

Oceanography

CAS NS 221 (3 credits)

Course Catalog Description (max. 40 words):

Explore how interconnected ocean characteristics (bathymetry, seawater chemistry, biological diversity) and processes (plate tectonics, surface and deep-water circulation, biological production) shape global patterns across multiple scales. Discuss destination-specific environmental issues and hot topics in marine research.

Instructor(s): Sea Education Association Oceanography Faculty

Location: SEA campus in Woods Hole, MA.

Prerequisites: Admission to SEA Semester.

Course Philosophy and Approach:

Oceanography is a six-week course designed to provide students with an understanding of the fundamentals of chemical, physical, biological and geological oceanography. Because field research is vital to the study of oceanography, students will also learn to develop research questions and proposals in preparation for their sea component. As a class, we will determine the scientific agenda of our subsequent research cruise aboard one of SEA's sailing school vessels. *Oceanography* thus serves as a precursor to *Oceanographic Field Methods* and the electives *Practical Oceanographic Research* and *Directed Oceanographic Research*, all of which occur during the sea component. This three-credit course consists of 47 contact hours of official instruction, through lectures, labs, research group meetings, visits to local oceanographic institutions and one field trip. The course calendar below provides preliminary details.

Learning Outcomes:

1. Gain knowledge of the fundamentals of chemical, physical, biological and geological oceanography, as well as their cross-disciplinary interactions.
2. Understand, from a scientific perspective, anthropogenic pressures on ocean ecosystems.
3. Utilize the scientific method to develop hypotheses and propose experimental methods to describe, explain, and predict natural phenomena; formulate and develop an oceanographic project proposal for research to be undertaken during the subsequent sea component.

Evaluation:

Exams	40%
Lab Exercises	10%
Data Analysis Exercises	5%
Research Proposal Preparation Process	
• Research Group Meetings (assignments and participation)	10%
• Proposal presentation	15%
• Written proposal	20%

Assignments:

Exams (2): Two exams, covering material from lectures, readings and discussions, will be given during the shore component. Emphasis will be on application of concepts, not rote memorization of facts.

Lab Exercises and Data Analysis Exercises: These exercises will introduce you to typical oceanographic data types and prepare you to conduct analyses of your own data while at sea.

Research Proposal Preparation Process: Under the mentorship of your oceanography faculty member, you will develop a proposal for a research project to be conducted during the sea component. You may work along or with a co-investigator. Proposal development will be guided through a series of research group meetings, for which thoughtful and well-prepared participation is expected of each student. Keeping up with each step of the process will prove essential to successful proposal creation. Research proposals will be presented orally to your classmates during Week 5 of the shore component. Final written proposals will be due in Week 6. Each proposal will include a carefully researched and written explanation of the scientific work to be undertaken at sea, including an introductory literature review, a statement of hypothesis to be investigated, intended methods and sampling locations, data analysis plan, and references.

Students will be provided full instructions for all assignments during class meetings at the beginning of the course. Specific requirements for the proposal presentation and written research proposal will vary depending on whether the student is subsequently taking *Practical Oceanographic Research* (XAS NS 226) or *Directed Oceanographic Research* (XAS NS 325).

Expectations and Requirements:

- Punctual attendance is required at every class meeting.
- Active participation in class discussion is expected.
- Late assignment submissions are not accepted.
- The policy on academic accuracy, quoted below, will be strictly followed in this class.

The papers that you submit in this course are expected to be ***your original work***. You must take care to distinguish your own ideas and knowledge from wording or substantive information that you derive from one of your sources. The term “sources” includes not only published primary and secondary material, but also information and opinions gained directly from other people and text that you cut and paste from any site on the Internet.

The responsibility for learning the proper forms of citation lies with you.

Quotations must be placed properly within quotation marks and must be cited fully. In addition, all paraphrased material must be acknowledged completely. Whenever ideas or facts are derived from your reading and research, the sources must be indicated. (Harvard *Handbook for Students*, 305)

- Considerations for use of internet sources:
As you browse websites, assess their usefulness very critically. Who posted the information and why? Can you trust them to be correct? Authoritative? Unbiased? (It's okay to use a biased source as long as you incorporate it knowingly and transparently into your own work.) Keep track of good sources that might be useful for subsequent assignments, and annotate in your bibliography any sites you cite. Your annotation should include the name of the author or organization originating any material that you reference. If you can't identify the source, don't use it!

Text(s):

Corso, W. and P.S. Joyce. 1998. *Introduction to Ocean Sciences*. Wadsworth Publishing Company, Belmont, CA.

Miller, C.B. 2004. *Biological Oceanography*. Blackwell Science, Oxford, UK.

Nybakken, J.M., and M. Bertness. 2005. *Marine Biology, an Ecological Approach*, 6th ed. Benjamin Cummings, 592 pp.

Segar, D.A. 2013. *Introduction to Ocean Sciences*. Online text, <http://www.reefimages.com/oceans/oceans.html>

Course Calendar:

Topic	Readings/Assignments Due
Week 1 (7 hours) – on shore at SEA campus in Woods Hole	
Introduction to Oceanography Foundations of Physical Oceanography: <ul style="list-style-type: none"> • Heat Budget, Atmospheric Circulation • Ocean Surface Circulation Cruise Track and Research Plan <ul style="list-style-type: none"> • Regional Oceanography MBL Library Orientation & Woods Hole Tour	Readings: Selections assigned from Corso and Joyce (1998) and Segar (2013).
Week 2 (7 hours) – on shore at SEA campus in Woods Hole	
Foundations of Physical Oceanography (cont.): <ul style="list-style-type: none"> • Geostrophic Flow • Thermohaline Circulation • Waves and Tides 	Readings: Selections assigned from Corso and Joyce (1998) and Segar (2013).

<p>Foundations of Chemical Oceanography:</p> <ul style="list-style-type: none"> • Physical Properties of Water • Seawater Chemistry • Biogeochemistry <p>Research Group Meetings</p>	
<p>Week 3 (12 hours) – on shore at SEA campus in Woods Hole</p>	
<p>Fundamentals of Biological Oceanography:</p> <ul style="list-style-type: none"> • Light and Nutrients • Life in the Ocean • Primary Production • Zooplankton Lab <p>Marine Pollution/Plastics in the Ocean</p> <p>Field Trip: New England Aquarium</p> <p>Research Group Meetings</p> <p>Oceanography Exam I</p>	<p>Readings: Selections assigned from Corso and Joyce (1998), Miller (2004), Nybakken and Bertness (2005), and Segar (2013).</p> <p>Project Topics due.</p>
<p>Week 4 (8 hours) – on shore at SEA campus in Woods Hole</p>	
<p>Fundamentals of Biological Oceanography (cont.)</p> <ul style="list-style-type: none"> • Secondary Production • Harmful Algal Blooms • Marine Ecosystems & Fisheries <p>Fundamentals of Geological Oceanography:</p> <ul style="list-style-type: none"> • Structure of Dynamic Earth • Seafloor Bathymetry • Plate Tectonics <p>Ocean Data View Lab</p> <p>Research Group Meetings</p>	<p>Readings: Selections assigned from Corso and Joyce (1998), Miller (2004), Nybakken & Bertness (2005), and Segar (2013).</p> <p>Outline of Proposal Introduction and Bibliography due.</p>
<p>Week 5 (7 hours) – on shore at SEA campus in Woods Hole</p>	
<p>Fundamentals of Geological Oceanography (cont.):</p> <ul style="list-style-type: none"> • Sediments • Coasts • Hydrothermal Vents <p>WHOI Core Lab Tour</p> <p>Research Proposal Presentations</p>	<p>Readings: Selections assigned from Corso and Joyce (1998) and Segar (2013).</p>

Week 6 (6 hours) – on shore at SEA campus in Woods Hole

Paleoceanography

Carbon Cycle

Abrupt Climate Change

Cruise Research Briefing

Oceanography Exam II

Written Project Proposal due.