I. CATALOG DESCRIPTION:

A:

Division: **Science & Math**
Department: **Geology**
Course ID: **GEOL 270x4**
Course Title: **Geology of the Eastern Sierra Nevada**
Units: **1**
Lecture: **5 hours**
Laboratory: **24 hours during a field trip**
Prerequisite: **GEOL 100 GEOL 101**

B. Course Outline:

Discussion and observation of the physical and historical geology of the Eastern Sierra Nevada Mountain Range and adjacent geomorphic provinces with specific emphasis on the geologic features relating to the volcanic and glacial history of the region. A series of introductory lectures preceding a 3-4 day field trip across the Mojave Desert and along the eastern face of the Sierra Nevada Mountain Range. The field trip route follows the eastern boundary between the Sierra Nevada and Basin and Range Province Provinces. The landform development in the area represents some of North America's best examples of Pleistocene volcanism and valley glaciation. A 3 - 4 day field trip is required For the successful completion of the class.

Schedule Description:

Discussion and observation of the physical and historical geology of the Eastern Sierra Nevada Province which includes a 3 - 4 day field trip along the eastern margin of the Sierra Nevada with emphasis on the volcanic and glacial features.

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: Four (4)

III. EXPECTED OUTCOME FOR STUDENTS:

Upon completion of the first repetition of the course, the student will be able to:

A. describe the general geologic features of the Sierra Nevada Mountain Range that expose the three principal rock types,
B. understand the origin and relative ages of the principal rock types making up the Sierra Nevada,
C. identify the major processes of erosion, mass wasting, and weathering, as they are manifested in the field trip area,
D. understand the reason for cinder cones, lava flows, air fall tuffs, giant calderas, hot springs, fumaroles and other volcanic phenomena,
E. distinguish between landscapes created by stream erosion and those created by glacial erosion, and
F. describe the plate tectonic origins of the igneous rocks making up the core of the Sierra Nevada.

Upon completion of the second repetition of the course, the student will be able to:

A. identify the full range of geomorphic features typical of uplifted block mountain formations in the Sierra Nevada and adjacent Basin and Range provinces,
B. demonstrate specific knowledge of large-scale geologic processes responsible for the formation of the block mountains, volcanics and glacial features found here, and
C. demonstrate knowledge of the geologic conditions responsible for the development of rock formations, both surface and underlying, to the point that the student will be able to analyze the full range of visible and subterranean rock formations to ascertain the specific processes from which they arose.

Upon completion of the third repetition of the course, the student will be able to:

A. based on observations of any geologic formation characteristic of the Sierra Nevada - Basin and Range provinces' boundary, analyze the processes that led to this formation with enough detail to "tell the story" of the geologic region,

B. explain how geologic factors combine, rather than acting in isolation, to produce the "transition" zones characteristic of the Sierra Nevada – Basin and Range, to the point that the student can make reasonable projections about the geologic future of the region, and

C. be able to perform field analyses to identify rocks and minerals characteristic of the Eastern Sierra Nevada – Basin and Range region.

Upon completion of the fourth repetition of the course, the student will be able to:

A. work independently in the field to make scientific observations, form and test hypotheses, make judgments to achieve a stated goal, research information as needed to effectively utilize field time, and write thorough, cogent, and persuasive journal entries and summative reports of the independent work.

IV. CONTENT:

A. The Geologic Provinces of North America
   1. What constitutes a Geologic Province
   2. General description of the Sierra Nevada Province
   3. General description of the Basin and Range Province

B. The Role of Plate Tectonics in the development of the Sierra Nevada Province
   1. Precambrian Igneous and Metamorphic complex
   2. The Quiet phase; Late Precambrian and Paleozoic Era
   3. The Dynamic Phases; Mesozoic and Cenozoic Tectonics

C. The Changing Earth
   1. Weathering and Erosion
   2. From Sediment to Rock: Rocks That Form Near the Earth's Surface
   3. Folds, Faults, and Geologic Maps
   4. Metamorphism: Making New Rock from Old
   5. The Rock Cycle Revisited

D. Water Influences - Liquid and Solid
   1. Flash Floods and Mudflows
   2. Stream Erosion and Deposition
   3. Valley Glacier Erosion, Deposition and Striations

E. Moraines
   1. How Moraines Reflect the Different Stages of Glaciation
   2. The Nature of Glacial Till and Vegetation Responses

F. Volcanism
   1. Cinder cones
   2. Mono Craters, Obsidian Coulees
   3. Inyo Craters, Phreatic Explosion Pits
   4. Long Valley Caldera and Obsidean Dome
   5. Earthquake Swarms as Precursors to Volcanic Activity
   6. Carbon Dioxide and Steam Release Mechanisms

G. Block Fault Graben Valley Formation
   1. Sierra Nevada Fault Systems
   2. Alluvial Fan and Bajada Formations
   3. Fan Patterns and Age of Gravels
   4. Clastic Size Distribution in Fans
   5. Pleistocene Glacial Lake Formations

H. Mines and Mining
   1. Mojave Borax Mine Volcanic Origins
   2. Cerro Gordo Mine Region
   3. Bishop Scheelite Mining Region
   4. Mining History in the Sierra Nevadas

I. Geologic Influences on Plant and Animal Distributions
   1. Climatic Zoning of Plants
   2. Orographic and Geologic Influences on Water Distribution
   3. Bristlecone Pine National Forest
   4. Sage Brush, Creosote Bush and Joshua Tree Zonations
   5. Wildlife Distributions Peculiar to the Eastern Sierra Nevadas

J. Archaeologic History of Region
   1. Native American Evidence
   2. Historical Mining Remnants
   3. Cattle and Farming Settlements
   4. Los Angeles Municipal Water District's Impact on Region
   5. Japanese Manzanar Internment site

V. METHODS OF INSTRUCTION:

A. Lecture, including directed discussion, instructor-guided investigations, instructor-moderated problem solving sessions, and audio-visual aids, including computer-generated lecture outlines, supervised illustration of major features.

B. Field trips in which students will be shown geologic features first hand, collect representative samples, perform field identifications, and assess the results of a variety of geologic processes. The Field Trip in this course is an essential part of the instruction and students will not be able to successfully complete the course without full participation in the field activities.

VI. TYPICAL ASSIGNMENTS:

A. Reading Assignments
   1. Selected assignments from the textbook.
   2. Articles covering current events in geology (landslides, earthquakes, volcanic eruptions, floods) as well as long-term events (for example, natural resource depletion, environmental effects of mining and processing ores).

B. Writing Assignments
   1. Selected chapter exercises from the textbook.
   2. Instructor-prepared exercises, especially those involving illustrations (maps, charts, diagrams, cross-sections) and their analysis.
   3. A Geologic formatted field trip journal and an annotated state of California map identifying the field trip sites prepared in the field.
   4. A course project report documenting the field trip sequence of events, including photos, collected literature, and postcards with a synthesized analysis of the geologic concepts and processes covered during the field trip.

C. Example
   1. Using the reference materials in the library or the Internet on a personal computer, discuss the concept of block fault mountain formation, sketch a typical example, describe the geologic processes that may lead to adjacent alluvial fan development, and identify a specific site in the Eastern Sierra Nevada region that exemplifies this feature.
   2. Upon entering your assigned field site, make a thorough evaluation of the morphologies of the visible rocks and geologic features within that locality. Include complete sketches and paragraph level journal entries.

VII. EVALUATION:

A. Methods of evaluation:
   1. Written quizzes and/or tests of a variety of types of questions from among true-false, multiple choice, fill-in, sentence completion, and short essay.
   2. Written exercises.
   3. Performance in the field including the thorough sequential geologic field journal and annotated state of California map.
   4. Performance on the course project report.

B. Frequency of evaluation:
   1. Quizzes are given in lecture at appropriate curriculum phase points.
   2. Exercises are assigned on a frequency sufficient to support comprehension of material.
   3. Course project report, field journal and map are graded at the completion of the course after the field trip.

C. Levels of Evaluation Upon Repetition
   1. First Enrollment
      Students are expected to draw conclusions from some of the more obvious geologic relationships that are immediately apparent.
   2. Second Enrollment
      Students are expected to demonstrate greater insight into geologic processes and be able to explain more complex geologic relationships.
   3. Third Enrollment
      Students are expected to work with little supervision to analyze and master the geomorphism of the field area visited. Third enrollment students will typically be assigned as group leaders to assist first and second enrollment students.
   4. Fourth Enrollment
      Students will be given an individual assignment commensurate with their interests and career goals that will require challenging and in-depth analysis of field observations.

D. Typical exam questions
   1. Discuss the Tioga and Tahoe glaciation influences on Owens Lake spillover into China Lake and concurrent erosion of the Owens Valley that created Fossil Falls.
   2. Explain the different cooling processes involved in the development of radiating airfall tuff columns in Bishop Gorge versus the vertical basaltic columns found in the Devils Postpile National Monument.

VIII. TYPICAL TEXTS:

Sharp, Robert P. and Allen F. Glazner, *Geology Underfoot in Death Valley and Owens Valley,* Mountain Press Publishing Co., 1997.

Sharp, Robert P., *A Field Guide to Southern California,* 3rd ed., Kendall/Hunt, 1994.

Schumacher-Smith, Genny, *"Mammoth Lakes Sierra", 4th ed.* Genny Smith Books, Palo Alto, CA, 1976.

IX. OTHER SUPPLIES REQUIRED OF STUDENTS:

A. Field supplies depending upon the particular trip.