SIOC 202A – FUNDAMENTALS OF WAVE PHYSICS

Welcome to the Course

Course Information

Course Description	*This course covers topics in surface waves and acoustic waves.*
Credits	*4 units/credit hours of lecture*
Instructor	*Xuanting Hao and Ying-Tsong Lin*

Prerequisites: familiarity with undergraduate-level fluid mechanics, calculus, ODE and PDE.

Classes

In-person lectures: MW   9:00am-10:20am   Location: Spiess Hall 330

Office hours:
Hao (week 1-5): M 8:00am-9:00am W 8:00am-9:00am, 10:30am-11:30am   Location: Keck Center 367   Email: x3hao@ucsd.edu
Lin (week 6-10): M 11:00am-1:00pm, T 11:00am-1:00pm and Th 11:00am-1:00pm, Location: Spiess 460   Email: ytlin@ucsd.edu (reservation required)

Asynchronous (Online) Course Elements:

UC San Diego's Learning Management System: https://canvas.ucsd.edu
Login: UC San Diego Active Directory credentials
Purpose*: Assignment submissions, lecture slides*

Course Materials and Tools

Text/Readings/Other Material

Textbooks
Surface waves:
- Rick Salmon, Introduction to Ocean Waves (lecture notes, to download: http://www-pord.ucsd.edu/rsalmon/)
- Young, I. R. Wind Generated Ocean Waves. Amsterdam; New York: Elsevier, 1999. https://doi.org/10.1016/S1571-9952(99)80001-4. (available online from UCSD library)
- Dean, R. G., and R. A. Dalrymple. Water Wave Mechanics for Engineers and Scientists. Singapore; Teaneck, NJ: World Scientific, 1991. (available from UCSD library)

Acoustic waves: (freely accessible through UCSD VPN)
- Herman Medwin and Clarence S. Clay, Fundamentals of Acoustical Oceanography. https://www.sciencedirect.com/book/9780124875708/fundamentals-of-acoustical-oceanography

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- Finn B. Jensen, William A. Kuperman, Michael B. Porter, Henrik Schmidt, Computational Ocean Acoustics. https://link.springer.com/book/10.1007/978-1-4419-8678-8
- L. M. Brekhovskikh, Yu. P. Lysanov, Fundamentals of Ocean Acoustics. https://link.springer.com/book/10.1007/b97388

Recommended reading:
- Chapter 7 on potential flow in Fluid Mechanics, 6th edition, P. K. Kundu, I. M. Cohen, D. R. Dowling, Academic Press, 2016. (available online from UCSD library)
- Discovery of Sound in the Sea https://dosits.org/
- Ocean Acoustics Library – OALIB https://oalib-acoustics.org/

Assignments, Projects, and Grading

Summary of Grade Criteria

Assignment	Weight	Due Date
Required assignments (8)	75%	11:59 pm weekly (submit online)
Final exam	25%	03/19/2025 W 8:00a-10:59a Location: TBD

Course Schedule (subject to change)

Week	Title / Topic	Activities, Assessments, and Due dates
1	• Kinematics of monochromatic waves • Two waves	Homework due on 1/15
2	• Wave statistics (multiple waves) • Hydrodynamics (deep water)	Homework due on 1/22
3	• Hydrodynamics (finite depth) • Shoaling waves	Homework due on 1/29

4	• Shallow water equation • Ship waves	Homework due on 2/5
5	• Wave forces	
6	• Introduction of Ocean Acoustics • Linear Acoustic Wave Equation and Fundamental Solutions	Homework due on 2/19
7	• Wavenumber Vectors, Wave Reflection and Wave Refraction • Ocean Acoustic Deep Water Waveguide	Homework due on 2/26
8	• Ocean Acoustic Deep Water Waveguide (cont.) • Ocean Acoustic Shallow Water Waveguide	Homework due on 3/5
9	• Introduction of acoustic scattering theory -- Huygens' Principle -- Helmholtz-Kirchhoff Methods	Homework due on 3/12
10	• SONAR Equations • Applications of Ocean Environmental Acoustics -- Marine Mammal Acoustics -- Seabed and Sediment Acoustics -- Ambient Sound and Soundscape Informatics	

Campus and Course Policies

We expect students to attend every lecture. UC San Diego permits absence for participation in religious observances; see Academic Regulations & Policies (ucsd.edu). UC San Diego expects all students will adhere to its standards of academic integrity; see UCSD Policy on Integrity of Scholarship.

Grading policy:
1. Late submissions:
Late submissions are allowed, but with limitations. Late submissions will be accepted within one day (24 hours) following the original assignment deadline and will be capped at 50% of the total grade. Therefore, it is strongly encouraged to submit assignments on time to maximize the potential for a higher grade.

2. Extensions: Extensions of assignment deadlines will only be granted in exceptional circumstances. Students should contact their instructor as soon as possible if they believe they have a valid reason for an extension.

Accommodations for Students with Disabilities
If a student foresees the need for accommodations, they should promptly schedule a meeting with the professor. Before accommodations can be implemented, students are required to furnish an Authorization for Accommodation (AFA) letter from the UCSD Office for Students with Disabilities (OSD). It's important to note that accommodations cannot be applied in hindsight, such as after an exam has taken place.

Campus Policies

- **UC San Diego Principles of Community**
- **UC San Diego Policy on Integrity of Scholarship**
- **Religious Accommodation**
- **Nondiscrimination and Harassment**
- **UC San Diego Student Conduct Code**

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