

Undergraduate (first-cycle) interdisciplinary science programme

Earth sciences in a changing world

Plan of study

If you wish to see a short description of the course please go to the further pages of the document or click on the course title to get the description directly.

1st semester

Course title	ECTS number	Hours	Obligatory (OB) / Optional (OP)
Health and Safety Training	0	4	OB
Foreign language	0	30	OB
Introduction to Chemistry	1	20	OB
Cultural heritage and development	1	15	OB
Physical geology	5	65	OB
The Earth-Life system evolution through the time	4	50	OB
Minerals of selected geological environments	4	50	OB
Dynamic geology field trips	2	25	OB
Meteorology and climatology	4	50	OB
Soil science and soil survey	4	50	OB
Protection of geodiversity	2	25	OP
Scientific information acquisition	1	13	OP
Cartography, topography and remote sensing	2	25	OP

2nd semester

Course title	ECTS number	Hours	Obligatory (OB) / Optional (OP)
Foreign language	0	30	OB
Geoethics	2	25	OB
Hydrology and Hydrogeology	4	50	OB
Geomorphology	4	50	OB
Global social and economic issues	2	25	OB
Anthropocene	2	25	OB
Energy sources	4	25	OB
Industrial technologies and their environmental impact	4	48	OB
Medical geology	2	26	OP
Geotourism	2	25	OP
Green Economy (GE) in Cities and Regions	3	30	OP
Topography application in field trips	1	13	OP
History of life	2	20	OP

3rd semester

Course title	ECTS number	Hours	Obligatory (OB) / Optional (OP)
Physical Education	0	30	OB
Foreign language	2	30	OB
Statistics in Earth Sciences	3	36	OB
Environmental geochemistry	2	28	OB
Petrology and evolution of the lithosphere	5	65	OB
Geochemistry	4	45	OB
Geological field trips: ore deposits, historical mining, anthropopression	3	40	OB
Geological mapping	2	25	OB
Biotic response to environmental changes in modern and fossil ecosystems	4	40	OP
Mass extinctions in the Earth history	3	35	OP
Geological project	2	25	OP
Minerals and rocks	3	45	OP
The Baltic Sea Region – Nature and Man	3	30	OP
Introduction to remote sensing	3	30	OP

4th semester

Course title	ECTS number	Hours	Obligatory (OB) / Optional (OP)
Physical Education	0	30	OB
Foreign language	2	30	OB
Introduction to Geographic Information Science	4	40	OB
Introduction to economic geography	2	25	OB
Geohazards and risk management	3	28	OB
Atmospheric physics	1	15	OB
Legal aspects of environmental protection	1	15	OB
Geography Seminar Series	3	30	OP
Hydrology of High Mountains	3	50	OP
Evolution of urban structures and milieus	3	30	OP
GIS for Urban Policy and Practice	3	30	OP
Techniques and technologies in environmental protection	2	25	OP
Exploitation of deposits: Social, economic and ethical issues	3	30	OP
Isotopes in the studies of environmental pollution	2	25	OP

5th semester

Course title	ECTS number	Hours	Obligatory (OB) / Optional (OP)
Licencjat (Bachelor) degree seminar	1	15	OB
Licencjat (Bachelor) degree laboratory	4	20	OB
Geology of mineral resources: Research methods, processing and stock enrichment	3	38	OB
Sedimentary environments and processes of sedimentation	3	38	OB
Climate changes in the past and the future perspective	2	25	OB
Urban, rural and population geography	2	25	OB
Practicals in ore geology – evaporates	1	14	OP
Practicals in ore geology – Zn-Pb ores	1	14	OP
Global environmental change	3	38	OP
Remote sensing in the Earth sciences	2	30	OP
Strategies of adaptation to climate change	3	38	OP
Soil erosion and conservation	1	20	OP
Knowledge Based Economy and Society from Local and Regional Perspective	1	13	OP
Information Communication Technology in Science Education	5	60	OP

6th semester

Course title	ECTS number	Hours	Obligatory (OB) / Optional (OP)
Licencjat (Bachelor) degree seminar	1	15	OB
Licencjat (Bachelor) degree laboratory	4	20	OB
Landscape ecology	2	25	OB
Novel materials and raw materials in future	2	25	OB
Methods of mineralogical and chemical analyses	4	50	OB
Air pollution: Contemporary challenge	2	25	OP
Waste management in natural resources politics	1	15	OP
Soil, water and natural resources protection	3	30	OP
Fossil fuels	2	25	OP
Sustainable development in raw materials management	2	25	OP
Role of education in environmental protection and sustainable development implementation	2	25	OP
Environmental mineralogy	2	25	OP
Volunteer project	2	25	OP

Description of the courses listed in the tables above

1st semester

Health and Safety Training

There are no ECTS points assigned for the course as it is an obligatory technical training for all students. The students will get familiar with basic safety rules concerning the function of the university buildings, safety procedures in case of emergency, and recommendations concerning health protection during the classes, including field trips.

Foreign language

There are no ECTS points assigned for the course as it is an obligatory module for all students. The offer of the language courses available for a particular academic year is announced in the organizational period before the beginning of the first or third semester.

Introduction to Chemistry

1 ECTS, 20 hours

Structure of the atoms and molecules, types of chemical bonds, structures of solid bodies and methods of research, elements of thermodynamics and chemical kinetics, chemical balance, theories of acids and alkaline, colloidal solutions, periodic table, classification and properties of elements and compounds, chemical nomenclature, methods of qualitative and quantitative chemical analysis.

Cultural heritage and development

1 ECTS, 15 hours

Drawing on theoretical frameworks and research developed within multidisciplinary studies of heritage (heritage studies, heritage science), including sociologic, geographic and economic perspectives, the aim of the course is to introduce students to diverse issues linked with considering cultural heritage and its various expressions (tangible and intangible, cultural landscapes) as a specific resource in local and regional development. This goal will be achieved by looking at the historical development of the concept of heritage, different legal definitions and regulations linked with it, major levels of heritage management (international, national, local) and case studies illustrating main potential spheres of impact of heritage on development processes as well as opportunities and challenges linked with sustainable management of heritage assets and the use of heritage in sustainable development.

Upon completion of this course students should be able to understand and explain the uniqueness and specificity of cultural heritage as a development asset, define its values, stakeholders and dimensions of potential impact on development as well as

learn to conduct a basic analysis of opportunities, and challenges linked with contemporary uses of heritage and undertaking particular heritage projects.

Physical geology

4 ECTS, 50 hours

Lecture: Earth structure, minerals and their physical properties, main rock types, paleomagnetism, heat flux, geological time, plutonism, volcanism, surface geological processes: denudation, erosion, mass movements, contemporary and past sedimentation environments (eolian, fluvial, glacial, marine), diagenesis, metamorphism, ground waters and their protection, karst phenomena, tectonics, earthquakes, Wegener hypothesis, lithosphere plates tectonics, orogenic ranges, mineral resources (oil, gas), effects of anthropogenic activity

Laboratory: characteristics, description and macroscopic recognition of rock-forming minerals and rocks (magmatic, metamorphic, sediment), rock classification, rock genesis recognition. Elements of sedimentology: sediment, erosion, deformation and biogenic structures. Recognition of macroscopic structures in rocks. Geological maps: types and elements. Parameters of stratum location. Application of geological compass. Measurements of horizontal and vertical angles. Methods of recording the measurements of stratum location. Theoretical principles of geological intersection. Methods of interpretation and drawing intersection lines. Reading geological maps, preparation of geological intersections.

The Earth-Life system evolution through the time

4 ECTS, 50 hours

Lecture: natural history, interactions between biosphere and geosphere in Earth history, basic facts from the Earth history, explanation of the spatial differentiation of natural processes, dynamics of biotic and abiotic environments

Laboratory: description and recognition characteristic facies and fossils.

Minerals of selected geological environments

4 ECTS, 50 hours

Students learn principles of basic methods of mineral identification. The practical classes allow students to identify mineral components of rock samples from selected geological environments by comparing observations from macro specimens with microscopy images of thin sections in plane polarized light and cross polars.

Dynamic geology field trips

2 ECTS, 25 hours

During field trips in Kraków neighborhood students learn major outlines of geology of Southern Poland what allows the discussion of the development of earth crust and its changes. Students examine the causes of the geological processes, study the results of their effect on the structure of the earth's comparing the landforms with geological information given and observed.

Meteorology and climatology

4 ECTS, 50 hours

The class consists of three components: lectures, laboratory classes and field classes. Lectures present composition and structure of the atmosphere, climate-forming factors and processes, radiation and heat balance, thermal regime of the active surface and the atmosphere, atmospheric water vapour and pressure issues, global atmospheric circulation including air masses and atmospheric fronts, climates of the Earth, climate change and variability.

Laboratory classes make students familiar with meteorological instruments, standard and automatic measurements of main elements: air pressure, temperature, humidity, precipitation and wind, basic numerical and graphical methods of data analysis used in climatology and environmental engineering. Field classes are organized to enable the students to use meteorological measurements at a weather station.

Soil science and soil survey

4 ECTS, 50 hours

The course 'Soil science and soil survey' consist of lectures, field-course and laboratory classes. The lectures introduce into the basics of soil science, namely the issues concerning weathering and soil genesis, components of soils, its properties and fundamental pedogenic processes around the world. The problems of soil threats and soil management are also emphasized. The field-course gives an opportunity to get acquainted with the diversity of soils and soil investigation methods and strategies. During the laboratory classes the issues of soil classification and cartography are raised.

Protection of geodiversity

2 ECTS, 25 hours

Lecture: abiotic nature, geological heritage, geoprotection and its history, geoprotection forms and organizations, geodiversity versus biodiversity, importance of geodiversity for human economy, science and esthetics, geodiversity resources in particular regions of the world, threats to the geodiversity, active and passive protection

of geodiversity (national parks, geoparks, museums), UNESCO list of world heritage, geological and cartographic records of geodiversity

Seminar: analysis of chosen sites with geodiversity protection

Scientific information acquisition

1 ECTS, 13 hours

Scientific and public libraries: organization and functioning, catalogues, book exchange mechanism, internet access to the libraries resources

Internet resources: access to scientific publication data bases, restrictions to data access, scientific bibliographies in internet, positioning internet sites in connection to finding information needs. Basic rules and terms linked to the intellectual property protection and authorship.

Cartography, topography and remote sensing

2 ECTS, 25 hours

Mathematic basis of maps. Map scale, coordinates, projections. Map classification, topographic, general and thematic maps. Content generalization. Map reading, cartometry. Methods of cartographic presentation. Chosen methods of remote sensing. Interpretation of airborne images. Satellite images and their application. Geographical information systems (GIS). Satellite positioning (GPS). Cartographic metadata.

2nd semester

Foreign language

There are no ECTS points assigned for the course as it is an obligatory module for all students. The offer of the language courses available for a particular academic year is announced in the organizational period before the beginning of the first or third semester.

Geoethics

2 ECTS, 25 hours

The interdisciplinary approach of the field between Geosciences and Ethics. During the course students are introduced to the basic problems and terminology of ethics with respect to the contemporary major discussions in the earth sciences field. The course will widen the understanding of earth sciences contemporary problems concerning georesources exploration and mining with respect to sustainable and peaceful development.

Hydrology and Hydrogeology

4 ECTS, 50 hours

Lecture: the water cycle: review of main processes in the hydrologic cycle such as precipitation, evapotranspiration and transpiration, runoff, infiltration, and ground water; regional distribution of water resources; an overview of some aspects of the field hydrology; some concepts and tools for water resources management

Seminar: regional examples of water resources management

Field classes: visiting an experimental catchment, measurements of river discharge, and physical and chemical properties of surface and ground water

Geomorphology

4 ECTS, 50 hours

Lecture: basic geomorphological terms, concepts, geomorphological factors and processes, structural and climatic controls of the land forms development, denudation and time, slope theory: material, processes, forms; fluvial and glacial forms and processes; glacial and periglacial relief, extent of ice-covered areas, types of deglaciation; eolian processes; land forms of arid areas, types of deserts, morphologic role of plants in the deserts; land forms in high mountains, morphogenetic vertical zones, asymmetry of mountain areas; land forms of the coasts, land areas modelling; land form development in connection with geology; volcanic and plutonic forms; long-term changes of sea level and its geomorphological effects; karstic processes and land forms; geomorphologic human activity

Field classes: monitoring of geomorphic processes in a river basin, sediments circulation in a river basin; relation of the land form and geological structure; recognition and analysis of land forms in chosen sites, main processes and role of anthropopression; landslides in the Carpathian Mts.

Global social and economic issues

2 ECTS, 25 hours

Identification of global processes: global financial crisis, effects of economic growth disproportionate to global resources, the issue of control over the activities of transnational corporations; disproportions in the possibilities of using new ICT, transport technologies, pressure of electronic media on cultural diversity. Westernization and Macdonaldisation. Areas of marginalization and social and economic exclusion. Alternatives to the pattern of continuous economic growth (global cities, global circulation of electronic money, cultural uniformity) - microcredit, slow food, alternative networks.

Anthropocene

2 ECTS, 25 hours

Lecture: Anthropocene: a new geological epoch, mass-media term, ethical, moral and political crisis synonym; criteria of its definitions, records in the sediments and environmental, social and political impact; anthroposphere and its metabolism; resources of the future, circular economy, sustainable development; ethics and responsibility in business. Seminar: discussion on environmental problems of chosen sites

Energy sources

4 ECTS, 25 hours

Classification of energy sources, fossil fuels, nuclear Energy, renewable energy sources, energy challenge of the future, impact of energy generation on the environment

Industrial technologies and their environmental impact

4 ECTS, 48 hours

Lecture: Industry development from the first industrial revolution through invention of nuclear bomb, development of transportation and chemical industry; chosen schemes of technologies in energy production, metallurgy, chemical industry, cement production; agriculture development and its connection to industry, together with environmental impact

Field classes: visits in chosen factories to learn about the technologies used and their impact on environment

Medical geology

2 ECTS, 26 hours

Importance of minerals for human health; geochemical issues: effects of iodine and selenium deficit, impact of radon on human body, mercury, arsenic and lead toxic effects; geological issues: health hazards due to volcanic eruptions and mining; anthropogenic issues: changes in particulate matters and their impact on human respiratory system, health effects of toxic organic compounds from coal, asbestos.

Geotourism

2 ECTS, 25 hours

Lecture: classification of geotourism forms, basic concepts, geodiversity, chosen geotouristic objects in different regions of the world, model of geotouristic evaluation, geotourism as a form of Earth science promotion

Seminar: a project of adaptation of geological objects for the geotourism needs. Geotouristic resources. Creation of the respectful attitude to the geological heritage.

Green Economy (GE) in Cities and Regions

3 ECTS, 30 hours

Green economy (GE) from local and regional perspective in Europe and in the world. (GE general dimension, GE sectors, GE tools, green growth in an urban context). Environmental dimension of GE in cities and regions (resources efficiency, energy efficiency, zero waste economy, climate change, air pollution, waste management systems, waste recycling). Economic and social dimension of GE in cities and regions (circular economy; service economy; sharing economy, GE growth; GE taxation, GE labour market, GE education, Ge influence on social equity and human well-being). Local and regional policy for GE implementation (smart/green/sustainable/circular cities, e-governance, informational technologies, industrial and urban symbiosis, eco-innovations). Spatial dimension and geographical areas of GE development (GE world best practices in cities and regions).

Topography application in field trips

1 ECTS, 13 hours

Field classes follow the lecture. Students are divided into groups which identify in chosen areas a number of points suggested in the maps. The task is to realize a pre-defined route in a limited time. The course is realized in the vicinities of Kraków where the land forms and the land use are rather diversified.

History of life

2 ECTS, 20 hours

Main assumptions of Darwin's theories of evolution and species origin processes. Genesis and early development of life on Earth. Main phases of the evolution of invertebrates, with special focus on groups stratigraphically significant (molluscs, arthropods, echinoderms). Early stages of the evolution of vertebrates.

3rd semester

Physical Education

There are no ECTS points assigned for the course as it is an obligatory module for all students. It comprises of regular sport sessions of gymnastics or group games.

Foreign language

There are no ECTS points assigned for the course as it is an obligatory module for all students. The offer of the language courses available for a particular academic year is announced in the organizational period before the beginning of the first or third semester.

Statistics in Earth Sciences

3 ECTS, 36 hours

Lecture: basic concepts in statistics, statistical methods, graphic methods of data presentation, statistical parameters, probability, data distribution, statistical reasoning, estimation, testing the hypotheses, correlation and regression, cluster analysis

Laboratory: preparation of histogram, calculation of basic statistics, practical application of estimation and statistical reasoning, testing the hypotheses, correlation and regression, cluster analysis

Environmental geochemistry

2 ECTS, 28 hours

Environments and inorganic processes. Role of biosphere. Environmental sample preparation and analysis. Environmental isotopes. Global ecosystem. Geochemical cycles. Chemical and toxic characteristics of selected elements. Environmental pollution: sources, causes and effects. Environmental impact of mining. Environment monitoring system and legal aspects. Revegetation and sustainable development.

Petrology and evolution of the lithosphere

5 ECTS, 65 hours

Evolution of the lithosphere, genesis of the continental crust and its evolution. Petrology of magmatic, metamorphic and sediment rocks. Classification of particular groups of rocks, processes and factors contributing to the genesis of particular groups of rocks, links to geomorphological processes and formation of mineral resources.

Geochemistry

4 ECTS, 45 hours

Chemical evolution of early Earth. Geochemical processes related to magmatic, sedimentary and metamorphic rocks. Application of trace elements in petrogenesis. Isotope geochemistry. Geochemistry of selected depositional environments. Geochemical characteristics and paleoclimate. Marine geochemistry. Elements of organic geochemistry and biochemistry.

Geological field trips: ore deposits, historical mining, anthropopression

3 ECTS, 40 h

Geological structure of the area studied during the field classes, acquisition of information on the geological structure, preparation of rock and geological phenomena description, exploitation of mineral resources, history of mining and land use, anthropopression and its impact on the environment

Geological mapping

2 ECTS, 25 hours

Surface and underground geological cartography, methods and techniques, types of geological maps, preparation of geological maps. Geological mapping in practice, construction of geological maps, cross-sections. Application of geophysical methods, remote sensing and computer techniques.

Biotic response to environmental changes in modern and fossil ecosystems

4 ECTS, 40 hours

Lecture: ecology of basic groups of fossil and contemporary marine organisms, changes in biocoenosis versus biotic, physical and chemical parameters of the environment, ecology of the biocoenosis in the context of the biosphere evolution

Laboratory: paleoecological analyses, interpretation of sedimentary environment with the application of biotic elements

Mass extinctions in the Earth history

3 ECTS, 35 hours

Analyses of the greatest mass extinction cases in Earth history; contemporary changes in the environment in the context of mass extinction cases. Students will prepare individual reports on chosen issues based on the analysis of selected publications.

Geological project

2 ECTS, 25 hours

One of the skills a scientist must possess is the ability to identify a problem, search the scientific literature on the selected problem, synthesize that literature into a coherent understanding of the problem, and then propose the research plan in order to tackle the specific scientific problems. The purpose of this course is to learn these essential skills and knowledge.

Minerals and rocks

3 ECTS, 45 hours

Student learns basic methods of laboratory investigations of rock forming minerals. The project which he has to be completed is based on minerals identification by means of X-ray diffractometry, IR spectroscopy, scanning electron microscope studies with point EDS chemical analyses.

The Baltic Sea Region – Nature and Man

3 ECTS, 30 hours

Physical geography of the Baltic. Life in the Baltic. Eutrophication of the Baltic Sea. Industrial emissions and toxic pollutants. The environmental impact of pollutants. Environmental policy and cooperation in the Baltic Region. The prospect of sustainable society. Local and regional development. Nations and religions in the Region.

Introduction to remote sensing

3 ECTS, 30 hours

This module gives a first insight into methods of remote sensing and their application in different fields of Earth Sciences. The beginning of module is an intense introduction to the basics of remote sensing that connects methodological components with problem oriented thematic research questions. A second part consists in advanced methods of RS considering applications in Earth Sciences.

4th semester

Physical Education

There are no ECTS points assigned for the course as it is an obligatory module for all students. It comprises of regular sport sessions of gymnastics or group games.

Foreign language

There are no ECTS points assigned for the course as it is an obligatory module for all students. The offer of the language courses available for a particular academic year is announced in the organizational period before the beginning of the first or third semester.

Introduction to Geographic Information Science

4 ECTS, 40 hours

The course introduces a domain of Geographic Information Science, in theoretical and practical aspects through lectures and hands-on exercises with computers and geographic information software. The students learn how various phenomena and objects in the real world are represented in spatial databases. Raster / vector models and spatial reference systems are discussed in detail. Then the course presents various methods of spatial data acquisition, with a focus on optical remote sensing (e.g., Landsat and Sentinel missions), elevation data acquisition (e.g., airborne laser scanning) and satellite navigation systems, and explains how various spatial data are currently integrated and made available through spatial information infrastructures. Finally, the students learn basic analytical methods and various aspects of cartographic visualisation.

Introduction to economic geography

2 ECTS, 25 hours

Demographic issues (eg. ageing, domestic and international migration); rural geographies; classical theories of industrial location; agglomeration and urbanisation economies, clusters and regional development; role of FDI in local economic development – critical perspective.

Geohazards and risk management

3 ECTS, 28 hours

Lecture: The impact of natural and man-made geohazards on lithosphere and landforms. Typology and features of geohazards. Characteristics of threatened areas. Methods to prevent the negative effects of geohazards. Forecasting and warning systems. Geohazards adaptation. Risk management.

Seminar: Review of selected geohazards (e.g. earthquakes, volcanic explosions, mass movements, tropical cyclones, tornadoes, tsunamis, storms, floods). Identification and monitoring of selected geohazards and their impact for risk management in threatened areas – Landslide Counteracting System (SOPO). Landslide mapping. Inventory framework. Field observations. Landslide inventory for hazard assessment in a local and regional scale.

Atmospheric physics

1 ECTS, 15 hours

The lecture presents evolution of the Earth's atmosphere and the atmospheres of other planets, energy transfer processes including radiation, cloud physics, basics of atmospheric chemistry, air pollution and its impact on the energy balance in the atmosphere, atmospheric boundary layer, methods of atmospheric research

Legal aspects of environmental protection

1 ECTS, 15 hours

Functioning of international governmental and non-governmental organizations whose activity is linked to environmental protection and sustainable development. Globalization and climate change versus legal regulations. Role of pro-ecological organizations in the contemporary system of environmental protection.

Geography Seminar Series

3 ECTS, 30 hours

A part of the seminar is scheduled for the lectures of foreign researchers coming to the Institute of Geography and Spatial Management, Jagiellonian University. They present the most recent issues from physical and human geography, studied currently. There is a discussion after each lecture. Other part of the seminar is organized as a combination of introductory lectures about current environmental problems (e.g. eutrophication, natural hazards), followed by the discussion based on individual input of every course's participant, who read in advance selected scientific papers about a given issue.

Hydrology of High Mountains

3 ECTS, 50 hours

Geographical characteristics of catchments in high mountain areas, the significance of glaciers in river hydrology, types of glaciers, transformation of snow to ice, mass balance and glacier movement, deformation of ice, thermal regime of glaciers, water in glaciers, river regimes in high mountains in different climatic zones, floods and droughts in high mountain catchments, water and humankind in the high mountains catchments, headwaters of the biggest rivers in the world.

Field classes: postglacial landforms and hydrographic network in the Tatra Mountains

Evolution of urban structures and milieus

3 ECTS, 30 hours

Concepts and theories of urbanization, metropolization and globalization. Processes of contemporary urbanization. Internal structure of a city and its changes. Spatial and functional structure of metropolitan areas and their changes. Globalization of Polish metropolias: challenges and hazards. Social problems in cities.

GIS for Urban Policy and Practice

3 ECTS, 30 hours

Sources of urban data: review of international data sources available for urban space analysis, crime mapping: systems and programs for crime mapping (RAIDS Online, Trulia, SpotCrime.com), urban land use changes: contemporary issues and methods. Application of GIS techniques in practice: clustering techniques for spatial patterns detection, GIS and urban land use mapping, application of DPSIR (Driver, Pressure, State, Impact, Response) as a support scheme for decision-making process by establishing spatial conflicts solutions

Techniques and technologies in environmental protection

2 ECTS, 25 hours

Sewage and exhaust gases treatment techniques, elimination of pollution from the waste, remediation of the soils, methods of sulphur elimination from coal and oil, visits in chosen factories in order to see in practice the application of the methods mentioned

Exploitation of deposits: Social, economic and ethical issues

3 ECTS, 30 hours

Exploitation of natural resources became the base for humane civilization development, and thus at the same time leading to armed conflicts. Reacting to the momentum of events, civilizations responded differently to solve social, economic and ethical issues they dealt with, which is shown on the historical background. The course will deepen the students' understanding of the earth sciences contemporary advances in georesource exploration and mining with respect to sustainable and peaceful development.

Isotopes in the studies of environmental pollution

2 ECTS, 25 hours

Methods of isotopic analyses, application of permanent and radiogenic isotopes in geochemical interpretations, examples of application of isotopic analyses in environmental pollution detection

5th semester

Licencjat (Bachelor) degree seminar

1 ECTS, 15 hours

During the seminar, students gradually present the outcomes of their research conducted for the needs of the licencjat (bachelor) thesis. The results presented are the subject of group discussion which helps to finally modify the thesis aim, title, structure etc. Additionally, students present their results in the context of international research, using relevant publications.

Licencjat (Bachelor) degree laboratory

4 ECTS, 20 hours

The course is realized individually and it consists of various scientific activities performed by a student in order to realize his/her licencjat (bachelor) thesis, e.g. field measurement campaigns, studies of the scientific papers, laboratory analysis, preparation of the text of the thesis, consultations with experts in the field of research.

Geology of mineral resources: Research methods, processing and stock enrichment

3 ECTS, 38 hours

Methods of study of mineral deposits. Ore-forming processes. Genetic types of ore deposits. Metallogenic provinces and epochs. World resources, distribution, exploitation and their future. Basic methods of prospection and exploration. Classification of mineral resources and reserves. Basic methods of exploitation and processing.

Sedimentary environments and processes of sedimentation

3 ECTS, 38 hours

Lecture: introduction to environmental sedimentology, sediments features, transportation, deposition; sedimentation in mountain, fluvial, lake, desert and anthropogenic environments; sedimentation in deltas, estuaries, shelf and sea.

Laboratory: petrographic composition and textural features of sediments in connection to the material origin, sedimentation structures versus deposition conditions

Climate changes in the past and the future perspective

2 ECTS, 25 hours

The course consists of lectures and a seminar. Lectures present causes of climate changes: astronomical and geographical theories, economic activity of man, human impact on the composition of the atmosphere: changes of carbon dioxide and trace gases concentration – the increasing greenhouse effect and the ozone layer depletion, recent climate changes and outlook for the future: climatic models and climate change scenarios, regional climate changes (Krakow, Southern Poland, Central Europe) and their impact on the environment and selected branches of economy. The issues discussed during the seminar include: long-term data series analyses, future climate projections, IPCC reports – overview and discussion.

Urban, rural and population geography

2 ECTS, 25 hours

Basic concepts of population geography, methods of research, sources of information. Development of global population, spatial distribution and density of population, changes population: reasons of the changes and indices which define it, migrations theories, classification of migrations, demographic structures and their variability, settlements and the geographical environment, functions and types of rural settlements, definitions and concepts concerning urban areas, phases and indices of urbanization, cities' hierarchy and functions.

Practicals in ore geology – evaporates

1 ECTS, 14 hours

Lecture on geology of salt deposits in Fore-Carpathian Basin. Visit to the currently inactive salt mine in Wieliczka (outside of tourist route) – observations on sedimentology, lithology and petrology of the salt deposits and its surrounding. Writing an essay on the Wieliczka salt mine geology and mining.

Practicals in ore geology – Zn-Pb ores

1 ECTS, 14 hours

Visit to the zinc and lead mine „Pomorzany” near Olkusz. The mineral deposit of Mississippi type is located in Triassic carbonate rocks. After the visit there will be a discussion on its origin.

Global environmental change

3 ECTS, 38 hours

Natural development of environment in geological and historical scale of time. Degradation and conservation of particular environmental components. Influence of particular branches of economy on environment. Threats for sustainability of great Earth's geo-ecosystems. State of the polar (Arctic and Antarctic) environment and its impact on the global environment. Areas environmentally protected and endangered. International collaboration in environment conservation.

Remote sensing in the Earth sciences

3 ECTS, 30 hours

The remote sensing in Earth Sciences is designed for advanced B.Sc. students who want to deepen and extend their remote sensing skills with regard to theory but also application, e.g., to pursue a thesis in remote sensing or as preparation for MSc studies. The module concerns with theory, concepts and methods from environmental monitoring and the analysis of terrestrial ecosystems as one of the key activities in Earth Observation (EO).

Strategies of adaptation to climate change

3 ECTS, 38 hours

Future climate change scenarios, climate models uncertainty as the source of different adaptation strategies, regional approaches; the risk of climate change for water resources, water availability according to different climate change scenarios, hydrological modelling (local approaches); the risk of climate change for vegetation (forestry, natural vegetation and agriculture), modelling of future land cover changes (local approaches)

Soil erosion and conservation

1 ECTS, 20 hours

Soil erosion on agricultural slopes: soil erosion by water (splash erosion, slope wash, interrill and rill erosion, ephemeral gully erosion, gully erosion), wind erosion, mass movement, suffosion. Tillage and harvest erosion. Soil erosion as a physical processes and factor affecting soil degradation. Monitoring, measuring and modeling soil erosion. Natural and anthropogenic conditions for soil erosion in various regions and climatic zones. Diversification of intensity and effects of soil erosion on a local, regional and global scale. Catastrophic soil erosion events (case study). Soil erosion impacts and economic costs. Techniques for control: relative efficiency techniques, cropping patterns, structural measures, other land-management practices.

Knowledge Based Economy and Society from Local and Regional Perspective

1 ECTS, 13 hours

The course aims at providing the insight in knowledge-based economy and information (digital) society. Firstly, spatiality in the information society and 'the death of distance' hypothesis will be discussed. Then, proximity-related studies will be described. Next, Krakow as the outsourcing and offshoring centre will be analysed. Finally, the concepts of smart specialisation and regional innovation systems will be discussed.

Information Communication Technology in Science Education

5 ECTS, 60 hours

The course combines field practice, laboratory experiments, creative techniques and ICT techniques in a student-created film narrative. It prepares students for integrated nature science teaching at the secondary level. Holistic perception of any phenomena and the use of various sources of information are a starting point for implementing transmedia in geography education. Using a range of media devices, transmedia present organized content and can thus be treated as an education strategy. The course consists in transmedia storytelling representing the main cognitive theme. The main plot (the narrative) is structured around the observation of urban landscape of Krakow, located in the valley of the Vistula River, on horst hills, an upland and foothills. A non-linear multiplatform narrative consists of seven interrelated non-hierarchical plots while the relations between the plots form the 'tissue' of the film. Students will independently choose to watch particular plots and add new parts of the film (create prequels and sequels). Application of transmedia in education requires critical thinking about modern media and current technologies and teaches the skill of using the media both as a recipient and a creator (prosumer). Such approach inherently involves co-operation, involvement as well as creation and sharing of ideas and communication on social networking services.

6th semester

Licencjat (Bachelor) degree seminar

1 ECTS, 15 hours

During the seminar, students gradually present the outcomes of their research conducted for the needs of the licencjat (bachelor) thesis. The results presented are the subject of group discussion which helps to finally modify the thesis aim, title, structure etc. Additionally, students present their results in the context of international research, using relevant publications.

Licencjat (Bachelor) degree laboratory

4 ECTS, 20 hours

The course is realized individually and it consists of various scientific activities performed by a student in order to realize his/her licencjat (bachelor) thesis, e.g. field measurement campaigns, studies of the scientific papers, laboratory analysis, preparation of the text of the thesis, consultations with experts in the field of research.

Landscape ecology

2 ECTS, 25 hours

Natural (abiotic and biotic) landscape components and interrelations between them. Landscape as the result of the “men – environment” system functioning. Functional landscape structure: matrix, patches, corridors. Hierarchic taxonomy of geo-complexes. Principles of landscape differentiation: latitudinal and altitudinal zones, landscape belts, oceanic–continental gradient, geomorphological sequence. Landscape boundaries. Landscape catena and mosaics. Landscape dynamics: functioning and development in natural conditions and under human pressure, plant and animal migrations in landscape. Natural and cultural landscapes. Landscape stability, sustainable development and conservation.

Novel materials and raw materials in future

2 ECTS, 25 hours

Basic mineral resources, including energy sources, methods of their enrichment, biomass processing, carbon nanomaterials, traditional and innovative polymer materials, transfer to nanoscale in metal and oxide materials

Methods of mineralogical and chemical analyses

4 ECTS, 50 hours

Acquisition and preparation of the samples for the analysis; spectral emissive analysis ESA, nuclear absorption spectrometry AAS and emissive one AES, nuclear emissive spectrometry ICP-AES and mass spectrometry ICP-MS, X-ray fluorescent spectrometry XRF, activation analysis AA, fluid inclusion studies, organic matter studies, imagery methods: scanning and transmission microscopy, EBSD and CL, microanalysis: spectroscopy of energy dispersion, spectroscopy of wave length, PIXE, SIMS, micro XRF, methods of molecular spectroscopy (IR, FTIR, micro FTIR, Raman spectroscopy), physical basis of X-ray diffractometry, analysis of phase composition

Air pollution: Contemporary challenge

2 ECTS, 25 hours

Sources of air pollution. Reactions in the atmosphere. Solid particles, primary and secondary air pollution, air pollution dispersion. Methods of air pollution measurements and analysis. Meteorological factors contributing to high air pollution concentrations. Anthropogenic versus natural aerosols and their interactions with global ecosystem. Air pollution in Central Europe.

Waste management in natural resources politics

1 ECTS, 15 hours

Waste management is an interdisciplinary issue merging e.g. engineering (limiting the impact of landfills on environment), health protection (limiting the possible epidemiological effects), and natural resources economy (recycling of energy). Mineral resources global demand. Concepts of economic development in relation to raw materials consumption. Raw materials politics. Various types of waste and the technical possibilities of their recycling. Visits in waste processing sites.

Soil, water and natural resources protection

3 ECTS, 30 hours

Inorganic and organic pollution of air, water and soil - classification, sampling, analytical methods, monitoring and remediation. Environmental impact of mining, processing and storage of minerals. Underground storage of mineral resources. Recycling. Wastes disposal.

Fossil fuels

2 ECTS, 25 hours

Types of fossil fuels, methods of research. Factors responsible for transformation of organic matter in the deposits. Coal origin processes. Organic and non-organic concepts of oil and gas origin. Non-conventional hydrocarbons resources. Ecological and climatological consequences of fossil fuel burning. Methods of extraction and chromatographic separation, elements of organic petrography.

Sustainable development in raw materials management

2 ECTS, 25 hours

Lecture: sustainable development definition, its main goals and concepts, historical background, international initiatives, impact on humanity (agriculture, transport, production, consumption, energy production and natural resources management), UN

document Agenda 2030 and its main assumptions, concept of circular economy, water crisis

Seminar: modes of implementation of sustainable development in chosen countries of the world

Role of education in environmental protection and sustainable development implementation

2 ECTS, 25 hours

Recognition and evaluation of chosen landscapes together with the identification of the forces which transform them, water resources of the world, climate changes and the relations man-nature, consequences of social, economic and religious discrimination, economic, culture and biological effects of urbanization and mass tourism. Formal and non-formal education, environmental knowledge versus ecological attitude. Introduction to cognitive psychology, motivation to study, raising interest and engagement, individual reflection.

Environmental mineralogy

2 ECTS, 25 hours

Lecture: main assumptions of environmental mineralogy, its historical development, analytical and experimental methods used, mineralogical aspects of environmental pollution, heavy metal pollution, iron and non-iron metals in industry, mining and its environmental impact, invention of new materials and technologies, application of mineral/synthetic sorbents in pollution removal, application of carbon nanomaterials, immobilization of nuclear waste, interaction between minerals and microorganisms in energy production

Laboratory: methods used in environmental mineralogy

Volunteer project

2 ECTS, 25 hours

An individual project aimed to improve social competences and professional qualifications. Development of individual interpersonal skills. Practical application of theoretical knowledge. Self-organized social activity. Time management skills improvement. The project is finalized with a report.