ORE 654: Applications of Ocean Acoustics

Syllabus

Fall Semester 2013
Tuesday/Thursday 12:00-1:15 PM
Holmes Hall 241
Instructor: Bruce M. Howe, POST 105G, bhowe@hawaii.edu
Office Hours: Tuesday/Thursday 1:30 – 2:30 PM
Course web page: http://www.ore.hawaii.edu/OE/ore_howe.htm

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.

Prerequisites
Consent of instructor
Designation Elective
Credits 3

Course topics
Fundamentals: Simple propagation, rays, sources and receivers, radiated sound, bioacoustics, waveguides, scattering by bubbles, interior fluctuations, and rough surfaces
The near surface ocean: upper ocean boundary layer and rain
Bioacoustics: sensing of plankton and nekton; passive acoustics and marine animals, marine mammals
Ocean Dynamics: tomography, time reversal, turbulence
Ocean Bottom: imaging hydrothermal vents, large scale mapping
Other topics: noise from pile driving, ocean energy devices, etc.

Textbook
Sound in the Sea, Medwin, Cambridge University Press, 2005

Reference Books
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
Sound transmission through a fluctuating ocean, Flatte, Cambridge University Press, 1979
The Sonar of Dolphins, Au, Springer-Verlag, 1993

Grading:
10% Class participation
40% Homework One every 2-3 weeks, 3 total; plus summaries of guest lectures
50% Project Week 4: topic chosen
Week 7: summary, outline, references, brief presentation
Week 13: written paper due
Week 14: project presentations

Course Project
A topic of interest to the student and instructor will be chosen. The student will read several research articles about the topic, and apply the knowledge to analyze a new situation of interest. This will be written up in a paper (1500-2500 words, < 6 pages with figures, in IEEE format) and a 15-minute presentation made to the class.

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