GE 112: Oceanography – Introduction to the Marine Environment
Fall 2016

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Office Hours Monday 10:15-12:15, Tuesday 11:15-12:15, and at other times by appointment.

Class meetings Lecture: Palamountain/Davis Auditorium M-W-F 9:05-10 am
Lab: Dana 165 Date and time vary by section.

Required Texts *Oceanography: An Invitation to Marine Science, 8th Ed.,* by Garrison. Prentice Hall. ISBN: 9780495391937, available from the Bookstore and other vendors new or used. Also available on reserve in the Library, and as an e-book rental from CourseSmart.com.

Other Resources More resources are available on *Blackboard (Bb), and will grow as the semester goes on.* Check learn.skidmore.edu a few times weekly.

Course Overview - Oceanography is the study of interactions among the physical, chemical and biological processes that operate in the great water bodies that cover nearly three-quarters of the earth's surface. Introduces the principles of physical and chemical oceanography, marine biology, and marine geology. Students also discuss oceanic change over time and marine environmental issues in the context of the innate relationship between people and the sea.

Three hours of lecture, two hours of lab per week. Fulfills All College requirements in the natural sciences and QR2. GE-112 counts for credit toward majors and minors in Geosciences, Environmental Studies, and International Affairs.

If you are a student with a disability and believe you need academic accommodations in this or any class you must make requests for such accommodation to Meg Hegener, the Coordinator for Students with Disabilities. You will also need to provide documentation which verifies the existence of a disability in support of your request. Accommodations must be approved in advance of exams to allow time to make any supporting arrangements. For further information and assistance with this process, call 580-8150, or stop by Student Academic Services in Starbuck Center.

GE 112: Oceanography Fall 2016

Learning Objectives - By the end of this course, you should be able to:

- Understand the scientific process. Be able to explain how science is communicated, critiqued, and revised over time by many practitioners.
- Understand different ways of visualizing geospatial data, in the context of the oceans.
- Understand how the ocean evolves over time. Explain how plate tectonics controls key features of marine geography. Understand how marine sediments are formed, and how they store information about past changes in the ocean. Explain the factors that affect sea-level change.
- Understand why and how the ocean moves; explain how fundamental physical processes control tides, currents, wind and waves, geography and coastal landforms.
- Understand the factors that control the distributions of salinity, temperature, nutrients, and dissolved gases in the ocean, and how organisms and people can alter these patterns.
- Understand essential marine biological and ecological processes, including adaptations to life in challenging environments from the tidal zone to deep sea trenches.
- Evaluate policy options for current ocean issues in a scientific context, including: global change, coastal management, fisheries and aquaculture, energy resources, and pollution.
- Understand how to effectively communicate about ocean science to public audiences through writing, media and the arts, and function as an informed consumer of science media.

Laboratory Objectives:

- Be able to interpret and explain information from graphical, numerical, and algebraic sources, including spatial and temporal data. Be able to estimate, represent data, and perform transformations including interpolation, graph analysis, and dimensional analysis.
- Be able to read and understand marine charts, bathymetric data, and coastal maps, including recognizing features that result from natural processes and human interventions.
- Be able to read wind and wave charts and understand different coastal hazards including: tsunami, storm surges, and earthquakes
- Relate physical processes such as surface gyres and deep currents, density stratification and mixing, upwelling and downwelling, to ocean chemistry and ocean life.
- Understand some challenges of marine fieldwork, including water profiling and sampling.
- Understand the tragedy of the commons and key challenges of sustainable fisheries policy.

Class Policies

Access and Office Hours - I am available for drop-in meetings during my posted office hours. If you are unable to meet during those times, you are welcome to make an appointment with me at a mutually convenient time. The best ways to set a meeting are to catch me in class or email me. I will respond to your email as soon as I can, usually within 48 hours and often much sooner. However, do not count on more rapid e-mail turn-around time just before exams or other deadlines!

Grading - You will earn your grade based on completing required assignments in the table below.

Exams (3)	40 %
In-class Participation	15
Lab exercises and participation	30
Homework (3)	15
TOTAL	100 %

Exams - Exams are cumulative; but, subsequent exams will focus primarily on topics presented since the previous exam. I offer four exams in this course, but only your top three grades will count toward your final course grade – in other words, I will drop the lowest of your four exam scores.

There are no make-ups for a missed exam. While your lowest exam score will simply be dropped, your study plans for the semester should include time to thoroughly prepare for all four exams. The dropped-score policy is intended to help you deal with *unplanned* events such as major illnesses, sudden life changes, and unexpected family crises. *At my discretion*, one make-up exam may be offered only in cases where a student has missed two exams due to circumstances *beyond the student's control* (travel for weekends and academic breaks, athletic events, job interviews, professional/post-graduate entrance exams, and work schedules are not acceptable reasons). Documentation is expected in such extremely rare instances. If you study hard and you are happy with your exam average after the first three exams, you may elect to skip the exam given during Finals (1:30-4:30 pm, Monday December 19, 2016).

Participation and Clicker Policies - We will use clickers in GE-112 so that you can have immediate feedback on how well you're understanding the material. You will earn in-class participation credit by using your registered clicker to answer multiple-choice clicker questions offered in class. Choosing correct answers earns additional points. No credit is earned if you are absent or forget to bring your clicker to class. If you bring your clicker to every class and try your best, you should find it easy to earn full participation credit. We will start using clickers on Friday Sept. 16th. You will be assigned your own clicker for the semester in lab on Sept 14-15. Lost clickers will result in a $50 charge to your student account. If you own a clicker, you are welcome to use it in GE-112; just let me know during lab on 9/14-15.

Practice problems – Occasional written practice problems (often taken from old exams) will be assigned at the end of a class period, then handed in and discussed *at the start* of the following class period. These problems will complement clicker questions by offering more in-depth opportunities to exercise your understanding of concepts covered in class. Practice problems will be graded on a credit/no-credit basis and will count towards your participation grade. *No late work* will be accepted for these problems; if you are late or absent on the day the problem is due, you won't earn credit.

Attendance and timeliness - As with any class, attendance and active participation are key. I will strive to be on time and prepared for every class, and I expect the same from all students. If under rare circumstances you must arrive a few minutes late, please enter quietly and find a seat quickly. I do not take attendance directly and there is no specific penalty for missed classes. However, if you miss class or forget your clicker you will miss opportunities to garner participation credit on those days. You are held accountable for the lecture material and any reading assignments, exams, deadlines or changes announced in class. If you miss class, it is your responsibility to make up what you've missed. Check with classmates, then see me. **Please note that these attendance policies apply to the *lecture* only; lab attendance is required every week and absences must be cleared in advance and made up afterwards (see separate lab syllabus for details).**

Laboratory – Hands-on, inquiry-driven experiences have proven extremely effective for learning oceanography, which why the laboratory component is so important. It is very unlikely that you can pass this course without making a good effort in the lab, worth 30% of your final grade. There are ten lab exercises planned including at least two outdoor trips, and each week you will take a quiz or submit a write-up. I will drop your lowest lab quiz grade of the semester.

Homework – Three graded homework assignments will be given in this course. Homework is only available during specific date windows. Follow directions about submitting assignments electronically via Blackboard. Assignments are to be submitted on or before the specified date and time. Late work will be marked down 5% per day past the due date—i.e., credit for an assignment turned in one week late will not exceed 70%. I reserve the right not to accept work that is more than one week late; if an assignment will be later than this you must see me about it.

Electronic Devices – Electronic devices and cell phones are allowed in class as long as they *do not distract you or those around you.* This means, for example, that cell phones must be silenced, and laptops used only for activities immediately relevant to this class. This policy, in which electronic devices are present but silent and unobtrusive, reflects the norms of the professional world that you will enter after you graduate. If I notice that you or your neighbors are distracted by your device(s), I reserve the right to restrict their use by everyone, for the remainder of the semester. Electronic devices and cell phones are not allowed during exams.

A note on laptop computers and notetaking – While many of us can type faster than we write by hand, research shows that we don't learn as well when we take notes on laptop computers. There

are two reasons. The first is obvious: an internet-connected computer offers distractions that take enormous willpower to ignore! The second reason is that your slower handwriting speed forces you to digest, paraphrase, and organize the ideas in the lecture. These are the first steps of knowledge retention. Therefore, while laptop notetaking is not prohibited, I urge you to consider taking notes the old-fashioned way, then revisiting the lecture slides and textbook as necessary during your out-of-class study time to fill in any missing details. Also, dropping by office hours is an excellent way to clarify your notes!

Academic Integrity - Plagiarism, cheating, and other violations of academic integrity including improper clicker use will not be tolerated, and will result in consequences in accordance with the Skidmore College Student Handbook (https://www.skidmore.edu/student_handbook/honor-code.php). All violations, no matter how minor, will be discussed with the Office of Academic Advising. When writing any kind of academic document, sources of information, including internet sources, must be properly cited, in accordance with the Skidmore College Honor Code. Detailed instructions regarding citation conventions are available from the Library.

Support – Get to know your classmates, both in lecture and lab. Set up your own study group and meet regularly throughout the semester… not just the week before exams. You can also improve or even excel with help from experienced students in regular study groups and one-on-one peer tutoring: http://www.skidmore.edu/academic_services/tutoring/faq.php. Of course, I am available to you for extra coaching or to discuss anything Earth/Ocean related that's on your mind anytime in office hours or by appointment.

If you find yourself starting to fall behind in GE-112 for any reason, please come talk with me right away.

Important Dates (subject to adjustment)

Homework

- Homework 1 – Science communication project proposal – more information during 2nd week of class
  - Due on Bb by 11:59 pm on **Sunday, Oct. 9th**
- Homework 2 – Science communication project
  - Due on Bb by 11:59 pm on **Sunday, Nov. 13th**
- Homework 3 – *Marine Ecosystems Quiz*. Complete on Bb between **Mon., Nov. 14th and 11:59 pm on Mon., Nov. 30th**

Exams

- Exam 1 – **Friday, Sept. 30th,** during class
- Exam 2 – **Monday, Nov. 7th,** during class
- Exam 3 – **Friday, Dec. 2nd**, during class
- Final Exam – **Monday, December 19th, 1:30-4:30 pm,** Davis Auditorium

GE 112: Oceanography Fall 2016

Schedule (subject to adjustment)

Assigned readings should be completed **before** Monday's class.

Week	Monday lecture	Wednesday lecture	Friday lecture	Lab topic
Sept. 7-9	No class	Introductions, logistics, and overview of oceanography	Maps, navigation, history of ocean exploration	No lab
Reading: Garrison, Ch. 2, "History"; Ch. 4, p. 112-120, "Bathymetry"; Appendix III, "Latitude and Longitude, Time, and Navigation; Appendix IV, "Maps and Charts"; examine the maps on p. 572-575				
Sept. 12-16	The scientific process, history of oceanography, and Earth's formation	Earth's structure, the scientific process continued, and intro to plate tectonics	Plate tectonics: Plate boundaries and interactions	Navigation and Bathymetry
Reading: Bauer and Longino excerpts on the scientific process; Garrison, Ch. 1, "Origins"; Garrison, Ch. 3, "Earth Structure and Plate Tectonics"				
Sept. 19-23	Plate tectonics: Life cycle and parts of an ocean basin	Volcanism in the oceans; introduction to sea-level change	Sea-level change continued; Emergent vs. submergent coasts, intro to sediments	Plate tectonics
Reading: Garrison Ch. 4, "Ocean Basins"; Ch. 12, "Coasts" p. 370-373; Ch. 5, "Sediments"				
Sept. 26-30	Sediments continued; erosional and depositional landforms	Coastal change and human shoreline modification	EXAM 1: MARINE GEOLOGY	Sediments
Reading: Garrison Ch. 12, "Coasts", p. 352-367 and 376-380				
Oct. 3-7	Properties of water, heat and salt in the ocean	Solar energy; global patterns in temperature and salinity	Stratification; Intro to the Coriolis Effect	Stratification
Reading: Garrison Ch. 6, "Water and Ocean Structure" ; Garrison Ch. 7, p. 206-217, "Ocean Chemistry"				
Oct. 10-14	The Coriolis effect, continued; intro to Ekman transport HOMEWORK 1 DUE SU. 10/9 11:59PM	No class (Yom Kippur)	No class	No lab
Reading: Garrison Ch. 8, "Circulation of the Atmosphere"; Garrison Ch. 9, "Circulation of the Ocean" p. 262-279				
Oct. 17-21	No class	Surface currents, geostrophic flow, and ocean gyres	Geostrophic flow continued; upwelling and downwelling	Saratoga Lake field trip
Review Garrison Ch. 9, "Circulation of the Ocean" p. 262-279				
Oct. 24-28	Eddies; how oceanographers measure surface currents	Deep water circulation, ocean-atmosphere oscillations	Deep water circulation, water masses	Argo floats (in the GIS Center)
Reading: Garrison Ch. 9 p. 280-295				
Oct. 31-Nov. 4	Shallow waves, refraction, and tsunami	Waves, continued; intro to tides	Tides, continued	Hurricanes and tsunami
Reading: Garrison Ch. 10, "Waves"; Garrison Ch. 11, "Tides"				
Nov. 7-11	EXAM II: PHYSICAL OCEANOGRAPHY	Ocean biology intro; photosynthesis and respiration	Light and nutrients	No lab (finish Homework 2)
Reading: Garrison, Ch. 13, "Life in the Ocean"; Garrison Ch. 14, "Plankton, Algae, and Plants"				

GE 112: Oceanography – Introduction to the Marine Environment
Fall 2016

Nov. 14-18	Pelagic ecosystems and classification of marine life HOMEWORK 2 DUE SU. 11/13 11:59PM	Ocean carbon and oxygen cycles	Ocean carbon cycle and climate	Plankton
Reading: Garrison, Ch. 7 p. 217-225, "Gases in seawater"				
Nov. 21-25	Adaptations for life in the ocean	No class (Thanksgiving)	No class (Thanksgiving)	No lab
Reading: Garrison, Ch. 15, "Marine Animals"				
Nov. 28-Dec. 2	Adaptations for life in the ocean; life at small scales HOMEWORK 3 DUE MO. 11/30 11:59PM	Benthic and neritic ecosystems	EXAM III: BIOLOGICAL OCEANOGRAPHY	Marine biodiversity
Reading: Garrison, Ch. 16, "Marine Communities"				
Dec. 5-9	Human impacts: Pollution	Human impacts: Corals and ocean acidification	Human impacts: Fisheries and aquaculture	Fisheries management
Reading: Garrison, Ch. 17, "Marine Resources"; Ch. 18, "The Ocean and the Environment"				
Dec. 12-16 **Reading:**	Human impacts: Marine Resources	Synthesis and wrap-up		No lab