



## Study Plan

**School:** School of Sciences and Technology

**Degree:** Bachelor

**Course:** Geology (cód. 135)

### Specialization Geology

#### 1st Year - 1st Semester

##### Specialization Geology

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
FIS2670L	General Physics	Physics	6	Semester	156
GEO0749L	General Geology	Geosciences	6	Semester	155
MAT0933L	Mathematics I	Mathematics	6	Semester	162
QUI1090L	General Chemistry	Chemistry	6	Semester	156
BIO2671L	Introduction to Biology Studies	Biology	3	Semester	78
PAO2672L	Basic Ecology	Environment and Ecology Sciences	3	Semester	78

#### 1st Year - 2nd Semester

##### Specialization Geology

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
GEO2673L	Field Techniques in Geosciences	Geosciences	6	Semester	156
GEO2674L	Paleontology	Geosciences	6	Semester	156
MAT0934L	Mathematics II	Mathematics	6	Semester	162
GEO2675L	Geological Cartography I	Geosciences	6	Semester	156
GEO2676L	Mineralogy	Geosciences	6	Semester	156

#### 2nd Year - 3rd Semester

##### Specialization Geology

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
GEO2677L	Igneous Petrology	Geosciences	6	Semester	156
GEO2678L	Sedimentology	Geosciences	6	Semester	156
MAT0925L	Introduction to Probability and Statistics	Mathematics	6	Semester	154
GEO10081L	Structural Geology	Geosciences	6	Semester	160
GEO10079L	Pedology	Geosciences	6	Semester	156



**2nd Year - 4th Semester  
Specialization Geology**

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
GEO0745L	Engineering Geology	Geosciences	6	Semester	159
GEO2679L	Metamorphic Petrology	Geosciences	6	Semester	156
GEO0761L	Geochemical Systems	Geosciences	6	Semester	156
GEO2680L	Stratigraphy	Geosciences	6	Semester	156
GEO0754L	Hydrogeology	Geosciences	6	Semester	156

**3rd Year - 5th Semester  
Specialization Geology**

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
GEO2376L	Geomorphology	Geography	6	Semester	156
FIS0708L	Applied Geophysics	Physics	6	Semester	156
GEO2682L	Mineral Resources	Geosciences	6	Semester	156

**Group of Options**

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
GEO1448L	Geology of Portugal	Geosciences	6	Semester	156
GEO2684L	SIGS in Geosciences	Geosciences	6	Semester	156

**Group of Free Options**

**3rd Year - 6th Semester  
Specialization Geology**

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
GEO2685L	Geodynamics and Tectonics	Geosciences	6	Semester	156
GEO2686L	Geological Cartography II	Geosciences	6	Semester	156
GEO0750L	Marine Geology	Geosciences	6	Semester	156
GEO1440L	Environment Geology and Regional Planning	Geosciences	6	Semester	156
GEO2687L	Seminar	Geosciences	6	Semester	156



## Conditions for obtaining the Degree:

\*\*\* TRANSLATE ME: Geologia

Para obtenção do grau de licenciado em Geologia &ndash; Ramo em Geologia é necessário obter aprovação a 168 ECTS em unidades curriculares obrigatórias e 12 ECTS em unidades curriculares optativas, distribuídas da seguinte forma:

1º Ano  
1º Semestre:  
6 UC Obrigatórias num total de 30 ECTS  
2º Semestre  
5 UC Obrigatórias num total de 30 ECTS  
  
2º Ano  
3º Semestre  
5 UC Obrigatórias num total de 30 ECTS  
4º Semestre  
5 UC Obrigatórias num total de 30 ECTS  
  
3º Ano  
5º Semestre  
3 UC Obrigatórias num total de 18 ECTS  
1 UC Optativa num total de 6 ECTS  
1 UC Optativa livre num total de 6 ECTS  
6º Semestre  
5 UC Obrigatórias num total de 30 ECTS \*\*\*

## Specialization Biology and Geology

### 1st Year - 1st Semester

#### Specialization Biology and Geology

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
FIS2670L	General Physics	Physics	6	Semester	156
GEO0749L	General Geology	Geosciences	6	Semester	155
MAT0933L	Mathematics I	Mathematics	6	Semester	162
QUI1090L	General Chemistry	Chemistry	6	Semester	156
BIO2671L	Introduction to Biology Studies	Biology	3	Semester	78
PAO2672L	Basic Ecology	Environment and Ecology Sciences	3	Semester	78

### 1st Year - 2nd Semester

#### Specialization Biology and Geology

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
GEO2673L	Field Techniques in Geosciences	Geosciences	6	Semester	156
GEO2674L	Paleontology	Geosciences	6	Semester	156
MAT0934L	Mathematics II	Mathematics	6	Semester	162
GEO2675L	Geological Cartography I	Geosciences	6	Semester	156
GEO2676L	Mineralogy	Geosciences	6	Semester	156

### 2nd Year - 3rd Semester

#### Specialization Biology and Geology

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
GEO2677L	Igneous Petrology	Geosciences	6	Semester	156
GEO2678L	Sedimentology	Geosciences	6	Semester	156
MAT0925L	Introduction to Probability and Statistics	Mathematics	6	Semester	154



**2nd Year - 3rd Semester**  
**Specialization Biology and Geology**

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
GEO10081L	Structural Geology	Geosciences	6	Semester	160
BIO10917L	Cell Biology	Biological Sciences	6	Semester	156

**2nd Year - 4th Semester**  
**Specialization Biology and Geology**

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
GEO2679L	Metamorphic Petrology	Geosciences	6	Semester	156
GEO0761L	Geochemical Systems	Geosciences	6	Semester	156
GEO2680L	Stratigraphy	Geosciences	6	Semester	156
BIO0408L	Microbiology	Biological Sciences	6	Semester	156
BIO2681L	Invertebrate Biology	Biology	6	Semester	156

**3rd Year - 5th Semester**  
**Specialization Biology and Geology**

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
GEO1448L	Geology of Portugal	Geosciences	6	Semester	156
GEO2682L	Mineral Resources	Geosciences	6	Semester	156
BIO2688L	Vertebrates Biology	Biology	6	Semester	156
BIO2689L	Plant Biology without Seeds	Biology	6	Semester	156
Group of Free Options					

**3rd Year - 6th Semester**  
**Specialization Biology and Geology**

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
BIO2690L	Molecular Biology	Biology	6	Semester	156
BIO0301L	Human Biology	Biology	6	Semester	156
BIO2691L	Plant Biology with Seeds	Biology	6	Semester	156
GEO2687L	Seminar	Geosciences	6	Semester	156
<b>Group of Options</b>					
Component code	Name	Scientific Area Field	ECTS	Duration	Hours
GEO2685L	Geodynamics and Tectonics	Geosciences	6	Semester	156
GEO0750L	Marine Geology	Geosciences	6	Semester	156
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5 UC Obrigatórias num total de 30 ECTS  
4º Semestre  
5 UC Obrigatórias num total de 30 ECTS  
  
3º Ano  
5º Semestre  
4 UC Obrigatórias num total de 24 ECTS  
1 UC Optativa livre num total de 6 ECTS  
6º Semestre  
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5 UC Obrigatórias num total de 30 ECTS

3º Ano

5º Semestre

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6º Semestre

5 UC Obrigatórias num total de 30 ECTS

Para obtenção do grau de licenciado em Geologia &ndash; Ramo em Biologia e Geologia é necessário obter aprovação a 162 ECTS em unidades curriculares obrigatórias e 18 ECTS em unidades curriculares optativas, distribuídas da seguinte forma:

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5 UC Obrigatórias num total de 30 ECTS

4º Semestre

5 UC Obrigatórias num total de 30 ECTS

3º Ano

5º Semestre

4 UC Obrigatórias num total de 24 ECTS

1 UC Optativa livre num total de 6 ECTS

6º Semestre

4 UC Obrigatórias num total de 24 ECTS

1 UC Optativa num total de 6 ECTS \*\*\*

## Program Contents



Back

### General Physics (FIS2670L)

- Chapter 1. Physics as a science and Review of fundamental physics-mathematical concepts;
- Chapter 2. Space and Time - motion of the particle
- Chapter 3. Dynamics of particle;
- Chapter 4. Work and Energy
- Chapter 5. Dynamic of particle system
- Chapter 6. Static;
- Chapter 7. Deformation and elasticity;
- Chapter 8. Fluids;
- Chapter 9. Thermodynamics;
- Chapter 10. Heat and Mass Transfer.

Back

### General Geology (GEO0749L)

- 1 - Introduction of the Geology. Geological Time. Geology and Society.
- 2 - Structure of the Earth. Direct and indirect methods. Physical and chemical zoning.
- 3 - Plate Tectonics and Wilson Cycle (tectonic cycle). Continental drift and seafloor spreading. Morphology and evolution of oceans and continents.
- 4 - Minerals. Major rock-forming minerals. Minerals and the rock cycle.
- 5 - Magmatic rocks. Magmas, partial melting, magma evolution. Systematic of magmatic rocks. Magmatism and plate tectonics. Volcanism.
- 6 - Sedimentary rocks. Weathering, transport, sedimentation and diagenesis. Systematic of sedimentary rocks.
- 7 - Metamorphic rocks. Types of metamorphism. Systematic of metamorphic rocks. Metamorphism and plate tectonics.
- 8 - Hydrologic Cycle. Chemical and physics weathering. River, coastal, glaciers systems and mass movements.
- 9 - Introduction to Geology of Portugal.

Back

### Mathematics I (MAT0933L)

- 1. Topological concepts in  $\mathbb{R}$
- 2. Differential calculus in  $\mathbb{R}$   
Derivative at a point and physical interpretation. Rules of derivation. Rolle, Lagrange and Cauchy Theorems. Cauchy and L'Hôpital Rules. Monotonicity, concavity and asymptotes
- 3. Primitives  
Primitives. Primitives by parts and by substitution. Primitives of rational functions
- 4. Integration  
Integral of Darboux and Riemann. Properties of the integral. The mean value theorem, fundamental theorem of calculus and formula Barrow. Integration by parts and substitution.
- 5. Applications of integral calculus  
Areas. Length of a line. Volumes and areas of solids of revolution.
- 6. Improper integrals  
Convergence theorems. Absolute Convergence
- 7. Numerical series  
Geometric series and Mengoli series. Nonnegative real series. Alternating series. Absolute convergence
- 8. Power series  
Definitions. Taylor and Mac-Laurin series
- 9. ODE  
Homogeneous non-homogeneous linear ODE of order  $n$ . Applications



[Back](#)

### **General Chemistry (QUI1090L)**

1. Constitution of matter
2. Periodic table
3. Chemical bonding
4. States of aggregation of matter
5. Solutions
6. Chemical thermodynamics
7. Chemical equilibrium
8. Equilibrium in heterogeneous systems
9. Ionic equilibria in homogeneous systems: acid-base
10. Electrochemistry
11. (Optional Chapter)  
Chemistry of life  
Chemical corrosion  
Chemical kinetics

[Back](#)

### **Introduction to Biology Studies (BIO2671L)**

1. What is Life?
2. Theories on the origin and diversity of life.
3. The cell as a unit of living beings.
4. Functional systems for Life: respiration and photosynthesis.
5. The hereditary mechanism: DNA and RNA as basic molecules of life.
6. The microbial world ("masters of the biosphere").
7. The plant world.
8. The animal world.
9. Evolution as a unifying theme in Biology.
10. Biotechnology and relevant social issues.

[Back](#)

### **Basic Ecology (PAO2672L)**

Structure and function of ecosystems: circulation of matter and energy; energy to control entropy.

Biogeochemical cycles: global and local, impacts of human activities.

Limiting factors: Leibig's and Shelford's Laws. Factors of production and decomposition. Implications: distribution of organisms, success of introductions  
Production and trophic structure: Energy fluxes between trophic levels and ecological efficiencies.  
Predominant paths.

Population: characteristics and vital rates. Models of growth. Selection strategies r and K. Predator-prey interactions, population cycles. Competitive interactions, competitive exclusion. Models of population regulation.

Community: Structure, stability, environmental quality. Resistance and resilience.

Succession: Primary and secondary. Natural and Cultural. Climax theories.





[Back](#)

### **Field Techniques in Geosciences (GEO2673L)**

Use the compass in geology: Reference to magnetic declination and its determination to 1:25,000 scale topographic maps; Orientation 1:25,000 scale topographic map using the compass; Determination of azimuths and location in the field by the method of inverse azimuths; Determination of the attitude of a plan; Determination of the attitude of a line.

Rocks and Minerals: Identification and characterization of minerals, sedimentary rocks, igneous and metamorphic rocks by gross examination.

Execution of geological profiles of the scale of the outcrop.

Execution of synthetic stratigraphic columns prepared in accordance with observations made on the scale of the outcrop.

Drafting of schematic plans interpretation the observations made at the outcrop scale.

Using GPS to support field work, regarding the geographical location marking points on the GPS and in topographic maps.

[Back](#)

### **Paleontology (GEO2674L)**

1. INTRODUCTION;
2. HISTORY OF PALEONTOLOGY IN PORTUGAL;
3. TAPHONOMY;
4. FOSSILIZATION;
5. TECHNIQUES APPLIED IN PALEONTOLOGY;
6. SYSTEMATIC PALEONTOLOGY;
7. MICROPALAEONTOLOGY;
8. PALAEOBOTANY;
9. PALAEOZOOLOGY;
10. HUMAN PALAEOONTOLOGY;
11. THE FOSSILS IN THE ALENTEJO REGION.

[Back](#)

### **Mathematics II (MAT0934L)**

I - Linear Algebra

1. Vector spaces and subspaces
2. Linear functions
3. Matrices and Linear Systems of Equations
4. Determinants
5. Eigenvalues and eigenvectors

II - Differential Calculus in  $\mathbb{R}^n$

1. Dot, crossed and mixed products
2. Topology
3. Scalar and Vector Fields
4. Limits and Continuity
5. Differential calculus



[Back](#)

### **Geological Cartography I (GEO2675L)**

Introduction to the course, cartographic methods.

Basic principles of cartography, methods and main types of maps. Examples of Portuguese maps.

The shape of the Earth: coordinate systems, projection systems and geographical referencing systems. North geographic, magnetic and cartographic, types of scales, methods of relief representation.

Lithological units and cartographic units. Criteria for the definition of geological boundaries.

Lithostratigraphic and chronostratigraphic maps. Stratigraphic units used in geological maps. Subdivisions in the system, series and stage. Definition of unit, group, formation, member and layer.

Types of contacts between geological units and associated cartographic patterns: stratigraphic contacts, unconformities, intrusive contacts, faults.

Methods used in cartography of sedimentary rocks. Cartography of volcanic rocks. Intrusive igneous bodies. Cartography of metamorphic regions.

Analysis and interpretation of geological maps.

[Back](#)

### **Mineralogy (GEO2676L)**

1. Introduction: History and evolution of Mineralogy.

2. Concept of mineral: Mineral and crystal concepts. State types of matter.

3. Elementary crystallography: Bravais lattices, crystal forms, crystal systems, and Miller indices.

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 minerals, isotropic, uniaxial anisotropic and biaxial anisotropy.

7. Systematic Mineralogy: Introduction to mineral systematic. Notions of class, family, group, specie and mineral series.

8. Systematic of the silicates: Nesosilicates, sorossilicatos, cyclosilicates, single chain inosilicates, double chain inosilicates, phyllosilicates and tectossilicatos.

[Back](#)

### **Igneous Petrology (GEO2677L)**

1 - Overview of magmatism and tectonics;

2 - Classification, textures and structures of igneous rocks;

3 - Partial Melting (mantle and crust);

4 - Magmatic Differentiation Processes;

5 - Igneous Geochemistry - processing and presentation of geochemical data;

6 - Partial melting and fractional crystallization ? quantification processes;

7 - Volcanism;

8 - Petrogenetic provinces: i) Mid Ocean Ridge Basalts ii) oceanic intraplate Volcanism iii) Continental Basalts iv) arc volcanism;

9 - Granitoids.



[Back](#)

### **Sedimentology (GEO2678L)**

The Sedimentology in the framework of the Geology.

The importance of the Sedimentology in the Geology, Environmental Sciences and Extractive Industry.

Formation and systematic of the sedimentary rocks.

Study methods of the sediments and sedimentary rocks.

Sedimentary structures.

Hydrodynamics and the sedimentation.

Sedimentary environments: i) Continental (Aeolian, Fluvial, Alluvial, Lacustrine); ii) Transitional (Estuarine, Deltaic, Lagoon, Coastal) and iii) Marine (Carbonate platform, Siliciclastic platform, Pelagic sedimentation).

Sedimentary cycles.

Diagenetic processes.

Portuguese sedimentary basins.

[Back](#)

### **Introduction to Probability and Statistics (MAT0925L)**

1. Descriptive Statistics - Brief Review

2. Basic Probability Notions - Brief Review

3. Conditional Probability and Independence

4. Discrete and Continuous Random Variables

5. Discrete Random Vectors

6. The Most Important Families of Discrete and Continuous Probabilities Distributions

7. An Introduction to Sampling Theory

8. Statistical Inference (parametric and non-parametric)

9. Introduction to Simple Linear Regression

10. Some Non-Parametric Tests (Kolmogorov-Smirnov, Chi-Square, etc.)

[Back](#)

### **Structural Geology (GEO10081L)**

Theoretical: 1 - Basic concepts of structural geology; 2 - Dynamic analysis; 3 - Kinematic analysis; 4 - Mechanical behavior of rocks, 5 - Descriptive Analysis and Classification: faults, folds, shear zones, joints and diaclasses; 6 - Relationship between Structural Geology and tectonics.

Theoretical and Practical: 1. Using geometric and statistical stereographic projection in structural geology, 2. Structural interpretation of geological maps, including the identification, description and interpretation of structures at various scales, as well as understanding the processes that originate them.

Fieldwork: Study visits for consolidation of knowledge. Annually two days of field work are planned in places where the conditions of the various geological structures allow excellent observation and interpretation.

[Back](#)

### **Pedology (GEO10079L)**

Soil functions, soils in space and time. Soil profile, horizons and soil materials. Soil parent materials, main rock types and weathering. Soil composition. Soil chemical properties. Soil physical properties. Soil classifications. Soil maps and soil information systems. Soil degradation types and sustainable soil use.



[Back](#)

### **Engineering Geology (GEO0745L)**

Theoretical component

Definition of Engineering Geology. Origin and development of engineering geology. Relations between the Engineering Geology and the other disciplines of Geotechnics.

Preliminary studies. Concept and methodology

Site engineering classification. Geological classification. Classification for engineering purposes: Soils; Rocks and rock masses.

Discontinuities. Definition and properties. Methods for the study of discontinuities

Subsurface exploration. Methods of subsurface exploration

Sampling. Methods of sampling. Undisturbed samples. Disturbed samples

Geophysical exploration. Electrical methods: Earth resistivity method. Seismic methods: refraction, reflection and direct.

Application of geophysical methods in geotechnical exploration

In situ testing. Introduction. Strength tests. Permeability tests. Deformability tests

Practical component

Laboratory classification testing on soils

Swelling test

Permeability test

Study visit to a Engineering Work

[Back](#)

### **Metamorphic Petrology (GEO2679L)**

1 - Overview of Metamorphism and Tectonics;

2 - Introduction to Metamorphism;

3 -Physical Processes of Metamorphism;

4 - Introduction to Phase Equilibria, diffusion, Kinetics and Thermodynamics of metamorphic reactions;

5 - Metamorphism and deformation;

6 - Classification and metamorphic textures;

7 - Stable mineral assemblages in metamorphic rocks,

8 - Metamorphic facies and metamorphic rocks;

9 - Metamorphism of series:

9.1 pelitic;

9.2 carbonated and quartz-feldspatic;

9.3 basic;

9.4 ultramafic;

10 - Very low grade and high grade metamorphism;

11 - Metamorphism, Geochronology and tectonics.



[Back](#)

### **Geochemical Systems (GEO0761L)**

Introduction

Energy, Entropy, and Fundamental Thermodynamics Concepts

Applications of Thermodynamics to the Earth

Equilibrium Constant, Oxidation and Reduction, Eh-pH diagrams and the stability of the minerals

Phase Diagrams and Geothermometry

Reaction Kinetics

Aquatic Chemistry: Acid-Base Reactions, Complexation, Precipitation and Dissolution, Adsorption

Surface Reactions and Diffusion

Stable and Radiogenic Isotope Geochemistry

Introduction to Cosmochemistry: Chemical Clues to the Formation of the Earth

Geochemistry of the Solid Earth: The Mantle and Core

Geochemistry of the Solid Earth: The Crust

Reactions at the Earth's Surface: Weathering, Soils, and Stream Chemistry

Organic Geochemistry

The Oceans as a Chemical System

The atmosphere as a Chemical System

Bio-geo-chemical cycles: Nitrogen, phosphorus, carbon dioxide and oxygen;

Introduction to environmental geochemistry and anthropogenic pressure.

[Back](#)

### **Stratigraphy (GEO2680L)**

Definition and objectives. Principles of Stratigraphy. Dimension "time" and ordering of events; Paleontology, Sedimentology and Geochronology applied to Stratigraphy; Biostratigraphy and Magnetostratigraphy; Analysis of sedimentary and volcanic-sedimentary sequences; Stratigraphic correlations; Sedimentary discontinuities, sedimentary facies, Paleogeography and Paleoclimatology; Chronostratigraphical and geochronological scales; Radiometric dating methods; The International stratigraphic chart;

The steps of the History and Evolution of Earth; Precambrian: Archean, Paleoproterozoic, Mesoproterozoic and Neoproterozoic; Phanerozoic: Paleozoic, Mesozoic and Cenozoic;

Supercontinent cycles: Rodinia, Gondwana and Pangea; The evolution of life on Earth; The evolution of plate tectonics, continental drift, crustal recycling and orogenies; Models of paleogeographic and paleoclimatic reconstructions.



[Back](#)

### **Hydrogeology (GEO0754L)**

Theoric classes:

Hydrogeology: concepts. Distribution of water resources on the Globe.

Hydrological cycle and water balance.

Aquifer types.

Types of porosity.

Storage coefficient (S).

Physical proprieties of the fluids. Basic equations of hydrodynamics.

Circulation in porous media.

Type of groundwater uses and contamination.

Oscillations of the piezometric groundwater levels.

Hydraulics of groundwater impounding.

Type of wells and flux generated.

Hydraulics of complete wells.

Flow tests.

Hydrogeology of Portugal.

Practical classes:

Granulometric analysis. Calculation of the Uniformity Coefficient (U). Calculation of the permeability based on the Hazen formulae. Horizontal and vertical permeability.

Geologic and hydrogeologic profile based on drilling reports.

Graphics flow/drawdown, specific flow/drawdown. Graphics time/flow and time/drawdown. Distinction between phreatic and confined aquifers.

Flow tests.

[Back](#)

### **Geomorphology (GEO2376L)**

Theoretical:

1 – slopes, process and forms, mass movements, 2 – fluvial processes; forms related with fluvial processes; 3

- estuaries and deltas; 4 – alluvial fans; 5 – coastal processes and landforms; 6 – glacial processes and

landforms, ice sheet and alpine glaciers, fluvioglacial processes, lacustrine sediments; 7 – Geomorphology of

arid regions, aeolian processes and landforms, formation of glaciais, pediments and pediplains; 8 – structural

reliefs and drainage patterns related with structural controls, tectonics and drainage adjustment; 9 – longterm

landscape evolution (cycle of erosion) and formation of planation surfaces.

Practical:

Identification of structural landforms, fluvial, coastal, glacial, periglacial, aeolian and karst, using topographic maps, aerial photography, MDT, and sketch maps to the appropriate topics.

Elaboration of a geomorphologic map.

Calculation of incision rates and uplift rates using fluvial and marine terraces as geomorphic references.

[Back](#)

### **Applied Geophysics (FIS0708L)**

I – Introduction

II – Electrical methods

III – Gravimetric methods

IV- Seismic methods

V – Well logging



[Back](#)

### **Mineral Resources (GEO2682L)**

Introduction to the geological resources: definitions; the geological context; their use;  
Global economy of the geological resources;  
The geology of the mineral resources in the broader context of the Earth sciences;  
Mineral exploration: Geophysical methods; Geochemical methods; Geochemical anomalies; Primary halos; Secondary halos;  
Energy resources: importance, types, production and consumption;  
Metallic ores: Methods of study: fluid inclusions and stable isotopes.  
Orthomagmatic ores;  
Disseminated and stockwork deposits;  
Skarns;  
Vein ores;  
Massive sulphides;  
Sedimentary ores;  
Portuguese examples;  
Marine mineral resources: Abyssal plains; Continental platform.

[Back](#)

### **Geology of Portugal (GEO1448L)**

Main geological units of Portugal.  
Short reference to the Proterozoic record.  
The evolution during the Paleozoic: The Variscan Cycle.  
The Early Paleozoic: stratigraphy and magmatism  
The Late Paleozoic: stratigraphy, magmatism, metamorphism and structure.  
Synthesis of the evolution of the Portugal Mainland during the Variscan Cycle and the transition to the Alpine Cycle  
The evolution of Meso-Cenozoic.  
The West and Algarve basins, its relations with the Atlantic and Tethys oceans.  
Stratigraphy  
Sedimentary environments and paleogeography  
Magmatism  
Short reference to the geology of Azores and Madeira islands.  
The Portuguese continental shelf.  
The geological evolution during the Plio-Pleistocene, Neotectonic activity and seismicity in Portugal.  
Analysis of selected sheets of the Geological Map of Portugal at different scales.



[Back](#)

### **SIGS in Geosciences (GEO2684L)**

GIS and the sciences.

Graphical representations; Projection Systems; Georeferencing; Scanning information.

- . Computer georeferenced data.
- . Symbols and Labels in GIS.
- . Creation of Layouts.
- . Scanning of points and lines.
- . Creating and editing symbols.
- . Layer Files type.
- . Georeferencing.
- . Digitizing polygons.
- . Creating layouts.
- . Information search the tools and basic SQL Databases.
- . Rules for creating maps.
- . Small GIS project.

NOTE: The theoretical and practical work will make use of practical examples ranging from applications to the study of the territory, the characterization of the terrain, geology and natural resources of a region.

[Back](#)

### **Geodynamics and Tectonics (GEO2685L)**

- 1 - Modern Tectonics and Internal Geodynamics.
- 2 - Tectonic Regimes: extensional, contractional and strike-slip.
- 3 - Fundamentals of Plate Tectonics.
- 4 - Morphology of the sea floor and continents.
- 5 - Rheological model of the structure of the Earth's, mantle properties and movements of lithospheric plates.
- 6 - Divergent margins: intra-continental rifting and triple-points.
- 7 - Divergent margins: rifting and intra-oceanic seafloor spreading.
- 8 - Drift of continents and the Earth's magnetic field.
- 9 - Transform and strike-slip faults.
- 10 - Convergent margins: subduction zones and magmatic arcs of the Pacific.
- 11 - Convergent margins: continental collision and orogeny system of Alps and Himalayas.
- 12 - Case studies of ancient orogenic systems.

[Back](#)

### **Geological Cartography II (GEO2686L)**

- 1 - Geological Cartography in plutonic igneous and metamorphic rocks.
- 2 - Planning a field campaign, logistics and material.
- 3 - Use coordinate systems of military maps of topographic and aerial photography.
- 4 - Field relations of plutonic igneous rocks with metamorphic country rocks.
- 5 - Mineralogy and textures of plutonic igneous rocks.
- 6 - Brittle and ductile structures in deformed igneous rocks.
- 7 - Field relations between metamorphic and deformed rocks.
- 8 - Mineralogy and textures of metamorphic rocks.
- 9 - Brittle and ductile structures in metamorphic rocks.
10. Prepare a geological map.
11. Complementary petrographic studies in plutonic igneous and metamorphic rocks.
12. Perform a report with presentation, treatment and interpretation of data collected in the field.





[Back](#)

### **Marine Geology (GEO0750L)**

The marine geology as discipline integrative of the geological and geophysical knowledge on oceanic basins.

The marine geology in the context of the global tectonics

Sedimentary and oceanographic processes

Sea waves

Wave energy use

Beach morphodynamics

Sedimentary budget along the coast line

Coastal protection structures

Ocean physiography

Indirect methods of study in marine geology

Direct methods of study in marine geology

Fluid escape in marine sedimentary basins

Oceanic magmatism

Mineral resources of the oceans

Usage of free software and databases in the study of the oceans

[Back](#)

### **Environment Geology and Regional Planning (GEO1440L)**

1 – Water cycle sustainability

2 – Geologic hazards and land-use planning

3 – Geologic risks and water resources

a) Floods

b) Groundwater contamination

c) Aquifer remediation and protection

5 – Sismicity

6 – Coastal hazards and coastal erosion

7 – Soils and erosion

8 – Mass movement

9 – CO<sub>2</sub> storage and climate change

[Back](#)

### **Seminar (GEO2687L)**

Initiation to Research Methods (Experimental and Theoretical) in Earth Sciences: development of research problems, data collection, processing and interpretation of results.

Development of a small research project accompanied by the teacher responsible.

[Back](#)

### **Cell Biology (BIO10917L)**

Methods and Techniques used in cell study. Biomolecules. Origin of life. Cells: paradigms and diversity.

Cellular organization: cell membrane; membrane-bound organelles; semi-autonomous organelles; cytosol

and its inclusions. Cytoskeleton. Extracellular structures: cell wall, extracellular matrix. Transmembrane

transport and metabolism: Functional order. Energy: thermodynamics in the cell; redox reactions; energy

conversion. Information: genomic information; intercellular and intracellular communication; cell

recognition. Cell Reproduction: Mitosis; mitotic chromosomes; the mitotic cycle. Meiosis. Cell proliferation

and differentiation: growth factors; mechanisms of differentiation. Cell death (apoptosis). Applications of

cell biology.



[Back](#)

### **Microbiology (BIO0408L)**

Theoretical:

1. Historical context and Ubiquity
2. Diversity of the Microbial World
3. Microbial Growth and Death
4. Metabolism
5. Basics of Molecular Microbiology: Microbial genetics, Virology, Immunology
6. Microbes and disease; Normal flora, Pathology, infection and disease, Mechanisms of pathogenicity, Principles of epidemiology
7. Food microbiology: Hygiene and concept of indicator. Processing and storage of food.

Foodborne diseases

8. Ecology and environmental microbiology: Soil and water, Biogeochemical cycles, Agricultural applications, Wastewater treatment, Biotechnology applications

Lab Practice:

Aseptic practice

Observation of bacteria, fungi and protists.

Demonstration of Ubiquity

Preparation and sterilization of culture media.

Isolation of pure culture.

Colonial and cellular morphology. Gram Staining

Microbial counts

Environmental conditions for growth (pH, temp., O<sub>2</sub>)

Anaerobic Culture

Antibiograms

[Back](#)

### **Invertebrate Biology (BIO2681L)**

With the first six lectures aim to achieve the following objectives: (1) Set some basic terminology, (2) introduce some new concepts, (3) To present some of the subjects will develop over the course. In other classes, these issues continue to be present, but now, in a comparative inter-and intra fee. The laboratory practical classes and their sequence, follow the thematic development of the program of lectures, reinforcing and complementing the learning process on the morphology and functional anatomy of the major invertebrate taxa. The first eight practical lessons will be dedicated to the study of morphology and functional anatomy of: Protozoa, sponges, cnidarians, flatworms, pseudocoelomate (nematodes and rotifers), annelids and arthropods (Queliceriformes, Myriapoda and insects). In the remaining laboratory classes will be studied the: Arthropods (Crustaceans - barnacles and Decapods), molluscs (Gastropoda Prosobrânquios, bivalves and cephalopods) and Echinodermata.

[Back](#)

### **Vertebrates Biology (BIO2688L)**

1. Levels of organization, morphological and functional characteristics, classification and general characteristics of the vertebrates.
2. Classification and phylogeny of the Agnatha.
3. Definition and classification of the Chondrichthyes.
4. Definition, classification, evolutionary history and diversity of the Osteichthyes.
5. Origin, classification and phylogeny of Amphibia.
6. Origin and Adaptive Radiation of Reptilian Groups.
7. Definition and classification of the birds.
8. Definition and classification of the mammals.



[Back](#)

### **Plant Biology without Seeds (BIO2689L)**

1. The evolution in the plant kingdom - Diversity and characteristics of major groups. Understanding plant taxonomy.
2. Cyanophyta - blue-green algae.
3. Protists: Euglenophyta, Rhodophyta, Dinophyta, and Myxomycota Protista II: Chlorophyta, Bacillariophyta, Phaeophyta, and Chrysophyta Oomycota.
4. Fungi: Ascomycota, Basidiomycota, Zygomycota and Deuteromycota.
5. Colonization of Earth. Comparison between aquatic and terrestria.l
6. Antocerophyta, and Bryophyta Hepatophyta.
7. Evolution of Tracheophyta. Fossil records.
8. Psilotophyta, lycophyte, Sphenophyta and Pteridophyta.

[Back](#)

### **Molecular Biology (BIO2690L)**

#### Part I. DNA REPLICATION

1. Genes and chromosomes
2. Replication of DNA
3. Recombination and transposition
4. Mutation and repair mechanisms

#### Part II. GENE EXPRESSION

5. Transcription
6. Translation
7. Regulation of gene expression

#### Part III. TECHNIQUES AND APPLICATIONS

8. Analytical and preparative methods in Molecular Biology
9. Techniques in molecular biology. Recombinant DNA techniques. Bioinformatics.
10. Applications in genetic engineering.

[Back](#)

### **Human Biology (BIO0301L)**

Introduction to the Study of Human Biology: Concept, importance and relationship with other disciplines.

Primatology: Man as a primate. Biogeography of primates: comparative anatomy of locomotion and dentition. Social and behavioral structures.

Human Evolution: hominoids, hominids and hominins; characterization and geographic distribution. The bipedalism: ecological framework and anatomy. The genus Homo and the output of Africa. Our species. Current populations and some polymorphisms. Structure and Function of cell: cellular homeostasis, cell cycle, signaling and cellular interactions, cell adhesion and communication, extracellular matrix; cell death, stress and cellular adaptation; carcinogenesis and cancer.

Stem cells: the concept, embryonic and adult stem cells, stem cell types. Cloning: types of cloning.

Blood: components (plasma, serum). Elements in the mammalian blood. Hematopoiesis.

Muscle-skeletal apparatus: bones, cartilage, joints,

[Back](#)

### **Plant Biology with Seeds (BIO2691L)**

LECTURES: 1. Morphofunctional organization of the seed plant body; 2. Adaptations to different environments;

3. Taxonomy and evolution of seed plants; 4. Principles of phytogeography.

LAB: 1. Comparative study of seed plant adaptations; 2. Collecting, pressing, drying and mounting plant specimens; 3. Recognition of flowering plant families; 3. Application of methodologies and cases study.