

1. Department, course number, and title
ORE 654 Applications of Ocean Acoustics

2. Designation
Elective

3. Course Catalog Description
Using sound to observe the ocean. Fundamentals of propagation, sources and receivers, radiated sound and scattering, bubbles, waveguides, scattering at rough surfaces, and bioacoustics. Topics include: marine mammals, fish and plankton imaging, navigation and communication, sound of seismics, ships, wind and rain, using sound to study ocean dynamics, flow imaging and measurement, mapping the seafloor and the combined forward/inverse problem.

4. Prerequisites
Consent of instructor

5. Textbook(s)
Sound in the Sea, Medwin, Cambridge University Press, 2005

Reference Books

Fundamentals of Acoustical Oceanography, Medwin and Clay, Associated Press, 1998
Acoustical Oceanography, Clay and Medwin, John Wiley & Sons, 1977
Underwater Acoustic Systems, Coates, John Wiley & Sons, 1989
Oceanography and Acoustics: Prediction and Propagation Models, Robinson and Lee, American Institute of Physics, 1994
Inverse Problems in Underwater Acoustics, Taroudakis and Makrakis, Springer, 2001
Sound transmission through a fluctuating ocean, Flatte, Cambridge University Press, 1979
Ocean Acoustic Tomography, Munk, Worcester, and Wunsch, Cambridge University Press, 1995
The Sonar of Dolphins, Au, Springer-Verlag, 1993
Principles of Underwater Sound, Urick, McGraw-Hill, 1975

6. ABET Course Learning Outcomes

7. Topics Covered

1. Fundamentals: Simple propagation, rays, sources and receivers, radiated sound, bioacoustics, waveguides, scattering by bubbles, interior fluctuations, and rough surfaces
2. The near surface ocean: upper ocean boundary layer and rain
3. Bioacoustics: sensing of plankton and nekton; passive acoustics and marine animals, marine mammals
4. Ocean Dynamics: tomography, time reversal, turbulence
5. Ocean Bottom: imaging hydrothermal vents, large scale mapping

8. Schedule

Two 1.25-hour sessions per week

9. Contribution of course to meeting the requirements of Criterion 5

Assessment

Assignments (40%)

Class participation (10%)

Project paper and presentation (50%)

Usage of Engineering Tools and Computers

Matlab and Excel

Contribution to Professional Component

Engineering Science: 3 credits

10. Relationship to Program Outcomes

Program Outcome 2: Basic science, mathematics, & engineering

Program Outcome 4: Ocean engineering specialization

Program Outcome 5: Use of latest tools in ocean engineering

Program Outcome 6: Problem formulation & solution

Program Outcome 9: Professional issues

Program Outcome 10: Communication skills

Program Outcome 11: Research & contemporary issues

11. Prepared by

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EXTRA INFO SUPPLIED BY AUTHOR

Course Objectives

The objective of this course is to provide the ocean engineering student an understanding of how sound propagates through the ocean environment and how to use that information to observe the ocean. The course will provide an overview of the fundamentals of sound propagation, sound of seismics, ships, wind and rain, bioacoustics, using sound to study ocean dynamics, and imaging and mapping the seafloor. At the outcome, students will be able to formulate the combined forward/inverse problem, from tracing rays and estimating sound levels to solving for rainfall or current velocity, for example.