

Format CO Course Outline

Physical Geology
Course Title

Science SC120
Dept. & Course No.

- I. Course Description:
This course will provide students with a sound understanding of the basic processes of geology. Topics include the origin, composition and structure of the earth; internal processes and plate tectonics; weathering and soil; and surface processes.
- II. Semester Credits: 4
- III. Contact Hours per Week: 3 3 6
Lecture Lab Total hours
- IV. Prerequisite: SC119
- V. Student Learning Outcome: VI. Course contents:

Upon completion of this course, the student will be able to perform the following with a minimum accuracy of 65%:

1. Give a concise definition of geology
 2. Compare and contrast the principles of **uniformitarianism** and **catastrophism** and give an example of each geologic change
 3. List the Earth's major eons in order of age and the three eras that comprise the most recent eons
 4. Briefly outline the formation of the universe and the solar system
 5. Define cost-benefit analysis and risk assessment and give examples of how these policies are implemented
 6. Explain the theories of continental drift and sea floor spreading, including supporting evidences for each theory
 7. Explain the theory of plate tectonics, including the major types of tectonic plate boundaries and the general relative motion of each, and their geologic implications; and describe a reasonable models for a mechanism that causes movement of tectonic plates
 8. Define a **mineral** by describing the properties that distinguish minerals from other substances and explain what is meant by "crystalline structure"
 9. Identify and describe conditions which allow minerals to grow well-formed crystals and conditions that prevent their growth.
 10. List and explain the physical properties of minerals most useful for identification; state the methods and techniques for identifying minerals and identify some common minerals
- A. Study of Earth and Geology
 1. The Science of Geology
 2. Uniformitarianism and Catastrophism
 3. Geologic Time
 4. Earth's Origin
 5. Geologic Changes & the Environment
 - B. Plate Tectonics
 1. Overview of Plate Tectonics
 2. The Earth's layers
 3. Plates and Plate Tectonics
 4. Consequences of Moving plates
 5. Mechanism of Moving Plates
 - C. Minerals
 1. What is a Mineral
 2. Chemical Composition of Minerals and Variations in Composition
 3. The Crystalline Nature of Minerals
 4. Physical Properties of Minerals
 5. Important Minerals
 6. Mineral Classification
 7. Silicate Minerals
 8. The Rock-Forming Minerals

11. List the rock-forming mineral groups, give an example of each mineral group, and further classify these minerals into silicate and non-silicate; explain why they are called “rock-forming”
12. Describe the term *rock* and explain the concept of the rock cycle by identifying the three basic types of rocks, and the process by which each type is formed
13. Compare and contrast the following: magma and lava; intrusive and extrusive igneous rocks; phaneritic and aphanitic texture
14. Compare and contrast the mineralogy, texture, and common geologic occurrence of the different types of igneous rocks: granite, rhyolite, basalt, gabbro, andesite, and peridotite
15. Briefly describe the phenomenon of *partial melting* and relate it to composition of igneous rocks
16. Compare and contrast the composition of granitic magma and basaltic magma and briefly explain the differences in behaviors of granitic magma and basaltic magma after they form and as they rise toward the Earth’s surface
17. Define the term *pluton*; identify and briefly describe the different pluton formations— batholith, stock, dike, dike swarm, sill
18. Describe the following types of geological structures formed when lava cool solidify: columnar joints, pillow lava; pyroclastic rock, volcanic ash, cinders, volcanic bomb
19. Compare the following types of volcanoes in terms to size, type of magma, style of activity, and form and provide examples of each: basalt plateau, shield volcano, cinder cone, composite volcano, and caldera
20. Briefly explain how geologist predict volcanic eruptions and strategies used to reduce risk of volcanic disasters
21. Explain the processes of soil *weathering, erosion, transport, and deposition*
22. Compare and contrast mechanical and chemical weathering
23. Briefly describe five processes which cause mechanical weathering: pressure-release fracturing, frost wedging, abrasion, organic activity, and thermal expansion and contraction
24. Briefly describe important processes of chemical weathering: dissolution, hydrolysis, and oxidation
25. Briefly describe the two processes which result from combinations of mechanical and chemical weathering —salt cracking and hydrolysis

D. Igneous Rocks

1. Rocks and the Rock Cycle
2. Igneous Rocks
3. Classification of Igneous Rocks
4. Common Igneous Rocks
5. Partial Melting

E. Plutons and Volcanoes

1. Behavior of Magma
2. Plutons
3. Volcanic Rocks and Volcanoes
4. Violent Magmas
5. Predicting Volcanic Eruptions & Risk Assessment

F. Weathering and Soils

1. Weathering
2. Mechanical Weathering
3. Chemical Weathering
4. Soil
5. Soil Nutrients
6. Soil-Forming Factors

26. Provide a **soil scientist's definition of "soil"**, identify components of healthy soil, and briefly describe the function of each
27. List the six soil-forming factors and briefly discuss each one: parent rock, climate, rates of plant growth and decay, slope angle and aspect, time, and transport
28. Briefly describe each type of sedimentary rock; Sedimentary rocks are broadly divided into four categories. List and briefly describe each category be able to cite examples of each category
29. Briefly describe the formation process of each type of sedimentary rock: lithification, precipitation & evaporation
30. Describe the following sedimentary structures and briefly explain how each one describes how sediment was transported and deposited: bedding or stratification, cross-bedding, ripple marks, graded bedding, mud cracks, and fossils
31. Briefly explain why accurate interpretations of depositional environments are important and give an example
32. Differentiate between a stable mineral and an unstable mineral; identify environmental conditions that when changed may cause a stable mineral to become unstable and metamorphous
33. Define the term **metamorphism**, and describe four main factors that cause and control metamorphism
34. Describe the two general kinds of changes that a rock undergoes during metamorphism, and briefly describe four types of metamorphism, describe the environment in which each occur, and name an example of each.
35. Describe metamorphic facies and explain how metamorphic rocks are grouped into facies.
36. Describe the two ways of measuring geologic time and briefly explain how they differ
37. Summarize the following principles and discuss how each one can be applied in the relative dating of rocks: **Principle of Original Horizontality**, **Principle of Superposition**, and **Principle of Crosscutting Relationship**
38. Explain a conformable relationship in sedimentary rocks and explain the differences among unconformities, disconformities, angular conformities, and nonconformities; identify geologic events recorded by disconformities, angular conformities, and nonconformities
39. Tell what fossils are; list five different types of fossils, and explain how they are formed; recognize some types of fossil organism

G. Sedimentary Rocks

1. Types of Sedimentary Rock
 - a. Clastic
 - b. Organic
 - c. Chemical
 - d. Bioclastic
2. Sedimentary Structures
3. Interpreting Sedimentary Rocks: Depositional Environments

H. Metamorphic Rocks

1. Mineral Stability and Metamorphism
2. Metamorphic Changes
3. Types of Metamorphism & Metamorphic Rocks
4. Measuring Metamorphic Grade

I. Geologic Time

1. Geologic Time
2. Relative Geologic Time
3. Unconformities
4. Fossils and Faunal Succession
5. Correlation
6. Absolute Geologic Time
7. Geologic Column and Time Scale

40. Discuss the **Principle of Faunal Succession** and the use of index fossil in time correlation
41. Differentiate between the two different types of correlations of rock units
42. Explain how radioactivity enables the absolute dating of some rocks; discuss the use of carbon dating
43. State the major events that mark the divisions of eons and eras; name the present eon and its three eras and twelve periods in chronological order
44. Explain the causes of earthquakes; explain how energy is stored prior to and then released during an earthquake
45. List five different factors that affect earthquake damage and discuss each one briefly
46. Discuss earthquake mechanisms at the three different types of tectonic plate boundaries
47. List safety measures to be taken before, during, and after an earthquake
48. Describe the Earth's interior structure and composition and how phases of each layers are determined
49. Describe the main differences between oceans and continents
50. Describe a magnetic reversal and explain how rocks preserve evidence of the orientation of the Earth's magnetic field at the time of their formation
51. Describe dimensions of mid-oceanic ridge and explain the origin of the rift valley in the center of the mid-oceanic ridge; sketch a cross-section of the mid-oceanic ridge, including the rift valley and label the topographic features
52. Describe the main types of sea-floor sediments and the origin of each type
53. Sketch a cross-section of both an active continental margin and a passive continental margin from the shoreline to the deep ocean basin and label the major topographic features of each and approximate elevation of each features
54. Compare and contrast seamounts, tablemounts, island arcs, oceanic islands
55. Describe the origin of a tectonic stress, the main types of stress—confining stress, directed stress, compression, extension stress, shear stress—and the geological implications of these stresses
56. Explain how mountains are formed
57. Describe the differences and similarities between the Andes and the Himalayan chain; explain why differences exist
58. Briefly outline one model for the formation of the continents

J. Earthquakes and the Earth's Structure

1. What is Earthquakes
2. Earthquake Waves
3. Earthquake Damage
4. Earthquakes and Tectonic Plate Boundaries
5. Earthquake Predictions
6. Earth's Interior

K. Geology of Oceans Basins

1. Earth's Ocean
2. Studying the Ocean Floor
3. Sea-Floor Magnetism
4. The Mid-Oceanic Ridge
5. Sediment and Rocks of the Deep Sea Floor
6. Continental Margins
7. Island Arcs
8. Seamounts and Oceanic Islands

L. Geologic Structures, Mountain Ranges, and Continents

1. Geologic Structures
 - a. Rock Deformation
 - b. Geologic Structures
2. Mountain Ranges and Continents
 - a. Mountains & Mountain Ranges
 - b. Island Arcs
 - c. The Andes
 - d. The Himalayan Mountain Chain
 - e. Origin of Continents

59. Define mass wasting; list and describe the different types of mass wasting and the subcategory of each type; list and describe the factors that control mass wasting and signs used to predict mass wasting; briefly describe steps that can be done to avoid landslides and/or reduce threats to human life and property damages
60. Describe the Earth's water resources, identify by percentage the amount of water stored in the major water reservoirs on Earth and the hydrologic cycle
61. Describe the factors that determine the velocity of stream flow and describe how those factors interact
62. Distinguish among the three types of stream erosion: hydraulic action, solution, and abrasion
63. List and explain three ways in which sediment can be transported by a stream; identify the type of transport that is independent of stream velocity and explain
64. Explain how a stream forms and shapes a valley
65. Describe the differences between an oligotrophic lake and a eutrophic lake
66. Differentiate between soil porosity and permeability; describe how soil porosity and permeability affects how water moves horizontally on the Earth's surface as well as vertically through the layers of the soil.
67. Describe reasons why ground water is a particularly valuable resource and the problems that can arise from excessive use of ground water
68. Discuss the differences between point and non-point pollution sources and their impacts on groundwater and other freshwater sources.
69. Explain karst topography, how it forms, and describe how it can be recognized; explain how caverns, speleothems, and sinkholes form
70. Describe a wetlands and the types of environments that are included in the wetlands category; describe how wetlands mitigate flooding and water pollution
71. Describe the three types of seawater movements
72. Draw a picture of a wave and label the crest, the trough, the wavelength, and the wave height; describe the factors that determine the size of a wave
73. Differentiate between emergent and submergent coastlines
74. Explain how global climate change and sea level rise affects coastlines.

M. Mass Wasting

1. Factors that Control Mass Wasting
2. Types of Mass Wasting
3. Mass Wasting Triggered by Earthquakes and Volcanoes
4. Predicting and Avoiding Landslides

N. Streams and Lakes

1. The Hydrologic Cycle
2. Streams
3. Stream Erosion
4. Stream Deposits
5. Downcutting and Base Level
6. Drainage Basins
7. Floods
8. Dams
9. Lakes

O. Groundwater and Wetlands

1. Characteristics of Groundwater
2. Movement of Groundwater
3. Use of Groundwater
4. Groundwater Pollution
5. Caverns & Karst Topography
6. Hot Springs and Geysers
7. Geothermal Energy
8. Wetlands

P. Coastlines

1. Ocean Waves, Tides, and Currents
2. The Water's Edge
3. Emergent and Submergent Coastlines
4. Sandy and Rocky Coastlines
5. Global Climate Change & Sea Level Rise

75. Briefly explain the conditions that produce deserts and explain why many deserts are concentrated along zones at 30° latitude in both the northern and southern hemisphere
76. Explain why angular topography is common in desert regions
77. Define the term *deflation* and explain why wind erosion is prominent in desert environment than it is in humid environment
78. Compare and contrast desert plateaus, mesas, and buttes; describe the formation of each
79. Define the term *desertification* and explain why land degradation is a better term for the changes that occur when a semiarid range is overgrazed.
80. Outline the major steps in the metamorphism of newly fallen snow to glacial ice
81. Differentiate between alpine glaciers and continental glaciers; distinguish between basal slip and plastic flow; describe the landforms created by alpine glaciers and continental glaciers
82. Define the term *drift* and differentiate between till and stratified drift, including the landforms composed of till and stratified drift
83. Describe the two categories of geologic resources and give examples of each
84. Differentiate between nonrenewable and renewable resources and give examples of each
85. Define the terms *ore* and *mineral reserves*; describe the three factors that can cause changes in estimates of mineral reserves
86. List the advantages and disadvantages of using coal, petroleum, and natural gas as fuels; describe the top three alternative resources and explain how conservation act as an alternative energy resource
87. Explain briefly how geological activities such as plate tectonic movements, mountain building, and volcanic eruptions influences climate change.

Q. Deserts

1. Desertification
2. Desert Landforms
3. Winds in Deserts
4. Changing Deserts

R. Glaciers and Ice Ages

1. Formation of Glaciers
2. Glacial Movement
3. Glacial Erosion
4. Glacial Deposits

S. Special Topics

1. Geologic Resources
 - a. Renewable vs. Nonrenewable
 - b. Metallic vs. Nonmetallic
 - c. Ore Formation
 - d. Mineral Reserves
 - e. Coal
 - f. Petroleum & Natural Gas
 - g. Nuclear Fuels
 - h. Alternative Energy Sources
2. Geology & Climate Change

VII. MATERIALS AND EQUIPMENT

- A. Laboratory and related equipments
- B. Standard Classroom equipments
- C. Laptop
- D. Digital Projector
- E. White screen
- F. TV / VCR / DVD
- G. Digital Camera
- H. Internet Access

VIII. TEXT

Required Student Textbook:

Hendrix, Thompson, & Turk. EARTH, 2nd Edition. Stamford, CT USA: Cengage Learning.
2015

IX. METHODS OF INSTRUCTION

- A. Lecture
- B. Class and lab demonstration
- C. Lab/Field Investigations
- D. Laboratory report writing
- E. Assigned reading in textbook
- F. In-class and take-home assignments based on textbook readings & class discussions
- G. Use of multimedia CDs & DVDs
- H. Internet Access to World Wide Web

X. METHOD OF EVALUATION

A. Grade Components

Component	Weight
Assignments & participation (lecture & lab)	20%
Laboratory reports	20%
Tests & Quizzes	20%
Mid-term Exam	20%
Final Exam	20%

B. Grade Scale

Percentage	Letter Grade
90% to 100%	A
80% to 89%	B
70% to 79%	C
65% to 69%	D
64% or below	F

**Form NC-2
TASK LISTING SHEET**

SC120 Physical Geology Credits: 3 1 48
Course No. & Title Lec Lab Total lab hrs.

Identify each laboratory objective below and list its accompanying task. Use the numbers for objectives and letters for tasks.

TASKS	TOTAL HOURS per OBJECTIVE
1. SLO #6 & 7 – Plate Tectonics Theory a) Recognize and name the major lithospheric plate of the earth and determine relative direction of motion for each major plate b) Reconstruct local histories of sea floor spreading and continental drift. c) Predict the effects of future plate movements.	3
2. SLO #9-11 - Identify minerals by testing each specimen for the following physical properties: a) Hardness b) Cleavage c) Streak d) Luster e) Color f) Magnetism g) Specific gravity	9
3. SLO #14, 28, 34 & 35 – Identify rocks by performing the following: a) Define the term <i>rock</i> b) State the three classification of rocks, c) Identify some common rocks in each classification d) Briefly explain formation of each e) Determine the major mineral composition of each rock.	6
4. SLO #11 – Identify rock-forming minerals by performing the following: a) Name the principal rock-forming minerals b) Determine the bonding or consolidation mechanism of igneous rocks, as contrasted with that of sedimentary rocks	3
5. SLO #55, 56 – Interpreting Topographic Maps by completing the following: a) Locate a point on topographic map and determine its elevation. b) Visualize topography by variations in the pattern of contour lines. c) Recognize changes in relative gradients and determine directions of stream flow. d) Calculate gradients between points. e) Construct a topographic map from an array of elevations.	3
6. SLO #51, 53, 54 –Construct Side-Profiles of Active and Passive Coastlines from topographic maps and identifying submarine features a) Construct topographic profiles and determine vertical exaggeration using bathymetric data from active shoreline and passive shoreline b) Recognize various types of ocean floor topography. c) Name specific submarine topographic features. d) Discuss the origin of submarine landforms. e) Discuss the differences between the active and passive shoreline submarine	3

features

7. **SLO #61-64 – Identify a major river on a topographic map of the local area and describe the drainage characteristics of the river and evaluate the factors which control drainage patterns and drainage density.** Visit the river to complete the following tasks: 6
- a) Measure water velocity, turbidity, and salinity at the different sections along the river including the river mouth and two different locations up stream to compare water chemistry
 - b) Collect sediment from these locations to determine the type of sediment in the river and observe sorting process as sediment flows downstream, and determine origin and maturity of sediments.
 - c) Identify various erosional and depositional landforms related to the action of flowing water in the river and flow of water
 - d) Evaluate the developmental stage of river segments
 - e) Observe the position of stream capture
8. **SLO #66, 67 – Ground Water** 3
- a) Evaluate ground water potential
 - b) Identify the various point-source and non-point source pollutants to an existing ground water that serves a local population or state
 - c) Explain why it is important to protect ground water and measures that need to take place to sustain local ground water resource
9. **SLO #69, 70 – Karst Topography and Wetlands** 6
- a) Observe and recognize karst topography around the island and relate island evolution to the formation of sinkholes and limestone caves
 - b) Visit a wetland and identify its unique properties and abilities to help surrounding ecosystems
10. **SLO #18, 28-31, 73 - Geological Structures (Volcanic Landforms & Sedimentary Structures) in Palau** 6
- a) Recognize geologic structures and volcanic landforms around Palau and explain their origin.
 - b) Recognize sedimentary structures around Palau and explain their origin
 - c) Determine whether coastlines are emergent or submergent and provide evidence(s) to justify reasoning

**PALAU COMMUNITY COLLEGE
SC120 Physical Geology
COURSE LEARNING OUTCOMES**

During the course experience, the *course learning outcomes* (CLOs) will be assessed through the use of signature assignments. A rating scale will be used to determine the students' proficiency level of each CLO using specifically aligned assignments. The numerical ratings of 5, 4, 3, 2 and 1 are not intended to represent the traditional school grading system of A, B, C, D and F. The descriptions associated with each of the numbers focus on the level of student performance for each of the course learning outcomes listed below.

Rating Scale:

4=Accomplished

3=Competent

2=Developing

1=Beginning

Course Learning Outcome #1: Knowledge on the basic concepts of physical geology – Students demonstrate competency in the basic concepts of physical geology by providing concise explanations and engaging in lively discussions about the way geology affects our planet and our lives in the following manner:

4	<p>Complete the following tasks with 90% accuracy or better:</p> <ul style="list-style-type: none"> • Summarize the formation of the Milky Way solar system, including Earth, its moon, its atmosphere, and its ocean; • Describe the unique characteristics of minerals, classify and identify common minerals; discuss the formation of the three types of rocks and identify common examples of each; • Explain why earthquakes occur and how they are measured; • Discuss formations of volcanoes and mountains and relate such geologic structures to the theory of plate tectonics; • Discuss the surface processes that shapes that shapes the Earth's surface including but not limited to soil formation and erosion, mass wasting, hydrologic cycle; • Differentiate between an emergent and submergent coastlines and the different features of each; • Discuss the formation and importance of various geologic resources including fossil fuel, mineral resources, and water; • Identify and briefly describe advantages and disadvantages of some alternative sources of energy that can be used for the purpose of sustaining nonrenewable geologic resources; • Relate geological activities such as plate tectonic movements, mountain building, and volcanic eruptions to global climate change
3	Complete all of the above with an accuracy of 70-89% or better
2	Completed all of the above with an accuracy of 65-69% or better
1	Complete all of the above with an accuracy of less than 65%