CORE CURRICULUM COMPONENT APPLICATION
Sam Houston State University

Revised October, 2012

PART I – Course Information

Course Type
☒ Existing/Restructured
☐ New Course Proposed Fall 2013
If new, have you submitted a Form B to the SHSU Curriculum Committee? ☐ Yes ☐ No

Course Prefix & Number: GEOL 1303/1103 (1403)

Texas Common Course Number (TCCN Matrix): GEOL 1303/1103

Course Title: Physical Geology and lab

Course Catalog Description (Copy and paste from online catalog for existing courses):
An introduction to the materials, processes, and structure of the earth. Topics include earthquakes, volcanoes, plate tectonics, mountain building, weathering and erosion, glaciation, oceans, and mineral resources. No prerequisite. Fall, Spring, Summer. Credit 3.
This course must be taken concurrently with GEL 133 <GEOL 1303>, Physical Geology. These laboratory experiences involve the study of rocks, minerals, and map interpretations. Credit 1.

Course Prerequisites: none

Available Online?
☒ Yes, currently developed in online delivery mode
☐ Anticipated development in online delivery mode (Semester, Year:)
☐ No

Number of Sections to be Offered per Academic Year: 7

Estimated Enrollment per Section: 60

Course Level (freshman, sophomore): freshman

Designated Contact Person (for follow-up communication purposes): Brian Cooper

E-Mail Address: bjcooper@shsu.edu

Phone: x41566

Approvals

Department Chair:	Brian Cooper Signature	10/18/12 Date
Academic Dean:	John B. Pascarella Signature	10/18/12 Date

Submit completed, signed form to Core Curriculum Committee - Box 2478 or Fax 4-1271

PART II – THECB Foundational Component Areas

See Appendix for full description of each component area.

Select Component Area: III. Life and Physical Sciences

In one paragraph, describe how the proposed course will fulfill the core and skill objectives of the component area: This course will focus on describing, explaining, and predicting natural geologic phenomena using the scientific method. Students will gain an understanding of interactions among natural phenomena such as those associated with the hydrologic cycle, the rock cycle, and the tectonic cycle. Students will also gain an understanding of the implications of scientific principles on the physical world and on human experiences such as those associated with geologic hazards and economically important earth materials.

PART III – Course Objectives & Student Learning Outcomes (SLO)

Insert the applicable course objectives stated as student learning outcomes (e.g., Students completing the course will be able to...) that support the core component area objectives. Please reference the component rubric for additional information on core component area objectives.

Objective/SLO 1: Apply scientific methodologies for the purpose of describing natural phenomena such as earth materials and landforms.

How will the objective be addressed (including strategies and techniques)?
The basic concept of the scientific method, scientific terminology (hypothesis, etc.), and examples will be provided at the beginning of the direct instruction portion of this course. The students will practice these scientific methodologies throughout the course, both in terms of understanding scientific concepts during direct instruction and applications during the experiential portion of the course.

The scientific method begins with making and describing observations.
The lecture portion of this course will cover terminology associated with features to be described. In the laboratory students will collect and analyze evidence to describe minerals, rocks, and landforms using appropriate scientific methodologies (measurements) and terminology.

For example: terminology associated with physical properties of minerals (hardness, cleavage, streak, etc.) will be presented in lecture and reading assignments.
In the laboratory students will measure and analyze physical properties of minerals and use this collection of evidence to describe each mineral sample using appropriate terminology.

Describe how the objective will be assessed: A pre-test will be administered on the second day of lecture. The pre-test will include questions concerning student perception/understanding of the components, steps, and concepts associated with the scientific method and terminology used to describe earth materials and landforms. Subsequent lecture and lab exams administered during the semester will include the same questions as the pre-test so that improvement in student skills can be evaluated. Students will discuss, compare, and record measurements, calculations, and analysis of the evidence used to describe each mineral sample in a lab report to be submitted by each team of students. This lab report is evaluated on the basis of correct use of scientific methodologies of inquiry and terminology as well as the accuracy of their descriptions of natural phenomena.

Objective/SLO 2: Apply scientific methodologies for the purpose of explaining the origin and history of earth materials and landforms based on their own observations and descriptions.

How will the objective be addressed (including strategies and techniques)?
The next step in the scientific method is to explain the obervations that have been described (essentially formulate a hypothesis). The origin and history of earth materials and landforms will be presented in lecture. In lab students will explain and evaluate the petrogenetic (origin) and historical implications of the evidence that they have collected and described.

For example: the origin and history of igneous rocks will be presented in lecture, starting with the formation of magmas all the way through to the solidification of that magma to form an igneous rock. In lab students will interpret textural evidence of igneous rocks that they collected and described to explain the possible origin and history of each igneous rock sample.

Describe how the objective will be assessed: A pre-test will be administered on the second day of lecture. The pre-test will include questions concerning the origin and history of earth materials and landforms. Subsequent lecture and lab exams administered during the semester will include the same questions as the pre-test so that improvement in student skills can be evaluated. Students will discuss and record explanations and evaluations of the possible petrogenetic and historical implications of the evidence that they have collected and described in a lab report to be submitted by each team of students. Each student will include their own explanation in the team report. This lab report is evaluated on the basis of the creative thinking and innovation expressed in the explanations and evaluations.

Objective/SLO 3: Apply scientific methodologies for the purpose of predicting natural phenomena such as mineral associations, landslides, and fault movement.

How will the objective be addressed (including strategies and techniques)?
The scientific method requires that the validity of explanations be checked by making and testing predictions. Relationships between various parameters will be presented during lecture. Students will evaluate their explanations and interpretations in light of these relationships to make and test predictions.

Examples: students will be told the relationship between mineral stability and temperature in lecture. In lab they will observe minerals in igneous rocks and based on their interpretation of mineral composition of the rock they will predict the temperature range present at the time of the rock's formation. The predicted temperature range will be compared to observed temperatures for similar igneous rocks. Students will learn about the relationship between slope angle and shear stress during lecture. They will measure and evaluate slope angles on topographic maps in lab and will combine these results with an interpretation of the local geology to predict likely

locations for landslides. The predicted locations will be compared to historical landslide activity in the area represented by the map.

Describe how the objective will be assessed: A pre-test will be administered on the second day of lecture. The pre-test will include questions concerning relationships between various parameters such as temperature versus igneous rock type and rate of cooling versus igneous rock texture. Subsequent lecture and lab exams administered during the semester will include the same questions as the pre-test so that improvement in student skills can be evaluated. Students will discuss and record their predictions and tests made on the basis of explanations and evaluations of the petrogenetic and historical implications of the evidence that they have collected and described in a lab report to be submitted by each team of students. This lab report is evaluated on the basis of the creative thinking and innovation expressed in the team's predictions and testing.

Objective/SLO 4: Communicate their understanding of the interactions among tectonic plates that cause natural phenomena such as earthquakes and volcanic eruptions.

How will the objective be addressed (including strategies and techniques)?
An introduction to plate tectonics will be presented early in the course and will provide a framework throughout the remainder of the course. Instruction concerning interactions among tectonic plates will lead to an understanding of how these interactions cause various types of volcanic and earthquake activity. Plate tectonics will be revisited near the end of the course after a foundation of earth materials and processes has been established.

Example: the students will be told the causal relationship between plate tectonic interaction and the type of volcanic activity that occurs along each type of plate boundary. During lab the students will make observations of various volcanic products and predict which type of plate interaction caused the formation of each volcanic product.

Describe how the objective will be assessed: A pre-test will be administered on the second day of lecture. The pre-test will include questions concerning the components of plate tectonics and the interactions among tectonic plates that cause natural phenomena such as earthquakes and volcanic eruptions. Subsequent lecture and lab exams administered during the semester will include the same questions as the pre-test so that improvement in student understanding can be evaluated. Students will discuss and record their predictions made on the basis of their understanding of how plate interactions cause various types of volcanic and earthquake activity in a lab report to be submitted by each team of students. This lab report is evaluated on the basis of the effective development of their ideas, their interpretation of the interactions, and their expression of their understanding and the team's predictions.

Objective/SLO 5: Explain the implications of geologic (scientific) principles on the physical world and on human experiences on this planet that includes the impact of geologic hazards and the need to find more natural resources.

How will the objective be addressed (including strategies and techniques)?
Scientific principles underlying various geologic hazards (landslides, flooding, volcanism, earthquakes) and how they shape the physical world will be discussed during lecture. Economic implications of earth materials to the human experience will also be covered in lecture. Students will work with economically important earth materials in lab and will learn about their specific uses. Topographic maps and geologic maps illustrating the physical world will be used in lab exercises concerning the implications of scientific principles on human experiences.

For example: students will be given a map of Mount Saint Helens as it appeared prior to the 1980 eruption. Students will be asked to describe, explain, and predict the implications of the specific type of volcanic hazard that could threaten various locations on the map based on their understanding of various volcanic eruptive activities and potential slope failure. Their predictions will then be compared to a post-eruption map of the region.

Describe how the objective will be assessed: A pre-test will be administered on the second day of lecture. The pre-test will include questions concerning the scientific principles underlying various geologic hazards (landslides, flooding, volcanism, earthquakes) and how they shape the physical world.
Subsequent lecture and lab exams administered during the semester will include the same questions as the pre-test so that improvement in student understanding can be evaluated. In a lab report to be submitted by each team of students, they will discuss and record their explanations of the implications of geologic (scientific) principles on the physical world and on human experiences on this planet that includes the impact of geologic hazards and the need to find more natural resources. This lab report is evaluated on the basis of the creative thinking and innovation expressed in the team's explanations.

PART IV – THECB Skill Objectives

Address each of the THECB skill objectives required within the component area. Explain how the skill is addressed, including specific strategies to address the skill(s). *Address ALL skill objectives associated with the selected Component Area. (See Appendix)*

1. Critical Thinking Skills: to include creative thinking, innovation, inquiry, and analysis, evaluation and synthesis of information

How will the skill be addressed (including specific strategies, activities, and techniques)?
Students will apply scientific methodologies to analyze and describe earth materials and landforms, especially during lab-based inquiry (SLO 1). Students will then evaluate the petrogenetic (origin) and historical implications of the evidence that they have collected and described (SLO 2). Students will synthesize this information and use creative thinking and

innovation to arrive at conclusions and make and test predictions concerning natural phenomena (SLO 3, 4 and 5).

2. Communication Skills: to include effective development, interpretation and expression of ideas through written, oral and visual communication

How will the skill be addressed (including specific strategies, activities, and techniques)? Students will interpret their collected earth material or landform evidence and express a description of the earth material or landform both orally during discussion with their team members and in writing in both individual and team lab reports. The team lab reports will include visual illustrations of the earth materials or landforms with labels and descriptions using appropriate terminology. Students will effectively develop conclusions and predictions that will be communicated in writing and visually with the use of graphs.

3. Empirical and Quantitative Skills: to include the manipulation and analysis of numerical data or observable facts resulting in informed conclusions

How will the skill be addressed (including specific strategies, activities, and techniques)? Students will manipulate numerical data and observable facts throughout the course. Students will measure the physical properties of minerals and manipulate those observable facts to determine the identity of minerals (SLO 1). Students will measure grain sizes, determine averages and ranges to obtain part of the textural evidence used to explain possible origins and histories of rocks (SLO 2). Students will measure distances and elevation changes on maps and then analyze this data to obtain areas, slope angles, average snowline, lake volumes, etc. (SLO 1 and 2). Students will use distance and rock ages to calculate average rates of plate movement (SLO 4). Students will be able to analyze earthquakes of various magnitudes and be able to determine differences in energy released and amount of ground movement (SLO 5).

4. Teamwork: to include the ability to consider different points of view and to work effectively with others to support a shared purpose or goal

How will the skill be addressed (including specific strategies, activities, and techniques)? Weekly team lab reports will be evaluated by the lab coordinator with input from lab instructors. Each member of the team will be responsible for a specific component of the lab report. The lab report will consist of an introduction concerning the week's lab, a summary of the team's discussions with contributions attributable to each team member, and the results/conclusions of the lab. Each report must also contain appropriate visuals (illustrations, photographs, or graphs).

5. Personal Responsibility: to include the ability to connect choices, actions and consequences to ethical decision-making

How will the skill be addressed (including specific strategies, activities, and techniques)?
NA

6. Social Responsibility: to include intercultural competence, knowledge of civic responsibility, and the ability to engage effectively in regional, national, and global communities

How will the skill be addressed (including specific strategies, activities, and techniques)?
NA

PART V – SHSU Core Curriculum Committee Requirements

1. Using a 15-week class schedule, identify the topics to be covered during each week of the semester. Provide sufficient detail to allow readers to understand the scope and sequence of topics covered.

Week 1	Introduction: scientific method as applied to geology, earth's place in space, earth's structure and surface features, hydrologic cycle, rock cycle, tectonic cycle and plate tectonics. Pre-Test
Week 2	Minerals: definition, what is and what is not a mineral, crystal structure, chemical composition, physical properties and their dependence on crystal structure and chemical composition. Lab One: introduction to measurement and analysis of physical properties, description of economic minerals and their uses. Team Lab Report One
Week 3	Igneous Rocks: definition of magma, origin of magmas, cooling and solidification of magmas, Bowen's Reaction Series, texture, origin and history of intrusive igneous rocks, origin and history of extrusive igneous rocks including volcanic activity. Lab Two: description of rock-forming minerals and their economic uses. Team Lab Report Two
Week 4	Sedimentary: sediments, sedimentary rocks, clastic sedimentary rocks, source, transport, depositional environments, lithification, classification, chemical sedimentary rocks, and fossil fuels. First Lecture Exam Lab Three: description of mineralogy and textures of igneous rocks, explanations of origin and history of individual samples with predictions of temperatures of formation and comparisons to actual temperatures of formation. Team Lab Report Three
Week 5	Weathering: disintegration and decomposition of rocks, mechanical weathering processes, chemical weathering processes, controlling factors, climate, specific surface area (calculation), mineral stability, weathering products, and soils. Lab Four: description of mineralogy and textures of sedimentary rocks, explanations of origin and history of individual samples with predictions of depositional environments and comparisons to actual depositional environments.

	Team Lab Report Four
Week 6	Metamorphic Rocks: metamorphism, controlling factors, metamorphic processes, metamorphic environments, contact metamorphism, regional metamorphism, subduction zone metamorphism, metamorphic grade, metamorphic zones, metamorphic facies, and facies series. Lab Five: description of mineralogy and textures of metamorphic rocks, explanations of origin and history of individual samples with predictions of metamorphic environments and comparisons to actual metamorphic environments. Team Lab Report Five
Week 7	Landforms/Mass movement: erosion, transport agents, mass movement, gravity, shear stress, shear strength, types of mass movement, hazards, remediation. Second Lecture Exam Lab Six: Rock and mineral practical that will test student's ability to describe, explain, and predict features and phenomena associated with earth materials.
Week 8	Streams: runoff, average stream velocity, downstream trends, sediment transport, drainage patterns, and flood plains. Lab Seven: introduction to topographic maps, scale, coordinate systems, contour lines, contour intervals, magnetic declinations, and selected map symbols. This is primarily a descriptive lab, with some calculations and unit conversions required. Team Lab Report Six
Week 9	Deserts: distribution, causes, wind erosion, sediment transport by wind, interior drainage basins, arroyos, alluvial fans, and types of sand dunes. Lab Eight: humid and arid landforms as expressed on topographic maps, description, explanation, comparison of humid and arid environments, with measurements and calculations required. Team Lab Report Seven
Week 10	Glaciers: locations, snowline, alpine glaciers, erosional and depositional processes associated with alpine environments, continental glaciers, erosional and depositional processes associated with continental glacial environments. Lab Nine: glacial, coastal, and karst landforms as expressed on topographic maps, description, explanation, comparison of the three different environments, with measurements and calculations required. Team Lab Report Eight
Week 11	Groundwater: economic importance, water table, groundwater flow, porosity, permeability, aquifers, aquicludes, overextraction, hazards such as sinkholes and subsidence, erosional and depositional processes, and uses of heated groundwater. Third Lecture Exam Lab Ten: introduction to geologic structures, strike and dip, principle of original horizontality, principle of superposition, horizontal strata and landforms, and folded strata and landforms. Measurements, calculations, and interpretation of structurally induced landforms required. Team Lab Report Nine
Week 12	Shorelines: interaction of hydrosphere, atmosphere, and lithosphere; uniqueness of wave-action to this environment, landforms, controls on shoreline development, submergent shorelines, and emergent shorelines. Lab Eleven: fault nomenclature, fault-controlled landforms, types of faults, predicting direction of fault movement. Measurements, calculations, and interpretation of structurally induced landforms required. Team Lab Report Ten

Week 13	Ocean Basins: continental margins, continental shelf, continental slope, abyssal plains, oceanic ridges, oceanic trenches, and fracture zones (transform faults). Lab Twelve: geologic hazards, landslide risks, earthquake hazards, volcanic hazards (before and after look at Mt. St. Helens and vicinity). Team Lab Report Eleven
Week 14	Plate Tectonics: evolution from "continental drift" to plate tectonics, the models comprising the paradigm, lithospheric plates, isostasy, seafloor spreading, subduction, transform faults, divergence, convergence, passive boundaries, and the ocean basin development cycle (or supercontinent cycle). Lab Thirteen: Final practical exam on student's ability to describe and interpret map information (topographic and geologic maps).
Week 15	Final Lecture Exam

2. Attachments (Syllabus Required)

Syllabus Attached? ☒ Yes ☐ No

Other Attached? ☐ Yes ☐ No If yes, specify:

Appendix: THECB Component Area Descriptions and Skill Requirements

I. Communication (Courses in this category focus on developing ideas and expressing them clearly, considering the effect of the message, fostering understanding, and building the skills needed to communicate persuasively. Courses involve the command of oral, aural, written, and visual literacy skills that enable people to exchange messages appropriate to the subject, occasion, and audience.)

II. Mathematics (Courses in this category focus on quantitative literacy in logic, patterns, and relationships. Courses involve the understanding of key mathematical concepts and the application of appropriate quantitative tools to everyday experience.)

III. Life and Physical Sciences (Courses in this category focus on describing, explaining, and predicting natural phenomena using the scientific method. Courses involve the understanding of interactions among natural phenomena and the implications of scientific principles on the physical world and on human experiences.)

IV. Language, Philosophy, and Culture (Courses in this category focus on how ideas, values, beliefs, and other aspects of culture express and affect human experience. Courses involve the exploration of ideas that foster aesthetic and intellectual creation in order to understand the human condition across cultures.)

V. Creative Arts (Courses in this category focus on the appreciation and analysis of creative artifacts and works of the human imagination. Courses involve the synthesis and interpretation of artistic expression and enable critical, creative, and innovative communication about works of art.)

VI. American History (Courses in this category focus on the consideration of past events and ideas relative to the United States, with the option of including Texas History for a portion of this component area. Courses involve the interaction among individuals, communities, states, the nation, and the world, considering how these interactions have contributed to the development of the United States and its global role.)

VII. Government/ Political Science (Courses in this category focus on consideration of the Constitution of the United States and the constitutions of the states, with special emphasis on that of Texas. Courses involve the analysis of governmental institutions, political behavior, civic engagement, and their political and philosophical foundations.)

VIII. Social and Behavioral Sciences (Courses in this category focus on the application of empirical and scientific methods that contribute to the understanding of what makes us human.
Courses involve the exploration of behavior and interactions among individuals, groups, institutions, and events, examining their impact on the individual, society, and culture.)

Required Skill Objectives

Foundational Component Areas	Skill Objectives					
	Critical Thinking	Communication	Empirical & Quantitative	Team Work	Social Responsibility	Personal Responsibility
Communication	✓	✓		✓		✓
Mathematics	✓	✓	✓			
Life and Physical Sciences	✓	✓	✓	✓		
Language, Philosophy & Culture	✓	✓			✓	✓
Creative Arts	✓	✓		✓	✓	
American History	✓	✓			✓	✓
Government/Political Science	✓	✓			✓	✓
Social and Behavioral Sciences	✓	✓	✓		✓	

- COURSE SYLLABUS -

GEL 1303/1103 (1403) PHYSICAL GEOLOGY

(4 Semester Credit Hours)

Professor: Dr. Brian Cooper
(SHSU Tel: 41566) (email: bjcooper@shsu.edu)

GEOLOGY 1303 - PHYSICAL GEOLOGY
Course Syllabus – 2014

INSTRUCTOR: Brian Cooper
OFFICE: 332G Lee Drain Building
OFFICE HOURS: after 2 pm MTuWThF, or by appointment.
OFFICE PHONE: 294-1566 e-mail: bjcooper@shsu.edu

TEXT: Lutgens/Tarbuck, *Essentials of Geology*, 11th ed.

ATTENDANCE: Attendance is required. There are **NO** excused absences. No visitors.

Each absence in excess of 6 absences costs 5 points off the final grade. Three tardies are equivalent to one absence. If you miss a lecture, it is your responsibility to obtain the material presented in the lecture from a fellow student.

Americans with Disabilities Act: According to University policy requests for accommodations must be initiated by the student. A student seeking accommodations should go to the Counseling Center in a timely manner and discuss any Students with Disabilities (SSD) issues. Every semester that the student desires accommodations, it is the student's responsibility to complete a Classroom Accommodation Request Form at the SSD office and follow the stated procedure in notifying faculty. Accommodations for disabled students are decided based upon documentation and need on a case-by-case basis by the Counseling Center.

Religious Holidays: University policy states that a student who is absent from class for the observance of a religious holy day should take an examination or complete an assignment scheduled for that day within a reasonable time after the absence. *The student, not later than the 15th calendar day after the first day of the semester, or the 7th calendar day after the first day of a summer session, must notify the instructor of each scheduled class that he/she would be absent for a religious holy day.*

Visitors In The Classroom: Unannounced visitors to class meetings must present a current, official SHSU identification card to be permitted in the classroom or at a restricted field site. They must not present a disruption to the class by their attendance. If the visitor is not a registered student, it is at the instructor's discretion whether or not the visitor will be allowed to remain in the class.

MAKE-UP EXAMS: If you miss any of the first three exams there will be a comprehensive make-up exam given at 2 pm on xxxxxx, 2014, in LDB 332.

RULES:
1. Class starts on time.
2. Class ends when I say it ends. Leaving early without permission = a tardy.
3. Keep quiet when I am lecturing.
4. Raise your hand if you have a question or need to leave for any reason.
5. No drinks, No food, No smoking in the classroom.
6. Switch all pagers and cell phones to a silent mode.
7. Violations result in student being asked to leave and being counted absent.

CHEATING: Cheaters will automatically fail. Please keep your eyes on your own exam. You get one warning, then you get a zero. See *Student Guidelines*.

COURSE GRADE:

Lecture:

180 - 200 points = A, 160 - 179 points = B, 140 - 159 points = C, 120 - 139 points = D, less than 119 points = F. No extra credit. Each of the four lecture exams is worth 50 points, for a total of 200, which counts toward 75% of the course grade.

Lab:

11 Team lab reports x 10 points each	= 110 points
11 Individual reports x 10 points each	= 110 points
6 Quizzes x 30 points each	= 180 points
2 practicals x 100 points each	= 200 points
Total	= 600 points

(600 – 540 A, 539 – 480 B, 479 – 420 C, 419 – 360 D, less than 360 F)
Lab will count 25 % of the total grade in the course.

DESCRIPTION: An introduction to the materials, processes, and structure of the earth. Topics include earthquakes, volcanoes, plate tectonics, mountain building, weathering and erosion, glaciation, oceans, and mineral resources. No prerequisite. 3 credit hours.

OBJECTIVES:

The following objectives are intended to meet The Higher Education Coordinating Board's Component Area III, Life and Physical Sciences which states that courses in this category focus on describing, explaining, and predicting natural phenomena using the scientific method. Courses involve the understanding of interactions among natural phenomena and the implications of scientific principles on the physical world and on human experiences.

Component area objectives:

Objective 1:

Apply **scientific method**ologies for the purpose of **describing natural phenomena** such as earth materials and landforms.

Objective 2:

Apply **scientific method**ologies for the purpose of **explaining** the origin and history of earth materials and landforms based on their own observations and **descriptions**.

Objective 3:

Apply **scientific method**ologies for the purpose of **predicting natural phenomena** such as mineral associations, landslides, and fault movement.

Objective 4:

Communicate their **understanding of the interactions among** tectonic plates that cause **natural phenomena** such as earthquakes and volcanic eruptions.

Objective 5:

Explain the **implications** of geologic (**scientific**) **principles on the physical world and on human experiences** on this planet that includes the impact of geologic hazards and the need to find more natural resources.

In addition to the component area objectives, there are four THECB Skill Objectives that must be met by courses in this component area:

1. Critical Thinking Skills

How will the skill be addressed (including specific strategies, activities, and techniques)?

Students will apply scientific methodologies to **analyze** and describe earth materials and landforms, especially during lab-based **inquiry** (SLO 1). Students will then **evaluate** the petrogenetic (origin) and historical implications of the evidence that they have collected and described (SLO 2). Students will **synthesize this information** and use **creative thinking** and **innovation** to arrive at conclusions and make and test predictions concerning natural phenomena (SLO 3, 4 and 5).

2. Communication Skills

How will the skill be addressed (including specific strategies, activities, and techniques)?

Students will **interpret** their collected earth material or landform evidence and **express** a description of the earth material or landform both **orally** during discussion with their team members and in **writing** in both individual and team lab reports. The team lab reports will include **visual** illustrations of the earth materials or landforms with labels and descriptions using appropriate terminology. Students will **effectively develop** conclusions and predictions that will be communicated in **writing** and **visually** with the use of graphs.

3. Empirical and Quantitative Skills

How will the skill be addressed (including specific strategies, activities, and techniques)?

Students will manipulate numerical data and observable facts throughout the course. Students will measure the physical properties of minerals and manipulate those observable facts to determine the identity of minerals (SLO 1). Students will measure grain sizes, determine averages and ranges to obtain part of the textural evidence used to explain possible origins and histories of rocks (SLO 2). Students will measure distances and elevation changes on maps and then analyze this data to obtain areas, slope angles, average snowline, lake volumes, etc. (SLO 1 and 2). Students will use distance and rock ages to calculate average rates of plate

movement (SLO 4). Students will be able to analyze earthquakes of various magnitudes and be able to determine differences in energy released and amount of ground movement (SLO 5).

4. Teamwork

How will the skill be addressed (including specific strategies, activities, and techniques)?

Weekly team lab reports will be evaluated by the lab coordinator with input from lab instructors. Each member of the team will be responsible for a specific component of the lab report. The lab report will consist of an introduction concerning the week's lab, a summary of the team's discussions with contributions attributable to each team member, and the results/conclusions of the lab. Each report must also contain appropriate visuals (illustrations, photographs, or graphs).

The weekly schedule for the semester:

1. Introduction: scientific method as applied to geology, earth's place in space, earth's structure and surface features, hydrologic cycle, rock cycle, tectonic cycle and plate tectonics.
Pre-Test

2. Minerals: definition, what is and what is not a mineral, crystal structure, chemical composition, physical properties and their dependence on crystal structure and chemical composition.
Lab One: introduction to measurement and analysis of physical properties, description of economic minerals and their uses.
Team Lab Report One

3. Igneous Rocks: definition of magma, origin of magmas, cooling and solidification of magmas, Bowen's Reaction Series, texture, origin and history of intrusive igneous rocks, origin and history of extrusive igneous rocks including volcanic activity.
Lab Two: description of rock-forming minerals and their economic uses.
Team Lab Report Two

4. Sedimentary: sediments, sedimentary rocks, clastic sedimentary rocks, source, transport, depositional environments, lithification, classification, chemical sedimentary rocks, and fossil fuels.
First Lecture Exam
Lab Three: description of mineralogy and textures of igneous rocks, explanations of origin and history of individual samples with predictions of temperatures of formation and comparisons to actual temperatures of formation.
Team Lab Report Three

5. Weathering: disintegration and decomposition of rocks, mechanical weathering processes, chemical weathering processes, controlling factors, climate, specific surface area (calculation), mineral stability, weathering products, and soils.

Lab Four: description of mineralogy and textures of sedimentary rocks, explanations of origin and history of individual samples with predictions of depositional environments and comparisons to actual depositional environments.
Team Lab Report Four

6. Metamorphic Rocks: metamorphism, controlling factors, metamorphic processes, metamorphic environments, contact metamorphism, regional metamorphism, subduction zone metamorphism, metamorphic grade, metamorphic zones, metamorphic facies, and facies series.
Lab Five: description of mineralogy and textures of metamorphic rocks, explanations of origin and history of individual samples with predictions of metamorphic environments and comparisons to actual metamorphic environments.
Team Lab Report Five

7. Landforms/Mass movement: erosion, transport agents, mass movement, gravity, shear stress, shear strength, types of mass movement, hazards, remediation.
Second Lecture Exam
Lab Six: Rock and mineral practical that will test student's ability to describe, explain, and predict features and phenomena associated with earth materials.

8. Streams: runoff, average stream velocity, downstream trends, sediment transport, drainage patterns, and flood plains.
Lab Seven: introduction to topographic maps, scale, coordinate systems, contour lines, contour intervals, magnetic declinations, and selected map symbols. This is primarily a descriptive lab, with some calculations and unit conversions required.
Team Lab Report Six

9. Deserts: distribution, causes, wind erosion, sediment transport by wind, interior drainage basins, arroyos, alluvial fans, and types of sand dunes.
Lab Eight: humid and arid landforms as expressed on topographic maps, description, explanation, comparison of humid and arid environments, with measurements and calculations required.
Team Lab Report Seven

10. Glaciers: locations, snowline, alpine glaciers, erosional and depositional processes associated with alpine environments, continental glaciers, erosional and depositional processes associated with continental glacial environments.
Lab Nine: glacial, coastal, and karst landforms as expressed on topographic maps, description, explanation, comparison of the three different environments, with measurements and calculations required.
Team Lab Report Eight

11. Groundwater: economic importance, water table, groundwater flow, porosity, permeability, aquifers, aquicludes, overextraction, hazards such as sinkholes and subsidence, erosional and depositional processes, and uses of heated groundwater.
Third Lecture Exam
Lab Ten: introduction to geologic structures, strike and dip, principle of original horizontality, principle of superposition, horizontal strata and landforms, and folded strata and landforms. Measurements, calculations, and interpretation of structurally induced landforms required.

Team Lab Report Nine

12. Shorelines: interaction of hydrosphere, atmosphere, and lithosphere; uniqueness of wave-action to this environment, landforms, controls on shoreline development, submergent shorelines, and emergent shorelines.
Lab Eleven: fault nomenclature, fault-controlled landforms, types of faults, predicting direction of fault movement. Measurements, calculations, and interpretation of structurally induced landforms required.
Team Lab Report Ten

13. Ocean Basins: continental margins, continental shelf, continental slope, abyssal plains, oceanic ridges, oceanic trenches, and fracture zones (transform faults).
Lab Twelve: geologic hazards, landslide risks, earthquake hazards, volcanic hazards (before and after look at Mt. St. Helens and vicinity).
Team Lab Report Eleven

14. Plate Tectonics: evolution from "continental drift" to plate tectonics, the models comprising the paradigm, lithospheric plates, isostasy, seafloor spreading, subduction, transform faults, divergence, convergence, passive boundaries, and the ocean basin development cycle (or supercontinent cycle).
Lab Thirteen: Final practical exam on student's ability to describe and interpret map information (topographic and geologic maps).

15. Final Lecture Exam