



Study Plan

School: School of Sciences and Technology

Degree: Bachelor

Course: Geological Engineering (cód. 176)

1st Year - 1st Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0900L	Linear Algebra and Geometry I	Mathematics	6	Semester	156
MAT0905L	Mathematical Analysis I	Mathematics	6	Semester	162
FIS0691L	Physics 1.1	Physics	5	Semester	136
QUI1090L	General Chemistry	Chemistry	6	Semester	156
GEO0749L	General Geology	Geosciences	6	Semester	155

1st Year - 2nd Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT0906L	Mathematical Analysis II	Mathematics	6	Semester	162
MAT0925L	Introduction to Probability and Statistics	Mathematics	6	Semester	154
FIS0692L	Physics 1.2	Physics	5	Semester	136
ERU0469L	Computer Assisted Technical Drawings	Civil Engineering	3	Semester	78
GEO1817L	Mineralogy	Geosciences	7	Semester	175
GEO1818L	Introduction to Geologic Engineering	Geological Engineering	4	Semester	100

2nd Year - 3rd Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
INF0878L	Programming	Informatics	6	Semester	156
ERU0482L	Surveying	Civil Engineering	4	Semester	104
GES0790L	Management	Management	5	Semester	135
GEO1819L	Petrology	Geosciences	6	Semester	160
GEO0748L	Structural Geology	Geosciences	6	Semester	160
Group of Free Options					

2nd Year - 4th Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
GEO0754L	Hydrogeology	Geosciences	6	Semester	156
GEO0763L	Field Techniques in Geosciences	Geosciences	5	Semester	132
GEO0745L	Engineering Geology	Geosciences	6	Semester	159
ERU0568L	Hydraulics	Water Resources Engineering	5	Semester	130



2nd Year - 4th Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
GEO0735L	SIG Remote Sensing	Geosciences	5	Semester	130
GEO0760L	Sedimentology	Geosciences	3	Semester	78

3rd Year - 5th Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
GEO0759L	Mineral Resources	Geosciences	6	Semester	160
GEO1820L	Mineral Resources	Geosciences	7	Semester	185
GEO0518L	Soil Mechanics and Foundations I	Geological Engineering	6	Semester	159
GEO1821L	Soil Mechanics and Foundations	Geological Engineering	7	Semester	180

Group of Options

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
ERU0480L	Strength of Materials I	Civil Engineering	5	Semester	130
FIS0708L	Applied Geophysics	Physics	6	Semester	156
FIS1824L	Applied Geophysics	Physics	7	Semester	185
GEO1825L	Surveys	Geological Engineering	4	Semester	104
GEO1826L	Surveys	Geological Engineering	5	Semester	135
GEO0516L	Geostatistics	Geological Engineering	5	Semester	130
GEO1827L	Geostatistics	Geological Engineering	6	Semester	150
GEO1828L	Safety Hygiene at Work	Geological Engineering	4	Semester	110
GEO1829L	Safety Hygiene at Work	Geological Engineering	5	Semester	135
QUI0574L	Quality and Use of Water	Water Resources Engineering	6	Semester	156
ERU0571L	Water Resources Monitoring	Water Resources Engineering	5	Semester	130

Group of Free Options

3rd Year - 6th Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
GEO0517L	Rock Mechanics	Geological Engineering	6	Semester	161
GEO1822L	Rock Mechanics	Geological Engineering	7	Semester	180
GEO0515L	Georesources Exploitation	Geological Engineering	9	Semester	234
GEO1823L	Georesources Exploitation (PE)	Geological Engineering	10	Semester	270



3rd Year - 6th Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
Group of Options					
Component code	Name	Scientific Area Field	ECTS	Duration	Hours
GEO0519L	Industrial and Ornamental Rocks	Geological Engineering	5	Semester	130
GEO1830L	Industrial and Ornamental Rocks	Geological Engineering	6	Semester	155
GEO1831L	Slope Stability	Geological Engineering	5	Semester	130
GEO1832L	Slope Stability (PE)	Geological Engineering	6	Semester	155
GEO0752L	Applied Geochemistry	Geosciences	5	Semester	130
GEO1833L	Applied Geochemistry (PE)	Geosciences	6	Semester	160
GEO0738L	Geological Cartography	Geosciences	5	Semester	140
GEO1834L	Geological Cartography	Geosciences	6	Semester	160
GEO1835L	Environment Geology and Regional Planning	Geosciences	5	Semester	130
ERU0567L	Inspection of Hydraulic Works	Water Resources Engineering	4	Semester	104
Group of Free Options					

Conditions for obtaining the Degree:

*** TRANSLATE ME: Engenharia Geológica

Para obtenção do grau de licenciado em Engenharia Geológica é necessário obter aprovação a 147 a 151 ECTS em unidades de curriculares obrigatórias e 29 a 33 ECTS em unidades curriculares optativas (esta variação depende se a UC decorre na Universidade ou numa empresa) distribuídas da seguinte forma:

1º Ano

1º Semestre:

5 UC Obrigatórias num total de 29 ECTS

2º Semestre

6 UC Obrigatórias num total de 31 ECTS

2º Ano

3º Semestre

5 UC Obrigatórias num total de 27 ECTS

1 UC Optativa livre num total de 3 ECTS

4º Semestre

6 UC Obrigatórias num total de 30 ECTS

3º Ano

5º Semestre

2 UC Obrigatórias num total de 12 a 14 ECTS

3 UC Optativa condicionadas num total de 14 a 16 ECTS

1 UC Optativa livre num total de 2 a 4 ECTS

6º Semestre

2 UC Obrigatórias num total de 15 a 17 ECTS

3 UC Optativa condicionadas num total de 13 a 15 ECTS

Program Contents



[Back](#)

Linear Algebra and Geometry I (MAT0900L)

Systems of linear equations.

Matrices.

Determinants.

Vector spaces.

Linear applications.

Eigenvalues and eigenvectors.

Geometry of plane and space.

Quadratic forms.

[Back](#)

Mathematical Analysis I (MAT0905L)

[Back](#)

Physics 1.1 (FIS0691L)



[Back](#)

General Chemistry (QUI1090L)

Course contents

1. Introduction

1.1 Models of atoms

The principal quantum number

Atomic orbitals

Hydrogen atom

Orbital Energies

Electronic structure of polielectronic atoms

The building-up Principle. The Aufbau rule. Exclusion Principle of Pauli. Hund's rule

1.2 The Periodic Table

Periodic classification of the elements.

Electronic structure and the Periodic Table

Periodic variation in physical properties

Effective nuclear charge

Atomic and ionic Radius

Ionization Energy, Electronegativity and electron Affinity

2. Chemical Bonding

2.1 Lewis structures. Octet Rule.

2.2 Bond types: ionic, covalent and metallic

2.3 The Ionic Bond

Ionic bond formation.

Ions interaction

Lattice energy of ionic compounds

Ionic solids

Polarizability and the ionic character of ionic bonds

2.4 The Covalent Bond

2.4.1 Lewis structure for polyatomic species

The concept of Resonance

Formal charge

Electronegativity and Polar bonds

2.4.2 Covalent bond strength.

The variation of bond strength. Dissociation energy. Bond length.

2.4.3 Exceptions to the Octet Rule: radicals and biradicals; expanded valence shell, incomplete octet

2.4.4 Coordinative covalent bond. Complexes and coordination compounds.

Ligands. Coordination number.

Chelate; bi- and polidentate ligands.

2.4.5 Molecular shape and structure

The VSEPR model

Molecules with lone pairs on the central atom

Valence Bond Theory

Hybridization of orbitals

Hybridization in a more complex molecules

Characteristics of double bonds

Benzene ring and Kekule structures

Polyatomic molecules

Polar molecules

2.5 Metallic bond

Band theory. Conductor and semiconductors.

Metals properties

3. Properties of gases, Liquids and Solids

3.1.1 Properties of gases

Pressure

Boyle's Law. Charles and Gay-Lussac's Law

Avogadro Principle.

3.1.2 The Ideal Gas model. Equation of Ideal Gases.

Gas density

3.1.3 Mixture of gases. Partial Pressure and Dalton's Law

3.1.4 Real Gases. Deviation from linearity.



[Back](#)

General Geology (GEO0749L)

[Back](#)

Mathematical Analysis II (MAT0906L)

[Back](#)

Introduction to Probability and Statistics (MAT0925L)

Descriptive Statistics Basic Probability Notions Conditional probabilities and independence Random Variables and Vectors More important Discrete and Continuous distributions Statistical Inference (parametric and non parametric) Linear Regression Analysis

[Back](#)

Physics 1.2 (FIS0692L)

[Back](#)

Computer Assisted Technical Drawings (ERU0469L)

[Back](#)

Mineralogy (GEO1817L)

1. Introduction: History and evolution of Mineralogy.
2. Concept of mineral: Mineral and crystal concepts. State types of matter.
3. Elementary crystallography: 2-D Symmetry, 2-D plane lattices and plane groups. 3-D Symmetry, crystallographic systems, Bravais lattice and 3-D point groups. Introduction to 3-D space groups. Crystal morphology, Miller index and crystallographic form. Introduction to x-ray crystallography and crystal axes. Twinning.
4. Crystal-chemistry: Ionic radius, coordination number and polyhedron coordination.
5. Physical properties of minerals: Color, luster, streak, habit, hardness, cleavage, fracture and magnetism.
6. Crystal-optics: Optical properties of minerals in polarized light. Opaque, isotropic, uniaxial and biaxial anisotropic minerals.
7. Systematic Mineralogy: Introduction to mineral systematic. Notions of class, family, group, specie and mineral series.
8. Non silicates systematic: Native elements, halides, sulfates, carbonates, phosphates, sulfides, oxides and hydroxides.

9. Silicates systematic: Nesosilicates, sorosilicates, cyclosilicates, single chain inosilicates, double chain inosilicates, phyllosilicates and tectosilicates.

[Back](#)

Introduction to Geologic Engineering (GEO1818L)



[Back](#)

Programming (INF0878L)

Introduction to programming in Python.
Using the interpreter in script and interactive mode.
Variables, expressions and instructions.
Definition and Use of Functions.
Control structures.
Native data structures.
Sequential data structures: lists, tuples, and strings.
Associative data structures: dictionaries.
Basic concepts of input / output (I / O).
File manipulation.
Graphic interface.
Using to libraries / modules.
Libraries with advanced functionality for scientific calculation.
Program development.

[Back](#)

Surveying (ERU0482L)

[Back](#)

Management (GES0790L)

[Back](#)

Petrology (GEO1819L)

[Back](#)

Structural Geology (GEO0748L)

[Back](#)

Hydrogeology (GEO0754L)

[Back](#)

Field Techniques in Geosciences (GEO0763L)

[Back](#)

Engineering Geology (GEO0745L)

[Back](#)

Hydraulics (ERU0568L)



[Back](#)

SIG Remote Sensing (GEO0735L)

[Back](#)

Sedimentology (GEO0760L)

[Back](#)

Mineral Resources (GEO0759L)

[Back](#)

Mineral Resources (GEO1820L)

[Back](#)

Soil Mechanics and Foundations I (GEO0518L)

[Back](#)

Soil Mechanics and Foundations (GEO1821L)

Theoretical component: Definition, purpose and scope of Soil Mechanics. Basic properties of soils. Definition of soil and soil mass. Relations of mass and volume between the soil phases. Identification of soils. Soil classification for engineering purposes. Residual soils. State of stress in soil masses. Principle of effective stress. Percolation. Permeability. Flow in porous media. Instability of hydraulic origin. Capillarity Compressibility and consolidation of clay layers. Stress-strain relationships in confined soils. Secondary consolidation. Acceleration of the consolidation. Compaction of soils. Compaction equipment. Control of compaction. Shear strength of soils. Stress-strain behavior of soils. Failure criteria. Experimental determination of the shear strength parameters of soils. Site Improvement for engineering purposes. Shallow foundations. Practical component Physical, compaction, compressibility, and shear strength soil laboratory testing. Study visit to a Engineering Work.



[Back](#)

Strength of Materials I (ERU0480L)

Basic concepts

Brittle and ductile material;

Stress and strain;

Energy of strain; Toughness and resilience;

Fatigue;

Principle of Saint-Venant;

Principle of superposition;

Safety;

Rods.

Normal force

Stress and strain under normal force;

Statically determinate structures under normal forces;

Statically indeterminate structures under normal forces;

Plastic strained systems.

Bending

Pure bending;

Eccentric tension-compression;

Transverse bending;

Elastoplastic bending.

Shearing force

Shearing stress on longitudinal sections;

Shearing stress at cross sections;

State of stress.

Torsion

Torsion of a rod of circular cross section;

Torsion of a thin-walled closed rod;

Rectangular cross section;

Thin-walled open section rod.

Elastic curve displacements in bending

Mohr theorems.

Stability of elastic systems compressed by central forces

Euler critical load;

Effect of end conditions on the critical load;

Critical stress and slenderness ratio.

[Back](#)

Applied Geophysics (FIS0708L)



[Back](#)

Applied Geophysics (FIS1824L)

I - Introduction - Forward and inverse problems in Geophysics. Physical properties. The signal in A. G.

II - Electrical methods - Electrical properties of rocks. Archie's Law. Concept of geoelectrical section. Wenner, Schlumberger, and dipole-dipole configurations. Electrical resistivity profiles and electrical soundings and their interpretation.

III - Gravimetric methods - Universal attraction. Geological and non-geological causes of gravity acceleration changes. Gravity meters. Gravity maps and profiles and their interpretation. Gravity response of some simple shapes.

IV - Seismic methods - Elements of Elasticity theory. Elastic constants and their physical meaning. Waves, wave reflection and wave refraction; Snell's Law. P and S waves. Reflection and refraction methods. Seismometers and geophones. Seismic refraction method; time-distance graphs and their interpretation.

V - Well logging - Electrical logs and nuclear logs.

[Back](#)

Surveys (GEO1825L)

[Back](#)

Surveys (GEO1826L)

[Back](#)

Geostatistics (GEO0516L)

[Back](#)

Geostatistics (GEO1827L)

Introduction to different types of Geosciences data and to its collection and preparation. Introduction to Geostatistics. R language as a tool for application in Geostatistics. Exploratory data analysis. Spatial data prediction. Theory of regionalized variables. Analysis of the spatial data structure: experimental variogram and modeling of the variogram. Geostatistical estimation or prediction: kriging. Basics of multivariate data analysis. Main types of kriging: general characterization and exercises in R. Geostatistical Simulation: general characterization and exercises in R.

[Back](#)

Safety Hygiene at Work (GEO1828L)

1 - Works accidents legislation.

2 - Risk analysis

3 - Administrative and organizational aspects related to health and safety.

4 - Security at work Technical Audits at safety

5 - Industrial Health

5.1 - Chemical Hazards (solids, liquids, gaseous and vapors)

5.2- Physical risks (noise, thermal / ventilation, vibrations)

6 - Ventilation

7 - Industrial Safety

7.1- Electrical hazards

7.2- Fire

7.3 - Ergonomy / loads and handling.



[Back](#)

Safety Hygiene at Work (GEO1829L)

- 1 - Works accidents legislation.
- 2 - Risk analysis
- 3 - Administrative and organizational aspects related to health and safety.
- 4 - Security at work Technical Audits at safety
- 5 - Industrial Health
 - 5.1 - Chemical Hazards (solids, liquids, gaseous and vapors)
 - 5.2- Physical risks (noise, thermal / ventilation, vibrations)
- 6 - Ventilation
- 7 - Industrial Safety
 - 7.1- Electrical hazards
 - 7.2- Fire
 - 7.3 - Ergonomy / loads and handling.

[Back](#)

Quality and Use of Water (QUI0574L)

Structure of water molecule.
Some properties of liquid water. Solute-solvent interaction. Hydration.
Kinetic behaviour of some compounds in the water. The gases dissolved in water. Oxygen. Factors responsible for variation of the oxygen in the water.
The metal ions in water. Precipitation, dissolution and complexation.
Water quality.
Sources of water contamination. Agricultural sources, domestic and industrial.
Treatment of water to produce water for public supply.
Quality indicators.
Wastewater treatment.
Water quality modelling.

[Back](#)

Water Resources Monitoring (ERU0571L)

- 1 - Objectives and methods of monitoring;
- 2 - Fields of water resources monitoring (water as a natural resource; quality, physics, chemistry, and ecological water concepts; water quality classifications; utilization and consumption; integrated water resources management);
- 3 - Measurements and observations (parameters and fundamental quantities to measure; supporting structures to measurements; systems and equipment for data acquisition; registration systems and equipment; systems and equipment of communications and data transmission);
- 4 - Water resources monitoring methods (data collection and storage; treatment of data and information; setting up of information);
- 5 - Water resource monitoring networks (basic networks; complementary or specific networks; SNIRH.).

[Back](#)

Rock Mechanics (GEO0517L)

[Back](#)

Rock Mechanics (GEO1822L)



[Back](#)

Georesources Exploitation (GEO0515L)

[Back](#)

Georesources Exploitation (PE) (GEO1823L)

[Back](#)

Industrial and Ornamental Rocks (GEO0519L)

[Back](#)

Industrial and Ornamental Rocks (GEO1830L)

[Back](#)

Slope Stability (GEO1831L)

[Back](#)

Slope Stability (PE) (GEO1832L)

Introduction: Types of slopes; Causes of slope instability; Influence of geological characteristics of the terrains in the stability of slopes.

Classification of mass movements: Types of mass movements; Classification of the mass movements according to the rate of movement; Consequences of mass movements.

Methodology of study and data processing: Geotechnical site characterization; Shear strength; Geotechnical exploration; Installation of instruments for geotechnical monitoring of the slope; Processing and presentation of data.

Slope stability analysis: Deterministic methods (limit equilibrium analyses at the circular failures in soil slopes and also at planar, wedge and toppling failures in rock slopes; for the more complex cases stress-strain analyses can be performed); Probabilistic methods; Choice of method of analysis; Specialized software for slope stability analysis.

Fundamentals of slope stabilization and instrumentation.

Study visit to a engineering work.

[Back](#)

Applied Geochemistry (GEO0752L)

1. Geochemistry as a geoscience to the study of interaction of geospheres.

2. Chemical equilibrium, Ions in solution and ionic mobility.

3. Oxide-reduction process: sedimentation and pH and Eh, Interpretation of Eh-pH diagrams, , the oxidation of the sulphites.

4. Geochemistry of weathering.

4.a. Weathering of the stone monuments: The main stomes of Portuguese monuments, Main pathologies: characterization and diagnosis, examples.

5. Sorption and ionic exchange on the surface of minerals.

6. New Minerals: Precipitation-dissolution and stability, Retention of pollutant metals, Examples in wastes and landfills.

7. Hydro-geochemistry and transport of pollutants.

8. Potentially toxic metal geochemistry: Origins of metals (anthropogenic and natural), Mobility of metals in natural environments, Examples of "natural" pollution, the example of the mines and abandoned wastes.

9. Correction strategies.



[Back](#)

Applied Geochemistry (PE) (GEO1833L)

1. Geochemistry as a geoscience to the study of interaction of geospheres.
2. Chemical equilibrium, Ions in solution and ionic mobility.
3. Oxide-reduction process: sedimentation and pH and Eh, Interpretation of Eh-pH diagrams, , the oxidation of the sulphites.
4. Geochemistry of weathering.
- 4.a. Weathering of the stone monuments: The main stones of Portuguese monuments, Main pathologies: characterization and diagnosis, examples.
5. Sorption and ionic exchange on the surface of minerals.
6. New Minerals: Precipitation-dissolution and stability, Retention of pollutant metals, Examples in wastes and landfills.
7. Hydro-geochemistry and transport of pollutants.
8. Potentially toxic metal geochemistry: Origins of metals (anthropogenic and natural), Mobility of metals in natural environments, Examples of "natural" pollution, the example of the mines and abandoned wastes.
9. Correction strategies.

[Back](#)

Geological Cartography (GEO0738L)

[Back](#)

Geological Cartography (GEO1834L)

- A. Introduction: Concepts and objectives. Main areas of importance and application of geological mapping. Relationship with other geosciences.
- B. Elements for the preparation of geological maps: legends, supplementary schemes and geological sections, symbols and abbreviations.
Methodologies for the geological mapping - planning and project planning, data collection and interpretation, preparation of sheets for fieldwork and maps in the office.
- C. Mapping geological units and structures: individualization of structures. Geological mapping of sedimentary, igneous and metamorphic rocks.
- D. Introduction to GIS in Geological Cartography.
- E. Reference and applications for geological mapping of professional interest.
- F. Practice: Lessons integrated office and field; Study of aerial photographs, treatment and representation of obtained data, preparation of graphs, drawings, sketches and final report. Field work classes consist of one day trips, to carry out geological maps in scale 1: 10 000.

[Back](#)

Environment Geology and Regional Planning (GEO1835L)

[Back](#)

Inspection of Hydraulic Works (ERU0567L)