MSCI 101: Introduction to Oceanography, the Ocean Environment, Syllabus

Instructor: Dr. Claudia Benitez-Nelson  
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EWS 408/409  
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Course Description: MSCI 101, The Ocean Environment. (4) 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 trips required.

Class Schedule: MWF from 9:40 to 10:30 am in Darla Moore School of Business 123

Office hours: M 2 - 3 pm; Th 3 - 4 pm, and by appointment. Please feel free to email me with questions as well.

Website: USC Blackboard:  http://blackboard.sc.edu

Instructional Assistants:

<table>
<thead>
<tr>
<th>IAs:</th>
<th>Email:</th>
<th>Sections:</th>
<th>Office # and hours:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sarah Vorsanger</td>
<td><a href="mailto:sarahlv@email.sc.edu">sarahlv@email.sc.edu</a></td>
<td>003 &amp; 007</td>
<td>EWS 403: T 2:15-4:15 pm</td>
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<tr>
<td>Kristin Heidenreich</td>
<td><a href="mailto:heidenrk@email.sc.edu">heidenrk@email.sc.edu</a></td>
<td>002 &amp; 004</td>
<td>PSC 514: W 11:00-1:00 pm</td>
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<tr>
<td>Michael Opiekun</td>
<td><a href="mailto:opiekun@email.sc.ed">opiekun@email.sc.ed</a></td>
<td>001 &amp; 005</td>
<td>EWS 613. Th 12:30-2:30pm</td>
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<tr>
<td>Doug Bell</td>
<td><a href="mailto:dwbell5@gmail.com">dwbell5@gmail.com</a></td>
<td>006 &amp; H01</td>
<td>PSC 514: T 10:30-12:30pm</td>
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<tr>
<td>Brian Duggan (Curator)</td>
<td><a href="mailto:bduggan@geol.sc.edu">bduggan@geol.sc.edu</a></td>
<td>Curator</td>
<td>EWS 512</td>
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Labs: You MUST READ the lab PRIOR to attending as you will be tested and expected to know the material! Please see the LAB SYLLABUS for details regarding the Lab Schedule and Expectations

- **Monday:** Section 001 (10:50 – 1:40pm) and 002 (2:20 – 5:10pm)  
- **Tuesday:** Section 003 (10:50 – 1:40pm) and 004 (2:20 – 5:10pm)  
- **Wednesday:** Section 005 (10:50 – 1:40pm) and H01 (2:20 – 5:10pm)  
- **Thursday:** Section 006 (11:40 – 2:30pm) and 007 (2:50 – 5:40pm)

Text: *Investigating Oceanography*, by Sverdrup and Kudela  
*The Ocean Environment Lab Manual*, 3rd edition. by Hardee, Benitez-Nelson, and Goldman  
Papers from the literature (posted on blackboard) and handouts.

Grading:  
- Three 1 hour exams (lowest grade dropped) 30% (15% each)  
- Final Exam, Wednesday, December 10 – 9:00 am 20%  
- Lecture Homework (lowest grade dropped) 20%  
- Laboratory quizzes and reports 30%  

Grades are awarded as straight percentages (> 90% = A, 88-89% = B+, 80-87% = B, etc.) with the option of curving an individual exam, if warranted.
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 time of the final exam is set by the registrar. Unless otherwise specified, exams are closed book/notes. Calculators and rulers are permitted. **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.

**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.

**Field Trip (required!):** November 9th (Weds), 10th (Thursday), or 11th (Friday). As time approaches, you will be given a sign-up sheet in LECTURE. First come first serve!

**Learning Outcomes:**
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 and be able to apply those concepts in the laboratory and in the field. This course is part of a two course series. In MSCI 101, we will focus more on the physical, chemical and geological aspects of Marine Science where as MSCI 102, will focus in depth on biology.

**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
This information will provide a solid foundation on which to pursue your upper level courses. Expect to hear about recent oceanographic discoveries, current issues, and environmental problems. By the completion of this course, you should have a clear definition of the field of marine science and the wonderful opportunities that exist within it. Take the time to become involved in your classes and the exciting research projects that are ongoing within the Marine Science Program. Be involved, ask questions, and think beyond what I talk about in lecture!

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.

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. Specific information concerning The Honor Code at USC can be found at: http://www.sc.edu/academicintegrity/honorcode.html.

By signing your name to a quiz or test you are acknowledging that you will adhere to The Honor Code at USC.

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. Provides tutoring and other assistance. Also houses 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, marine science, mathematics, logic, and psychology, etc.

Location: Thomas Cooper Library (mezzanine)
Phone: 777-0684 Website: http://www.sa.sc.edu/ssc/

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/
Course Outline (Schedule subject to change)

1. Introduction and history of Marine Science
   Careers in Marine Science, misconceptions and preconceptions
   First Scientific Expeditions (early Polynesians, Challenger)
   Lab 1: Introduction to the Course, Navigation & Bathymetry/
   Conversion Homework!
   22\textsuperscript{nd} – 26\textsuperscript{th} Aug

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
   Labs 2: Minerals, and Rocks
   29\textsuperscript{th} Aug – 2\textsuperscript{nd} Sept

3. Continental margins and ocean basins
   Bathymetry and basic topography
   Lab 3: Introduction to the seafloor and plate tectonics
   12\textsuperscript{th} – 16\textsuperscript{th} Sept

4. Sediments
   Sources, size classes, classification, transport
   Distribution and the sedimentary record
   Lab 4: Seafloor spreading and Data analysis
   19\textsuperscript{th} – 23\textsuperscript{rd} Sept

First Exam: Friday September 23\textsuperscript{rd}

5. Ocean structure
   The water molecule
   Heat Capacity
   Water temperature and density
   Introduction to thermohaline circulation
   Lab 5: Thermohaline circulation and density
   26\textsuperscript{th} – 30\textsuperscript{th} Sept

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\textsubscript{2} and O\textsubscript{2} (intro to climate change)
   Carbonate buffer system and pH (Revelle factor and C\textsubscript{02})
   Lab 6: Salinity and dissolved oxygen
   3\textsuperscript{rd} – 7\textsuperscript{th} Oct

7. 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-ρ diagrams)
Lab 7: Surface currents and Hurricanes
   17th – 21st Oct

Second Exam: Friday, October 21st

8. 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)
      Lab 8: Nutrients and CDOM
      24th – 28th Oct

9. Waves and tides
   Descriptions, properties
   Generation and propagation: wind waves, seiches and tsunamis
   Tide theory and patterns (moon versus the sun)
      Lab 9: Waves and Coastal Processes
      31st Oct – 4th Nov

10. Coasts and coastal processes
    Estuary circulation and evolution
    Sediment transport and accumulation
       Beaches
       Sand spits
       Barrier islands
    Anthropogenic impacts: flooding, and erosion.
       Lab 10: Coasts and Salt Marsh Field Trip and Report **
       9th – 11th Nov FIELD TRIP
       Lab 11: Tidal Pattern Discovery and Tide Charts
               14th – 18th Nov

Third Exam: Friday, November 18th

11. Oceans and climate change: rising sea level
    Greenhouse gases, ocean acidification
    El Nino, La Nina
    Fe fertilization

Final Exam: Monday, December 5 – 9-11:30 am. CUMULATIVE