

# **ESCI 1006/1106 Oceanography**

Fall, 2016

**Instructor:** Daniel Jones, Ph.D.

Contact: dsjones@umn.edu

Office: 383 Shepherd Labs

Office hours: Th 1:00-2:00 PM, F 10:00-11:00 AM or by appointment

## **ESCI 1006: 4 credits**

Satisfies CLE requirements for Physical Science Core with Lab  
and CLE requirement for the Environment Theme

## **ESCI 1106: 3 credits**

Satisfies CLE requirement for the Environment Theme

### **COURSE OVERVIEW**

Welcome to Oceanography! Although the oceans surround us, in many ways they remain more mysterious than the surface of the Moon. The world ocean includes the deepest places and the largest mountains on earth, a dynamic and ever-changing pattern of waves, tides, and currents, and an array of unfamiliar creatures that live in a three-dimensional solution of life-sustaining chemical nutrients. Humans derive great benefits from the oceans in terms of food, recreation, and mineral resources. And the oceans impact our daily lives, even in Minnesota, as a controlling force for weather patterns and global climate. In the short space of a semester, this course will provide at least a flavor of the geological, physical, chemical, and biological processes of this complex and fascinating part of our world.

There are no prerequisites for this course, other than an interest in marine science.

### **COURSE OBJECTIVES**

Through this course, students will:

- Learn the scientific process, and that science is a way of viewing and explaining the world around us. It is a social and historical process, not simply a growing collection of "facts" handed down by people older or deader than you. I will encourage critical evaluation of the assumptions and evidence behind scientific information, both using historical examples as well as topics that currently impact policy decisions.
- Learn basic principals of oceanography. Successful students will be able to explain (in words and diagrams, not equations) the physics governing tides and ocean currents, the geology of different features on the sea floor, and the biological and chemical processes responsible for cycling important elements like carbon and phosphorus
- Learn how organisms interact with the geological, physical, and chemical processes of the ocean and atmosphere. For example, successful students will be able to explain feedbacks among organisms, the carbon cycle, and global climate (past and present).
- Gain an appreciation for the complex environmental issues currently facing the ocean, and the interrelationship between humans and the marine environment.

## **LECTURES**

Section 002 M 6:30-9:00 PM

275 Nicholson Hall

**Facilitators:** Christie Cino (cinox001@umn.edu) and Patricia Kang (kangx691@umn.edu)

## **LABS**

- ESCI 1006 only
- All labs meet in 100 Pillsbury Hall
- Labs start Monday, 12 Sept
- You must go to the lab for which you are registered

## **Lab sections**

101 M 10:10 AM - 12:05 PM

102 M 12:20 PM - 2:15 PM

103 M 3:35 PM - 5:30 PM

104 Tu 9:05 AM - 11:00 AM

105 Tu 11:15 AM - 1:10 PM

106 Tu 1:25 PM - 3:20 PM

107 Tu 3:35 PM - 5:30 PM

108 W 10:10 AM - 12:05 PM

109 W 12:20 PM - 2:15 PM

110 Th 3:35 PM - 5:30 PM

111 Th 9:05 AM - 11:00 AM

112 Th 11:15 AM - 1:10 PM

113 Th 1:25 PM - 3:20 PM

## **Lab teaching assistants**

Jacob Moen

moenx268@umn.edu

Elizabeth Roepke

roep0043@d.umn.edu

Tatsuro Tanioka

tanio003@umn.edu

Jacob Zahn

zahnx041@umn.edu

## **TEXT**

Garrison, Tom. *Oceanography: An Invitation to Marine Science, 8th Edition.*

Note: Other readings will be assigned from time to time

Lab manual: ESCI 1006 lab manual (purchase this in advance and bring it to the first lab)

## **WEBSITE**

Moodle course website

<https://ay16.moodle.umn.edu/>

## **GRADING**

### **ESCI 1006:**

30% Labs

35% Quizzes (best 4 of 5)

10% Midterm

25% Final Exam

### **ESCI 1106:**

60% Quizzes (best 4 of 5)

15% Midterm

25% Final Exam

## **FINAL EXAM (COMPREHENSIVE)**

Monday, December 19<sup>th</sup>, 6:30 PM – 8:30 PM, same room (275 Nicholson)

Quizzes will be bi-weekly, and the first quiz will be week 3. Most quizzes will be given during the final 40 minutes of class, and will cover material from the previous two lectures. Quizzes will contain a mixture of multiple choice and short answer questions. There will be five quizzes total, and you will be graded on your best four scores. (That is, your lowest score is dropped.) If you miss a quiz due to an unexcused absence, you will score a zero but that quiz can be the one you drop. For additional information, please see the section on missing class.

There will be an **in-class midterm** exam week 9, which will cover material from weeks 1-8.

## **FIELD TRIP**

Note that the lab portion of the course includes a required trip to “Underwater World” at the Mall of America. More information will be given out in labs.

## **GRADING INFORMATION**

Following University of Minnesota policy, the major letter grades in this course are defined as follows: A, achievement that is outstanding relative to the level necessary to meet course requirements; B, achievement that is significantly above the level necessary to meet the course requirements; C, achievement that meets the course requirements in every respect; D, achievement that is worthy of credit even though it fails to meet fully the course requirements; F, achievement not worthy of credit or a course not completed and no agreement with the instructors about assigning an Incomplete. For additional information, please refer to: <http://policy.umn.edu/education/gradingtranscripts>.

The grading scale is as follows:

A	100.00-93.33
A-	<93.33-90.00
B+	<90.00-86.67
B	<86.67-83.33
B-	<83.33-80.00
C+	<80.00-76.67
C	<76.67-73.33
C-	<73.33-70.00
D+	<70.00-66.67
D	<66.67-60.00
F	<60.00

If the average overall score in the course after all points for all assignments are accounted for drops below 80%, the average score will determine the C+/B- boundary. The other divisions and subdivisions will be based on the distribution of scores around the average. If the average is above 80%, there will be no curve for the final grade. It is possible for everyone to get an A.

During the semester, I will offer several opportunities for extra credit. Most of these will be at the end of class as small group activities. **Beyond these specifically designated opportunities, no other extra credit is available.** I will look over any exam or homework questions you think are not graded correctly and adjust your score as appropriate, but will not negotiate your final grade for even a fraction of a point. If you are having trouble in class for academic or any other reasons and are concerned about your grade, you should talk to me or to your laboratory TA early on so we can discuss how you can improve your understanding and your performance.

You can take the course S-N if you choose and it fits with your degree requirements. A grade of S represents achievement that is satisfactory and is equivalent to a C- or better; a grade of N represents achievement not worthy of credit or a course not completed and no agreement with the instructors about assigning an Incomplete. By University policy, I will notify you during week 6 if you are at risk of scoring a D, F, or N. This notice will be based on your grade on course work at that point in the semester.

### **OTHER THINGS**

Attendance at both lecture and your lab section is required and expected. Lecture starts at 6:30 PM. Please be prompt and ready to start at that time. If you arrive late, your entrance will disrupt the lecture and disturb those students who did arrive on time.

**Turn off all cell phones, MP3 players, and other gadgetry** before you come to class and remove any headphones or headsets. If your cell phone rings during lecture or an exam, **I will answer it for you.** This is no joke, but it will be funny.

Unless specifically allowed by me or the TAs, no devices that allow communication of any kind may be used during examinations (quizzes or final exams). This includes, but is not limited to: cell phones, pagers, messaging devices, PDAs, and computers with wireless network connections. Laptops, tablets, and other electronic note taking devices are allowed during normal lecture.

**Missing class:** You must notify us in advance of any travel plans for university-sponsored events (athletics or other activities) that will interfere with scheduled course work, including exams. If you are sick and miss scheduled course work, you must bring in medical verification of your illness. Students will not be penalized for absence during the semester due to unavoidable or legitimate circumstances. Such circumstances include verified illness, participation in intercollegiate athletic events (see Administrative Policy: *Intercollegiate Athletic Events during Study Day and Finals Weeks: Twin Cities*, which prohibits intercollegiate athletic competition during study and finals week except under certain circumstances), subpoenas, jury duty, military service, bereavement, and religious observances. Such circumstances also include activities sponsored by the University if identified by the senior academic officer for the campus or his or her designee as the basis for excused absences. Such circumstances do not include voting in local, state, or national elections. You will not be allowed to make up work missed for unexcused absences. For complete information, please see: <http://policy.umn.edu/education/makeupwork>.

If you have any physical or learning needs that might impact your learning and evaluation in this course, please let us know as soon as you can so I can make any necessary arrangements with you. The University has a multitude of resources so don't hesitate to let us know.

According to University policy, for 1006, you should expect to spend a total of 12 hours per week working to earn your 4 credits in this class. This includes lecture and lab, which account for 5 of those 12 hours. The remainder should be spent reading your textbook, studying your notes, or coming to office hours. Reviewing your notes for just 30 minutes after each lecture—or over a cup of coffee or soft drink the following morning—will be tremendously helpful as a review, for identifying concepts you do not understand, or for discovering gaps in your notes. I will cover many topics, most of which will be new and unfamiliar to most of you. I will do my part to make it as clear and accessible as possible; you do your part and do your reading and review your notes day to day. I think you will be surprised how manageable quizzes and exams become when you are already prepared before you start studying.

## **UMN POLICY STATEMENTS**

### **Scholastic Dishonesty**

You are expected to do your own academic work and cite sources as necessary. Failing to do so is scholastic dishonesty. Scholastic dishonesty means plagiarizing; cheating on assignments or examinations; engaging in unauthorized collaboration on academic work; taking, acquiring, or using course materials without faculty permission; submitting false or incomplete records of academic achievement; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement; altering, forging, or misusing a University academic record; or fabricating or falsifying data, research procedures, or data analysis. (From the Student Conduct Code:

[http://regents.umn.edu/sites/regents.umn.edu/files/policies/Student\\_Conduct\\_Code.pdf](http://regents.umn.edu/sites/regents.umn.edu/files/policies/Student_Conduct_Code.pdf)) If it is determined that a student has cheated, he or she may be given an "F" or an "N" for the course, and may face additional sanctions from the University. For additional information, please see: <http://policy.umn.edu/education/instructorresp>.

The Office for Student Conduct and Academic Integrity has compiled a useful list of Frequently Asked Questions pertaining to scholastic dishonesty: <http://oscai.umn.edu/avoid-violations/avoiding-scholastic-dishonesty>. If you have additional questions, please clarify with your instructor for the course. Your instructor can respond to your specific questions regarding what would constitute scholastic dishonesty in the context of a particular class—e.g., whether collaboration on assignments is permitted, requirements and methods for citing sources, if electronic aids are permitted or prohibited during an exam.

### **Academic Freedom and Responsibility**

Academic freedom is a cornerstone of the University. Within the scope and content of the course as defined by the instructor, it includes the freedom to discuss relevant matters in the classroom. Along with this freedom comes responsibility. Students are encouraged to develop the capacity for critical judgment and to engage in a sustained and independent search for truth. Students are free to take reasoned exception to the views offered in any course of study and to reserve

judgment about matters of opinion, but they are responsible for learning the content of any course of study for which they are enrolled.\*

Reports of concerns about academic freedom are taken seriously, and there are individuals and offices available for help. Contact the instructor, the Department Chair, your adviser, the associate dean of the college, or the Vice Provost for Faculty and Academic Affairs in the Office of the Provost.

*\* Language adapted from the American Association of University Professors "Joint Statement on Rights and Freedoms of Students".*

### **Student Conduct Code**

The University seeks an environment that promotes academic achievement and integrity, that is protective of free inquiry, and that serves the educational mission of the University. Similarly, the University seeks a community that is free from violence, threats, and intimidation; that is respectful of the rights, opportunities, and welfare of students, faculty, staff, and guests of the University; and that does not threaten the physical or mental health or safety of members of the University community.

As a UMN student, you are expected adhere to Board of Regents Policy: *Student Conduct Code*. To review the Student Conduct Code, please see:

[http://regents.umn.edu/sites/regents.umn.edu/files/policies/Student\\_Conduct\\_Code.pdf](http://regents.umn.edu/sites/regents.umn.edu/files/policies/Student_Conduct_Code.pdf)

Note that the conduct code specifically addresses disruptive classroom conduct, which means "engaging in behavior that substantially or repeatedly interrupts either the instructor's ability to teach or student learning. The classroom extends to any setting where a student is engaged in work toward academic credit or satisfaction of program-based requirements or related activities."

### **Sexual Harassment**

"Sexual harassment" means unwelcome sexual advances, requests for sexual favors, and/or other verbal or physical conduct of a sexual nature. Such conduct has the purpose or effect of unreasonably interfering with an individual's work or academic performance or creating an intimidating, hostile, or offensive working or academic environment in any University activity or program. Such behavior is not acceptable in the University setting. For additional information, please consult Board of Regents Policy:

<https://regents.umn.edu/sites/regents.umn.edu/files/policies/SexHarassment.pdf>

### **Appropriate Student Use of Class Notes and Course Materials**

Taking notes is a means of recording information but more importantly of personally absorbing and integrating the educational experience. However, broadly disseminating class notes beyond the classroom community or accepting compensation for taking and distributing classroom notes undermines instructor interests in their intellectual work product while not substantially furthering instructor and student interests in effective learning. Such actions violate shared norms and standards of the academic community. For additional information, please see section 6 of:

<http://policy.umn.edu/education/studentresp>

### **Equity, Diversity, Equal Opportunity, and Affirmative Action**

The University will provide equal access to and opportunity in its programs and facilities, without regard to race, color, creed, religion, national origin, gender, age, marital status, disability, public assistance status, veteran status, sexual orientation, gender identity, or gender expression. For more information, please consult Board of Regents Policy:

[https://regents.umn.edu/sites/regents.umn.edu/files/policies/Equity\\_Diversity\\_EO\\_AA.pdf](https://regents.umn.edu/sites/regents.umn.edu/files/policies/Equity_Diversity_EO_AA.pdf)

### **Disability Accommodations**

The University of Minnesota is committed to providing all students equal access to learning opportunities. Disability Services (DS) is the campus office that works with students who have disabilities to provide and/or arrange reasonable accommodations. Students who have, or think they may have, a disability (e.g. mental health, attentional, learning, vision, hearing, physical or systemic), are invited to contact DS to arrange a confidential discussion at 612- 626-1333 (V/TTY) or [ds@umn.edu](mailto:ds@umn.edu). Students registered with DS, who have a letter requesting accommodations, are encouraged to contact the instructor early in the semester to discuss accommodations outlined in their letter. Additional information is available at the DS website <http://diversity.umn.edu/disability>.

### **Mental Health Services**

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce your ability to participate in daily activities. University of Minnesota services are available to assist you with addressing these and other concerns you may be experiencing. You can learn more about the broad range of confidential mental health services available on campus via <http://www.mentalhealth.umn.edu>.

### **Other important dates**

For other important academic dates during the semester and the academic year, including drop/add dates and policies, see information at this webpage:

<http://onestop.umn.edu/calendars/#fall2016>

## Class Schedule for ESCI 1006/1106 Oceanography

Fall 2016, section 002

M 6:30-9:00 PM 275 Nicholson Hall

READINGS: Reading should be done before or immediately after the lecture for which it is assigned. This schedule may be updated during the semester, especially reading assignments that may change from time to time to maximize learning strategies. Readings currently listed as TBA will be chosen based on current events (environmental and other issues), and will be announced in advance of that lecture.

“Garrison” refers to the main text (Garrison, Tom. *Oceanography: An Invitation to Marine Science, 8th Edition*)

LABS: Lab sections are arranged and taught separately from lecture. Many of the labs will be on topics not yet covered in lecture. **You are responsible for any other pre-lab reading assigned by the lab instructor and for the topics covered in lab**, regardless of whether or not we have covered the lab topic in lecture.

QUIZZES AND EXAMS: Quizzes will be in class, at the end of class, and will cover material from the previous two lectures.

### CLASS SCHEDULE

#### Week 1: Introduction

---

12 September: Introduction to oceanography; syllabus and course information; origins and history of the Earth and oceans; latitude and longitude  
Readings: Garrison, Ch. 1 (optional), appendix II  
Lab: Lab 1, Plate tectonics and isostasy

#### Week 2: Geological oceanography and plate tectonics

---

19 September: Navigation and finish latitude/longitude; structure of the Earth; plate tectonics  
Readings: Garrison, Ch. 2, 3, appendices II & III  
Lab: Lab 2, Ocean and lake sediments

#### Week 3: Sea floor topography and ocean sediments

---

26 September: Topography and features of the sea floor; erosion and sedimentation; sediments  
Readings: Garrison, Ch. 4, 5  
Lab: Lab 3, Ocean chemistry, pH and buffering capacity  
**Quiz 1**

**Week 4: Physical and chemical properties of water**

---

3 October: The water molecule; physical properties of water; density; ocean chemistry, dissolved gasses, salts, and residence time

Readings: Garrison, Ch. 6, 7

Lab: Lab 4, Salinity of seawater

**Week 5: Circulation of oceans and the atmosphere**

---

10 October: Radiative balance; the Coriolis effect; general atmospheric circulation; hurricanes

Readings: Garrison, Ch. 8

Lab: Lab 5, Thermohaline circulation

**Quiz 2**

**Week 6: Ocean circulation continued**

---

17 October: Deep ocean circulation; surface ocean circulation; gyres and upwelling

Readings: Garrison, Ch. 9

Lab: Lab 6, Surface current flow

**Week 7: Waves**

---

24 October: Basics of waves; waves in the ocean; storm surges; tsunamis; introduction to tides

Readings: Garrison, Ch. 10

Lab: Lab 7, Waves and tides

**Quiz 3**

**Week 8: Tides**

---

31 October: Gravitational forces; equilibrium and dynamic theories of tides

Readings: Garrison, Ch. 11

Lab: Lab 8, Google Earth and the cryosphere

**Week 9: The oceans and climate**

---

7 November: CO<sub>2</sub> in air and water; the greenhouse effect; ice and climate feedbacks; past and future climate; start photosynthesis and respiration

Readings: TBA; Garrison, Ch. 7.3-7.4

Lab: Lab 9, Nutrients and primary productivity

**MIDTERM EXAM (material from weeks 1-8)**

**Week 10: Ocean life and biogeochemistry**

---

14 November: Photosynthesis and respiration; marine biogeochemistry; the carbon cycle and the biological pump

Readings: Garrison, Ch. 13.5-13.7

Lab: Lab 10, El Niño Southern Oscillation (ENSO)

**Week 11: Marine life: from microbes to whales**

---

21 November: Challenges of life in the ocean; whales and whale evolution; whale falls; TBA

Readings: Garrison, Ch. 13,15.11

Lab: no lab (*Thanksgiving break*)

**Quiz 4**

**Week 12: Marine life: from fish to phosphorus**

---

28 November: Nutrients and primary productivity; nutrient cycling; El Niño case study; trophic levels; fish and marine ecosystems;

Readings: Garrison, Ch. 14; Ch 15.7-8; review Ch. 9.5

Lab: Lab 11, Energy, economy and global environment

**Week 13: Marine resources and environmental concerns, the carbon cycle and global warming**

---

5 December: Fish and marine ecosystems continued; overfishing and marine reserves; corals, carbonates, and ocean acidification

Readings: TBA; Garrison, Ch 12.5; Ch. 17.4

Lab: Lab 12, Underwater World (Mall of America)

**Quiz 5**

**Week 14: Hydrothermal vents; course review**

---

12 December: Hydrothermal vents and biogeochemical cycling; course review

Readings: TBA; Garrison, Ch. 16.4 (p. 484-488)

Lab: no lab

**FINAL EXAM (comprehensive)**

---

19 December, 6:30 PM – 8:30 PM, same room