

# ESCI-1050: INTRODUCTION TO OCEAN STUDIES

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## Cuyahoga Community College

### Viewing: ESCI-1050 : Introduction to Ocean Studies

**Board of Trustees:**

2018-06-28

**Academic Term:**

Fall 2021

**Subject Code**

ESCI - Earth Science

**Course Number:**

1050

**Title:**

Introduction to Ocean Studies

**Catalog Description:**

Introduction to Ocean Studies will focus on the world's oceans, emphasizing both the physical and chemical properties, circulation, and interaction between the ocean and other components of the Earth system. This course is for general science majors and non-majors, and will expose the student to the world's oceans and the vital role in the earth system.

**Credit Hour(s):**

3

**Lecture Hour(s):**

3

## Requisites

**Prerequisite and Corequisite**

ENG-1010 College Composition I or concurrent enrollment; and MATH-0990 Math Literacy for College Students or concurrent enrollment, or MATH-0955 Beginning Algebra or concurrent enrollment; or appropriate score on Math Placement Test.

## Outcomes

**Course Outcome(s):**

Employ the scientific method using real-world data, including formulation of hypotheses, and utilization of varied approaches (observational and experimental) for testing hypotheses, in order to interpret and critique of data and literature encountered in class.

**Essential Learning Outcome Mapping:**

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

**Objective(s):**

1. Discuss the history of partitioning of the ocean as it relates to different countries and cultures, highlighting the importance of the ocean on economies and livelihoods.
2. Identifies and describes basic facts, empirical data, principles, theories and methods of modern science, utilizing these methodologies to describe observed ocean phenomena.
3. Explain the distribution of continents and ocean basins in relationship to tectonic activity, geomorphology, and identify the major features of each ocean basin (ridges, rises, faults, trenches and fracture zones) and the processes that create volcanic islands, atolls and coral reefs.
4. Analyze satellite imagery and maps, providing interpretation of marine and coastal features and their corresponding general geological history.
5. Identify the forces that govern oceanic circulation and tidal ranges.

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**Course Outcome(s):**

Identifies and evaluates the relationship and interactions between humans and the oceans. Summarizes and connects the physical and ecological Properties of the ocean and coastal system, to importance of mariculture, artisanal fishing, industry, health, and economic well-being of different cultures.

**Essential Learning Outcome Mapping:**

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Cultural Sensitivity: Demonstrate sensitivity to the beliefs, views, values, and practices of cultures within and beyond the United States.

**Objective(s):**

1. Discuss the history of partitioning of the ocean as it relates to different countries and cultures, highlighting the importance of the ocean on economies and livelihoods.
2. Identify and explain methods of ocean navigation in the context of history.
3. Evaluate the interaction between humans and the ocean.
4. Examine ocean policy and human impact on the coastal zone and open ocean while identifying sources of pollution and prospects for environmentally sound laws and regulations.
5. Identify sources of pollution and prospects for environmentally sound laws and regulations.

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**Course Outcome(s):**

Explain how physical and chemical factors in the ocean affect the climate in the past, present and future, extending these principles to major components of ocean circulation.

**Essential Learning Outcome Mapping:**

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

**Objective(s):**

1. Recognizes the physical and chemical properties of water, and relate these properties to ocean composition and circulation.
2. Describe the interaction of incoming solar radiation with the atmosphere, ocean and continents, outlining major controls of weather and climate, including the important interface between the ocean and atmosphere.
3. Analyze satellite imagery and maps, providing interpretation of marine and coastal features and their corresponding general geological history.
4. Predict distribution of organisms based on physical and chemical hydrographic data.
5. Identify the forces that govern oceanic circulation and tidal ranges.
6. Outline and discuss the corresponding types of data which inform predictive models of global climate and and climate change.

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**Course Outcome(s):**

Assess news with respect to ocean events or oceanography in general; interpret and explain these events within the context of course material.

**Essential Learning Outcome Mapping:**

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Cultural Sensitivity: Demonstrate sensitivity to the beliefs, views, values, and practices of cultures within and beyond the United States.

**Objective(s):**

1. Summarize the connections and distribution of the marine food web in the context of marine biology, illustrating the differences between habitats in all depth zones of the ocean.
2. Identify sources of pollution and prospects for environmentally sound laws and regulations.
3. Outline and discuss the corresponding types of data which inform predictive models of global climate and and climate change.

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**Course Outcome(s):**

Discuss origin of the Earth and differentiate between the components of the four spheres of the Earth System, while identifying the role of global oceans within each; atmosphere, biosphere, hydrosphere, cryosphere and geosphere.

**Essential Learning Outcome Mapping:**

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

**Objective(s):**

1. Demonstrate the connectivity of the earth systems by outlining and describing the various biogeochemical cycles, highlighting interactions between biotic and abiotic components.
2. Analyze satellite imagery and maps, providing interpretation of marine and coastal features and their corresponding general geological history.

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**Course Outcome(s):**

Provide examples of the interdisciplinary nature of oceanography

**Essential Learning Outcome Mapping:**

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

**Objective(s):**

1. Identifies and describes basic facts, empirical data, principles, theories and methods of modern science, utilizing these methodologies to describe observed ocean phenomena.
  2. Describe the interaction of incoming solar radiation with the atmosphere, ocean and continents, outlining major controls of weather and climate, including the important interface between the ocean and atmosphere.
  3. Analyze satellite imagery and maps, providing interpretation of marine and coastal features and their corresponding general geological history.
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**Methods of Evaluation:**

- Article reviews, summaries and critiques
- Examinations
- Short quizzes
- Online data exploration, GIS and mapping investigations using archived and real time data
- Research papers
- Discussions, both in class and web based

**Course Content Outline:**

1. General Introduction to Ocean Studies
  - a. Earth system approach
  - b. The Hydrosphere and Cryosphere
  - c. Biogeochemical cycles
  - d. The Water cycle, phases and movement of water through the earth system
  - e. Origin/Properties of water
2. Observation methods (ocean based)
  - a. Remote and in-situ
    - i. Passive and active sensing
    - ii. Modelling the ocean
3. Ocean Basins and Plate Tectonics
  - a. Composition and mechanical properties of the earth
  - b. Earth materials
  - c. Ocean/continental plate characteristics
  - d. Development of the Tectonic Theory
    - i. Wilson Cycles
    - ii. Marine Volcanism
4. Water in the earth system
  - a. Structure of water
  - b. Phases of matter and the implication for global heat transfer
  - c. Sea water, chemical properties and pH
  - d. Principle of constant proportions
  - e. Global patterns of salinity
  - f. Sound Fixing And Ranging (SOFAR) channel and sound transmission
5. Marine sediments
  - a. Origins and distributions
  - b. Environments of deposition
  - c. Marine snow and carbon compensation depth
6. The Atmosphere/ocean interface
  - a. Earths movements, rotation and revolution
  - b. Nature of solar radiation/Measurement and solar budget
  - c. Specific heat variation between land and water
  - d. Maritime and continental climates, differences and ocean

- e. Photic and aphotic zones
- f. Green house gas model, pros and cons
- g. Anthropogenic forcing of climate and natural climate controls
- 7. Origin of Wind
  - a. Wind and density driven currents
  - b. Heating/cooling imbalances of the earth
  - c. Thermohaline circulation
- 8. Ocean currents and depth zones of the ocean
  - a. Currents, identification, and characteristics
    - i. Coriolis
    - ii. Friction
    - iii. Ekman transport
  - b. Coastal up and downwelling
  - c. Monitoring of the depths of the Ocean
    - i. Submersibles
    - ii. Cabled and coastal ocean profilers
  - d. Deep water masses, formations and locations
- 9. Waves and tides
  - a. Waves, formation and life
  - b. Deep, shallow and seich waves
  - c. Gravity, sun, moon and tidal relationships
- 10. The Dynamic Coast
  - a. Coastline formation and features
  - b. Sediment budget
  - c. Wetlands
  - d. Human alterations to coastline )
  - e. Estuaries, morphology and functions
- 11. Atmospheric disturbances
  - a. Origins, lifecycle and locations of development
    - i. Tropical cyclones
    - ii. Extra tropical cyclones
    - iii. Scales of measurement
- 12. Components of the Marine ecosystem
  - a. Interactions of the 4 spheres of the earth
  - b. Ecosystem structure
  - c. Energy transfer and production
  - d. Bioaccumulation
  - e. Microbial Marine systems
  - f. Flora and fauna
    - i. Adaptions
    - ii. Evolutions
- 13. The changing climate and the ocean system
  - a. Role of the Ocean in our climate
  - b. Climate oscillations
    - i. Types (ENSO, PDO, EL NINO)
    - ii. Frequency
    - iii. Historical and contemporary data
  - c. Proxy climate data
  - d. Geologic Time and the climate record
  - e. Factors contributing to climate change
    - i. Natural
    - ii. Anthropogenic
  - f. Feedback systems and climate models
  - g. Climate changes and case studies of human response
- 14. The future of Ocean science
  - a. Historical observation and documentation
  - b. Technological advances and challenges
- 15. Ocean Policy and Stewardship

- a. Fisheries, sustainability
  - i. Mariculture
  - ii. Recreational
  - iii. Industrial
- b. Species, endangered and recovering
- c. Impact of humans on the ocean
- d. Policies
  - i. Freedom of seas
  - ii. Magnuson act
  - iii. Antarctic treaty
- e. Pollution
  - i. Point and non point source
  - ii. Human manipulation of climate
    - 1. Deep carbon storage
    - 2. Iron fertilization
    - 3. Stratospheric aerosol injection

## Resources

Moran, Joseph. *Ocean Studies: Introduction to Oceanography*. 3rd. Washington, American Meteorological Society, 2011.

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Trujillo, Alan P. and Harold V. Thurman. *Essentials of Oceanography*. 12th ed. Boston, MA: Pearson, 2016.

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Sverdrup, Keith A. and Raphael M. Kudela. *Investigating Oceanography*. 2nd ed. New York, NY: McGraw Hill Education, 2017.

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Garrison, Tom S. and Robert Ellis. *Essentials of Oceanography*. 8th ed. Boston, MA: Cengage Learning, 2018.

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## Resources Other

Google Earth, web based software to immerse the students in elements of geography and ocean studies

## Instructional Services

### OAN Number:

Ohio Transfer 36 TMNS

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Key: 1890