



Study Plan

School: School of Sciences and Technology
Degree: *** TRANSLATE ME: Curso de Formação ***
Course: Geotechnical (cód. 696)

1st Year - 1st Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
MAT00900L	Linear Algebra and Geometry I	Mathematics	6	Semester	156
GEO12906L	Soil Mechanics and Foundations Engineering I	Geological Engineering	6	Semester	156
GEO12919L	Rock Mechanics	Geological Engineering	6	Semester	156
ERU13333L	General Hydraulics	Rural Engineering	6	Semester	156
ERU13337L	Topography	Rural Engineering	3	Semester	78
ERU13334L	Computer Assisted Technical Drawings	Rural Engineering	3	Semester	78

1st Year - 2nd Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
GEO11397L	Health and Safety at Work	Geological Engineering	3	Semester	78
GEO12927L	Drilling Methods	Geological Engineering	3	Semester	78
GEO12922L	Ornamental and Industrial Rocks	Geological Engineering	6	Semester	156
GEO12924L	Slope Stability	Geological Engineering	6	Semester	156
GEO12918L	Georesources Exploitation	Geological Engineering	6	Semester	156
GEO12928L	Geological Engineering Internship	Geological Engineering	6	Semester	156

Conditions for obtaining the Degree:

*** TRANSLATE ME: Para a conclusão do curso é necessário obter aprovação a 60 ECTS em unidades de curriculares distribuídas da seguinte forma:

1º Ano

1º Semestre:

6 UC Obrigatórias num total de 30 ECTS

2º Semestre

6 UC Obrigatórias num total de 30 ECTS ***

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Linear Algebra and Geometry I (MAT00900L)

Systems of linear equations.

Matrices.

Determinants.

Vector spaces.

Linear applications.

Eigenvalues and eigenvectors.

Geometry of plane and space.

Quadratic forms.

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Soil Mechanics and Foundations Engineering I (GEO12906L)

Theoretical:

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:

Physical, compaction, compressibility, and shear strength soil laboratory testing.

Study visit to a Engineering Work.

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Rock Mechanics (GEO12919L)

Theoretical component:

Main concepts, objective and scope of Rock Mechanics.

Rock and rock mass.

Weak rocks and weak rock masses.

Weathering of rocks and rock masses.

Rock physics. Physical and mechanical properties of rocks. Geotechnical classifications of rocks.

Discontinuities: influence on the behavior of rock masses. Description, classification and zoning of rock masses.

Deformability: Types of behavior of rocks. Creep. Anisotropy. Characterization of the deformability of rocks and rock masses.

Strength of rocks and rock masses. Failure criteria. Shear strength of discontinuities. Characterization of the strength of rocks and rock masses.

In situ stresses in rock masses. The natural in situ stress states in rock masses. Methods for the determination of the in situ stress state.

Practical component:

Laboratory testing: i) physical tests; ii) mechanical tests; iii) index tests. In-situ testing.

Solving various problems of applying of the theoretical concepts.



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General Hydraulics (ERU13333L)

1. Fluids physical properties; 2. Hydrostatics: Hydrostatic pressure; Pressure measurement; Manometers; hydrostatic impulsion. 3. Hydrocinematics: Types of flow; Continuity equation; Applications. 4. Hydrodynamics: Bernoulli Theorem, application to real fluids; Hydraulic power; Euler Th. 5. Head Losses in uniform flow. 6. Pressurized flows; Calculation of installations and pipe trajectory. 7. Pumps. 8. Free surface flow: Types of flow; Application of the Bernoulli Th. to open channels flow. 9. Flow through holes and weirs.

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Topography (ERU13337L)

The main programmatic lines are:

- A. Reviews (scales, angular units and it's conversions; elementary trigonometry);
- B. Introduction to the concepts of geoid, ellipsoid, geographic coordinates, map projection systems, geodetic datum, geodetic network; rectangular plane coordinates (distance and direction calculations, coordinates transportation, orientation), introduction to notions of altimetry and planimetry for the interpretation and use of topographic maps, terrain cross sections and longitudinal cross sections, calculation of cut and fill volumes;
- C. Surveying: with optical level (geometric), with a theodolite (trigonometric) and topographic GPS (DGPS).
- D. Introduction to Surveying software (Autodesk LandDesktop).

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Computer Assisted Technical Drawings (ERU13334L)

- 1. General Aspects of Technical Drawing. Standart writing; types of lines; drawing sheets; legends; margins and frames; CAD Applications.
- 2. Orthogonal projections. Projections; European and American methods; projection representation in multiple views, meaning of lines; views needed and adequate, and choice of views, partial views, displaced and interrupted views; auxiliary views; CAD Applications.
- 3. Perspectives. Types of perspectives; isometric perspectives; CAD Applications.
- 4. Dimensioning and scales. General aspects of dimensioning; elements of dimensioning; inclusion of dimensions in the drawings, elements dimensioning; criteria for dimensioning; CAD Applications.
- 5. Cuts and sections. Introduction to 3D. Ways to cut the pieces, cuts by parallel or concurrent planes; general rules of the cuts and sections; CAD Applications.

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Health and Safety at Work (GEO11397L)

Module 1 - Industrial Hygiene

I - Chemical hazards (solids, liquids, gases and vapors);

II - Physical hazards (noise, heat / ventilation, vibration);

Module 2 - Industrial Safety

I - Electrical hazards;

II- Fire;

III ? Ergonomy / loads and movement;

IV- Protection machinery;

V- Protection tools and utensils at work;

VI- Prevention in cargo handling operations;

VII- Individual protection of industrial accidents. Protection equipments.

Module 3 - Risk analysis and safety and health plans.

Module 4 - Technical audits of safety.

Module 5 - Legislation.



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Drilling Methods (GEO12927L)

- 1- Introduction
- 2- Drilling planning
- 3- Drilling with trade
- 4- Percussion drilling
- 5- Drilling geometry
- 6- Rotation drilling with probe recovery
- 7- Samplers
- 8- Casing
- 9- Underwater drilling
- 10- Rotary drilling
- 11- Oil drilling
- 12- Drilling muds
- 13- Roto-percussion drilling
- 14- Mine drilling
- 15- Geotechnical recognition using drilling
- 16- Drilling for water abstraction
- 17- Filters
- 18- Equipment manufacturers

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Ornamental and Industrial Rocks (GEO12922L)

Theoretical

1. Introduction

- National and global framework of ornamental stones, aggregates and ores; varieties, trade and industry. Definitions, occurrences and applications.

Dimension Stones

2- Transformation of marble, limestone, granite and schist as ornamental rocks (processes and equipment):

Aggregates and Ores

3- Characterization of concentration (ponderal yield, recovery, degree of release and content of concentrate).

4- Production of aggregates and ores (processes and equipment).

Practice

1 - Design of ornamental stones transformation plants

2- Design of crushing lines.

3 - Aggregates characterization tests (European Standard):

4 – Technical visits to ornamental stones factories, crushing lines and ores concentration units.

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Slope Stability (GEO12924L)

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.



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Georesources Exploitation (GEO12918L)

Rocks and Industrial Minerals

- 1 - Quarries exploitation (types of mining and conditionings);
- 2 - Quarries Exploitation Methods of Dimension Stones;
- 3 - Aggregates exploitation methodologies and gravel quarries;
- 4 - Underground Exploitation.

Water

- 1 - Methods and projects of groundwater wells;
- 2 - Type of wells;
- 3 - Drilling methods;
- 4 - Application to the different types of aquifers;
- 5 - Well dimension's;
- 6 - Definition of drilling diameters and well casing diameters;
- 7 - Dimension of screens and sand package;
- 8 - Construction of wells;
- 9 - Flow tests;
- 10 - Definition of abstraction volumes;
- 11 - Definition of protection areas.

Technical visits to extractive units with a report by visit.

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Geological Engineering Internship (GEO12928L)

The syllabus is adapted to the internship that the students will perform, preparing them for the tasks they will perform in the companies.

Expected syllabus:

- Underground mining;
- Improvement and concentration of metallic and non-metallic raw materials;
- Opencast mining (ornamental rocks and / or aggregates);
- Improvement of ornamental stones and / or production of aggregates;
- Prospecting and exploitation of groundwater. Dimensioning and monitoring of abstraction;
- Engineering Geology, mechanics of soils and rocks, slope stability, landfills, underground and sea works.