



National University of Engineering (UNI)

School of Civil Engineering

Syllabus 2027-I

1. COURSE

CE1G1. General Geology (Mandatory)

2. GENERAL INFORMATION

2.1 Course	: CE1G1. General Geology
2.2 Semester	: 2 nd Semester.
2.3 Credits	: 3
2.4 Hours	: 3 HT; 2 HP;
2.5 Duration of the period	: 16 weeks
2.6 Type of course	: Mandatory
2.7 Learning modality	: Face to face
2.8 Prerequisites	: None

3. PROFESSORS

Meetings after coordination with the professor

4. INTRODUCTION TO THE COURSE

The General Geology course provides the future civil engineer with the descriptive and analytical foundations of Earth Sciences: the minerals and rocks that constitute geological materials, the structures that record the deformation of the Earth's crust, surface weathering and erosion processes, geological time and the reading of geological maps, and an introduction to applied geology for site characterization. This knowledge constitutes the indispensable conceptual foundation upon which subsequent courses in Soil Mechanics and Geotechnical Engineering are built.

5. GOALS

- Identify the most common minerals and rocks and relate their properties to their expected engineering behavior.
- Recognize and interpret geological structures — folds, faults, and joints — and their influence on the stability of rock masses.
- Understand the processes of weathering, erosion, and landform development relevant to site condition assessment.
- Read and interpret geological maps, stratigraphic columns, and cross-sections.
- Apply the fundamentals of general geology to the preliminary reconnaissance and descriptive characterization of civil engineering sites.

6. COMPETENCES

ABET-1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. (Usage)

ABET-6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions. (Usage)

7. TOPICS

Unit 1: Mineralogy (6 hours)	
Competences Expected: ABET-1,ABET-6	
Topics	Learning Outcomes
• Crystal structure and habit of minerals • Main groups of rock-forming minerals: silicates, carbonates, oxides, and sulfates • Mohs hardness scale and scratch tests • Cleavage, fracture, and other diagnostic physical properties • Luster, color, and streak as identification criteria • Basic chemical composition and reaction with dilute hydrochloric acid	• Identify the most common rock-forming minerals using physical properties [Familiarity] • Apply the Mohs scale to determine the relative hardness of mineral samples [Usage] • Distinguish similar minerals through cleavage, fracture, and luster [Assessment] • Relate the mineral composition of a rock to its expected engineering behavior [Familiarity] • Perform simple field tests (scratch, acid, luster) for mineral identification [Usage]
Readings : [Tarbuck2014]	

Unit 2: Petrology and the Rock Cycle (6 hours)	
Competences Expected: ABET-1	
Topics	Learning Outcomes
• Classification of intrusive and extrusive igneous rocks by texture and composition • Sedimentary rock formation processes: erosion, transport, deposition, and lithification • Classification of clastic, chemical, and biochemical sedimentary rocks • Metamorphic processes: contact and regional metamorphism • Classification of foliated and non-foliated metamorphic rocks • The rock cycle and transformations between lithologic types • Relevant engineering properties of rocks: strength, durability, and alterability	• Classify hand samples of igneous rocks according to their texture and mineral composition [Assessment] • Explain the formation processes of sedimentary rocks and their engineering significance [Familiarity] • Recognize foliated and non-foliated metamorphic textures in hand samples [Usage] • Trace the pathways of the rock cycle among the three lithologic groups [Familiarity] • Qualitatively evaluate the suitability of a rock type for use as a construction or foundation material [Assessment]
Readings : [Tarbuck2014], [Marshak2015]	

Unit 3: Structural Geology (6 hours)	
Competences Expected: ABET-1,ABET-6	
Topics	Learning Outcomes
• Stress and strain concepts in rocks • Fold types: anticlines, synclines, and their geometric elements • Fault types: normal, reverse, and strike-slip • Joint sets and their influence on rock mass strength • Measurement and interpretation of strike and dip • Unconformities and their significance in geologic history • Influence of geologic structures on slope and excavation stability	• Differentiate folds, faults, and joints based on their geometric features [Familiarity] • Measure the strike and dip of geologic planes using a geologic (Brunton-type) compass [Usage] • Interpret the orientation of structural discontinuities relative to an excavation or slope [Assessment] • Assess the influence of joint sets on the stability of a rock mass [Assessment] • Recognize unconformities and relate them to regional geologic history [Familiarity]
Readings : [Billings1972]	

Unit 4: Geomorphology, Weathering, and Erosion Processes (4 hours)	
Competences Expected: ABET-1	
Topics	Learning Outcomes
• Physical weathering: thermal fragmentation, frost wedging, and unloading • Chemical weathering: hydrolysis, oxidation, and dissolution • Biological weathering and bioerosion • Residual soil formation from in-situ weathering • Main landforms: valleys, terraces, alluvial fans, and debris cones • Water and wind erosion processes and mass wasting processes	• Distinguish physical, chemical, and biological weathering types present at an outcrop [Familiarity] • Relate the degree of weathering of a rock to the expected quality of a rock mass [Usage] • Identify landforms and their geomorphological origin [Familiarity] • Evaluate the susceptibility of a slope to erosion and mass wasting processes [Assessment] • Apply weathering grade classification criteria to estimate the durability of rock materials in slopes [Usage]
Readings : [Tarbuck2014]	

Unit 5: Geologic Time, Stratigraphy, and Geologic Mapping (6 hours)	
Competences Expected: ABET-6	
Topics	Learning Outcomes
• The geologic time scale and the magnitude of deep time • Principles of relative dating: superposition, original horizontality, and cross-cutting relationships • Construction and interpretation of stratigraphic columns • Symbolology and conventions of geologic maps • Construction of geologic cross-sections from maps • Stratigraphic discontinuities and their expression on geologic maps • Basic field geologic mapping techniques	• Explain the principles of relative dating to establish stratigraphic sequences [Familiarity] • Read and interpret standard geologic maps, including their symbolology and legend [Usage] • Construct a geologic cross-section from a geologic map and strike/dip data [Assessment] • Correlate stratigraphic units between columns from different localities [Assessment] • Apply basic field geologic mapping techniques for a simple survey [Usage]
Readings : [Compton1985]	

Unit 6: Basic Surface and Groundwater Hydrology of Geologic Materials (4 hours)	
Competences Expected: ABET-1	
Topics	Learning Outcomes
• Porosity and permeability of soils and rocks • Water table concept and the unsaturated zone • Basic concepts of aquifer, aquitard, and aquiclude • Springs, seeps, and their relationship to the geologic context • Surface drainage patterns and their relationship to lithology and structure • Water-rock interaction and its influence on weathering	• Differentiate the concepts of porosity and permeability for different geologic materials [Familiarity] • Describe the position of the water table and its seasonal variation at a given site [Familiarity] • Relate the occurrence of springs and seeps to the local geologic and hydrogeologic context [Usage] • Identify surface drainage patterns characteristic of different geologic conditions [Assessment] • Explain conceptually the water-rock interaction and its role in chemical weathering [Familiarity]
Readings : [Tarbuck2014]	

Unit 7: Applied Geology (6 hours)	
Competences Expected: ABET-1,ABET-6	
Topics	Learning Outcomes
• Preliminary geologic site reconnaissance • Qualitative description of rock masses: degree of fracturing and weathering • Types of geologic hazards: landslides, rockfalls, seismic and volcanic activity • Use of aerial photographs and remote sensing imagery in geologic reconnaissance • Basic elements of a preliminary geologic site report • Use of field tools: geologic compass, GPS, hand lens, and rock hammer • Influence of geologic conditions on infrastructure site selection	• Conduct a preliminary geologic reconnaissance of a site of interest for civil engineering [Usage] • Qualitatively describe the degree of fracturing and weathering of a rock mass [Assessment] • Recognize the main types of geologic hazards that can affect an infrastructure project [Familiarity] • Use basic field tools to gather geologic information [Usage] • Prepare a preliminary geologic site report with basic recommendations for further studies [Assessment]
Readings : [GonzalezDeVallejo2002]	

8. WORKPLAN

8.1 Methodology

Individual and team participation is encouraged to present their ideas, motivating them with additional points in the different stages of the course evaluation.

8.2 Theory Sessions

The theory sessions are held in master classes with activities including active learning and roleplay to allow students to internalize the concepts.

8.3 Practical Sessions

The practical sessions are held in class where a series of exercises and/or practical concepts are developed through problem solving, problem solving, specific exercises and/or in application contexts.

9. EVALUATION SYSTEM

***** EVALUATION MISSING *****

10. BASIC BIBLIOGRAPHY