General Education Course Proposal

Proposed Course: GEOL (Prefix) 168 (No.) CALIFORNIA'S EARTH SYSTEM (Title) Units 3

Department: GEOLOGY School: NATURAL SCIENCES

GE Category (Indicate one category only):

Foundation: A1___; A2___; A3___; B4___

Breadth: B1___; B2___; C1___; C2___; D___; E___

Integration: B X; C___; D___; International/Multicultural___

Existing Course___; Revised Course X; New Course___

Course Included in Current GE Program X (Capstone)

New courses require the Undergraduate Course Proposal form in addition to this form.

Revised courses require the Undergraduate Course Change Request in addition to this form.

Proposed catalog description: Limit course description to 40 words using succinct phrases. Include prerequisites, limitations, lecture/lab hours. Indicate former course number, e.g., (Former Biol 105)

Prerequisites: General Education Quantitative Reasoning and Area B Breadth Requirements. Interaction of earth, water, air, and life in California's Earth System over geologic time. Geophysical processes, biogeochemical cycles and energy involved in system behavior. Human interaction with the environment. (e.g. mining, flooding, earth quakes, climate change, water contamination, soil erosion; habitat preservation). Not applicable to B.S. in geology. General Education, Upper Division, Integration: B. (Formerly Geol 168 - Capstone)

rollment limit per section: 50

Expected number of sections per semester – Year 1 1-2; Year 3 1-2

Attachments:

1. A statement presenting the ways in which this course meets the Specifications provided in the appropriate section of the General Education Policy as well as in the Policies for Inclusion and Evaluation of General Education Courses.
2. A statement of elements common to all sections of this course, identifying content, objectives, required student activities, grading policy, representative texts, and an approximate schedule for the course. Required student activities include such things as papers, research projects, homework, laboratory and/or studio performance, recitations, participation, attendance, and exams.
3. A typical syllabus for a particular offering of the course.
4. Any special cost factors associated with this course.

Approval for Inclusion in General Education

D Mannser 4/24/98
Department Chair Date

D Mannser 9/21/98
School Curriculum Committee Date

Stanley M. Zeigh 9/22/98
ool Dean Date

Peter Cannel 12/15/98
General Education Subcommittee Date

Brandt Kehoe 12/22/98
Associate Provost Date

1/14/98

GENERAL EDUCATION COURSE PROPOSAL

Geology 168. California's Earth System

Proposed to fit Upper Division Integration, Area B, GE Category
(Modification of existing GE Capstone Course)

Attachment 2. A statement of elements common to all sections of this course, identifying content, objectives, required student activities, grading policy, representative texts, and an approximate schedule for the course. Required student activities include such things as papers, research projects, homework, laboratory and/or studio performance, recitations, participation, attendance, and exams

Refer to the attached materials:

Appendix A. Course Description (for a specific section, proposed for Fall 1999)
This contains the following statements:

1. Course Rationale, including definition, history, and justification for using the integrative approach of Earth System Science
2. Goals and Objectives
3. Possible Outcomes - possible changed or developed student perceptions
4. Audience and Student Background in Geoscience
5. Grading
6. Exams, including schedule
7. Quizzes
8. Class Participation Component (news discussion)
9. Required Reading (summary of requirement)
10. Handouts
11. Optional Field Trips
12. Outline of Course Topics (16 major units, 13 case histories)

Appendix B. Term Research Paper
Includes deadlines and detailed description of project components, student and faculty responsibilities, guidelines and evaluation criteria.

2.1 Common Elements

2.1.1. Course Components and Grading: The overall course grade includes contributions for exams and quizzes, a major term paper, and student participation in class discussions (see Appendix A, Syllabus, p. 2., "Grades"). If multiple sections are offered, the definition of these components and their weighting may vary somewhat for different instructors. Before multiple sections are taught, the department chair will hold a course coordination discussion for the involved instructors. Preliminary syllabi will be shared and discussed beforehand to assure consistency among multiple sections. All sections will share similar goals and objectives; emphasis on the major grade

components (exams, a term paper, and other analytical writing); course outline and texts; and evaluation procedures.

The specific section planned for Fall 1999 will follow procedures developed in the Capstone version of Geology 168: past exams are made available, review sessions are held, and the specifics of exam evaluation are discussed when exams are returned. Evaluation standards for term papers are explained in week 1, and the instructor's grading/evaluation form is shared (Appendix D). Students are expected to interact closely with the instructor at identified stages in the research process (Appendix B). Students attend a library orientation session keyed to the relevant professional reference materials ,have access to a *Guide to Reference Materials* and extensive reserve readings (selected excerpts in Appendix B), and receive feedback and partial grades on their term paper topic focus, outline, and reference list at check points during the semester. Samples of successful papers have been placed on library reserve.

The following grade scale is typical for individual assignments and the whole course:

A	90-100 %	Excellent; class work consistently of the highest quality
B	80-89 %	Very good; consistently above average effort
C	70-79%	Average; all work completed at least to minimum professional standards
D	60-69 %	Below average; minimally acceptable or passing work overall
F	< 60 %	Failing; insufficient results to justify passing; or work not consistently completed to minimum standards

The average grade for Geol 168 is generally 78-82 % (C+ to B-).

2.1.2. Course Content: The mix of class topics and their depth of coverage will vary somewhat from semester to semester, depending on current issues, the instructor, and class interests and background, as surveyed at the beginning of the semester. The syllabus lists major topics (with numbered headings) and "Case Histories" that further develop and apply the content of the major topics (see topic list, Appendix A, and supporting references for selected topics, Appendix C). Each semester, some of the case studies will be featured, and new ones may be added. Current news items (e.g. real-time examples of flooding, landslides and erosion, earthquakes, and volcanic eruption precursors) are formally discussed (see "Student Participation Component" in Appendix A). Students may pursue subjects listed on the syllabus but not covered in lecture as term paper topics.

2.1.3. Texts and Readings:
Two Earth System Science texts (***Environmental Geology: An Earth System Science Approach***, by Merritts, de Wet, and Menking; and Mackenzie's ***Our Changing Planet: An Introduction to Earth System Science and Global Environmental Change***) and ***California Geology*** by Deborah Harden of San Jose State should work well in the revised version of Geology 168. Harden's text was used for the first time in Geol 168 in Spring 1998 with excellent student response. Both current instructors have

agreed to use it in the future (see Appendix C). Additional readings include articles from periodicals, such as ***Earth*** magazine and ***California Geology*** (published by the California Division of Mines and Geology), and popular science books like John McPhee's ***Assembling California***, and ***The Control of Nature***, Kenneth Brown's ***Cycles of Rock and Water at the Pacific Edge***, Kerry Sieh and Simon LeVay's ***The Earth in Turmoil***, and Marc Reisner's ***Cadillac Desert***.. Current status reports on environmental hazards will be gathered routinely from numerous web sites maintained by state and federal agencies and university scientists.

2.2. Student Activities

2.2.1. Term Paper Assignment: See Appendix B and the above statement.

2.2.2. Evaluation of Mastery of Course Content Through Exams and Quizzes: Students are tested using in-class examinations and quizzes (announced and unannounced) and take-home questions. These take-home assignments add a significant increment to the writing students perform in this class (several thousand additonal words beyond the 4000-word term paper assignment). Standards and expectations are discussed when assignments are distributed and when student work is returned. Examples of exams are made available so the format is known. Exam coverage, especially the relative importance of topics, is announced in advanced. Actual exam topic weighting is checked for consistency with these announcements.

2.2.3. Student Participation in News Discussions: See description under "Class Participation Component", Syllabus, p. 3 (Appendix A).

MATRIX RELATING COMMON COURSE ELEMENTS TO COURSE SYLLABUS AND AREA B1 (PHYSICAL SCIENCE) SPECIFICATIONS

WEEK	TOPIC	AREA BI SPEC
1	Geoscience background	
	A. Beginnings of the science of geology (rock families, rock cycle uniformitarianism)	1,2,3,4 5a,5b
	B. Composition of the earth and earth materials	5c,5d
	C. Sedimentation and sedimentary rocks	5f
	D. Geologic time, age dating of rocks, and geologic principles	
2	Fresno's Geologic History (exclusive of plate tectonics)	1,2,3,4
	West Coast plate tectonics	5a,5b
	A. Distribution and activity of currently active plates and plate margins	5c,5e 5f
	B. Extrapolating likely activity into immediate geologic past and future	
3	Igneous activity, volcanoes, and volcanic hazards	1,2,3,4
	A. Distribution of volcanic centers in California	5a,5b
	B. Igneous activity and plate tectonics	5e, 5f
	C. Volcanic activity in California over geologic time	
	D. Current hazards in relation to eruption style and volcanic rock compositions (e.g. Mount Shasta and Long Valley Caldera)	
	E. Monitoring, prediction, and mitigation	
4	Geologic history of California and western North America (from the plate tectonic perspective)	1,2,3,4 5a, 5f
5	Recent evolution of California's climate and environments (also see desertification below)	1,2,3,4 5a, 5b 5c, 5e
6	Earthquakes and plate tectonics	1,2,3,4
	A. Faults and faulting (causes, types, relationship to plate tectonics)	5a
	B. Origin of earthquakes and propagation of seismic energy	
	C. Earthquake energy, magnitude, intensity, and damage	
	D. Major faults in California (distribution, origin, activity)	
	E. Historic seismicity in California (e.g. 1906 San Francisco, 1989 Loma Prieta, etc.)	
	F. Recognition of active faults	
	G. Earthquake prediction and risk evaluation (e.g. the Parkfield experiment)	
	H. Earthquake preparedness and regulations (Getting ready for the "Big One")	
7	Introduction to mineral resources	1,2,3,4
	A. Population and economic growth and demand for earth materials	5a,5b 5c, 5d
	B. The Earth's concentrating mechanisms--mineral deposits and the rock cycle	5e, 5f
	C. Overview of mineral resources in California: distribution and history of exploitation	
	D. Mining law, mining methods and costs, environmental issues	
	E. Building materials (e.g. sand and gravel, concrete)	

8	Selected minerals resources	1,2,3,4
	A. Metallic resources (e.g. gold and the Mother Lode belt)	5a, 5c
	B. Chemical feedstocks (e.g. boron and evaporite minerals)	5e
	C. Status and prognosis of mining in California	
9	Energy resources	1,2,3,4
	A. Origin of fossil fuels--e.g. petroleum (oil and natural gas) and coal	5a,5b 5c, 5e
	B. Geology of California's sedimentary basins and fossil fuel resources	
	C. Exploitation of fossil fuels in California	
	D. Geothermal energy	
	E. Direct and indirect uses of solar radiation (e.g. water and wind power, biomass, ocean thermal energy), tidal power	
	F. Current sources and energy futures for California	
10	Water resources	1,2,3,4
	A. Hydrologic cycle	5a, 5c
	B. Surface water and ground water - processes, patterns, supplies	5e
	C. Supply systems, water projects, and use patterns	
	D. Water quality and pollution	
11	Rivers, flooding, and surface water supplies	1,2,3,4
	A. Basic fluvial processes-erosion and sedimentation	5a,5c
	B. Causes and effects of flooding	5d,5e
	C. Examples of flooding in California	
	D. Prevention, monitoring, mitigation of flooding	
12	Landslides	1,2,3,4
	A. Landslide types, causes, and mechanisms	5a,5c
	B. Identifying past landslides and landslide-prone areas in California	5d,5e
	C. Effects on man-made structures	
	D. Planning, prevention, mitigation	
13	Soils, erosion, and related engineering problems (subsidence and expansivity)	1,2,3,4 5a,5c
	A. Causes and effects	5e
	B. Prevention and mitigation	
14	Coastal processes and engineering	1,2,3,4
	A. Coastal geology	5a,5c
	B. Coastal processes - erosion and sedimentation (beaches and wave action)	5e
	C. Problems of coastal areas in California	
	D. Monitoring and mitigation	
15	Hazardous waste containment and disposal	1,2,3,4
	A. Requirements, current practices and problems	5a,5b
	B. Future efforts	5c,5d
	C. Case studies in California	5e
16	Desertification	1,2,3,4
	A. Causes and mechanisms of soil loss	5a,5c
	B. Desertification in California - effects and costs	5d,5e
	C. Mitigation and prevention	

APPENDIX A. Syllabus

California State University, Fresno
Department of Geology
Fall 1999

GEOLOGY 168 -- CALIFORNIA'S EARTH SYSTEM

Instructor: Prof. Arthur H. Barabas
Office: MCL-289 **E-mail:** art_barabas@csufresno.edu
Phones: 278-2912 (office/voice mail), 278-3086 (Geology Dept., MCL-283, Ms. Ballí, Dept. Secretary)
Office Hours: M: 3-4 PM; Tu: 2-3:30 PM; W: 2-4 PM; Th: 3-3:30 PM; or by appointment.

COURSE RATIONALE, GOALS, AND OBJECTIVES

This course deals with California's natural environment--its processes, interactions, evolution, human modifications, and future--from the perspective of **Earth System Science**. Earth System Science (ESS) is an interdisciplinary approach to understanding how the natural world works. It has been developed through a concerted international effort over the past 15 years, supported in the United States by the National Aeronautics and Space Administration (NASA), the National Academy of Sciences (NAS), the National Science Foundation (NSF), and many other institutions and agencies.

Earth System Science is based on the recognition that the **Earth System** is comprised of four closely coupled and interacting components: **earth** (geosphere or lithosphere), **water** (hydrosphere), **air** (atmosphere), and **life** (biota or biosphere). These components have been evolving continuously over geologic time, through **geophysical processes** and **biogeochemical cycles**, in response to activity in space and the planet's interior. ESS takes advantage of a number of recent developments: the rapidly expanding field of environmental geosciences, global environmental monitoring enabled by satellite communication and remote-sensing platforms in space (e.g. the Earth Observing System, EOS), **systems thinking** and its application in the model simulations possible with super computers, and easy access to the real-time, data-rich Internet.

Earth System Science recognizes that the boundaries between the traditional scientific disciplines are arbitrary and that an integrated, interdisciplinary perspective is necessary to understand, protect, and manage the natural environment and to build sustainable societies. The ESS approach integrates information, concepts, principles, and models from chemistry, physics, biology, and the earth sciences (geology, oceanography, hydrology, pedology, space and atmospheric science). This synthesis defines our current best approximation of how the Earth works.

Goals and Objectives: The goals of this course are to

- Review general concepts and to define the processes and cycles involved in the four individual components of California's Earth System (geosphere, atmosphere, hydrosphere, and biosphere);
- Develop quantitative data and models describing how these components presently interact, and how the whole system has evolved over geologic time;
- Understand the intricate interactions between humans and California's Earth System--how the environment affects us and how human activities have altered the processes and resulting environments;
- Focus attention on the evolving Earth System during the last several million years, as a baseline for understanding the current situation and for predicting likely future system behavior; and to
- Foster the use of our understanding of California's Earth System to sustain the biosphere and build a human society committed to working with Nature.

Possible Outcomes: As with other educational experiences, this course will inform you and possibly change your current perspectives. By the end of the semester you may agree with the following statements, which are offered as provocative hypotheses or tentative conclusions to examine and test in detail during the semester:

- Many of the so called "natural disasters" so common in California are actually natural processes that only become disasters when humans are involved (usually because the people do not understand the Earth System where they live and work).
- The human history of California has been determined by natural resources and our future will also be affected by resource availability, development, and management.

- The limited perspective of less than 250 years of recorded human history in California, and an even shorter baseline of environmental monitoring, may not give a complete or accurate picture of Earth System behavior.
- The "cost of living and doing business" here is high because California is particularly active geologically.
- These costs have increased due to population growth, lack of information, and poor land-use decisions.
- Building a sustainable society is desirable, for economic, as well as quality-of-life, reasons.
- Further population and economic growth will increase the need to understand the Earth System. If growth is indiscriminate we can expect the per capita environmental costs to increase.
- The areas of greatest resource potential, geologic instability and hazard, as well as those of heightened environmental sensitivity, can be identified if sufficient resources are devoted to careful scientific study.
- Enhanced education about California's Earth System will lead to greater public awareness and involvement in making policy and wise land-use decisions.
- Increasing environmental career opportunities are expected. These include jobs in scientific research, environmental monitoring and impact assessment, land use and public policy, and education.

COURSE AUDIENCE AND GEOSCIENCE BACKGROUND

Students taking this course generally show a wide range of career objectives and previous exposure to science. Some have strong interests and backgrounds in the sciences; they may have already taken other geoscience courses. Others have not had geoscience. In order to accomodate the needs and interests of this diverse audience, I expect that those lacking background will make a concerted effort to "catch up" to the average class level of geoscience knowledge.

To remedy a weak background, I propose a program of readings and quizzes (see other parts of the syllabus). Many students have accepted the challenge in past semesters; they excelled in the course (the old Capstone course, Geology of California) by first learning background fundamentals and then mastering the more advanced reading and lecture materials included under each topic on the syllabus. It has been especially gratifying to observe the progress of entry-level students; many of the highest grades in Geology 168 have been earned by students who initially lacked formal exposure to geoscience.

All students are expected to have an introductory geoscience text available for reference and background. The text should cover either Earth System Science, Environmental Geoscience, Physical Geology, or Earth Science. If you haven't taken geoscience previously, borrow a book or purchase a copy of the "semi-required" text available at the campus bookstore. Complete the background readings in this text (listed separately in the Required Readings) during the first month of the semester or as each new lecture topic is begun. It should be possible to readily find this material in other books, because most geoscience texts have similarly titled chapters and outline headings. If you have had a geoscience course, review your background and perform readings, as necessary. Quizzes covering background may be given as each major topic is begun in lecture.

GRADING, COURSE MATERIALS, AND ASSIGNMENTS

Grades: Final grades in the course will be assigned on the following basis:

A	90-100 %	D	60 to 69 %
B	80-89 %	F	less than 60 %
C	70-79 %		

The class average for students completing this course is typically in the C+ to B- range (78-82 %). The final grade for the course will be based on the following maximum percent contributions to the 100 % course total:

Three exams, including a final (with take-home and in-class parts)	12 points each; 36 total
Quizzes	14 points
Term paper	40 points
Class participation	10 points

Exams: Three equally-weighted exams will be given. Exams may have in-class, closed-book and take-home, open-book portions. Typically, the exams are comprised of multipart essays, requiring examination and evaluation of evidence and models derived from these data. Relatively more attention is paid to writing and organization on the take-home portions. At least 2 weeks in advance, exam topics are defined and copies of past exams are made available. Optional review sessions are scheduled 2 to 7 days before in-class exams. Tentative exam schedule:

Hour Exam: Week 5
Hour Exam: Week 10
Final Exam (including evaluation): Tuesday, Dec. 16, 1100-1300, and Thursday, Dec. 18, 1745-1945

Quizzes: Announced or unscheduled quizzes will be given at the beginning of class throughout the semester. Quizzes will cover either background fundamentals, the reading assignment for the day, previous readings, or lecture material from previous classes. The reading assignments are to be completed **before** the lectures dealing with the topics are held. This will reinforce the lectures and enhance the learning process. The dates by which the readings must be completed are indicated on the list of ***Required Readings***. Changes will be announced.

Term Paper: A term paper focusing on some aspect of California's Earth System is required (see handout).

Class Participation Component: Once we have gotten through the introductory and background topics at the beginning of the term (the first 3 weeks, or so), every 1-2 weeks, time permitting, we will devote 15 minutes of class to a discussion of current events relevant to California's Earth System. Starting immediately, read the newspapers and periodicals, listen to and watch news shows on radio and TV, and surf the Internet. Clip articles, print out articles from the Internet, and record reference citations. Be prepared to participate when class discussions begin.

Full credit for this grade component (10%) can be earned by (1) attending and participating in the news discussions, (2) by submitting original copies of a dozen relevant articles (i.e. those that meet the criterion of a California Earth System focus, as defined in class) or complete, printed reports from the Internet, and (3) attaching complete citations to submitted materials (e.g. newspaper or magazine name, date, URL - Internet address). These materials will not be returned, so make a copy for yourself, if necessary. Articles you submit may be posted on the bulletin boards along the hall in the Geology Department. News items discussed in class will be covered on the exams.

Required Readings: The separate handout ***Required Readings*** lists assignments in Harden's textbook, a Course Reader of photocopied articles, and Reserve references. The availability of photocopied materials will be announced in class. Bibliographic citations for required readings, as well as for recommended background and in-depth references are given in an extensive ***Guide to Reference Materials***, prepared for this course.

Handouts: Course handouts will also be sold at the Kennel Copy Center. The handouts may be available as a single bound package or as separate packets covering individual subjects. Copies of past exams are generally included. You will be informed when these materials are ready for sale. From that point, you are required to purchase and bring them to each class.

Field Trips: Students are encouraged to attend the 4-day Geology 3 field trip to Death Valley this semester (Oct. 9-12). An optional one-day trip, examining local geologic history will be available for introductory students (Geology 1, 2, and 168) in October. This trip is an excellent hands-on complement to our in-class case history "Fresno's Geologic Story" (see below). Stay tuned for dates and logistic information!

OUTLINE OF COURSE TOPICS

Lecture topics will be selected from the following list. Case histories can be expected to change, especially to incorporate topics of current interest. It will be impossible to treat all of these topics in class. Those we don't cover may provide good term paper topics. Others may figure in news discussions (see above).

I. **Course Introduction: Organization, Term Paper Preparation**

II. **Earth System Science, Environmental Earth Science, and Public Planning**

III. **Background - "The Geologist's Toolkit"**
- **Solid Earth Materials (Minerals, Rocks, Surficial Deposits, and Resources)**
- **Seeing Through "Deep Time"** - Geologic Time, Age Dating Principles, Relative and Absolute Time (A "how to" guide for developing the geologic history of an area)

IV. Geologic History of California

Case History: Fresno's Geologic Story

V. Feel the Heat: West Coast Plate Tectonics
(Seafloor Spreading, Subduction, and the Earth's Internal Heat)

VI. California's "Hot Spots": Subduction, Magma and Granite Batholiths, Volcanoes and Volcanic Hazards, Metallic Deposits and Geothermal Energy

Case History: Predicting Future Eruptions from Long Valley Caldera and the Mono-Inyo Craters

VII. Seafloor and Accreted Terranes in the Coast Ranges, Sierra Nevada, and Klamath Mountains

VIII. Introduction to Mineral Resources

IX. Energy Resources

X. Metallic Resources: Gold and Mercury

Case Histories: Reclamation of Metal Mines with Potential Cyanide Contamination and Acid Mine Drainage

XI. Earthquakes, Faults, and Moving Plates

Case History: The Parkfield Earthquake Prediction Experiment

XII. California's Current Climate and Hydrologic Cycle: El Niño Events, Drought, and Floods

XIII. Changing Climate: Paleoclimatology, Glaciers, Desertification, and Global Warming

XIV. The Sierra Nevada: Geologic Evolution, Environment, and Human Development

XV. The Central Valley Environment: Rock Weathering, Erosion and Sediment Deposition, Floods and Floodplains, Soils, Water, Land Use and Resource Development

Case History: California's First Major Environmental Crisis - Hydraulic Mining Debris and Flooding of the Sacramento River

Case History: The San Joaquin River: Flooding and Fluvial Landforms, Sand and Gravel Resources, Human Development of the River Bottom and the River Parkway

Case History: Modification of the Sacramento-San Joaquin Delta, San Francisco Bay and Estuary

Case History: Viability of Agriculture on the Westside of the San Joaquin Valley (Selenium, Saline Drainage and the Ecosystem, Expansive Soils, Groundwater Withdrawl and Surface Subsidence)

Case History: Ozone and Acid Atmospheric Deposition in the High Sierra; Snowmelt Chemistry; Alkalinity and Buffering of Lakes, Streams, and Soils; Effects on Sensitive Ecosystems

Case Histories: Landslides and Floods, Water Quality and Diversions, Fire and Ecosystems, Effects of Forestry and Other Land Uses (Sierra Nevada and Coast Ranges)

Case History: Landslides Along U.S. Highway 50, American River Canyon, Sierra Nevada

XVI. The California Coast: Processes and Evolution; Erosion and Coastal Engineering; Sea Level Change and Human Habitation; El Niño, Coastal Currents, Nutrient Upwelling, and the Marine Ecosystem

XVII. Water: The Natural Systems and Human Development of The Essential Resource (Surface and Ground Water, Water Supply and Quality; Water Projects)

Case History: Fresno's Water Supply (Addressing Contamination, Guaranteeing Supply)

Case History: Waste Disposal, Water Quality, and Land Use Mangement, Lake Tahoe Area

APPENDIX B

CALIFORNIA STATE UNIVERSITY, FRESNO
Department of Geology
Geology 168 - California's Earth System - Fall 1999

TERM RESEARCH PAPER

An original term research paper on an approved topic will comprise 40% of your final course grade. The paper must have a specific focus in California's Earth System, as broadly defined by the course syllabus. All papers must demonstrate in-depth research of the chosen topic: by developing a bibliography of primary references that any knowledgeable person would agree are significant, by mastering the content of these materials, and by demonstrating your understanding in a tightly-organized, and well-written paper treating information and analysis at an appropriate level for this course.

The paper you submit must be your own--i.e. it must be written in your own words, avoiding plagiarism. You are responsible for being familiar with the University's Policy on Plagiarism and Cheating. Plagiarism in any form is an academic crime that I will punish with the severest penalty possible. (Crediting sources is covered below.)

In addition, your term paper must be for this course only. Several students may collaborate by investigating different aspects or components of a single topic, but this kind of arrangement must be approved by me. Please be aware that professors often retain copies of papers submitted in their classes (including "yours truly"), so that allegations of plagiarism, or submitting work from other courses, can be documented.

Defining a Topic and Narrowing the Focus: In order to find a topic, I suggest that you identify one or more broad areas of personal interest by surfing the Internet, and examining the course topical outline, the required readings, the geoscience journals in Periodicals, and the references on Reserve for Geology 168 in the library. Especially useful is the ***Guide to Reference Materials*** , a 20 page guide to publications about California geosciences and the environment. Many good term paper topics involve topics listed on the syllabus that will not be covered formally in lecture due to time constraints. In the past, most term papers have been based on conventional library research, but others have investigated local or state-wide problems and issues using materials available in the files of government agencies.

Once you have defined a general area of interest, the next step is to refine and focus your topic. First, I recommend that you consult the course list of ***Required Readings*** and perform all those that seem relevant to your general subject. You'll be required to do them eventually, so why not get a head start? Since everyone in the class is expected to complete the required readings, your term paper must go beyond the required readings. The required readings define the background level of your potential readers, including the instructor.

Some idea about suitable topics may be gained by examining the attached list of past paper topics. I recommend against redoing the topics on the list; I would much rather read papers on new and original subjects. Note that it is not necessary that the entire paper have a geological focus (for example, you could deal with the political or environmental implications of developing a resource), but at least half should deal specifically with the relevant geologic background and context.

Library orientation sessions to acquaint you with research and bibliographic materials on California will be held . These classes will be held at the library (Room); we will not meet in McLane. One of the reference librarians most familiar with your assignment and with California materials will conduct these classes. You are expected to attend the orientation, even if you have attended those for other courses, and to use the bibliographic search techniques covered in the session. Use the Reference Librarians for assistance throughout this assignment.

I would be happy to discuss strategies for narrowing topics. An approved topic should be specific and limited so that the resultant paper demonstrates the required in-depth research and mastery of applicable course material and concepts. You may treat subjects discussed in class, but a greater depth of coverage and a more specific focus must be achieved.

Tutoring at the Writing Center: Many students are apprehensive about major writing assignments like this one. You may not have had much writing experience, you may have been unsuccessful with similar projects in the past, or you may lack confidence in your abilities. For most of you, this will be your first exposure to the technical literature of California's Earth System. Assistance is available at the English Writing Center, but you must register for a one unit tutorial. **Enrollment is in Room 184, Education Building, generally limited to week 1. Check the recently installed Web Site.**

Approval of Topics: Preliminary topics must be submitted by the **Tuesday of week 3 (Sept. 9)**. Submit your ideas on a 3x5 inch index card along with your name and telephone number. I will either call you or confer with you during office hours about your topic ideas. I may be able to give you suggestions for focusing your topic and possible reference materials. You are responsible for having a final, focused topic approved by **Thursday, Sept. 18 (week 4)**.

Past history indicates that the most successful papers are begun early. It is to your advantage to get a topic approved as early as possible, since only one person will be allowed to research each narrowly defined subject. **Your topic must be approved.** Please get approval before spending a lot of time on a topic. In the past, term papers on unapproved topics have been unacceptable and the students had to re-enroll the following semester to complete the course. Approval is also important, because I may be familiar with relevant reference materials and I have experience in identifying which topics are likely to result in successful papers. If you approach me before a deadline you can expect me to devote some time and effort to the conference.

Obtaining Reference Materials: Once your topic is approved, don't relax, because the next step, finding adequate and relevant information, may be the most difficult, frustrating, and time-consuming part of the project. My approval of your topic does not mean that you will find adequate materials in the CSU Fresno library. You may have to identify individuals to contact locally or at the state level, or to order publications by mail or through interlibrary loan, which takes 3-4 weeks. Sometimes other students may get to the library materials first, so start your search early.

Submittal of Outline and Reference List: By **Tuesday, Oct. 9 (week 7)** each student is expected to submit a one-page topical outline and a professionally formatted list of relevant, specific references. What you submit will be evaluated and graded. The grade you receive will comprise 50% of Research Quality Component of the Termpaper Assessment. (This contributes 25% of the term paper grade, and 12.5% of the overall course grade.) Late work will be penalized. You can expect prompt feedback on work completed by the deadline.

Make the outline as thorough as possible. The major topics and subtopics should give me a clear picture of the focus you intend to pursue, so that I can assess the appropriateness of your topic focus and its development. If there are problems, this is a good time to catch them!

The best reference list is one that is very close to what you will include in the final paper. You should have complete citations for a minimum of a dozen technical references. Consult the ***Guide to Reference Materials*** for assistance in determining which bibliographic materials are acceptable. The reference list should be typed with a computer and word processor and printed neatly, using a **standard reference citation style**. You may use any of the standard styles, such as the one that is appropriate for your major. You should have a personal copy of the manual for your style. A **complete reference citation for the style manual** is required at the bottom of the reference list.

Submitting Your Final Paper: Completed papers must be submitted to me personally or to my mailbox in the Geology Department by **5 PM, Tuesday, Nov. 11 (week 12)**. All papers must be date stamped by me or by the Department Secretary (only available during normal work hours). Do not stuff papers under office doors! Papers handed in after the due date, up to one week late (i.e. by **5 PM, Tuesday, Nov. 18 (the week before Thanksgiving, Week 13)**, will be penalized one letter grade (10%). Failure to submit a paper by Nov. 19th will result in a grade of "0" for the paper, and almost certainly an F for the course. A grade of **Incomplete** will not be given to students who complete all parts of the course except the termpaper. Students failing the termpaper will have to re-enroll and complete an acceptable termpaper by the deadline established for that semester. Grades of completed assignments may be applied toward a final grade submitted for a future semester.

If you **submit two complete copies**, I will return one to you with my comments at the end of the semester. One copy of your paper will be kept permanently on file in the Geology Department.

Paper Requirements, Evaluation, and Recommendations:

1) The minimum paper length is 4000 words (a requirement for upper division general eduction courses). Report your word total on the last page of text. The final text should be a dark copy, double-spaced, with ten point type, and one inch margins. This will allow me to make comments between the lines and in the margins.

2) Use a computer with a word processing program to prepare your report. Rewriting is necessary to produce a good paper and this greatly facilitated with a computer. Please be aware, however, that using a word processor may create problems. I have read quite a few papers that have a "cut and pasted" feel, because the writer was not careful in weaving together the pieces of information gathered from different sources. Give yourself enough time to proofread the whole paper to eliminate repetition, tighten organization, correct typographical errors, and fix other rough spots.

3) I will grade your paper using the attached **evaluation form** as a guide. The overall grade will be based on an assessment of **"Research Quality"** and **"Presentation"**, weighted equally (see evaluation form for detailed criteria). "Presentation" includes careful organization (including tight structuring and balance among the parts of the paper), correct research paper formatting, and effective writing (correct grammar and word choice, clarity and conciseness of expression, effective use of specialized vocabulary, etc.).

4) Clear organization is essential to achieving full credit for "Presentation". Use an outline to help organize your writing, especially in deciding how and when to cover each piece of information, idea, and concept. Use headings and subheadings in the text to show your organization. Begin by clearly stating your objectives and plan of attack in a brief **Introduction** (also see statement on the evaluation form). Then present the **Information** you located (**Data** section). After introducing these "facts" present a **Discussion**, in which you analyze the information, compare it with other examples or case histories, discuss its meaning or significance, and draw inferences from it. Finally, present your **Conclusions**, including suggestions for further work. Attach a **References Cited** list, with complete citation in an approved format. Every source in your reference list should appear at least once in a footnote or in-text reference citation.

5) "Research Quality" is the second major evaluation category (50% of assignment). To maximize the credit for Research Quality", the second major evaluation category, you must choose a narrowly-defined topic and find very specific, primary reference materials. The reference list submitted part way through the semester will comprise half of the "Research Quality" grade. The other half will be based on an overall assessment of research quality.

6) I **strongly recommend** using figures and tables taken from your references to aid in presenting the information you found. Experience shows that it is easier to organize a paper and tell the story using illustrations instead of just an outline in your head. Despite the gaps they create, these materials often improve the flow of text. Including them should contribute to the "Presentation" grade. Presenting detailed information in visual aids generally adds to the grade for "Research Quality", as well. It also may be easier to cite all your references if you use these "props". When you use figures, call the reader's attention to them in the text (usually in the **Introduction** and **Information** sections). Be sure to give reference citations in figure and table captions. Note that visual aids are not counted as pages of text.

7) I believe the ability to write effectively is the most important skill that you can learn in school. By paying close attention to your writing efforts and rewarding them, I plan to encourage your commitment to improve your abilities. If you have had little experience writing or have encountered problems in the past, you are likely to have them again with this assignment. Please anticipate your problems by arranging and using a variety of support resources (e.g. tutors, good writers in the class, proofreaders, the on-campus Writing Lab). The feedback that I give on the term paper copy I return is intended to help you to improve. Unfortunately though, teaching you how to write is beyond the scope of this course.

8) Examples of several successful past papers are on reserve in the library.

9) Separate guidelines for using and referencing information from the Internet will be distributed.

Titles of Some Successful Past Term Papers

1. California's State Gemstone: Benitoite (Its unique deposits, geologic origin, and unusual properties)
2. The 1952 Kern County earthquake and the White Wolf Fault
3. Groundwater availability and quality in the hardrock basement of the Sierra Nevada foothills near Fresno
4. Serpentinite in the Coast Ranges: Its geology, soils, and vegetation
5. Faults and earthquake potential of the western margin of the San Joaquin Valley
6. The Corcoran Clay--its origin and effects on agriculture in the San Joaquin Valley
7. The Santa Barbara oil spill--An ecological perspective
8. Geothermal energy development in the Imperial Valley
9. The correlation of El Niño-produced weather systems and accelerated erosion of the California coast
10. The geologic origin and proposed stabilization of the Portuguese Bend landslide, Palos Verdes Peninsula
11. Mount Diablo coal mines
12. Acid mine drainage from the West Shasta mining district
13. Degradation of groundwater quality in the Salinas River basin by marine salt water intrusion
14. The effects of sediment pollution on game fish in the Sierra Nevada
15. Tsunami: A rare but dangerous threat to the California coastline
16. Flood protection for the Sacramento-San Joaquin Delta
17. Landslides on timber roads in the Sierra Nevada with workable solutions
18. Origin, distribution, and effects on agriculture of boron in alluvial deposits of the Westside foothills
19. The pre-historic record of right-lateral slip and great earthquakes along the northern San Andreas fault
20. The record of Holocene climate change in bogs and lake sediments of the Sierra Nevada.
21. The effects of sea-level and lake-level changes on California's prehistoric inhabitants
22. The geologic environment, paleoecology, and paleoclimate of the Fairmead mammoth site, Madera County
23. Rare limestones in the Coast Ranges: Paleolatitudes, microplate migration, and accretion to North America