

# FACULTY OF **ENGINEERING**

## DEGREE COURSE: **CIVIL AND ENVIRONMENTAL ENGINEERING**

### MASTER DEGREE: **CIVIL ENGINEERING**

#### **SUBJECT:** APPLIED GEOLOGY

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#### **OBJECTIVES:**

- 1 – Providing the essential tools to solve some important engineering problems and reduce the geological hazards arising in the interaction between man and environment ;
- 2 - Providing the essential tools to conduct enquiries and to give an interpretation of data contained in geological and technical geological reports.
- 3 -Providing knowledge about the means and methodology of a survey in order to be used in applied geology.

#### **CONTENTS:**

1. Activity inside the Earth
  - A. The interior of the Earth
    - I. Constitutive model of the Earth
    - II. Generation and propagation of the heat
    - III. Thermal state
  - B. Seismic activity
    - I. Nature and origin of earthquakes
    - II. Seismic waves propagation and recording
    - III. Magnitude and intensity
    - IV. Effects of earthquakes
    - V. Geographic distribution of earthquakes
  - C. Volcanoes activity
    - I. The different types of volcanoes
    - II. Volcanic deposits
    - III. Types of volcanic eruptions
    - IV. The geographical distribution of volcanoes
    - V. Secondary effects of volcanic eruptions
    - VI. Geothermia
    - VII. Hydrothermalism
  - D. Igneous rocks
    - I. Fusion and crystallization
    - II. Magmatic differentiation
    - III. Magma genesis
  - E. Metamorphic rocks

- I. Metamorphism
- II. Thermal metamorphism
- III. Regional metamorphism
- F. Litogenetic cycle
- G. Plate tectonics
  - I. The global model
  - II. Expansion of the ocean floor and continental drift
  - III. The driving force behind plate tectonics
- 2. The Earth's Crust
  - A. Modeling of the Earth
    - I. Weathering
    - II. The geomorphic action of wind
    - III. Mechanical action of water currents
    - IV. Solvent action of water
      - 1. Karstic phenomena and the water cycle
    - V. Geomorphic effects of glaciers
    - VI. Coastal erosion
  - B. Sedimentary processes
    - I. Sedimentary cycle
    - II. Environments of sedimentation
  - C. Sedimentary rocks
    - I. Clastic and detrital rocks
    - II. Organogenic rocks
    - III. Rocks with chemical origins
- 3. Deformation of the Earth's Crust
  - A. The lithological succession
    - I. Facies
    - II. Transgressions (to provide information about the changes in sea level ) and gaps
  - B. Deformation of the rocks
    - I. Fractures
    - II. Folds
  - C. The geometry of geological bodies
- 4. Methods of subsoil investigation, directly and indirectly
  - A. The mechanical explorations
    - I. Drilling methods
    - II. Drawing a stratigraphic profiles
  - B. Geophysical explorations
    - I. Gravity survey
    - II. Electrical prospecting
    - III. Seismic prospection
    - IV. GPR global positioning system
- 5. Geological detection techniques
  - A. The subject and the methods of geological detection
  - B.
  - C. Methods of mapping
    - I. Geological maps
      - 1. Elaboration
      - 2. Interpretation
    - II. The geological sections
- 6. Geological hazard

- A. Rock mass and geomechanical classification
  - B. Porosity and permeability in the rocks mass and in the land
  - C. Criteria to evaluate the existence of groundwater.
  - D. The identification of acquirers and their classification
  - E. Well pumping
  - F. Landslides: factors, causes and classification.
  - G. Defence works to control soil erosion.
  - H. Protection against avalanches
  - I. Preliminary investigations, remediation and monitoring
7. Applied geology used in Civil Engineering
- A. Foundation
    - I. Stability of the foundation soils
    - II. Criteria for the selection of the foundation
  - B. Lines of communication
    - I. Roads trenches, road embankments
    - II. Railways
    - III. Airports
  - C. Underground excavations
    - I. Geomorphic conditions and tendency to change tectonic stratigraphy
    - II. Hydrogeological conditions
    - III. Tools of excavation and methods of continuing
    - IV. The resistance of breakdown
    - V. Presence of gas and geothermal conditions
  - D. Reservoirs and dams
    - I. Geological criteria for the site selection and dam division
    - II. Water proofing of the reservoirs
    - III. Stability of the banks
    - IV. Monitoring the stability of the structure
  - E. Complements:
    - I. Complement 1: Mechanical drilling
    - II. Complement 2: Hydrogeology
    - III. Complement 3: Piezometers
    - IV. Complement 4: Samples
    - V. Complement 5: Hydraulic barriers
    - VI. Complement 6: D.LGS.81/08

## **ASSESSMENT**

Written exam: multiple choice and open questions

## **RECOMMENDED TEXTBOOKS**

Terry R. West, Geology Applied to Engineering

Waveland Press, Incorporated, 2010

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