Study Plan

School: School of Sciences and Technology
Degree: Master
Course: Earth, Atmospheric and Space Science (cód. 441)

Specialization Meteorology, Climate and Environment

1st Year - 1st Semester
Specialization Meteorology, Climate and Environment

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
FIS10340M	Earth and Atmospheric Physics	Physics	6	Semester	156
FIS10341M	Solar and Planetary Physics	Physics	6	Semester	156
FIS10342M	Observation Methods and Tecniques in Earth, Atmospheric and Space Sciences	Physics	6	Semester	156
FIS10343M	Signal Analysis and Inversion Methods	Physics	6	Semester	156
FIS10344M	Radiation, Clouds and Precipitation	Physics	6	Semester	156

1st Year - 2nd Semester
Specialization Meteorology, Climate and Environment

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
FIS10345M	Energy, Environment and Sustainability	Renewable Energy Engineering	6	Semester	156
FIS10346M	Computational Methods in Physics and Engineering	Physics	6	Semester	156
FIS10347M	Climate, Climate Modelling and Climate Change	Physics	6	Semester	156
QUI13041M	Atmospheric Pollution and Gas Effluents Emission	Chemistry	6	Semester	156
FIS10348M	Remote Sensing and Environmental Satellites	Physics	6	Semester	156

2nd Year - 3rd Semester
Specialization Meteorology, Climate and Environment

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
FIS10349M	Synoptic Meteorology and Weather Forecast	Physics	6	Semester	156
FIS10350M	Athmosferical Boundary Layer Micrometeorology	Physics	6	Semester	156
FIS10351M	Seminar on Earth, Atmospheric and Space Sciences	Physics	6	Semester	156
Dissertation					

2nd Year - 4th Semester
Specialization Meteorology, Climate and Environment

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
Dissertation					

Conditions for obtaining the Degree:

*** TRANSLATE ME: Área de Especialização em Meteorologia, clima e Ambiente:{\}newline
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Para aprovação na componente curricular nesta área de especialização é necessário a a provação (através de avaliação ou creditação) das seguintes unidades curriculares.{\}newline
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Para obtenção do grau, é necessário também a aprovação em Dissertação, com o total de 42 ECTS, no 3.º e 4.º Semestre ***

Specialization Internal Geophysics

1st Year - 1st Semester
Specialization Internal Geophysics

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
FIS10340M	Earth and Atmospheric Physics	Physics	6	Semester	156
FIS10341M	Solar and Planetary Physics	Physics	6	Semester	156
FIS10342M	Observation Methods and Tecniques in Earth, Atmospheric and Space Sciences	Physics	6	Semester	156
FIS10343M	Signal Analysis and Inversion Methods	Physics	6	Semester	156
FIS10352M	An Introduction to Space Geodesy and Crustal Deformation	Physics	6	Semester	156

1st Year - 2nd Semester
Specialization Internal Geophysics

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
FIS10345M	Energy, Environment and Sustainability	Renewable Energy Engineering	6	Semester	156
FIS10346M	Computational Methods in Physics and Engineering	Physics	6	Semester	156
FIS10353M	Seismology	Physics	6	Semester	156
FIS10354M	Applied and Environmental Geophysics	Physics	6	Semester	156
FIS10355M	Seismicity and Seismotectonics	Physics	6	Semester	156

2nd Year - 3rd Semester
Specialization Internal Geophysics

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
FIS10356M	Geothermics	Physics	6	Semester	156
FIS10357M	Seismic Risk and Strong Ground Movements	Physics	6	Semester	156
FIS10351M	Seminar on Earth, Atmospheric and Space Sciences	Physics	6	Semester	156
Dissertation					

2nd Year - 4th Semester
Specialization Internal Geophysics

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
Dissertation					

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Specialization Environmental Instrumentation

1st Year - 1st Semester
Specialization Environmental Instrumentation

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
FIS10340M	Earth and Atmospheric Physics	Physics	6	Semester	156
INF10358M	Programming and Intelligent systems	Informatics	6	Semester	156
FIS10342M	Observation Methods and Tecniques in Earth, Atmospheric and Space Sciences	Physics	6	Semester	156
FIS10343M	Signal Analysis and Inversion Methods	Physics	6	Semester	156
EME10359M	Instrumentation	Electrotechnical Engineering	6	Semester	156

1st Year - 2nd Semester
Specialization Environmental Instrumentation

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
FIS10345M	Energy, Environment and Sustainability	Renewable Energy Engineering	6	Semester	156
FIS10346M	Computational Methods in Physics and Engineering	Physics	6	Semester	156
FIS10348M	Remote Sensing and Environmental Satellites	Physics	6	Semester	156
QUI13041M	Atmospheric Pollution and Gas Effluents Emission	Chemistry	6	Semester	156
FIS10360M	Environmental Sensors	Physics	6	Semester	156

2nd Year - 3rd Semester
Specialization Environmental Instrumentation

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
FIS10361M	Optoelectronics	Electrotechnical Engineering	6	Semester	156
INF10362M	Data Mining	Informatics	6	Semester	156

2nd Year - 3rd Semester
Specialization Environmental Instrumentation

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
FIS10351M	Seminar on Earth, Atmospheric and Space Sciences	Physics	6	Semester	156
Dissertation					

2nd Year - 4th Semester
Specialization Environmental Instrumentation

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
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Specialization Degraded Environments Rehabilitation

1st Year - 1st Semester
Specialization Degraded Environments Rehabilitation

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
GEO10363M	Environmental Hydrogeology	Geology	6	Semester	156
GEO10093M	Applied Geochemistry	Geosciences	6	Semester	156
FIS10342M	Observation Methods and Tecniques in Earth, Atmospheric and Space Sciences	Physics	6	Semester	156
QUI10364M	Environmental Chemistry	Chemistry	6	Semester	156
BIO10365M	Evaluation of the state of surface freshwaters	Biological Sciences	6	Semester	156

1st Year - 2nd Semester
Specialization Degraded Environments Rehabilitation

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
FIS10345M	Energy, Environment and Sustainability	Renewable Energy Engineering	6	Semester	156
GEO10366M	Biogeochemistry of aquatic sediments	Geology	6	Semester	156
QUI13041M	Atmospheric Pollution and Gas Effluents Emission	Chemistry	6	Semester	156
GEO10080M	SIG Remote Sensing	Geology	6	Semester	156
FIS10354M	Applied and Environmental Geophysics	Physics	6	Semester	156

2nd Year - 3rd Semester
Specialization Degraded Environments Rehabilitation

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
PAO10367M	Methods for the recovery of degraded areas	Environment and Ecology Sciences	12	Semester	312
FIS10351M	Seminar on Earth, Atmospheric and Space Sciences	Physics	6	Semester	156
Dissertation					

2nd Year - 4th Semester
Specialization Degraded Environments Rehabilitation

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
Dissertation					

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3º Semestre:{\}newline

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Área de Especialização em Geofísica Interna:{\}newline

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1º Semestre:{\}newline

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{\}newline

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3º Semestre:{\}newline

3 UC Obrigatórias num Total de 18 Ects{\}newline

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Para obtenção do grau, é necessário também a aprovação em Dissertação, com o total de 42 ECTS, no 3.º e 4.º Semestre{\}newline

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Program Contents

Back

Earth and Atmospheric Physics (FIS10340M)

The shape of the Earth and the gravity field .
Introduction to Seismology.
Some comments about geophysical prospection.
Geomagnetism.
Introduction to paleomagnetism.
Introduction to the study of the heat flow from the Earth.
Composition and structure of the Earth's atmosphere.
Thermodynamics of the atmosphere: thermodynamic characteristics of dry and moist air. Thermodynamic processes in the atmosphere. Formation of dew, frost, fog and clouds. Statics of the atmosphere. The hydrostatic equation. Atmospheric stability. Clouds and precipitation.
Radiation: Earth radiation budget. Physical radiation laws of the blackbody. Radiation transmission in the atmosphere. Absorption. Emission and scattering. Radiative transfer equation. Greenhouse Effect. Aerosol effects. Radiative forcing.
Atmospheric dynamics: Fundamental forces in the atmosphere. Equations of fluid motion. The general
circulation of the atmosphere.

Back

Solar and Planetary Physics (FIS10341M)

(I) Astrophysics and the Universe:
(i.1) Introduction. Basic Concepts in Astronomy and Astrophysics.
(i.2) Formation and Evolution of our Universe.

(II) - Physics of the Sun
(ii.1) Introduction to the structure of the Sun,
(ii.2) Atmosphere of the Sun
(ii.3) Internal structure of the Sun,
(ii.4) Theory of helioseismology
(ii.5) Comments in helioseismology
(ii.6) Evolution of the Sun as a star,
(ii.7) Solar Neutrinos,
(ii.8) Sun-Earth Interaction
(ii.9) the Solar System: the Sun and its evolution.

(III) The solar system and its constituents:
(iii.1) The planets of the solar system
(iii.2) Other constituent bodies of the solar system,
(iii.3)The spatial distribution of bodies in the solar system
(iii.4) The dynamics of the solar system.

(IV) Planetary formation and evolution:
(iv.1) Formation of the Solar System: The solar disk,
(iv.2) Formation of the Solar System and the conservation of angular momentum. Formation of the Solar System and the origin of planets and asteroids.

Back

Observation Methods and Tecniques in Earth, Atmospheric and Space Sciences (FIS10342M)

Study of different remote sensing ground based instruments and their physical priciples (RADAR,LIDAR, Spectroscopy, Photometry, Interphotometry). Satellite remote sensing sensors. Physical principles of remote sensing. Passive and active systems. In situ monitoring systems. Meteorological instruments and radiosounding systems. GPS. Seismometers, gravity meters, magnetometers. Global observation network. Observation, interpretation and record of distinct geophysical field data found in different places.

Back

Signal Analysis and Inversion Methods (FIS10343M)

Digital signal processing and inversion methods - Analysis of discrete and continues time series. Applications of multivariate analysis to geophysics and climate. Principles and techniques of signal treatment geophysics and climate. Fast Fourier Transforms (FFT), Z transforms Laplace transforms. Deconvolution, fileter design and transfer function. Spectral analysis. Inverse problem in geophysics and Atmosphere.
Methods of linear and non linear inversion. Problem of non-unicity; Analysis of data and model resolutions. Applications.

Back

Radiation, Clouds and Precipitation (FIS10344M)

Back

Energy, Environment and Sustainability (FIS10345M)

1. The Earth: subsystems and their interaction. The resources: content, availability and strategic importance. Duration of resources and their distribution.
2. Sustainability and use of resources: Biocapacity and ecological footprint, the ecological balance, the water footprint and the carbon footprint. Energy and sustainability: "life-cycle assessment"in the scope of sustainability. Diagnosis for the sustainability in Portugal.
3. Energy, entropy and exergy. Thermodynamic cycles.
4. Energy sources: fossil fuels, nuclear energy and alternative sources (renewable energy).
5. Energy and exergetics analysis. Energy efficiency. Energy storage.
6. Energy and environment: pollution, greenhouse effect and climate change.

Back

Computational Methods in Physics and Engineering (FIS10346M)

1. Introduction - The actual paradigm in computation, computational algorithms and languages, computational arithmetic
2. Basic numerical methods - operation with matrix, differentiation and integration, interpolation, nonlinear equations, systems of linear equations, systems of nonlinear equations, approximation of functions
3. Differential equations - Ordinary differential equations and partial differential equations
4. Modelling of continuous systems - diffusion equation, wave equation and hydrodynamic equations
5. Spectral analysis - continuous Fourier transform, discrete Fourier transform, FFT, determination of spectral energy density
6. Optimization and inversion - Linear programming, quadratic, nonlinear and integer; linear and nonlinear inverse problem, least square method, Baysian formulation of inverse problem, a priori information, analysis of resolution and errors.

Back

Climate, Climate Modelling and Climate Change (FIS10347M)

The Climate system. Spatio-temporal scales; non-linearity and feedbacks; climate variability and predictability; brief history of the climate; palaeoclimatology.
The Observed general circulation of the atmosphere and the oceans; The global cycles of energy, angular momentum, water and carbon dioxide, quasi periodic oscillations and teleconnections.
Radiation and radiative forcing; gases, aerosols, clouds and radiation in the atmosphere, radiative transfer models. The greenhouse effect of the atmosphere.
Climate change. Climate change detection and attribution of causes; Observations on the surface, atmosphere, oceans and cryosphere
Climate models; Energy balance models, general circulation climate models and its components; Evaluation and validation of climate models
Scenarios of future climate. Downscaling of future climate scenarios

Back

Atmospheric Pollution and Gas Effluents Emission (QUI13041M)

Air pollutants and its action. Strotospheric ozone. Photochemical smog. Acid rain. Air particles in suspension. Volatile organic compounds. Greenhouse effect gases. Metals and metalic compounds. Air pollutants monitoring. Environmental laws. Standard methods for monitoring the main air pollutants. Methods for gaseous emission treatment. Gravity settlers. Cyclones. Electrostatic precipitators. Filtration. Washers. Dispersion of pollutants in the atmosphere. Elements of atmospheric physics and dynamics. Atmospheric circulations and the transport of pollutants. Atmospheric Boundary Layer and Turbulence. Air pollution dispersion models.

Back

Remote Sensing and Environmental Satellites (FIS10348M)

1. Introduction: Basic concepts in remote sensing; Brief history of remote sensing; Benefits of Remote Sensing in Earth Sciences. 2. Fundamentals of radiation: Nature and properties of radiation: The electromagnetic spectrum; Radiometric quantities and measurement unit: Laws of radiation: Interaction of radiation with the environment; Introduction to radiative transfer; Radiative transfer codes. 3. Satellites and sensors: Orbital mechanics and types of orbits; Observation geometries; Types of sensors; Satellite images and resolutions; Global spatial observation system; Environmental missions; Geographic information system: a useful tool in remote sensing; Other open access computer applications. 4. Image processing and analysis: Introduction; Pre-processing; Enhancement operations and transformations; Classification and analysis; 5. Calibration and validation; 6. Environmental applications: The problem of inversion in remote sensing; Monitoring; Emergency and alert.

Back

Synoptic Meteorology and Weather Forecast (FIS10349M)

The general circulation of the atmosphere and the scales in meteorology. Global meteorological observations and synoptic weather charts. Structure and evolution of the main synoptic weather systems.
Synoptic meteorology equations: The fundamental equations of the atmospheric motions; scale analysis and approximations; circulation and vorticity; the vorticity equation;
The quasi-geostrophic approach and the extra-tropical circulations; Diagnosis of the vertical motion.
Introduction to numerical weather prediction: historical aspects of weather forecasting; methods of discretization and numerical integration of the equations.
Parametrization and representation of sub-scale physical phenomena in NWP models: turbulence, clouds and precipitation, radiation, surface-atmosphere interaction.
Data assimilation and meteorological analysis. Predicatbility and Probabilistic prediction.
Nowcasting and
Very Short Term Forecasting

Back

Athmosferical Boundary Layer Micrometeorology (FIS10350M)

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Seminar on Earth, Atmospheric and Space Sciences (FIS10351M)

Due to the specific objectives of this curricular unit, the contents will vary from year to year, being influenced mainly 1) by the scientific partnerships established within the scope of ongoing research projects in which the teaching staff are working and 2) by the events that take place and can be easiliy integrated into the topics of the UC.
However, the program will provide advanced knowledge in the areas of Earth, Atmosphere and Space Sciences, in particular in the following domains: Meteorology, Climate, Climate Variability and Climate Change, Observation and detection systems and techniques for monitoring the atmosphere and the space, Seismology and seismic risk, Geophysical prospecting, Genesis and dynamics of geological materials, mineral resources, environmental impacts, genesis and dynamics of geological materials, distribution of geological materials on the Earth's surface.

Back

An Introduction to Space Geodesy and Crustal Deformation (FIS10352M)

1. Elastic and viscoelastic models that explain the crustal deformation: seismic cycle; deformations of the continents; kinematics of the lithospheric plates

2 Operating means of calculus
a) Tensor calculus
b) Stress tensor and properties
c) Tensor of the deformations and properties
d) Relations between stresses and strains in isotropic materials

3. Mechanics of earthquakes
a) Models of rupture;
b) Quantification of the source
c) Relations of scale

4. Analytical and numerical models of crustal deformation
a) analytical Okada formulas for point-source situations
b) analytical and numerical methods for modeling the deformation produced by finite sources (EDMC and Coulomb programs)

5. Techniques based on space geodesy to measure the deformation: global positioning system (GPS) and differential radar interferometry (DInSAR)

6. Modeling of surface deformation associated with a published source model of a recent earthquake. The results will be compared with GPS or InSAR registered data

Back

Seismology (FIS10353M)

1) Complements of continuum mechanics.
2) Equations of motion.
3) wave propagation inside the Earth.
4) Internal waves, surface waves.
5) inelasticity and anisotropy.
6) Earth eigenmodes.
7) Seismic Source.
8) synthetic seismograms.
10) Analysis of seismic data.

Back

Applied and Environmental Geophysics (FIS10354M)

1. Introduction to geophysical methods
2. Gravimetric method
3. Magnetic method
4. Seismic methods
5. Electromagnetic methods
6. Electrical method
7. Planning a geophysical survey
8. Conducting a geophysical survey
9. Conducting a final report

Back

Seismicity and Seismotectonics (FIS10355M)

Back

Geothermics (FIS10356M)

Introduction. Some data . Heat transport mechanisms. Thermal properties of the rocks. Heat originated by radioactive elements. Heat flow in oceans, age of the crust and bathymetry.
Heat flow in continents. Problems found in the calculus of geotherms in continents. Heat flow from the mantle.
Secular variations of temperature and heat flow. Secular cooling of the lithosphere. Secular decrease of the heat flow from the mantle and thickness increase of the lithosphere.
Thermal perturbations related with orogenies, metamorphism, erosion or material deposition. Thermal regime in extension regions. Horizontal heat transport.
Some problems associated with depth temperature calculation, based on data obtained from the surface. Adiabatic gradient.
Analysis of maps of Portugal with thermal springs and chemical classification and water temperature.
Prospection of geothermal systems. Geophysical methods used.

Back

Seismic Risk and Strong Ground Movements (FIS10357M)

Back

Programming and Intelligent systems (INF10358M)

1. Object oriented programmig paradigm. Data structures. Flow Control instructions. Control and monitoring systems application.
2. Graphical user interfaces - Instrument Data logging, data transmission to instruments, PLCs and computers. Data presentation; time series, andn alarm settings. . Recebimento de ordens provenientes de um utilizador humano através da interface gráfica. Data processing.
3. Control and automation. - Application to control an d automation processes of production processes.

Back

Instrumentation (EME10359M)

Back

Environmental Sensors (FIS10360M)

Main environmental quantities that should be monitored. International System of Units.
Transducers for mechanical, thermal, electric, magnetic, radiation and chemical quantities. Optical or electrical signal acquisition and processing; data transmission and storage. Considerations about the most frequently used sensors. Physical principles of the sensors that are part of the satellite and surface based, earth observation systems. Automatic calibration, digital image acquisition and transmission.
Sensitivity and precision. Sampling problems.

Back

Optoelectronics (FIS10361M)

1. Introduction to optoelectronic systems.
2. Light sources: LEDs and LASERS (gas and solid state). Noise and coherence.
3. Optical detectors: photodiodes, phototransistors, photoconductors. Silicon array sensor: CCDs, photodiodes arrays.
4. Lenses, prism and mirrors.
5. Light polarization, matter interaction and birefringence.
6. Diffraction gratings, holography, converters and electro-optic modulators.
7. Optical fibers.
8. Optical measurements.
9. Construction of optical systems and design of electronic subsystems.
10. Photovoltaic energy systems.

Back

Data Mining (INF10362M)

1. Introduction: Machine learning and data mining
2. Classification problems
3. Naive Bayes
4. Decision trees
5. Instance based algorithms
6. SVM
7. Input: concepts, instances e attributes
8. Output: knowledge representation
9. Performance evaluation
10. Data Processing for "knowledge discovery"
11. Clustering
12. Data association
13. Visualization
14. Applications

Back

Environmental Hydrogeology (GEO10363M)

Rational exploitation, over-exploitation, methods of contamination and protection of aquifers against contamination. Wellhead protection areas. Remediation measures in aquifers. Remediation of groundwater contaminated with metals. Remediation of hydrocarbons, volatile or nonvolatile, dense or light. Remediation of organic contaminants, chlorinated solvents, sulfates, nitrates and other contaminants. Methodologies used for treatment of groundwater, bioremediation, oxidation/reduction chemistry, in situ flushing, air sparging, permeable reactive barriers, electrochinectics, thermal methods, steam, treatment by UV/oxidation, horizontal holes, vertical circulation holes, hydraulic and pneumatic fracturing applied to groundwater remediation, stabilization/solidification, natural attenuation, etc. .. Interaction groundwater/surface water. Methodology for identification and their importance in the hydrological cycle. Groundwater-dependent ecosystems. Methodology of identification.

Back

Applied Geochemistry (GEO10093M)

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

Environmental Chemistry (QUI10364M)

1. Introduction

1.1 General concepts

1.2 Pollution and environmental problems. Natural pollution versus anthropogenic pollution

2. Water and liquid effluents

2.1 Water pollution. Surface and groundwater. Parameters that determine water quality and methods of analysis used

2.2 European and national legislation

2.3 Characterization of water and wastewater:

2.3.1 Physical parameters

2.3.2 Chemical parameters

2.3.3 Biological parameters

3. Water and effluent treatment processes

3.1 Water treatment processes for human consumption (WTP's)

3.2 Wastewater treatment processes (WWTPs)

4. Soil chemistry

4.1 Contamination of the soil. Organic and inorganic pollutants (trace metals)

5. Remediation of contaminated soils and food safety

5.1 Chemical and biological remediation

6. Phytoremediation of soil and water

6.1 Case Studies

Back

Evaluation of the state of surface freshwaters (BIO10365M)

1. Freshwater ecosystems: diversity at a global scale (Definition of inland water ecosystems; Climate, hydrology and spatial and temporal scales; Components of the hydrological regime; Physical, chemical and biological processes; Links at river basin scale; Hydrographic network, river basins and hydrographic regions in Portugal (regional scale))
2. Lentic ecosystems (Physical-chemical and biological processes)
3. Lotic ecosystems (Physical-chemical and biological processes)
4. Biological indicators (Natural disturbances versus anthropogenic disturbances; European Union Water Framework Directive (WFD))
5. Ecosystem Services (Commitment, synergy and disservice; biodiversity; Valorization and benefits of Ecosystem Services; involvement and perception of social actors)
6. Ecological Conservation and Restoration (Dimensions of restoration; uncertainty, challenges/opportunities, success; Public perception of river restoration; Naturally Based Solutions

Back

Biogeochemistry of aquatic sediments (GEO10366M)

Biogeochemistry of aquatic systems: Introduction
River Sediments: Characteristics of rivers, Material flows through rivers, Chemical fluxes and dynamics of rivers.
Lacustrine sedimentation in artificial systems: The natural erosion and accelerated erosion of soils in the watersheds of the lake systems, Physical and chemical processes in lake systems, Dams and reservoirs and nutrient cycles, Factors controlling the transport of materials and sedimentation in dams, Transport and sedimentation of materials, Mechanisms of Transport and Deposition of Clay Minerals, Chemical fluxes and dynamics of lakes.
Biogeochemistry of river and lake sediments: major elements (Ca, Mg, Na, K, Na), metallic elements, trace metals, nitrogen, phosphorus, carbon, methane, redox potential.
Pollution and remediation of aquatic systems: Acidification, Pollution by pathogens and toxins, Eutrophication, The redox potential and recovery of lakes, Dredging as a recovery technique.

Back

SIG Remote Sensing (GEO10080M)

GENERAL CONCEPTS
Graphic representations; Projection Systems; Georeferencing.
Spatial data informatics.
Raster and vector data.
Organization of information.
Data types and structures.

GIS
Symbology and labels.
Creation of vector data.
Treatment and vector data.
Creating Layouts.

RS
Aerial, drone and satellite photography, principles of image acquisition and processing.
Orthorectified and stereoscopic images.
Creation of digital elevation and terrain models.

Project
Problematization, design and implementation of a DR & GIS project applied to geosciences.
Final report writing.

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Methods for the recovery of degraded areas (PAO10367M)

1. Introduction to the concepts of rehabilitation and containment of degraded areas - objectives, criteria and rehabilitation targets
2. Impacts due to mining and other activities (industry or military). Treatment in degraded areas
3. Correction of impacts of superficial water systems
4. Rehabilitation of aquifers
5. Soil, sediments and water contamination. Corrective measures.
6. Correction of impacts on air, soil, landscape and ecological systems.
7. Project.