OCN 201 SCIENCE OF THE SEA

3 Credits

Monday 5:30-8:15 pm

Hale Imiloa Rm. 117 (Oceanography Laboratory)

INSTRUCTOR: **Dr. Floyd W. McCoy**
OFFICE: **Hale Imiloa 115**
OFFICE HOURS: **Tues., Tues. 2:00-4:30; Thurs. 2:00 – 3:30**
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EFFECTIVE DATE: **Fall, 2015**

WINDWARD COMMUNITY COLLEGE MISSION STATEMENT

Windward Community College is committed to excellence in the liberal arts and career development; we support and challenge individuals to develop skills, fulfill their potential, enrich their lives, and become contributing, culturally aware members of our community.

CATALOG DESCRIPTION

An introductory course to oceanography covering the dimensions of the science of oceanography, the physical and chemical properties of sea water, waves, tides, currents, life in the ocean, the geologic structure of the ocean floor, environmental concerns, and human use and management of the oceans.

Activities Required at Scheduled Times Other Than Class Times

Announced in class.

STUDENT LEARNING OUTCOMES

The student learning outcomes for the course are:

- Students should understand how the scientific method works, how it has been applied in Earth science, and how it differs from other ways of acquiring knowledge.
- Students will be able to articulate how the Earth is in integrative system across many scientific disciplines.
- Students should understand the internal structure of the Earth and the dynamic processes of plate tectonics that shape its surface, including seafloor spreading, subduction, and continental drift.
- Students should understand the causes of rising sea level and its impacts on coastal areas, including erosion and beach loss.
- Students will be able to identify the major pathways of chemicals to the oceans and the effect that biological processes have on redistributing and removing chemicals from the oceans.
- Students will be able to describe the major processes that cause the deep and shallow circulation of water in the oceans.
- Students will be able to identify the major marine habitats, the types of organisms that live in those habitats, and give examples of how organisms are adapted to their habitat.
- Students will be able to describe the types of interactions that occur among organisms in the marine food web and between organisms and their environment.

"Water, water everywhere... ." *Samuel Coleridge, American poet*

COURSE CONTENT

Concepts or Topics

- Latitude and longitude
- Map projections
- Geography and physiography of the sea floor and continental margins
- Mapping the sea floor
- Plate tectonics
- Hydrothermal vents and ecosystems
- Origin of the oceans and sea water
- Marine sediments and sampling technology
- Chemical and physical properties of sea water
- Heat budget and circulation of the atmosphere and oceans
- Temperature, salinity and density of sea water at the surface and at depth; biological zonation
- Horizontal circulation and patterns, Coriolis effect, Eckman transport, La Nina and El Nino conditions, PDO, NAO changes
- Vertical thermohaline circulation, upwellings and downwellings, biological productivity
- Lagoonal and estuarine circulation
- Waves – wind, tsunami, rogue, internal, seiche, storm surges
- Tides and the tidal wave
- Nearshore processes
- Beaches, sand budgets, and coastlines
- Greenhouse gasses and global climate change
- Law of the Sea

Skills or Competencies

1. Understand the scientific method, and how it is used and applied.
2. Understand the metric system.
3. Apply an understanding of physical, chemical, and biological processes to interpreting ocean properties and processes.
4. Use basic mathematical statements to describe oceanic properties and processes.
5. Distinguish and reject *faux* science and misrepresentations of science.
6. Appreciate the technology behind the science of oceanography.
7. Appreciate the spectrum of science and engineering endeavors that underlie the study of the oceans.
8. Appreciate the history, literature, music, and mythology of the sea.
9. Comprehend the benefits and dangers of the coastal zone and oceans to society, and the mitigation of ocean hazards.

Essentially this course asks, and attempts to answer, fundamental questions such as these concerning the oceans:

Over the 3.5 billion years the oceans have existed, why haven't they filled with mud washed off land? Where have the sediments gone?

Why are the ocean floors so rugged with much bare rock; what is sculpting them, at what pace?

Why is the deepest portion of the ocean not in the middle of the ocean basin, but along its edges?

Why do ocean basins exist? How permanent are they? What has been their configuration in the geologic past?

What might the role of the oceans be in the origin and preservation (through geological extinction events) of life?

What is the aquarium pump for the global ocean? Why haven't the oceans become permanently stagnant & smelly?

Where did the water in the oceans come from; how old is it; how is it recycled & cleansed; how does it circulate?

Why is the ocean water salty? Why is it blue? Has the volume and saltiness changed through geologic time?

How do we manage, preserve, study, and monitor the oceans?

How will the oceans respond to global climate change?

"All the rivers run into the sea, yet the sea is not filled."
Ecclesiastes I, 7 (about 200 BCE)

COURSE TASKS, ASSESSMENT AND GRADING

Type of examinations: written; questions require essays of varying length from short (single sentence) to longer (no more than 10 minutes) answers; some questions may involve plotting information on maps.

Examination schedule:

One midterm: 1 hour, covering all material discussed up to the examination date; if this examination is not taken on the scheduled date, a make-up exam. will be given (this will be a different, and more difficult, examination).

Final exam.: 2 hours, concerned with the entire course, with some emphasis on the last third of the course; must be taken on scheduled date.

Extra/special credit: awarded for visits to oceanographic ships in port, for attendance at symposia, exhibitions and talks at WCC, UH-Manoa, Bishop Museum, etc., as well as for participation in various Marine Option Program events - before doing any of these, please check with Dr. McCoy.

Grading scheme: numerical grades calculated from an average of all test scores, with the midterm = 35%, the final = 45%, and quizzes/short essays = 20% of the total grade; total possible numerical grade = 100; letter grades assigned with:

A = 90 - 100	B = 80 – 89	NC = no credit, no grade assigned
C = 70 - 79	D = 60 – 69	N = course not completed due to unforeseen difficulties
F = < 60	I = incomplete due to unusual circumstances and assigned only with permission of the instructor; no credit given until this grade is changed to an A-D letter grade - it is your responsibility to make this change.	

Attendance: This is a university course that you have selected and paid for. The presumption is that you will attend lectures. Accordingly, attendance is not taken – simply stated: given the wonderful and spectacular complexities of how the global ocean works, there is little prospect of passing this course without attending lectures that expand upon presentations in the textbook.

LEARNING RESOURCES

Trujillo & Thurman; *Essentials of Oceanography*, any edition (latest = 10th Ed.), Pearson/Prentice-Hall

Garrison; *Oceanography – An Invitation to Marine Science*, any edition, may also be used.

http://www.soest.hawaii.edu/oceanography/courses_html/OCN201/

This is the website for the course as taught at UH Manoa, a valuable source of additional material in Oceanography as well as useful as a study guide.

Additional Information

Ancillary Activities:

- Numerous seminars, talks, symposia and exhibits occur throughout the university system and at various museums, you are particularly encouraged and welcomed to these. Whenever possible, these will be announced in class.

- The Marine Option Program (MOP) is a certificate program at most campuses of the university that encourages direct participation in the science, sociology, art, management, engineering and literature of the oceans. MOP participation is essential to a career in oceanography within Hawaii. MOP is an especially viable and active program at WCC; as a university-wide program, you may easily transfer MOP credits, projects, contacts and friendships to any campus following graduation from WCC. Announcements concerning MOP events and programs are made in class and/or posted on bulletin boards in the MOP office, Hale 'Imiloa, room 118.

- Supplementary, non-required reading is in the library, both on reserve and on open shelves; these include magazines and books; you are encouraged to peruse this literature.

- SOEST (School of Oceanography, Earth Science, and Technology) Open House – October 21, 22 – a wonderful opportunity to see demonstrations of the research programs and equipment (including tours of oceanographic ships).

  Extra credit provided for participation at any of these – simply submit a brief (one page minimum) written account of your attendance before the last day of classes.

Schedule of lectures and corresponding chapters in the textbook*:

Marine biology, marine ecology, the history of oceanography, in addition to the techniques, equipment and methods used in doing oceanographic work, are imbedded within every lecture rather than isolated into a separate series of lectures.

WEEK	SUBJECT	CHAPTER*
1	Introduction, metric (SI) system; Marine Option Program,	App. I
	latitude & longitude, map projections; geography of the oceans	1, App. III
	---------- Geological Oceanography ----------	
2	Geography & bathymetry of the seafloor	3
	Continental margins	3
3	Mapping the seafloor	3
	Structure of the earth	1, 3
4	Plate tectonics	2
5	Underwater volcanism & hydrothermal vents: geology/biology/chemistry	3, 15
	Geologic time - origin of the earth, oceans, atmosphere & life	1, 2
	Paleo-oceanography and sea-level changes	1, 10
6	Marine sediments and fossils, marine stratigraphy, marine habitats	4, 12, 14, 15
	Seafloor sedimentary & biologic processes	4
	Sampling methods	4
	---------- Chemical Oceanography ----------	
7	Chemical & physical properties of water	5, App. IV
8	Heat budget of the earth & oceans	6
	Climate & atmospheric circulation	6
	---------- Physical Oceanography ----------	
9	Review	1-6, 10, 12, 14-15,
	Midterm Examination	App.s I, III, IV
10	Temperature, salinity & density distribution at the surface	6
	Horizontal circulation: Coriolis force; Eckman transport	6, 7
	Horizontal circulation: geostrophic transport	7
	Ocean-surface circulation patterns, estuarine and lagoonal circulation	7, 11
11	Temperature, salinity & density distribution at depth	5
	Light, ecosystems & acoustics at depth	6
	Vertical & thermohaline circulation	6, 7
	Oceanic circulation patterns, El Nino/La Nina (ENSO), Pacific Decadal Oscillation/ Atlantic Decadal Oscillation/Arctic Oscillation	7
12	Shallow and deep-water waves, wind waves	8
	Internal waves, tsunami, storm surges, seiche	8
13	Tides and the tidal wave	9

"I never saw the use of the sea. Many a sad heart it has caused, and many a sick stomach... the boldest sailor climbs on board with a heavy soul and leaps on land with a light spirit."

Benjamin Disraeli, "Vivian Grey", 1837

	---------- Nearshore Oceanography ----------	
14	Nearshore (littoral) oceanographic processes	10
14	Beaches and coastlines	10
	--------- Environmental/Political Oceanography ----------	
15	Politics/management of the coastal zone; Coastal Zone Management (CZM)	11
15	CO_2 cycle, greenhouse gasses, global climate change	6, 11
	Marine pollution; International Convention for the Prevention of Pollution from Ships (MARPOL Protocol)	11
	Law of the Sea (LOS)	11

* Chapters are for Trujillo & Thurman; *Essentials of Oceanography* (9th Ed.), Pearson/Prentice-Hall. Equivalent chapters in other textbooks, such as Garrison, are not noted but should be clear].

He had bought a large map representing the sea,
without the least vestige of land:
And the crew were much pleased when they found it to be
a map they could all understand.

"What's the good pf Mercator's North Poles and Equators,
Tropics, Zones, and Meridian Lines?"
So the Bellman would cry: and the crew would reply
"They are merely conventional signs!"

"Other maps are such shapes, with their islands and capes!
But we've got our brave Captain to thank":
(So the crew would protest)"that he's brought us the best –
A perfect and absolute blank."

This was charming, no doubt; but they shortly found out
that the captain they trusted so well
had only one notion for crossing the ocean,
and that was to tingle his bell.

The Bellman's Tale, from "The Hunting of the Snark" by Lewis Carroll