



# NATIONAL UNIVERSITY OF ENGINEERING COLLEGE OF CIVIL ENGINEERING

## CIVIL ENGINEERING PROGRAM

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### SYLLABUS - APPLIED GEOLOGY

#### I. GENERAL INFORMATION

<b>CODE</b>	: GE831
<b>SEMESTER</b>	: 8
<b>CREDITS</b>	: 4
<b>HOURS PER WEEK</b>	: 6 (Theory – Practice)
<b>PREREQUISITES</b>	: Soil Mechanics II
<b>CONDITION</b>	: Compulsory
<b>DEPARTMENT</b>	: Soil Mechanics
<b>INSTRUCTOR</b>	: Jorge Agramonte, Cesar Vasquez, Julio Zedano, Luis Gonzales
<b>INSTRUCTOR E-MAIL</b>	: jagram@gmail.com

#### II. COURSE DESCRIPTION

Identify soils and rocks upon which civil engineering works are built, and have a vast knowledge about several geological phenomena related to diverse types of civil engineering constructions. Every single class students carry out workshop. 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. Students should be able to describe and analyze several geological processes that occur on Earth.
2. Students will be able to identify and describe the geological context in the application to several civil engineering works.

#### IV. LEARNING UNITS

##### 1. 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

##### 2. SOILS, VALLEYS AND GROUNDWATERS / 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.

##### 3. 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.

#### **4. GEOLOGICAL PLANES AND PHOTO GEOLOGY / 4 HOURS**

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

#### **5. 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.

#### **6. TUNNELS / 4 HOURS**

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

#### **7. 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.

#### **8. CONSTRUCTIONS / 4 HOURS**

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

#### **9. 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.

#### **10. SOIL REMOVAL / 8 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 the soil removal.

#### **V. PRACTICAL EXPERIENCES**

Two field practices are carried where students, under the guidance of instructors, analyze the geological characteristics of different regions of Lima or other nearby cities. Students should present a report.

#### **VI. METHODOLOGY**

Exposition of the learning units using multimedia projection. Discussion about every single subject with all the class, questions on that regard to students and answers to questions posed by students. Presentation and discussion on geological cases in Peru.

#### **VII. EVALUATION FORMULA**

The average grade PF is calculated as follows:

$$PF = 0.3 EP + 0.3 EF + 0.2 PP + 0.2 PC$$

EP: Mid-Term Exam

EF: Final Exam

PP: Average of four quizzes

PC: Two report of in-field practice

#### **VIII. BIBLIOGRAPHY**

**1. KRYNINE. D. JUDD, W**

Principles of Geology and Geotechnics for Engineers  
Omega Editions, Mexico, 2001

**2. LEGGET, R. KARROW, P**

Geology Applied to Civil Engineering  
Mc. Graw-Hill, 2002

## IX. COURSE CONTRIBUTIONS TO STUDENT OUTCOMES ATTAINMENT

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

**K** = Key

**R** = Related

**Empty box** = Does not apply

	<b>Outcome</b>	<b>Contribution</b>
Engineering Design	Design civil works satisfying requirements and needs as well as given constraints and limitations.	<b>R</b>
Problem solving	Identify, formulate and solve engineering problems properly using the methods, techniques and tools of civil engineering.	<b>K</b>
Sciences Application	Apply the knowledge and skills of mathematics, sciences and engineering to solve civil engineering problems.	<b>K</b>
Experimentation	Conceive and conduct experiments, analyze data and interpret results	<b>K</b>
Modern Engineering	Use and apply techniques, methods and tools of modern engineering necessary for the practice of civil engineering.	<b>R</b>
Engineering Impact	Understand the impact of engineering solutions on people and society in local and global contexts.	<b>R</b>
Project Management	Plan and manage civil engineering projects taking into account efficiency and productivity criteria.	<b>K</b>
Environmental Appraisal	Takes into account the importance of preserving and improving the environment in the development of their personal and professional activities.	<b>K</b>
Lifelong Learning	Recognize the need to keep their knowledge and skills up to date according to advances of civil engineering and engage in lifelong learning.	<b>R</b>
Contemporary Issues	Know and analyze relevant contemporary issues in local, national and global contexts.	<b>K</b>
Ethics and Professional Responsibility	Evaluate their decisions and actions from a moral perspective and assume responsibility for the executed projects.	<b>R</b>
Communication	Communicate clearly and effectively in oral, written and graphical formats, interacting with different types of audiences.	<b>K</b>
Teamworking	Appraise the importance of teamworking and participate actively and effectively in multidisciplinary teams.	<b>K</b>