EL CAMINO COLLEGE
COURSE OUTLINE OF RECORD - Approved

I. Course Information

Course Acronym: **OCEA**
Course Number: **10**
Descriptive Title: **Introduction to Oceanography**
Division: **Natural Sciences**
Department: **Oceanography**
Course Disciplines: **Earth Science**

Catalog Description:
This introductory course in oceanography presents the ocean in terms of its physical, chemical and biological environments. The topics include studies of: formation and modification of various wave types; tidal behavior; formation of water masses and ocean currents; beaches and the changing shoreline; coral reefs; physical and chemical properties of ocean water; marine environments; marine sediments; origin of sea floor and coastline features; the spreading sea floor and drifting continents. This introductory course in oceanography presents the ocean in terms of its physical, chemical and biological environments. The topics include studies of: formation and modification of various wave types; tidal behavior; formation of water masses and ocean currents; beaches and the changing shoreline; coral reefs; physical and chemical properties of ocean water; marine environments; marine sediments; origin of sea floor and coastline features; the spreading sea floor and drifting continents.

Conditions of Enrollment:
Recommended Preparation: eligibility for English 1A or qualification by appropriate assessment

Course Length: Full Term

Hours Lecture (per week): 3
Hours Laboratory (per week): 3
Outside Study Hours: 6
Total Hours: 108

Course Units: 4

Grading Method: Letter Grade only
Credit Status: Credit, degree applicable

Transfer CSU: Yes Effective Date: Prior to July 1992
Transfer UC: Yes Effective Date:

General Education:
ECC
Area 1 - Natural Sciences
Term: **Other:**

CSU GE:
Area B1 - Physical Universe and its Life Forms: Physical Science, Area B3 - Physical Universe and its Life Forms: Laboratory Activity
Term: **Other:**

IGETC:
Area 5A - Physical Science, Area 5C - course that incorporate a laboratory
Term: **Other:**

II. Outcomes and Objectives

A. Student Learning Outcomes (SLOs) (The course student learning outcomes are listed below.)

SLO #1 Basic Knowledge
Students can identify the salient features of the basic concepts of oceanography. This includes the ability to recall the definitions of the specialized vocabulary of oceanography.

SLO #2 Relationship with Their Environment
Students recognize and can accurately articulate how the ocean affects humans' lives and how human activities affect the ocean.

SLO #3 Nature of Science
Students can identify the key elements of the scientific method in popular accounts of scientific research in magazines, newspapers, etc

B. Course Objectives (The major learning objective for in this course are listed below)

1. Explain the theory of plate tectonics and the formation and evolution of ocean basins through time and evaluate the data upon which the theory is based.
2. Analyze the chemical and physical principles involved in the changing characteristics of ocean water and how these properties affect the behavior and movement of seawater.
3. Explain interactions between the ocean and atmosphere, including how the ocean affects climate and the impact of global warming on the ocean.
4. Compare and contrast the formation of surface ocean currents and the circulation of deep ocean water in terms of wind forces, Coriolis effect, and thermohaline differences.
5. Explain how various wave phenomena such as refraction, reflection, standing waves, wave dispersion, the formation of surf, and the formation of tsunamis affect the formation of waves on the ocean.
6. Evaluate the formation of tides in terms of dynamic and equilibrium theories and the daily and monthly cycles of tides and why these cycles occur.
7. Explain the origin of coastal features such as marine terraces, barrier islands, spits, and tombolos in terms of wave energy, tidal influx, and sediment dynamics.
8. Explain the origin and movement of marine sediments through the oceanic environment and explain the chemical and biological factors involved in the deposition and modification of sediments.
9. Analyze the nature and distribution of productivity within the marine environment and the movement of energy through higher trophic levels.
10. Compare and contrast the adaptations of organisms within different marine environments in terms of their response to physical and chemical factors.
11. Interpret nautical charts, bathymetric maps and profiles.
12. Perform dimensional analysis calculations and calculate percent, area, and volume.
13. Prepare and analyze graphs, including time-series graphs, histograms, multivariate graphs, scatter plots, and pie charts.
14. Utilize the scientific method to assemble a logical chain of reasoning from observation to inference.

III. Outline of Subject Matter

(Topics should be detailed enough to enable an instructor to determine the major areas that should be covered to ensure consistency from instructor to instructor and semester to semester.)

Major Topics

I. INTRODUCTION TO THE EARTH AND OCEANS (6 hours, lecture)
1. History of Oceanography
2. The Scientific Method
3. Theories of the Formation of the Universe, the Solar System, the Atmosphere, and the Ocean

II. PLATE TECTONICS (5 hours, lecture)
1. Interior of the Earth
2. Data Supporting the Theory and the Development of the Theory
3. Plate Boundaries and Motion
4. Convergent Boundaries
5. Divergent Boundaries
6. Transform Boundaries

III. SEDIMENTS (3 hours, lecture)
1. Kinds of Sediments
    1. Lithogenous
    2. Biogenous
    3.Hydrogenous
2. Sources and Movement

IV. OCEAN WATER (4 hours, lecture)
1. The Chemical and Physical Properties of Water and Seawater

V. OCEAN-ATMOSPHERE INTERACTIONS (6 hours, lecture)
1. Climate Zones
2. Atmospheric Circulation
3. Hurricanes
4. The Greenhouse Effect and Global Warming

VI. OCEAN CIRCULATION (4.5 hours, lecture)
1. Wind-driven Surface Currents
2. Geostrophic Currents
3. Thermohaline Circulation
4. El Niño

VII. WAVES (4.5 hours, lecture)
1. Growth of Waves and Surf
2. Interference
3. Dispersion
4. Refraction
5. Reflection
6. Tsunami
7. Storm Surge

VIII. TIDES (3 hours, lecture)
1. Daily and Monthly Cycles
2. Equilibrium Theory of the Tides
3. Dynamic Theory of the Tides

4. Seiches

IX. COASTLINES (6 hours, lecture)
1. Depositional and Erosional
2. Emergent and Submergent
3. Coastal Water Bodies and Circulation

X. HUMAN IMPACTS ON THE OCEAN (6 hours, lecture)
1. Resources (extraction)
2. Pollution
3. Overfishing

XI. PRODUCTIVITY OF AND ENERGY FLOW THROUGH MARINE ENVIRONMENTS (6 hours, lecture)
1. Spatial and Temporal Distribution and Variation of Productivity
2. Controls on Productivity
3. The Flow of Energy through Different Ecosystems
    1. Intertidal
    2. Open Ocean
    3. Deep Sea
    4. Coral Reefs
    5. Kelp Forests
4. Organisms Adaptations to the Physical and Chemical Conditions in Different Ocean Ecosystems

XII. Map Skills (3 hours, lab)
1. Latitude and Longitude
2. Nautical Charts
3. Map Projections
4. Map Scales

XIII. Contour Maps (3 hours, lab)
1. Reading Bathymetric and Profile Contour Maps
2. Making Contour Maps
3. Creating a Profile using a Bathymetric Contour Map

XIV. Plate Tectonics (3 hours, lab)
1. Plate Boundaries
2. Hotspots
3. History of Plate Movement

XV. Sediments (3 hours, lab)
1. Changes in Sediment Characteristics from Mountain to Coast
2. Changes in Sediment Characteristics from Beach to Deep Basins
3. Grain Size and Wave Size
4. Sources of Sediments on the Hawaiian Islands
5. Changes in Beach Minerals from Summer to Winter
6. Kinds of Light-Colored Sands
7. Deep-Ocean Sediments
8. Sediment Cores and Plate Tectonics

XVI. Sedimentary Rocks (1 hour, lab)
1. Identification of Sedimentary Rocks
2. Depositional Environment of Sedimentary Rocks

XVII. Water and Seawater Chemistry (4 hours, lab)

1. Adhesion, Cohesion, Surface Tension, and Capillarity
2. Solubility
3. Latent Heat of Evaporation
4. Diffusion and Temperature
5. pH of Fluids
6. Buffering
7. Heat Capacity
8. Density, Temperature, and Salinity
9. Density and Buoyancy
10. Electrical Attraction

XVIII. Climate Change (3 hours, lab)

1. Carbon Dioxide in the Atmosphere
2. Local and Global Changes in Temperature
3. Changes in the Earth's Climate in the Past
4. Global Warming and the Ocean

XIX. Ocean Currents (3 hours, lab)

1. Drifter Data
2. Gyres
3. Ocean Circulation and Satellite Images of Ocean Temperature
4. Upwelling and Downwelling
5. Thermohaline Circulation
6. El Niño

XX. Waves (3 hours, lab)

1. Basic Wave Characteristics
2. Standing Waves
3. Progressive Waves
4. Progressive Waves on a Beach
5. Speed of Shallow- and Deep-Water Waves
6. Internal Waves

XXI. Tsunami (2 hours, lab)

1. Tsunami Height and Wavelength
2. Simulation of a Tsunami in California
3. Tsunami Speed and Run-Up
4. Tsunami Safety

XXII. Tides (2 hours, lab)

1. Reading Tide Charts
2. Changes in Tides Over a Month
3. Tides and Humans

XXIII. Shorelines (3 hours, lab)

1. The Origin of Waves
2. Wave Climate along the Coast of California
3. Wave Refraction and the Longshore Transport of Sand
4. Estuaries and Wetlands
5. Rivers and Deltas
6. Barrier Islands, Bars, Spits, and Tombolos
7. Sea Cliffs, Wave-Cut Terraces, and Marine Terraces
8. Headlands, Coves, Sea Stacks, and Sea Arches

9. Hard Stabilization

XXIV. Remote Sensing (3 hours, lab)
1. The San Andreas Fault
2. Mt. St. Helens
3. Hawaii
4. Hurricane Andrew
5. Average Precipitation
6. Flooding in Bangladesh
7. Ozone Holes over the Poles
8. Average Wind Speed over the Ocean
9. Average Wave Height
10. Average Sea Surface Temperature
11. El Niño
12. Spatial Distribution of Phytoplankton
13. Tides in Wattenmeer Bay
14. The Adriatic Sea
15. The Gulf Stream
16. Oil Tanker Accident
17. Changes in Sea Ice around Antarctica
18. Coral Reefs
19. The Netherlands

XXV. Primary Productivity (3 hours, lab)
1. The Coastal Ocean
2. Water Temperature
3. The Coast of California
4. The Equator
5. Samples of Plankton
6. Seasonal Productivity
7. Harmful Algae Blooms
8. Measuring Primary Productivity

XXVI. Coral Reefs (3 hours, lab)
1. Coral Biology
2. Kinds of Coral Reefs
3. Spatial Distribution of Coral Reefs
4. Zonation of Coral Reefs
5. Coral Reefs and Humans

XXVII. Rocky Shoreline Alternate Site Meeting (3 hours, lab)
1. Headlands and Coves
2. Waves
3. Marine and Wave-Cut Terraces
4. Tides
5. Sea Cliff Erosion
6. Sediments
7. Life along a Rocky Shore

XXVIII. Sandy Shoreline Alternate Site Meeting (3 hours, lab)
1. Sediments
2. Beach Profile
3. Tides

4. Rip Currents
5. Waves
6. Longshore Transport and Hard Stabilization
7. Life on a Sandy Beach
8. Pollution

XXIX. Pier Alternate Site Meeting (3 hours, lab)
1. Plankton Sample
2. Secchi Disk
3. Surface Temperature, Salinity, pH, and Oxygen
4. Temperature and Salinity Below the Surface and in the Harbor
5. Weather and Waves
6. Hard Stabilization
7. Pollution
8. Tides

XXX. Cabrillo Aquarium Alternate Site Meeting (3 hours, lab)
1. Salinas de San Pedro (Saltmarsh)
2. Coastal Cliffs
3. Habitats and Feeding Styles
4. Kelp and Kelp Forests
5. Sandy and Muddy Shores
6. Wetlands
7. The Deep Ocean
8. Anatomy of Marine Mammals

Total Lecture Hours: 54
Total Laboratory Hours: 54
Total Hours: 108

IV. Primary Method of Evaluation and Sample Assignments

A. Primary Method of Evaluation
1) Substantial writing assignments

B. Typical Assignment Using Primary Method of Evaluation
After reading the chapter on plate tectonics, write a one-page description of the development of the theory of seafloor spreading. Include specific examples of evidence that supports the theory.

C. College-level Critical Thinking Assignments
Critical Thinking Assignment 1:
In a one-page essay, describe how the construction of coastal engineering structures like groins, seawalls, etc. affect the coastline, and explain how and why they alter the coastline.

Critical Thinking Assignment 2:
Suppose that there was no Moon. Write a one-page essay describing how the tides would be different. In other words, would high tides be higher than they are now or not as high as they are now? Would low tides be lower or not as low? Would sea level change from high tide to low tide more frequently or less frequently? How often would spring and neap tide conditions occur? In each case, explain your reasoning.

D. Other Typical Assessment and Evaluation Methods
Objective Exams, Quizzes, Multiple Choice, Completion, Matching Item, True/False

V. Instructional Methods

Demonstration, Discussion, Group Activities, Lab, Lecture, Multimedia presentations
Alternate Site Meetings: Aquarium Visit, Cruise, Measurements from a Pier, Rocky Shoreline, Sandy Shoreline

If other:

Note: In compliance with Board Policies 1600 and 3410, Title 5 California Code of Regulations, the Rehabilitation Act of 1973, and Sections 504 and 508 of the Americans with Disabilities Act, instruction delivery shall provide access, full inclusion, and effective communication for students with disabilities.

VI. Work Outside of Class

Study
Answer questions
Required reading
Problem solving activities
Written work
Observation of or participation in an activity related to course content

If Other:

VII. Texts and Materials

A. Up-to-date Representative Textbooks: (Please use the following format: Author, Title, Edition, Publisher, Year. If you wish to list a text that is more than 5 years old, please annotate it as a "discipline standard".)

Trujillo & Thurman. Essentials of Oceanography. 13th Edition ed. Prentice Hall, 2020.

Earth Science Faculty. Exploring Southern California Oceanography Laboratory Manual. ECC Bookstore, 2019.

B. Alternative Textbooks: (Please use the following format: Author, Title, Edition, Publisher, Year. If you wish to list a text that is more than 5 years old, please annotate it as a "discipline standard".)

C. Required Supplementary Readings

D. Other Required Materials

VIII. Conditions of Enrollment

A. Requisites (Course Prerequisites and Corequisites) Skills needed without which a student would be highly unlikely to succeed.

Requisite:

Category:

Requisite course(s): List both prerequisites and corequisites in this box.

Requisite and Matching skill(s): Bold the requisite skill. List the corresponding course objective under each skill(s).

B. Requisite Skills: (Non-Course Prerequisite and Corequisites) Skills needed without which a student would be highly unlikely to succeed.

Requisite:

Requisite and Matching Skill(s): Bold the requisite skill(s). If applicable

C. Recommended Preparations (Course) (Skills with which a student's ability to succeed will be strongly enhanced.)

Requisite course:

Requisite and Matching skill(s):B old the requisite skill. List the corresponding course objective under each skill(s).

D. Recommended Preparation (Non-Course) (Skills with which a student's ability to succeed will be strongly enhanced.)
Requisite: Eligibility for English 1A

Requisite and Matching skill(s): Bold the requisite skill. List the corresponding course objective under each skill(s). If applicable

Course objectives for OCEA-10 include evaluating the validity of different hypotheses based on observational evidence (continental drift, causes of tidal patterns, origin of shoreline features, etc.). Methods of evaluation in this course include essay exams, reading reports, written homework, lab reports, and term papers. Therefore, students should able to use written sources of information to support an argument and address counterarguments in writing. In addition, students should be able to compose a term paper.

ENGL A - Read and apply critical thinking skills to college-level expository prose for the purposes of writing and discussion.
ENGL A - Apply appropriate strategies in the writing process including prewriting, composing, revising, and editing techniques.
ENGL 84 - Select and employ reading strategies to interpret the content of a college-level textbook, with special focus on constructing a thesis statement and providing valid support.
ENGL 84 - Identify an implied main idea (thesis), and support with major and minor details, from a longer text or novel.
ENGL A - Demonstrate ability to incorporate into draft revision information received in peer review and one-on-one tutorials.
ENGL 84 - Interpret a book-length work through discussion, journal writing, or composition writing.
ENGL A - Plan, write, and revise 500-word multi-paragraph expository essays including an introduction and conclusion, exhibiting coherence and unity, avoiding major grammatical and mechanical errors that interfere with meaning, and demonstrating awareness of audience, purpose, and language choice.
ENGL 84 -Compare and contrast college-level texts to evaluate content.
ENGL A - Utilize MLA guidelines to format a document, to cite sources in the text of an essay, and to compile a Works Cited list.

E. Enrollment Limitations

Enrollment Limitations and Category:

Enrollment Limitations Impact:

Course Created by: A. B. Cockrum and R. H. Arntson Date: 11/30/1969

Original Board Approval Date:

Last Reviewed and/or Revised by: Thomas Noyes Date: 05/24/2021

Last Board Approval Date: 07/19/2021