Course Number and Name
GSC 111: Principles of Geology

Catalog Description
An introduction to minerals, rocks and geologic features which comprise the Earth; analysis of internal and external processes controlling the features of the planet. 4 lectures per week. Corequisite: GSC 141L (optional for nonmajors).

Learning Outcomes:
This course will provide you with a fundamental understanding of geology, and familiarize you with the scientific method, concepts, processes and principles. You will develop a new awareness and deep appreciation for the interconnectedness of the Earth's various systems. Upon completing thiscourse you will have a clear understanding of:
1. The major groups of rocks, the rock cycle and geological time.
2. The basics of structural geology, geophysics and tectonics.
3. The processes that shape ocean basins, continents and mountains.
4. The human influence on Earth's climate system, and energy resources.

Course Number and Name
GSC 116: Introduction to Astronomy

Catalog Description
A synthesis of our current knowledge of the cosmos and techniques used in its investigation. Primary emphasis is on the composition, history, and dynamics of the solar system (the sun, planets, moons, comets, asteroids, and meteors) and theories of its origin and evolution. The second part of the course examines the nature of stars, galaxies, and the universe as interpreted from analysis of starlight. Topics include distance, magnitude, luminosity, temperature, and composition of stars, stellar evolution, other solar systems, and search for extraterrestrial life. Special attention is given to independent stargazing activities, currentcelestial events, and new information revealed by satellite data or unmanned space missions. 4 hours lecture.

Learning Outcomes:
Upon completing course, students shall have attained working knowledge of content areas and developed practical skills or gained experiences as listed below:

1. Structure and composition of the solar system and its position in the in the Milky Way galaxy
2. Sun-Earth relations and bearing on seasons and variations of sun angle over time
3. Lunar phases and tides and their relationship to Earth-moon dynamics
4. Reasons for observed patterns and movements of planets and stars in the night sky
5. Special geometric conditions resulting in lunar and solar eclipses
6. Evolution of scientific thought from a geocentric to heliocentric point of view
7. Details of the planets' composition and structure revealed by unmanned spacecraft
8. Influences of the universal force of gravity on celestial phenomena
9. Model for formation and evolution of the Solar system based on scientific observations
10. General nature of light and the electromagnetic spectrum as applied to analysis of stars, galaxies, and the universe
11. Measurement or determination of star distance, magnitude, luminosity, temperature, color, composition, mass, and age
12. Basic fusion processes in stars
13. Models of stellar evolution as inferred from stars at various stages of their life cycle
14. The concept of an expanding universe
15. Distance and time scales used by astronomers
16. Evidence for existence of planets in other star systems
17. Conduct independent astronomical observations over a specific time period
18. Write report detailing measurement methods, variation of data with time, and interpretation of results related to independent astronomical observations

Course Number and Name
GSC 120: Introduction To Oceanography

Catalog Description
An introduction to the marine sciences. Properties of water, ocean currents, waves, tides, beaches, marine life, marine resources and the nature and origin of the sea floor. This course is a broad purveyance that interconnects with the disciplines of chemistry, biology, geology, astronomy, and climatology, by demonstrating how these seemingly disparate fields of inquiry are linked through the worlds oceans. 4 lectures.

Learning Outcomes
Upon completing course, students shall have attained working knowledge of content areas and developed practical skills or gained experiences as listed below:

1. A general knowledge Marine Geology. This includes:
    a) the morphology and nature of the sea floor
    b) the processes operative on, under and to the sea floor
    c) knowledge of sea floor spreading and plate tectonics
    d) an understanding of marine sediments and sedimentation
2. A general knowledge of the Physical and Chemical Properties of Water:
    a) structure of the water molecule in determining chemical and physical properties
    b) the contributions of temperature, salinity, and pressure in determining seawater density
    c) the importance of density in controlling marine food chains
    d) an understanding of the importance of pH and buffering to the maintenance of marine life
    e) an understanding of the principal of constant proportions
3. An understanding of the general circulation of the atmosphere and the major climatological regions of the world.
4. A knowledge of the nature of surface wind driven and deep ocean circulation.
5. A knowledge of the nature and origin of common disturbances of the sea surface: wind waves, tsunamis, tides.
6. A knowledge of beach morphology and beach processes.

Course Number and Name
GSC 141L: Principles of Geology Laboratory

Catalog Description
Classification of minerals and rocks. Reading and interpreting topographic and geologic maps. 1 three-hour laboratory. Must be taken concurrently with GSC 111. Laboratory optional for non-majors.

Learning Outcomes
Upon completing course, students shall have attained working knowledge of content areas and developed practical skills or gained experiences as listed below:

1. Identify common rock forming minerals, and associate with important economic uses and basic chemical groups
2. Identify and understand environments of formation for common igneous, sedimentary, and metamorphic rocks
3. Obtain basic information from topographic maps and construct topographic profiles
4. Interpret crosscutting relationships involving rocks of different relative age
5. Interpret geologic maps and aerial photographs
6. Construct geologic cross sections through sequences of folded and faulted rock

Course Number and Name
GSC 151L: Earth, Time and Life Laboratory

Catalog Description
Classification of fossil invertebrates, studies of paleogeographic maps and geologic maps and problems in structural geology. 1 three hour laboratory. Must be taken concurrently with GSC 112. Optional for nonmajors. Field trips required. Field trip fee required.

Learning Outcomes
The purpose of this course is to complement the lecture course (GSC 112) and give students "hands on" experience with rocks, fossils, maps, and cross sections that are essential to a study of historical geology. Although GSC 151 is designed to stand alone as a one unit geology course, it is **STRONGLY RECOMMENDED** that it be taken together with GSC 112 as a coherent package.

Upon successful completion of Earth, Time, and Life Laboratory, the student should have an understanding of the following concepts, processes, and phenomena:

- the solid materials of the Earth's lithosphere: common minerals and rocks (with emphasis on the sedimentary rocks); the rock cycle
- the interpretation of ancient environments from the characteristics of sedimentary rocks; facies changes; transgression/regression
- ancient tectonic settings and their recognition
- evidence of plate tectonics and sea-floor spreading
- recognition of ancient shorelines (paleogeography)
- dating the past – how geologists "tell time;" relative *versus* "absolute" dating (radiometric dating)
- fossils and fossilization; fossils as evidence of evolution in the past
- taxonomic classification of geologically significant groups of invertebrate fossils; morphology of selected invertebrate taxa
- how to "read" a geologic map
- construction of geologic cross sections
- correlation of geologic cross sections: lithostratigraphic, biostratigraphic correlation
- recognition of faults, folds, unconformities, and their significance
- selected regional geologic histories (Canadian Shield, American "Heartland," Colorado Plateau, and Grand Canyon, Basin and Range; California Coast Ranges)

Course Number and Name
GSC 195: Earthquake Country

Catalog Description
Introduction to earthquakes, their causes and effects, with specific emphasis on southern California. Basic science of earthquake geology and seismology, integrated with discussion of the latest research results, recent technological advances and practical information. Specific topics include: earthquake distribution in space and time, faulting, historical earthquakes in California and their impact on society, measuring and monitoring earthquakes, secondary effects and hazards, reducing earthquake hazard, prediction and forecasting. 4 hours of lecture.

Learning Outcomes:
Motivation: The goal of this class is to inform students about the hazards associated with earthquakes in southern California and how to live with them. The impact earthquakes have had on society in the past few centuries will be examined in the greater context of how scientists, engineers and policy makers have started to address their hazards. Additionally, this course will enable students to make better decisions regarding earthquakes and earthquake related hazards and will teach students how to evaluate scientific information in its political, economic, and social context.

After completing this course students should have developed or gained the following knowledge and skill sets:
1. Understanding of the large-scale tectonic features of California, its main faults and what types of earthquakes occur on these faults.
2. Working knowledge of the determination of earthquake magnitude and location and the characteristics of the different types of seismic waves.
3. Increased understanding of the nature of the scientific process and the ability to relate the different elements of the scientific process to the specific examples of the development of the science of earthquakes (seismology) and the theory of plate tectonics.
4. Cognitive understanding of the major concepts of earthquake forecasting, seismic hazard and practical countermeasures, especially as they relate to the southern California area.
5. Knowledge of the history of major California earthquakes, their impact on society and how they led to changes in building codes, policy and earthquake science.
6. Ability to use specific Internet sites to obtain near real-time and post-earthquake information on large global and local earthquakes. Students will also learn where to find maps showing earthquake related hazards for their local area and how to interpret these maps.

Students shall furthermore demonstrate:
1. knowledge of specific facts, terms and theories by their ability to answer questions on quizzes and exams.
2. application of knowledge to new problems by their ability to analyze earthquake data

(both in the form of earthquake catalogs as well as earthquake ground motion records), in small groups as well as individually, graph and display the results of their analysis and interpret these results in the framework of the theories discussed in class.
3. synthetic understanding by integrating ideas by researching a specific question related to California earthquakes and presenting their findings in a written report or oral presentation.

Course Number and Name
GSC 215 / GSC 215L: Mineralogy

Catalog Description
Identification, occurrence, origin and uses of the common minerals. Quantitative xray diffraction microanalysis, physical and chemical properties of minerals and introductory morphologic crystallography. Three lectures, one three hour laboratory. Prerequisites: GSC 111, GSC 141L. Field trip fee required.

Learning Outcomes:
Upon completing course, students shall have attained working knowledge of content areas and developed practical skills or gained experiences as listed below:

1. Recognize and utilize the common physical properties of minerals to include: crystal form, cleavage, hardness, luster, streak, specific gravity.
2. Understand the fundamentals of applied crystallography particularly forms; symmetry operations; crystal systems and the Bravais Lattices.
3. Perform symmetry operations on model crystals and relate the symmetry to the Struss classification system.
4. Understand and apply Miller Indices.
5. Complete simple stereographic projections, calculate axial ratios and interfacial angles.
6. Be able to utilize X-ray Crystallography to identify and index common minerals.
7. Understand the fundamentals of chemical mineralogy including atomic radii; bonding and atomic structures.
8. Apply common twin laws.
9. Understand the anion classification of minerals and know the major subgroups within the classification.
10. Identify approximately 100 of the most common minerals.
11. Understand common mineral associations and occurrences.

Course Number and Name
GSC 225: Quantitative Applications in Earth Sciences

Catalog Description
Solving realistic quantitative problems in the Earth Sciences using standard mathematical procedures as well as more specialized techniques. Use of symbols, scientific notation and units. Different functional forms of the geotherm. Earthquake statistics. Determining angles and distances from maps and cross sections. Analysis of plate motions. Geological and geophysical data visualization using graphing. Hazard analysis. Calculation of rates of geological processes and volumes of geological landforms. 4 hours of lecture and problem solving. Prerequisites: MAT 115 or consent of the instructor.

Learning Outcomes:
The objectives of this class are to improve students' problem solving skills and their understanding of the standard mathematical procedures they have learned in the prerequisite mathematics classes as well as more specialized techniques, by applying these methods to problems they are likely to encounter in their careers in the Earth sciences. The focus of this class is on the development of the core skills important in the quantitative Earth Sciences. The example problems will illustrate the display, processing and interpretation of geological and geophysical data and will thus address the specific issues involved with data from the Earth Sciences.

After completing this course students should have developed significant working knowledge of the following facts, terms or theories and how to apply them to solve quantitative problems in the Earth Sciences:

1) Scientific notation and exponents

2) Units and their conversion

3) Relating depth to temperature using different functional representations of the geotherm

4) Applying the Gutenberg-Richter relationship and Omori's law to determine earthquake distributions

5) Calculating aftershock probabilities based on 4) above

6) Using the equation for gravitational acceleration to derive the mass and average density of the Earth

7) Checking answers using approximation, dimensional analysis and common sense

8) Determining unknown angles and distances from maps and cross sections

9) Using plate velocities and directions to determine relative plate motions and spreading rates

10) Displaying geological and geophysical data by using triangular diagrams, polar graphs and 2-D projections of a sphere

11) Basic concepts of hazard analysis: recurrence rates and their uncertainties, ground motion probabilities.

12) Determining rates of geological processes (e.g. sedimentation rates and the determination of the free air gravity correction)

13) Estimating the volume and volume change of geologic landforms (e.g. volcanoes, the Earth) by integration Students shall demonstrate application of knowledge to new problems by their ability to apply the methods discussed in the classroom to a wide variety of problems in the Earth Sciences in homework assignments. Students shall demonstrate knowledge of specific facts, terms or theories by their ability to solve problems on two exams given towards the middle and end of the quarter. Students shall demonstrate comprehension during group work in the classroom by solving problems that are either similar to those discussed by the teacher but with slightly modified numbers or functions, or applying a similar methodology to a different problem.

Course Number and Name
GSC 255 / GSC 255L: Field Methods

Catalog Description
Techniques of recognizing, mapping, analyzing and interpreting geologic structures and earth features. Surveying with plane table, alidade, Brunton compass and tape. 1 lecture/problem, 3 three-hour laboratories. Prerequisites: GSC 145L. Field trips required. Field trip fee required.

Learning Outcomes:
Upon completing course, students shall have attained working knowledge of content areas and developed practical skills or gained experiences as listed below:

1. Description of field relationships involving common igneous, sedimentary, and metamorphic rocks, including crosscutting relationships between faults, intrusions, and unconformities
2. Systematic documentation of field observations (rock unit descriptions and structural orientation data) in a field notebook
3. Facility with a Brunton compass to measure planar and linear orientation data
4. Measurement of a stratigraphic section in sedimentary and/or volcanic terrain
5. Ability to locate points of observation on a topographic base map
6. Creation of a geologic map from outcrop locations and observational data
7. Construction of geologic cross sections and stratigraphic columns from geologic maps

Course Number and Name
GSC 300: Introduction to Geochemistry

Catalog Description
An examination of the interrelationship of geology and chemistry in the near surface environment. The course focuses on low temperature groundwater systems and geothermal fluids. Topics of discussion include the chemistry of meteoric and connate waters, application of Eh-pH and log fugacity of 02 diagrams to the modeling of aqueous fluids, stable isotopic fractionation in the hydrosphere, chemical reactions at the water- rock interface and dynamics of hydrothermal systems. 3 lectures/problems, one 3 hour laboratory. Prerequisites: CHM 121/121L.

Learning Outcomes
Upon completing course, students shall have attained working knowledge of content areas and developed practical skills or gained experiences as listed below:

1. Understand the fundamentals and basic laws of thermodynamics.
2. Be able to relate the concept of free energy to basic phase equilibria.
3. Construct a simple phase diagram using the aforementioned thermodynamic concepts.
4. Understand the use and application of XRF to geochemical analysis and interpretation.
5. Collect and analyze rock sample/water samples and/or soil samples.
6. Interpret binary and ternary phase diagrams and apply the results to real-world geologic problems.
7. Understand simple Mineral Stability diagrams and their application.
8. Apply the fundamental concepts of clay mineralogy to the identification and study of basic clay minerals.
9. Understand the process of radioactive decay, its applications to geology and perform calculations to determine age dates and isotopic ratios.
10. Apply knowledge of stable isotopes to real-world interpretation of geologic problems
11. Understand the fundamentals of low temperature aqueous geochemistry to include the concepts of "mass action", LeChatelier's Rule, acids and bases, hydrolysis and buffers.
12. Construct, interpret and apply Eh-pH diagrams.

Course Number and Name Course Number:
GSC 304: Meteorology

Catalog Description
Framework topics, such as atmospheric structure, composition, heating, pressure, humidity form the base upon which a process-oriented semi-quantitative, descriptive survey of major weather phenomena, including winds, clouds, precipitation, and storms is conducted. 4 lecture / discussions. Prerequisites: One GE course from each of the following sub-areas: A1, A2, A3, B1, B2, B3. GE Synthesis course for Sub-area B4.

Learning Outcomes
Upon completing course, students shall have attained working knowledge of content areas and developed practical skills or gained experiences as listed below:

1. A recognition and understanding of key atmospheric phenomena
2. An understanding of why various atmospheric phenomena take place
3. An understanding of the application of concepts in mathematics as they apply to the atmosphere
4. An understanding of the application of physics concepts as they apply to the atmosphere
5. An understanding of the application of chemical concepts as they apply to the atmosphere
6. An appreciation of the various techniques of meteorological data gathering
7. An appreciation of the various technologies used in the formulation of weather predictions
8. Gain experience in seeking information via library resource data bases and the Internet

Course Number and Name
GSC 307 / GSC 307L: Introduction to Global Geophysics

Catalog Description
The physics of the solid Earth and its applications. The following topics will be discussed: the theory of plate tectonics; magnetics, seismology and gravity; radioactivity and heat; the deep interior of the Earth and the physical processes of the mantle and core; applications to specific regions on Earth. Throughout the course, special attention will be given to new research results and the interpretation of actual data. 3 hours of lecture + 3 hours lab

Expected Educational Outcomes
Upon completing course, students shall have attained working knowledge of content areas and developed practical skills or gained experiences as listed below:

1) Major internal divisions of the Earth
2) Theory of plate tectonics and the underlying evidence
3) Characteristics of the Earth's magnetic field and its reversals
4) Different types of plate boundaries
5) How the movement of plates across the Earth can be parameterized as rotation around a pole
6) Seafloor magnetic anomalies and how seafloor spreading explains their occurrence
7) Characteristics of the different types of waves that are generated by earthquakes
8) How seismic waves can be used to study the interior of the Earth
9) How seismic waves can be used to study the faulting process and magnitude of earthquakes
10) Gravity and shape of the Earth
11) How gravity anomalies can be used to investigate isostasy
12) Decay of radioactive isotopes and its application in geochronology
13) Simple geotherms and oceanic/continental heat flow
14) The internal structure of the Earth: velocities, density, composition and elastic moduli
15) Convection in the mantle and outer core
16) Characteristics of and basic processes active at ridges, rifts, transform faults and subduction zones

Students shall demonstrate knowledge of specific facts, terms or theories by their ability to answer questions on two exams given towards the middle and end of the quarter. Students shall further demonstrate comprehension by their ability to read several research publications on related topics and summarize these papers in short presentations. Students shall demonstrate application of knowledge to new problems by their ability to carry out scientific measurements in small groups, graph and display these measurements and interpret them. Students shall demonstrate comprehension by their ability to write short scientific reports on these experiments. Students shall demonstrate synthetic understanding by integrating ideas into a solution by researching a specific question related to a geophysical topic and presenting their findings in a classroom presentation.

Course Number and Name
GSC 310 / GSC 310L: GIS Applications for Earth Scientists I

Catalog Description
Practical techniques for converting traditional coordinate based geoscience data into digital map layers. Digitizing methods applied to creation of geologic, hydrologic, meteorologic, and oceanographic maps. One hour lecture plus two 3hour laboratory sessions.

Expected Educational Outcomes
Upon completing course, students shall have attained working knowledge of content areas and developed practical skills or gained experiences as listed below:
1. Know standard procedures for geo-registering various raster images (topographic maps, satellite images, aerial photos, geologic maps, etc.) into ArcGIS and OziExplorer platforms.
2. Utilize Adobe Photoshop in concert with ArcGIS to splice together fragments of raster images (maps, satellite photos, etc.) and create a composite geo-registered base layer.
3. Demonstrate ability to superimpose map layers of differing datum and/or projection using appropriate transformation tools in ArcGIS
4. Convert raw field notes or field data to Excel spreadsheets containing columns for X,Y, Z coordinates and various geologic, hydrologic or meteorology attributes.
5. Plot conventional symbols for various geologic, hydrologic or meteorology attributes keyed to specific columns in Excel spreadsheets, applying the appropriate tools for creating, rotating and labeling the corresponding symbol.
6. Create gridded base maps in appropriate datum/projection to aid in direct plotting of measurements or observations acquired in the field.
7. Acquire raw field data (e.g., X,Y, Z coordinates and various geologic or hydrologic attributes) at a remote field site using conventional surveying and mapping equipment.
8. Download Garmin GPS waypoints directly onto geo-registered base layers using ArcGIS and OziExplorer programs
9. Apply various data analysis tools to create contour maps of geographic, geologic or hydrologic attributes that may include elevations, metal assays, structural measurements, precipitation, stream discharge, temperature, wind speed.
10. Utilize Adobe Illustrator to enhance map products originally created in ArcGIS

Course Number and Name
GSC 311 / GSC 311L: GIS Applications for Earth Scientists II

Catalog Description
Practical GIS methods for geologic map representation and quantitative analysis of real world coordinate based geoscience data. Manipulation and enhancement of digital data layers in contemporary drafting programs. Creation and interpretation of contour maps, isopach maps, and slope stability maps. Three dimensional analysis of borehole data; construction of cross section images. One hour lecture plus two 3-hour laboratories.

Expected Educational Outcomes
Upon completing course, students shall have attained working knowledge of content areas and developed practical skills or gained experiences as listed below:

1. Review, practice and demonstrate competency in the many learning outcomes listed for GSC 310/GSC 310L
2. Create contour maps of various topographic, geologic, hydrologic and meteorology data sets, then use ArcGIS Analysis tools to generate derivative maps showing spatial variation in slope aspect, gradient, precision, etc.
3. Utilize slope aspect and slope gradient maps in concert with structural data to determine areas of “daylighting condition” subject to potential landslide hazard
4. Utilize ArcCatalog to set up geo-database needed to convert raster scans of raw geologic maps into digital geologic maps.
5. Know basic procedures for digitizing line, polygon and point data from geo-registered raster scans of conventional geologic maps or satellite images.
6. Demonstrate ability to create a clean topology from digitized line and polygon files.
7. Link digitized topology elements to geo-database using ArcMap in concert with ArcCatalog.
8. Utilize area analysis tools to derive statistical information form digitized polygon maps; e.g. percentage of area covered by land with specific attribute, etc.
9. Complete a capstone field project with class team-mates, entailing: a. Acquisition of raw field data (e.g., X,Y, Z coordinates and various geologic or hydrologic attributes) at a remote field site using conventional surveying and mapping equipment, b. Creation of digital map and corresponding geo-database, and c. Written description and analysis of field relationships.

Course Number and Name
GSC 320: Studies Of A Blue Planet

Catalog Description
Science-based issues related to the ocean-atmosphere system which directly impact Humankind are examined. Global environmental change, El Niño / La Niña, ozone depletion, sea level changes, coastal development, alternative energy sources and satellite monitoring of earth are investigated. Four lecture / discussions per week. Prerequisites: One GE course from each of the following sub-areas: A1, A2, A3, B1, B2, B3. GE Synthesis course for Sub-area B4.

Learning Outcomes
Upon completing course, students shall have attained working knowledge of content areas and developed practical skills or gained experiences as listed below:

1. Have an appreciation for how truly special Planet Earth is.
2. Have a knowledge of the nature and origin of the hydrosphere and the atmosphere which make the planet unique in the Universe.
3. Have an understanding of the various ways the ocean and atmosphere are linked.
4. Have a knowledge of the scientific principles and methods of measurement of such global problems as global environmental change, ozone depletion, sea level changes.
5. Have a knowledge of how industrialization may have altered global earth systems.
6. Have an earth history perspective (geological perspective) upon which to judge issues related to global change.
7. Have a knowledge of how major global earth processes impact the fabric of Humankind -- economic issues, ethical issues, environmental issues.
8. Gain experience in seeking information via library resource data bases and the Internet.

Course Number and Name
GSC 321 / GSC321L: Engineering Geology I

Catalog Description
Fundamentals of geology applied to engineering problems. Includes rock types, structure, erosion, sedimentation, seismic explorations, rock/soil movements, and dam site evaluations. Individual and group study of selected engineering geology problems. Instruction is carried out in the field and laboratory. 3 hours lecture/discussion, 1 laboratory. Prerequisites: one course from each of the following Sub-areas: A1, A2, A3 and B1, B2, B3. GE Synthesis course for Sub-area B4.

Learning Outcomes
Upon completing course, students shall have attained working knowledge of content areas and developed practical skills or gained experiences as listed below:

1. Classification, names, physical appearances, and engineering properties of various solid earth materials
2. Topographic, hydrologic, and geologic maps and associated profile/cross section illustrations
3. Methods and techniques for obtaining quantitative information from (1) and (2) above
4. Geological engineering applications including rock mechanics, dam site analysis, dam/reservoir design, hydrogeology, slope stability, geologic hazard assessment, groundwater, mining, and petroleum resource evaluation
5. Presentation of final group projects in oral format to student peers, with a written report submitted to the instructor for evaluation

Course Number and Name:
GSC 323 / GSC 323L: Geomorphology

Catalog Description
Introduction to the modern geologic study of Earth surface processes and landforms. Geomorphic analysis of landscape evolution, dynamic equilibrium, and topographic response to tectonic and climatic forcing. Terrain analysis utilizing geomorphic field data, remote sensing imagery, and numerical models. Emphasis on practical applications to natural hazards and resource problems. Topics may include active tectonics, river systems, hill slopes, coastlines, glaciers, soils, wind, and climate change. This course includes 3 lecture discussions and 1 field laboratory (3 hrs.) per week. Required field trips during lab sessions and on at least one weekend. Prerequisite: GSC 111 or permission from instructor.

Expected Educational Outcomes
Upon completing course, students shall have attained working knowledge of content areas and developed practical skills or gained experiences as listed below:

Course Number and Name
GSC 325 / GSC 325L: Optical Mineralogy
Catalog Description
The chemistry (primarily phase relationships) of the common rock-forming minerals. The description, composition, texture and origin of the common rock-forming minerals according to their optical properties as determined with the petrographic microscope. 2 lectures/problem solving, 2 three-hour laboratories. Prerequisite: GSC 215/215L.

Learning Outcomes
Upon completing course, students shall have attained working knowledge of content areas and developed practical skills or gained experiences as listed below:

1. Attain familiarity with the moving parts of a petrographic microscope.
2. Understand optical theory pertaining to transmission of light through isotropic and anisotropic minerals.
3. Apply Snell's law to quantify light refraction through different transparent and translucent media whose boundaries are oriented at various angles to incident light.
4. Recognize and demonstrate fundamental differences between isotropic, uniaxial, and biaxial minerals through optical tests performed with a petrographic microscope.
5. Utilize optical properties to identify common rock forming minerals in grain mounts and thin section.
6. Estimate mineral modes (volume % proportions) in thin sections of igneous, sedimentary, and metamorphic rocks.
7. Utilize mineral modes and textural features in conjunction with traditional classification schemes to name various rocks viewed in thin section.

Course Number and Name
GSC 331 / GSC 331L: Invertebrate Paleontology

Catalog Description
Morphology and evolution of fossil invertebrates. Includes discussion of ancient environments and changes in life forms with time. 3 lectures/problemsolving, 1 three hour laboratory. Prerequisite: GSC 112 and GSC 151L. Field trips required. Field trip fee required.

Learning Outcomes
Upon completing course, students shall have attained working knowledge of content areas and developed practical skills or gained experiences as listed below:

- Detailed knowledge of the Geologic Time Scale and "how it grew" including the most significant biological events of the Phanerozoic Eon
- The various processes of fossilization including "what is a fossil?" with examples
- Taxonomic and habitat classification of major invertebrate groups; phylogeny of dominant invertebrate taxa – grades and clades
- Anatomy of stratigraphically significant invertebrate taxa
- Chronostratigraphic distribution of dominant invertebrate groups
- Invertebrate fossils as indicators of ancient environments
- Major extinction events in the biologic history of Earth as evidenced in the fossil record
- The use of common, stratigraphically significant, fossil invertebrates in solving geologic problems: correlation, structure sections, and paleogeographic maps.
- Application of fossil invertebrates in oil and gas exploration

Course Number and Name
GSC 333 / GSC 333L: Structural Geology

Catalog Description
Investigation of the deformation of the earth's lithosphere. Solution of geologic field problems. 3 lectures/problem-solving, 1 three-hour laboratory. Prerequisites: GSC 111, GSC 141L, GSC 145L, and GSC 255/255L. Field trips required. Field trip fee required.

Learning Outcomes
Upon completing course, students shall have attained working knowledge of content areas and developed practical skills or gained experiences as listed below:

1. Understand the rule of V's as applied to interaction of topography with variably oriented rock layers
2. Construct true scale geologic cross sections from a geologic map base
3. Recognize, describe, and accurately measure various classes of geologic structures (including bedding, unconformities, intrusive contacts, faults, fault striations, foliation, lineation, folds, fold hinges, axial planes, etc.) in their natural field setting
4. Precisely locate structural orientation data with appropriate symbols on topographic base maps and/or satellite images
5. Plot various types of structural orientation data on a stereonet diagram
6. Interpret the 3-dimensional geometry of structures plotted on stereonet diagrams
7. Understand geometric relationships between three main classes of faults and orientations of the principle stresses
8. Apply the strain ellipsoid concept to measurement and interpretation of 3-dimensional strain in naturally deformed rock masses
9. Utilize drawings of progressive deformation to illustrate fundamental differences between coaxial plane strain (pure shear) and noncoaxial plane strain (simple shear)
10. Understand Mohr-Coulomb theory of rock failure and its application to earthquake faulting
11. Recognize and describe various classes of kinematic indicators associated with ductile shear zones
12. Classify fold geometries in terms of inter-limb angle and orientations of hinges and axial planes.
13. Relate the concept of cylindrical folding to stereonet representations of structures associated with folded surfaces
14. Understand geometric relationships of S folds, Z folds, W folds, M folds, and axial plane cleavage/foliation to larger scale folds in folded terrain

Course Number and Name
GSC 335: Exploring the Oceans: Oceanography

Catalog Description
Fundamental ocean processes emphasizing physical, chemical, and geological oceanography. Topics include currents, tides, waves, beaches, chemistry of ocean water, ocean basin evolution and physiography, and sedimentation as well as specific, relevant biological processes. Research vessel cruise.
Lecture/discussion/demonstration. Prerequisites: one course from each of the following Subareas: A1, A2, A3 and B1, B2, B4. GE Synthesis course for Subarea B5.

Learning Outcomes
Upon completing course, students shall have attained working knowledge of content areas and developed practical skills or gained experiences as listed below:

- Hypotheses to explain the origin of the Solar System and the Water Planet "Oceanus" (= Earth)
- The origin of the World Ocean and the distribution of water on the Earth's surface
- The necessity of the oceans as an environment suitable for the origin and maintenance of life on Earth
- The occurrence of water elsewhere in the Solar System
- The chemistry and physics of water; the "states of matter" as exemplified by the water molecule
- The composition and structure of the water molecule
- How the polarity of the water molecule accounts for the unusual physical properties of water (high specific heat; "universal solvent;" high surface tension)
- Salinity: definition of the term and the sources of the dissolved ions which contribute to the "saltiness" of the sea water
- How salinity is measured; various sampling devices and procedures; sigma t maps and salinity profiles
- The origin of continents and ocean basins; plate tectonics and seafloor spreading
- The land beneath the sea; the topography of the ocean floor and its origins
- Classification and origin of marine sediments; common examples of dominant sediment types
- Waves on water; origin of ocean waves; anatomy and propagation of waves and classification of wave forms; waves and beaches - surfing!
- Special types of waves: tides and tsunami; causes and "types" of tides
- Energy from waves and tides – practical applications
- Ocean circulation: wind driven ("horizontal") *versus* density driven ("vertical") circulation
- The winds that drive the major current systems and their origins; the major horizontal wind systems of each hemisphere; the *El Nino* phenomenon
- Minerals and energy from the sea; marine mining and petroleum extraction from the seabed – promise and perils of resource recovery
- The future of the marine environment

Course Number and Name
GSC 350: Natural Disasters

Catalog Description
The scientific study of natural disasters and their impact on humankind. A variety of hazards related to plate tectonics and climate are examined from a scientific perspective. Topics may include earthquakes, tsunami, volcanic eruptions, landslides, flooding, hurricanes, tornadoes, and climate change. Recent events and notable case histories are studied through lecture, Internet, video, field trips, and student presentations. GE Synthesis course for Subarea B4.

Learning Outcomes
Upon completing course, students shall have attained working knowledge of content areas and developed practical skills or gained experiences as listed below:

1. Understand the geographic distribution of Earth's plate boundaries and their influence on the global occurrence of earthquakes and volcanic eruptions.
2. Distinguish between physical processes and tectonic settings that create basaltic vs. silicic volcanic eruptions, characterize their different eruptive styles, and describe both beneficial and detrimental human consequences.
3. Understand the mechanics of earthquake faulting, methods for measuring and monitoring seismic activity, and physical explanations for variations in the intensity of ground shaking.
4. Characterize various geologic or hydrologic factors and human-induced ground disturbances leading to landslides, slope failures and other mass movements
5. Describe physical driving mechanisms, spatial and temporal distribution, and human consequences of severe weather phenomena, including hurricanes, thunderstorms, tornadoes and windstorms.
6. Understand the causes and consequences of river flooding
7. Demonstrate ability to access contemporary web resources to obtain real-time information on natural disasters.
8. Know basic methods to prepare for and mitigate natural disasters.
9. Present a formal research report or case study on a historical natural disaster in both oral and written format.

Course Number and Name
GSC 360 / GSC 360L: Hydrogeology

Catalog Description
Groundwater occurrence and movement. Role of groundwater in the hydrologic cycle and geologic processes. Groundwater resource evaluation, geotechnical problems, groundwater contamination. 3 hours lecture, one 3 hour laboratory per week.

Learning Outcomes
Upon completing course, students shall have attained working knowledge of content areas and developed practical skills or gained experiences as listed below:

1. Diagram the hydrologic cycle and illustrate the role of aquifers and groundwater flow.
2. Understand various techniques for measuring and quantifying precipitation, evaporation and runoff.
3. Apply the water budget equation to natural hydrologic data sets, and solve for unknown quantities of groundwater flow.
4. Utilize ternary “Piper” diagrams to plot chemical analyses of surface water or groundwater samples
5. Recognize important natural or man-made sources of major ions encountered in groundwater.
6. Understand the physical derivation of Darcy’s law, and its applicability to groundwater flow problems.
7. Understand the concept of hydraulic head: its physical derivation, how it is measured, and how it is utilized to solve groundwater flow problems.
8. Utilize flow net constructions and associated calculations to solve groundwater flow problems.
9. Analyze drawdown data to determine fundamental properties of pumped aquifers.
10. Know various geologic processes and environments that favor formation of aquifers.
11. Understand exploration methods used by hydrogeologists to locate aquifers and predict their extent

Course Number and Name
GSC 410: Earth Science Seminar

Catalog Description
Observation and evaluation of oral presentations associated with professional Earth science seminars. Discussion and practice of the design, mechanics and style of presenting Earth science information with Powerpoint slides and overhead transparencies. 2 hours seminar.

Learning Outcomes
This seminar course provides students practical experience with the preparation and critique of oral presentations intended to disseminate Earth science information in a professional or academic setting. Students are instructed in methods of organizing and presenting Earth science data in an oral seminar forum. Through direct observation and critique of talks or seminars, students reinforce their oral presentation experience and skills.

Upon completing this course students should have developed significant experience with the design, implementation and evaluation of oral presentations related to Earth science topics. Each student shall complete the following;

1. Observation of five official seminar talks on an Earth science topic
2. Compilation of a portfolio containing evaluation of each seminar talk
3. Oral presentation to peers summarizing a specific research topic or literature related to Earth science

Course Number and Name
GSC 415 / GSC 415L: Engineering Geology II

Catalog Description
Application of geologic and geophysical principles to engineering problems encountered in the geotechnical industry. Lecture topics include earthquake faults and seismology of Southern California, earthquake induced strong ground motion and site effects, seismic instrumentation and shake maps, probabilistic hazard analysis, Alquist Priolo/fault trench studies, stability analysis of slopes and dams, and case studies of landslides, earthquakes, and dam failures. Laboratory sessions involve 3-dimensional analysis of geologic data, field measurement and analysis of unstable slopes, and investigation of dam sites. 3 units lecture/discussion scheduled for evening. 1 unit laboratory requires field trips to be conducted on selected Saturdays. Prerequisites: Equivalent of GSC 111/GSC 141L or GSC 321/GSC 321L.

Learning Outcomes
Upon completing course, students shall have attained working knowledge of content areas and developed practical skills or gained experiences as listed below:

1. Ability to recognize geologic site conditions leading to problems related to stability or safety of man-made structures (buildings, roads, dams, or cut slopes)
2. Knowledge of earthquake faults and related seismic hazards in southern California
3. Understanding of seismic wave propagation, strong ground motion, and site effects associated with earthquakes
4. Ability to access and interpret various forms of geologic hazards maps produced by government agencies (shake maps, landslide hazards maps, probabilistic seismic hazards maps)
5. Understanding of the Alquist-Priolo Act and its foundations in fault trenching studies
6. Facility with a Brunton compass to measure fractures and other planar discontinuities in natural and cut slopes.
7. Ability to statistically analyze planar orientation data with a Stereonet.
8. Oral presentation of a case study synthesis focusing on a historical landslide, earthquake, or dam failure.

Course Number and Name:
GSC 423/423L: Sedimentary Geology

Catalog Description
Stratigraphic procedures, correlation, depositional environments, classification and origin of stratigraphic units, chemical, mineralogic and textural studies of sedimentary rocks, using petrographic, mechanical and x-ray techniques. Theory of the classification and origin of these rocks. Field trips. 3 lectures, 2 three-hour laboratories. Prerequisite: GSC 325/325L. Field trips required. Field trip fee required.

Learning Outcomes
Upon completing course, students shall have attained working knowledge of content areas and developed practical skills or gained experiences as listed below:

1. A knowledge of the origin of sedimentary materials – weathering processes.
2. An understanding of particle / fluid interactions – entrainment, transportation and deposition of sedimentary materials.
3. An understanding of the fundamental properties and characteristics of sedimentary deposits – grain size, shape, texture, porosity, permeability, etc.
4. A general knowledge of sediment diagenesis – the making of sedimentary rocks.
5. An understanding of the major sedimentary rock classification schemes.
6. A knowledge of essential primary and post-depositional sedimentary structures.
7. A knowledge of the fundamental principles of stratigraphy.
8. A knowledge of key sedimentary environments.
9. An ability to study and classify sedimentary rocks in thin section.
10. An ability to recognize key fossil fragments in thin section.
11. A knowledge of and experience with conducting size analysis of unconsolidated sediment.
12. An understanding of the various techniques for correlating sedimentary rock units.

Course Number and Name
GSC 424: Igneous and Metamorphic Petrology

Catalog Description
Theory of the origin, classification, chemistry and mineralogy of igneous and metamorphic rocks. 3 lectures. Prerequisites: GSC 325/325L. Corequisite: GSC 425L.

Learning Outcomes
Upon completing course, students shall have attained working knowledge of content areas and developed practical skills or gained experiences as listed below:

1. Know the common classifications of igneous and metamorphic rocks and be able to apply those classifications.
2. Apply phase diagrams to the understanding of igneous rocks.
3. Be able to relate differences in major and minor element chemistry of rocks to genesis.
4. Understand the basics of magma differentiation and diversification.
5. Possess a working knowledge of the genesis of basalts, mafic and ultramafic rocks.
6. Understand the fundamental felsic rock suites, their mode of formation, how they differ and their genesis.
7. Understand and apply the concept of metamorphic facies.
8. Apply chemographic diagrams to genetic studies of igneous rocks.
9. Interpret field maps of metamorphic and igneous rock terrains.
10. Prepare a detailed field description and interpretation of a selected field area.

Course Number and Name
GSC 425L: Igneous and Metamorphic Petrology Laboratory

Catalog Description
Mineralogy, texture and description of igneous and metamorphic rocks with the petrographic microscope, mineral separation techniques and xray diffraction. Field trips. Prerequisite GSC 325. Corequisite GSC 424. 2 threehour laboratories. Field trips required. Field trip fees required.

Learning Outcomes
Upon completing course, students shall have attained working knowledge of content areas and developed practical skills or gained experiences as listed below:

1. Identify common rock-forming minerals in thin section.
2. Be able to petrographically classify igneous and metamorphic rocks.
3. Recognize and interpret rock textures and structures.
4. Collect, analyze and interpret suites of rocks from field areas.
5. Apply the commonly utilized rock classifications in the field and lab.

Course Number and Name
GSC 433 / GSC 433L: Ore Deposits

Catalog Description
A systematic study of the deposition of metallic ores. Preparation of comprehensive ore deposit models is stressed requiring the integration of mineralogy, petrology and structural geology. Discussions and practical exercises on wall rock alteration, paragenesis, metal zoning and fluid inclusion geothermometry are important components of the course. Laboratory examination of polished sections and thin sections from "classic" mining districts throughout the world and field trips to important mining districts compliment the lecture. Three lectures and one 3 hour lab. Prerequisite: GSC 215/215L. Required field trips. Field trip fee required.

Learning Outcomes
Upon completing course, students shall have attained working knowledge of content areas and developed practical skills or gained experiences as listed below:

1. Ore deposits is a capstone experience and students will be required to apply knowledge from many previous geology classes, e.g. Mineralogy, Optical Mineralogy, Geochemistry, Igneous and Metamorphic Petrology, Structural Geology and Sedimentary Geology.
2. Understand the fundamental morphology of ore deposits.
3. Apply the Lindgren classification.
4. Use reflected light microscopes to identify common ore-forming minerals.
5. Understand and interpret ore textures.
6. Analyze fluid inclusions.
7. Prepare genetic models for various types of ore deposits including porphyry copper & moly deposits; epithermal gold deposits; kimberlites/carbonatites; layered mafic intrusive; komatiites; massive sulfide deposits; Mississippi-valley type deposits; banded Iron Formation and Uranium Deposits.

Course Number and Name
GSC 434 / GSC 434L: Shallow Subsurface Geophysics

Catalog Description
Geophysical techniques. Gravity, magnetic, electrical and seismic methods applied to the solution of geologic problems. 3 lectures/problem solving, 1 three hour laboratory. Prerequisites: GSC 111, GSC 141L, PHY 132 and PHY 132L or PHY 122 and PHY 122L. Field trips required. Field trip fee required.

Learning Outcomes
This course discusses several different methods and approaches in geophysics for exploring the shallow subsurface. The level of the course is directed towards advanced undergraduate and graduate students in the Natural Sciences and Civil Engineering. Some of the lab time will be used to conduct geophysical field experiments and analyze the resulting data using computer processing.

After completing this course students should have developed significant working knowledge of the following facts, terms or theories:
1) Types of seismic waves, their velocities and propagation
2) Principles and laws governing ray paths in layered materials
3) Wave attenuation and amplitude
4) Types of seismic sources used in surveys
5) Travel time equations and determination of layer thicknesses for subsurface structures ranging in degree of complexity from a homogeneous subsurface to multiple dipping interfaces using the seismic refraction method
6) Methods of detecting hidden zones in the subsurface, such as low-velocity or thin layers
7) Travel time equations and determination of layer thicknesses for subsurface structures ranging in degree of complexity from a single horizontal subsurface interface to a dipping interface using the seismic reflection method
8) Analysis and processing of reflection data
9) Common field procedures in seismic reflection and refraction studies
10) The Earth’s gravitational field
11) Types of gravity measurements and procedures for obtaining gravity data in the field using Department gravimeter
12) Common corrections applied to observed gravity measurements
13) Predicted gravity effects of simple geometric shapes
14) Analysis of gravity anomalies
15) Fundamentals of the magnetic method, ground penetrating radar and electrical resistivity

Students shall demonstrate knowledge of specific facts, terms or theories by their ability to answer questions on two exams given towards the middle and end of the quarter. These exams are designed to test basic understanding of material and students' ability to apply principles and solve applied problems with geophysics. Students shall further demonstrate comprehension by their ability to read research and/or industry publications on exploration surveys and summarize these papers in short presentations

and written summaries. Students shall utilize scientific methodologies and technical skills acquired in previous Science and Mathematics courses. Students shall demonstrate application of knowledge to new problems by their ability to analyze data from geophysical surveys, in small groups as well as individually, graph and display the results of their analysis and interpret them in the framework of the models discussed in class. Students will have learned to use seismic refraction equipment to conduct a seismic refraction survey and to interpret the waveform data generated in this experiment in the framework of a simplified model of the shallow subsurface. Students shall demonstrate comprehension by their ability to write short scientific reports on their findings. Students shall demonstrate their understanding of basic computer processing by using applications to perform forward and inverse modeling for the geophysical methods covered in class and in lab/homework assignments.

Course Number and Name:
GSC 444 / GSC 444L: Geotectonics

Catalog Description
Study of the major tectonic elements of the Earth, their geometry, kinematics and dynamics with special emphasis on the Cordillera of Western North America. All of the tectonic features will be analyzed in the context of plate tectonics. Prerequisites: GSC 111, GSC 141L. Field trips required. 3 lectures/problem-solving, 1 three-hour laboratory.

Learning Outcomes
Upon completing course, students shall have attained working knowledge of content areas and developed practical skills or gained experiences as listed below:

1. Know the historical development of ideas and scientific breakthroughs associated with formulation of Plate Tectonics theory.
2. Understand the basic geophysical and geochemical observations that constrain our modern models for Earth's internal structure.
3. Know the names and absolute time boundaries for major eons, eras, periods, and epochs of the geologic time scale.
4. Know distinctive rock assemblages and geologic structures associated with modern extensional, compressional, and strike-slip tectonic environments.
5. Describe salient characteristics of the five Archean microcontinents composing the core of the North American (Laurentian) craton.
6. Describe the major tectonic cycles (Wilson cycles) associated with formation, breakup, and dispersal of the Rodinia and Pangaea supercontinents.
7. Outline the Paleoproterozoic to Recent tectonic history of southwestern North America, with an emphasis on distinctive rock packages and structures preserved in southern California.
8. Conduct literature research on a topic related to tectonic development of a noteworthy rock assemblage, fault zone, or historical earthquake in southern California.
9. Present an oral report of research topic to peers in an appropriate field setting.
10. Write a formal research paper on chosen topic, formatted to Geological Society of America Bulletin specifications.

Course Number and Name:
GSC 450 / GSC450L: Introduction to Seismology, Earthquakes and Earth Structure

Catalog Description
The study of the generation, propagation and recording of seismic waves and of the sources that produce them. Stress and strain. Body waves and ray theory. Surface waves and free oscillations. Seismometry. Interpretation of seismograms. Determination of Earth structure. Reflection seismology. Seismic sources. Strong motion seismology and earthquake hazard. Earthquake statistics. Seismotectonics. 3 hours of lecture + 3 hours lab

Expected Educational Outcomes
This course discusses the basic principles of seismology and is intended for advanced undergraduate and graduate students in the Natural Sciences and Civil Engineering. Throughout the course a connection will be made between theories of wave propagation and earthquake sources and observational research on earthquake rupture processes and the structure of the Earth. In the labs actual seismic data (waveforms as well as earthquake catalogs) will be analyzed using scientific methods.

Specific Learning Outcomes for GSC 450/450L: After completing this course students should have developed significant working knowledge of the following facts, terms or theories:

1) Basic history of seismology
2) Stress and strain and their relationship
3) Characteristics of body waves: P- and S-Waves
4) Snell's Law
5) Travel time curves
6) Reflection and transmission coefficients
7) Phases and techniques used in reflection seismology
8) Characteristics of surface waves: Love and Rayleigh waves
9) Free oscillations of the Earth
10) Excitation and propagation of tsunami
11) Basic functionality of seismometers and seismic networks
12) Different types of earthquake faulting
13) Determining the source mechanism of an earthquake
14) Seismotectonics: different types of plate boundaries and the earthquakes associated with them
15) Different scales of earthquake size: intensity and magnitude
16) Earthquake dynamics: particle velocity, directivity and rupture velocity
17) Earthquake sequences: aftershocks, foreshocks, swarms and earthquake statistics
18) Earthquake prediction and forecasting Students will also learn how they can use specific Internet sites to obtain, both global as well as local, seismic data, and where on the Internet they can find near real-time and post-earthquake information on large global and local earthquakes.

General Learning Outcomes for GSC 450/450L: Students shall demonstrate knowledge of specific facts, terms or theories by their ability to answer questions on two exams given towards the middle and end of the quarter. Students shall further demonstrate comprehension by their ability to read several research publications on seismological topics and summarize these papers in short presentations. Students shall demonstrate application of knowledge to new problems by their ability to analyze seismic data, both waveforms as well as earthquake catalogs, in small groups as well as individually, graph and display the results of their analysis and interpret them in the framework of the theories discussed in class. Students shall demonstrate comprehension by their ability to write short scientific reports on their findings. Students shall demonstrate synthetic understanding by integrating ideas by researching a specific question related to a seismological topic and presenting their findings in a classroom presentation.

Course Number and Name
GSC 491L: Field Module

Catalog Description
Advanced geologic mapping in a variety of geologic settings. Field reports, maps and cross sections required. Techniques emphasized include surveying, GPS mapping, satellite and aerial photo interpretation, Brunton compass pace and traverse. Each module requires a minimum of five field days with additional field and lab time as necessary to complete the assignments. Students are expected to complete four (4) modules to fulfill the Geology BS degree requirement. Each module must be topically distinctive. Modules must be taken from at least two different instructors. Total credit limited to 8 units with a maximum of 4 units per quarter. Individual modules count for 2 units laboratory.

Learning Outcomes
Depending on the topical focus and expertise of the instructor(s), students shall attain working knowledge of content areas and developed practical skills or gained experiences as listed below:

- Demonstrate proficiency with the Brunton compass to map rock and soil units and geologic structures,
- Utilize hand held GPS units for location as well as geologic mapping,
- Acquire and utilize high resolution 3-D satellite imagery for base mapping and structural depiction,
- Possess the fundamental skills necessary for surveying areas to prepare base maps with a Total Station or Laser Rangefinder,
- Convert raw field data and personal field observations into geologic maps and cross sections; prepare topographic and geologic maps and other drawings with computer software as needed,
- Integrate GPS data into in ArcGIS and other GIS software,
- Compile and analyze computer data from a variety of sources and present it in a coherent format,
- Integrate field data into a larger scale understanding of the regional geologic and tectonic picture,
- Prepare a final field report that mimics the type of report that will be required as employees in the geotechnical fields.