I. INTRODUCTION

A. Environmental Geology is an introductory one-semester course about the earth as a habitat, and the course explores the interrelationships between humans and the environment. Discussion topics include the various geologic factors to be addressed and considered in urban and regional land use planning.

B. The course satisfies the physical requirement in many curricula. This course also satisfies the laboratory science requirement in many curricula. This course is often a requirement for many degree programs having direct or indirect relationships to the environment. This course may or may not transfer to a given college or university. The student has the ultimate responsibility to ascertain whether this course will be accepted at their target instruction.

C. This course is occupationally related and it serves as preparation for careers in teaching, the earth sciences, military sciences, engineering, hydrological science, environmental science, business, and perhaps other fields as well.

D. Prerequisite: None.

II. LEARNING OUTCOMES

Upon successful completion of GEOL 1405, Environmental Geology, the student will:

A. Examine basic and general geologic principles, process and phenomena, then relating them to humankind and human endeavors. (C5, C6, C7, C15, F1, F5, F8, F10, F11, F12)
B. Explain how geology and its principles can be applied to improving the human condition. (C5, C6, C7, C15, F1, F5, F10, F11, F12)

C. Explain the underlying causes of many of our present environmental problems. (C5, C6, C7, C15, F11, F5, F10, F11, F12)

D. Identify and describe the kinds of geologic hazards, state what mitigation efforts may be appropriate and explain the pros and cons of each kind of mitigation effort. (C5, C6, C7, C10, C12, F1, F2, F5, F7, F8, F9, F10, F11, F12, F14, F15, F17)

E. Demonstrate a greater level of scientific literacy. (C3, C5, C6, C7, F1, F5, F10)

F. Demonstrate increased knowledge of North American and world geography as it applies to historical geology. (C5, C6, C7, F1, F5, F10)

G. Show greater knowledge and understanding of local, Texas, North American geology and the process which have produced the present and past landscapes. (C5, C6, C7, F1, F5, F10, F12)

H. Understand, describe, and trace the interrelationships of the various Earth processes as they apply to the various geological cycles. (C5, C6, C7, C15, F1, F5, F11, F12)

I. List and describe current topics of continuing study and which concern humanity's relationship and with the environment. (C5, C6, C7, F1, F5, F10, F11)

J. Explain how geology benefits humanity. (C5, C6, C7, F1, F5, F14)

K. Defend geology as a worthy field of endeavor. (C3, C5, C6, C7, F1, F5)

L. Demonstrate the ability to read and interpret geological diagrams, graphs, tables and models (both mental and physical). (C3, C5, C6, C7, C10, C12, C14, F1, F2, F3, F4, F6, F8, F9, F10, F11, F12, F13, F15, F16)

M. Show positive attitudinal changes regarding the geosciences. (F14)
N. Recognize that the principles of cause and effect and feedback apply directly to the several areas and themes of geology. (C5, C6, C7, F1, F5, F8, F10, F11, F12)

III. INSTRUCTIONAL MATERIALS

The instructional materials identified for this course are viewable through www.ctcd.edu/books

All students will need a copy of Environmental Geology by Carla Montgomery ISBN: 9780077791735

IV. COURSE REQUIREMENTS

A. Your primary responsibility is to function as a college student, interested in putting forth the effort required to obtain a passing grade in Physical Geology. You are to put into use all your learning skills, acquired from past and present educational experiences, in order to carry out this requirement. Your instructor expects 100% effort on your part.

B. Reading Assignments: The specific pages from the required text will be included in the course outline given in Section VIII. Students are required to read the assigned chapters or pages before coming to lecture. Additionally students are required to read the assigned laboratory exercises before coming to laboratory.

C. Each lecture is not self-contained. You may expect that basic concepts presented at the beginning of the course will be built upon day by day, added to, expanded upon, etc., so that with time you will have both specific and overall understandings. It is important to link together each piece in an attempt to achieve the comprehensive realization. Participation in class discussions is suggested.

D. You are expected to maintain good class notes, since any material discussed in class may be included on exams. Because the lectures may not exactly follow the material sequence of the textbook, lecture outlines are to be found in the first part of the supplemental packet.

E. Lab activities are a significant part of the course and it is impossible to pass Physical Geology without attending lab regularly. The student should realize that many lab skills, such as learning to identify rock and mineral specimens, may require additional work or study on the student's part, including the investment of time beyond the allocated time for lab.
V. EXAMINATIONS

Lecture: Four hourly lecture exams and a final exam are given during the semester. Each unit exam is given at the conclusion of the appropriate unit. The exams given may include any or all of the following types of questions: multiple choice, fill-in-the-blank, matching, true/false, discussion, and identification. The final exam will be comprehensive. Please be advised that your instructor gives challenging exams which involve many levels of question difficulty, including questions which require analysis, synthesis, and other higher-order thinking skills.

The exams are scheduled as follows:
1st Unit Exam 100 Points
2nd Unit Exam 100 Points
3rd Unit Exam 100 Points
4th Unit and Final Exam 200 Points
Total Lecture Points 500 Points

If a student takes all four exams, the lowest grade will be dropped. If a student misses a unit exam, then the zero achieved on that exam will be dropped. The final exam may NOT be missed or dropped. Make-up exams will NOT be given!

Laboratory Exercises: You are required to perform a number of laboratory exercises which will enhance and reinforce your knowledge of environmental geology. Those exercises are about a wide range of topics and subjects, and they will directly relate to topics and subjects discussed in lecture. 200 points

Lab Practical Exam: Geologic Principles 100 Points
Lab Practical Exam: Fossils (written) 100 Points
Lab Practical Exam: Fossil Identification 100 Points
Total lab points 300 Points

VI. SEMESTER GRADE COMPUTATION

The final grade in GEOL 1405 is attained by adding together all points on exams, quizzes, and additional items, including writing assignments. The grade distribution scale is as follows:

<table>
<thead>
<tr>
<th>Points</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>720-800 (90-100%)</td>
<td>A</td>
</tr>
<tr>
<td>640-719 (80-89%)</td>
<td>B</td>
</tr>
<tr>
<td>560-639 (70-75%)</td>
<td>C</td>
</tr>
<tr>
<td>480-559 (50-69%)</td>
<td>D</td>
</tr>
<tr>
<td>0-479 (0-59%)</td>
<td>F</td>
</tr>
</tbody>
</table>
VII. NOTES AND ADDITIONAL INSTRUCTIONS FROM THE INSTRUCTOR

A. **Course Withdrawal:** It is the student's responsibility to officially withdraw from a class if circumstances prevent attendance. Any student who desires to, or must, officially withdraw from a course after the first scheduled class meeting must file a Central Texas College Application for Withdrawal (CTC Form 59). The withdrawal form must be signed by the student.

CTC Form 59 will be accepted at any time prior to Friday of the 12 week of classes during the 16 week fall and spring semesters. The deadline for sessions of other lengths is:

- 10 week session: Friday of the 8th week
- 9 week session: Friday of the 6th week
- 5 week session: Friday of the 4th week

The equivalent date (75% of the semester) will be used for sessions of other lengths. The specific last day to withdraw is published each semester in the Schedule Bulletin.

A student who officially withdraws will be awarded the grade of "W" provided the student's attendance and academic performance are satisfactory at the time of official withdrawal. Students must file a withdrawal application with the college before they may be considered for withdrawal.

A student may not withdraw from a class for which the instructor has previously issued the student a grade of "F" or "FN" for non-attendance.

B. **Administrative Withdrawal:** An administrative withdrawal will be initiated when the student fails to meet college attendance requirements. The instructor will assign the appropriate grade on CTC Form 59 for submission to the registrar.

C. **Incomplete Grade:** The college catalog states, "An incomplete grade may be given in those cases where the student has completed the majority of the course work but, because of personal illness, death in the immediate family, or military orders, the student is unable to complete the requirements for a course ...." Prior approval from the instructor is required before the grade of "I" is recorded. A student who merely fails to show for the final examination will receive a zero for the final exam and an "F" for the course.

D. **Cellular Phones and Beepers:** Cellular phones and beepers will be turned off while the student is in the classroom, laboratory, or in any other learning situation.
E. **American With Disability Act (ADA):** Disability Support Services provides services to students who have appropriate documentation of a disability. Students requiring accommodations for class are responsible for contacting the Office of Disability Support Services (DSS) located on the central campus. This service is available to all students, regardless of location. Explore the website at [www.ctcd.edu/disability-support](http://www.ctcd.edu/disability-support) for further information. Reasonable accommodations will be given in accordance with the federal and state laws through the DSS office.

F. **Instructor Discretion:** The instructor reserves the right to final decision in course requirements.

G. **Civility:** Individuals are expected to be cognizant of what a constructive educational experience is, be respectful, and show civility to those participating in a learning environment, including field trips and any other situation whose purpose is to promote or enhance learning. Failure to do so can result in disciplinary action up to and including expulsion. Minimal civility includes:

- Being in class on time;
- Staying in class for the entire class period;
- Informing the instructor prior to class that an unavoidable conflict requires your early departure from class, and thereafter positioning yourself to the exit so that your departure causes a minimum disruption or distraction.
- Avoiding such uncivil conduct as talking, sleeping, reading papers or magazines, or working on some assignment which is not directly pertinent to the learning situation at hand;
- Using socially acceptable language in classroom discussions and elsewhere in learning situations

Additionally your instructor requires you to take personal responsibility for your actions.

H. The following specific rules apply to absences: Each instructor shall keep a record of class attendance. An administrative withdrawal may be submitted when a student's absences exceed **four (4)** class meetings. The instructor will note administrative withdrawals as the grade of "F Non-attendance" on the roll and record book. As a matter of policy, administrative excuses from classes are not provided for any reason. Regardless of the nature of the absence, students are responsible for completing all course work covered during any absence.

I. For complete information consult the college catalog and Student Handbook.
VIII. COURSE OUTLINE

Unit I: Foundations and Internal Processes in Environmental Geology.

A. Unit Objective: Upon successful completion of this unit the student will:

1. Discuss our planetary environment, physical and human. (C5, C6, C7, F1, F5, F11)
2. Describe the Earth's materials. (C5, C6, C7, F1, F5, F10, F11, F12)
3. Explain the theory of plate tectonics. (C5, C6, C7, F1, F5, F10, F11)
4. Describe and explain earthquakes, stating possible hazards and possible mitigation techniques. (C5, C6, C7, F1, F5, F11)
5. Describe and explain volcanoes, stating possible hazards and possible mitigation techniques. (C5, C6, C7, F1, F5, F11)

B. Learning Activities:

1. Read the related text material prior to the lecture.
2. Lecture and discussion on topics, including the use of A V materials.
3. Lab:
   a) Earth materials, geologic time, and geologic processes.
   b) Maps, aerial photographs, and satellite images.
   c) Measurements, basic calculations and conversion, and graphs.
   d) Volcanoes and volcanic hazards
   e) Hazards of Mount St. Helens

C. Unit Outline

Chapter I: An overview of our Planetary Environment:

a) Earth in space and time
b) Geology, past and present
   c) Nature and rate of population growth
d) Impacts of the human population

Chapter 2: Rocks and Minerals, A First Look

a) Atoms, elements, isotopes, ions, and compounds
b) Minerals - general
c) Types of minerals
d) Rocks

Chapter 3: Plate Tectonics

a) Plate tectonics - underlying concepts
b) Plate movements - accumulating evidence
c) Types of Plate tectonics
d) How far, how fast, how long, how come?
e) Plate tectonics and the rock cycle

Chapter 4: Earthquakes

a) Earthquakes - terms and principles
b) Seismic waves and earthquake severity
c) Earthquake-related hazards and their reduction
d) Earthquake prediction in North America
e) Earthquake control
f) Future earthquakes in North America?

Chapter 5: Volcanoes
a) Magma sources and types
b) Styles and locations of volcanic activity
c) Hazards related to volcanoes
d) Issues in predicting volcanic eruptions

Unit 2: Surface Processes in Environment Geology

A. Unit Objective: Upon successful completion of this unit the student will:
1. Describe stream processes and discuss mitigation techniques. (C5, C6, C7, F1, F5, F10, F11, F12)
2. Identify coastal zones, describe their processes and describe mitigation techniques. (C5, C6, C7, F1, F5, F10, F11, F12)
3. Describe mass movements and discuss mitigation techniques. (C5, C6, C7, F1, F5, F10, F22, F12)
4. Discuss the relationship of geology and climate. (C5, C6, C7, F1, F5, F10, F11)

B. Learning Activities:
1. Read the related text material prior to the lecture.
2. Lecture and discussion on topics, including the use of AV materials.
3. Lab exercises:
   a) Earthquake, epicenters, intensities, risks, faults, nonstructural hazards, and preparation.
   b) The Lorna Prieta earthquake of 1989
   c) Subsidence

C. General Unit Outline

Chapter 6: Streams and Flooding
a) The hydrologic cycle
b) Streams and their features
c) Flooding
d) Consequences of development in floodplains
e) Strategies for reducing flood hazards

Chapter 7: Coastal Zones and Processes
a) Nature of the coastline
b) Emergent and submergent coastline
c) Coastal erosion and "stabilization"
d) Especially difficult coastal environments
e) Costs of construction - and reconstructions - in high energy environments
Chapter 8: Mass Movements
   a) Factors influencing slope stability
   b) Types of mass wasting
   c) Consequences of mass movements
   d) Possible preventive measures

Chapter 9: Ice and Glaciers, Wind and Deserts
   a) Glaciers and glacial features
   b) Wind and its geologic impacts
   c) Deserts and desertification

Chapter 10: Climate - Past, Present and Future
   a) Major controls on global climate, the greenhouse effect
   b) Climate and ice revisited
   c) Oceans and climate
   d) Other aspects of global change
   e) Evidence of climates past
   f) Whither for the future? Climate feedbacks, predictive uncertainty

Unit 3: Resources

A. Unit Objective: Upon successful completion of this unit the student will:
   1. Discuss the significance of water as a resource, explain problems and possible solutions. (C5, C6, C7, F1, F5, F10, F11, F12)
   2. Discuss the significance of soil as a resource, explain problems and possible solutions. (C5, C6, C7, F1, F5, F10, F11, F12)
   3. Identify and describe the many kinds of mineral resources, problems associated and possible mitigation techniques. (C5, C6, C7, F1, F5, F10, F11, F12)
   4. Identify and describe the kinds of fossil fuels, problems associated and possible mitigation techniques. (C5, C6, C7, F1, F5, F10, F11, F12)
   5. Discuss alternative energy sources and describe the pros and cons associated with each. (C5, C6, C7, F1, F5, F10, F11, F12)

B. Learning Activities:
   1. Read the related text material prior to the lecture.
   2. Lecture on topics, including the use of AV materials.
   3. Lab exercises:
      a) River Floods
      b) Coastal hazards
      c) Groundwater hydrology
      d) Water quality data and pollution sources

C. General Unit Outline
   Chapter II: Water as a Resource
a) Fluid storage and movement: porosity and permeability
b) Subsurface waters
c) Aquifer geometry and groundwater flow
d) Consequences of groundwater withdrawal
e) Impacts of urbanization on groundwater systems
f) Karst and sinkholes
g) Water quality
h) Water use, water supply.
i) Case studies in water consumption
j) Extending the water supply

Chapter 12: Soil as a Resource
a) Soil formation
b) Chemical and physical properties of soils
c) Soils and human activities

Chapter 13: Mineral Resources
a) Ore deposits
b) Types of mineral deposits
c) Mineral and rock resources - examples
d) Mineral supply and demand
e) Minerals for the future: some options considered
f) Impacts of mining-related activities

Chapter 14: Energy Resources - Fossil Fuels
a) Formation of oil and natural gas deposits
b) Supply and demand for oil and natural gas
c) Oil spills
d) Coal
e) Environmental impacts of coal use
f) Oil shale
g) Tar sand

Chapter 15: Energy Resources - Alternative Sources
a) Nuclear power - fission
b) Nuclear power - fusion
c) Solar energy
d) Geothermal power
e) Hydropower
f) Energy from the oceans
g) Wind energy
h) Biofuels

Unit 4: Waste Disposal, Pollution, Health, and Other Related Topics
A. Unit Objective: Upon successful completion of this unit the student will:
   1. Identify the kinds of waste and describe ways of disposal and explain
possible mitigation techniques. (C5, C6, C7, F1, F5, F10, F11, F12)
2. Identify the sources and kinds of water pollution and state ways of mitigation. (C5, C6, C7, F1, F5, F10, F11, F12)
3. Identify the sources and kinds of air pollution and state ways of mitigation. (C5, C6, C7, F1, F5, F10, F11, F12)
4. Discuss important aspects of environmental law (C5, C6, C7, F1, F5, F11)

B. Learning Activities
1. Read the related text material prior to the lecture (see lecture-lab schedule).
2. Lecture on topics, including the use of A V materials.
3. Lab:
   a) Lake and river contamination from industrial waste
   b) Groundwater and surface water contamination from resource extraction
   c) Groundwater overdraft and saltwater intrusion
   d) Geology and regional planning
   e) Global change and sustainability

C. General Unit Outline
   Chapter 16: Waste Disposal
   a) Solid wastes - general
   b) Municipal waste disposal
   c) Reducing solid waste volume
   d) Toxic waste disposal
   e) Sewage treatment
      f) Radioactive wastes

   Chapter 17: Water Pollution
   a) General principles
   b) Organic matter
   c) Industrial pollution
   d) Agricultural pollution
   e) Reversing the damage - surface water
   f) Groundwater pollution
      g) New technology meets problems from the past

   Chapter 18: Air Pollution
   a) Atmospheric chemistry - cycles and residence times
   b) Types and sources
   c) Acid rain
   d) Air pollution and weather
      e) Toward air pollution control

   Chapter 19: Environmental Law and Policy
   a) Resource law water
   b) Resource law: minerals and fuels
   c) International resource disputes
d) Pollution and its control
e) Cost benefit analysis
f) Laws relating to geologic hazards
g) The National Environmental Policy Act (1969)

Chapter 20: Land Use Planning and Engineering Geology
a) Land use planning – Why?
b) Lane use options
c) The federal government and land use planning
d) Maps as a planning tool
e) Engineering geology – some considerations
f) The role of testing and scale modeling
g) Dams, failures and consequences