Las Positas College
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Course Outline for GEOL 1L

PHYSICAL GEOLOGY LABORATORY

Effective: Fall 2010

I. CATALOG DESCRIPTION:
GEOL 1L — PHYSICAL GEOLOGY LABORATORY — 1.00 units

Laboratory course to supplement the physical geology lecture course. Introduction to the materials and techniques of geology. Includes minerals, rocks, topographic and geologic maps, structural geology, identification and interpretation of landforms, geologic time and relative age dating analysis, etc.

1.00 Units Lab

Prerequisite
GEOL 1 - Physical Geology
or

GEOL 5 - Environmental Geology: Hazards & Disasters
or

GEOL 7 - Environmental Geology: Resources, Use Impact & Pollution

Grading Methods:
Letter or P/NP

Discipline:

	MIN
Lab Hours:	54.00
Total Hours:	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. GEOL1
B. GEOL5
C. GEOL7

IV. MEASURABLE OBJECTIVES:
Upon completion of this course, the student should be able to:

1. apply the scientific method;
2. test and identify rocks and minerals;
3. identify the common minerals and rocks;
4. inspect and interpret topographic maps and prepare topographic cross-sections;
5. deduce landforms and geology from topographic maps;
6. analyze geologic maps and develop geologic cross-sections from structural data presented on maps;
7. decipher the geologic histories from relative age-dating scenarios;
8. conduct a geologic field trip where the student analyzes geologic formations and features, and to then present the field trip data and observations in a structured report that includes photos, observations, interpretations, reference sources, and formation locations correlated to a base map.

V. CONTENT:
A. How to test and differentiate minerals
1. The scientific method
2. Moh’s Hardness Scale
3. Luster
4. Specific gravity
5. Crystal habit
6. Cleavage
7. Fracture
8. Magnetism
9. Reaction to weak acid

10. Flourescence
11. Combustibility
12. Tenacity
13. Malleability
14. Smell, etc.

B. Minerals
    1. Silicates; including Quartz (varieties including rock crystal, milky quartz, rose quartz, amethyst, tiger's eye, etc.), Potassium Feldspars and Plagioclase Feldspars, Micas (muscovite, biotite, lepidolite, etc.), Corundum, Garnet, Talc, Olivene, Augite, Hornblende.
    2. Carbonates; including Calcite, Dolomite, Azurite and Malachite. At the instructor's discretion: magnesite and siderite.
    3. Salts such as Halite and Sylvite.
    4. Flourides: Fluorite
    5. Sulphurs, Sulphides and Sulphates; including Gypsum (varieties including selenite, statin spar, etc.), Sulphur, Sphalerite, Pyrite, Chalcopyrite, Bornite, Arsenopyrite, Stibnite and Galena.
    6. Oxides: Hematite (including the varieties red ochre, oolitic, kidney stone, botryiodal, specular, etc.), Limonite, Magnetite and Chromite. Pyrolusite at the instructor's discretion.
    7. Basic Elements: Graphite and Sulphur.
    8. Other minerals at the instructor's discretion.

C. Igneous Rocks
    1. The basic igneous rocks
        a. Volcanic (extrusive)
        b. Plutonic (intrusive)
        c. Sialic/Felsic
        d. Mafic
    2. The basic classification systems and rock origins

D. Sedimentary Rocks
    1. The basic sedimentary rocks
        a. Clastic
        b. Chemical
            1. Biogenic; including fossils
            2. Preciptitated
    2. The basic classification systems and rock origins

E. Metamorphic Rocks
    1. The basic metamorphic rocks
        a. Foliated
        b. Non-Foliated
    2. The basic classification systems and rock origins

F. Topographic maps
    1. Reading Contour lines
        a. Reading elevations and depths
    2. Map Scale
        a. Bar scale
        b. RF (representative fraction) ratio scale
    3. Measuring real distances from map representations
    4. Understanding Different Map Locational Systems
        a. Latitude and Longitude
        b. Public Land System (section/township/range)
        c. UTM (universal transmercator)
        d. GPS (global positioning system)
    5. Analyzing and interpreting geomorphic shapes as represented on topographic maps
        a. River systems and alluvial geomorphology
        b. Desert and dune geomorphology
        c. Groundwater and karst geomorphology
        d. Glacial geomorphology
        e. Volcanic geomorphology
        f. Coastal geomorphology
        g. And other geomorphology at the instructor's discretion
    6. Understanding and interpreting basic map symbols and colors
    7. Accurate construction of Topographic Cross-sections
        a. Proper measurement of topographic contour data from real topographic maps (e.g., 7.5' or 15' quadrangles)
        b. Construction of proper topographic graphs across specified transects
        c. Inclusion of appropriate data points to display the topographic terrain, without parsing the cross-section inappropriately (e.g., inclusion of more data points where the terrain is highly variable)
        d. Presentation of an accurate, finished profile that appropriately represents the transected topography
    8. Calculation of Vertical Exaggeration
    9. Map Orientation and Magnetic Declination

G. Dating of Rocks, Fossils and Geologic Events
    1. Law of Horizontality
    2. Law of Superposition
    3. The Present is the Key to The Past
    4. Cross-cutting relationships
    5. Unconformities
    6. Radiometric Age Dating

H. Geologic Maps and Cross-Sections
    1. Basic Geologic Map Symbols & Legends
        a. Strike and Dip
        b. Folds and Faults
    2. Basic Geologic Map Patterns correlated with Geologic Structure
        a. Horizontal strata patterns
        b. Dendritic erosional patterns
        c. Anticline and syncline map patterns
        d. Plunging fold map patterns
        e. Dome and basin map patterns
        f. River patterns
        g. Alluvial patterns
        h. And other geologic features and patterns at the instructor's discretion
    3. Construction of Geologic Cross-sections from Geologic Map Data – this is the capstone, culminating product of this lab course.
        a. Incorporates student understanding of the numerous rocks and minerals and their processes of formation and occurrence

b. Incorporates student understanding of the geologic time scale
c. Incorporates student understanding of basic geologic map symbols
d. Requires students to extrapolate from 2-dimensional structural representations to 3-dimensional geologic features
e. Students must present their results in the proper professional geologic format
    1. Structural data must be transferred and extrapolated appropriately and accurately (including surface contact data, strike and dip angles, strata thicknesses)
    2. Geologic structures must be properly analyzed and presented (including anticlines, synclines, faults, etc.)
    3. Strata and structures should be properly inferred where appropriate (e.g. inclusion of layers at depth that do not intersect the transect line, but are shown on other portions of the map and/or are included on the geologic column)
    4. Surface features are properly included on the cross-section, without being improperly included in the geology at depth (e.g., lakes and rivers)
    5. Formation colors and patterns are appropriately keyed to the geologic map and column

I. Field Work
1. Field Observations of geologic and/or geomorphic features/formations
2. Field Notes & Report – student geologic interpretations spatially keyed to appropriate base map(s)
    a. Photos of at least 10 different geologic features/formations/rock types
    b. Student interpretations/analysis of each geologic feature
    c. Sources cited
    d. A base map (or maps) that covers the area of the field trip, with each geologic feature spatially located and properly keyed to the submitted field report.
    e. Group reports are not acceptable. Students may work in groups, but must submit their own reports, with their own individual and unique geologic formations identified.

J. Additional Labs – at the instructor's discretion
1. Plate Tectonics lab exercises
2. Earthquake lab exercises
3. Historical Geology exercises
4. Subsurface Petroleum Exploration Cross-section Construction and Interpretation
5. Additional Map and Compass Exercises

VI. METHODS OF INSTRUCTION:

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

VII. TYPICAL ASSIGNMENTS:

A. Rock and/or Mineral Labwork
1. Test all of the minerals in the lab-set.
2. Figure out and confirm what identifying properties are distinctive and characteristic of each mineral.
3. For each mineral 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 (typically open book); complete the practice quiz based on your pre-lab work and your lab exercise notes.
D. Field Work; attend a scheduled field trip floowing the instructor's directions with submitted field report.

VIII. EVALUATION:

A. **Methods**

1. Other:
    a. Laboratory exercises, assignments and reports (typically at least one of these occurs every week or lab meeting).
    b. PreLab Exercises and Quizzes
    c. Lab Practical Exams applying laboratory techniques
    d. In-Lab Quizzes
    e. Field Trip Report(s)
    f. Attendance and/or participation (at the instructor's discretion)

B. **Frequency**

1. Each week, at least one of the following: laboratory exercises, assignments, quizzes, or reports (for a total of at least 8 through the course of the term)
2. PreLabs and PreLab Quizzes; at the instructor's discretion
3. Laboratory Practical Exams; at least two
    a. Rock and Mineral Lab Practical Exam (3 hour exam)
    b. Geologic and Topographic Exam including structural geology, relative age dating, construction of geologic and topographic cross-sections, vertical exaggeration, geologic and geologic interpretation of topographic and geologic map data, etc. (3 hour exam)
4. In-Lab Practice Quizzes; weekly - or at instructor's discretion.

IX. TYPICAL TEXTS:

1. Busch, R.M. ed, and Tasa,D (illustrator). (2009). *AGI/NAGT Laboratory Manual in Physical Geology* (8th ed.). Upper Saddle River, New Jersey: Prentice-Hall Publishers.
2. Hamblin, W.K. and Howard, J.D (2000). *Exercises in Physical Geology* (12th ed.). Upper Saddle River, New Jersey: Prentice-Hall Publisher.
3. Jones, N.W. and Jones, C.E (2003). *Laboratory Manual for Physical Geology* (4th ed.). San Francisco: : McGraw Hall Publisher, .
4. Zumberge, J.H., Rutford, R.H. and Carter, J (2005). *Physical Geology Laboratory Manual* (12th ed.). San Francisco: McGraw-Hill Publisher.

X. OTHER MATERIALS REQUIRED OF STUDENTS:

A. Ruler and protractor
B. Lecture textbook
C. Colored pencils

D. Calculator capable of addition, subtraction, multiplication and division
E. Workbook produced by the instructor (at the instructor's discretion)
F. A rock and mineral testing kit (including streak plate, hardness plate, handlens, magnet, nail, etc.)
G. One topographic map – Livermore, or another (at the instructor's discretion)
H. LPC computer access and/or print card
I. Computer/Internet access at home or ability to access the LPC on-campus facilities