NATIONAL UNIVERSITY OF ENGINEERING

COLLEGE OF GEOLOGICAL, MINING AND METALLURGICAL ENGINEERING

MINING ENGINEERING PROGRAM

GE102 – FIELD GEOLOGY

I. GENERAL INFORMATION

CODE	**:**	GE102 Field Geology
SEMESTER	**:**	8-10
CREDITS	**:**	3
HOURS PER WEEK	**:**	5 (Theory – Practice)
PREREQUISITES	**:**	GE001 General Geology
CONDITION	**:**	Elective (E)

II. COURSE DESCRIPTION

Identify soils and rocks and have a vast knowledge about several geological phenomena related to diverse types of geological and mining engineering. In every class students carry out workshops. Students will be provided knowledge about minerals, soils and rocks, tectonics, valleys, groundwater, geological planes, photogeology, the rock as construction material, tunnels, coastal defense, sedimentation, constructions, bridges, pavement, airports, dams, soil removal, channels, external geodynamics and internal geodynamics.

III. COURSE OUTCOMES

1. Describe and analyze several geological processes that occur on Earth.
2. Identify and describe the geological context in the application to several civil and mining engineering works.

IV. LEARNING UNITS

1. GENERAL CONCEPTS / 4 HOURS

Introduction / Reason for the course of Geology / Definitions of geology, Applied Geology and Geotechnics / Geological History/ Geology History / Geological time scale /Peru geography and physiography / Mineralogy / Definition of minerals / Physical properties of minerals.

2. ROCKS AND TECTONICS / 4 HOURS

Classification of rocks: igneous rock and its minerals / sedimentary rock and its minerals / metamorphic rocks and its minerals / Rock engineering properties.

Structural geology: fractures and faults / Form of folds

3. SOILS, VALLEYS AND GROUND WATERS / 4 HOURS

Geological study of soil: Soil parts / Types of soil. Types of valleys: river valley / Glacial valley. Development of a river: juvenile sector, maturity, old age. Groundwater research: Groundwater parts / Determination of the groundwater trajectory direction, its velocity, its gradient, its water level and its permeability coefficient.

4. UNDERGROUND RESEARCH / 4 HOURS

Soil sampling: How to carry out soil sampling / Drilling: Types of drilling and its registers / Geophysical research / Types of geophysical research: Seismic geophysical research / electric geophysical research / Magnetometric geophysical research / gravimetric geophysical research.

5. GEOLOGICAL PLANES AND PHOGEOLOGY / 4 HOURS

Geological cartography: Steps in the geological surveying / Scales / Conventional signals / Photogeology; its importance / Scales, interpretation / Geological sketch surveying with aerial photographs.

6. ROCK AS CONSTRUCTION MATERIAL / 4 HOURS

Research of construction materials: Their application / Quarry / Exploitation / rock material crushing: dangers / Gravel and sand study / Aggregate / Aggregate for roads and railroads.

7. TUNNELS / 4 HOURS

Geological study of tunnels: terminology, sustainability / Tunnel behavior in relation to stratus and faults position / Their temperature / Rock pressure in tunnels / Geological surveying of a tunnel.

8. COASTAL DEFENSE AND SEDIMENTATION / 4 HOURS

Geological study of coastal defense: coasts and beaches, tides, ocean soil subdivisions / Sandspit, ports location, airports location according to wind.

Sedimentation engineering elements / Reservoir life by sedimentation effect.

9. CONSTRUCTIONS / 4 HOURS

Foundation: types of foundation / Piers / Foundation according to soil type / Foundation in residential, commercial and industrial buildings.

10. BRIDGES, PAVEMENTS AND AIRPORTS / 4 HOURS

Geology for bridges / types of bridges / Bridge support and piers / Geological research about bridges / Dry dams, pavement geology: types of pavement, parts of pavement in vertical section. Geology in airport construction / Airport foundation.

11. DAMS / 4 HOURS

Geology applied to dams: Classification of dams / brickwork dam / Buttress dam / Arc dam / Weir. Dam Geotechnics: displacement, turn, settlement, damming, support and base problem, dam foundation, case hardening to waterproof the dam support and base / Geological research for the location of a dam.

12. SOIL REMOVAL / 4 HOURS

Geological aspects in the soil removal: terminology / Soil removal equipment / Soil quarry / Embankment foundations / Embankment density, Compaction trial / Soil mechanics study of soil embankments. Soil dams: Generalized definitions of soil dams / Side protection of soil dams / Channels formation, how to avoid those channels, Soil dam rupture / Geotechnical research in soil removal.

13. CHANNELS / 4 HOURS

Channels geology: types and parts of a channel / Channel lining / Geotechnical research of channels.

14. EXTERNAL AND INTERNAL GEODYNAMICS / 4 HOURS

External geodynamics geology / Displacements, detachments / landslides, downhill creep, sand liquefaction, settlement / Solution to those external geodynamics phenomena.

Earthquakes / Origin of earthquakes / Hypocenter and epicenter / Types of seismic waves / Earthquake scale / Earthquake problem in civil engineering.

V. PRACTICAL EXPERIENCES

Two field practices will be carried out: The first field practice will be at Malecón de Chorrillos, Costa Verde and La Herradura, this practice will be held on Sunday, the field grade will be averaged out with the handing over of a report, and such test corresponds to the 3rd practice given before the midterm exam. The second field practice will be held in a place to be determined one Sunday, the field grade will be averaged out with the handing over of a report and such test correspond to the 5th practice given before the final exam.

VI. METHODOLOGY

Exposition of the units with transparencies and multimedia. Discussion about every single subject with all the class, questions on that regard to students and answers to questions posed by students. Complementation of the exposition of transparencies mentioned with slides about cases in Peru. At the beginning of the class 1 hour theory and 1 hour workshop.

VII. EVALUATION FORMULA

The average grade PF is calculated as follows:

PF = (EP+EF+((1PA+2PC+3PA+4PC+5PA)/4)/3

EP: Mid-Term Exam EF: Final Exam
PA: Classroom practice PC: Field practice

VIII. BIBLIOGRAPHY

1. **KRYNINE. D. JUDDD, W**
   "Principles of Geology and Geotechnics for Engineers" (Spanish)
   Omega Editions, Mexico, p. 1-829, 1986
2. **LEGGET, R. KARROW, P**
   Geology Applied to Civil Engineering (Spanish)
   Mc. Graw-Hill, p. 1-900, 1986

IX. COURSE CONTRIBUTIONS TO STUDENT OUTCOMES ATTAINMENT

Course contributions to Student Outcomes are shown in the following table:

Level 1: Know
Level 2: Comprehend, calculate
Level 3: Model, apply, solve
Level 4: Apply at advanced level, design. Achievement of Student Outcome

Outcome	Contribution
1. Engineering Design Design and integrate mining systems and components satisfying requirements and needs as well as given technical, economic, social and legal constraints and limitations.	3
2. Problem solving Identify, formulate and solve engineering problems properly using the methods, techniques and tools of mining engineering.	4
3. Sciences Application Apply the knowledge and skills of mathematics, sciences and engineering to solve mining engineering problems.	4
4. Experimentation and Testing Conceive and conduct experiments and tests, analyze data and interpret results.	4
5. Modern Engineering Practice Use and apply techniques, methods and tools of modern engineering necessary for the practice of mining engineering.	4
6. Engineering Impact Understand the impact of mining engineering solutions on people and society in local and global contexts.	4
7. Project Management Determine the budgets, schedules and feasibility of engineering projects, and participate in its management for the attainment of goals.	3
8. Environmental Appraisal Take into account the importance of preserving and improving the environment in the development of their personal and professional activities	4
9. Lifelong Learning Recognize the need to keep their knowledge and skills up-to-date according to advances of mining engineering and engage in lifelong learning.	3
10. Contemporary Issues Know and analyze relevant contemporary issues in local, national and global contexts.	4
11. Ethics and Professional Responsibility Evaluate their decisions and actions from a moral perspective and assume responsibility for the executed projects.	4
12. Communication Communicate clearly and effectively in oral, written and graphical formats, interacting with different types of audiences.	4
13. Teamworking Appraise the importance of teamworking and participate actively and effectively in multidisciplinary teams.	4