

## HARRY S TRUMAN COLLEGE

## Oceanography 101

# SYLLABUS

## Spring 2012

## Truman Mission Statement

Our Mission dedicates us to deliver high-quality, innovative, affordable, and accessible educational opportunities and services that prepare students for a rapidly changing and diverse global economy.

DEPARTMENT – Physics – Oceanography 101

**Credit Hours:** 3

**Contact Hours:** Lecture hours - 3.15

**Course Length:** One Semester - 14 weeks.

Prerequisite: None

**Course Description:** This is designed to provide a comprehensive introduction to the physical features and processes of the ocean and seafloor as well as the origin and evolution of the earth and its ocean basins. The course emphasizes the geology of the coastal ocean, beaches, and estuaries and leads into a discussion of the ocean's major communities and the biotic and physical factors structuring them. Topics of current interest (global warming, coastal development, coral reef management, and hydrothermal vents) are examined and discussed.

**Students course is expected to serve:** Students seeking to fulfill a comprehensive background in the study of the world of Oceans. Also, students wanting to gain a wide-ranging knowledge in the subjects of Geology, Climatology and, to certain extent, Marine Biology.

**The Course Active Pursuit:** In order to pass the course, the students need to take two term exams and a final exam. In addition, the students are required to deliver a final research topic in order to take the final exam. Students who have not actively pursued the course, as evidenced by completed papers, exams, quizzes or projects, during the three-week period prior to midterm will receive a midterm grade of ADW. To comply with Truman policy on weekend courses, students who fail to show up for the first lecture will be automatically withdrawn from the course unless they contact the instructor in advance.

## Student Learning Outcomes:

1. Students will be able to analyze the different geological processes that gave origin to the Oceans after a series of slides and films are shown in class
2. Students, presented with photographic and film material, will be able to analyze and interpret how Oceans affect world climate
3. Students will be able to analyze current scientific literature that studies several oceanic features like sea floor spreading, sedimentation and marine volcanism.
4. Students will be able to examine in detail the different properties of ocean water and to distinguish how physical, chemical and biological characteristics affect the Ocean's diverse landscapes.
5. Students will be able to find a strong relation between ocean temperature and global and local climate after examination of weather phenomenon such as Hurricanes and Typhoons.
6. Students will be able to compare the continental and the oceanic environments and to describe their interaction.

## Course Schedule:

### Lecture-Discussion Topics

#### Lecture I

##### (Part I)

What is Oceanography? Differences between Oceanography and Marine Biology. The relevance of Oceanography in today's world. Early Cultures and the Sea. The Phoenicians. The first explorers and the first Oceanographers.

##### (Part II)

The Formation of Earth and the Oceans. Birth of the Planet. Cold Accretion. The Iron Catastrophe. Convection and Differentiation. **Focus on the Iron Catastrophe.** Origin of the Oceans. Primitive Atmosphere and Early Oceans.

#### Lecture II

Properties of Sea Water. The Water Molecule. Surface Tension. Heat Capacity. The Chemistry of Sea Water. Sources and Sinks. Gases in Seawater. Physical Properties of Seawater. Focus on Density and Pressure. Light in the Ocean. Sound in the Ocean. Color in the Ocean.

#### Lecture III

##### (Part I)

Oceans of the World. Physical Characteristics of the Pacific, Atlantic, Indian, Southern and Antarctic Oceans. Inner Seas. The Mediterranean, Caspian and Red Seas. The Aral and Black Seas. **Focus on the Dead Sea.**

##### (Part II)

Physical Features of the Sea Floor. Ocean Depth and Zonation. The Continental Shelves, Continental Slope and Continental Rise. Abyssal Plains Ocean Trenches and Ocean Ridges. **Focus on The Mariana Trench.** Underwater mapping and cartography.

#### **Lecture IV**

Voyage to the bottom of the Sea. Geological and Geographical features of the bottom of the sea. Seamounts. Guyots. Sea mounts and Upwelling. Sea Mounts and sea life. The Orange Roughy's Story. . Seamounts distribution. **Focus on Surtsey: Birth of an Island.** Hydrothermal Vents. Cold Seeps. Black and White smokers.

#### **Lecture V**

Back to the surface. Ocean Zones. Life and Light in the Ocean. Photic and aphotic zones. The surface layer. Epipelagic characteristics. Plankton and Nekton. **Focus on Plankton as a biological pump.** The Nekton. Vertical Migration and the surface layer. Back to the bottom of the sea. The Epipelagic zone. The Mezopelagic and Bathipelagic Zones. **Focus on The Twilight zone.** The Hadopelagic Zones.

#### **Lecture VI**

Plate tectonics and Continental Drift. The Theory and how the theory works. Back to convection and differentiation. Lithosphere and asthenosphere. Underwater volcanology. **Focus on Subduction.** Transform, Divergent and Convergent boundaries. Continental Drift. **Focus on Alfred Wegener.** Early continents. The Cambrian, Devonian, Carboniferous, Jurassic, Cretaceous and the Eocene. Earthquakes and Tsunamis. **Focus on the 2004 Indian Ocean Tsunami.**

#### **Lecture VII**

##### **(Part I)**

Ocean Winds. Air and Sea surface. The Principles of Air Circulation. Factors driving global winds. Atmospheric Cells. Hadley, Polar and Ferrell cells. **Focus on The Coriolis Effect and Force.** Prevailing winds. Pressure-System Winds. Coastal Breezes.

##### **(Part II)**

Surface Currents. Wind driven Currents. Ocean Gyres. **The Ekman Spiral and Ekman transport.** Boundary currents. Meeting of Currents. Biological importance of sea currents. The Gulf Stream and the North Atlantic Drift. **Focus on Benjamin Franklin.**

#### **Lecture VIII**

Underwater Circulation. The Thermohaline Circulation. The Ocean Conveyor Belt. The sinking of dense water at the North Pole. Upwelling. Deep water circulation. The Thermocline and Pycnocline. Surface vs. Depth. What drives the THC? Is the THC pulled or pushed? Significance for climate change. **Focus on The great Lakes and the Ice Ages.**

#### **Lecture IX (Part I)**

Global Water Cycle, Oceans and Climate. The Hydrologic Cycle. Earth's water reservoirs. Ocean Evaporation and Precipitation. Freshwater inflow. The Ice-Sea Cycle.

##### **Part II**

Oceans and Climate. Oceans heat absorption. Warm and Cold Currents. The Carbon Cycle. Global carbon budget. Focus on Green house gases. **Focus on carbon dioxide.** An inconvenient truth. How inconvenient?

##### **Part III**

El Nino, La Nina. How a phenomenon of the Pacific Ocean affects the whole world.

#### **Lecture X**

Hurricanes and Typhoons. Hurricanes Development. Focus on Low pressure System. Cyclonogenesis. Tropical Depressions. Hurricane Structure. A close Eye to the Eye. Inside the Hurricane. Coastal Effects. Katrina. The Path of the Hurricane. **Focus on historical perspectives of human settlements along the Louisiana Coast.** The taming of the Mississippi. Was Katrina a disaster waiting to happen? Environmental Effects during and after the hurricane.

#### **Lecture XI**

Ocean Waves. Waves and the environment. Wave Properties. Wave Generation. Wave classification. Wave propagation. Arrival on shore. Wave effect of Coastal Profiles. **Focus on Tsunami waves**

## **Lecture XII**

The Moon and its gravitational pull. Tides. Tidal and Lunar Cycles. Tidal patterns. High and Low Tides. Diurnal Tides. Semi-diurnal tides. Mixed tides. Tidal Range. The Monthly Tidal Cycle. The Lunar Cycle. Spring and Neap tides. Tidal profiles. Tidal Currents. Tidal Races. Whirlpools, Eddies and Tide Rips. Rip Tides and Beach structure. **Focus on Tidal Bores.**

## **Lecture XIII**

The Coast. Sea Level Change and Coastal Landscapes. Global Sea-Level Change. Local Sea Change. Focus on Glacial Rebound. Submerged Coasts. Emergent Coasts. Coastal Profiles. Classification of Coasts. Primary and Secondary Coasts. Rias and Fjords. Wave –erosion Coasts. Marine Deposition Coasts. Long Shore drift and coastal formation. Estuaries and Coastal Lagoons. Estuary formation. Type of Estuaries. Estuarine Environments.

## **Lecture XIV**

Coral Reefs. The anatomy of a Coral Polyp. Types of Reef. Fringing Reefs. Barrier Reef. Platform Reefs. Reef formation. Parts of the reef and reef zonation. The Atoll, its formation and development. Coral reef Distribution. Zooxanthellae and its importance to coral. **Focus on Coral Bleaching.** Importance of the reef. Vulnerability of the reef.

## **Academic Integrity**

The CCC has no tolerance for violations of academic integrity. The student policy manual states, “Plagiarism and cheating of any kind are serious violations of these standards and will result, minimally, in the grade of ‘F’ by the instructor” (39). All course work will be checked for Academic Integrity. In this course, the first violation will result in an “F” for the assignment; the second violation will result in course failure. Make-ups and revisions are not available after an infraction of academic integrity.

## **Truman Gen Ed Goals**

- The student exhibits social and ethical responsibility and is aware of her or his place in the global community.
- The student performs effectively in the workplace and has the ability to work and make effective use of a wide variety of current technologies.
- The student communicates effectively in both written and oral formats.
- The student demonstrates the ability to think critically, abstractly, and logically.
- The student gathers interprets and analyzes data.

## **Academic Support Services**

**Tutoring Center.** For students who need help with their assignments: room L129, 773-907-4785, [www.trumancollege.edu/studentservices/tutoring](http://www.trumancollege.edu/studentservices/tutoring).

**Student Success and Leadership Institute (SSLI).** For students who need various other support services to achieve their educational goals: room 1435, 773-907-4714, [www.trumancollege.edu/studentservices/ssli](http://www.trumancollege.edu/studentservices/ssli).

**TRIO Student Support Services.** For low-income students, first generation college students, or students with disabilities who need academic support: room 1435, 773-907-4797, [www.trumancollege.edu/trio](http://www.trumancollege.edu/trio). Registration is required at the start of each semester.

**Disability Access Center.** The Center verifies needs pursuant to the American Disabilities Act (ADA), determines student academic accommodations, and issues accommodation letters. Room 1428, 773-907-4725, [www.trumancollege.edu/studentservices/dac](http://www.trumancollege.edu/studentservices/dac). Registration is required at the start of each semester.

## **FERPA**

FERPA (Family Educational Rights and Privacy Act) is a federal law that protects the privacy of student educational records: [www.ed.gov/policy/gen/guid/fpco/ferpa/index.html](http://www.ed.gov/policy/gen/guid/fpco/ferpa/index.html). Faculty cannot reveal information about students, or discuss student records over the phone or unsecure e-mail. CCC student e-mail meets FERPA requirements.

## **Methods of Evaluation:**

Two term exams, a final research paper and a final exam.

Text book:

### **Invitation to Oceanography**

Paul R, Pinet

Fifth Edition

Jones and Barlett Publishers

**ISBN 978-0-7637-5993**

## **Optional Materials**

- I. After each class students are provided with a handout summarizing the topics covered during the lecture.
- II. Approximately 30 slides are shown in each class to support the discussed material.
- III. Nine documentaries are shown during the course of the semester.
- IV. Several articles and research papers relevant to the studied material are discussed.