

SIOC 202B: Fundamentals of Wave Physics: Optics Part (Spring 2021)

INSTRUCTOR:

Dariusz Stramski

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Office hours: Office hours: Virtual meetings with scheduling in advance

PREREQUISITES:

Students admitted to the SIO graduate program or permission of instructor

COURSE DESCRIPTION:

Units: 4 (combined with SIO202B: Seismic Part); Grade: Letter grade only; Required a passing score on midterm and final exams and participation in lectures.

This course is an introduction to physics of light as it pertains to the study of propagation of light within the ocean, interactions of light with seawater constituents, and applications of optical methods in oceanography. Course meetings will consist of lectures by instructor (see Lec on Schedule).

COURSE GOALS:

- (1) To gain basic understanding of light and mechanisms by which light interacts with matter.
- (2) To become acquainted with concepts and methods of aquatic optics which are used to characterize radiative transfer processes, light fields, and optical properties within natural water bodies.
- (3) To appreciate the links and interactions between underwater light, optical properties, and constituents of natural water bodies.
- (4) To appreciate the strong flavor of diversity of optical applications in oceanography.

READING:

Ocean Optics Web Book: <https://www.oceanopticsbook.info/>

C. Mobley "Light and Water. Radiative Transfer in Natural Waters" Academic Press, 1994.

A comprehensive text on radiative transfer in aquatic environments. Part I can serve as a standard reference work on introduction to ocean optics. Required reading: Chapters 1 and 3.

J.T.O. Kirk "Light and Photosynthesis in Aquatic Ecosystems", Cambridge Univ. Press, 1994. The first part of the book is an introductory text on ocean optics. Recommended reading: Part I.

S. Johnsen “The Optics of Life. A Biologist's Guide to Light in Nature”, Princeton University Press, 2012.

Lucid account of all the essential aspects of light and optical processes in nature, especially as they pertain to biological research. Recommended reading.

N.G. Jerlov “Marine Optics”, Elsevier, 1976.

Classic text in ocean optics.

Handbook of Optics, 2nd edition, McGraw-Hill, Inc. 1995.

Includes a chapter on Optical Properties of Water (Chapter 43 by C. Mobley)

Example textbooks covering basic topics of electromagnetic theory and light:

Hecht, E., Physics, Brooks/Cole Publishing Co, 1994.

Hecht, E., Optics, Addison-Wesley, 1998.

GRADING:

Midterm exam: 50%

Final exam: 50%

ASSIGNMENTS:

Students will receive take-home problem sets for midterm and final exams. Students must work on these exams alone and must return the problem sets with solutions by the deadline.

SCHEDULE:

Course meetings will include lectures by instructor (Lec) and will take place twice a week of 1 hr 20 min duration each during a 5-week period of the quarter. Days/time will be determined in consultation with students at the beginning of the quarter.

Week	Type of Activity	Topic
1	Lec	Basic physics of light: The nature of light
2	Lec	Interactions of light and matter
3	Lec	Radiometry, light fields within and leaving the ocean
4	Lec	Inherent and apparent optical properties of the ocean
5	Lec	Radiative transfer in the ocean

Spring 2021

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SIO 202B - Wave Physics

John Hildebrand

jahildebrand@ucsd.edu

Week 1: Introduction to Seismic Waves, Simple Harmonic Motion

Week 2: Elastic Waves, Strain, Stress, Dynamical Equations

Week 3: Elastic Constants, Stiffness, Attenuation

Week 4: Reflection and Transmission, Slowness Surfaces

Week 5: Surface Waves, Rayleigh and Love Waves, Instrumentation

Course Summary:

Date	Details	Due
Mon Apr 12, 2021	Homework 1	due by 11:59pm
Tue Apr 20, 2021	Homework 2	due by 11:59pm

Course Status

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To Do

4 [Grade Homework 1](#)
100 points • Apr 12 at 11:59pm