

GLENDALE UNIFIED SCHOOL DISTRICT

Senior High School

Department: Science

Course Title: Geology of Disasters; a Hazus Training Course

Course Number:

Grade Level: 10-12

Semester Hours: (2 semesters)

Prerequisites: Technology Literacy, algebra (B or better required in all courses, or instructor approval)

Course Description: The Geology of Disasters; a Hazus-MH Training Course is appropriate for 10th through 12th grade students who are interested in disaster preparedness planning and mitigation with geographic information systems. The major focus of the Geology of Disasters course is to prepare students to do risk analysis, loss estimation and evaluate mitigation techniques for earthquake, flood and hurricane wind disasters. The Geology of Disasters gives students the opportunity to develop skills and understanding of course concepts through project-based learning.

Students will employ GIS analysis integrated with cartographic and scientific concepts for the investigation of disaster related problems. Students will develop problem-solving skills and apply their knowledge of research and design to create solutions to various challenges throughout the course. Students will also learn how to document their work, and communicate their findings to their peers and members of the professional community.

Students will increase their skills and knowledge in science and computer technology by applying academic content in their research and course studies. This class was designed to meet both Career Technology Education standards for Engineering and Design Industry Sector, Environmental and Natural Science Engineering pathway and the University of California "g" science elective. **This class does not replace a core science course.**

Graduation Requirement: College Prep Elective

California Standard: Dynamic Earth Processes. This standard states:

3. Plate tectonics operating over geologic time has changed the patterns of land, sea, and mountains on Earth's surface. As the basis for understanding this concept:
 - a. Students know features of the ocean floor (magnetic patterns, age, and sea-floor topography) provide evidence of plate tectonics.
 - b. Students know the principal structures that form at the three different kinds of plate boundaries.
 - c. Students know how to explain the properties of rocks based on the physical and chemical conditions in which they formed, including plate tectonic processes.
 - d. Students know why and how earthquakes occur and the scales used to measure their intensity and magnitude.
 - e. Students know there are two kinds of volcanoes: one kind with violent eruptions producing steep slopes and the other kind with voluminous lava flows producing gentle slopes.
 - f.* Students know the explanation for the location and properties of volcanoes that are due to hot spots and the explanation for those that are due to subduction.

California Standard: Energy in the Earth System. This standard states:

4. Energy enters the Earth system primarily as solar radiation and eventually escapes as heat. As a basis for understanding this concept:
 - a. Students know the relative amount of incoming solar energy compared with Earth's internal energy and the energy used by society.
 - b. Students know the fate of incoming solar radiation in terms of reflection, absorption, and photosynthesis.

- c. Students know the different atmospheric gases that absorb the Earth's thermal radiation and the mechanism and significance of the greenhouse effect.
- d.* Students know the differing greenhouse conditions on Earth, Mars, and Venus; the origins of those conditions; and the climatic consequences of each.

5. Heating of Earth's surface and atmosphere by the sun drives convection within the atmosphere and oceans, producing winds and ocean currents. As a basis for understanding this concept:

- a. Students know how differential heating of Earth results in circulation patterns in the atmosphere and oceans that globally distribute the heat.
- b. Students know the relationship between the rotation of Earth and the circular motions of ocean currents and air in pressure centers.
- c. Students know the origin and effects of temperature inversions.
- d. Students know properties of ocean water, such as temperature and salinity, can be used to explain the layered structure of the oceans, the generation of horizontal and vertical ocean currents, and the geographic distribution of marine organisms.
- e. Students know rain forests and deserts on Earth are distributed in bands at specific latitudes.
- f.* Students know the interaction of wind patterns, ocean currents, and mountain ranges results in the global pattern of latitudinal bands of rain forests and deserts.
- g.* Students know features of the ENSO (El Niño southern oscillation) cycle in terms of sea-surface and air temperature variations across the Pacific and some climatic results of this cycle.

6. Climate is the long-term average of a region's weather and depends on many factors. As a basis for understanding this concept:
- a. Students know weather (in the short run) and climate (in the long run) involve the transfer of energy into and out of the atmosphere.
 - b. Students know the effects on climate of latitude, elevation, topography, and proximity to large bodies of water and cold or warm ocean currents.
 - c. Students know how Earth's climate has changed over time, corresponding to changes in Earth's geography, atmospheric composition, and other factors, such as solar radiation and plate movement.
 - d.* Students know how computer models are used to predict the effects of the increase in greenhouse gases on climate for the planet as a whole and for specific regions.

California Standard: Structure and Composition of the Atmosphere. This standard states:

8. Life has changed Earth's atmosphere, and changes in the atmosphere affect conditions for life. As a basis for understanding this concept:
- a. Students know the thermal structure and chemical composition of the atmosphere.
 - b. Students know how the composition of Earth's atmosphere has evolved over geologic time and know the effect of outgassing, the variations of carbon dioxide concentration, and the origin of atmospheric oxygen.
 - c. Students know the location of the ozone layer in the upper atmosphere, its role in absorbing ultraviolet radiation, and the way in which this layer varies both naturally and in response to human activities.

California Standard: California Geology. This standard states:

9. The geology of California underlies the state's wealth of natural resources as well as its natural hazards. As a basis for understanding this concept:

- a. Students know the resources of major economic importance in California and their relation to California's geology.
- b. Students know the principal natural hazards in different California regions and the geologic basis of those hazards.
- c. Students know the importance of water to society, the origins of California's fresh water, and the relationship between supply and need.
- d.* Students know how to analyze published geologic hazard maps of California and know how to use the map's information to identify evidence of geologic events of the past and predict geologic changes in the future.

California Standard: Investigation and Experimentation. This standard states:

1. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other four strands, students should develop their own questions and perform investigations. Student learning objectives; students will:
 - A. Select and use appropriate tools and technology (such as computer-linked probes, spreadsheets, and graphing calculators) to perform tests, collect data, analyze relationships, and display data.
 - B. Identify and communicate sources of unavoidable experimental error.
 - C. Identify possible reason for inconsistent results, such as sources of error or uncontrolled conditions.
 - D. Formulate explanations using logic and evidence.
 - E. Recognize the usefulness and limitations of models and theories as scientific representations of reality.

- F. Create and design topographic and geologic maps.
- G. Recognize the issues of statistical variability and the need for controlled tests.
- H. Recognize the cumulative nature of scientific evidence.
- I. Analyze situations and solve problems that require combining and applying concepts from more than one area of science.
- J. Investigate a science-based societal issue by researching the literature, analyzing the data, and communicating the findings. Examples of issues include effects of Marine Protected Areas, biomagnification in marine life, and oil platforms as artificial reefs in California.
- k. Recognize the cumulative nature of scientific evidence.
- l. Analyze situations and solve problems that require combining and applying concepts from more than one area of science.
- m. Investigate a science-based societal issue by researching the literature, analyzing data, and communicating the findings. Examples of issues include irradiation of food, cloning of animals by somatic cell nuclear transfer, choice of energy sources, and land and water use decisions in California.
- n. Know that when an observation does not agree with an accepted scientific theory, the observation is sometimes mistaken or fraudulent (e.g., the Piltdown Man fossil or unidentified flying objects) and that the theory is sometimes wrong (e.g., the Ptolemaic model of the movement of the Sun, Moon, and planets).

Additional Learning Objectives:

- A. Students will increase their understanding of physical sciences and demonstrate their ability to solve problems and think critically by effectively completing risk assessments, loss estimations and loss mitigation strategies for disasters in Hazus-MH, which can include but is not limited to the fields of Geography, Geology and Emergency Management.
- B. Students will develop advanced technical reading and writing skills and will be able to understand and critically evaluate the content of scientific text and print materials.

- C. Students will investigate factual material for information and analysis and will be able to write in a technical report with appropriate composition.

CTE Foundation Standards; Engineering and Design Industry Sector

Specific applications of Investigation and Experimentation standards (grades nine through twelve):

- (1.a) Select and use appropriate tools and technology (such as computer-linked probes, spreadsheets, and graphing calculators) to perform tests, collect data, analyze relationships, and display data.
- (1.d) Formulate explanations by using logic and evidence.
- (1.l) Analyze situations and solve problems that require combining and applying concepts from more than one area of science.

1.4 Visual and Performing Arts

Specific applications of Visual Arts standards at the advanced level (grades nine through twelve):

- (2.3) Assemble and display objects or works of art as a part of a public exhibition.
- (2.4) Demonstrate in their own works of art a personal style and an advanced proficiency in communicating an idea, theme, or emotion.
- (2.6) Present a universal concept in a multimedia work of art that demonstrates knowledge of technology skills.
- (3.1) Identify contemporary styles and discuss the diverse social, economic, and political developments reflected in the works of art examined.

2.0 Communications

Students understand the principles of effective oral, written, and multimedia communication in a variety of formats and contexts.

2.1 Reading

Specific applications of Reading Comprehension standards (grades nine and ten):

- (2.1) Analyze the structure and format of functional workplace documents, including the graphics and headers, and explain how authors use the features to achieve their purposes.
- (2.6) Demonstrate use of sophisticated learning tools by following technical directions (e.g., those found with graphic calculators and specialized software programs and in access guides to World Wide Web sites on the Internet).

Specific applications of Reading Comprehension standards (grades eleven and twelve):

(2.3) Verify and clarify facts presented in other types of expository texts by using a variety of consumer, workplace, and public documents.

Specific applications of Writing Strategies and Applications standards (grades eleven and twelve):

(1.6) Develop presentations by using clear research questions and creative and critical research strategies (e.g., field studies, oral histories, interviews, experiments, electronic sources).

(1.8) Integrate databases, graphics, and spreadsheets into word-processed documents.

(2.6) Deliver multimedia presentations:

- a. Combine text, images, and sound and draw information from many sources (e.g., television broadcasts, videos, films, newspapers, magazines, CD-ROMs, the Internet, electronic media-generated images).
- b. Select an appropriate medium for each element of the presentation.
- c. Use the selected media skillfully, editing appropriately and monitoring for quality.
- d. Test the audience's response and revise the presentation accordingly.

Specific applications of Listening and Speaking Strategies and Applications standards (grades eleven and twelve):

(1.3) Interpret and evaluate the various ways in which events are presented and information is communicated by visual image makers (e.g., graphic artists, documentary filmmakers, illustrators, news photographers).

(1.8) Use effective and interesting language, including:

- a. Informal expressions for effect
- b. Standard American English for clarity
- c. Technical language for specificity

(1.10) Evaluate when to use different kinds of effects (e.g., visual, music, sound, graphics) to create effective productions.

(2.4) Deliver multimedia presentations:

- a. Combine text, images, and sound by incorporating information from a wide range of media, including films, newspapers, magazines, CD-ROMs, online information, television, videos, and electronic media-generated images.
- b. Select an appropriate medium for each element of the presentation.
- c. Use the selected media skillfully, editing appropriately and monitoring for quality.
- d. Test the audience's response and revise the presentation accordingly.

2.5 Multimedia

Understand the importance of technical and computer-aided design and drawing technologies essential to the language of the engineering and design industry, including reading, writing, interpreting, and creating drawings, sketches, and schematics using engineering and design industry conventions and standards; interpreting and understanding detailed information

provided from available technical documents, both print and electronic, and from experienced people; and using computers, calculators, multimedia equipment, and other devices in a variety of applications.

4.0 Technology

Students know how to use contemporary and emerging technological resources in diverse and changing personal, community, and workplace environments:

- 4.1 Understand past, present, and future technological advances as they relate to a chosen pathway.
- 4.2 Understand the use of technological resources to gain access to, manipulate, and produce information, products, and services.
- 4.3 Understand the influence of current and emerging technology on selected segments of the economy.

5.0 Problem Solving and Critical Thinking

Students understand how to create alternative solutions by using critical and creative thinking skills, such as logical reasoning, analytical thinking, and problem-solving techniques:

- 5.1 Apply appropriate problem-solving strategies and critical thinking skills to work-related issues and tasks.
- 5.2 Understand the systematic problem-solving models that incorporate input, process, outcome, and feedback components.
- 5.3 Use critical thinking skills to make informed decisions and solve problems.

7.0 Responsibility and Flexibility

Students know the behaviors associated with the demonstration of responsibility and flexibility in personal, workplace, and community settings:

- 7.1 Understand the qualities and behaviors that constitute a positive and professional work demeanor.
- 7.2 Understand the importance of accountability and responsibility in fulfilling personal, community, and workplace roles.
- 7.3 Understand the need to adapt to varied roles and responsibilities.
- 7.4 Understand that individual actions can affect the larger community.

8.0 Ethics and Legal Responsibilities

Students understand professional, ethical, and legal behavior consistent with applicable laws, regulations, and organizational norms:

- 8.1 Know the major local, district, state, and federal regulatory agencies and entities that affect the industry and how they enforce laws and regulations.
- 8.2 Understand the concept and application of ethical and legal behavior consistent with workplace standards.

8.3 Understand the role of personal integrity and ethical behavior in the workplace.

9.0 Leadership and Teamwork

Students understand effective leadership styles, key concepts of group dynamics, team and individual decision making, the benefits of workforce diversity, and conflict resolution:

9.1 Understand the characteristics and benefits of teamwork, leadership, and citizenship in the school, community, and workplace settings.

9.2 Understand the ways in which preprofessional associations, such as SkillsUSA, and competitive career development activities enhance academic skills, promote career choices, and contribute to employability.

9.3 Understand how to organize and structure work individually and in teams for effective performance and the attainment of goals.

9.4 Know multiple approaches to conflict resolution and their appropriateness for a variety of situations in the workplace.

9.5 Understand how to interact with others in ways that demonstrate respect for individual and cultural differences and for the attitudes and feelings of others.

9.6 Understand how to organize, conduct, lead, and participate in student-centered activities and events through student-based organizations.

10.0 Technical Knowledge and Skills

Students understand the essential knowledge and skills common to all pathways in the Engineering and Design sector:

10.1 Use and maintain industrial and technological products and systems.

10.2 Understand the importance of technical and computer-aided technologies essential to the language of the engineering and design industry.

10.3 Understand how to use, adjust, maintain, and troubleshoot the equipment and tools of the engineering and design industry in a safe, effective, and efficient manner.

10.4 Acquire, store, allocate, and use materials and space efficiently.

10.5 Understand the role of the engineering and design industry in the California economy.

10.6 Understand and apply the appropriate use of quality control systems and procedures.

10.7 Understand the need and process to obtain and maintain industry-standard, technical certifications and affiliations with professional organizations, including the American Society for Engineering Education, the Accreditation Board for Engineering and Technology, and the American Society of Civil Engineers.

10.8 Understand the need to obtain and maintain industry-standard, technical certifications significant to a particular industry.

11.0 Demonstration and Application

Students demonstrate and apply the concepts contained in the foundation and pathway standards.

E. Environmental and Natural Science Engineering Pathway

The Environmental and Natural Science Engineering Pathway provides students with the opportunity to prepare for careers in the environmental and natural sciences. They learn to design and develop processes, equipment, and systems that are used to create, monitor, prevent, or correct environmental events and conditions.

E1.2 Know the current industry standards for illustration and layout.

E2.0 Students study and understand the fundamentals of earth science as they relate to environmental engineering:

E2.3 Know how to assess and evaluate geological hazards.

E2.4 Understand how to read, interpret, and evaluate topographical maps and images.

E2.5 Use global positioning systems equipment and related technology to locate and evaluate soil or geological conditions or features.

E3.0 Students understand the effects of the weather, the hydrosphere, and the atmosphere on the environment:

E3.3 Analyze atmospheric pressure and weather systems.

E3.5 Analyze the mechanisms for air mass movement.

E5.0 Students understand the design process and how to solve analysis and design problems:

E5.1 Understand the steps in the design process.

E5.2 Determine what information and principles are relevant to a problem and its analysis.

E5.3 Choose between alternate solutions in solving a problem and be able to justify choices in determining a solution.

E5.5 Understand the process of developing multiple details into a single solution.

E8.0 Students understand fundamental automation modules and know how to set up simple systems that will complete preprogrammed tasks:

E8.1 Use appropriate tools and technology to perform tests, collect data, analyze relationships, and display data in a simulated or modeled automated system.

II. Sample Assessments

A. Traditional forms of assessment

1. Printed reports including risk assessments, loss estimations and loss mitigation strategies

2. Printed maps in standard cartographic format
 3. Written tests
 4. Individual oral/visual presentations
- B. Project Based
1. Project selection and development
 2. On-going cumulative portfolio record of project and accomplishments
 3. Group presentations (as necessary)
 4. Individual presentation to the professional community (conference or science fair)
 5. Final project
 6. Individual assessment

III. Topic of Study - Suggested Time Distribution

This class is half academic study and half modeling analysis with Hazus-MH software.

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| 1. Academic Geology principles | 40% |
| 2. Instruction on GIS and computer modeling in Hazus-MH | 30% |
| 2. Presentations to fellow classmates | 5% |
| 3. Final projects and other assessments | 20% |
| 4. Attending conferences | 5% |

IV. Recommended Materials

A. Required texts for Geology of Disasters include:

1. Student FEMA Workbook for ArcGIS for Emergency Managers
2. Student FEMA Workbook for Basic Hazus-MH
3. Student FEMA Workbook for Application of Hazus-MH for Risk Assessment
4. Geology Textbook (TBD)

B. Supplemental texts for Geology of Disasters include:

1. Student FEMA Workbook Comprehensive Data Management for Hazus-MH
2. Student FEMA Workbook for Hazus-MH for Earthquake
3. Student FEMA Workbook for Hazus-MH Flood
4. Student FEMA Workbook for Hazus-MH Hurricane
5. Using Hazus-MH for Risk Assessment
6. Developing the Mitigation Plan
7. Designing Better Maps; A guide for GIS Users
8. Differential GPS Explained

C. Community partners willing to provide data and expertise include:

1. FEMA
2. GeoRevs LLC.
3. Verdugo Fire Communications
4. City of Glendale
5. Rio Honda Community College
6. California State University, Northridge
7. ESRI
8. Los Angeles County Department of Public Works
9. Los Angeles County Information Office