Office of the Registrar					
No document changes					
Student Academic Support System					
No document changes					
Catalog					
No document changes					
College Notified					
No document changes					

Course|New for request 10489

Info

Request: EEL4558 Acoustics
Submitter: Edvardsson, Laurie laurie@ece.ufl.edu
Created: 11/17/2015 2:39:18 PM
Form version: 3

Responses

Recommended Prefix: EEL
Course Level : 4
Number : 558
Lab Code : None
Course Title: Acoustics
Transcript Title: Acoustics
Effective Term : Fall
Effective Year: 2016
Rotating Topic?: No
Amount of Credit: 3
Repeatable Credit?: No
S/U Only?: No
Contact Type : Regularly Scheduled
Degree Type: Baccalaureate
Weekly Contact Hours : 3
Category of Instruction : Joint (Ugrad/Grad)
Delivery Method(s): On-Campus
Course Description : Governing equations for wave theory of sound; Character of plane acoustic waves and 3-D acoustic fields; Sound transmission/reflection at an interface between two media; Waves transmission/attenuation inducts; Low frequency approximations (lumped-element modeling) and transducers; sources of sound.
Prerequisites : MAP 2302(C) & (either EEL 3111C(C) or EEL 3003(C) or consent of the instructor)
Co-requisites : None
Rationale and Placement in Curriculum : This course is a technical elective that will be co-owned between the Electrical & Computer Engineering and the Mechanical & Aerospace Engineering departments.
Course Objectives : The student will have a working understanding of the basic theory of physical acoustics, wave theory for sound generation/radiation, and propagation.
Course Textbook(s) and/or Other Assigned Reading: Required text: Fundamentals of Physical Acoustics, David T. Blackstock, Wiley-Interscience, 2000

Recommended readings:
Acoustics: An Introduction to its Physical Principles and Applications, A. D. Pierce, Acoustical Society of America, 1989

Theoretical Acoustics, P. M. Morse and K. U. Ingard, Princeton University Press, 1968

Weekly Schedule of Topics : Lecture 1: Introduction and Definitions
a) Observations of waves
b) Dynamic response of an elastic medium
c) Types of waves
d) Why study acoustics?
e) Physical versus psycho-acoustics
f) Characteristics of sound propagation

Lecture 2: Introduction and Definitions / Derivation of the Governing Equations
a) Power scales and spectra
b) Continuum assumption

Lecture 3: Derivation of the Governing Equations
a) Derivation of conservation of mass
b) Begin conservation of momentum

Lecture 4: Derivation of the Governing Equations
a) Derivation of linear momentum
b) Assumptions for linear lossless acoustic motion

Lecture 5: Derivation of the Governing Equations
a) Equation of State
b) Derivation of Pressure Wave Equation

Lecture 6: Derivation of the Governing Equations
a) Derivation of Particle Velocity Wave Equation
b) Evaluation of isentropic speed of sound
c) Velocity Potential in Acoustics

Lecture 7: Plane Wave Propagation
a) General solution arbitrary time
b) Characteristics representation

Lecture 8: Plane Wave Propagation
a) Specific Acoustic Impedance
b) Mechanical and acoustic impedances

Lecture 9: Plane Wave Propagation
a) Plane progressive waves of finite amplitude (NL acoustics)

Lecture 10: Plane Wave Propagation
a) Acoustic intensity

Lecture 11: Plane Wave Propagation
a) Energy considerations

Lecture 12: Plane Wave Propagation
a) Harmonic solution for 1-D waves
b) Plane wave expansion

Lecture 13: Exam 1 Review

Lecture 14: Plane Wave Propagation
a) Wavenumber space
b) propagating waves vs. evanescent waves

Lecture 15: Spherically Symmetric Waves
a) General solution
b) Arbitrary time

Lecture 16: Spherically Symmetric Waves
a) Radiation condition
b) Time harmonic

Lecture 17: Spherically Symmetric Waves

a) Near field vs. far field

Lecture 18: Spherically Symmetric Waves
a) Pulsating sphere
b) Radiation impedance
c) Power

Lecture 19: Sound transmission/reflection at an interface between two media
a) Review of impedances
b) Infinite planar interface between two media
c) Definitions: reflection and transmission coefficients

Lecture 20: Sound transmission/reflection at an interface between two media
a) Physical examples
b) Characteristic plane and image waves
c) Area change at interface between two media

Lecture 21: Sound transmission/reflection at an interface between two media
a) Impedance terminations
b) Phasor plots

Lecture 22: Sound transmission/reflection at an interface between two media
a) Standing wave patterns

Lecture 23: Sound transmission/reflection at an interface between two media
a) Two microphone method
b) Impedance boundary conditions

Lecture 24: Sound transmission/reflection at an interface between two media
a) Lumped-element, mass-spring-damper panel
b) Generalized 3-medium problem
c) Special cases

Lecture 25: Sound transmission/reflection at an interface between two media
a) Special cases of 3-medium problem

Lecture 26: Exam II review

Lecture 27: Sound transmission/reflection at an interface between two media
a) Oblique Incidence Reflection and Transmission
b) Return to k-space
c) Law of specular reflection
d) Snell's law

Lecture 28: Sound transmission/reflection at an interface between two media
a) Oblique Incidence Reflection and Transmission
b) Oblique Impedance
c) Locally reactive surfaces

Lecture 29: Sound transmission/reflection at an interface between two media
a) Critical angle
b) Angle of intromission

Lecture 30: Sound transmission/reflection at an interface between two media
a) Barrier penetration
b) Coincidence effect

Lecture 31: Lumped-Element Modeling and Transducers

a) Background
b) Assumption

Lecture 32: Lumped-Element Modeling and Transducers
a) Power flow
b) Conjugate power variables for various energy domains

Lecture 33: Lumped-Element Modeling and Transducers
a) One-port elements sign convention
b) Effort and flow sources
c) Compliance, inertance, and dissipation

Lecture 34: Lumped-Element Modeling and Transducers
a) Equivalent circuits
b) Impedance and admittance analogies
c) Generalized KEL and KFL

Lecture 35: Lumped-Element Modeling and Transducers
a) Element extraction: pipe flow example
b) Helmholtz resonator

Lecture 36: Lumped-Element Modeling and Transducers
a) Two-port network theory
b) Gyrator and Transformers
c) Impedance and source transformation

Lecture 37: Lumped-Element Modeling and Transducers
a) Introduction to transducers
b) Linear conservative transducers (LCT)

Lecture 38: Lumped-Element Modeling and Transducers
a) LCT impedance analogy
b) LCT admittance analogy

Lecture 39: Lumped-Element Modeling and Transducers
a) Electrodynamic transducer
b) Speaker example

Lecture 40: Lumped-Element Modeling and Transducers
a) Electrostatic transducer

Lecture 41: Lumped-Element Modeling and Transducers
a) Condenser microphone example
b) Bode plots drawn from circuit topology

Grading Scheme : 75% Exams
25% Quizzes/Projects

Note: This course is co-listed with the graduate class. The homework portion of the graduate section will involve additional work and more advanced concepts with respect to the undergraduate section. The exams will also involve more advanced concepts with respect to the undergraduate section.

Instructor(s) : Dr. Mark Sheplak

EEL 4558 Acoustics

1. Catalog Description – (3 credits) Governing equations for wave theory of sound; Character of plane acoustic waves and 3-D acoustic fields; Sound transmission/reflection at an interface between two media; Waves transmission/attenuation inducts; Low frequency approximations (lumped-element modeling) and tranducers; sources of sound

2. Pre-requisites – MAP 2302 and either (EEL 3111C or EEL 3003) or permission of the instructor.

3. Course Objectives – The student will have a working understanding of the basic theory of physical acoustics, wave theory for sound generation/radiation, and propagation.

4. Contribution of course to meeting the professional component (ABET only – undergraduate courses) – 3 credits of Engineering Science

5. Relationship of course to program outcomes: (ABET only undergraduate courses) – ABET Outcome a

6. Instructor – Dr. Mark Sheplak
    a. Office location: 215 Larsen
    b. Telephone: 392-3983
    c. E-mail address: sheplak@ufl.edu
    d. Class Web site:
    e. Office hours: M & W 8th period (3:00 – 3:50 pm), other times by appointment

7. Teaching Assistant - None

8. Meeting Times and Location - MWF 4th period (10:40-11:30 pm) in Benton 328

9. Class/laboratory schedule - 3 class periods each week consisting of 50 minutes each

10. Material and Supply Fees - None

11. Textbooks and Software Required -
    a. Title: Fundamentals of Physical Acoustics
    b. Author: David T. Blackstock
    c. Publication date and edition: Wiley-Interscience, 2000
    d. ISBN number:

12. Recommended Reading -
    a. Title: Acoustics: An Introduction to its Physical Principles and Applications
    b. Author: A. D. Pierce
    c. Publication date and edition: Acoustical Society of America, 1989
    a. ISBN number:

a. Title: Theoretical Acoustics
b. Author: P. M. Morse and K. U. Ingard
c. Publication date and edition: Princeton University Press, 1968
d. ISBN number:

13. Course Outline (provide topics covered by week or by class period) –

Lecture 1: Introduction and Definitions
a) Observations of waves
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e) Physical versus psycho-acoustics
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b) Bode plots drawn from circuit topology

14. Attendance and Expectations - Students are expected to attend class. Cell phones and other electronic devices are to be silenced. No text messaging during class or exams.

The course will be taught from a Tablet PC using my typeset “summary” notes. These notes are meant to accompany the assigned readings from the text and reference books. **<u>They are not to be considered substitutes.</u>** You will be responsible for both the material covered in class and the assigned readings.

Reading assignments will be made periodically. You are responsible for the material the next class meeting. If I feel that the bulk of the class is not keeping up with the reading assignments, I reserve the right to give unannounced quizzes.

It is expected that this course will require at least 15 hours of effort per week when you consider time spent for lectures, reading assignments, homework, and re-writing of your class notes. I also expect that you will attend every lecture. If you cannot attend a lecture, please notify me prior to class. I strongly recommend that you implement the "Five Times Strategy" for learning in this class. This requires that you cover the course material at least 5 times before exams. The first time that you cover the material is when you perform your reading assignment before class. The second time that you cover the material is during lecture. The third time that you cover the material is when you re-write your "lecture set" of notes that includes material from lecture and the reading assignments, including all derivations and your additions. The fourth time that you cover the material is when you do your homework assignments. Finally, the fifth time that you cover the material is when you study for your exams. This technique will help you master the material and also will provide you with a comprehensive set of notes to potentially teach from one day.

Homework will be assigned periodically. They will be collected via Sakai. I will post solutions on Sakai for you to review.

- Homework is an essential element of this course.
- Homework will be assigned periodically. They will be collected via Sakai. I will post solutions on Sakai for you to review.
- Performance on the homework will not count towards the student's final grade directly, but exam material may be taken directly from HWs. Consequently, individual work must be expected on all problems to ensure a proper grasp of the material. Students are encouraged to discuss the general principles involved in the homework sets with one another, but the solution of each problem must be attempted individually.

Here is a suggested format for HWs that will help you organized your thoughts

1. Use 8.5" x 11" paper and write on one side. Do not use pages torn from a spiral notebook. State each problem on a new page.
2. Each homework problem must be completed in a standard format, which includes the following labeled steps:
    - *GIVEN:* After carefully reading the problem, state briefly and concisely what is known. Do not repeat the problem statement.
    - *FIND*: State briefly and concisely what must be found.
    - *SCEMATIC:* Draw a schematic of the physical problem to be considered. Note the control volumes used in the analysis by dashed lines on the sketch. Include coordinate axes when appropriate, and label relevant dimensions and velocities.
    - *BASIC EQUATIONS:* Provide the appropriate assumptions and mathematical formulation for the basic laws that you consider necessary to solve the problem.
    - *SOLUTION:* Provide full details of the analysis in a logical manner. Develop the analysis as far as possible before substituting numerical values. Give the answer algebraically before computing the final numerical result (if required). Clearly indicate your final answer.
    - Attach a listing of any computer program(s) used in the solution

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found in the online catalog at: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx

15. Grading –

Exam 1	30 %
Exam 2	30 %
Exam 3	30 %
HWs	10 %
Total	100 %

Note: This course is co-listed with the graduate class. The homework portion of the graduate section will involve additional work and more advanced concepts with respect to the undergraduate section. The exams will also involve more advanced concepts with respect to the undergraduate section.

16. Grading Scale –

A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E
93-100	90-92	87-89	83-86	80-82	77-79	73-76	70-72	67-69	63-66	60-62	0-59

"A C- will not be a qualifying grade for critical tracking courses. In order to graduate, students must have an overall GPA and an upper-division GPA of 2.0 or better (C or better)." Note: a C- average is equivalent to a GPA of 1.67, and therefore, it does not satisfy this graduation requirement. For more information on grades and grading policies, please visit: https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

17. Make-Up Exam Policy - No late homework assignments will be accepted. Makeup exams are not allowed. If you cannot attend an exam or cannot meet a due date, you must contact the instructor **prior** to the exam or due date.

    If you have a University-approved excuse and arrange for it in advance, or in case of documented emergency, a make-up exam will be allowed and arrangements can be made for making up missed work. University attendance policies can be found at: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx

18. Honesty Policy – UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

19. Accommodation for Students with Disabilities – Students requesting classroom accommodation must first register with the Dean of Students Office. That office will provide documentation to the student who must then provide this documentation to the course instructor when requesting accommodation.

20. UF Counseling Services – Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:
    - UF Counseling & Wellness Center, psychological and psychiatric services, 3190 Radio Rd, 392-1575, online: http://www.counseling.ufl.edu/cwc/Default.aspx,
    - Career Resource Center, Reitz Union, career and job search services, 392-1601.
    - University Police Department, 392-1111 or 911 for emergencies

21. Software Use – All faculty, staff and student of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

22. Course Evaluation – Students are expected to provide feedback on the quality of instruction in this course based on 10 criteria. These evaluations are conducted online at: https://evaluations.ufl.edu. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at: https://evaluations.ufl.edu/results.