SYLLABUS for SIO190

Introduction to Acoustics,
Winter 2022, 11-11:50am MWF, IGPP 4301

Instructor:
Janet M. Becker
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Problem Solving Sessions: TBD
Office Hours (on Zoom): TBD or by appointment (e-mail me)

Academic Prerequisites: Math 20D, 20E, 18 or 31AH and Physics 2C or consent of instructor.

Textbooks: We will use selected sections of the following textbook that is available online from the UCSD library. Reading from other sources also may be assigned.

H. Medwin and C.S. Clay (MC98), Fundamentals of Acoustical Oceanography, 1998: This text is available through your UCSD account at: https://www.sciencedirect.com/book/9780124875708/fundamentals-of-acoustical-oceanographybook-info

Canvas website: Assignments will be posted on Canvas. We will use Gradescope for homework submissions.

Course description: In this course, we will study sound propagation in fluids with a focus on aspects of acoustics that are relevant to the ocean including the interaction of acoustic waves with the surface and seafloor as well as volume scatterers (e.g. bubbles, fish) and the processing of ocean acoustic time series data. Experts in ocean acoustics will provide a few guest

lectures on real world applications. Proposed topics covered may be added or deleted as appropriate.

Proposed topics to be covered (all chapters and sections refer to MC98):

1. Ocean acoustics overview (Chapter 1)
2. Sound propagation (Chapter 2)
   (a) Huygen's principle for impulses: Refraction, Reflection and Diffraction (§§ 2.1-2.2)
   (b) Sound propagation for plane waves, spherical waves, interference (§§ 2.3-2.4)
   (c) Conservation laws, the equation of state for linear acoustics, and the wave equation (§ 2.5), the wave equation in 3D (§ 2.7)
   (d) Plane waves, reflection and transmission (§ 2.6).
3. Transmission along ray paths (Chapter 3)
   (a) Impulse sources and CW (continuous wave) propagation (§ 3.1)
   (b) Ray paths, travel time, and reflection at interfaces (§3.2)
   (c) Refraction of ray paths in a lossless ocean (§ 3.3).
   (d) Attenuation due to absorption and scattering, the SONAR equations (§ 3.4).
   (e) Dopper theory (§ 3.6)
4. Sources and Receivers (Chapter 4, §4.1 briefly).
5. Digital signal processing of acoustic data (Chapter 6, Professor Hodgkiss)
6. Sound scattered from a body (§§ 7.1,7.5)
7. Passive bioacoustics (Professor Hildebrand)
8. Wave guides and normal modes (§§ 11.1, 11.2)
9. Seafloor mapping (parts of Chapter 14).

Course grade:
The final course grade will be based on following:
Homework assignments (40%), mid-term exam (15%), and final exam (45%).

Homeworks: We will have weekly homework assignments.
Exams:
- Midterm exam: 2 February 2022
- Final exam: Monday, 14 March 2022, 11:30am-2:30pm.

Course policy and Academic integrity:

1. Homework assignments and solutions will be available on the Canvas website.
2. All students are expected to adhere to the UCSD Policy on Integrity of Scholarship. You may discuss homework problems, but must prepare and submit homework reports on your own. Exams will have clear rules provided to students, and will be designed and administered to uphold academic integrity. For problems assigned from the textbook, use of online solutions manuals is prohibited.
3. Homework must be written clearly and neatly. The homework is due at the time specified on the assignment and your solutions will be uploaded to gradescope. No late homework will be accepted unless justified.
4. Asking questions during the lectures is encouraged and appreciated.

Disability Resources: Students requesting accommodations for this course due to a disability must provide a current Authorization for Accommodation (AFA) letter issued by the Office for Students with Disabilities (OSD) which is located in University Center 202 behind Center Hall. Students should present their AFA letters to Faculty (please make arrangements to contact me privately) at least two weeks prior to an exam to ensure that accommodations may be arranged.

Contact the OSD for further information:
T: 858.534.4382
E: osd@ucsd.edu
W: http://disabilities.ucsd.edu