I. BULLETIN INFORMATION
MSCI 101 - The Ocean Environment (4 credit hours)

Instructors/Instructional Assistants
Instructor: Dr. Howie Scher Email: hscher@geol.sc.edu
Office: PSC 519B Phone: 777-2410
Office hours: Monday 1-2 pm; T 2:30-3:30 pm, and by appointment.

IA: Douglas Bell Email: belldw@email.sc.edu
Office: PSC 514 Phone: n/a
Office hours: Tuesday 10:30 am – 12:30 pm

Course Description:
Origin and evolution of the oceans, plate tectonics, ocean circulation, waves and tides, seawater and sediment composition, and influences on biology. Three lecture and three laboratory hours per week. Scheduled field trip required.

Prerequisites: science, engineering, or education major or consent of instructor

Schedule
Lectures: T & Th 1:15 – 2:30 pm; Jones PSC 201
Labs: W 2:20 – 5:10 in EWSC 111

II. COURSE OVERVIEW
Marine science is inherently integrative, encompassing four main scientific sub-disciplines: biological, chemical, geological, and physical oceanography. Therefore, in order to understand the oceans and become a marine scientist, one must first know the fundamental concepts within each of these areas. This course is part of a two course series. In MSCI 101, we will focus more on the geological, chemical, and physical aspects of Marine Science whereas MSCI 102 will focus in depth on biology.
Texts: 1) Investigating Oceanography, Keith Sverdrup and Raphael Kudela

Alternatively you can use the free online Oceanography text by Douglas A. Segar. [http://www.reefimages.com/oceansci.php](http://www.reefimages.com/oceansci.php). Free to download, save, and print for personal use. Published under the creative common license.

2) The Ocean Environment, lab manual, 3rd Ed., by Michelle Hardee and Claudia Benitez-Nelson

3) Papers from the literature and handouts, reliable Internet sources

Grading:

- Three in class midterms (lowest dropped) 30% (15% each)
- Final Exam (cumulative), Dec. 8th, 12:30-3pm 20% (cannot be dropped)
- Lecture homework (lowest dropped) 20%
- Laboratory quizzes and reports 30%

Grades are awarded as straight percentages (> 90% = A, 87-89% = B+, 80-86% = B, etc.) with the option of curving an individual exam, if warranted.

Attendance is MANDATORY: Following University Policy: Failure to attend class will affect your grade. For every 5 days of missed class, your final grade will be reduced by one letter.

Make up exams will not be given. If you miss an assignment or homework, THAT grade will be counted as your dropped grade. The final exam cannot be dropped.

As part of the laboratory exercises there is a mandatory field trip to the coast.

Exams: The format of the exams will vary between multiple choice, short answer, diagram interpretation, and short essay. Exams will take place during regularly schedule lectures. The registrar sets the time of the final exam. Unless otherwise specified, exams are closed book/notes. Calculators and rulers are permitted.

Exam dates (all exams are held in Jones PSC 201)

- 9/8/16 Thursday Midterm 1 (covering 6 lectures)
- 10/11/16 Thursday Midterm 2 (covering 11 lectures)
- 11/22/16 Thursday Midterm 3 (covering 8 lectures)
- 12/8/16 Thursday Final exam; 12:30-3:00 pm

Homework: Unless otherwise specified homework assignments are due each Tuesday afternoon at the beginning of class.
I-Clicker: In class I-Clicker pop quizzes will be given occasionally to clear up misconceptions and preconceptions about the subject at hand. Every question is worth one point and points earned from correct answers will be added to the next exam as extra credit.

Labs: All labs will meet in EWS 111. Proper attire is required, especially closed-toe shoes – no flip-flops or sandals. You MUST READ the lab PRIOR to attending as you will be tested and expected to know the material! This is a lab science credit course, and attendance at labs is mandatory.

Field Trip: Wednesday November 9th or Thursday November 10th or Friday November 11th to Huntington Beach State Park. You must attend ONLY ONE of the days. The field trip runs from 6am to 6pm, you will be provided with a permission form to give to your other instructors for classes you will miss. Transportation is by coach bus. Bus leaves from the Russell House promptly at 6am each morning.

A sign up sheet for the field trip will be posted outside of PSC 519 in late October. First come, first serve.

Final exam: Thursday, December 8th, 12:30 – 3:00 pm. The registrar sets exam time and duration. The final will be cumulative and cannot be dropped. Format is identical to midterms. No make-ups or early exams so plan accordingly to be in attendance.

Make-up Policies: There will be NO make-ups for missed exams, pop quizzes or missed labs/lab quizzes. If you miss an assignment or homework THAT grade will be counted as your dropped grade. The final exam cannot be dropped.

This being said, your IA’s and I are reasonable people who understand that this course is but a part of your busy schedule. With the understanding that you are doing all that you can to fulfill your obligations as a student in this course, we will make every attempt to fairly resolve conflicts that arise during the semester.

III. ITEMIZED LEARNING OUTCOMES
Upon successful completion of Marine Science 101, students will be able to:

1. Demonstrate understanding of current theories concerning the origin of the Earth and the waters that cover its surface.
2. Identify oceanic physical features and relate their structures to theories of their origin.
3. Demonstrate the use of basic Marine Science principles to develop first order hypotheses on the basic chemical properties of seawater in terms of the unique
features of the water molecule, dissolved salts, and dissolved gases. Why is the ocean salty?
4. Describe atmospheric circulation and explain how it impacts the ocean.
5. Describe motions in the sea—currents, waves, and tides—in terms of their causes and their effects on the land.
6. Discuss the ocean’s role in global climate and the impact on the oceans and society as the ocean is impacted by changes in climate.
7. Identify the causes of marine pollution, and demonstrate understanding of the problems of containment and alleviation.
8. Demonstrate understanding of the history of oceanography and the advancements in technology used in exploring the ocean.
9. Describe the differences between inductive and deductive reasoning.
10. Describe the contemporary issues related to ocean acidification and global climate change and the impacts on society.

ASSIGNMENTS AND/OR EXAM
1. Three midterm exams: The format of the exams will vary between multiple choice, short answer, diagram interpretation, and short essay. Exams will take place during regularly scheduled lectures. Unless otherwise specified, exams are closed book/notes. Calculators and rulers are permitted. The lowest midterm exam grade will be dropped.
2. Final Exam: Cumulative with format identical to midterms. The final cannot be dropped. The date and time of the final exam is set by the registrar.
3. Lecture Homework: Format of lecture homework will vary between quantitative, essay, short answer, and data interpretation.
4. Laboratory quizzes and reports: As part of the laboratory exercises there is a mandatory field trip to the coast.

COURSE OUTLINE WITH TIMELINE OF TOPICS (subject to change)

READINGS/ASSIGNMENTS, EXAMS/PROJECTS
**Week 1:** Introduction and history of Marine Science
Careers in Marine Science, misconceptions and preconceptions
First Scientific Expeditions (early Polynesians, Challenger)

**Week 2:** Plate tectonics
Formation and basic structure of the Earth
The layered Earth
Introduction to ocean basin features
Seafloor spreading
Plate boundaries: Faults, earthquakes, and volcanism
Hot Spots
Week 3:  Continental margins and ocean basins  
Bathymetry and basic topography

Week 4:  Sediments  
Sources, size classes, classification, transport  
Distribution and the sedimentary record

Exam 1

Week 5:  The water molecule  
Heat Capacity  
Water temperature and density  
Energy in the sea

Week 6:  Seawater chemistry  
Constituents of seawater (sources, sinks and distributions)  
Conservative versus non conservative behavior  
Effects of salinity on water properties (e.g. density)  
Residence times  
Dissolved gases, CO$_2$ and O$_2$ (intro to climate change)  
Carbonate buffer system and pH (Revelle factor and CO$_2$)

Week 7:  Planetary Energy Balance  
The Greenhouse Effect  
Ocean atmosphere interactions  
Troposphere convection  
Atmospheric structure

Week 8:  Ocean structure and circulation  
Gyres and surface winds  
Convergence and divergence  
Ocean and atmospheric circulation  
Heat budgets  
High/low pressure  
Hadley cells, wind bands  
Coriolis, hurricanes and typhoons  
Wind driven circulation  
major ocean currents  
Coriolis, Ekman pumping, geostrophic flow, upwelling  
Thermohaline circulation revisited (T-S-p diagrams)

Exam 2
**Week 9:** Waves and tides  
Descriptions, properties  
Generation and propagation: wind waves, seiches and tsunamis  
Tide theory and patterns (moon versus the sun)

**Week 10:** Coasts and coastal processes  
Estuary circulation and evolution  
Sediment transport and accumulation  
Beaches  
Sand spits  
Barrier islands  
Anthropogenic impacts: flooding, and erosion.

**Week 11:** Introduction to Primary Production/Biogeochemical cycles  
Phytoplankton and zooplankton  
Interaction of light, nutrients, mixed layer  
Photosynthesis (CO2 and O2), respiration, redox chemistry  
Trophic dynamics, food web (Intro to microbial loop versus export production)  
Hydrothermal vent communities and anoxic basins (chemosynthesis)

**Exam 3**

**Week 12:** Sea level rise  
Ocean acidification  
Arctic Ocean in the 21st century

**Collaboration:** As Marine Science is an interdisciplinary course; marine scientists often work collaboratively on projects. We expect that many of you will choose to work in groups on assignments for this course. Please review the definitions below and come talk to one of us if you are unclear about how these apply to working together on projects.

**University of South Carolina Honor Code**

“It is the responsibility of every student at the University of South Carolina Columbia to adhere steadfastly to truthfulness and to avoid dishonesty, fraud, or deceit of any type in connection with any academic program. Any student who violates this Honor Code or who knowingly assists another to violate this Honor Code shall be subject to discipline.”
Forms of academic dishonesty:

**Plagiarism**: 1. The action or practice of taking someone else's work, idea, etc., and passing it off as one's own; literary theft.

**Cheating**: 1. To defraud; to deprive of by deceit. 2. To deceive, impose upon, trick. 3. To deal fraudulently, practice deceit.

**Fabrication**: 1. The use of invented information or the falsification of research or other findings.

**Academic Misconduct**: 1. An act that disrupts the educational process or provides a student with an academic advantage over another student.

*I deal swiftly and harshly with all instances of academic dishonesty*
Need Help with Classes? Check out these other resources!

**Student Success Center (SSC)** - Assists students with academic goal-setting and skill development, personal transition to the university setting, and effective decision-making. Location: Thomas Cooper Library (mezzanine) Phone: 777-0684 Website: http://www.sa.sc.edu/ssc/

**Academic Centers for Excellence (ACE)** - Provides free academic success coaching, writing consultations, math tutoring, and a variety of other resources to help students at Carolina reach their academic goals. Locations: Thomas Cooper Library (mezzanine), Sims Hall, Bates House, Columbia Hall Phone: 777-0684 Website: http://www.housing.sc.edu/ace/

**Supplemental Instruction (SI)** - Peer-facilitated study sessions led by qualified and trained undergraduate SI leaders, undergraduate students who themselves have been successful academically and are willing and able to help their fellow students by facilitating study sessions for many critical first-year courses. Courses typically that employ SI include first-year biology, chemistry, mathematics, logic, and psychology. Location: Thomas Cooper Library Phone: 777-0684 Website: http://www.sa.sc.edu/supplementalinstruction/

**Math Tutoring Center** - Free tutoring to University students. Sponsored by the Department of Mathematics, the center is staffed with talented undergraduate and graduate students who can answer questions about material in MATH 111, 115, 122, 141, 142, 170, 221, 222, or 241. The center also maintains a list of private tutors for math and statistics. Location: LeConte, Room 105 Website: http://www.math.sc.edu/mathlab.html Math tutoring is also available through the ACE centers in Columbia Hall, Bates House, and Sims Hall. Please see the schedule at http://www.housing.sc.edu/ace/mathtutoring.html

**Writing Center** - Free consultations to University students, faculty, and staff. Sponsored by the Department of English Language and Literature, the Writing Center provides feedback to help writers accomplish their goals. Appointments are recommended. Locations: Byrnes 703 (main); satellites in Bates House, Columbia Hall, Sims Hall, and the Thomas Cooper Library Phone: 777-2078 Website: http://artsandsciences.sc.edu/write/