Department of Ocean and Mechanical Engineering
Florida Atlantic University
Course Syllabus

1. Course title/number, number of credit hours	
Acoustics for Ocean Engineers – **EOC 3306**	3 credit hours
2. Course prerequisites, co-requisites, and where the course fits in the program of study	
Prerequisites: Circuits I (EEL 3111), OE Lab (EOC3130L) (all with a grade of C or above).	
3. Course logistics	
Term: Spring 2019 This is a classroom lecture course *Class location and time*: FL 404 WF 2:00 -3:20 PM (Lecture) This course has no design content.	
4. Instructor contact information	
Instructor's name *Office address* *Office Hours* *Contact telephone number* *Email address*	Dr. Stewart Glegg, Professor Engineering West (Blg 36) Bldg., Room 185 T: 9-11 am, 561-297-2633 sglegg@fau.edu
5. TA contact information	
TA's name *Office address* *Office Hours* *Contact telephone number* *Email address*	
6. Course description	
Fundamentals of acoustics. Sound propagation in fluids; speech, hearing, noise, architectural acoustics, loudspeakers, microphones, transducers, underwater sound transmission.	
7. Course objectives/student learning outcomes/program outcomes	
Course objectives	1) To introduce the principles of underwater and airborne acoustics 2) To provide a practical working knowledge of underwater acoustics through problem solving and projects 3) To provide the fundamental knowledge needed for designing acoustic systems. 4) To provide practice using the computer as an everyday engineering tool. 5) An understanding of professional and ethical responsibility
Student learning outcomes & relationship to ABET 1-7 objectives	1. An ability to apply the knowledge of mathematics for formulation and analysis of acoustics problems (a,e/1) 2. A thorough knowledge of the basic properties of sound propagation and mechanisms of sound generation (a,e/1) 3. An ability to calculate sound levels (a,e/1)

	4. A ability to write simple computer codes (a,e,k/1,2,6) 5. An understanding of professional and ethical responsibility (f/4)

8. Course evaluation method

Two exams during class (15% ea) 30% Quizzes 20% Projects & computer tasks 20% Comprehensive Final Exam 30% 100%	*Note*: The minimum grade required to pass the course is C. Quizzes will be held on a regular basis throughout the semester based on homework assignments on acoustics and engineering ethics. Make up quizzes may be given, but only with prior permission from the instructor based on an email request.

9. Course grading scale

Grading Scale:
95 and above: "A", 90-95: "A-", 85-90: "B+", 80-85: "B", 75-80 : "B-", 70-75: "C+", 65-70: "C", 60-65: "C-", 55-60: "D+", 50-55: "D", 45-50: "D-", 45 and below: "F."

The final grade for the course will be the numerical average of grades assigned for all work in each of the categories listed above weighted according to the percentages shown.
The instructor reserves the right, in exceptional cases, to raise or lower the final numerically averaged course grade by 2.5% in cases where the instructor does not believe that the average is representative of the student's performance in the class. Normally, the student will receive the numerically-averaged letter grade for the course.

10. Policy on makeup tests, late work, and incompletes

Students are expected to attend all classes and complete all project and computer assignments.
Any exam, assignment or quiz missed or not submitted will be averaged as a zero. Make-ups will not be given except in the case of illness, or with the prior permission of the instructor.

An Incomplete, or an "I" grade, will only be given if a student, while carrying a passing average, becomes ill and is unable to complete the course on time. An "I" will not be given out to a student failing the course

11. Special course requirements

12. Classroom etiquette policy

University policy requires that in order to enhance and maintain a productive atmosphere for education, personal communication devices, such as cellular phones and laptops, are to be disabled in class sessions.

13. Disability policy statement

In compliance with the Americans with Disabilities Act Amendments Act (ADAAA), students who require reasonable accommodations due to a disability to properly execute coursework must register with Student Accessibility Services (SAS)—in Boca Raton, SU 133 (561-297-3880); in Davie, LA 203 (954-236-1222); or in Jupiter, SR 110 (561-799-8585) —and follow all SAS procedures.

14. Honor code policy

Students at Florida Atlantic University are expected to maintain the highest ethical standards. Academic dishonesty is considered a serious breach of these ethical standards, because it interferes with the university mission to provide a high quality education in which no student enjoys unfair advantage over any other. Academic dishonesty is also destructive of the university community, which is grounded in a system of mutual trust and place high value on personal integrity and individual responsibility. Harsh penalties are associated with academic dishonesty. See University Regulation 4.001 at www.fau.edu/regulations/chapter4/4.001_Code_of_Academic_Integrity.pdf

Cell phones are not allowed during exams. If cell phones are detected during any exam periods, this will result in a **grade of "zero" on that exam and a note in the student's academic file.**

15. Counseling and Psychological Services Center

Life as a university student can be challenging physically, mentally and emotionally. Students who find stress negatively affecting their ability to achieve academic or personal goals may wish to consider utilizing FAU's Counseling and Psychological Services (CAPS) Center. CAPS provides FAU students a range of services – individual counseling, support meetings, and psychiatric services, to name a few – offered to help improve and maintain emotional well-being. For more information, go to http://www.fau,edu/counseling/

16. Required texts/reading

Class notes will be provided in the form of a textbook

17. Supplementary/recommended readings

1. Fundamentals of Acoustics, 4th edition, Kinsler, Frey, Coppens and Sanders, Wiley, 1999

18. Course topical outline, including dates for exams/quizzes, papers, completion of reading

1. Introduction to Acoustics
1.1. Ocean Engineering and Underwater Acoustics
1.2. Applications of Acoustics in Ocean Engineering
1.3. Overview of Sonar Systems
1.4. Noise Control and System Design to control radiated noise

1.a Professional and Ethical Responsibility in Engineering, see (http://www.nspe.org/Ethics/CodeofEthics/index.html)

2. Sound Waves
2.1. Concept of a wave
2.2. Progressive waves
2.3. Energy Acoustics
2.4. Decibels and Sound Pressure Levels

3. The Sonar Equation
3.1. Source Level, Transmission Loss and Attenuation
3.2. Echo level, Target strength, Detection Threshold and Ambient noise
3.3. Reverberation

4. The Acoustic Wave Equation

4.1. Acoustic Variables
4.2. Basic Assumptions
4.3. The Equation of State
4.4. The Equation of Continuity
4.5. Forces on the Fluid Particle and Euler's equation
4.6. The Linearized Acoustic Wave Equation in One Dimension
4.7. The Linearized Acoustic Wave Equation Derivation in Three Dimensions
4.8. The Solution to the Wave Equation
4.9. Complex Numbers and Harmonic Signals
4.10. Particle velocity, Acoustic impedance, and Acoustic Intensity
4.11. The Speed of Sound in Fluids

5. Reflection and Transmission of Acoustic Waves
5.1. Sound Transmission from One Medium to another (Normal Incidence)
5.2. Sound Transmission through a Fluid Layer (Normal Incidence)
5.3. Sound Power Conservation
5.4. Transmission Loss through a Wall (Panels and Partitions)
5.5. Oblique Waves at an Interface
5.6. Snell's Law, Reflection Coefficient, Critical Angle, Angle of Intromission
5.7. Method of Images
5.8. Lloyd's Mirror Effect

6. Acoustic Sources
6.1. Sound Field from a Simple Source – Pulsating Sphere
6.2 Distributions of Point Sources and the Far Field Approximation
6.3. Acoustic Intensity and Sound Power Output
6.4. Sound Radiation from a Continuous Line Radiator (Line source)
6.5. Source Directionality
6.6 Sonar Receivers
6.7. Radiation from Circular Piston in a Baffle (Simple Model for Loudspeaker)
6.8. Mechanical Impedance and Radiation Impedance
6.9. Radiated Sound Power and Radiation Efficiency

Computer Assignment: Calculating Sound Levels (MATLAB required)
Project: Evaluating Sonar Systems

Homework problems will be assigned during class and are at the end of each chapter in the notes.

Exam # 1: February 15th, 2019
Exam # 2: March 22rd, 2019
Final Exam: Wed. May 1st, 2019 1.15 pm-3.45 pm

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