

MIDDLESEX COUNTY COLLEGE
EDISON, NEW JERSEY
DEPARTMENT OF NATURAL SCIENCES

Course ID and Name: SCI 160: Essentials of Oceanography

Department: Department of Natural Sciences

Chairperson: Dr. Donna Howell

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Prerequisites: MAT 013 or appropriate score on the College Placement Test and one year of high school laboratory science

Co-requisites: N/A

Course Description:

The focus of this course deals with aspects of geology, chemistry, physics, climatology, environmental science and biology as they apply to the oceans. The physical aspects of the world's oceans; the history of marine exploration, the structure of ocean basins, plate tectonics, the distribution of marine sediments, oceanic circulation and productivity, marine fauna and flora, shore processes, and the effects of deep ocean circulation on world climate will make up the core of course content. The course will enable students to present science in a social context and to be intelligent participants in important societal discussions that involve environmental issues touching on oceans, climate and coastal zones.

General Education Status: Science

Credits: 4**Lecture Hours:** 3**Lab Hours:** 2

Learning Outcomes:

Upon successful completion of this course, student will be able to:

- 1.Explain the Scientific Method and how it will be used to study the world’s oceans.
- 2.Identify the major features of the ocean floor, to include continental margins, canyons, trenches and mid-oceanic ridges.
- 3.Illustrate the hydrologic cycle to include freshwater and seawater characteristics.
- 4.Describe the many factors that contribute to the development of the ocean currents.
- 5.Explain the classification system for marine life and identify the different species of marine life on earth.

Course Requirements:

Students must attend every lecture and laboratory session. Lecture performance is evaluated by exams, homework assignments, class participation and quizzes. Laboratory performance is measured by laboratory reports, lecture exams and observation of student laboratory technique. Laboratory assignments augment lecture material.

| Assessment tool | % of final grade |
|--|------------------|
| 4 Lecture Exams | 60% |
| Laboratory Exercises and Field Trips | 15% |
| Current Events presentation and Plastic Project | 15% |
| Homework, Quizzes, Class Participation, Attendance | 10% |

GRADING STANDARD:

Upon completion of the course, grades will be assigned as follows:

A= 90 – 100%

B+ = 86 - 89%

B-= 80 - 85%

C+ = 76 - 79%

C= 70 - 75%

D= 60 - 69%

F = <60%

Course Content Areas:

1. The Big Bang Theory , Solar Nebular Theory, Formation of Earth & its Oceans
2. Plate tectonics
3. Marine Provinces and techniques used to determine bathymetry
4. Oceanic sediment and sediment transport mechanisms
5. Ocean chemistry & physical characteristics of ocean water
6. Origin and description of waves and tides
7. Surface and subsurface circulation of ocean waters , ocean-atmosphere interactions (including climate, monsoons, hurricanes, and El Niño events)
8. Marine organisms, ecology and their classification
9. Coastlines and their management
10. Oceanic resources & pollution of the oceans (environmental issues)

Textbooks for Course:

| <u>Author</u> | <u>Title</u> | <u>Publisher</u> | <u>Copyright</u> |
|-----------------------|---|------------------|------------------|
| Trujillo & Thurman | Essentials of Oceanography with mastering - 11 th Edition | Pearson | 2014 |
| Online component | http://www.masteringgeology.com/site/login.html | | |

Lecture Outline

IChapter 1 Introduction to Oceanography and Cartography

- A. Map Projections
- B. Cartography
- C. Early Ocean Exploration
- D. Formation of Earth and the Solar System
- E. Formation of the Atmosphere and Ocean
- F. Origin of Earth

II Chapter 2 Plate Tectonics

- A. Radiometric Dating
- B. Continental Drift
- C. Paleomagnetism
- D. Plate Boundaries
- E. Hot spots and Mantle Plumes
- F. Paleogeography

III Chapter 3 Marine Provinces

- A. Bathymetry
- B. Soundings and Echo Soundings
- C. Seismic Reflection Profiles
- D. Passive vs Active Continental Margins
- E. Deep Ocean Basins
- F. Mid-Ocean Ridges and Hydrothermal Vents

IV Chapter 4 Marine Sediments

- A. Collection techniques of Marine Sediments
- B. Resources of Marine Sediments
- C. Lithogeneous Sediment
- D. Biogenous Sediment
- E. Hydrogenous Sediment
- F. Cosmogenous Sediment
- G. Pelagic and Neritic Deposits

V Chapter 5 Water & Seawater

- A. Waters Unusual Chemical Properties
- B. Properties of Water

- C. Salinity
- D. The pH Scale
- E. The Carbonate Buffering System
- F. Desalination

VI Chapter 6 Air Sea Interaction

- A. The seasons
- B. Variations in Solar Radiation
- C. Physical Properties of the atmosphere
- D. Coriolis Effect
- E. Global Atmospheric Circulation
- F. Sea Ice Formation
- G. Iceberg Formation
- H. Wind Energy

VII Chapter 7 Ocean Circulation

- A. Surface Current Measurements
- B. Surface Currents
- C. Upwelling and Downwelling
- D. Deep-Ocean Current
- E. Current Energy

VIII Chapter 8 Waves & Water Dynamics

- A. Wave Generation
- B. Terminology
- C. Development
- D. Surf Zone
- E. Tsunami
- F. Wave Energy

IX Chapter 9 Tides

- A. Tide Generating Forces
- B. The Monthly Tidal Cycle
- C. Tidal Patterns
- D. Tidal Phenomena in Coastal Regions
- E. Tidal Energy

X Chapter 10 The Coast: Beaches and Shoreline Processes

- A. Coastal Regions
- B. Sand Movement
- C. Erosional Shores
- D. Depositional Shores
- E. Hard Stabilization

XI Chapter 11 The Coastal Ocean

- A. Law of the Ocean
- B. Salinity
- C. Temperature
- D. Estuaries
- E. Lagoons
- F. Marginal Seas
- G. Wetlands
- H. Marine Pollution

XII Chapter 16 The Oceans & Climate Change

- A. Earth Climate System
- B. Paleoclimatology
- C. Proxy data
- D. Causes of Climate Change
- E. Impacts of Climate Change on the Ocean
- F. Greenhouse Effect
- G. Greenhouse Gas Reduction

XIII Chapter 12 Marine Life & The Marine Environment

- A. Domains of Life
- B. Linnaeus and Taxonomic Classification
- C. Plankton
- D. Nekton
- E. Benthos
- F. Adaptations of Marine Organisms

XIV Chapter 13 Biological Productivity & Energy Transfer

- A. Primary Productivity

- B. Photosynthetic Marine Organisms
- C. Flow of Energy in Marine Systems
- D. Marine Ecosystems
- E. Fisheries

XV Chapter 14 Animals of the Pelagic Environment

- A. Use of Gas Containers
- B. Ability to Float
- C. Mobility: Lungers vs Cruisers
- D. Cold blooded vs Warm blooded
- E. Schooling
- F. Symbiosis
- G. Mammalian Characteristics
- H. Migration Routes

Chapter 15 Animals of the Benthic Environment

- A. Communities in Rock Shores
- B. Communities in Sediment Covered Shores
- C. Communities on Shallow Ocean Floor
- D. Communities on the Deep Ocean Floor

Lab Outline

| Week | Lab |
|------|---|
| 1 | <p>Bathymetric Charts</p> <p>Eratosthene's calculation: The circumference of the Earth</p> <p>2. Identify the major features of the ocean floor, to include continental margins, canyons, trenches and mid-oceanic ridges.</p> |
| 2 | <p>Contouring</p> <p><i>Contour map and cross section of the Raritan Bay</i></p> <p>2. Identify the major features of the ocean floor, to include continental margins, canyons, trenches and mid-oceanic ridges.</p> |
| 3 | <p>Geologic Time</p> <p>http://www.hhmi.org/biointeractive/earthviewer</p> <p>1. Explain the Scientific Method and how it will be used to study the world's oceans.</p> <p>4. Describe the many factors that contribute to the development of the ocean currents.</p> |
| 4 | <p>Sediment</p> <p><i>Grain size measurement and shape determination with microscope.</i></p> <p><i>Classification into sediment type and paleoenvironment</i></p> <p>2. Identify the major features of the ocean floor, to include continental margins, canyons, trenches and mid-oceanic ridges.</p> |
| 5 | <p>Physical Properties of Water</p> <p><i>Cohesion, Solubility, Heat Capacity</i></p> <p>3. Illustrate the hydrologic cycle to include freshwater and seawater characteristics.</p> |
| 6 | <p>pH and Carbonate Buffering System</p> <p><i>pH scale and the ocean as a carbon dioxide sink</i></p> <p><i>Climate Change and Ocean Acidification</i></p> <p>3. Illustrate the hydrologic cycle to include freshwater and seawater characteristics.</p> |
| 7 | <p>Myth Busters:</p> <p><i>Cause of Seasons and Egg on the Equinox</i></p> <p>1. Explain the Scientific Method and how it will be used to study the world's oceans.</p> |

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| 8 | <p>Field trip: Water sampling Raritan River and Garbage Clean up</p> <p><i>Water Sampling pH, dissolved oxygen, salinity, nitrates, phosphates, temperature</i></p> <p>3. Illustrate the hydrologic cycle to include freshwater and seawater characteristics.</p> |
| 9 | <p>Wards Model:</p> <p><i>Thermocline and Upwelling/ Halocline and deep ocean currents</i></p> <p>1. Explain the Scientific Method and how it will be used to study the world's oceans.</p> <p>4. Describe the many factors that contribute to the development of the ocean currents.</p> |
| 10 | <p>Filed Trip: Tides and Hard Stabilization Lawrence Harbor</p> <p><i>Determining Tidal Cycle / Shell Mapping</i></p> <p><i>Water Sampling pH, dissolved oxygen, salinity, nitrates, phosphates, temperature</i></p> <p>3. Illustrate the hydrologic cycle to include freshwater and seawater characteristics.</p> |
| 11 | <p>Filed Trip: Drowned Rivers: Big Brook Fossils</p> <p><i>Water Sampling pH, dissolved oxygen, salinity, nitrates, phosphates, temperature</i></p> <p>3. Illustrate the hydrologic cycle to include freshwater and seawater characteristics.</p> |
| 12 | <p>Field Trip: Estuaries and Wetlands Cheesequake State Park</p> <p><i>Characteristics and Species of Estuaries and Wetlands</i></p> <p><i>Water Sampling pH, dissolved oxygen, salinity, nitrates, phosphates, temperature</i></p> <p>3. Illustrate the hydrologic cycle to include freshwater and seawater characteristics.</p> <p>5. Explain the classification system for marine life and identify the different species of marine life on earth.</p> |
| 14 | <p>Field Trip: Seining Raritan Bay</p> <p><i>Species Identification – BioAssessent</i></p> <p><i>Water Sampling pH, dissolved oxygen, salinity, nitrates, phosphates, temperature</i></p> <p><i>Shell Mapping, Hard Stabilization Assessing Tides</i></p> <p>3. Illustrate the hydrologic cycle to include freshwater and seawater characteristics.</p> <p>5. Explain the classification system for marine life and identify the different species of marine life on earth.</p> |
| 15 | <p>Field Trip: Raritan Bay Boat Trip</p> |

Plankton collection and identification, Water Sampling, Fish identification, Trawl Net Bio Assessment

5.Explain the classification system for marine life and identify the different species of marine life on earth.

4.Describe the many factors that contribute to the development of the ocean currents.

