University of South Carolina
Carolina Core

MARINE SCIENCE 101
THE OCEAN ENVIRONMENT

BULLETIN INFORMATION
MSCI 101 - The Ocean Environment (4 credit hours)
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 trips required.
Prerequisites: science, engineering, or education major or consent of instructor

SAMPLE COURSE OVERVIEW
Marine science is inherently integrative, encompassing four main scientific sub-disciplines: biological, chemical, geological, ad 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 physical aspects of Marine Science whereas MSCI 102 will focus in depth on Biology.

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

SAMPLE REQUIRED TEXTS/SUGGESTED READINGS/MATERIALS

1. An Introduction to the World's Oceans, 10th Ed., by Keith Sverdrup and Virginia Armburst
2. The Ocean Environment, lab manual, 2nd Ed., by Michelle Hardee and Claudia Benitez-Nelson
3. Papers from the literature and handouts, reliable Internet sources

SAMPLE ASSIGNMENTS AND/OR EXAM

1. **Three hour 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.
2. **Final Exam:** Cumulative with format identical to midterms
3. **Lecture Homework**
4. **Laboratory quizzes and reports:** As part of the laboratory exercises there is a mandatory field trip to the coast.

SAMPLE COURSE OUTLINE WITH TIMELINE OF TOPICS, 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: Ocean structure

The water molecule
Heat Capacity
Water temperature and density
Introduction to thermohaline circulation

Weeks 6-7: 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, CO2 and O2 (intro to climate change)
Carbonate buffer system and pH (Revelle factor and C02)

Week 8: 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)
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 10-11: 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)

Week 12 -13: Coasts and coastal processes
Estuary circulation and evolution
Sediment transport and accumulation
Beaches
Sand spits
Barrier islands
Anthropogenic impacts: flooding, and erosion.
Exam 3

Week 14: Oceans and climate change: rising sea level
Greenhouse gases, ocean acidification
El Nino, La Nina, Fe fertilization

Final Exam according to University exam schedule