ENGINEERING GEOLOGY GEOL 293 Fall, 2008

Engineering Geology is the interdisciplinary field of study in which geology is applied to engineering. It is also one of the oldest branches of geology. A rigorous definition of Engineering Geology is: *The application of geologic data, techniques and principles to the study of naturally occurring rock and soil materials or subsurface fluids. The purpose is to assure that geologic factors affecting the planning, design, construction, operation, and maintenance of engineering structures and the development of natural resources are recognized, adequately interpreted, and presented for use in engineering practice.*

This course is designed for the student with some background in geology who is interested in the physical properties of earth materials, the engineering considerations required to build safe and durable structures on the surface, and the problems associated with structures designed and built neglecting physical environmental conditions.

Learning Objectives:

1. Recognize, classify and compute the internal and external engineering properties of natural materials.

2. Outline the distribution of stresses and strains on natural materials under normal and adverse conditions.

3. Discuss gross and specific characteristics of geologic materials and their inherent effect on the stability of natural and man-made structures.

4. Develop a quantitative understanding of natural processes (earthquakes, landslides, floods, etc.) and the appropriate engineering considerations for structures built in areas where they occur.

5. Understand and be able to apply general geophysical principles to characterize physical properties of natural materials.

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Office hours –T-TH 2:00 – 3:00 pm

Grades - Your course grade will be determined by your performance on three exams (20% each) including a comprehensive final, several exercises (20%) and the written and oral presentation of select material (20%).

Exams – The three exams will consist of short answer and problem solving questions that cover material from class readings, presentations, and exercises. Each exam will be worth 25% of your course grade. If you must miss an exam please make prior arrangements with me or, if ill, call and let me know the problem. There will be no make-up exams without an excused absence. Probable exam dates will be **October 7th, November 11th** and **Finals week**.

Exercises – Throughout the course of the semester, you will be tasked with completing exercises that are designed to help you understand concepts and solve problems. These exercises are mandatory and will comprise 15% of your semester grade. Late assignments will not receive full credit and no late assignments will be accepted after the assignments have been graded and handed back.

Written and Oral Presentations –There will be several outside papers that you are required to read and discuss in the classroom. Readings will be discussed in general by the class with a graduate student moderator for each paper. Moderators will present a brief synopsis of the paper to the class and generate two inquiry questions from the to-be-read materials - handing them out to students (and me) one week before that discussion is to take place. Answers to those questions must be written out and submitted by class discussion time (about a page in length).

Undergraduate students will choose a paper (either on our own or from a list of potential topics that I have) that you will explore, organize and present as an oral presentation to the class. These ongoing efforts will be worth 10% of your grade.

Field Trip – I have a field trip planned for us to explore mass wasting in the Sierra Nevada. The trip will be led by Dr. Tom Koler (USFS Geomorphologist) and will take place on Saturday, November 1, 2008. We will talk much more in depth on this trip but clear your calendar for this time now.

Textbook for the course will be
Forensic Engineering, Shuirman and Slosson, 1992 (ISBN #0-12-640740-1)**.**

Optional text
Principles of Engineering Geology, Johnson and DeGraff, 1988 (ISBN-13 # 978-0471034360).

TENTATIVE OUTLINE OF DISCUSSION TOPICS AND READINGS

Introduction - Application of geology to engineering and environmental science, engineering demand and a growing world population, available tools (maps, published data) for any investigation.

(State of the profession – 2005)

(Development of Engineering Geology in the West)

Mechanics of Earth Materials - General types of earth materials, stress, strain, and deformational characteristics, engineering classification of intact rock, rock-mass properties

Igneous, Sedimentary and Metamorphic Rocks and Processes - Characteristics and engineering properties of igneous, sedimentary and metamorphic rocks.

(Erosion and sediment control on construction sites)

Weathering, Erosion and Soils, Mechanics and Hazards - Mechanical weathering, chemical weathering, stability, weathering and landforms, rock weathering and erosion; Soil profile, soil-forming factors, engineering properties of soil, index properties and classification, settlement and consolidation, clay minerals, soil hazards, land subsidence

(Rates of weathering and temporal changes in strength)

Mass Movement and Slope Stability - Types of slope movements, causes of slope movements, slope stability analysis and design

(A critical review of landslide monitoring)

(Malibu landslide: massive litigation – Forensic Engineering)

Earthquakes and Volcanoes - Earthquake and volcanic hazards, hazard risks and land-use planning, hazard engineering,

(Lessons from the Kobe earthquake)

(Volcanic hazards and their mitigation)

Ground Water - Groundwater flow, groundwater resources, groundwater and geotechnical problems.

(Hazards by GW recharge in urbanization)

(Land subsidence on a large scale: Dire consequences – Forensic Engineering)

Engineering Geophysics - Seismic theory and application, resistivity theory and application

Rivers - Stream dynamics, structures in rivers

(Fire:flood sequence – a deadly combination – Forensic Engineering)

(River morphology: mining versus agriculture – Forensic Engineering)

(Flooding outside a floodplain – was it really a flood? – Forensic Engineering)