

Las Positas College  
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## Course Outline for GEOL 12L

### INTRODUCTION TO OCEANOGRAPHY LABORATORY

Effective: Fall 2010

#### I. CATALOG DESCRIPTION:

GEOL 12L — INTRODUCTION TO OCEANOGRAPHY LABORATORY — 1.00 units

Laboratory course to supplement the oceanography lecture course. Introduction to the materials and techniques of oceanic science. Includes sea floor rocks, oceanic geography, bathymetric maps, seismic reflection, seawater physics and chemistry, beach sand, tides, waves, marine life and marine fossils, sea floor spreading rates, etc.

1.00 Units Lab

#### Prerequisite

GEOL 12 - Introduction to Oceanography

#### Grading Methods:

Letter or P/NP

#### Discipline:

	<u>MIN</u>
<b>Lab Hours:</b>	54.00
<b>Total Hours:</b>	54.00

#### II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: 1

#### III. PREREQUISITE AND/OR ADVISORY SKILLS:

**Before entering the course a student should be able to:**

A. GEOL12

#### IV. MEASURABLE OBJECTIVES:

**Upon completion of this course, the student should be able to:**

1. explain and apply the scientific method;
2. test and identify sea floor rocks;
3. interpret bathymetric and sea floor geomorphic maps;
4. identify and locate the basic features of the sea floor on geomorphic maps;
5. interpret landforms and sea floor geology from bathymetric and geomorphic maps;
6. construct bathymetric contours and cross-sections (profiles);
7. perform laboratory measurements using basic equipment to measure chemical and physical properties of sea water for pH, salinity, density, etc.;
8. evaluate data for tides, tidal currents, waves, and currents;
9. access and understand real-time coastal marine conditions on the Internet;
10. recognize and identify the basic types of marine life and their fossils;
11. interpret simple seismic reflection profiles and be able to identify basic geomorphic and geologic features including seamounts, trenches, MOR, sea floor sediments, basement rock, submarine canyons, shelf, slope, abyssal plain, etc.;
12. calculate sea floor spreading rates from magnetic stripe information, radiometric age data, etc.;
13. test and identify the basic types of beach sand and explain how they are formed.

#### V. CONTENT:

##### A. Marine Conditions

1. Internet access; applications and interpretation of data
2. Tides
3. Waves
4. Marine Weather forecasts

##### B. Bathymetric Maps

1. Constructing bathymetric maps
2. Contour lines
3. Interpreting the geomorphology and geology from the bathymetric map
  - a. Understanding slope and shape from contour lines
  - b. Identifying hills and depressions
  - c. Identifying common marine features such as seamounts, the shelf, the slope, submarine canyons, etc.
4. Constructing cross-sections (profiles)
  - a. Vertical exaggeration

- C. Marine Geography
  - 1. Memorizing the locations of features such as the mid-oceanic ridge, the 90 East Ridge, the Bering Sea, the Arabian Sea, the Sargasso Sea, the Emperor Seamount Chain, Easter Island, the Maldives, etc.
- D. Marine Life
  - 1. Learn how to identify the basic types of marine life from photos, videos and/or visits to regional aquariums (e.g., the Monterey Bay Aquarium or the Steinhart Aquarium in Golden Gate Park)
    - a. To include: abalone, barnacles, brachiopods, brittle stars, bryozoans, cetaceans, clams, coral, crabs, crinoids, cuttlefish, eels, fish, hydroids, hydrothermal vent life, jellies, kelp, lobsters, manta rays, manatees, microplankton (diatoms, coccolithophores, radiolarians, foraminifera, dinoflagellates, etc.), mussels, nautilus, nudibranchs, octopus, penguins, sand dollars, sea anemones, sea cucumbers, sea hares, sea horses, seals and sea lions, sea otters, sea pens, sea stars, sea turtles, sea urchins, scallops, sharks, shrimp, snails, sponges, squid, stingrays, stromatolites, tunicates (sea squirts, salps), walruses, whale sharks, worms (burrowing, spaghetti and tube), etc.
  - 2. Marine environments such as tropical, polar, coral reef, kelp forest, benthic, pelagic, etc.
- E. Marine Fossils
  - 1. Basic/common types of marine fossils
    - a. To include: barnacles, belemnites, brachiopods, clams, coral, crinoids, sand dollars, sea urchin tests, shark's teeth, marine snails, ammonites, sponges, trilobites, microplankton shells (diatoms, coccolithophores, radiolarians, foraminifera, dinoflagellates, etc.), etc.
  - 2. Correlate the skeleton with what the organism looked like when alive
  - 3. When did the organism live?
  - 4. Where did the organism live?
- F. Sea-Floor Spreading
  - 1. Magnetic stripe records
  - 2. Calculation of sea floor spreading rates
- G. Seismic Reflection/Refraction Profiles
  - 1. Interpretation of simple seismic reflection/refraction profiles
  - 2. Identification of basic oceanic geology
    - a. Water
    - b. Sediment
    - c. Basement rock
    - d. Seamounts
    - e. Shelf
    - f. Slope
    - g. Rise
    - h. Abyssal plain
    - i. Submarine canyons
    - j. Trenches
    - k. Etc.
  - 3. Calculation of water depth and sediment thickness
- H. Sea Floor Rocks
  - 1. To include basalt, gabbro, rhyolite, andesite, conglomerate, sandstone, mudstone, limestone (including coquina and chalk), chert, and granite. Additional samples at the instructor's discretion
  - 2. Test and identify the basic sea floor rocks
- I. Beach Sand
  - 1. Test and identify the basic types of sand
    - a. Continental/sialic quartz sand
    - b. Black sand
    - c. Green sand
    - d. Coral/shell sand
    - e. Magnetic sand
    - f. Etc.
  - 2. Provenance and origin/formation
- J. Seawater Physics and Chemistry
  - 1. Archimedes Principle and the determination of density
    - a. Explicitly applying the scientific method
    - b. Formal scientific lab report; including error analysis
  - 2. Measuring pH
  - 3. Measuring salinity
  - 4. Stratification: Haloclines, pycnoclines, thermoclines, etc.
- K. Radiometric Age Dating (at the discretion of the instructor if there is time in the semester for a lab on this)
- L. Student-run personal field trip (at the instructor's discretion)
  - 1. Observation, photos and notes on shoreline geologic features and/or marine life
  - 2. Including marine conditions such as tides, waves, coastal marine forecasts, etc.

## VI. METHODS OF INSTRUCTION:

- A. Laboratory sessions
- B. Laboratory exercises, quizzes, reports
- C. Map Exercises
- D. Sea Floor Rock samples
- E. Instructor presentations 1. Demonstrations 2. 35 mm slides and/or PowerPoint slides 3. CD-ROM animations 4. Video Clips 5. Directed student exploration 6. Internet in-class and for use on homework
- F. Pre-Lab Assignments
- G. Laboratory Manual
- H. Lecture Textbook
- I. Practice Quizzes
- J. Basic Rock and Mineral Testing Equipment

## VII. TYPICAL ASSIGNMENTS:

- A. Sea Floor Rock Labwork
  - 1. Use the provided testing equipment to differentiate the provided sea floor samples.
  - 2. Figure out and confirm what identifying properties are distinctive and characteristic for each sample
  - 3. For each sea floor sample with several varieties, figure out what distinguishing properties are common for all varieties
- B. Pre-Lab Assignments/Quizzes (open book)
  - 1. Look up the following information and vocabulary
  - 2. Take the online open-book, prelab quiz after you have finished looking up the pre-lab information
- C. In-Lab Practice Quizzes (open book); complete the practice quiz based on your pre-lab work and your lab exercise notes.
- D. Field Work; Student-run personal field trip (at the instructor's discretion)
  - 1. Observation and notes on shoreline geologic features and/or marine life
  - 2. Including marine conditions such as tides, waves, coastal marine forecasts, etc.

## VIII. EVALUATION:

### A. **Methods**

### B. **Frequency**

1. Laboratory exercises, assignments, reports – weekly (at each class meeting)
2. PreLabs and PreLab Quizzes; weekly – or at the instructor's discretion
3. Laboratory Practical Exams (3 hour exams); at least one (more at the instructor's discretion)
4. In-Lab Practice Quizzes; weekly – or at the instructor's discretion

## IX. TYPICAL TEXTS:

1. Anderson, F.E. *Introduction to Oceanography Laboratory Manual*. 3rd ed., Kendall/Hunt, 1998.
2. Pipkin, B.W., et.al *Laboratory Exercises in Oceanography*. 3rd ed., Freeman Publisher, 2001.
3. Johnson, R.E. *Oceanography Laboratory Manual*. 5th ed., Kendall/Hunt, 2003.
4. Rowell, B.F. and Ryan, W.L. *Methods in Introductory Oceanography*. Latest ed., Wm. C. Brown Publishers, 1996.
5. Weise, K. *Oceanography 1L Lab Manual*, . Latest ed., Department of Earth Sciences, 2008.

## X. OTHER MATERIALS REQUIRED OF STUDENTS:

- A. A. Lecture textbook B. Colored pencils C. Ruler and protractor D. Calculator capable of addition, subtraction, multiplication and division E. Workbook and/or handouts produced by the instructor (at the instructor's discretion) F. LPC computer access and/or print card G. Computer/Internet access at home or ability to access the LPC on-campus facilities