NATIONAL AND KAPODISTRIAN UNIVERSITY OF ATHENS
SCHOOL OF SCIENCE
DEPARTMENT OF GEOLOGY AND GEOENVIRONMENT

UNDERGRADUATE STUDIES PROGRAM
GEOLOGY AND GEOENVIRONMENT

SYLLABUS and STUDENT HANDBOOK

Academic Year
2024-2025

ATHENS 2024

CERTIFIED STUDY PROGRAMME
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Hellenic Quality Assurance and Accreditation Agency

HELLENIC REPUBLIC
National and Kapodistrian University of Athens

School of Science
Department of Geology and Geoenvironment

GEOLOGY AND GEOENVIRONMENT
UNDERGRADUATE STUDY PROGRAM

CURRICULUM AND STUDENT HANDBOOK
ACADEMIC YEAR
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Department of Geology and Geoenvironment:
Chairperson: Prof. Asimina Antonarakou
Deputy Chairperson: Professor Ioannis Alexopoulos
Secretary: Dimitrios Psarris, Administrative Staff
Website: http://www.geol.uoa.gr

Undergraduate's Student Book Committee:
Coordinator: Daphne Stamboliadi, Administrative Staff
Members:
Olga Koumoutsakou, Laboratory Teaching Staff
Zacharenia Kypritidou, Laboratory Teaching Staff
Stylianos Chailas, Laboratory Technical Staff

Coverpages Figures: "Naturally carved", Location: Faraklou geological park, Lemnos
Front: Bird, hunting
Back: Puffy shoe
(Photos: Stelios Chailas)

Version: July 15, 2024

PREFACE

The science of geology has its roots in human experience dating back to the Paleolithic era. Man from the moment of his appearance sought suitable mineral raw materials for the manufacture of tools and weapons, for building adobe or stone houses, temples, retaining walls, fortresses and monuments. Also important are the land reclamation and other technical works that were constructed in various countries, millennia ago, and which are preserved to this day, many of them in excellent condition. The search and processing of precious and basic metals such as gold, silver, tin, copper, as well as minerals suitable for medical-pharmaceutical purposes was based on specialized groups of people who had knowledge related to geology and metallurgy. Characteristic are the descriptions of writers of antiquity and the Middle Ages, such as Theophrastus, Diodorus Siculus, Vitruvius, Strabo, Agricola and others, on how to search, find, test and process raw materials.

In modern times around the world, Geology is a key factor in the development of the economy of each country. Many of them have a special Geological Research Department, attached to competent Ministries. The Geological Survey of many countries has an official age of more than 130 years, for example Britain [1835], Spain [1849] and the USA [1879], while in Russia the corresponding service was officially established about 300 years ago, in 1719. In our country, geological research through the centuries has shown intense activity but also periods of decline, depending on the prevailing social, economic and political conditions. The first silver-lead and copper farms of Lavreotiki and the Cyclades are lost in the mists of history.

As far as education in modern times is concerned, the first geo-cognitive courses were taught at the University of Athens since its foundation in 1837. The current Department of Geology and Geoenvironment of the National and Kapodistrian University of Athens became an autonomous department in 1970, the year when the then Department of Physiognosy was divided into two departments, Geology and Biology. The official state body of our country, the Institute of Geological and Mineral Exploration [IGME, former IGEY and NAGME] was founded after the war and specifically in 1952.

The first graduates of the Department joined secondary education, the scientific staff of IGME, the Observatory, PPC, mining, hydrogeological and technical companies and consulting offices, as well as hydrocarbon exploration and exploitation bodies. The main responsibility of geologists was to carry out mapping in the countryside, underground works and mines, study earthquakes, geophysical and hydrogeological surveys, supervise drilling works and technical works.

With the beginning of the 21st century, the role of the geologist emerges and expands to new specializations. Today, graduates of our Department work in public and private companies, institutes and organizations. They carry out field work, mapping, chemical analysis of water, minerals and rocks. They use geographic information systems and modern methodologies for the study, research and evaluation of raw material deposits, geothermal fields, movements of the earth's surface, causes of earthquakes, seismic risk and seismic hazard, landslides, creep and natural disasters. They also deal with the identification and monitoring of the evolution of pollution of various origins in water, soils, rocks and the seabed, the quality control of industrial products, the determination of technical and physicomechanical characteristics of raw materials, in order to produce innovative and competitive products and the valorization of waste or by-products of industry (recycling). Geophysical and geochemical research contributes to environmental protection issues, to soil and geotechnical studies of important projects such as tunneling and major roads, road construction, dam construction, archaeometric surveys such as radiocarbon dating and subsoil structure surveys. In addition, geologists, aware of the perpetual evolution of various life forms and paleoenvironments of our planet, contribute both to understanding the interactions of current ecosystems, of which humans are part, and to outlining future environmental and climate changes. The aforementioned topics include a large number of specializations that make Geology one of the most interesting and inexhaustible fields of knowledge. Geosciences are now an indispensable tool for the development and protection of the environment as well as modern society.

A list of about 150 important institutions from all over Greece, in which geologists work and who have participated as host institutions in the internship of our students is available at the Department. This list is constantly enriched with new companies in the industry, an indication of the increased demand of our graduates in modern society.

The graduates of our Department are still successfully staffing and rich activity ministries and state organizations (Ministry of Environment & Energy, Ministry of Culture, PATHE, OASP, Archaeological Service), prefectures, research institutes (IGME, HCMR, National Observatory of Athens, etc.), large companies of the technical sector (PPC, cement companies, design, construction and mining companies), are active as designers of public works. Part of our graduates choose education, secondary and tertiary in Greece and abroad. An example of the quality of education that our students receive in undergraduate and postgraduate courses is their unhindered access to universities of international prestige abroad.

Participation in the ERASMUS student exchange program has given a large number of our students the opportunity to train in European Union universities, develop relationships with colleagues abroad and shape a new perspective on the modern multicultural world.

This Study Guide includes information related to the structure of the Department, the staff, the curriculum at undergraduate and postgraduate level, the timetable and the examination schedule.

Interested parties are advised to refer to the website of the Department of www.geol.uoa.gr for more complete information on current issues [timetable, educational material for the taught courses, outdoor exercises, information on the examination schedule, events of the Department, conferences, announcements, programs, electronic version of this guide, etc.] and any changes related to the Study Guide.

The Department of Geology and Geoenvironment of the University of Athens seeks the continuous improvement of the educational process, the participation of students in research programs, as well as their training and specialization in new methodologies - technologies. In this way, it aims to promote young scientists with modern perception and excellent scientific training, who will contribute to the development and improvement of Earth and environmental sciences.

Believing in your participation in this common effort, we wish our students, old and new, success in their studies and in the goals they have set.

CONTENTS

THE ROLE OF GEOSCIENCES

The science of Geology is considered by many to be a "new" science, despite the fact that the first geological or geological treatises were written in antiquity, most notably the works of Aristotle, Theophrastus, Strabo, Pliny, etc. The slower evolution of Geology, compared to the "traditional" Sciences, is partly due to man's inability to perceive the spatial and mainly the temporal scale that governs the earthly processes that often take place before our eyes. The observation and study in the present time provides information about the events that took place in the past (distant and/or recent), while at the same time it foreshadows the possible future development, concepts that are inextricably related to Geological Time and the Geological Cycle. For a long time the view of the Earth remained attached to theories and views that operated axiomatically, such as "Creationism" and "Catastrophism".

The science of geology is not based on axioms. Its basic and fundamental principles have been fiercely questioned over time and have been the subject of intense controversy until pioneering theories, such as the "Lithospheric Plate Theory", were established, revolutionizing the way of perceiving and viewing the Earth, which is henceforth considered a biogeodynamic system constantly evolving in space and time. Geology differs from other sciences, as laboratory experiments with scale models and a defined set of factors have limited value, requiring the application of other research methods. Geology is characterized by the descriptive approach of specific structures under specific conditions. Complex geological processes and structures such as orogeny, weathering/erosion processes, sedimentary processes, earthquakes, volcanoes, crustal deformation and climate-orogeny interaction are not satisfactorily approximated with simple mathematical models. Nevertheless, Mathematics, Physics and Chemistry contributed to the development of branches of geosciences, the accurate measurement of quantities and the quantitative study of geological processes. Towards the end of the 19th to the beginning of the 20th century, atomic-nuclear physics and crystallography give new impetus to the metrology of geosciences and to the development of disciplines such as mineralogy, petroleology, paleontology, as well as geophysics as a synergistic field of physics and geology. In the decades that followed, especially after 1960, mathematics, statistics, informatics, as well as modern microscopic and analytical techniques were increasingly utilized. Geology is quantified to a significant extent, but not without methodological difficulties. Further technological progress has had a decisive influence on the evolution of Geology, and Geosciences in general, since it has allowed a more objective understanding of complex processes from the surface of the Earth's crust to the core and from mega to nanoscale and subsequently to their modeling. For example, the possibility of studying with satellite methods, analyzing and dating rocks and fossils, even at microscopic and sub-microscopic scales, combined with a number of other scientific methods, have given new impetus to solving research questions related to the broader scientific context.

Geology, as a distinct science, consists of specializations of many sub-disciplines-, basic and applied research, such as Mineralogy, Petrology, Physics Geography, Paleontology, Stratigraphy, Climatology, Seismology, Tectonics, Geochemistry, Geophysics, Volcanology, Depositology, Hydrogeology, Geothermal, Soil-/Rock-Engineering, Geological Oceanography, Environmental, and Planetary Geology. In addition, the utilization by Geology of a series of related and non-related sciences (from Mathematics, Engineering, Chemistry, Biology, to Medicine and Archaeology) gives the geoscientist a holistic philosophy of management and treatment of his research subject. The Geologist as a scientist is equipped in a way that can respond to the resulting multi-factorial, multi-parametric and interdisciplinary challenges. However, the geologist is still the scientist who derives his primary data from the Earth, and outdoor work is a primary and fundamental step in its path, despite technological progress. Every model he develops, every data he receives from the analysis of a satellite image, a statistical study, a mechanical or numerical model must be verified, even in today's era, by the use of simple, timeless "tools": the geological hammer, the compass, the magnifying glass and the geological map. The collection of primary data, which can be enhanced with modern means -such as portable X-ray analyzers, LIDAR and SWATH technology for the extremely detailed mapping of terrestrial and underwater relief- and recorded in geographic information systems combined with global positioning systems-, is followed by their analysis and evaluation in the laboratory, using conventional, but also highly advanced and complex techniques that can, for example, They are based on the use of data from satellites or even particle accelerators and synchrotron radiation. Thus, the geoscientist divides his time between the countryside and the laboratory, since the former needs the latter in order to be exploited, and the latter cannot exist without the former. The study of minerals and rocks, fossils, the structure of the Earth, seismic and volcanic activity and generally the deformation of the earth's crust are just some of the topics related to the research field of Geology. Consequently, geosciences acquire an important role in modern times due to their contribution to the exploitation of mineral raw materials (including industrial minerals as well as critical and precious metals & stones), to the discovery of energy sources, to the research and management of surface and groundwater, to the development and management of technical projects, to the prevention and management of natural disasters, and of course to environmental management (environmental impact forecasting, planning and monitoring of rational management of sensitive natural resources, restorations, decontamination). Studies for the identification of deposits of metals, solid fuels, hydrocarbons, natural gas and geothermal fields provide possibilities for the exploitation and exploitation of the energy field contributing positively to the GDP of each country. In the context of mineral raw materials, the anthropogenically modified environment (mining waste, sanitary management of pollutants, etc.) is also the subject of research. In addition, conducting research on the mechanical and chemical properties of

minerals and rocks and their use as building materials offers new perspectives on the creation of modern and ecological constructions and infrastructures. In addition, water identification, exploitation and protection research is considered vital and contributes to the development of an area. Regarding the construction industry (dams, tunnels, road, transport, port works, etc.), the science of Geology contributes to critical areas. For example, the detailed geological study prevents failures in infrastructure projects, but also provides for the environmental impact of the presence and operation of projects. The construction of projects of all scales and the expansion of settlements require, in addition, studies of soil-subsoil suitability, seismic activity and seismotectonic characteristics of the area, in order to carry out the appropriate planning to reduce seismic risk. Also, other natural disasters that over time are magnified due to excessive population growth in locations with a high degree of risk, or climate change, need to be studied and effectively managed.

The Geoscientist of the 21st century is called upon to address and manage issues related to the welfare of society as a whole and the economic development of each country in combination with environmental protection. As a scientist, he knows more than anyone else the wider Geoenvironment and clearly understands that the Earth is a living planet, a system of atmosphere-biosphere-hydrosphere-lithosphere interaction where the living world coexists with the inorganic. Planet Earth has existed for 4.5 billion years, during which life appeared and evolved sometimes slowly and sometimes rapidly. Geo-bioscientific research proves that, during these millions of years, numerous mass (or not) extinctions, organisms, natural disasters, climatic fluctuations, ecosystem changes and the appearance of new species have been recorded. Evidence for the oldest life forms is found in sediments (now poly-metamorphic rocks), either as fossils or as mineralogical/geochemical/isotopic traces. All microorganisms associated with primary life forms, such as bacteria and archaea, do chemosynthesis, that is, they get their energy from the chemical and mineral phases with which they interact. These organisms live today in extreme geochemical environments, the study of which gives us clues about the early stages of life of the planet but also about the evolution of life on Earth and other planets. The Holocene, the present geological period during which human civilization developed, began only 11,700 years ago with the end of the last—but not the only—Ice Age and was until recently considered a relatively stable geological period. However, the ever-increasing influence of human activity resulting in the disturbance of the delicate balance of the geoenvironment and the physics of climatic variation, as well as instability in the hydrosphere and biosphere, have led to the proposal to call the modern period the Anthropocene. In this ever-changing world, the study, management and protection of the Geoenvironment is imperative for humanity. The well-trained Geoscientist is called upon to play an important role in the demand of modern societies for geo-environmental policy making in the context of sustainable development and with respect for the environment.

The aim of the undergraduate program of studies of the Department of Geology & Geoenvironment of the National and Kapodistrian University of Athens is to prepare the future colleague to be able to manage and deal with a variety of academic and applied problems, while further training within or outside the borders is considered necessary due to the aforementioned range of Geosciences. Geosciences – and geoscientists – will play an important role in expected momentous events, and answering questions about the existence of water, mineral raw materials or tectonic activity on Mars or other planets will contribute, in addition to protecting and preserving planet Earth, to the possible colonization of space and the evolution of human existence and civilization in the present 21st century.

Chapter 1

NATIONAL AND KAPODISTRIAN UNIVERSITY OF ATHENS

HELLENIC REPUBLIC
National and Kapodistrian University of Athens
EST. 1837
Department of Geology and Geoenvironment

1.1 ADDRESS

Central Administration:
30 Eleftheriou Velizelou Av.
106 79, Athens, Greece

WEBPAGE (URL):http://www.uoa.gr

NKUA on the map:http://maps.uoa.gr

1.2 OVERVIEW AND MISSION

The NKUA has recently celebrated 180 years as of its foundation and is the oldest university in Greece, as well as the higher education institution in the Balkans and the Eastern Mediterranean. Given its historical background and through the significant efforts of its human resources, the NKUA has attained recognition as a center of educational and scientific excellence.

The NKUA comprises eight Schools and offers a broad range of study areas; prospective students can choose among 33 undergraduate and 183 postgraduate study programs, as well as pursue doctoral and post-doctoral studies.39,088 undergraduate students, 11,479 postgraduate students, 14,240doctoral candidates and 5,654foreign students pursue their studies and foundation of their careers at the NKUA; all these are taught by 2,104 Professors and other Research and Teaching Staff, and are supported by 1087 administrative and technical staff. The total area spanned by the university's teaching and research facilities is approximately 700,000 square meters.

The NKUA cares about, and to a considerable degree caters for the personal and professional success of its graduates and endeavours to make them highly employable and influential in their respective professional spheres. To this effect, the curricula of the NKUA's departments are constantly upgraded and educational/ research activities are aggressively pursued.Because the NKUA is a research university, all faculty members and researchers are continuously encouraged to push and expand the boundaries of knowledge in their respective fields of expertise. Students are also encouraged to participate and excel in Olympiads and international academic competitions; they are also invited to participate in educational and research activities conducted in the NKUA's laboratories, libraries, and museums.

The internationalization of the NKUS is a priority for both Rectoral Authorities and members of its Academic Community. Decades of cooperation with partner institutions from most European Union and other European countries as well as the participation in international organizations, associations and university networks, have led to a consistent development of the NKUA's international profile and its fundamental role in student and staff mobility. The NKUA strongly believes that cooperation between higher education institutes is essential to the strengthening of bilateral and multi-lateral relations between sovereign countries. The mobility activities foreseen by the ERASMUS+ program for the academic year 2018-19 are based on 655 Erasmus Agreements between the NKUA and 336 universities of 31 European countries. Finally and importantly, the NKUA is involved in 60 scientific cooperation agreements with universities of EU countries, the US, Canada, China, the Russian Federation, Japan, Australia, Israel, Jordan, Korea, Iran , Taiwan and others, as well as with high profile research centres such as CERN (Switzerland), INRIA (France) and A*STAR (Singapore).

1.2.1 SCHOOLS, DEPARTMENTS AND STUDY PROGRAMS

- The NKUA comprises 9 Schools and 43 Departments; detailed information can be found in: https://en.uoa.gr/schools_and_departments/
- The NKUA offers 43 Undergraduate Study Programs; detailed information can be found in: https://en.uoa.gr/studies/undergraduate_programs/
- The NKUA offers 187 Postgraduate Study Programs in addition to the PSP "Eartch Sciences and the Geoenvironment". Information can be sought in: https://en.uoa.gr/studies/postgraduate_programs/
- The NKUA offers several Postgraduate Study programs in languages other than Greek. For information please visit: https://en.uoa.gr/studies/master_programs_in_various_languages/

1.2.2 PERSONNEL

- Professors (all ranks): 1,588
- Research associatesand other teaching, laboratoryand technical staff: 327
- Administrative staff: 1,061

1.2.3 STUDENTS

- 45,408 undergraduates
- 17,348 graduate students at Master level
- 8,719 Ph.D candidates

1.2.4 INTERNATIONAL STUDENTS

- 7,957 Undergraduates
- 448 Graduate Students at Master level
- 212 Ph.D Candidates

1.2.5 ERASMUS+ STUDENT MOBILITY (2021 - 2027)

- 354 Incoming Students
- 755 Outgoing Students

1.3 LANGUAGE POLICIES

The official language of the University of Athens is Greek, which is the official language of the country, as well as one of the 23 languages of the European Union.

The language in which access to knowledge is achieved and the work language of the Postgraduate Programs that leads to obtaining a post graduate specialty degree or to acquiring a doctoral degree is Greek, except if the internal regulation of the Postgraduate Program makes provision for the use of other languages. The writing up of the doctoral dissertation for the Postgraduate Programor the dissertation for the doctoral degree may be realized in Greek or in another language, according to the internal regulations of the Program. The bibliography that is suggested and is currently used in the Postgraduate is in Greek and in other languages and for this reason, the knowledge of foreign languages by the prospective incoming students of the Postgraduate Program of the University of Athens is either obligatory or optional but desired.

1.3.1 TEACHING OF FOREIGN LANGUAGES

The National and Kapodistrian University of Athens, within its instructive and broader educational scope, offers its students the possibility of acquiring, during their studies, the knowledge of one or more foreign languages, which constitute necessary tools for scientific fulfillment.

This important task of foreign language learning is accomplished by the Foreign Language Teaching Centre ('Didaskaleio') of the University of Athens.

Didaskaleio is an independent and autonomous academic teaching unit, which offers high-standard foreign language tuition.

At present, 22 foreign languages of all levels of competence, are being taught at Didaskaleio: English, Albanian, Arabic, Bulgarian, Czech, Chinese, Danish, Dutch, French, Finnish, German, Hindi, Italian, Japanese, Korean, Norwegian, Persian, Portuguese, Russian, Serbian, Spanish, Swedish and Turkish.

In addition, special programs are offered for those wishing to specialize in language skills: language laboratories, translation, law and medical terminology. More analytically:

- IELTS Course (International English Language Testing System) (three-hour sessions three times per week)
- Lab for Written and Spoken English; Levels B1-B2
- Lab for Spoken English (Debating-Public Speaking); Levels C1-C2
- English Lab for Academic Writing; Levels C1-C2
- Medical Terminology in English (Medical School Students - Doctors - Nursing Staff)
- Law Terminology in English
- Translation in the English and Greek Language; B2 level and above
- Lab for Spoken French; Levels B1-B2
- Law Terminology in French
- Institutions, Terminology and Translation of European Union Documents in French
- Lab for Written and Spoken German; Levels C1-C2
- Lab for Written and Spoken Spanish; Levels B2-C1
- Lab for Written and Spoken Italian (Levels B2-C1)

Lessons are conducted either in the city centre, or at the University Campus in Zografou and can be attended not only by home students but also by students of other Greek Universities or of Technological Institutes as well as by anyone interested sincetuition fees are particularly low.

Upon successful completion of attendance, the Foreign Language Teaching Centre provides students with the following certificates: a Certificate of Attendance and a Certificate of Studies.

Address: Foreign Language Teaching Center, Hippokratous 7, 106 79, Athens

Telephone: 210–3688204, 210-3688232, 210-3688265, 210-3688266, 210-3688263

e-mail: info@greekcourses.uoa.gr

WEBPAGE (URL): http://www.didaskaleio.uoa.gr/

1.3.2 GREEK AS A FOREIGN LANGUAGE

The Modern Greek Language Teaching Centre of the National and Kapodistrian University of Athens has been functioning since the 1950s, initially with a very limited number of students. In the decades that followed the number of students increased exponentially. The Modern Greek Teaching Centre is the largest of its kind in the world. Many of its graduates are today teachers of Modern Greek and Philology at Universities throughout the world, members of the diplomatic corps in their own countries, church leaders, renowned scientists, company managers, respected artists and business professionals.

The Teaching Centre is under the auspices of the Interdepartmental Programme for the Teaching of Modern Greek as a second/foreign language along with the similarly titled Master's Degree Programme of The Department of Philology and The Department of Philosophy, Pedagogy and Psychology.

The aims of the Modern Greek Teaching Centre are as follows:

1. The teaching of Modern Greek as a second/foreign language;
2. The certification of the level of knowledge of Modern Greek as second/foreign language;
3. The exposure of foreigners to various facets and themes of the Greek culture;

4. Hands-on practical training of students of the Master's Degree Programme for the Teaching of Modern Greek as a second/foreign language.

Address: Modern Greek Language Teaching Center, University Campus, 157 84 Zografou

Telephone: 210-727 7672, 210 727 7971

E-mail: info@greekcourses.uoa.gr

1.4 ERASMUS+

Erasmus+ is the EU funding programme for education, training, youth and sport 2014-2020. Erasmus+ combines previous funding programmes in the sector, including the Lifelong Learning Programme (Comenius, Leonardo, Erasmus, Grundtvig and Transversal Programmes), Youth in Action and five international cooperation programmes (Erasmus Mundus, Tempus, Alfa, Edulink and the programme for cooperation with industrialised countries.Erasmus+ supports the following main Actions:

- Key Action 1: Learning Mobility of Individuals
- Key Action 2: Co-operation for Innovation and the Exchange of Good Practices
- Key Action 3: Support for Policy Reform

For more information please consult the following web pages:

https://www.iky.gr/en/discover-erasmus (IKY - Erasmus National Agency in Greece), and

http://ec.europa.eu/programmes/erasmus-plus/node_en (European Commission)

Eligible countries are divided into two groups, Programme countries and Partner countries. Although Programme countries are eligible for all actions of Erasmus+, Partner countries can only take part in some, and are subject to specific conditions.

For more information, see:

http://ec.europa.eu/programmes/erasmus-plus/node/3_en

Switzerland at the moment is not participating in Erasmus+ programme on an equal footing with Member States (i.e. as a "Programme Country") but is enjoying the status of other third countries (i.e. as a "Partner Country") and is financing all incoming and outgoing mobilities.

For more, see: http://ec.europa.eu/programmes/erasmus-plus/updates/20140128-participation-switzerland-erasmus-plus_en

The National and Kapodistrian University of Athens participates in the Erasmus+ programme having been awarded the Erasmus Charter for Higher Education:**31475-EPP-1-2014-1-GR-EPPKA3-ECHE**

Institutional Erasmus Code: **G ATHINE01**

PIC NUMBER OF THE UNIVERSITY: **999643007**

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Chapter 2

DEPARTMENT OF GEOLOGY AND GEOENVIRONMENT

2.1 CONTACT INFORMATION

Address: University Campus, Zografou 15784, Greece

Tel: +30 210 727 4279

WEBPAGE (URL):http://www.geol.uoa.gr

Info:secr@geol.uoa.gr

The Department of Geology and Geoenvironment is a part of the School of Sciences. It is the oldest Earth Science establishment in Greece – its history can be traced to the establishment of the University in 1839. At present, it is also the biggest academic unit in which Earth Sciences are taught and comprises six departments covering a broad range of earth science subjects. The Department's objective is to prepare students for careers in environmental science, natural hazard assessment and mitigation, geotechnical engineering, exploration and exploitation of mineral and energy resources etc.; it also aims at promoting research that leads to academic careers in universities, research institutes and museums worldwide.

2.2 ADMINISTRATIVE FRAMEWORK

Competent organs for the administration of the Department are the Chairperson and Deputy Chairperson, the Governing Board and the Assembly.

2.2.1 CHAIRPERSON

The Chairperson and Deputy Chairperson are elected by the complement of the teaching, research, technical and administrative staff of the Department of a two-year terms. The Chairperson:

a) Supervises the proper functioning of the Department and ensures the observance of the competent laws and regulations.

b) Drafts the agenda of the Assembly, convenes and presides over the Assembly, appoints rapporteurs and ensures the implementation of the Assembly's resolutions.

c)Drafts the agenda, convenes and presides over the Governing Board and ensures the implementation of its resolutions.

d)Ensures the proper implementation of study programs and pertinent educational activities.

e) Establishes committees and boards to study and handle the affairs and activities of the Department.

f) Liaises the resolutions and decisions of the Assembly to the competent organs of the NKUA.

g) Is responsible for keeping the record of scientific activity and publications of the Department.

h) Represents the Department in the Senate and liaises the deliberations and decisions of the Senate to the Department.

The Deputy Chairperson assumes the duties and responsibilities of the Chairperson in the event of his/her absence or impediment. If the Chairperson resigns or expires before the end of his term, the Deputy Chairperson assumes their duties until the end of the term.

2.2.2 GOVERNING BOARD

The Board of Directors consists of the Chairperson, the Deputy Chairperson, the Directors of the Department's Sections, one representative of the Research and Teaching Staff and one representative of the Administrative and Technical Staff. The Board proposes to the Assembly issues of its competence and processes issues referred to it by the Assembly.

2.2.3 THE ASSEMBLY

The Assembly is the ultimate decision-making organ of the Department. The Assembly comprises faculty members (professors), the Chairperson, the Deputy Chairperson the Directors of the Department's Sections, one one representative of the Research and Teaching Staff and one representative of the Administrative and Technical Staff and six representatives of the undergraduate and postgraduate students. The Assembly:

a) Determines the general educational and research policy of the Department and the strategies of its development, always within the general framework of the guidelines set by the University and the School of Sciences.

b) Supervises the implementation of the curriculum, assigns teaching duties approves textbooks and issues degrees and certificates of study.

c)Negotiates with the Deanship of the School of Sciences, the organization of common curricula/studies between the Department of Geology and Geoenvironment and other Departments of the NKUA.

d) Supervises the internal evaluation/accreditationof the Department.

e) Initializes the process of creating/filling new staff positions and ensures due observance of the competent legislation and regulations during the process.

f) Establishes committees and boards to study/handle the affairs and activities of the Department and decides upon their recommendations.

2.3 PREMISES

The Department is housed in the building complex of the Faculty of Sciences in Panepistimiopoli (see ANNEX - DIAGRAMMS). The premises occupy the southwest quadrant of the complex.

The Department has 3 large amphitheaters (A13, G10, ΦΜ) and 19 smaller classrooms (Γ1-Γ19) equipped with modern image projection and sound reproduction equipment, as well as internet connection. Laboratory space (rooms and halls) is also located in the premises of Academic Sections (see below). Computer rooms and dedicated software for studying, analyzing and processing geological data are also available. Plan views of the Department's premises can be found in ANNEX - DIAGRAMMS.

The Library of the Department is part of the Library of the School of Sciences and is housed in the building of the Department of Mathematics on the 1st and 2nd floor (Panepistimiopoli, Zografou). Information can be sought in telephone numbers 2107276599 and 2107276525 (secretariat) or by e-mail in sci@lib.uoa.grand sci-loan@lib.uoa.gr(loans); the website is www.lib.uoa.gr/sci. Opening Hours: Monday to Friday 08:30-19:30, Sat-Sat: 09:30-14:30. The library remains closed on public holidays.

2.4 ACADEMIC SECTIONS

The Department is organized in 10 academic units comprising six Sections with their dependencies (Laboratories or Museums) and four independent Laboratories:

2.4.1 SECTION OF MINERALOGY AND PETROLOGY

The Department of Mineralogy and Petrology addresses questions pertaining to the description, classification and formation of minerals and rocks. Special emphasis is put on mineral chemistry and structure as well as on igneous, sedimentary and metamorphic processes and their evolution in space and time. The social, environmental and health impact of rocks and minerals and the nature and consequences of volcanism are also examined in detail.

Specific research topics include:

- Geometrical properties and internal structure of crystals
- Formation, growth and systematic classification of minerals
- Generation, evolution and emplacement of magmas
- Volcanoes, their activity and products; volcanic hazards and their management
- Depositional and diagenetic processes, products and environments of sedimentary rocks; tectonic settings of sedimentary deposits; provenance analysis of siliciclastic rocks
- Metamorphism at spreading centers, subduction zones, collisional orogens and the deep interior of the Earth
- Physicochemical conditions and thermodynamic modelling of igneous of metamorphic reactions and processes
- Dating of geological processes through mineral and whole-rock isotopic techniques
- Environmental and applied mineralogy and petrology.
- Archaeometry – Conservation and restoration of monuments.
- Gemmology and medical geology.

Web address: http://minpet.geol.uoa.gr/index.htm

2.4.1.1 LABORATORY OF MINERALOGY AND PETROLOGY

The ***Laboratory of Mineralogy and Petrology*** carries out basic and applied research and projects related to basic and applied research including the development of environmental and industrial applications. Its main activities include sampling and processing of rocks and minerals, determination of the internal structure of minerals, qualitative and quantitative determination of the chemical composition of rocks and minerals as well as chemical analyses of surface and subsurface fluids and gases. Determination of physical properties of geological samples such as crystal dimensions, shape, orientation, and intergrowth also takes place. In addition, the laboratory determines physical/mechanical properties of rocks and minerals and runs gemological analyses to examine the quality of precious and semiprecious stones. The infrastructure is available for research and education to undergraduate and postgraduate students and includes:

- Equipment for sample preparation (jaw crusher, cutting saw, lapping system, polishing system, mortar grinder, ball mill, hydraulic press (25T) and pellet press)
- Various bench top analytical instruments (pH-meter, conductivity meter, colorimeter, microhardness tester)
- X-Ray Diffractometer,
- ED & WD X-Ray Fluorescence Spectrometers
- Direct Current Plasma Atomic Emission Spectrometer,
- Transmitted-light polarizing microscopes equipped with digital cameras
- Dark room for Optically Stimulated Luminescence (infrared).

Web address:
http://minpet.geol.uoa.gr/MINPETesot_files/ergastiria.htm

2.4.2 SECTION OF HISTORICAL GEOLOGY AND PALAEONTOLOGY

The ***Section of Historical Geology and Palaeontology*** studies the scientific topics of Historical Geology, Stratigraphy, Palaeontology and Sedimentology, as well as many other more specialized topics, thus producing important scientific and educational work in the Department of Geology and Geoenvironment. These topics include:

- Invertebrate Palaeontology.
- Micropalaeontology
- Vertebrate Palaeontology, Palaeoanthropology, bone and teeth diagenesis
- Palaeobotany, Palynology
- Fossilization, geochronology, Archaeometry, geoarchaeology
- fossil conservation and preparation, museum studies, Enhancing of geological heritage
- Lithostratigraphy, biostratigraphy, chemostratigraphy, magnetostratigraphy, stratigraphy of alpine and metalpine formations, etc
- Palaeoecology, palaeoclimatology, evolutionary palaeoecology, palaeogeography
- Environmental micropalaeontology, palaeoenvironments
- Sedimentary basin analysis, Marine geology
- History and Philosophy of geosciences, didactics of Geosciences

All the above contribute to the knowledge concerning the evolution of life and biodiversity on the planet, the reconstruction of environmental conditions during the geological past, palaeogeography, climatic changes in older geological periods and their effect on living organisms, the use of microfossils as indices of environmental health in marine environments, monuments of Geological heritage. Palaeontological excavations are also conducted by our Section.

Web address: http://geopal.geol.uoa.gr

2.4.2.1 LABORATORY OF HISTORICAL GEOLOGY AND PALAEONTOLOGY

The ***Laboratory of Historical Geology and Palaeontology*** is one of the oldest in the University. To this day, it plays a very important role in education and scientific research of the Section, in topics such as Palaeontology, Micropalaeontology, Stratigraphy, Sedimentology, Historical Geology, Palaeoecology and Ecostratigraphy. The Laboratory facilities include a modern thin section lab, a modern lab for the retrievement and preparation of fossils and microfossils as well as the conservation and creation of moulds/casts. There is also a modern lab for the analysis of sedimentary basins.

For the educational and research needs of the Section, the Laboratory also includes an e-teaching hall/room, with 24 computers and stereoscopes, 5 polarizing microscopes, three of which are connected to computers, and a Scanning Electron Microscope (SEM) connected to an X-ray Microanalysis system (WDS).

The laboratory may provide the following services: a) thin sections of rocks, sediments and fossils; retrievement and preparation of fossils; construction of fossil casts, b) identification of nano-, micro-, macro- fossils, c) analysis of sediments and sedimentary environments with applications in Hydrocarbon and water resources research, d) analysis of texture, composition, granulometry and identification of inorganic and organic composites of sediments, e) preparation of samples for C, O and S stable isotope analysis in sediments, f) digital logging and mapping of aqueous floors, g) stereotransportation (sedimentation) and hydrodynamic parameters measurements and h) protection of Geological Heritage.

Web address: http://labgeopal.geol.uoa.gr

2.4.2.2 LABORATORY OF GEOSCIENCE TEACHING AND LEARNING

The ***Laboratory of Geoscience Teaching and Learning*** (LAGETEL) was established with the main purpose of promoting a holistic approach to geoscience education, and achieving geoscientific literacy of society as a whole, which will contribute to the rational management of geo-environmental challenges.

The goals and areas of activity of the Laboratory are:

a) Meeting the educational needs (at undergraduate and postgraduate level) of the Section of Historical Geology - Palaeontology and the Department of Geology and Geoenvironment, as well as of other Departments of the National and Kapodistrian University of Athens, and/or of other educational institutions of the country, in the scientific field of Geoscience Education.

b) The development and promotion of basic and applied research on the Geoscience Education. In the context of basic research, principles, procedures and general/specific problems of Geoscience teaching and learning are studied and relevant studies are carried out. In the context of applied research, multidisciplinary approaches are adopted in order to produce innovative methods of teaching Geoscience at each level of education.

c) The promotion of cooperation with primary and secondary education in order to train and support teachers and students and to familiarize them with modern methods of teaching Earth Sciences. Indicatively, relevant actions may include: provision of specialized educational Matterial, development of IT applications, implementation of pilot educational interventions, etc.

d) The promotion of cooperation with other scientific disciplines (such as Pedagogy, Psychology, Sociology, etc.), with the aim of highlighting the multifactorial dimension of Geoscience teaching and learning. For the implementation of the above, the Laboratory organizes conferences, symposia, seminars, summer schools and workshops, conferences, lectures, and other scientific events, as well as special publications and editions, and invites Greek and foreign internationally recognized scientists, teachers and researchers.

e) The encouragement of socially multi-level actions aiming at the dissemination of geoscientific knowledge and the interconnection of the Laboratory with society. Familiarizing society as a whole with geological concepts is a prerequisite for understanding the geo-environmental challenges (e.g., floods, landslides, desertification, etc.) that the country is called to face. Education is the first stage in dealing with these challenges in a rational way. In this direction, the Laboratory develops all forms of cooperation (educational, research, writing, etc.) with public and private entities (e.g., local government, scientific/social/business organizations, etc.).

2.4.3 SECTION OF GEOGRAPHY AND CLIMATOLOGY

The ***Section of Geography and Climatology*** (SGC) deals with earth surface processes, both terrestrial and marine. It hosts the Laboratory of Physical Geography (LPG) and the Laboratory of Climatology and Atmospheric Environment (LACAE). It offers the Postgraduate course of "Geography and Environment", since 1991; it is also involved in the Postgraduate program "Oceanography and Management of Marine Environment" since 1978 (School of Sciences). The SGC has participated in several national and international (mostly European) research programmes (e.g. MATER, CINCS, PDTD, INTERREG IIIB-CADSES, CAVESNETWORK - INTERREG III C., COST Action C22, INTERREG III B ARCHIMED (ARISTHOT), INTERREG IIIB (MEDOCC), IKYDA and has hosted a Marie-Curie fellowship.

Research topics include:

- The recent geomorphological and geological evolution of the terrestrial and seabed surface.
- The atmosphere and climate change, the processes of extreme weather/climate events and their adverse effects on the natural and social environment
- Coastal and inland waters with emphasis on the management and utilization of aquatic systems

- Coastal erosion and sea level rise effects
- Desertification phenomena and the environmental consequences of extensive forest fires
- The study, analysis, assessment and management of natural hazards and mitigation of impacts
- The management of complex environmental problems of habitats and of the coastal zone
- The development of techniques for digital analysis and modelling of geomorphological processes
- The study, protection and promotion of karst forms
- Land-use planning and regional planning, from a geographical-geomorphological point of view

Web address: geogclim.geol.uoa.gr

2.4.3.1 Laboratory of Climatology and Atmospheric Environment

The ***Laboratory of Climatology and Atmospheric Environment*** (LACAE) specialises in the study of climate change on various time and space scales, urban climatology, studies on the ozone layer, measurements of ultraviolet radiation, meteorological parameters and air quality, climatic effects from aircraft emissions and impacts of weather/climate variability and air quality on human health. The members of LACAE have long experience in teaching in undergraduate and postgraduate courses and have supervised many undergraduate and postgraduate theses in the fields of climatology and the atmospheric environment. It is equipped with:

- One Brewer MK IV monochromator measuring columnar amounts of ozone, SO_2 and NO_2.
- Two Yankee UV-B instruments measuring solar erythermal doses
- Instruments measuring atmospheric pollution (CO, CO_2, NO_2, PM)
- A complete autonomous/automatic meteorological station.
- A portable meteorological station

Web address: http://lacae.geol.uoa.gr

2.4.3.2 Laboratory of Physical Geography

The ***Laboratory of Physical Geography*** (LPG) deals with air-sea-land interactive processes forming the earth's surface morphology (sub-aerial and sub-aqueous), i.e. river deltas, beach zones, fluvial geomorphology, morphotectonic processes, karstification, aeolian processes, geoarchaeological studies, coastal indicators of relative sea level changes, climate change (past, present and future), coastal oceanography, sediment dynamics, photogeology, remote sensing and GIS applications.
It is equipped with:

- autonomous driller of fine-grained sediments,
- sieving analysis (dry and wet),
- autonomous continuous recording tidal gauge,
- manual operated current meter
- thermo-salino-meter,
- portable weather stations,
- GPS
- Tachymeter
- Software: SPS (statistics), MATLAB (incl. fuzzy logic tools), ERDAS (analysis of satellite images) CEDAS (nearshore hydrodynamics), DAVIS (weather station software), ArcGIS (handling, interpreting, presenting geo-data.

Web address: http://pg.geol.uoa.gr

2.4.4 Section of Geophysics and Geothermy

The *Section of Geophysics and Geothermy* was established in 1983, as successor to the Chair of Seismology (est. 1931) and the Laboratory of Seismology (est. 1929). The Section underwent rapid and multi-faceted development during the last 25 years, keeping pace with the corresponding rapid development of geophysics and Seismology at the international level. This, in turn has led to the establishment of a second dependent laboratory, the Laboratory of Geophysics (1999).

Throughout its long history, the Section has accumulated extensive experience in practically all aspects of pure and applied geophysics by teaching and researching topics such as: Theoretical and Applied Geophysics, Physics of the Earth's interior, Earth System science, mineral and energy resource prospecting, Engineering and Environmental Geophysics, Seismology, Engineering and Historical Seismology, Seismotectonics and Geodynamics, Physics of the earthquake source, Geomagnetism, Palaeomagnetism, Physical Volcanology and Geothermics, Remote Sensing, Satellite Geodesy and space-borne applications to Earth Sciences and Earth system Science. It has also developed intensive cooperation with numerous international research establishments and academic institutions.

The Section offers under- and post-graduate courses in geophysics, seismology, environmental science and natural disaster analysis, assuming an integrated approach towards the earth system sciences. The educational, research and other activities of the Section of Geophysics are thoroughly presented in the web pages of the Section and its dependent laboratories (see below).

Web address: http://www.geophysics.geol.uoa.gr/

2.4.4.1 Laboratory of Geophysics

The mission of the ***Laboratory of Geophysics*** (est. 1999) is:

- To provide high level practical training (laboratory and field exercises) and modern analytical skills, as part of the geophysics courses offered by the Section, at the under- and post-graduate levels.
- To support research with state-of-the-art instrumentation and analytical facilities.
- To offer advanced geophysical services to public and private sector patrons, requiring the application of state-of-the-art or cutting edge technologies.

During the recent few years, significant effort has been directed towards the development of modern/high resolution exploration technologies and geophysical data analysis software. The hitherto, teaching and research activities of Laboratory can be summarized as follows:

- Methodological developments in near-surface and deep geophysical exploration methods.
- Environmental and Engineering geophysics
- Geothermal and other energy resource exploration
- Mineral resource prospecting.

- Physics of the Earth's interior – determination and analysis of Earth structure at all depth scales.
- Physics of the earthquake source and earthquake prediction
- Geomagnetism, Geoelectromagnetism and Palaeomagnetism
- Space borne applications in the Earth Sciences and Geodynamics (DGPS, SAR/DINSAR, thermal imaging etc.).
- Geophysical software development.
- Earth System Science.

The Laboratory has developed multiple cooperative ties with corresponding national and international research establishments and academic institutions. It is also actively involved in outreach and dissemination of scientific information by organizing seminars, symposia and lectures for scientists and the general public. Moreover, it offers a broad range of geophysical services to public and private sector establishments, with particular reference to engineering and environmental applications, mineral and groundwater resource prospecting and geothermal prospecting.

Web address: http://geophysicslab.geol.uoa.gr

2.4.4.2 LABORATORY OF SEISMOLOGY

The ***Laboratory of Seismology*** was established in 1929 in order to contribute to the education of students attending the Faculties of Physics and Natural Science, as well as in monitoring and researching the seismicity of Greece.

The Scientific and Technical Staff of the Laboratory has frequently been commended by Civil Authorities and the University Administration for its immediate response and major contribution in the relief operations and research of major destructive earthquakes. Their expertise is reflected in numerous publications, a multitude of research and civil protection programmes, extensive collaboration with international research and educational establishments and consultancies of public and private sector companies.

The Laboratory maintains the state-of-the-art ATHENET network, comprising 32 stations in Central Greece and the Cyclades (real time seismicity at Follow this link). It also possesses an extensive inventory of seismometric and accelerometric equipment, as well as data analysis facilities.

The principal teaching and research activities of the Laboratory are:

- Seismicity monitoring.
- Engineering Seismology and earthquake hazard analysis (including microzonation, vulnerability analysis and strong ground motion analysis,).
- Physics of the earthquake source and earthquake prediction.
- Seismotectonics, Geodynamics and Earth System Science.
- Macroseismology, Historical Seismology and Archaeoseismology.
- Preparedness and protection against earthquake disasters, including the training of students, schools and the general public at the SEISMOPOLIS earthquake simulation centre

Web address: http://dggsl.geol.uoa.gr/en_index.html

2.4.5 SECTION OF ECONOMIC GEOLOGY AND GEOCHEMISTRY

Economic Geology and Geochemistry combines the study of geology of ore deposits and geochemistry to describe and understand the processes of mineral resource formation as well as to quantify the environmental impact of mineral and energy resource exploitation. Research in the Section is also focused on the development of techniques and solutions related to sustainable production of mineral resources, quality control of industrial raw Matterials and assessment of contaminated land and water.

Research topics include:

- Exploration and assessment of mineral resources
- Baseline geochemistry of soils and water
- Biogeochemical processes related to ore deposits
- Environmental impact of mining activities
- Use of mineral resources for environmental protection
- Recycling of by-products from metal mining and metallurgy
- Soil and water pollution assessment and management
- Sustainable reclamation of polluted grounds
- Urban Geochemistry

Web address: http://geochem.geol.uoa.gr/index_gr.htm

2.4.5.1 LABORATORY OF ECONOMIC GEOLOGY AND GEOCHEMISTRY

The ***Laboratory of Economic Geology and Geochemistry*** supports and facilitates research activities involving sampling and chemical analysis as well as mineralogical analysis of a variety of geological samples (rocks, minerals, ores, soil, sediment, water etc.). Laboratory infrastructure includes:

- Manually operated systems for sample and microscopy specimen preparation (crushing, screening and splitting bulk samples, pulverizing and homogenizing subsamples to prepare them for chemical analysis; thin and polished section preparation)
- Chemical laboratory equipped with various instruments for sample dissolution, microwave digestion, leaching experiments, filtration, high temperature sample treatment, sample storage and incubation etc.
- Atomic Absorption Spectroscopy unit operated in flame and graphite furnace modes
- Scanning Electron Microscopy unit equipped with a SEM-EDS microanalysis system
- X-Ray Diffraction unit
- Flame photometer
- Bench -top and portable spectrophotometers
- Optical microscopes
- Fluid inclusion- microthermometry unit equipped with optical microscope and digital monitor

Web address: http://geochem.geol.uoa.gr/lab_gr.htm

2.4.6 SECTION OF DYNAMIC, TECTONIC AND APPLIED GEOLOGY

The Section ***s***tudies the dynamic interior of the Earth. To this effect, it collects geological data and develops new tools for their analysis and interpretation, complemented by numerical modelling and use of digital technology. The research and educational interests and activities of the Section span a wide range of topics including tectonics and structure of the Earth's crust and lithosphere, seismic hazard, dynamics of plates, engineering geology, hydrogeology, environmental geology and natural disasters. The

educational curriculum offered by the Section includes, besides classroom lectures and exercises, a wide range of field exercises which, together with the field course of geological mapping, provide students with the necessary foundations and experience for subsequent scientific development.

Through a wide network of collaborations, both at the national and international level, with educational and research institutions, the Section has developed interdisciplinary research activities, funded mainly by EU research grants and the wider public sector (Ministries, Prefecture and Local Authorities etc.). Many of these programs are innovative and have enjoyed international recognition. Research topics include:

- Development of geotectonic maps (both conventional and offshore),
- Restoration of Uncontrolled Waste Disposal Sites,
- Water Resources Management,
- Geotechnical design of large scale infrastructure projects (roads, dams, foundations of buildings, industrial plants, oil pipelines and natural gas, etc.) in Greece and abroad.

2.4.6.1 LABORATORY OF TECTONICS AND GEOLOGICAL MAPPING

The ***Laboratory of Tectonics and Geological Mapping*** covers the educational and research needs of the Section and the Department in the fields of Tectonics, Structural Geology, Geological Mapping, Hydrology, Hydrogeochemistry and Soil and Rock Mechanics. Within this frame we develop educational curricula and conduct basic and applied research; cooperate and exchange scientific knowledge with other academic or research institutions from Greece and abroad; organize seminars, symposia, conferences, and lectures; provide services to external bodies from the public and the private sector.

Ample laboratory space is available for various activities including full IT support supplemented by modern computing and printing facilities, testing of physical and mechanical properties of rocks and soils and chemical analysis of water samples. Available equipment includes a variety of instruments for field research, a total station, auger corers, triaxial, uniaxial, point and unimpeded loading apparatuses, rock sample corer, portable stations for chemical analysis of water samples, turbidity meters, groundwater samplers, etc. Efforts are constantly made for the upgrading of the existing infrastructure.

2.4.7 LABORATORY OF REMOTE SENSING

The ***Laboratory of Remote Sensing*** (LRS) was established in order to meet the educational and research requirements of the Department of Geology during the early 1990's. Its research interests expand in the fields of modern space-borne Earth Observation Systems associated with the disciplines of Geodesy (Satellite Geodesy), Surveying, Photogrammetry, Digital Cartography and Remote Sensing. In general, the purpose and function of the LRS within the University of Athens and the Department of Geology and Geoenvironment, is the following:

1. To satisfy under- and post-graduate educational requirements of the Department.
2. To develop teaching and research curricula for the post-graduate study programmes.
3. To pursue basic and applied research aiming at:
   2.1. The development of techniques and applications associated with the Country's needs,
   2.2. The creation of opportunities for collaboration between the Academic staff and the Industry,
   2.3. To pursue and promote collaborative research between researchers of Hellenic Universities and Research Institutions,
   2.4. To provide services in accordance with Law 159/1984.

Current activities of the LRS members, include GPS measurements and Radar Interferometry (both conventional and advanced InSAR (PS and Stacking), including satellite imaging analysis (LANDSAT, ASTER, IKONOS, QUICKBIRD) and Orthorectification.

2.4.8 LABORATORY FOR PREVENTION AND MANAGEMENT OF NATURAL DISASTERS

The ***Laboratory on Prevention and Management of Natural Hazards*** was established in 2003 within the Department of Geology and Geoenvironment of the University of Athens. The Laboratory participates in a number of research projects financed by national, European or other international and bilateral organizations. Current activities focus on emergency planning, development of action plans, seismic hazard, tsunamis, forest fires, floods, landslides and volcanic hazard. The scientific activities of the Laboratory include the organization of seminars, lectures, symposia and related disseminating scientific activities involving the scientific as well as the social sector. It is an educational and research unit utilized by the undergraduate students of The Department and the Postgraduate Studies Programme on Prevention and Management of Natural Hazards.

Web address: http://labnathaz.geol.uoa.gr

2.4.9 LABORATORY AND CENTRE OF MUSEUM RESEARCH

The laboratory was founded in 2007, and it assists the research and teaching activities of NKUA on museum studies. The laboratory aims to assist the relevant research projects and teaching activities of the undergraduate and postgraduate programmes of the NKUA courses of the University of Athens. It further aims to the development of the museums of the NKUA, through specialized studies and services. The laboratory promotes the collaboration between the members of the Faculties of the NKUA and the Department of Conservation of Antiquities and Works of Art of the University of West Attica. The laboratory is located at the facilities of the Postgraduate Studies Program of Museum Studies, at the University Campus (Panepistimiopoli).

Tel: 210-7276499, 210-7276465, 210-7276434

2.4.10 MUSEUM OF PALAEONTOLOGY AND GEOLOGY

The ***Museum of Palaeontology and Geology*** is hosted by the Department of Geology and Geoenvironment. It has a rich collections of vertebrate and invertebrate animal, as well as plant fossils from Greece and abroad. It conducts scientific surveys and excavations throughout the country constantly enriching its collections. It is open daily for school visits and the public and also offers guided tours. The Museum, in collaboration with the local

authorities, operates an Annex at Vryssa (Polychnitos, Lesvos Island, Greece). The Annex houses local natural history collections including unique findings such as mammoths, rhinoceroses, antelopes, gazelles, giant tortoises, oversized horses etc.

The Museum of Palaeontology and Geology is hosted in the building of the Department of Geology and Geoenvironment at the University Campus (Panepistimiolpoli).

Although the Museum was founded in 1906, its history can be traced back to 1858 with the foundation of the Natural History Museum of Athens. Its current collection includes fossil vertebrates and invertebrates from Greece, historical specimens, comparative zoological and teaching specimens. It includes approximately 100,000 specimens, making it the largest collection of fossils in Greece. Its main exhibition includes fossils vertebrates from Pikermi, Peloponnesus and Crete.

The museumconducts scientific surveys and excavations throughout the country constantly enriching its collections. It is open daily for school visits and the public and also offers guided tours. The Museum, in collaboration with the local authorities, operates an Annex at Vrissa (Polychnitos, Lesvos Island, Greece). The Annex houses local natural history collections including unique findings of Early Pleistocene vertebrates.

Contact Info:

Mail Address: Department of Geology and Geoenvironment, Zografou University Campus, GR 15784 Telephone: +30 210-727 4086, +30 210-727 4202

E-mail: palaeo-museum@geol.uoa.gr

Web address:http://paleo-museum.uoa.gr/paleontology

VryssaAnnexTelephone: +30 22520 61890

2.4.11 MUSEUM OF MINERALOGY AND PETROLOGY

The rock and mineral collections of ***Mineralogy and Petrology Museum*** were assembled by the Physiographic Society (est. 1835). They are exhibited in a gallery of 1100 m^2 at the premises of the Department. They are not only the oldest in Greece, but also include rare specimens of interest to the international community. The museum is open daily for schools and the general public and also offers guided tours.

Contact Info:

Mail Address: Department of Geology and Geoenvironment, Zografou University Campus

Telephone: +30 210-727 2129

E-mail: voudouris@geol.uoa.gr

2.5 PERSONNEL

CHAIRPERSON

- Prof. Asimina Antonarakou
  Τηλ: 210 727 4166
  e-mail: chair@geol.uoa.gr, aantonar@geol.uoa.gr

DEPUTY CHAIRPERSON

- Prof. Ioannis Alexopoulos
  Τηλ: 210 727 4106
  e-mail: jalexopoulos@geol.uoa.gr

SECRETARIAT

ADDRESS:

Panepistimiopolis, Zografou, GR-157 84

Tel: +30 210 727 4279

e-mail: secr@geol.uoa.gr

Web page: http://www.geol.uoa.gr

Supervisor:	Dimitrios Psarris		
Name	**Status**	**E-mail**	**Telephone**
Dimitrios Psarris	Administrative Staff	dpsarris@geol.uoa.gr	210 727-4279
Taxiarchis Skenteris	Administrative Staff	taxskent@geol.uoa.gr	210 727-4062
Kalliope Chorafopoulou	Administrative Staff	kelchor@geol.uoa.gr	210 727-4061

FRONT DESK AND MAIL DISTRIBUTION OFFICE

Name	**Status**	**E-mail**	**Telephone**
Spyridon Sokalis	Administrative Staff	spirossok@uoa.gr	210 727-4219

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	Telephone (landline)
Person in Charge: V. Valsamakis	210 727-6527
Secretariat	210 727-6525

SECTION OF MINERALOGY AND PETROLOGY

DIRECTOR: Dimitrios Kostopoulos, Assoc. Professor

Name	Status	E-mail	Telephone
	Secretariat		210 727-4128 fax:4883
Panayotis Voudouris	Professor, *Head of Museum of Mineralogy and Petrology*	voudouris@geol.uoa.gr	210 727-4129
Athanasios Godelitsas	Professor, *Head of Laboratory of Mineralogy and Petrology*	agodel@geol.uoa.gr	210 727-4689
Panagiotis Pomonis	Professor	ppomonis@geol.uoa.gr	210 727-4844
Dimitrios Kostopoulos	Assosciate Professor	dikostop@geol.uoa.gr	210 727-4127
Marianna Kati	Assistant Professor	kati@geol.uoa.gr	210 727-4442
Ifigenia Megremi	Laboratory Teaching Staff	megremi@geol.uoa.gr	210 727-4112
Eleni Moustaka	Laboratory Teaching Staff	emoustaka@geol.uoa.gr	210 727-4112
Efstathios Vorris	Laboratory Technical Staff	svorris@geol.uoa.gr	210 727-4112

SECTION OF HISTORICAL GEOLOGY AND PALAEONTOLOGY

HEAD: Harikleia Ntrinia, Professor

Name	Status	E-mail	Telephone
	Secretariat		210 727-4179
Asimina Antonarakou	Professor	aantonar@geol.uoa.gr	210 727-4166
Efterpi Koskeridou	Professor *Director of the Museum of Palaeontology and Geology*	ekosker@geol.uoa.gr	210 727-4165
Harikleia Drinia	Professor *Director, PSP "Earth Sciences and the Environment"* *Director, Laboratory and Centre of Museum Research*	cntrinia@geol.uoa.gr	210 727-4394
MariaTriantafyllou	Professor *Director of Laboratory of Historical Geology and Palaeontology*	mtriant@geol.uoa.gr	210 727-4893
Aikaterini Kouli	Professor	akouli@geol.uoa.gr	210 727-4896
Margarita Dimiza	Associate Professor	mdimiza@geol.uoa.gr	210 727-4920
Georgios Lyras	Associate Professor	glyras@geol.uoa.gr	210 727-4897
Socrates Rousiakis	Associate Professor	srousiak@geol.uoa.gr	210 727-4169
Ioannis Panagiotopoulos	Associate Professor	ipanagio@geol.uoa.gr	210-727-4467
Theodora Tsourou	Assistance Professor	ttsourou@geol.uoa.gr	210 727-4172
Georgios Kontakiotis	Laboratory Teaching Staff	gkontak@geol.uoa.gr	210 727-4804
Olga Koumoutsakou	Laboratory Teaching Staff	okoumout@geol.uoa.gr	210 727-4178
Panagiota Makri	Laboratory Teaching Staff	pmakri@geol.uoa.gr	210 727-4259
Athanasia Bakopoulou	Laboratory Teaching Staff	abakopoulou@geol.uoa.gr	210 727-4635
Evangelia Besiou	Laboratory Teaching Staff	evabesiou@geol.uoa.gr	210 727- 4804
Elisavet Skampa	Laboratory Teaching Staff	elskampa@geol.uoa.gr	210 727-4187
Elizabeth Stathopoulou	Laboratory Teaching Staff	estathop@geol.uoa.gr	210 727-4178
Nikolaos Tsaparas	Laboratory Teaching Staff	ntsapar@geol.uoa.gr	210 727-4898
Dimitrios Velitzelos	Laboratory Technical Staff	veljim@geol.uoa.gr	210 727-4344
Vasiliki Lianou	Laboratory Technical Staff	vlianou@geol.uoa.gr	210 727-4693
Vasileios Karzis	Administrative Staff, *Museum of Palaeontology and Geology*	vkarzis@geol.uoa.gr	210 727-4086

SECTION OF GEOGRAPHY AND CLIMATOLOGY

HEAD: Emmanouil Vasilakis, Assoc. Professor

Name	Status	E-mail	Telephone
	Secretariat		210 727-4144 fax: 210 7247569
Panagiotis Nastos	Professor *Director of the Laboratory of Climatology and Atmospheric Environment*	nastos@geol.uoa.gr	210 727-4191
Seraphim Poulos	Professor *Director, Laboratory of Natural Geography*	poulos@geol.uoa.gr	210 727-4143
Nike Evelpidou	Professor	evelpidou@geol.uoa.gr	210 727-4297
Emmanuel Vassilakis	Associate Professor *Director, Laboratory of Remote Sensing (Departmental)*	evasilak@geol.uoa.gr	210 727-4400
Konstantinos Eleftheratos	Associate Professor	kelef@geol.uoa.gr	210 727-4133
Paraskevi Nomikou	Professor	evinom@geol.uoa.gr	210 727-4865
Maria Hatzaki	Associate Professor	marhat@geol.uoa.gr	210-727-4192
Michalis Diakakis	Assistant Professor	diakakism@geol.uoa.gr	
Christos Angelopoulos	Laboratory Teaching Staff	cangelop@geol.uoa.gr	210 727-4183
Karkani Anna	Laboratory Teaching Staff	ekarkani@geol.uoa.gr	210-727-4927

SECTION OF GEOPHYSICS AND GEOTHERMY

HEAD: Nikolaos Voulgaris, Professor

Name	Status	E-mail	Telephone
	Secretariat		210 727-4446 fax: 4787
Ioannis Alexopoulos	Professor *Director, Laboratory of Geophysics*	jalexopoulos@geol.uoa.gr	210 727-4106
Filippos Vallianatos	Professor	fvallian@geol.uoa.gr	210 727-4630
Nikolaos Voulgaris	Professor	voulgaris@geol.uoa.gr	210 727-4431
Vasiliki Kouskouna	Associate Professor	vkouskouna@geol.uoa.gr	210 727-4421
Andreas Tzanis	Professor	atzanis@geol.uoa.gr	210 727-4785
Georgios Kaviris	Associate Professor *Director, Laboratory of Seismology*	gkaviris@geol.uoa.gr	210 727-4841
Spyridoula Vassilopoulou	Laboratory Teaching Staff	vassilopoulou@geol.uoa.gr	210 727-4392
Kyriaki Pavlou	Laboratory Teaching Staff	pavlou@geol.uoa.gr	210 727-4791
Vasileios Sakkas	Laboratory Teaching Staff	vsakkas@geol.uoa.gr	210 727-4914
Alike-Maria Moumoulidou	Laboratory Technical Staff	amoumoul@geol.uoa.gr	210 727-4692
Stylianos Chailas	Laboratory Technical Staff	schailas@geol.uoa.gr	210 727-4940
Vasileios Nikolis	Laboratory Technical Staff	vnicolis@geol.uoa.gr	210 727-4426

SECTION OF ECONOMIC GEOLOGY AND GEOCHEMISTRY

HEAD: Stefanos Kilias, Professor

Name	Status	E-mail	Telephone
	Secretariat		210 727-4208
Stephanos Kilias	Professor	kilias@geol.uoa.gr	210 727-4211
Ariadne Argyraki	Professor *Director, Laboratory of Economic Geology and Geochemistry*	argyraki@geol.uoa.gr	210 727-4314
Christina Stouraiti	Associate Professor	chstouraiti@geol.uoa.gr	210-727-4941
Haralambos Vasilatos	Associate Professor	vasilatos@geol.uoa.gr	210 727-4664
Efstratios Kelepertzis	Assistant Professor	kelepert@geol.uoa.gr	210 727-4867
Zacharenia Kypritidou	Laboratory Teaching Staff	zach-kyp@geol.uoa.gr	210 727-4210
Angeliki Papoutsa	Laboratory Teaching Staff	angpapou@geol.uoa.gr	210 727-4214
Vasileios Skounakis	Laboratory Technical Staff	vskoun@geol.uoa.gr	210 727-4183

SECTION OF DYNAMIC, TECTONIC AND APPLIED GEOLOGY

HEAD: Stylianos Lozios, Professor

Name	Status	E-mail	Telephone
	Secretariat		210 727-4414 fax: 4096
Maria Stavropoulou	Professor	mstavrop@geol.uoa.gr	210 727-4778
Stylianos Lozios	Professor *Director, Laboratory of Structural Geology and Geological Mapping*	slozios@geol.uoa.gr	210 727-4413
Haralambos Kranis	Associate Professor *Director, Laboratory on Prevention and Management of Natural Hazards(Departmental)*	hkranis@geol.uoa.gr	210 727-4862
Emmanuel Skourtsos	Associate Professor	eskourt@geol.uoa.gr	210 727-4863
Konstantinos Soukis	Assistant Professor	soukis@geol.uoa.gr	210 727-4869
Varvara Antoniou	Laboratory Teaching Staff	vantoniou@geol.uoa.gr	210 727-4223
Georgios Danamos	Laboratory Teaching Staff	gdanamos@gmail.com	210-727-4859
Dimitrios Theocharis	Laboratory Teaching Staff	dtheocharis@geol.uoa.gr	210 727-4866
Christos Filis	Laboratory Teaching Staff	chfilis@geol.uoa.gr	210 727-4876
Emmanouel Andreadakis	Laboratory Technical Staff	eandreadk@geol.uoa.gr	210 727-4861
Eleni Kapourani	Laboratory Technical Staff	elkap@geol.uoa.gr	210 727-4861
Ioannis Bantekas	Laboratory Technical Staff	mpantekas@geol.uoa.gr	210 727-4866
Christina Lekka	Administrative Staff	xlekka@geol.uoa.gr	210 727-4783
Sotirios Marselos	Technical Staff	smarselos@geol.uoa.gr	210 727-4783
Paraskevi Tsiouma	Administrative Staff	ptsioum@geol.uoa.gr	210 727-4783

MUSEUM OF PALAEONTOLOGY AND GEOLOGY

DIRECTOR:	Efterpi Koskeridou,Professor

Tel.: 210 7274086
E-mail: palaeo-museum@geol.uoa.gr

Name	Status	E-mail	Telephone
Efterpi Koskeridou	Professor	ekosker@geol.uoa.gr	210 727-4165
Vasileios Karzis	Administrative Staff	vkarzis@geol.uoa.gr	210 727-4086

MUSEUM OF MINERALOGY AND PETROLOGY

DIRECTOR:	Panagiotis Voudouris,Professor

Tel.: 210 7274124
E-mail: : voudouris@geol.uoa.gr

Governing Board:

Name		E-mail	Telephone
Panagiotis Voudouris	Professor	voudouris@geol.uoa.gr	210 727-4129

Chapter 3

UNDERGRADUATE STUDIES IN THE DEPARTMENT OF GEOLOGY AND GEOENVIRONMENT

3.1 CURRICULUM

3.1.1 INFORMATION CURRICULUM

Awarded title: Bachelor (Bsc Level 6, 240 ECTS) (New graduates from the academic year 2018-2019 receive a Certificate of Pedagogical Competence).

Name of qualification and title conferred: "PTYCHIO GEOLOGIAS KAI GEOPERIVALLONTOS" - BACHELOR DEGREE (New graduates from the academic year 2018-2019 receive a Certificate of Pedagogical Competence)

Duration of the programme: 4 academic years (8 academic semesters)

ECTS credits: 60 ECTS per academic year, 240 total

National and European Qualifications Framework: Level 6 (EQF)

Field of Education (ISCED – F):

0521 Environmental sciences

0532 Earth sciences

Special admission requirements (if applicable): Special legal provisions are provided by the Greek legal system

Scope and objectives: The curriculum of the Department has been designed to provide students with a high level of education and training in basic and applied research, in order for them to acquire knowledge, skills and values that will be useful in their future scientific and/or professional careers. The structure of the Bsc aims at transferring the necessary know-how and strengthening critical thinking, so that the new graduates of the Department have the necessary skills to face the challenges and develop innovative methods in geosciences and the geo-environment.

The curriculum, which has been reformed over the years and has been implemented from the academic year 2021-2022, reflects the academic character of the Department. A key axis in the development of the programme is the objective of covering the entire scope of the science of Geology and Geoenvironment, which includes both basic and applied research. This is because the applications of this science are directly linked to both the country's basic infrastructure and important production processes, as well as the modern imperatives related to the environment and sustainable development (major engineering projects, natural and mineral wealth, natural disasters, environment, etc.).

Over time, the Department's subjects have included disciplines that cover the entire geosphere, namely the subsurface (classical geological sciences), the marine environment (oceanography), the earth's surface (physical geography and geomorphology) and the atmosphere (climatology, meteorology and renewable energy).

The teaching staff of the Department covers a wide range of specializations and disciplines, in order to cover all the educational needs of the curriculum. In order to best meet the educational and research needs of the Department, the teaching staff includes people whose main degree (or PhD) does not come from Geology Departments, but from other Departments, such as Physics, Mathematics, Chemistry and Metallurgical Engineering.

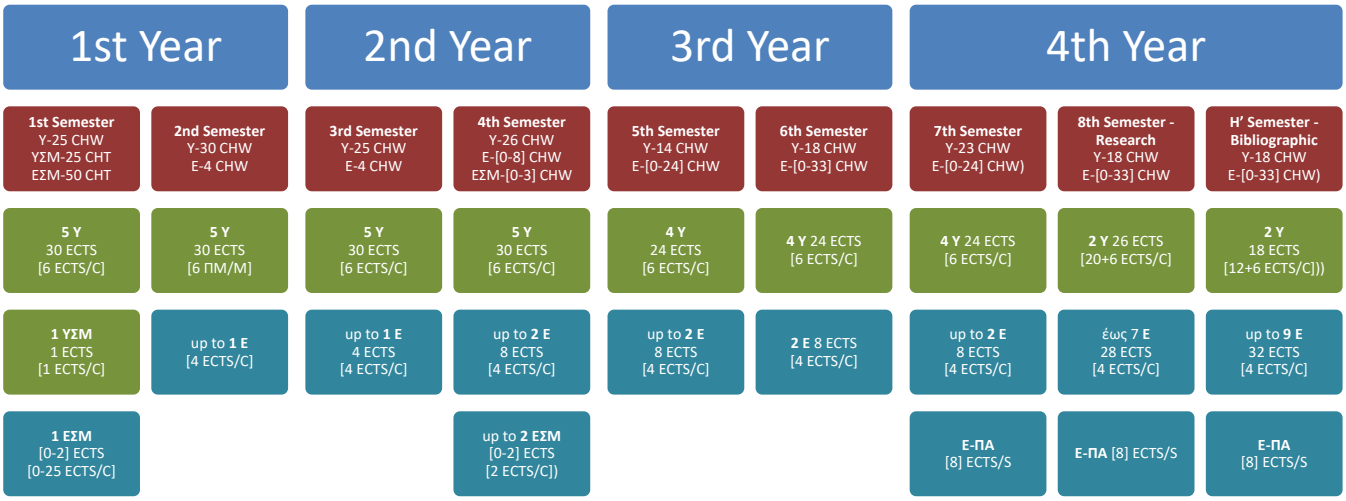
Learning outcomes of the programme

Generic Competences

- Ability to apply knowledge in practical situations
- Promote free, creative and inductive thinking
- Ability to plan and manage time
- Ability to work in a team
- Ability to search for, process and analyse information with the use of necessary technologies
- Adapt to and act in new situations and cope under pressure
- Ability to be critical and self-critical
- Oral and written communication of scientific issues
- Decision making
- Ability to undertake research at an appropriate level
- Autonomous work
- Information and Communication Technology (ICT) skills
- Ability to work in an international context
- Commitment to conservation of the environment

Structure of the curriculum: 60 ECTS units per academic year

PROGRAM STRUCTURE with Academic Units (ECTS)



OFFERED COURSE ELEMENTS per Academic Unit

Attendance: full

Examination arrangements and grading scale:

The DPS is graded on a 0 to 10 scale and follows:

Excellent (8,5-10)

Very good (6,5-8,49)

Good (5-6,49)

Obligatory or selective mobility window: Not foreseen

Work placement possibilities: Students are expected to carry out an optional internship (see Elective PA001). Details in the corresponding chapter entitled Internship

Professional Profile of graduates:

Graduates can be employed in a very broad spectrum of private and public sector enterprises, as well as in relevant to their spe-

cialty positions in organizations/services of the central or decentralized government.

Access to further studies:

Holders of this type of qualification have access to programmes of study at the same level or at level 7 or 8.

3.1.2 Structure of Studies in the Greek Education System

3.1.2.1 Duration of Studies

The academic year begins on September 1st and ends on August 31th of the following calendar year. The September re-examination period is considered to relate to the previous academic year. The teaching work of each academic year is structured in two (2) academic semesters.

The structure of the first cycle curricula are such as to include educational activities corresponding to sixty (60) European Credit Transfer and Accumulation System (ECTS) credits per academic year.

3.1.2.2 Maximum Duration of Studies and Part-Time Studies

The duration of studies is set to eight (8) academic semesters, including the time required for production of a graduate Dissertation.

The maximum duration of study in a first cycle programme of study with a minimum duration of eight (8) academic semesters for the award of the degree is this time plus four (4) academic semesters.

In cases of serious personal, familial, professional or economic adversities, PG students have the right to request temporary suspension of their studies. To this end, they submit a reasoned application that is appraised by the CC and forwarded to the Assembly for final decision. Temporary suspension may be granted *for four at most* academic semesters. The duration of the suspension is not counted in the maximum term allowed for the completion of studies.

The following are eligible to apply for part-time study:

a) **students who can prove that they work at least twenty (20) hours per week,**
b) **students with disabilities and special educational needs**,
c) **students who are also athletes and during their studies belong to sports clubs registered in the electronic register of sports clubs** of article 142 of Law. 4714/2020 (A' 148), kept at the General Secretariat of Sport (G.G.A.) under the following conditions:
   i. **for as many years they occupy a distinction of 1st to 8th place in national championships of individual sports** or
   ii. **they participate at least once, during their studies in the course of the programme of study for which they are applying for part-time status, in Olympic, Paralympic and Deaf Olympic Games.**

For part-time students, each semester counts as half an academic semester. Such students may not register for and be examined in more than half the number of course elements provided for in the curriculum for that semester.

3.1.2.3 Internal Mobility Programme for Students

Students who have enrolled in first cycle courses of a Department of a higher education institution (Department of origin) and have not exceeded the minimum attendance threshold, as this is specified in the decision establishing the programme of study, **may apply to attend first cycle course elemnts or educational activities of a Department of another higher education institution in Greece (host Department)**. Mobility may be driven to similar or dissimilar programmes of study at other higher education institutions and the duration of the course of study shall be for a period of one (1) academic semester.

The right of mobility may be applied once (1) until the completion of the first cycle study programme and the award of the degree by the higher education institution of origin.

Students admitted to first cycle programmes of study after a qualifying examination may request exemption from the obligation to attend and successfully complete courses or educational activities of the programme of study in which they were successfully assessed under the internal mobility programme, regardless of whether they count towards a degree. A decision of the Departmental Assembly, at the request of the student, shall determine the courses and educational activities in the curriculum from which the student is exempted from the obligation to attend and successfully complete the assessment.

For each first cycle study programme, **the maximum number of students admitted to the internal mobility programme per academic semester shall be set at ten per cent (10%) of the total number of students admitted,** as applicable each academic year.

3.1.3 Organisation of Studies at the Department of Geology and Geoenvironment

Each academic year is divided into teaching periods called semesters, the winter and spring semesters. The courses of the Department's curriculum are divided into mandatoty and elective courses and are divided into eight (8) semesters. During the winter semester, the courses that fall under the 1st , 2nd , 5th and 7th semesters of the curriculum are taught. During the spring semester, the courses falling under semesters 2nd , 4th , 6th and 8th of the curriculum are taught.

The education of the students of the Department of Geology and Geo-environment takes place through the delivery of Lectures, laboratory and practice exercises, fieldwork exercises and excursions/visits to areas or facilities of specific interest and is completed with the preparation of a thesis. The new curriculum of the Department of Geology and Geo-environment was reformed in the academic year 2011-2012 in order to adapt to the increased needs of the modern era, and was modified in the academic year 2021-2022.

The main points of the modification concerned:

- the reduction of the mandatory weekly attendance of students in order to allow time for study, preparation of exercises and assimilation of the taught material,
- avoiding duplication of teaching material,
- increasing the number of interdisciplinary courses,
- an increase in the number of field exercises,

- strengthening the teaching of mathematics by introducing additional subjects and/or enriching the curriculum,
- that there is provision for Proffessors' Meetings and Students' General Meetings.

Specifically, the provision of a specific day and time in the timetable for the holding of the Department's Assemblies, with a specific duration, is established. On days when no Assembly is held, the Assemblies of the Sections and of the Students as well as Seminars with invited speakers can be held during this period. The same is proposed for Student Assemblies, which could also be held on a specific day (the time scheduled for the Departmental Assembly when it is not held) in addition to a specific day and time.

Student Assessment - Examinations

Students are evaluated at the end of each semester with written or oral examinations, mid-term progress examinations, written assignments, laboratory or clinical exercises, a combination of different assessment methods or other assessment methods that are appropriate to the nature of each educational process. When written or oral examinations are used as assessment methods, the integrity of the process shall be guaranteed. If more than one (1) of the assessment methods referred to in the first subparagraph are included in the curriculum regulations as possible, the teacher shall choose the one he/she considers most appropriate for the assessment of students. If the assessment is carried out by final examinations, the examinations shall be conducted after the completion of the academic semester for first cycle curricula and by a re-examination after the completion of the academic year.

During the re-examination, students are entitled to be examined in courses and educational activities irrespective of the academic semester during which they are provided in accordance with the approved curriculum, if they have not been successfully assessed in them. In particular, students in first cycle programmes of study who have completed the period of regular attendance, which is the minimum number of academic semesters necessary for the award of the degree, shall be entitled to be examined during the examination period of each academic semester.

Distance Learning

The training process may be carried out using sychronous distance learning methods **only** in the following cases:

i) **provision of teaching work** in first cycle curricula**, conducted with the participation of Professors from foreign institutions or Associate Professors**,

ii) **teaching** in the context of joint study programmes **with foreign institutions**,

iii) t**he provision of teaching work in the context of first cycle interdepartmental or interdepartmental programmes,** for the part of the teaching work provided under the responsibility of the collaborating departments, where the collaborating departments are located in different cities,

iv) **the provision of teaching work on second cycle programmes of study,** and

v) **n cases of force majeure or exceptional circumstances,** where it is not possible to conduct the educational process in person or to use the infrastructure of the Higher Educational Institution (HEI) for the conduct of its educational, research and other activities,

vi) **the organisation of immersion courses and tutorial exercises, in addition to the compulsory teaching hours per course**.

The organisation of the educational process using distance learning methods ensures accessibility for people with disabilities and special educational needs.

Exceptionally, it is possible to organise the educational process in person, with simultaneous synchronous transmission of the teaching work carried out using electronic media, exclusively for students from other departments of the same higher education institution, if they choose to attend courses and educational activities of other departments of the same higher education institution, provided that the students to whom the course is addressed attend a department located in a different regional unit or city from that of the department in which the course is offered. The assessment of students shall be carried out in a uniform manner, irrespective of the method of conducting the educational process and monitoring the students.

E-Class

The **Electronic Classroom (eClass**) is an integrated e-learning management system and supports the asynchronous distance learning service at the National and Kapodistrian University of Athens without restrictions and commitments. Educational material per course is posted on the electronic platform, which includes notes, presentations, exercises, indicative solutions, as well as video-recorded lectures, provided that the current legislation on personal data protection is respected. The educational material of any kind is provided exclusively for the educational use of students and is protected by Law No. 2121/1993 (A' 25), provided that the relevant conditions are met.

Access to the e-class service is possible from the link https://eclass.uoa.gr. Students, once they create their online account in the EKPA e-classroom, are required to register for all the courses of the Programme of Studies they are going to attend during the semester in question.

3.1.3.1 Mandatory Courses

Mandatory courses are those courses whose attendance and successful examination is considered necessary for all students of the Department.

Attendance of the theory lectures of the courses is an academic obligation of the student. Systematic attendance of the lectures is absolutely necessary for the proper theoretical training of the student. Only direct contact with the lecturer can lead to a thorough knowledge of the subject matter of each course.

Examinations are given by the lecturer(s) at the end of the semester on a set syllabus. Examinations may be written or oral. The grade of the course is expressed as a whole number on a scale of zero to ten (0-10), with a pass mark of five (5). In case of failure, the student has the possibility of a supplementary examination. If the student also fails the supplemental examination, the student will be required to re-enroll in the course and take the course in the following semester.

The curriculum includes thirty-two (32) sub-credit courses. From the academic year 2021-2022 onwards, all compulsory courses

have a workload equivalent to 6 ECTS. Therefore, the 32 mandatory courses have a total workload of **192 ECTS**.

In addition to the 32 mandatory courses, the Programme of Studies also provides for the mandatory preparation of a Diploma Thesis, for which there is a special reference below (DiplomaDissertation).

3.1.3.2 ELECTIVE COURSES

Elective courses are a set of courses from which the student completes the number of courses required for a degree. The student must take electives from at least two (2) fields. Elective courses are declared by students in the semester in which they are taught or later.

With regard to the examinations and grading of each elective course, the same applies as for mandatory courses. In case of failure, the student may re-enroll in the course and take it in a subsequent semester or enroll in another elective course.

The curriculum includes 52 elective courses with 4 ECTS each, of which the student must choose seven (7) or nine (9), depending on the type of Thesis chosen.

3.1.3.3 LABORATORY EXERCISES

Many of the mandatory or elective courses are accompanied by practical training of students in specially equipped rooms with instruments and devices (laboratories). The content of the laboratory exercises is related to the subject matter of the same course.

The practice is compulsory and for practical reasons the students are divided into sections.

In order for a student to be considered successful in the laboratory, he/she must have successfully completed all the exercises prescribed by the programme of each laboratory.

In case of absence or failure of the student in some exercises, the exercises may be repeated, after consultation with the person in charge of the laboratory, provided that this possibility is available. Each student's participation in the laboratory is graded by the laboratory grade, which is included in the calculation of the single course grade. A prerequisite for participation in the course examinations is the completion of the corresponding laboratory exercises. The course is considered successful when the theoretical and laboratory part of the course is passed.

3.1.3.4 FIELD WORK

Field Work is a mandatory for all students and are related to the mandatory and elective courses. Field work takes place, for the winter semester courses, over a two-week period, from the end of November to the beginning of December, and for the spring semester courses, between 15-30 May. The students are divided into groups and each group is led outdoors by teachers and E.D.I.P. from all sectors. The mandatory course "Geological Mapping" (Y6203) is held in the 6th semester, between 15-30 May, is interdisciplinary and includes: i) Preparation in the laboratory, ii) Mapping in the field (general geological and specific) and iii) Delivery of a report - examination. For students in the last two years of study, Interdisciplinary Field Exercises are also offered, in which multifaceted topics are examined, taking into account the knowledge of most of the courses taught in all years of study.

3.1.3.5 INTERNSHIP

In the first and second cycle curricula, students may be required to undertake an internship as a mandatory or optional educational activity of the curriculum aimed at the practical application of the theoretical scientific knowledge acquired through the successful completion of the curriculum and the familiarization of students with possible workplaces. The practical training of students is carried out in public services, legal entities under public law, first and second degree local authorities, legal entities under private law and enterprises, hereinafter referred to as 'host institutions', under the supervision of a lecturer of the programme of study. Practical training may also be carried out in foreign institutions, provided that supervision of the educational process is feasible, in accordance with the rules of procedure of the study programme referred to in paragraph 1. 2. For student internships, an internship contract shall be concluded between the higher education institution (HEI), the student and the host institution. Successful completion of the internship shall result in the award of the number of credit points (ECTS), which shall be determined by decision of the Departmental Assembly.

3.1.3.6 DIPLOMADISSERTATION

The dissertation is the student's first comprehensive study as a Geologist and Geoenvironmentalist and includes in general: a. literature study, b. field work and/or laboratory analysis, c. extraction of results and formulation of conclusions on the specific subject matter and d. writing and appropriate presentation of these data.

The subject of the dissertation must be relevant to the content of the courses attended by the student. The choice of the subject of the dissertation is made from a list of topics, which are communicated each year by the Sections of the Department. The student is supervised by a faculty member, who is responsible for the guidance and at the end grades the student's performance. A copy of the dissertation is submitted in electronic form to the Library of the Faculty of Science.

The "Diploma Dissertation" is divided into "Dissertation Thesis-Research" with 20 ECTS and "Dissertation Thesis-Bibliographical" with 12 ECTS respectively. The choice of a bibliographical dissertation (12 ECTS) implies the additional attendance of 2 more elective courses corresponding to 8 (2x4) ECTS.

3.1.3.7 SEMINAR COURSES

There are four (4) Seminar Courses covering the subjects of Introduction to Geosciences, Computer Science and Programming Language, Scientific Writing. In addition, they cover the needs of informing and educating students on issues related to the Geological Sciences, strengthening students' digital literacy, which will help them to successfully attend courses and workshops, and familiarizing students with the search and use of scientific literature, the writing of papers and technical reports and the techniques of presenting scientific results.

Seminar courses receive 0.5 ECTS each, are not taken into account for the acquisition/grading of the degree and will be included in the **Diploma Supplement**, as is the case with the Practical Training (PA001, 8ECTS).

3.1.3.8 Elective Courses Offered In Foreign Languages For CIVIS

CIVIS (European University Cooperation for Citizens of Europe) is a network of public European Universities with the aim of creating a European University. The eight universities that are members of this network are:: University Aix - Marseille (Aix-en-Provenceand Marseille, France), NAtional and Kapodistrian University of Athens Αθηνών (Athens, Greece), Université Libre de Bruxelles (Bruxelles, Belgium), Universitatea din Bucureşti (Bucarest, Romania), Universidad Autónoma de Madrid (Madrid, Spain), Sapienza Università di Roma (Rome, Italy), Stockholms universitet (Stockholm, Sweden), and Eberhard -Karls- Universität Tübingen (Germany).

The Department of Geology and Geoenvironment participates in CIVIS by offering the following courses in foreign languages: E5209 "Environmental Geochemistry-Environmental Geochemistry" (4 ECTS)

E5210 "Palaeobotany-Climate reconstruction techniques-Palaeobotany-Climate reconstruction techniques" (4 ECTS)

E7217 "Mineral Resources and Energy Transition - Mineral Resources and Energy Transition" in G semester (4 ECTS)

E7220 "Environmental Micropaleontology-Palaeoclimatology - Environmental Micropaleontology-Palaeoclimatology" (4 ECTS)

3.1.4 Prerequisites for Obtaining a Graduate Degree

In order to obtain the degree of Geology and Geo-environment, the student must meet the following requirements:

1. The following requirements must be met.
2. Eight (8) credits.
3. Successfully complete a minimum of forty (40) semester courses (mandatory and elective). The mandatory courses include the Diploma Thesis.

After successful completion of the (32) Mandatory Courses, the student shall accumulate one hundred and ninety-two (192) credits. To complete the number of two hundred and twenty (240) credit hours, the student may choose additional:

- **either "Diploma Thesis-Research"** with 20 ECTS **and seven (7) electives** for the completion of forty (40) course
- **or " Diploma Thesis - Bibliographical"** with 12 ECTS **and nine (9) elective courses,** and the completion of forty-two (42) courses

Remarks

Course registrations are made at the beginning of the semester.

Students are required to register for all mandatory courses of the semester in which they are enrolled.

A prerequisite for taking the course examinations is the completion of the corresponding laboratory exercises.

3.1.5 Online Secretarial Services For Undergraduate Students

The web site of the secretariats of the National and Kapodistrian University of Athens (http://my-studies.uoa.gr) offers the following services:

Overview of the Curriculum of the Department of Geology and Geoenvironment

Courses registration

View and print course grades: in some or all examination periods, in one or more courses, or in aggregate, based on successful or unsuccessful attempts

Electronic request for the issue of certificates from the Department's Secretariat (detailed grades, recruitment, tax, etc.)

In order to access the service, students must obtain a username and password from: http://webadm.uoa.gr, following the links "New User Request" and then "Undergraduate students".

All students are obliged to register online all the courses they wish to attend and take exams. Automatic registration of courses is not possible under any circumstances by the Secretariat. If a course is not registered by the student, it is not possible for the lecturer to submit the student's marks.

3.1.6 Academic Advisor

The purpose of the introduction of the institution of the Academic Advisor (AA) is to improve the level of studies by offering responsible advisory work, also on a personal level, to undergraduate students. The advisory work concerns the general case of guidance on the pace of course selection and attendance as well as specific issues that may arise.

The role of academic advisor is undertaken by faculty members of the Department, regardless of rank and position. AAs shall undertake the mentoring of new students, provided that they have at least 4 years of remaining tenure. The AS will monitor the students they take on from the beginning to the end of their studies.

3.1.7 Credit of Courses for Admission by Candidate Examination

Students come to the Secretariat where they submit the relevant application for the recognition of courses for which they have successfully passed the examinations in their home department. The application must be accompanied both by a detailed score from the Department of origin showing that the course has been passed and by a detailed description of the course to be recognised (syllabus). The content and subject matter of the course to be recognised may also be demonstrated by the syllabus of the Department of origin.

3.1.8 Method of Calculating the Degree Grade

Prerequisites for obtaining a Degree:

In order to obtain the degree, the student must have successfully completed either at least 40 courses if he/she chooses the "Diploma Thesis-Research" which requires 20 ECTS for its completion or, at least 42 courses if he/she chooses the "Diploma Thesis-Bibliographical" which requires 12 ECTS respectively.

The degree is related to the number of ECTS credits and is calculated on the basis of either the 40 courses if the "Diploma Thesis-Research" is included or the 42 courses if the "Diploma Thesis-Bibliographical" is included. In order to obtain the degree, each course is first multiplied by its credit points. The sum of the multiplication is then calculated and finally the degree is obtained by dividing this sum by the 240 ECTS credits required for the degree. It is recalled that all Mandatory courses (except the Diploma Thesis) have 6 ECTS and all Elective courses have 4 ECTS.

In case the student has attended and obtained a positive grade in more courses than those required for the degree (thus having exceeded the required number of 240 credits), he/she must choose at graduation which of the elective courses he/she does not wish to include in the calculation for the degree, so that the degree is calculated on the basis of the total number of credits required.

The degree is expressed as a whole number to two decimal places (scale 5 to 10) and the performance is described as: "Good" (grade: 5 to 6.49), "Very Good" (grade: 6.50 to 8.49) and "Excellent" (grade: 8.50 to 10.00

3.1.9 The Curriculum within the National Qualifications Framework

3.1.9.1 The National Qualifications Framework

It is a framework for classifying qualifications, i.e. the qualifications held by each citizen. These qualifications are acquired after completing a learning process.

It is addressed to all those who can take advantage of the benefits it offers: learners, workers, unemployed, employers, education and training providers, qualification certification bodies, guidance counsellors, professional sectors, social partners, and every citizen, holder of a qualification.

It aims to ensure the existence of a single tool through which all qualifications awarded in Greece can be described and evaluated.

It offers all citizens the opportunity to systematically present the content of their qualifications, with reference to the National and European Qualifications Framework. Learners and employees who wish to change educational paths or jobs or countries have a tool for "translation" and comparability of their qualifications. Employers have the possibility of "quick reading" of the knowledge, skills and competences hidden behind the titles (degrees, diplomas, certificates, certificates of competence). The national qualification certification system is becoming clear and understandable at international level. Lifelong Learning becomes attractive to citizens, because they know that through the National Qualifications Framework the interconnection of all forms of learning is strengthened and the qualifications acquired through all kinds of learning paths (formal, non-formal, informal) are evaluated, validated, recognized, certified, classified at the levels of the National Qualifications Framework and assigned to the levels of the European Qualifications Framework. A wide range of stakeholders work together in an open dialogue. The analysis of the characteristics of qualifications in order to classify them at the levels of the National Qualifications Framework contributes to mobility and facilitates integration into the labour market, ensuring quality and transparency.

What changes does it bring? It formally adopts the learning outcome approach as a necessary condition for the award of qualifications. It enhances the ability to control and ensure the quality of all qualifications awarded in our country.

The architectural structure of the National Qualifications Framework is simple and mainly functional:

Levels – Learning Outcomes – Descriptors – Types of Qualifications.

During the design of the National Qualifications Framework, the current needs of the country as well as the relevant European and international developments were taken into account.

Levels The 8 levels of the National Qualifications Framework cover the entire range of qualifications from primary to higher education. Each level includes a set of knowledge, skills and competences that determine learning outcomes. The learning outcomes constitute the qualifications of the respective level.

Learning outcomes Qualifications take the form of learning outcomes classified into levels. Learning outcomes, i.e. what a person knows, understands and can do after completing a learning process, are categorized into knowledge, skills and competences.

Descriptors Learning outcomes corresponding to qualifications at a given level are determined by descriptors, which are determined by qualitative and quantitative gradations of knowledge, skills and competences.

Qualification Types Qualifications are categorized into types. Qualification Types represent groups of qualifications with common characteristics. The use of the Qualification Types facilitates the process of categorisation of qualifications, which are classified at the same level.

The Undergraduate Program of Studies of the Department of Geology and Geoenvironment is assigned to level 6 of the NQF.

According to the descriptors of the NQF for the studies of the 6th level, the graduate of the Undergraduate Program of Studies

- Has advanced knowledge in the scientific fields of geosciences and the environment, which implies a critical understanding of theories and principles.
- Possesses advanced skills and has the ability to demonstrate the required craftsmanship and innovation to solve complex and unpredictable geological problems.
- Can manage complex technical or professional activities or work projects, taking responsibility for decision-making in unpredictable work or study environments. Takes responsibility for managing the professional development of individuals and teams.

Regarding the learning outcomes of graduates of this level of study, according to the EQF they are summarized as follows:

Knowledge

Graduates of this level:

- Have a coherent and comprehensive body of knowledge, which includes elements from cutting-edge scientific or other developments and understand the concepts, methods and practices of a theoretical scientific, technological or artistic field of knowledge that includes elements from the respective professional fields in order to deepen, broaden and enhance their previous knowledge.

- Have an understanding of the evolutionary dynamics of the scientific field of knowledge and current and/or innovative applications.
- Possess analytical and advanced knowledge of their subject, including a critical understanding of theories, basic concepts, principles and methodologies of the scientific or applied cognitive field.

Skills

Graduates of this level:

- Analyze and adapt their acquired knowledge in order to apply it to various topics of the scientific field of study and/or professional field, as well as to acquire new knowledge.
- They correctly apply the appropriate tools and analysis techniques in the investigation of the basic topics of their scientific field of study.
- They solve complex or new problems of their scientific field of study, developing integrated, as well as creative or innovative solutions and approaches, while supporting their solutions and views in a methodical and scientific way.
- Using scientific sources or sources specialized in theoretical, technical and professional issues, they gather, analyze and select, in a critical and responsible way, ideas and information on those elements that concern them.
- They develop issues, mainly in the context of their knowledge and professional field, based on scientific documentation and form valid judgments, which take into account the relevant social, economic, cultural and ethical dimensions of the issue.
- Communicate with specialized and non-specialized groups and audiences in order to convey orally, in writing and by other means, information, ideas, problems and solutions to specific issues.

Abilities

Graduates of this level:

- They design, manage and implement supervised research projects within their scientific field of study, both individually and collectively.
- They transfer the knowledge and skills acquired in a professional or business context and apply them autonomously and in a way that shows professionalism and social responsibility, so as to plan and manage complex technical or professional activities or tasks.
- They make decisions, evaluate them and assume their responsibility in complex professional and business contexts that change and evolve.
- They are able to take responsibility, within defined frameworks, for developing the knowledge, skills and competences of individuals and groups.

3.1.10 The European Credit Transfer and Accumulation System ECTS

(From ECTS Guide)

The European Credit Transfer and Accumulation System (ECTS) is a tool of the European Higher Education Area (EHEA) aiming at greater transparency of studies and consequently improving the quality of higher education.

The ECTS system was introduced in 1989 under the ERASMUS programme as a way of converting the credits that students earned during their studies abroad into credits that count towards their study programme after returning to their home institution. In the following years, the system was used not only for the transfer of credits, based on the workload and learning outcomes achieved, but also for their accumulation in curricula of institutions. ECTS contributes to the design, description and implementation of programmes, helps integrate different types of learning with a lifelong learning perspective and facilitates student mobility by removing obstacles to the recognition of qualifications and academic periods of study. ECTS can be applied to all programmes, regardless of their teaching mode (classroom course/assignments/distance learning) or student status (full-time, part-time) and all types of learning environments (formal, non-formal and informal).

3.1.10.1 Basic Features of the ECTS System

ECTS is a student-centred credit accumulation and transfer system, based on the principle of transparency in learning, teaching and assessment processes. It aims to facilitate the design, implementation and evaluation of curricula and student mobility, recognising learning achievements, qualifications acquired as well as learning periods.

ECTS credits represent the volume of learning based on defined learning outcomes and the associated workload. 60 credits are assigned to the learning outcomes and associated workload of a full-time academic year or equivalent, which usually includes a number of modules in which credits are allocated (based on learning outcomes and workload). ECTS credits are generally expressed in whole numbers.

Learning outcomes are a statement of the knowledge, understanding and competence that the individual has acquired upon completion of the educational process. The achievement of learning outcomes must be assessed through processes based on clear and transparent criteria. Learning outcomes are attributed to individual training modules and curricula as a whole. They are also used in European and national qualifications frameworks to describe the individual level of qualification.

Workload is the estimation of the time typically needed to complete all learning activities such as attending lectures, seminars, assignments, practical work, workplace internships and individual study, required in order to achieve the defined learning outcomes in typical learning environments. The matching of a year's full-time workload to 60 credits is usually formally defined at national legal framework level. In most cases, the workload varies from 1,500 to 1,800 hours in an academic year, which means that one unit corresponds to 25 to 30 hours of work. It should be noted, however, that this number represents the typical workload and that the actual time required to achieve learning outcomes for each student varies.

Allocation of credits in the ECTS system is the process of allocating a specific number of credits to titles, programmes of study or individual modules. Credits are awarded to all qualifications or programmes of study acquired in accordance with national legislation or practice, as appropriate, and in relation to national and/or European qualifications frameworks. They are divided into training modules, such as courses, dissertations, on-the-job training, and workplace internships, based on the performance of 60

credits per full-time academic year, according to the estimated workload required to achieve the learning outcomes defined for each module.

The assignment of credits in the ECTS system refers to the official registration of these credits to students and other trainees, which correspond to the degree and/or the individual modules of the program, if they achieve the predetermined learning outcomes. National competent authorities should indicate which institutions are entitled to provide ECTS credits. Credits are awarded to students individually upon completion of the required learning activities and achievement of predetermined learning outcomes, as evidenced by relevant assessment. Where students and other learners have achieved learning outcomes in other formal, non-formal or informal learning environments or time frames, credits can be awarded through assessment and recognition of these learning outcomes.

Accumulation of credits in the ECTS system is the process of accumulating credits corresponding to: a) the achievement of learning outcomes in educational units integrated into formal settings and b) other learning activities integrated in informal and non-formal environments.

The student can accumulate academic credits with the aim of:

- the acquisition of titles, in accordance with the requirements of the institution awarding them,
- the provision of certification of his/her personal achievements within the framework of lifelong learning programmes.

Credit transfer is the process by which credits accumulated in one learning context (curriculum, educational institution) are recognised in another typical learning context with the aim of obtaining a qualification. The credits that students accumulate in a program of study at a particular institution may be transferred to another program offered either at the same institution or at another. Credit transfer is key to successful student mobility. Institutions, faculties and departments may conclude agreements guaranteeing automatic recognition and transfer of credits.

ECTS documentation: The use of ECTS credits is facilitated and quality is improved by the accompanying documents (Study Guide, Learning Agreement, Transcript of Records and Internship Certificate). The ECTS system also enhances transparency in other documents such as the Diploma Supplement.

3.1.10.2 ECTS AND SUPPORTING DOCUMENTS

The implementation of ECTS is supported by documents. This section suggests the elements that should be included in these documents, as they are a widely applied and accepted way of communicating information useful to all students (whether participating in mobility programmes or not), academic and administrative staff, employers and other stakeholders.

Institutions, in order to serve the needs of students, must record their achievements in a transparent and comprehensible way. This Guide therefore provides information to be included in key mobility documents in order to provide a fuller understanding between different institutions and countries, as well as between internal and external stakeholders.

TRANSCRIPT OF RECORDS CERTIFICATE

The Transcript of Records is an updated record of the progress of the student's studies as it includes the educational modules chosen, the number of ECTS credits collected, and the grades obtained.

As the Transcript of Records is an important document for recording progress and recognising learning achievements, it is vital to determine who is responsible for drafting it, how it is issued and how it is granted. Most institutions issue the Transcript of Records from their databases. Please note that the Transcript of Records may be used in different contexts, so the information should be comprehensive and provided in a transparent and clear manner.

In the case of credit mobility, the host institution issues a Transcript of Records for each student participating in a mobility programme and sends it to the home institution and the student at the end of the study period, in order to officially certify the work completed, the credits earned as well as the marks obtained during the period of mobility at the host institution. The Certificate must be sent within a reasonable period of time from the official announcement of the student's results to the host institution (see chapter on credit mobility and recognition).

The home institution must provide the student with a Transcript of Records (or equivalent document/database) within a reasonable time, without any further formalities. This ensures transparency about the results of the recognition of the mobility period abroad.

For study mobility, it is recommended to include the modules of the home institution's study programme that have been replaced, the number of credits they represent and, where appropriate, an explanation of the student's score obtained abroad.

In cases where the mobility period is recognised globally and not per module, the home institution should only record the number of credits, the points from the host institution (where applicable) and the learning outcomes determined for the entire duration of the mobility.

In the case of practical training, the transcript of records of the home institution will contain at least the necessary information on the fulfilment of the requirements for recognition signed in the Learning Agreement before the start of the mobility. This Agreement may provide for the award of a certain number of credits, grades, etc.

3.1.11 LIST OF COURSES – VALID FROM 10/1/2021

1st SEMESTER

Code	Course Title	M[1]	E	CHW	ECTS
	MANDATORY COURSES				
Y1201	Physical Geography and the Environment	3	2	5	6
Y1202	Physics	3	2	5	6
Y1203	Chemistry	2	3	5	6
Y1204	Introduction to Differential and Integral Calculus and Statistics	4	2	6	6
Y1205	Mineralogy-Crystallography	2	2	4	6
	SEMINAR COURSES				
ΣΜ001	Seminar Courses 1: Getting Acquainted With Geoscience	2		2	1
ΣΜ002	Seminar Courses 2: Informatics	2		2	2

2nd SEMESTER

Code	Course Title	M	E	CHW	ECTS
	MANDATORY COURSES				
Y2201	Introduction to Geology	4	3	7	6
Y2202	Systematic Mineralogy-Mineral Identification	3	3	6	6
Y2203	Climatology and Climate Changes	3	2	5	6
Y2204	GIS and Introduction to Remote Sensing	3	3	6	6
Y2205	Macropalaeontology	3	3	6	6
E4201	Mathematical Methods in Geosciences	2	2	4	4

L: Lecture hours, E: Exercise/Lab hours, CHW: Contact Hours per Week, ECTS: ECTS Credits per Course

3rd SEMESTER

Code	Course Title	L[1]	E	CHW	ECTS
	MANDATORY COURSES				
Y3201	Igneous Rocks-Magmatic Processes	3	2	5	6
Y3202	Petrology Of Sedimentary Rocks	3	2	5	6
Y3203	Seismology	3	2	5	6
Y3205	Structural Geology and Tectonics	4	2	6	6
Y3206	Micropalaeontology	2	2	4	6
	ELECTIVE COURSES				
E3202	Rock-Forming Minerals	2	2	4	4
E4203	Exploration of the Earth's Interior	2	1	3	4
	SEMINAR COURSES				
ΣM003	Seminar Courses: Programming-Applications in Geoscience	2		2	2
ΣM004	Seminar Courses: Essay Writing	1		1	2

4th SEMESTER

Code	Course Title	L	E	CHW	ECTS
	MANDATORY COURSES				
Y4201	Petrology of Metamorphic Rocks	2	2	4	6
Y4202	Geophysics	4	2	6	6
Y4203	Geochemistry	4	2	6	6
Y4205	Oceanography	3	2	5	6
Y4206	Sedimentary Environments and Processes	3	2	5	6
	ELECTIVE COURSES				
E4202	Dynamic Geology	2	1	3	4
E4203	Exploration of the Earth's Interior	2	1	3	4
	SEMINAR COURSES				
ΣM003	Seminar Courses: Programming-Applications In Geoscience				0,5
ΣM004	Seminar Courses: Essay Writing				0,5

L: Lecture hours, E: Exercise/Lab hours, CHW: Contact Hours per Week, ECTS: ECTS Credits per Course

5th SEMESTER

Code	Course Title	L[1]	E	CHW	ECTS
	MANDATORY COURSES				
Y5201	Geomorphology	3	2	5	6
Y5202	Stratigraphy	3	2	5	6
Y5203	Engineering Geology	4	2	6	6
Y5204	Geology of Greece	3	4	7	6
	ELECTIVE COURSES				
E5201	Seismology of Greece - Plate Tectonics	2	1	3	4
E5202	Quaternary Geology and Archaeogeomorphology	2	1	3	4
E5203	Volcanology	2	1	3	4
E5207	Karst Geomorphology-Principles of Spelaeology	2	1	3	4
E5208	Applied and Environmental Oceanography	2	1	3	4
E5209	Environmental Geochemistry	1	2	3	4
E5210	Palaeobotany-Climate Reconstruction Techniques	1	2	3	4
E5211	Analytical Methods of Rocks and Ores - Fluid Inclusions	2	1	3	4

6th SEMESTER

Code	Course Title	L	E	CHW	ECTS
	MANDATORY COURSES				
Y6201	Applied and Engineering Seismology	2	2	4	6
Y6202	Hydrogeology	2	4	6	6
Y6203	Geological Mapping - Field Course	2	2	4	6
Y6205	Geology of Magmatic and Hydrothermal Ore Deposits	2	2	4	6
	ELECTIVE COURSES				
E5205	Soil and Rock Mechanics	2	1	3	4
E6201	Renewable Energy Resources: Solar and Wind Energy - Geothermy	2	1	3	4
E6202	Macroseismology	2	1	3	4
E6203	Coastal and Submarine Geomorphology and Coastal Zone Management	2	1	3	4
E6204	Applied Geomorphology – Urban Geomorphology	2	1	3	4
E6205	Remote Sensing - Photogeology - Mathematical Geography	2	1	3	4
E6206	Industrial Minerals	1	2	3	4
E6209	Petrogenesis of Igneous Rocks and Ophiolithic Complexes	2	1	3	4
E6210	Microtectonics and Structural Analysis	1	2	3	4
E6213	Analytical And Isotopic Geochemistry	1	2	3	4
E6214	Petrogenesis of Sedimentary Rocks	2	1	3	4

L: Lecture hours, E: Exercise/Lab hours, CHW: Contact Hours per Week, ECTS: ECTS Credits per Course

7th SEMESTER

Code	Course Title	L[1]	E	CHW	ECTS
	MANDATORY COURSES				
Y7201	Environmental Geology	4	2	6	6
Y7203	Applied Geophysics	3	3	6	6
Y7204	Geology of Sedimentary and Supergene Deposits	2	2	4	6
	ELECTIVE COURSES				
E7201	Natural Disasters	1	3	4	4
E7202	Satellite Techniques and GIS in Geosciences	2	1	3	4
E7203	Earthquake Prediction	2	1	3	4
E7206	Evolutionary Palaeontology - Palaeoanthropology	2	2	4	4
E7207	Vertebrate Palaeontology	2	1	3	4
E7208	Marine Geology	2	1	3	4
E7209	Petrogenesis of Metamorphic Rocks and Elements of Thermodynamics	2	1	3	4
E7210	Neotectonics	2	1	3	4
E7213	Ground Hydraulics	2	1	3	4
E7214	Geophysical Fluids and Induced Seismicity	3	1	4	4
E7215	Hydrogeochemistry	1	2	3	4
E7216	Atmospheric Pollution	2	1	3	4
E7217	Mineral Resources and Energy Transition	2	2	4	4
E7218	Applied and Environmental Mineralogy and Petrology	2	1	3	4
E7219	Applied Climatology	2	1	3	4
E7220	Environmental Micropalaeontology - Palaeoclimatology	2	1	3	4
E7221	Geotechnical Projects	2	1	3	4
E8207	Mineral Resources and the Environment	2	1	3	4
ΠΑ001	Internship				8

8th SEMESTER

Code	Course Title	L	E	CHW	ECTS
	MANDATORY COURSES				
Y8202	Dissertation-Research			9	20
Y8203	Dissertation-Literature Review			9	12
E8206	Didactics of Geology and Environmental Sciences	2	2	4	6
	ELECTIVE COURSES				
E8201	Engineering and Enviromental Geophysics	2	1	3	4
E8203	Stratigraphy and Palaeogeography of Greece	2	1	3	4
E8211	Geology of Europe	2	1	3	4
E8215	Applied Geophysics in Geology	2	1	3	4
E8216	Volcanic Seismology	2	1	3	4
E8217	New Venture Creation	2		2	4

L: Lecture hours, E: Exercise/Lab hours, CHW: Contact Hours per Week, ECTS: ECTS Credits per Course

Γ8218	Palaeoecology	3	1	4	4
Γ8219	Oil Exploration - Sedimentary Basins and Petroleum Systems	2	1	3	4
Γ8220	Geological Heritage and Geoconservation	2	1	3	4
Γ8221	Methods in Mineral Exploration	2	1	3	4
Γ8222	Water Resources Management - Vulnerability	2	2	4	4
ΠΑ001	Internship				8

Note: In order to be taught, elective courses must have been registered by at least seven (7) students.

3.1.12 ASSIGN OLD AND MODIFIED SYLLABUS COURSES

Courses now offered in a different semester:

COURSE CODE	COURSE TITLE	OLD SEMESTER	NEW SEMESTER
E4201	Mathematical Methods in Geosciences	4th	2nd
E5205	Soil and Rock Mechanics	5th	6th
E8207	Mineral Resources and the Environment	8t	7th

Course overhaul

In detail, the new courses offered to undergraduate students with admission year from 2018-2019 onwards and the courses corresponding to the old program, are the following:

CLARIFICATION: Undergraduate students of the admission years 2018-2019 and onwards, for whom the implementation of the curriculum reform applies, have passed courses of the old program that have now changed, secure for the acquisition of a degree the courses with the code, name and credits that were valid during the examination period they successfully completed.

NEW CODE	NEW COURSE TITLE	SEMESTER	ECTS	CORRESPONDENCE with old course title	OLD CODE
Y3206	Biogeosciences-Principles of Micropalaeontology	3rd	6	Micropaleontology	**Y3204**
Y4206	Sedimentary Environments and Processes	**4th**	6	Sedimentology	**Y4204**
Y6205	Geology of Magmatic and Hydro-thermal Ore Deposits	6th	6	Ore Mineral Deposites	**Y6204**
Y7204	Geology of Sedimentary and Super-gene Deposits	**7th**	6	Genesis of Ore Mineral De-posites	**Y7202**
Y8202	Dissertation-Research	8th	20	Dissertation	**Y8201**
Y8203	Dissertation-Literature Review *compulsory 2 additional elective courses	8th	12 + (2ΕΠΙx4) =20	Dissertation	**Y8201**

NEW CODE	NEW COURSE TITLE	SEMESTER	ECTS	CORRESPONDENCE with old course title	OLD CODE
E3202	Rock-Forming Minerals	3rd	4	Petrogenetic Minerals and crys-tallization processes	**E3201**
E5210	Palaeobotany-Climate Reconstruction Techniques	**5th**	4	Palaeobotany	**E7212**
E5211	Analytical Methods of Rocks and Ores - Fluid Inclusions	**5th**	4	Analytical Methods of Ores - Fluid Inclusions	**E6208**
E6213	Analytical And Isotopic Geochemistry	6th	4	Hydrogeochemistry and Analytical Geochemistry	**E6212 part**
E6214	Petrogenesis of Sedimentary Rocks	6th	4	Petrography of Sedimentary Rocks	**E5206**

E7219	Applied Climatology	7th	4	Applied Climatology-Air Pollution-Palaeoclimatology	**E7204 part**
E7220	Environmental Micropalaeontology - Palaeoclimatology	7th	4	Applied Environmental Micropaleontology	**E7205**
E7221	Geotechnical Projects	7th	4	Geotechnical Constructions + Geology of Technical Projects	**E7211+E6211**
E7218	Applied and Environmental Mineralogy and Petrology	7th	4	Applied, Analytical and Environmental Mineralogy and Petrology	**E5204**
E7215	Hydrogeochemistry	7th	4	Hydrogeochemistry and Analytical Geochemistry	**E6212 part**
E7216	Atmospheric Pollution	7th	4	Applied Climatology-Air Pollution-Palaeoclimatology	**E7204 part**
E7217	Mineral Resources and Energy Transition	7th	4	Energy raw materials	**E6207**
E8218	Palaeoecology	8th	4	Palaeoecology-ΟικοStratigraphy	**E8202**
E8219	Oil Exploration - Sedimentary Basins and Petroleum Systems	8th	4	Oil Exploration + Sedimentary Basins and Petroleum Systems	**E8210+ E8204**
E8220	Geological Heritage and Geoconservation	8th	4	Geological Heritage	**E8205**
E8221	Methods in Mineral Exploration	8th	4	Methods of research, identification and evaluation of mineral raw materials	**E8209**
E8222	Water Resources Management - Vulnerability	8th	4	Aquifer Protection-Vulnerability + Water Resources Management	**E8212+ E8213**

Note: **In the remaining courses** there has been **no change** in the Semester of Teaching, the Title and the Code.

3.2 COURSE UNITS OUTLINES

A. MANDATORY COURSES

Y1201 PHYSICAL GEOGRAPHY AND THE ENVIRONMENT

Instructors

Lectures: Prof. P. Nomikou - Prof. S. Poulos - Assoc. Prof. M. Hatzaki

Lab. Training: Prof. P. Nomikou – C. Angelopoulos, Laboratory Teaching Staff – V. Antoniou, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 1st

TYPE: **MANDATORY /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures-seminars & laboratory work and exercises, optional fieldwork

3 hours of lecturing and 2 hours of practical exercises per week, 6 ECTS credits.

Prerequisites: NONE

Language of instruction and Assessment: Greek [1]

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

On successful completion of the course the student:

- **Defines** and **articulates** the natural processes (internal and external) that shape the Earth's topography
- **Understand** the mechanisms of natural hazards and **evaluate** ways of dealing with them
- **Compares** the impact of the human factor on natural processes, natural resources and the environment in general and **develops** environmental awareness
- **Combine** and **interpret** landforms to identify the main morphological structures
- **Use** techniques to represent relief morphology in topographic sections
- **Recognizes** the processes of submarine topography and relates land and marine morphological features
- **Knowledge** of the basic processes of the climate system and the spatial distribution of meteorological phenomena sciences.

Generic Competences:

- Ability to apply knowledge in practical situations
- Promote free, creative and inductive thinking
- Ability to search for, process and analyse information with the use of necessary technologies
- Decision making
- Ability to undertake research at an appropriate level
- Ability to work in an international context
- Commitment to conservation of the environment

COURSE CONTENT:

A. Lectures

The content of the course is structured in the following thematic sections:

- History and divisions of Geography (Physical Geography, Mathematical Geography, Anthropogeography)
- Erosion; Corrosion; Landscape formation; Types of landforms;
- Exogenous processes, landform, soil and plants, climate change;
- Landforms and climate;
- Characteristics of submarine terrain, coastal processes, fiord, coral reefs;
- Shape of the Earth; Earth in space; Evolution of the Earth's atmosphere;
- Hydraulic cycle, surface water, rivers, lakes, glaciers;
- Geological structure and landforms
- Environmental and Climate change;
- Topographic maps; Examination and interpretation of aerial photography;
- Physical geography and the environment;
- The atmosphere and the climate; Atmosphere pollution;
- The hydrosphere, coastal and river pollution; Lithosphere degradation and land pollution;
- Land corrosion processes; Biosphere and urban pollution;
- Detection, mapping and managing of environmental changes;
- Pollution in Greece;
- Physical Geography of Greece.

B. Laboratory Exercises:

Exercise 1 Coordinates, Topographic map
Exercise 2 Identify morphological structures on topographic maps.
Exercise 3 Topographic profile and hydrographic network
Exercise 4 Stages of the evolution of erosion and river deposits
Exercise 5 River and Coastal Terraces
Exercise 6 Coastal Morphology: Primary and Secondary
Exercise 7 Mid-examination
Exercise 8 Volcanic Morphology: Stages of the evolution of a volcano, geomorphological features of a volcano, volcanoes in Greece
Exercise 9 Pluton morphology: Stages of the evolution of the plutonic rocks
Exercise 10 Karst landscape: Recognition of karsts
Exercise 11 Landscape caused by landslides: Detection of main fault structures

[1] I.S.: Incoming students (e.g. ERASMUS Student)

Exercise 12 Landscape of folded rocks: Syncline and Anticline structures
Exercise 13 Submarine terrain: Geomorphological characteristics of the seafloor, plot of a bathymetric profile
Exercise 14 Final examination

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY
- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES
- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	39 hours
Practice exercises	18 hours
Fieldwork	-
Tutorials	-
Essey writing	18 hours
Autonomous study	50 hours
Final assessment preparation	25 hours
Total student's effort	**150** hours

ASSESSMENT METHODS AND CRITERIA:

I. LECTURES (50%)
- Final written Exam (summative)

The written exam includes Short Answer Questions and Multiple Choice Test

Ii. LABORATORY WORK (50%)
- Weekly Written Essays for every Lab Exercise (formative)
- Mid-term examination (formative, summative).

or
- Final written examination (summative)

The written exam includes Short Answer Questions, Multiple Choice Test and Solving Exercises

Supplementary material (questions, exercises, etc.) for the exams is posted on the online **e-Class** platform (https://eclass.uoa.gr/courses/GEOL177/).

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL
- Vouvalidis K., 2011. Physical Geography (in Greek)

II. ADDITIONAL READING
- Gournelos Th., 2015. Physical Geography and Environment Σημειώσεις (in Greek)
- Robert Christopherson, Ginger H. Birkeland, 2018, Geosystems: An Introduction to Physical Geography, 10th edition
- Joseph Holden 2004, Introduction to Physical Geography and the Environment. Prentice-Hall, London.
- Marsh, William M.; Kaufman, Martin M. (2013). Physical Geography: Great Systems and Global Environments. Cambridge University Press.
- Pidwirny, Michael. (2014). Understanding Physical Geography. Planet Earth Publishing, Kelowna, Canada.

III. JOUNRALS
- Progress in Physical Geography, SAGE publications
- Physical Geography, Taylor & Francis Online
- Bulletin of Geography. Physical Geography Series
- Progress in Physical Geography: Earth and Environment, Sage Journals
- Applied Geography, ScienceDirect.com by Elsevier
- Geojournal, Springer Link

WEBPAGE (URL):

http://eclass.uoa.gr/courses/GEOL177

Y1202 PHYSICS

Instructors

Lectures: Prof. P.T. Nastos- Assoc. Prof. M. Hatzaki – Assoc. Prof. G. Kaviris

Lab. Training: Assoc. Prof. E. Skordas - Assoc. Prof. S. Gardelis - Assoc. Prof. M. Hatzaki– V. Sakkas, Laboratory Teaching Staff – A. Kapoyannis, Laboratory Teaching Staff – E. Prosalentis, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 1st

TYPE: **MANDATORY /** Background

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Practical exercises

3 hours of lecturing and 2 hours of practical exercises per week, 6 ECTS credits.

Prerequisites: There are no prerequisite courses, but basic knowledge of High School Physics is required

Language of instruction and Assessment: Greek [1]

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

On successful completion of the course the student:

- **Identifies** and the fundamental physical quantities
- **Interpret** the basic principles of kinematics, Newtonian dynamics, oscillations, wave mechanics and optics
- **Solves** problems based on the above principles of physics
- **Use**s computers to solve problems
- **Combines** and critically **evaluates** the data and results of the problems to be solved
- Identifies laboratory instruments and uses them to make simple measurements.
- Applies the knowledge acquired to relevant subjects in geology

Generic Competences:

- Autonomous work
- Oral and written communication of scientific issues
- Ability to apply knowledge in practical situations
- Work in a team
- Ability to undertake research at an appropriate level
- Adapt to and act in new situations and cope under pressure
- Commitment to conservation of the environment

COURSE CONTENT:

A. Lectures:

- Basic concepts of Physics. Physical quantities and measurement standards. Conversion of units. Measurements and uncertainty. Vector and scalar quantities.
- Mechanics: Motion in one and more dimensions. Laws of motion and applications. Work and kinetic energy. Potential energy and conservation of energy. Momentum, impulse and collisions. Rigid object dynamics. Elastic properties of solids.
- Oscillations: Motion of an object attached to a spring. Mathematical representation of Simple Harmonic Motion. Energy of the Simple Harmonic Oscillator. The pendulum. Damped oscillations/ forced oscillations
- Waves: Propagation of a disturbance. Sinusoidal waves. The linear wave equation. Rate of energy transfer by sinusoidal waves. Superposition and interference. Reflection and transmission. Standing waves. Sound waves.
- Optics: Nature of light. Reflection. Refraction. Dispersion and prisms. Geometric optics (image formations, mirrors, lenses). Light waves (interference, diffraction, polarization)

Laboratory work:

Laboratory Exercises are carried out in groups of 2 or 3 students and an individual written assignment is delivered:

Exercise 1. Measurements, uncertainties, errors, graphs
Exercise 2. Measurement of focal length of a converging lens
Exercise 3. Measurement of gravity acceleration with pendulum
Exercise 4. Electric circuit - Ohm's law
Exercise 5. Laser beam wavelength (He-Ne) measured with optical barrier
Exercise 6. Thermocouple Calibration - Thermoelectric Phenomenon
Exercise 7. Internal friction coefficient measurements

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	39 hours
Practice exercises	14 hours
Fieldwork	–
Tutorials	20 hours
Essey writing	20 hours
Autonomous study	42 hours
Final assessment preparation	15 hours
Total student's effort	**150** hours

ASSESSMENT METHODS AND CRITERIA:

I. LECTURES (**67%**)

- Solving exercises in the classroom or at home during the semester (formative)
- Written Exam (formative, summative)

Exams include short or extended answer questions and solving exercises and problems.

II. LABORATORY EXERCISES (**33%**)

I.S.: Incoming students (e.g. ERASMUS Student)

- Weekly assessment of written essays for every Laboratory Exercise (formative, summative)

Supplementary material for the exams (questions, exercises etc.) is posted on **e-Class** platform (https://eclass.uoa.gr/courses/PHYS193/).

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- Giancoli, **Physics for Scientists and Engineers, Volume A,** Tziola [EUDOXUS code: 112692104] in Greek
- Giancoli, **Physics for Scientists and Engineers, Volume B**, Tziola [EUDOXUS code: 122074700] in Greek
- Halliday D., Resnick R., Walker J., **Physics,** Gutenberg [Κωδ. ΕΥΔΟΞΟΣ: 41959145] in Greek
- Serway R.A., Jewett J.W., **Physics for Scientists and Engineers, Volume A**, Kleidarithmos [EUDOXUS code: 22750100] in Greek
- Serway R.A., Jewett J.W., **Physics for Scientists and Engineers, Volume B**, Kleidarithmos [EUDOXUS code: 22750112] in Greek
- Young H., Freedman R., **University Physics, Volume A**, Papazisi [EUDOXUS code: 68387911] in Greek
- Young H., Freedman R., **University Physics, Volume B**, Papazisi [EUDOXUS code: 68387930] in Greek

II. ADDITIONAL READING

- Feynman, Leighton, Sands, 1989, **The Feynman Lectures on Physics, Volume A,** California Institute of Technology
- Paul G. Hewitt, 2022, **Conceptual Physics**, 13th ed. Pearson
- R. Shankar, 2014, **Fundamentals of Physics**, Yale University Press

WEBPAGE (URL):

http://eclass.uoa.gr/courses/PHYS193

Y1203 CHEMISTRY

Instructors

Lectures: Prof. P. Paraskevopoulou

Lab. Training: Prof. P. Paraskevopoulou - Assoc. Prof. A. Philippopoulos – Dr M. Roulia, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 1st

TYPE: **MANDATORY /** Background

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, seminars & laboratory training

2 hours of lecturing and 3 hours of practical exercises per week, 6 ECTS credits.

Prerequisites: NONE

Language of instruction and Assessment: Greek
Availability to Erasmus+ Students: NO

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

This course introduces the fundamental principles of Chemistry via both a theoretical and a practical approach, and emphasizes the connection between Chemistry and Geology. On completion of the course the student will have the following subject specific competences:

- Understanding of the fundamental principles of chemistry via both a theoretical and a practical approach
- Understanding of the multi-thematic dimension of the subject of Chemistry
- Ability to solve elementary problems related to the basic principles of Chemistry
- Understanding of the connection between Chemistry and Geology
- An elementary skill in Chemistry through the combination of theory and practice (laboratory exercises)

Knowledge

- Knowledge and understanding of the relationship of atomic structure with the Periodic Table
- Knowledge and understanding of atomic, hybrid and molecular orbitals, and chemical bonding
- Knowledge and understanding of intermolecular forces and state of matter
- Knowledge and understanding of the basics of chemical thermodynamics and chemical equilibrium (homogeneous and heterogeneous systems)
- Basic knowledge of chemical kinetics and reaction mechanisms
- Knowledge and understanding of acids-bases, pH, indicators, buffers
- Basic knowledge of metal complexes and application to the determination of water hardness

- Basic knowledge of redox reactions, electrode potentials and electrochemical cells
- Basic knowledge of ion determination in solution
- Basic knowledge of organic chemistry (nomenclature, homologous series, chemical bonds, stereochemistry)
- Knowledge and understanding of safety procedures in the chemical laboratory

Skills

- Skills in solving basic Chemistry problems
- Skills in identifying proper methods for simple analyses in Chemistry and Geology
- Skills in evaluation and exploitation of experimental data

Abilities

- Ability to apply the knowledge gained by the students in dealing with problems related to Chemistry and Geology
- Ability to work responsibly and safely in a chemical laboratory
- Ability to evaluate and correlate experimental data with chemical processes and calculate the requested values
- Ability to work with others constructively in a laboratory environment

Generic Competences:

- Search, analysis and synthesis of data and information, using the necessary technologies
- Ability to work autonomously
- Ability to work in a team
- Work in a multicultural environment
- Work in an interdisciplinary environment
- Promoting free, creative and inductive thinking
- Ability to make reasoned decisions

COURSE CONTENT:

Lectures:

- Atomic Structure and the Periodic Table
- Chemical Bonding and Molecular Structure
- Intermolecular Forces
- States of Matter
- Solutions
- Chemical Thermodynamics
- Chemical Equilibrium
- Chemical Kinetics
- Reaction Mechanisms
- Acid-Base Chemistry
- Metal Complex Compounds
- Redox Chemistry
- Qualitative Analysis
- Introduction to Organic Chemistry

Laboratory training:

- Laboratory safety rules - Laboratory equipment and functions
- Preparation of solutions
- Solubility of salts in water
- Chemical equilibrium
- Heat of reaction
- pH determination - Titration
- Water hardness
- Redox reactions
- Qualitative analysis

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity:	Student's effort
Lectures	26 hours
Laboratory training	39 hours
Studying	39 hours
Homework essays	39 hours
Preparation of evaluation	7 hours
Total student effort	**150** hours

ASSESSMENT METHODS AND CRITERIA:

- **Oral examination** during the laboratory sessions. (formative,)
- **Evaluation of the laboratory reports** submitted after each laboratory session. (formative, summative)
- **Theory and practical examination** (written, and/or oral, when recommended) at the end of the semester. (summative)

To pass the Course, a minimum grade **5** (**out of 10**) is necessary in both the **theory and the practical examination at the end of the semester**. The **final grade** is calculated as follows: **0.7 × (theory grade) + 0.3 × (practical grade).** The practical grade includes the grade of the practical examination at the end of the semester, the grade of the oral examination during the laboratory sessions and the grades assigned to the laboratory reports.

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- Βασικές Αρχές Ανόργανης Χημείας, Γ. Πνευματικάκης, Χ. Μητσοπούλου, Κ. Μεθενίτης [Κωδ. ΕΥΔΟΞΟΣ: 59396599]
- Γενική χημεία, Chang R., Overby J. [Κωδ. ΕΥΔΟΞΟΣ: 102074446]

II. ADDITIONAL READING

-

III. RELATIVE JOURNALS

- Journal of Chemical Education, American Chemical Society

WEBPAGE (URL):

e-Class - CHEMISTRY

Y1204 INTRODUCTION TO DIFFERENTIAL AND INTEGRAL CALCULUS AND STATISTICS

Instructors: Prof. Ch. Tsitouras

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 1st
TYPE: **MANDATORY /** Background

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

4 hours of lecturing and 2 hours of tutorials per week, 6 ECTS credits.

Prerequisites: NONE

Language of instruction and Assessment: Greek
Availability to Erasmus+ Students: NO

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences: The purpose of the course is for students to acquire the ability to handle basic algebra and analysis tools that will help them in the computational part of their work. In this context, basic concepts of Linear Algebra and Integral and Differential Calculus are taught in this course. After successful completion of the course the student will be able to:

- Perform matrix operations and find the inverse of a matrix.
- Solve systems of equations using Matrices.
- To find the eigenvalues and eigenvectors of a matrix and to square it.
- Predict the limits of functions.
- Calculate derivatives of functions of one variable and partial derivatives of functions of two or more variables.
- Evaluate indefinite, definite, and generalized integrals of functions of one variable.
- Calculate double integrals.
- To calculate the area of surfaces using an integral.
- Calculate volumes of solids using double integrals.
- To be able to use the least squares method.

The second aim of the course is to acquaint students with basic concepts and results of Probability and Statistics, with the aim of modeling problems involving randomness in applications from various scientific areas. By successfully attending and completing the course, the student is able to:

- To know the concepts of random experiment, sample space and simple event.
- To know the classical and axiomatic foundations of probability theory as well as its basic properties.
- Know the concept of conditional probability and stochastic independence of possibility and solve probability problems by applying the Theorem of Total Probability and Bayes formula.
- Know the concept of random variable, distribution function and probability density function. To know the most basic discrete and continuous distributions.
- To construct confidence intervals for the unknown parameter of the sampling distribution that will contain it with a certain probability.
- Conduct basic statistical hypothesis tests to draw conclusions about the unknown parameter of the sampling distribution.

Generic Competences:

- Promoting free, creative and inductive thinking
- Ability to work autonomously
- Ability for free, creative and inductive thinking
- Ability for analysis and synthesis
- Ability to be critical and self-critical
- Ability to resolve problems

COURSE CONTENT:

Introduction to Differential and Integral Calculus

- Basic definitions of matrices, matrix operations, matrix inverse, solving systems using inverses, determinants of matrices, properties of determinants, finding inverse matrix using adjoint, solving systems using Cramer's method, Eigenvalues and eigenvectors - definitions and properties, eigenspaces, Characteristic polynomial, matrix similarity, diagonalization, Cayley-Hamilton Theorem.
- Derivative of a function, geometric interpretation, rules of derivation, derivative of a complex function, limit of a function, l'Hospital rules.
- Indefinite integral- definition and properties, methods of integration.
- Definite integral- definition and properties, calculation of definite integral, Generalized integrals, applications.
- Functions of many variables. Partial derivative, higher order derivatives, calculation of partial derivatives.
- Least squares method.
- Double integral- definition and properties, calculation of double integral (Cartesian-polar coordinates), contour integral, applications.

Statistics

- Sum principle, multiplicative principle, sample space, simple events (intersection, union and difference of events, complementary event, disjoined and independent events, De Morgan formulas), classical definition of Probability (Laplace), axiomatic definition of Probability (Kolmogorov) and properties, probability of complementary events, probability of union of events, conditional probability, Total Probability Theorem, Bayes formula, independence of events, probability of intersection of independent events.
- Random variable, distribution function, probability density function, mean, variance, standard deviation, Poisson distribution, Normal distribution.
- Random sample, sample mean, sample variance, confidence intervals, and hypothesis tests for the mean of the distribution of random sample data.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY
- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

– Use of ICT in teaching (lectures, lab exercises, fieldwork).
– Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity:	Student's effort
Lectures	78 hours
Individual Study/ Bibliography Analysis/ Preparation	97 hours
Σύνολο Μαθήματος	**175** hours

ASSESSMENT METHODS AND CRITERIA:

Assessment/Marking: Final written exams in Greek (**100%**)

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- General Mathematics (in Greek), Ch. Massouros, Ch. Tsitouras, ISBN: 9786185066512 [Eudoxus code: 59392755]

II. ADDITIONAL READING

-

III. RELATIVE JOURNALS

-

Suggested Bibliography:

WEBPAGE (URL):

http://eclass.uoa.gr/courses/GEOL535

Y1205 MINERALOGY-CRYSTALLOGRAPHY

Instructors

Lectures: Prof. A. Godelitsas - Prof. P. Voudouris –I. Megremi, Laboratory Teaching Staff

Lab. Training: Prof. A. Godelitsas - Prof. P. Voudouris –I. Megremi, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 1st

TYPE: **MANDATORY /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures-seminars & laboratory work and exercises, optional fieldwork

2 hours of lecturing and 2 hours of practical exercises per week, 6 ECTS credits.

Co-requisites: Knowledge of (Y1202).Physics and (Y1203) Chemistry

Language of instruction and Assessment: Greek[1]

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences: Minerals are the primary constituents of Earth materials and essential components of the Solar System and the Universe. They are also produced by living organisms to form a variety of biominerals. The fundamental understanding of their structure and composition is crucial for all fields within the Earth & Environmental Sciences. This course aims to provide knowledge on modern Mineralogy-Crystallography needed principally in Geology, and particularly in Petrology/Geochemistry/Ore & Economic Geology. Moreover, to introduce the students to macroscopic, microscopic, analytical, thermal, and X-ray techniques applied in minerals research.

On successful completion of the course the student:

- **Comprehend** the importance of minerals and Mineralogy to society and to the study of the Earth & Environment and how the properties of chemical elements and their bonds regulate the structure and composition of minerals.
- **Describe** the concepts of symmetry, crystallographic axis, unit cell, enantiomorphism/chirality, Quasicrystals, allotropy, polymorphism, solid solutions/isomorphism, exsolution, polytypism, defects/impurities, epitaxy, topotaxy, intergrowths, twinning, mineral growth, refractive index, isotropic/anisotropic, pleochroism, optical axis, uniaxial/biaxial, birefringence/interference color, thermal behavior of minerals and X-ray diffraction (XRD) patterns of simple/basic minerals (e.g. halite, calcite, quartz),), relevant rocks (e.g. lime-

[1] I.S.: Incoming students (e.g. ERASMUS Student)

stone), selected biominerals (e.g. whewellite) and molecular/organic crystals (e.g. sucrose)
- **Apply and Evaluates** specialized (free) software for studying crystal morphology & structure and interpreting powder X-ray diffraction data (WinXMorph, JCrystal, KrystalShaper, Kristall2000, VESTA, PowDLL, QualX2).

Generic Competences:

- Ability to search for, process and analyse information with the use of necessary technologies
- Decision making
- Autonomous work
- Work in a team
- Commitment to conservation of the environment
- Promote free, creative and inductive thinking

COURSE CONTENT:

A. Lectures – Laboratory Exercises

- Introduction to Mineralogy and Materials Science
- historical aspects
- principles of Crystallography and crystal chemistry
- crystalline and amorphous solid materials
- unit cell and crystal lattice
- geometrical/morphological Crystallography (symmetry, crystal systems, Miller indices, crystallographic symbols, enantiomorphism/chirality, stereographic projection)
- Quasicrystals and related minerals and natural phases
- intergrowth and twinning
- crystal and mineral nucleation & growth (crystallization), crystal growth inhibition
- formation of minerals and growth from melt/magma & hydrothermal solutions, effect of pressure and metamorphic & deep minerals, minerals precipitating in solutions, biominerals
- epitaxy, topotaxy, exsolution, phase diagrams
- introduction to microscopic techniques (optical microscopy, SEM, TEM, AFM)
- basic principles of instrumental analysis in mineralogy (X-rays, e^-, p^+, Laser, MS, ion-beams)
- optical Crystallography-Mineralogy (polarizing/petrographic microscope, optical properties of minerals, refractive index, isotropic/anisotropic, pleochroism, optical axis, uniaxial/biaxial, birefringence/interference color)
- introduction to Solid-State Chemistry and structural Crystallography-Mineralogy (crystal structure, defects/impurities & color, solid solutions/isomorphism, allotropy, polymorphism, polytypism)
- X-rays and characterization of materials and minerals by means of powder X-ray diffraction (Bragg's law, X-ray diffraction patterns, unit cell constants)
- X-ray diffraction using Synchrotron radiation and portable & remote equipments
- Thermal behaviour of minerals
- thermal analyses (TGA, DTA, DSC);
- introduction to selective -free- software (WinXMorph, Crystal & KrystalShaper, Kristall2000, VESTA , PowDLL, QualX2).

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	26 hrs
Practice exercises	26 hrs
Seminars	13 hrs
Tutorials	-
Essey writing	40 hrs
Autonomous study	45 hrs
Final assessment preparation	-
Total student's effort	**150** hours

ASSESSMENT METHODS AND CRITERIA:

Theory and practical examination (written and/or oral) at the end of the Course

To pass the Course, a minimum grade **5** (out of 10) is necessary.

Supplementary material for the exams (questions, exercises etc.) is posted on **e-Class** platform (https://eclass.uoa.gr/courses/GEOL314/).

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- GODELITSAS A. and PAPOULIS D.: **Nanogeosciences**, Gotsis publications 2021, (in Greek).

II. ADDITIONAL READING

- ΘΕΟΔΩΡΙΚΑΣ Σ.Σ.: **Ορυκτολογία-Πετρολογία**, Εκδόσεις Χ. Σαούλη Ο.Ε., 2η Έκδοση, Θεσσαλονίκη 2002.
- ΚΟΚΚΟΡΟΣ Π.: **Γενική Ορυκτολογία**, Εκδόσεις Δ.Ν. Παπαδήμα, Έκδοσις Θ, Αθήνα 1987.
- ΟΙΚΟΝΟΜΟΥ Κ.Ε.: **Γεωμετρική και Οπτική Κρυσταλλογραφία**, Παν/μιο Αθηνών 1988.
- ΧΡΙΣΤΟΦΙΔΗΣ Γ. - ΣΟΛΔΑΤΟΣ Τ.: **Οπτική Ορυκτολογία**, Εκδόσεις Γιαχούδη 2012.
- GAINES R.V. et al.: **Dana's New Mineralogy**, J.Wiley & Sons Inc. 1997.
- PERKINS D.: **Mineralogy**, Prentice Hall, 2nd Ed. 2001.
- PUTNIS A.: Introduction to Mineral Sciences, Cambridge Univ.

III. RELATIVE JOURNALS

- Proceedings of the National Academy of Sciences (PNAS)
- American Mineralogist

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL314

http://users.uoa.gr/~agodel/Files/courses.html

Y2201 INTRODUCTION TO GEOLOGY

Instructors

Lectures: Assoc. Prof. H. Kranis– V. Antoniou, Laboratory Teaching Staff

Lab. Training: Assoc. Prof. H. Kranis– D. Theocharis, Laboratory Teaching Staff – I. Bantekas, Laboratory Technical Staff –G. Danamos, Laboratory Teaching Staff – C. Filis, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 2nd

TYPE: **MANDATORY /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures-seminars & laboratory work and exercises, optional fieldwork

4 hours of lecturing and 3 hours of practical exercises per week, 6 ECTS credits.

Prerequisites: NONE

Γλώσσα διδασκαλίας: Greek

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences: This is the fundamental course for all geology students, providing them with an outline of the various disciplines and methods used in Geology. The course serves as an introduction to most of the subjects covered in the curriculum of the Department of Geology and Geoenvironment.

On completion of the course the student will be able to:

- understand the nature of the Science of Geology and its relationship to the other natural sciences, the reasons why we study the earth and the geologists' scope of work;
- describe the origin, formation and evolution of the Earh and its position in the solar system;
- describe the nature of the earth's interior and the processes that take place within it;
- identify the composition differentiation and the characteristics of the Earth's layers (i.e. crust, mantle, core, lithosphere, asthenosphere);
- describe the scientific progress that led to the unifying theory of lithospheric plates;
- identify the main lithospheric plates and the types of lithospheric plate boundaries
- assess and understand the concept of geological time and the processes that take place within this time frame and apply the basic principles of relative and absolute dating;
- describe the main surficial processes (i.e. weathering, erosion, sedimentation;
- identify basic mineral and rock types and their basic physical properties;
- describe the types of tectonic processes within the crust and identify the main deformational structures;
- recognize and classify the main types of natural hazards;
- understand the importance of mineral resources and ore formation;
- collect, combine, compare and correlated the various types of geological data that are necessary for the assessment and management of various geological and environmental issues related to human activity and prosperity and environmental sustainability.

Generic Competences:

- Ability to search for, process and analyse information with the use of necessary technologies
- Ability to be critical and self-critical
- Autonomous work
- Oral and written communication of scientific issues
- Ability to apply knowledge in practical situations
- Promote free, creative and inductive thinking
- Ability to plan and manage time

COURSE CONTENT:

A. Lectures

- **Earth in space**: planetary system, formation of the earth.
- **Configuration of the earth's surface**: maps, terrestrial and ocean relief, map elements, topographic and geological maps.
- **Earth Structure and plate tectonics**: history of the exploration of the Earths' interior – the crust, mantle and core; lithosphere and asthenosphere – earths' magnetic field – isostacy – the evolution of the Lithospheric Plates unifying theory – Plate boundary types and associated processes – The Wilson and supercontinent cycles – hot spots and mantle plumes – mantle dynamics and the driving forces of plate tectonics.
- **Earth-surface dynamics**: internal and external processes, weathering and erosion, sedimentation. Soils. Mass wasting.
- Surface and ground-water. The hydrosphere, hydrological cycle, drainage networks, springs.
- **Earthquakes**: earthquake generation, seismic waves and sequences, measuring earthquakes, earth's seismic zones, earthquake concomitant effects, earthquake prediction.
- **Volcanoes**: the concept of volcanism, structure and life cycle of a volcano, volcano types, volcanic territories, monitoring and prediction of volcanic activity.
- **Minerals and rocks**: mineral chemistry and crystal structure, rock-forming minerals, igneous rocks, magma formation, plutons, sedimentary facies and environments, metamorphism, pressure and temperature conditions in the earth's interior, geobarometers-geothermometers, metamorphic facies, metamorphic types.
- **Geological time and the fossil record**: absolute and relative dating of rocks and events, fossils and fossil types, the organic world in the geological past, origin and evolution of humans.
- **Deformation of rocks**: types of tectonic deformation: faults and folds, lithological and depth constraints on deformation, experimental deformation.
- **Geological synthesis on local scale – the geological history concept.** Reading and interpreting a geological map – stratigraphic configuration – the stratigraphic column – cross-cutting relationships – maps of simple geological structures.
- **Geological Structure of the Hellenic Domain**: the Hellenic orogenic arc – alpine, pre- and post-alpine rocks of Greece – geo-

tectonic units – seismicity and volcanism of Greece- A concise outline of the geological evolution of Greece.
- **Ores, industrial minerals and energy resources**: the concept of ore – ore and industrial deposits – an outline of energy resources – hydrothermal and geothermal energy.
- **Geology and the environment**: environmental geology – natural disasters and geological hazards – groundwater pollution – atmospheric pollution – geology in technical works and urban planning – geosites and natural heritage geological sites.

B. Laboratory Exercises

- The students work on simplified geological maps containing outcrops of horizontal, inclined, faulted, faulted and unconformable strata. They identify and characterize the structural elements of the maps and work on simple problems including map completion, cross sections and outcrop and subcrop patterns.

C. Fieldwork

SINGLE-DAY FIELD COURSE IN BEOTIA; CENTRAL GREECE. Field recognition of basic rock types; types of geological contacts (stratigraphic, tectonic); basic principles of geological mapping

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	52 hours
Practice exercises	39 hours
Fieldwork	12 hours
Tutorials	-s
Essey writing	5 hours
Autonomous study	20 hours
Final assessment preparation	22 hours
Total student's effort	**150** hours

ASSESSMENT METHODS AND CRITERIA:

The assessment process is conducted, either with progressive exams in separate sections of the course content or with the final examination of the entire course material which includes:

I. LECTURES (37.5%)

- Oral Examination (formative, summative)and/or
- Written Exam with Short Answer Questions and Multiple Choice Test (formative, summative)and/or
- Written Exam with Extended Answer Questions (formative, summative)

II. LAB EXERCISES (37.5%)

- Written exam with Solving Exercises and Problems (formative, summative)

II. FIELD EXERCISES (25%)

- Oral examination in the field and with evaluation of deliverables of required Work or Report (formative, summative)

The evaluation criteria of the course and the participation rates are described in the Chapter «3.3 Evaluation Criteria » of this syllabus and student handbook.

Auxiliary material (questions, exercises, etc.) for the exams is posted on the online **e-Class** platform (https://eclass.uoa.gr/courses/GEOL157/).

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- Γεωλογία. Η επιστήμη της Γης, Παπανικολάου Δ. Ι.,Σίδερης Χ. Ι. [Κωδ. ΕΥΔΟΞΟΣ: 21407] –[IN GREEK][

II. ADDITIONAL READING

- ΚΡΑΝΗΣ, Χ. & ΣΚΟΥΡΤΣΟΣ, Ε., 2020: Κεφάλαια Μαθήματος «Εισαγωγή στη Γεωλογία»: Δομή της Γης και Εισαγωγής στην Τεκτονική των Λιθοσφαιρικών Πλακών. Διδακτικές Σημειώσεις, 71 σ.
- GROTZINGER, J., JORDAN, T., PRESS, F., SIEVER, R., 2007. Understanding Earth, 5th ed. W.H. Freeman & Co., New York.
- LUTGENS, F., TARBUCK, E.J., 2012. Essentials of Geology. 11th Ed. 550 p. Prentice-Hall, New Jersey.
- MARSHAK, S., 2008. Earth: portrait of a planet, 3rd ed. W.W. Norton & Co., New York.
- MONROE, J., WICANDER, R., HAZLETT, R., 2007. Physical Geology – Exploring the Earth, 6th ed. Thomson – Brooks Cole. MONROE, J., WICANDER, R., 2006. The changing Earth, 3rd ed. Brooks/Cole.
- THOMSON, G., TURK, J., 1998. Introduction to Physical Geology. Saunders College Publications.

III. RELATIVE JOURNALS

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL157

Y2202 SYSTEMATIC MINERALOGY-MINERAL IDENTIFICATION

Instructors

Lectures: Prof. P. Voudouris - Prof. A. Godelitsas –I. Megremi, Laboratory Teaching Staff

Lab. Training: Prof. P. Voudouris - I. Megremi, Laboratory Teaching Staff - E. Vorris, Laboratory Technical Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 2nd

TYPE: **MANDATORY /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Lab Exercises and Fieldwork

3 hours of lecturing and 3 hours of practical exercises per week, 6 ECTS credits.

Prerequisites: [recommended]

Y1203 Chemistry

Y1202 Physics

Y1205 Mineralogy-Crystallography

Language of instruction and Assessment: Greek [1]

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

On successful completion of the course the student:

- **Define** and **formulate** the basic principles, methods and applications of Systematic Mineralogy-Mineral Identification.
- **Classify** and **describe** the main groups of minerals, their physico-chemical properties, their structural characteristics, their associations and formation conditions, as these are essential components for understanding geological processes on our planet.
- **Comprehend** the basic Mineralogy required in the subjects of Geology-Geoenvironment, Petrology, Geochemistry, Ore Deposit formation, and Structural Geology.
- **Apply** the techniques of Systematic Mineralogy-Mineral Identification, and of optical microscopy with the aim of developing mental and practical skills that include mineral identification both macroscopically and under the microscope, as well as (free) software for determining the structural formula and of minerals from their electron probe microanalysis. The field exercise carried out aims to identify and collect minerals in the field.

Generic Competences:

- Ability to search for, process and analyze information with the use of necessary technologies.
- Autonomous work.
- Ability to apply knowledge in practical situations.
- Work independently.
- Promote free, creative, and inductive thinking.
- Ability to plan and manage time.
- Information and Communication Technology (ICT) skills.

COURSE CONTENT:

A. Lectures

- Introduction to Systematic Mineralogy. Mineral definition. Nomenclature of minerals. Habit and growth of crystals. αντοχή, Physical properties of minerals: color, streak, hardness, luster, transparency, cleavage and fracture, density and specific gravity, magnetic and electrical properties, fluoresence, radioactivity.
- Chemical composition, structure and chemical properties of minerals: chemical elements, bonding, coordination polyhedra, ionic structures, isomorphism, solid solution, polymorphism, exsolution, pseudomorphism. Calculation of structural formula and nomenclature of a mineral from the electron probe microanalysis.
- Mineral formation and growth of minerals. Stability fields of minerals. Mineral assemblages. Paragenesis. Geological environments of mineral formation. Minerals in igneous, metamorphic and sedimentary rocks. Bowen's reaction series. Inclusions in minerals.
- Classification and description of minerals: Native elements, Sulfides, Antimonides, Arsenides, Selenides, Tellurides, Sulfoarsenides, Sulfosalts, Halides, Carbonates-Borates-Nitrates, Sulfates, Chromates-Tungstates-Molybdates, Phosphates-Arsenates-Vanadates, Oxides-Hydroxides, Nesosilicates, Sorosilicates, Cyclosilicates, Inosilicates, Phyllosilicates, Tectosilicates.
- Minerals of Greece and conditions of their genesis. Visit to the Mineralogy-Petrology Museum and description of the mineral groups through the museum's collections.

B. Lab exercises.

Practice exercises are taught in small groups of students and are graded at the end of the exercise.

Exercise 1. Introduction to the macroscopic identification of minerals. Familiarity with mineral samples and identification of their hardness based on the Mohs Hardness Scale.

Exercise 2. Macroscopic identification of Native Elements, Halides and Sulfate minerals. Description of their physical properties and their chemical composition.

Exercise 3. Macroscopic identification of Sulfides. Description of their physical properties and their chemical composition.

Exercise 4. Macroscopic identification of Carbonates. Description of their physical properties and their chemical composition.

Exercise 5. Macroscopic identification of Nesosilicates, Sorosilicates, Cyclosilicates. Description of their physical properties and their chemical composition.

Exercise 6. Macroscopic identification of Inosilicates, Phyllocilicates and Tectosilicates. Description of their physical properties and their chemical composition.

Exercise 7. Macroscopic identification of Oxides/Hydroxides. Description of their physical properties and their chemical composition.

I.S.: Incoming students (e.g. ERASMUS Student)

Exercise 8. Microscopic identification of Tectosilicates with Transmitted Light Microscopy.
Exercise 9. Microscopic identification of Inosilicates with Transmitted Light Microscopy.
Exercise 10. Microscopic identification of Phyllosilicates with Transmitted Light Microscopy.
Exercise 11. Microscopic identification of Nesosilicates, Sorosilicates and Cyclosilicates with Transmitted Light Microscopy.
Exercise 12. Microscopic identification of Halides, Carbonates and Sulfates with Transmitted Light Microscopy.
Exercise 13. Calculation of mineral structural formula and nomenclature of minerals from chemical analyses using PC software programs.

C. Fieldwork

C1. One day field excursion in the Lavreotiki area. Introduction to the geology and mineralization of Lavreotiki area. Information on the ancient methods of mining and ore processing in the area. Collection and identification of minerals and rocks.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY
- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES
- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	39 hours
Practice exercises	39 hours
Fieldwork	9 hours
Tutorials	–
Essey writing	10 hours
Autonomous study	37 hours
Final assessment preparation	16 hours
Total student's effort	**150** hours

ASSESSMENT METHODS AND CRITERIA:

I. LECTURES (**60%**)
- Oral or written final examination (summative).

Exams include short or extended answer questions, multiple choice tests.

II. LAB EXERCISES (**37.5%**)
- Oral or written final examination on macroscopic and microscopic identification of minerals (summative).
- Solving problems of calculating the chemical formula and nomenclature of minerals from their chemical analysis. Delivery of report with calculated structural formulas (**12.5%**, summative).

III. FIELDWORK (**12.5%**)
- Sampling and identification of minerals and rocks. Assessment of fieldwork report (**12.5%**, summative).

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- Katerinopoulos, A., 2008, **The world of Minerals**, Publ. S. Athanassopoulos, (EUDOXUS code: 45279), in Greek.

II. ADDITIONAL READING
- Theodorikas S.S., 2013, Mineralogy-Petrology, Melissa Publ., in Greek.
- Christofides, G. & Soldatos, T., 2012, Optical Mineralogy, Giahoudi Publ., in Greek.
- Dyar, M.D. et al., 2008, **Mineralogy and Optical Mineralogy**, MSA, Chantilly.
- Gaines, R.V. et al., 1997, **Dana's New Mineralogy**, J.Wiley & Sons Inc.
- Hibbard, M.J. & Hibbard M., 2001,**Mineralogy: A Geologist's Point of View**, McGraw-Hill Science/Engineering/Math, 1st Ed.
- Perkins, D., 2001, **Mineralogy**, Prentice Hall, 2nd Ed.
- Voudouris, P., Karampelas, S., Melfos, V. & Graham, I., 2020, **Mineralogy and Geochemistry of Gems**. Minerals MDPI, 528p, https://doi.org/10.3390/books978-3-03928-077-3 2020

III. RELATIVE JOURNALS
- European Journal of Mineralogy, Online ISSN: 1617-4011, Print ISSN: 0935-1221, DMG, SEM, SIMP, SFM.
- Minerals, Online ISSN: 2075-163X, MDPI.

WEBPAGE (URL):

http://eclass.uoa.gr/courses/GEOL215

Y2203 CLIMATOLOGY AND CLIMATE CHANGES

Instructors

Lectures: Prof. P.T. Nastos

Lab. Training: Assoc. Prof. M. Hatzaki – Assoc. Prof. K. Eleftheratos

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 2nd

TYPE: **MANDATORY /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures-seminars & laboratory work and exercises, optional fieldwork

3 hours of lecturing and 2 hours of practical exercises per week, 6 ECTS credits.

Prerequisites: There are no prerequisite courses, but basic knowledge of High School Physics is required in the relevant subjects of Geology

Language of instruction and Assessment: Greek [1]

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

On successful completion of the course the student:

- **Explains** the physical principles that underpin the science of Climatology
- **Understand** and **interpret** the basic processes of the climate system
- **Define** and **articulate** the main climatic elements at different scales of space and time
- **Identify** and **describe** the characteristics of the climate system at global, regional and local scales
- **Understand** the difference between climate variability and climate change
- **Knows** the principles of operation and use of meteorological instruments to make meteorological and climatological measurements
- **Combines** and **evaluates** climatic data and information to solve problems related to both basic research and applied subjects in the Earth sciences.

Generic Competences:

- Ability to apply knowledge in practical situations
- Ability to search for, process and analyse information with the use of necessary technologies
- Oral and written communication of scientific issues
- Autonomous work
- Information and Communication Technology (ICT) skills
- Commitment to conservation of the environment

[1] I.S.: Incoming students (e.g. ERASMUS Student)

COURSE CONTENT:

Lectures: The content of the course is structured in the following thematic sections:

- History and division of Climatology.
- Composition and structure of the atmosphere.
- Radiation and energy balance.
- Temperatures on the earth's surface.
- Water in the atmosphere. Humidity, Clouds, Precipitation
- Pressure and Motion in the Atmosphere - General circulation of the atmosphere
- Winds and local wind systems
- Atmospheric disturbances.
- Classification, description and configuration of the earth's climates
- Climatic and bioclimatic indicators.
- Climate change (theories of climate change, changes during the period of instrumental observation, changes in historical times, methods of paleoclimatology, feedback mechanisms and impacts on climate).
- Introduction to climate models.
- Climate of Greece (climatic factors, climatic elements, climate change).

Laboratory work:

Laboratory exercises include the submission of short individual assignments on a weekly basis.

Exercise 1. Error Analysis
Exercise 2. Frequency Distribution of Climatic Parameters
Exercise 3. Solar and Earth Radiation
Exercise 4. Air temperature
Exercise 5. Atmospheric Humidity
Exercise 6. Precipitation
Exercise 7. Atmospheric Pressure
Exercise 8. Wind
Exercise 9. Satellite products in meteorology and climatology & Weather forecasting (takes place at the facilities of the Hellenic National Meteorological Service).

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Lectures	39 hours
Practice exercises	18 hours
Fieldwork	-
Tutorials	-
Essey writing	18 hours
Autonomous study	50 hours
Final assessment preparation	25 hours
Total student's effort	**150** hours

ASSESSMENT METHODS AND CRITERIA:

I. LECTURES (50%)

- Final written Exam (summative)

The written exam includes Short Answer Questions and Multiple Choice Test

Ii. LABORATORY WORK (50%)

- Weekly Written Essays for every Lab Exercise (formative, summative)
- Final written exam (summative)

The written exam includes Short Answer Questions, Multiple Choice Test and Solving Exercises

Supplementary material (questions, exercises, etc.) for the exams is posted on the online **e-Class** platform (https://eclass.uoa.gr/courses/GEOL149/).

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- Barry R.G., Hall-McKim E.A., Nastos P. (scientific editor), 2022, **Climatology and Climate Change** [EUDOXOS code:112691796] in Greek
- Maheras P., Balafoutis C., 1997, **General climatology with elements of meteorology**, UNIVERSITY STUDIO PRESS [Κωδ. ΕΥΔΟΞΟΣ: 17166] in Greek

II. ADDITIONAL READING

- Barry R.G., Hall-McKim E.A., 2014, **Essentials of the Earth's Climate System**, Cambridge University Press

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL149

Y2204 GIS AND INTRODUCTION TO REMOTE SENSING

Instructors

Lectures: Prof. N. Evelpidou - Assoc. Prof. E. Vassilakis – Assist.Prof. M. Diakakis - A. Karkani, Laboratory Teaching Staff

Lab. Training: Prof. N. Evelpidou - Assoc. Prof. E. Vassilakis – Assist.Prof. M. Diakakis - A. Karkani, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 2nd

TYPE: **MANDATORY /** Skills Developement

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures-seminars & laboratory work

3 hours of lecturing and 3 hours of practical exercises per week, 6 ECTS credits.

Prerequisites: NONE

Language of instruction and Assessment: Greek [1]

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences: The aim of the course is to understand the basic principles of Geographical Information Systems, the acquaintance with remote sensing data and the processing of geographical data, as necessary tools for studies in the field of geosciences. Students will become familiar with Geographical Information Systems and Remote Sensing, both theoretically and practically, using the appropriate specialized software.

On successful completion of the course the student:

- **Defines** and **formulates** the basic principles, methods and applications of Geographic Information Systems (GIS).
- **Comprehends** the different coordinate systems.
- **Comprehends** the different types of data in a GIS (raster, vector and raster grid).
- **Applies** methods of numerical and statistical analysis of geographic data.
- **Combines** different data types to **create** thematic maps.
- **Describes** the different simulation methods and modeling of geographic data
- **Defines** and **formulates** the basic principles, methods and applications of Remote Sensing.
- **Applies** techniques to process remote sensing data.

Generic Competences:

- Ability to apply knowledge in practical situations
- Promote free, creative and inductive thinking
- Ability to plan and manage time

I.S.: Incoming students (e.g. ERASMUS Student)

- Ability to search for, process and analyse information with the use of necessary technologies
- Adapt to and act in new situations and cope under pressure
- Autonomous work
- Information and Communication Technology (ICT) skills

COURSE CONTENT:

A. Lectures:

General Characteristics of Geographical Information Systems

- Input Data
- Data Analysis
- Coordinate Systems
- three-variable variables
- Applications of arithmetic and statistical analysis
- Introduction to Remote Sensing
- Elements of electromagnetic radiation
- Types of Remote Sensing Data
- Forms of resolution
- Stages of digital data processing.

B. Practical Exercises:

- Introduction to ArcGIS
- Raster Data Input
- Vector Data Input – Digitization
- Vector Data Input from Databases
- Data Analysis
- Cartography
- Three-variable variables
- Input of Remote Sensing data, Spectral Channels
- Surface temperature distribution maps, True color image composition
- Composition of false color images, Geometric correction

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	39 hours
Practice exercises	39 hours
Fieldwork	-
Tutorials	-
Essey writing	-
Autonomous study	42 hours
Final assessment preparation	30 hours
Total student's effort	**150** hours

ASSESSMENT METHODS AND CRITERIA:

Course theory (50%): (summative)

- The grade is based on the written examination at the end of the semester.

Laboratory Exercises (50%).

The score is distributed as follows:

- The weekly participation in the homework (**20%**) that is done in the classroom is evaluated (formative)
- Two progress tests, one in the middle of the semester and one at the end, each of which receives **40%** of the lab score. (formative)

Supplementary material with lectures and exercises is posted on the **e-Class** platform http://eclass.uoa.gr/courses/GEOL123

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- Evelpidou N., Tzouxanioti M., Karkani A., 2023. Geographical Information Systems from Theory to Practice: Use of ArcGIS Pro. Kallipos, Open Academic Editions (in Greek). https://dx.doi.org/10.57713/kallipos-367 [Code Eudoxous: 127532912]
- Evelpidou N., Tzouxanioti M., Karkani A., 2022. Geographic Information Systems. Tziola, Athens (in Greek). [Code Eudoxous: 102072040]
- Evelpidou N., Antoniou V., 2015. Geographical Information Systems. Kallipos, Open Academic Editions. (**e-book:** PDF, e-pub) [Code Eudoxous: 320066] (in Greek).
- Vaiopoulos D., Vassilopoulos A. P., Evelpidou N., 2008. Geographical Information Systems from Theory to Practice, [Code Eudoxous: 45423] (in Greek)

II. ADDITIONAL READING

- Astaras Th., 2010. Remote sensing Photointerpretation in Geosciences, Pub. Giourdas, pp.484, [Code Eudoxous: 12992734] (in Greek).

III. RELATIVE JOURNALS

- GIS and Remote Sensing Journal
- Journal of Geographic Information System
- Transactions in GIS
- International Journal of Remote Sensing (ISSN: 1366-5901)
- Remote Sensing (ISSN 2072-4292)

WEBPAGE (URL):

http://eclass.uoa.gr/courses/GEOL123
https://delos.uoa.gr/opendelos/search?dp=geol&av=-1&st=4e812e15

Y2205 MACROPALAEONTOLOGY

Instructors

Lectures: Prof. E. Koskeridou - Prof. K. Kouli - Assoc. Prof. G. Lyras - Assoc. Prof. S. Roussiakis - E. Stathopoulou, Laboratory Teaching Staff - N. Tsaparas, Laboratory Teaching Staff

Lab. Training: Prof. E. Koskeridou - Prof. K. Kouli - Assoc. Prof. G. Lyras - Assoc. Prof. S. Roussiakis - A. Mpakopoulou, Laboratory Teaching Staff - E. Stathopoulou, Laboratory Teaching Staff - N. Tsaparas, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 2nd

TYPE: **MANDATORY /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures-seminars &laboratory work and exercises, optional fieldwork

3 hours of lecturing and 3 hours of practical exercises per week, 6 ECTS credits.

Prerequisites: NONE

Language of instruction and Assessment: Greek

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

Upon successful completion of the course, students will be able to:

- define the basic principles of Palaeontology
- understand the atmosphere-hydrosphere-biosphere- lithosphere relationship in the global ecosystem and the evolution of organisms in relation to terrestrial and extraterrestrial phenomena.
- Apply the basic principles of description, identification, and taxonomy of the main groups of invertebrate fossils (porifera, cnidarians, brachiopods, mollusks, arthropods, echinoderms), vertebrates (fishes, amphibians, reptiles, birds, mammals) and plants (pteridophytes, gymnosperms, angiosperms).
- Comprehend the significance of animal and plant fossils in geology/stratigraphy.
- recognize the use of animal and plant fossils and unknowledge their applications as geological facies indicators and tools for the interpretation of palaeoenvironmental and palaeoclimatic changes.
- Examine and determine the relative age of geological formations using fossils
- communicate issues relating to the history and evolution of life on Earth to specialist and broad audiences.

Generic Competences:

- Ability to search for, process and analyse information with the use of necessary technologies
- Autonomous work
- Ability to work in a team
- Ability to apply knowledge in practical situations
- Oral and written communication of scientific issues
- Ability to undertake research at an appropriate level
- Commitment to conservation of the environment

COURSE CONTENT:

This is the introductory course in the science of Palaeontology. The course deals with the study of the main groups of fossils corresponding to invertebrate, vertebrate animals and plant organisms. These organisms serve as dating tools, but also as palaeoecological indicators and are highlighted as ideal tools in environmental and geo-environmental research.

Lectures

Research Object and Study Methods. Applications of Palaeontology. Fossils, types of fossils and fossilization methods, facies. The significance of fossils.

Systematics, fossil terminology, nomenclature, and classification. Principles of evolution, palaeoecology, and taphonomy. Fossils and geological time, stratigraphic scale, biochronology, biosratigraphy, temporal constants in independent time scales. Early life forms, evolution of living organisms in geological time, mass extinctions. Applied Palaeontology: The contribution of Palaeontology to Stratigraphy, palaeobiogeography, palaeogeography, mapping, palaeoenvironment, palaeoceanography, palaeoclimatology. Introduction to Palaeontology: the main taxonomic groups of Invertebrates, Vertebrates and Plants with an emphasis on the Greek fossil record. Principles of palaeontological material conservation, palaeontological excavations. Natural History Museums, fossil curation and palaeontological outreach, palaeontological collections and databases.

Laboratory and practical exercises

Exercise 1: Recognition of fossil categories, types of fossils, fossilization methods, and nomenclature of fossils.

Exercise 2: Recognition and identification of anthozoans and sponges genera, understanding their fossilization process. Comprehension of their use in stratigraphy and palaeoenvironment.

Exercise 3: Recognition and identification of brachiopod genera. Understanding their use in stratigraphy and the palaeoenvironment.

Exercise 4: Recognition and identification of bivalve mollusk genera. Understanding their use in stratigraphy and the palaeoenvironment.

Exercise 5: Recognition and identification of gastropod mollusk species and cephalopod genera. Understanding their use in stratigraphy and the palaeoenvironment.

Exercise 6: Recognition and identification of trilobites, ammonites, rudists, and echinoderms. Understanding their use in stratigraphy and the palaeoenvironment

Exercise 7: Identification of invertebrate fossils in the legents of geological maps. Interpretation of the relative stratigraphical age and paleoenvironment.

I.S.: Incoming students (e.g. ERASMUS Student)

Recognition and identification of trilobites, ammonites, rudists, and echinoderms. Understanding their use in stratigraphy and the palaeoenvironment.

Exercise 8: Introduction to mammal odontology, morphological types of teeth.

Exercise 9: Recognition of fossils of basic taxonomic groups of vertebrates (Horses and Hipparions, Rhinoceroses, Hippos, Pigs, main Proboscidean groups) based on their dental morphological characteristics.

Exercise 10: Practical training in the Department's Museum of Palaeontology and Geology, recognizing fossils, significant vertebrate faunas in the Greek region.

Exercise 11: Introduction to Palaeobotanical methodology, leaf morphology and identification.

Exercise 12: Identification of Palaeophytic plant fossils (Pteridophytes, Gymnosperms). Fossil plant assemblages as a biostratigraphic proxy.

Exercise 13: Identification of Cenophytic plant fossils (Conifers, Angiosperms). Palaeoclimatic reconstruction based on plant fossil assemblages.

Fieldwork

C1. One-day field exercise in the broader area of Pikermi-Rafina: Terrestrial facies and characteristics of Pikermi fauna. Marine facies (Neritic) and characteristics of Macrofossils in the formations of the Lower Pliocene.
Collection of palaeontological samples in these formations (recognition of different lithological horizons and the macrofossils characterizing them, sampling method, recording sampling details: identification of macrofossils, interpretation of palaeoenvironment, correlation with significant geological events and natural hazards).

C2. Botanical Garden Julia & Alexander N. Diomedes: Plant observation, plant diversity/major taxonomic groups, geobotany

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	39 hours
Practice exercises	39 hours
Fieldwork	12 hours
Tutorials	- hours
Essey writing	6 hours
Autonomous study	30 hours
Final assessment preparation	24 hours
Total student's effort	**150** hours

ASSESSMENT METHODS AND CRITERIA:

Students are assessed as follows:

- Small individual exercise assignments **10%** (formative)
- Fieldwork exercises **10%** (formative)
- Written exam including multiple-choice/free text questions and fossil Identification **80%** (summative)

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

II. ADDITIONAL READING

- Dott, R.H. & Prothero, D.R., 1994. Evolution of the Earth. McGraw-Hill, INC.
- Γεωργιάδου-Δικαιούλια Ε., Συμεωνίδης Ν.Κ. & Θεοδώρου Γ.Ε. (2003). Παλαιοντολογία. Μέρος Β΄: Ασπόνδυλα, σελ. 1-237, Αθήνα.
- Γεωργιάδου-Δικαιούλια Ε., Συμεωνίδης Ν.Κ. & Θεοδώρου Γ.Ε. (2003). Παλαιοντολογία. Μέρος Γ΄: Σπονδυλωτά, σελ. 1-277, Αθήνα.
- Benton M.J. (2005). Vertebrate palaeontology. Blackwell Publishing, 1-455.
- Willis K., McElwain J. (2002) The Evolution of Plants. Oxford University Press, 408 Pages

III. RELATIVE JOURNALS

- Palaeontology ISSN 1475-4983
- Review of Palaeobotany and Palynology ISSN: 0034-6667

WEBPAGE (URL):

http://eclass.uoa.gr/courses/GEOL237

Y3201 IGNEOUS ROCKS-MAGMATIC PROCESSES

Instructors

Lectures: Prof. P. Pomonis - Assoc. Prof. D. Kostopoulos

Lab. Training: Prof. P. Pomonis - I. Megremi, Laboratory Teaching Staff - E. Vorris, Laboratory Technical Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 3rd

TYPE: **MANDATORY /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures and Practical exercises

3 hours of lecturing and 2 hours of practical exercises per week, (4 τμήματα), 6 ECTS credits.

Prerequisites: Y2202 Systematic Mineralogy – Mineral Identification

Language of instruction and Assessment: Greek [1]

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

On successful completion of the course the student:

- **Comprehens** the basic petrological concepts, the rock-forming minerals and the methods of petrological research (from sampling to preparation).
- **Identifies** and **describes** the mineralogical constituents and textures of igneous rocks at macroscopic and microscopic scales (using a polarizing microscope).
- **Classifies** the igneous rocks using their classification methods (geological, mineralogical, chemical).
- **Explains** the mechanisms through which magma is created and knowing its composition (e.g. granitic, basaltic), **interprets** its physical properties (e.g. viscosity).
- Theoretically and experimentally **approaches** melting, crystallisation, differentiation, annealing and cooling of magma by constructing and applying binary and ternary phase diagrams.
- **Distinguishes** between the forms of intrusive and extrusive magmatic bodies, the categories and forms of different types of volcanoes and their products.
- **Synthesizes** and **combines** petrological data of petro-tectonic assemblages and ophiolitic complexes and **interprets** their evolution in geological time and space and in different geotectonic environments.

Generic Competences:

- Ability to apply knowledge in practical situations
- Promote free, creative and inductive thinking
- Ability to plan and manage time
- Ability to work in a team
- Ability to search for, process and analyse information with the use of necessary technologies
- Autonomous work
- Information and Communication Technology (ICT) skills

COURSE CONTENT:

A. Lectures

- Rocks and the rock-cycle (Definitions)
- From the birth of the Universe to the creation and evolution of the Earth - Petrological perspective
- The interior of the Earth (Crust - Mantle - Core).
- Lithospheric plates, magmatism and volcanism.
- Composition of igneous rocks.
- Classification (geological, structural, mineralogical, petrochemical, chemical) of igneous rocks
- Textures of igneous rocks: degree of crystallinity, grain size, shape, mode of bonding, arrangement and orientation, degree of deformation or recrystallisation.
- Magma (origin, characteristics in terms of mineralogical and chemical composition, homogeneous melt and volatile content, temperature, density, viscosity, flow)
- Thermodynamics of magmas (introduction) – Phase Rule
- Melting and crystallization
- Phase diagrams (simple one-component, binary, ternary) examples from igneous petrology. Equilibrium, fractional crystallization and melting, water and silicate melts.
- Formation of magmas (primary and derived magmas) - Partial melting.
- Basaltic magma (origin, mantle source, parent rocks, physicochemical controls on partial melting)
- Granitic magma (origin, mantle source, parent rocks, physicochemical factors controlling partial melting)
- Magma diversity (primary and derived magmas, magmatic differentiation, magma contamination or assimilation, magma mixing)
- Rise of Magma
- Crystallisation of magma
- Igneous structures (types of magmatic bodies)
- Volcanoes and volcanism (classification, explosivity, products)
- Volcanic centres of world interest
- The Aegean volcanic arc

B. Practical and Laboratory Exercises :

Exercises 1&2: Practice in methods of classification of igneous rocks (geological, mineralogical, chemical). Use of igneous rock nomenclature. Practice in projection on I.U.G.S. ternary diagrams. Calculation of normative mineralogy of a rock by converting its chemical composition into equivalent mineral percentages using MS Office Excel.

Exercises 3&4: Identification of structural characteristics of igneous rocks (texture) based on morphological, mineralogical and tectonic parameters.

Exercise 5: Identification and determination of petrographic characteristics (macroscopic and microscopic) of acid plutonic rocks (Granitoids).

Exercise 6: Identification and determination of petrographic characteristics (macroscopic and microscopic) of intermediate and basic plutonic rocks (Diorite, Gabbroic).

Exercise 7: Identification and determination of petrographic characteristics (macroscopic and microscopic) of ultramafic rocks (Peridotites, Pyroxenites) and Ophiolite Complexes Units.

[1] I.S.: Incoming students (e.g. ERASMUS Student)

Exercise 8: Identification and determination of petrographic characteristics (macroscopic and microscopic) of acid volcanic rocks.
Exercise 9: Identification and determination of petrographic characteristics (macroscopic and microscopic) of intermediate and basic volcanic rocks.
Exercise 10: Identification and determination of petrographic characteristics (macroscopic and microscopic) of subvolcanic rocks.
Exercise 11: Identification and determination of petrographic characteristics (macroscopic and microscopic) of pyroclastic rocks.
Exercises 12&13: Construction and interpretation of binary phase diagrams.

C. Fieldwork

ONE DAY FIELDWORK IN ATTICA - CORINTHIA: Triassic pyroclastic rocks (Parnitha), Ophiolite complex of Gerania (Corinthia), Quaternary volcanic rocks (Corinthia). Study of igneous rocks of various lithologies (acidic pyroclastics, mantle rocks, lavas and pyroclastics of basic composition). Training in fieldwork methods, development of sampling methods, identification of the main mineralogical constituents of igneous rocks, their structural and morphological characteristics, classification of igneous rocks based on their macroscopic petrographic characteristics. Collection, synthesis and evaluation of petrological and geological data, report writing.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY
- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES
- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	39 hours
Practice exercises	26 hours
Fieldwork	10 hours
Tutorials	-
Essey writing	12 hours
Autonomous study	36 hours
Final assessment preparation	27 hours
Total student's effort	**150** hours

ASSESSMENT METHODS AND CRITERIA:

I. LECTURES (**50%**)
- Written final examination (summative).

II. LAB EXERCISES (**42%**)
- Weekly assessment of lab exercises (formative).
and
- Written final examination (summative).

III. FIELDWORK (**8%**)
- Oral examination in the field with assessment of the field book and/or the required report or essay (formative, summative).

Supplementary material for the exams (questions, exercises etc.) is posted on e-Class platform (https://eclass.uoa.gr/courses/GEOL235/).

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL
-

II. ADDITIONAL READING
- Textbooks and notes uploaded on the electronic platform **e-class**
- Κοκκινάκης, Α. (2011): «Μαγματικά Πετρώματα», σελ. 389.
- Best, M.G. (2002): Igneous and Metamorphic Petrology (2nd Edition), p. 752.
- Philpotts, A. & Ague, J.J. (2009): Principles of Igneous and Metamorphic Petrology (2nd Edition), p. 684.
- Winter, J.D. (2009): Principles of Igneous and Metamorphic Petrology (2nd Edition), p. 720.

III. RELATIVE JOURNALS
- Journal of Petrology, Online ISSN 1460-2415, Print ISSN 0022-3530, Oxford University Press.
- Contributions to Mineralogy and Petrology, Online ISSN 1432-0967, Print ISSN 0010-7999, Springer Nature.
- Earth and Planetary Science Letters, Online ISSN 1385-013X, Print ISSN 0012-821X, Elsevier.

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL235

Y3202 PETROLOGY OF SEDIMENTARY ROCKS

Instructors

Lectures: Assist. Prof. M. Kati

Lab. Training: Assist. Prof. M. Kati - I. Megremi, Laboratory Teaching Staff - E. Moustaka, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 3rd

TYPE: **MANDATORY /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Practical exercises,Laboratory exercises, and Fieldwork

3 hours of lecturing and 2 hours of practical exercises per week, (4 τμήματα), 6 ECTS credits.

Prerequisites: [recommended]

Y2202 Systematic Mineralogy-Mineral Identification

Language of instruction and Assessment: Greek [1]

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

On successful completion of the course the student:

- **Defines** and **formulates** the basic principles, methods, and applications of Sedimentary Petrology.
- **Classifies** and **describes** rocks from all sedimentary lithologies.
- **Identifies** and **records** the components, textures, structures, and particular features of the main petrological types of sedimentary rocks.
- **Comprehends** and **evaluates** their depositional and diagenetic processes and environments.
- **Specifies** and **applies** appropriate techniques in the discrimination and study of sedimentary minerals and rocks.
- **Comprehends** and **applies** the methodology for the study of sedimentary rocks in the field.
- **Constructs** the graphic log and column of a sedimentary succession and **distinguishes** and **describes** its main units/lithofacies.
- **Combines** and **evaluates** the depositional and diagenetic characteristics of sedimentary rocks in the exploration of natural mineral- and energy resources, in industrial applications, and in paleogeographical, paleoclimatic and archaeometric studies.

Generic Competences:

- Ability to search for, process and analyse information with the use of necessary technologies.
- Autonomous work.
- Ability to apply knowledge in practical situations.
- Work in a team.
- Promote free, creative, and inductive thinking.
- Ability to plan and manage time.
- Information and Communication Technology (ICT) skills.

COURSE CONTENT:

It is the basic course that deals with the origin, composition, chemistry, processes and environments of deposition and diagenesis of sedimentary rocks while accents their significant contribution to the understanding of the geological history of the Earth, and their great economic importance.

A. Lectures

- Introduction (Fundamentals of Sedimentary Petrology - Origin and kinds of sedimentary constituents – Sedimentary processes - Sedimentary environments - Plate-tectonic classification of sedimentary basins).
- Mineralogy and chemistry of sedimentary rocks – Geochemical classification of sedimentary environments.
- Weathering and Residual deposits (Soils, Laterites, Bauxites)
- Depositional processes and environments of sedimentary rocks.
- Diagenetic processes, products, and environments of sedimentary rocks.
- Sedimentary structures (groups, main types and their location, standard sequences of sedimentary structures).
- Petrophysical characteristics (porosity and permeability).
- Generalized genetic models – Tectonic settings.
- Siliciclastic rocks (Conglomerates and breccias, Sandstones, Mudstones and shales)
- Volcaniclastic deposits (Agglomerates and volcanic breccias, Lapillistones, Tuffs)
- Carbonate rocks (Limestones, Dolomites)
- Evaporites
- Sedimentary iron deposits
- Cherts
- Phosphorites
- Organic-rich deposits (Coals, Oil shales, and Petroleum)

B. Practical and Laboratory Exercises :

Part A (Exercises 1, 2): Definitions, methodology of macroscopic study and laboratory methods/techniques of sedimentary rocks. Identification, classification and description of the physical and petrophysical characteristics of sedimentary rocks. Petrogenetic minerals of sedimentary rocks. Sedimentary lithologies

Part B (Exercises 3, 4): Sedimentary textures – Textural features and their practical applications/measurements.

Part C (Exercise 5): Identification and description of sedimentary structures. Graphic representation methods of a sedimentary succession (log, column). Introduction to facies analysis.

Part D (Exercises 6 - 12): Identification, description and systematic classification of the main petrological types from all sedimentary lithologies, using rock hand specimens (macroscopic study) and thin sections (microscopic study) from special collections.

Part E (Exercise 13): Essay delivery, discussion and evaluation of the field exercise.

I.S.: Incoming students (e.g. ERASMUS Student)

C. Fieldwork

One-day field excursion (Loutraki – Vouliagmeni Lake in Corinthia): Field study techniques and sampling methods of sedimentary rocks. Identification, discrimination, description, and petrogenetic history of sedimentary rocks/formations from various groups/lithologies. Measurement, data recording and representation of a selected sedimentary succession (drawing of a simplified sketch of sedimentary section, and construction of graphic log and sedimentary column).

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

– Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

– Use of ICT in teaching (lectures, lab exercises, fieldwork).
– Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	39 hours
Practice exercises	26 hours
Fieldwork	8 hours
Tutorials	-
Essey writing	12 hours
Autonomous study	30 hours
Final assessment preparation	35 hours
Total student's effort	**150** hours

ASSESSMENT METHODS AND CRITERIA:

I. LECTURES (65%)

- Written examination with short or extended answer questions and multiple choice tests (summative).
  or
- Oral final examination (summative).

II. PRACTICE EXERCISES (25%)

- Individual practical training assignments (formative).
- Identification-description-classification of sedimentary rock hand specimens (formative, summative).

III. FIELDWORK EXERCISE (10%)

- Oral examination in the field (formative).
- Assessment of the field exercise essay (summative).

Supplementary material (tables, exercises, guides, etc.) for the exams of the course and the fieldwork, is posted on **e-Class** platform

ΒΙΒΛΙΟΓΡΑΦΙΑ

I. ADDITIONAL READING

- M. Kati, **Petrology of Sedimentary Rocks** (Course text, in Greek).
- Blatt, H. & Tracy, R.J., 1996, ***Sedimentary Rocks. In: Petrology: Igneous, Sedimentary, and Metamorphic (2nd edition),*** Freeman and Company, New York, 514 p.
- Boggs, S.Jr., 2009, ***Petrology of Sedimentary Rocks (2nd edition),*** Cambridge, 600 p.
- James, N.P. & Jones, B., 2016, ***Origin of Carbonate Sedimentary Rocks,*** Wiley, UK, 446p.
- Pettijohn, F.J., Potter, P.E. & Siever, R., 1987, ***Sand and Sandstone (2nd edition),*** Springer-Verlag, New York, 618 p.
- Tucker, M.E., 2001, ***Sedimentary Petrology (3rd edition),*** Blackwell Science, Oxford, 262 p.
- Tucker, M.E., 2011, ***Sedimentary Rocks in the Field (4th edition),*** Wiley-Blackwell, 275 p.

II. RELATIVE JOURNALS

- Journal of Sedimentary Research, Online ISSN: 1938-3681, Print ISSN: 1527-1404, SEPM.
- Sedimentary Geology, Online ISSN: 1879-0968, Print ISSN: 0037-0738, Elsevier.
- Sedimentology (IAS), Online ISSN: 1365-3091, Print ISSN: 0037-0746, IAS, Wiley.

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL228

Y3203 SEISMOLOGY

Instructors

Lectures: Assoc. Prof. G. Kaviris - Prof. N. Voulgaris –K. Pavlou, Laboratory Teaching Staff

Lab. Training: Assoc. Prof. G. Kaviris - Prof. N. Voulgaris –K. Pavlou, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 3rd

TYPE: **MANDATORY /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Practical Exercises & Laboratory work and exercises

3 hours of lecturing and 2 hours of practical exercises per week, 6 ECTS credits.

Prerequisites: NONE

Language of instruction and Assessment: Greek

Availability to Erasmus+ Students: NO

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

On successful completion of the course the student:

- **Describes** the basic principles of Seismology.
- **Determines** arrival times and seismic wave amplitudes.
- **Distinguishes** the types of seismic waves.
- **Calculates** the source parameters.
- **Determines** focal mechanisms.
- **Combines** knowledge of the properties of the Earth's interior to determine its structure.
- **Suggests** the appropriate magnitude scale.

Generic Competences:

- Ability to apply knowledge in practical situations
- Promote free, creative and inductive thinking
- Ability to plan and manage time
- Ability to search for, process and analyse information with the use of necessary technologies
- Oral and written communication of scientific issues
- Autonomous work
- Information and Communication Technology (ICT) skills

COURSE CONTENT:

A. Lectures:

- Historical review and basic concepts of Seismology
- Elements of the theory of oscillation and elastic waves, motion equation
- Types and propagation of seismic waves, structure and characteristics of the Earth's interior
- Seismic motion recording instruments, basic principles of seismometer and seismograph operation
- Methods for the determination of seismic parameters
- Basic principles of rupture, geometrical parameters of a seismic fault, focal mechanism
- Macroseismic effects of earthquakes (intensity, scales)
- Elements of Earthquake Prediction
- Spatial and temporal distribution of seismic activity and correlation with active tectonic structures

B. Practical Exercises & Laboratory work and exercises:

PART A: Measurement of seismic parameter, error calculation and graphs.
PART B: Seismogram analysis (determination of arrival times, travel times, origin time, epicentral and hypocentral distances, azimuth and backazimuth).
PART C: Determination of earthquake magnitude and seismic moment.
PART D: Microseismic hypocenter determination.
PART E: Focal mechanism determination.
PART F: Macroseismic epicenter and magnitude determination.
PART G: Study of an aftershock sequence.
PART H: Calculation of focal parameters using PC

C. Field exercises

One-day Educational Exercise at the premises of the Geodynamic Institute of the National Observatory of Athens: Historical evolution of seismological instruments and seismological data analysis

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	39 hours
Practice exercises	26 hours
Fieldwork	5 hours
Tutorials	-
Essey writing	22 hours
Autonomous study	42 hours
Final assessment preparation	16 hours
Total student's effort	**150** hours

ASSESSMENT METHODS AND CRITERIA:

Theory and practical examination (written and/or oral) at the end of the Course

To pass the Course, a minimum grade **5** (**out of 10**) for both the theory and practical examinations is necessary.

I. LECTURES (50%)

- Written or Oral Examination (Summative)

II. LABORATORY EXERCISES (40%)

- Problem solving during practical exercises, delivery of laboratory exercises (Formative)
- Written or oral examination with Solving Exercises and Problems (Summative)

III. FIELDWORK EXERCISE (10%)
- Oral examination (in-situ) (Formative)
- Delivery of Fieldwork report (Formative)

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL
- Introduction to seismology. Papazachos B.C., G.F. Karakaisis, P.M. Chatzidimitriou. [Code EUDOXUS: 11254], in Greek
- General seismology vol. A, A. Tselentis [Code EUDOXUS: 59395397], in Greek

II. ADDITIONAL READING
- I. Kassaras and G. Kaviris, 2017. Laboratory Seismology, 268 pp., Athens. Available in e-class, in Greek
- Kaviris, G., Papadimitriou, P., Kravvariti, Ph., Kapetanidis, V., Karakonstantis, A., Voulgaris, N. and Makropoulos, K., 2015. A detailed seismic anisotropy study during the 2011-2012 unrest period in the Santorini Volcanic Complex. Physics of the Earth and Planetary Interiors, 238, 51-88
- Makropoulos, K., Kaviris, G. and Kouskouna, V., 2012. An updated and extended earthquake catalogue for Greece and adjacent areas since 1900. Nat. Hazards Earth Syst. Sci., 12, 1425-1430.

III. RELATIVE JOURNALS
- Bulletin of the Seismological Society of America, SSA Journals
- Geophysical Journal International, Oxford University Press
- Journal of Geophysical Research, AGU Publications
- Physics of the Earth and Planetary Interiors, Journal, Elsevier
- Tectonophysics, Journal, Elsevier

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL137

Y3205 STRUCTURAL GEOLOGY AND TECTONICS

Instructors

Lectures: Prof. S. Lozios

Lab. Training: Prof. S. Lozios– Assoc. Prof. H. Kranis – D. Theocharis, Laboratory Teaching Staff – I. Bantekas, Laboratory Technical Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 3rd
TYPE: **MANDATORY /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS
Lectures, Lab Exercises and Fieldwork
4 hours of lecturing and 2 hours of practical exercises per week, (3 τμήματα), 6 ECTS credits.

Prerequisites: Lab exercises of the course: Introduction to Geology (Y2201).

Language of instruction and Assessment: Greek (I.S. [1] English)
Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:
On successful completion of the course the student:
- **Define** and **formulate** the basic principles, methods and applications of Structural Geology and Tectonics.
- **Classify** and **describe** in three dimensions (3D), the brittle or plastic tectonic structures and fabrics, produced during deformation, in all scales of observation and structural levels.
- **Comprehend** the deformation mechanisms and the relationships between tectonic structures from microscopic to meso- and macroscopic scale.
- **Determine**, using various techniques, the components of deformation, the three-dimensional strain and the oriented strain ellipsoid.
- **Define** the forces, the oriented stress ellipsoid and the stress field, resulting to deformed rocks and their structures and fabrics.
- **Apply** the structural analysis and synthesis techniques revealing the deformation and stress field history in different geotectonic regimes.
- **Combine** and **evaluate** various structural data using classical and modern techniques (software and apps) of structural geology, to solve geological problems related to both basic and applied research.

Generall competences:
- Ability to search for, process and analyze information with the use of necessary technologies.

I.S.: Incoming students (e.g. ERASMUS Student)

- Autonomous work.
- Ability to apply knowledge in practical situations.
- Ability to work in a team
- Promote free, creative, and inductive thinking.
- Ability to plan and manage time.
- Information and Communication Technology (ICT) skills.

COURSE CONTENT:

A. Lectures

– Introduction to Structural Geology and Tectonics.
– The frame of plate tectonics.
– Force and stress.
– Deformation and strain.
– Rock mechanics and rheology.
– Fractures and brittle deformation.
– Extensional fractures, joints, and veins.
– The birth and growth of faults.
– Kinematic and paleostress analysis.
– Recognition of faults in the field.
– Folds and fold mechanisms.
– Foliation and cleavage.
– Lineations.
– Boudinage.
– Shear zones and fault-related rocks.
– Contractional regimes and thrust faults.
– Extensional regimes and normal faults.
– Strike-slip faults, transpression and transtension.

B. Lab exercises.

Practice exercises are taught in small groups of students and are graded at the end of the exercise.

Exercise 1. Stereographic projection of planar and linear fabrics on the Schmidt and Wulff nets. Use of stereonet software and apps.

Exercise 2. Calculation of angular relationships between planar and linear features, using a Schmidt or Wulf stereonet.

Exercise 3. Solve geological problems with the Schmidt net. Statistical analysis of structural data.

Exercise 4. Constructing a geological cross section in kink folded and unconformably covered strata.

Exercise 5. Constructing a geological cross section in geological strata deformed by upright folds, strike-slip faults, and dykes.

Exercise 6. Classification of faults based on the dip of the fault plane and the pitch (Angelier and Mariolakos-Papanikolaou methods).

Exercise 7. Classification of folds based on a) the dip of the axial plane and the plunge of the fold axis (Fleuty method), b) the interlimb angle and c) Ramsay's dip isogons method.

Exercise 8. Calculating elongation in two dimensions (planar strain), using balanced cross-sections with normal or thrust faults and deformed objects (fossils, reduction spots, minerals etc.).

Exercise 9. Calculating elongation in two dimensions (planar strain), in folded strata (upright folds).

Exercise 10. Plotting oriented strain ellipsoids on the Flinn diagram and relate them to specific fold and normal or reverse fault patterns.

Exercise 11. Correlation of oriented stress ellipsoids with specific shear, open or close fracture patterns. Drawing of principal stress axes and related fractures in map and cross-section view and their projection in stereonet.

Exercise 12. Constructing a geological cross section in an extended part of the lithosphere under pure shear conditions. Determination of strain and stress ellipsoids. Projection of the principal stress and strain axes and the related conjugate set of normal faults in a Scmidt net.

Exercise 13. Determination of the stress ellipsoid using fault kinematic data in combination with data from laboratory triaxial compression tests on samples of the fractured rock.

C. Fieldwork

C1. One day field excursion in the wider area of Corinth Canal – Gerania Mt. Normal faults cutting the Neogene formations and marginal active normal faults on the southern margin of Gerania Mt. horst.

C2. One day field excursion in the wider area of Corinthia and Argolida Prefecture. Marginal normal faults, bounding small Neogene continental basins (Corinthia). Syn-sedimentary and thrust faults in the Tripolis and SubPelagonian units (Argolida).

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

– Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

– Use of ICT in teaching (lectures, lab exercises, fieldwork).
– Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	52 hours
Practice exercises	26 hours
Fieldwork	14 hours
Tutorials	–
Essey writing	–
Autonomous study	42 hours
Final assessment preparation	16 hours
Total student's effort	**150** hours

ASSESSMENT METHODS AND CRITERIA:

I. LECTURES (**35%**)

- Short test at the end of each lecture (formative).
- Mid-term examination (formative, summative).
  or
- Oral or written final examination (summative).

Exams include short or extended answer questions, multiple choice tests, simplified sketches and drawings, simplified cross-sections and maps and stereographic projections.

II. LAB EXERCISES (**35%**)

- Weekly assessment of lab exercises (formative, summative).
  or/and
- Written final examination (summative).

II. FIELDWORK (**30%**)

- Oral examination in the field with assessment of the field book and/or the required report or essay (formative, summative).

Supplementary material for the exams (questions, exercises etc.) is posted on **e-Class** platform (https://eclass.uoa.gr/courses/GEOL135/).

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- D. Papanikolaou & S. Lozios. **Structural geology and Tectonics**, da Vincy, 480 p., (EUDOXUS code: 32998223), in Greek.

II. ADDITIONAL READING

- Davis, G. H., Reynolds, S. J. & Kluth, Ch. F., 2011, **Structural Geology of Rocks and Regions**, Wiley, 839 p.
- Fossen, H., 2016, **Structural Geology**, Cambridge, 510 p.
- Fossen, H., 2016, **Structural Geology (e-modules)**, https://folk.uib.no/nglhe/StructuralGeoBookEmodules2ndEd.html
- Moores, M., E. & Twiss, J., R., 1995, **Tectonics**, W. H. Freeman and Company, 415 p.
- Van der Pluijm, B. & Marshak, S., 2004, **Earth Structure. An Introduction to Structural Geology and Tectonics**, W.W. Norton & Company, 674 p.

III. RELATIVE JOURNALS

- Journal of Structural Geology, Online ISSN: 1873-1201, Print ISSN: 0191-8141, Elsevier.
- Tectonics, Online ISSN:1944-9194, Print ISSN:0278-7407, AGU Publications.
- Tectonophysics, Online ISSN: 1879-3266, Print ISSN: 0040-1951, Elsevier.

WEBPAGE (URL):

http://eclass.uoa.gr/courses/GEOL135

http://opencourses.uoa.gr/courses/GEOL4/

Y3206 BIOGEOSCIENCES-PRINCIPLES OF MICROPALAEONTOLOGY

Instructors

Lectures: Prof. M. Triantaphyllou - Prof. A. Antonarakou - Assoc. Prof. M. Dimiza - Assist. Prof. T. Tsourou- E. Skampa, Laboratory Teaching Staff

Lab. Training: Prof. M. Triantaphyllou - Prof. A. Antonarakou - Assoc. Prof. M. Dimiza - Assist. Prof. T. Tsourou - E. Skampa, Laboratory Teaching Staff - E. Stathopoulou, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 3rd

TYPE: **MANDATORY /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures-seminars & laboratory work and exercises, optional fieldwork

2 hours of lecturing and 2 hours of practical exercises per week, 6 ECTS credits.

Prerequisites: Knowledge of Paleontology (Y2205 Macropalaeontology)

Language of instruction and Assessment: Greek [1]

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

Upon successful completion of the course the student:

- Defines and formulates the relationship between the applications of geobiological knowledge in paleoenvironments and in modern depositional environments
- Comprehends and applies the basic principles of Micropaleontology, concerning laboratory techniques for processing and preparation of micropaleontological samples, as well as optical and electron microscopy techniques
- Combines and evaluates problems related to the above principles
- Comprehends the atmosphere-hydrosphere-biosphere-lithosphere relationship and its functions in space and time, the process of accumulation of energy and materials in terrestrial ecosystems and the degree of anthropogenic impact.
- Defines the biosynthetic and metabolic processes necessary for the development of life, the role of microorganisms in the control of biogeochemical cycles, as well as the role of molecular markers in the reconstruction of oceanic, terrestrial and atmospheric paleo-conditions.
- Applies the basic principles of identification, description and classification of the main groups of microfossils (coccolithophores/calcareous nannoplankton, benthic and planktonic

[1] I.S.: Incoming students (e.g. ERASMUS Student)

foraminifera, diatoms, radiolaria) based on their physiological and morphological data
- Comprehends and explains the overall role of microfossils in geology, stratigraphy and sedimentary processes as also their contribution to modern geo-environmental and climate research
- Classifies and describes the microfossil groups and applies them as biostratigraphic and paleoceanographic indices
- Combines and evaluates the relevant literature, with an emphasis on studies in the Greek area.

Generic Competences:

- Ability to apply knowledge in practical situations
- Promote free, creative and inductive thinking
- Ability to plan and manage time
- Ability to work in a team
- Oral and written communication of scientific issues
- Autonomous work
- Information and Communication Technology (ICT) skills
- Commitment to conservation of the environment
- Ability to work in an interdisciplinary context

COURSE CONTENT:

A. Lectures:

Introduction to BioGeosciences

Basic elements of cell function, the role of biological metabolism in changing environmental conditions, the biological derivatives preserved in the geological record as well as the changes that occur in biomolecules and elements due to sedimentary processes and the recycling of organic matter and inorganic elements through biogeochemical cycles.

Basic principles of Micropaleontology

Physiology and morphology, basic principles of identification, description, determination and classification of the main groups of microfossils (coccolithophores / calcareous nannoplankton, benthic and planktonic foraminifera, diatoms, radiolaria).

Geoenvironmental applications of microfossils

Use of microfossils in biostratigraphic applications, and in paleoceanographic, paleoenvironmental and paleoclimatic research, as well as their contribution to the processes of sedimentation and their interaction with the modern environment and climate. Computational exercises.

Laboratory techniques

Sampling and analyses protocols.

Biofacies

Identification and use of the microfacies and the content in microfossils for the determination of the characteristic sedimentary sequences in the Greek area.

B. Practical and Laboratory Exercises :

Exercises 1 to 4 Identification of the main microfossil groups (coccolithophores/calcareous nannoplankton, benthic and planktonic foraminifera): with contemporaneous use of PCs, stereoscopes and polarizing microscopes.

Exercises 5 & 6 Dating of depositional sequences based on calcareous nannoplankton and planktonic foraminifera - biostratigraphy. Understanding of transport and reworking processes in the sedimentary sequences.

Exercise 7 Practical exercises in the lab and the Scanning Electron Microscope.

Exercise 8 Computational exercise-methods for estimating marine environmental paleo-conditions in the surface sediments.

Exercise 9 Computational exercise-methods for estimating marine environmental paleo-conditions in the water column.

Exercise 10 Microfacies-microfossils in carbonate rocks

C. Fieldwork

C1. One day field excursion in the wider area of Corinth Canal – Gerania Mt.

C2. One day field excursion in the wider area of Corinthia and Argolida Prefecture.

Facies (neritic-pelagic) and characteristic microfossils of alpine and postalpine formations.

Collection of micropaleontological samples in alpine and postalpine deposits (recognition of various lithologies and included microfossils, sampling techniques in the field: sample collection and coding)

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

– Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

– Use of ICT in teaching (lectures, lab exercises, fieldwork).
– Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	26 hours
Practice exercises	26 hours
Fieldwork	14 hours
Tutorials	-
Essey writing	24 hours
Autonomous study	20 hours
Final assessment preparation	40 hours
Total student's effort	**150** hours

ASSESSMENT METHODS AND CRITERIA:

For the lab:

- Lab essays **30%** (formative, summative)
- Written final examination during the last (13) week of semester (**20%**) (summative)
- concerning the identification of microfossils,
- biostratigraphic applications, proxies calculations and computational exercises

For the theoretical part:

- written assessment and multiple choice exercises (**35%**) (summative)
- questions concerning the topics discussed in the fieldwork (**15%**) (summative)

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- Triantaphyllou, M.V., Dimiza, M.D., 2012. Micropaleontology & Geoenvironment. ION publications, 168 pp., ISBN 978-960-508-058-7. [EUDOXUS code: 22769096], in Greek
- **II. ADDITIONAL READING**
- Dermitzakis, M.D., Georgiades-Dikaioulia, E., 1985, Introduction to Marine Micropaleontology, 720 pp., Eptalofos publications, Athens, in Greek
- Micropaleontology and Applications, Zambetakis-Lekkas, A., Antonarakou, A., Drinia, H., Tsourou, Th., A. Di Stefano, N. Baldassini (e-book: pdf, e-pub)[Eudoxus code: 320254]
- Haq, B.U., Boersma, A., 1998. Introduction to marine micropaieontology. Elsevier Science (Singapore) Pte Ltd, p. 376.
- Armstrong, H.A., Brasier, M.D., 2005. Microfossils. Blackwell Publishing Ltd, p. 296.
- Bown, P.R., 1998. Calcareous Nannofossil Biostratigraphy. Chapman and Hall, Kluwer Academic,
- Thierstein, H.R., Young, Y.R., 2004. Coccolithophores from Molecular Processes to Global Impact. Springer, Berlin
- Murray, J., 2006. Ecology and Applications of Benthic Foraminifera. Cambridge University Press, p. 426.
- Nomaki et al., 2015. Variation in the nitrogen isotopic composition of amino acids in benthic foraminifera: Implications for their adaptation to oxygen-depleted environments. Limnology and Oceanography 60, 1906-1916.
- **III. RELATIVE JOURNALS**
- **Marine Micropaleontology,** Online ISSN: **1872-6186**
- **BioGeosciences,** Online ISSN: 1726-4189
- **Revue de Micropaleontologie,** Online ISSN: 1873-4413

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL163

Y4201 PETROLOGY OF METAMORPHIC ROCKS

Instructors

Lectures: Assoc. Prof. D. Kostopoulos – Prof. P. Pomonis

Lab. Training: Assoc. Prof. D. Kostopoulos – E. Moustaka, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 4th

TYPE: **MANDATORY /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Practical Exercises, Laboratory exercises, Fieldwork

2 hours of lecturing and 2 hours of practical exercises per week, 6 ECTS credits.

Prerequisites: [recommended]

Y2202 Systematic Mineralogy-Mineral Identification
Y3201 Igneous Rocks-Magmatic Processes
Y3202 Petrology Of Sedimentary Rocks

Language of instruction and Assessment: Greek [1]
Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

Upon successful completion of the course, the student:

- rigorously **describes** mineral assemblages of metamorphic rocks and **identifies** their corresponding petrological types as well as their corresponding protoliths before metamorphic imprinting took place.
- **assesses** the geotectonic environment of formation of a metamorphic rock series and **infers** its genetic mechanisms.
- **estimates** the temperature and pressure conditions of rock metamorphism in the Earth's interior and the time required for metamorphic events to take place at both macro (e.g., orogenic) and micro (e.g., chemical zoning in minerals) scales.
- **extracts** physicochemical information from minerals and rocks and **proposes** their spatiotemporal evolution, **stands** by its opinion, supports its arguments, **revises** current views, and **generates** new knowledge.
- **evaluates** the geodynamic evolution of the Greek area over time within the wider region of the Eastern Mediterranean (Balkans – Asia Minor).

Generic Competences:

- Ability to apply knowledge in practical situations
- Promote free, creative and inductive thinking
- Ability to plan and manage time
- Ability to work in a team
- Ability to search for, process and analyse information with the use of necessary technologies
- Autonomous work

[1] I.S.: Incoming students (e.g. ERASMUS Student)

- Information and Communication Technology (ICT) skills
- Ability to work in an international context
- Commitment to conservation of the environment
- Ability to work in an interdisciplinary context

COURSE CONTENT:

A. Lectures:

The content of the lectures includes five thematic units:

- DISTRIBUTION OF PRESSURE, TEMPERATURE AND DENSITY IN THE EARTH (Sources of heat in the crust and mantle, heat flow, continental and oceanic crustal geotherms, lithostatic pressure and tectonic overpressure, spatial distribution of pressure and temperature in crustal-scale shear zones, mineralogical stratification of the upper mantle, geotectonic environments and geothermal gradients, heat transfer during continental collision, and thermal evolution of thickened crust).
- TYPES OF METAMORPHISM, METAMORPHIC TEXTURES, METAMORPHIC TIME SCALES, METAMORPHISM AND GEOTECTONIC SETTINGS (Criteria for classification of metamorphic types, metamorphic grade, progressive and retrograde metamorphism, isograds, metamorphic facies, series and sequences, spatial distribution of metamorphic facies in active continental margins and oceanic subduction zones, description of metamorphic textures and fabrics, crystalloblastic series).
- PETROLOGY OF METAMORPHIC ROCKS DERIVED FROM DIFFERENT IGNEOUS AND SEDIMENTARY PROTOLITHS (mafic, ultramafic, argillaceous/pelitic, carbonate, quartzose, quartzofeldspathic).
- ULTRAHIGH-PRESSURE AND ULTRAHIGH-TEMPERATURE METAMORPHISM (Greek and Bulgarian Rhodope Metamorphic Province).
- METAMORPHIC CASE STUDIES (Scottish Highlands and Cyclades).

B. Practical Exercises :

The content of the practice exercises includes four thematic modules:

PART A. Lithostatic pressure in the crust and mantle. Calculation of steady-state continental geotherms and surface heat flow.

PART B. ACF and AFM diagrams (mineral and rock projections, identification of metamorphic reactions and facies).

PART C. Diffusion, closure temperature and cooling rates. Calculation of chemical zoning in minerals and investigation of the suitability of minerals as chronometers and thermometers.

PART D. Thermodynamics. Calculation of metamorphic-reaction boundaries (ideal endmembers and solid solutions, water-absent and water-present reactions, investigation of the importance of heat capacity in the calculations), solution and applications of geothermobarometers.

Γ. Laboratory Exercises

Macroscopic identification of metamorphic minerals and metamorphic rocks of the Greek area derived from different igneous and sedimentary protoliths.

C. Field exercise

ONE-DAY FIELD EXCURSION TO MOUNT PENDELI AND/OR MOUNT HYMETTUS. Training in identifying metamorphic rocks from different igneous and sedimentary protoliths, sampling methods (recording of longitude, latitude, altitude, labeling and description of samples), measuring of structural elements (foliation, lineation), identifying kinematic indicators, making geodynamic interpretation of the site based on observations and measurements.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity:	Student's effort
Lectures	26 hours
Practical Exercises	22 hours
Laboratory work and/or exercises	4 hours
Fieldwork	8 hours
Preparation of field-exercise report (observations, measurements, sample description and interpretation)	10 hours
Homework	20 hours
Preparation for laboratory progressive exams	20 hours
Preparation for final Assessment	40 hours
Total student effort	**150** hours

ASSESSMENT METHODS AND CRITERIA:

The assessment method through which the final grade is determined includes a series of tests as follows:

I. LECTURES (**50%**) (summative)

- Oral Examination and/or
- Written Examination with Short-Answer Questions and Multiple-Choice Test and/or
- Written Examination with Extended-Answer Questions

II. PRACTICE AND LABORATORY EXERCISES (**40%**)

- Written progress examination in the practice exercises during the semester (**10%**) (formative)
- Written examination involving solving exercises and problems in the Practice Exercises and Oral Examination in the Laboratory Exercises (**30%**) (summative)

III. FIELD EXERCISES (FIELDWORK) (**10%**)

- Active participation in the compulsory field exercise followed by a written report (**10%**) (formative)

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- Petrology of Metamorphic Rocks, D. Kostopoulos (Κωδ. ΕΥΔΟΞΟΣ: 122076666)
- Petrology of Metamorphic Rocks - Thermodynamic and Thermomechanical Processes (in Greek; EUDOXUS Code No.: 86195557)

II. ADDITIONAL READING

- Frank S. Spear, 1993. Metamorphic Phase Equilibria and Pressure-Temperature-Time Paths. Monograph, Mineralogical Society of America
- Anthony R. Philpotts & Jay J. Ague, 2009. Principles of Igneous and Metamorphic Petrology (2nd Edition) Cambridge University Press
- John D. Winter, 2014. Principles of Igneous and Metamorphic Petrology (2nd Edition) Pearson Education Limited

III. RELATIVE JOURNALS

- Journal of Petrology (Oxford University Press)
- Journal of Metamorphic Geology (Wiley)
- Lithos (Elsevier)
- Contributions to Mineralogy and Petrology (Springer Link)

WEBPAGE (URL):

http://eclass.uoa.gr/courses/GEOL217

Y4202 GEOPHYSICS

Instructors

Lectures: Prof. A. Tzanis – Prof. F. Vallianatos - Prof. I. Alexopoulos

Lab. Training: V. Sakkas, Laboratory Teaching Staff - Prof. A. Tzanis - Prof. F. Vallianatos - Prof. I. Alexopoulos – S. Vassilopoulou, Laboratory Teaching Staff –S. Chailas, Laboratory Technical Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 4th

TYPE: **MANDATORY /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures and Practical Training

4 hours of lecturing and 2 hours of practical exercises per week, 6 ECTS credits.

Prerequisites: [recommended]

Y1202 Physics
Y1204 Introduction to Calculus and Statistics
Y2201 Introduction to Geology
Y2204GIS and Introduction to Remote Sensing

Language of instruction and Assessment: Greek [1]

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

On completion of the course the students will have acquired:

- Comprehension of the place of planet Earth in the Cosmos and of the consequences on the evolution of its inanimate and animate sub-systems.
- Understanding of the structure and evolution of planet Earth, i.e. of the complex processes that formed its internal composition and organization and which are continuously reconfiguring its surface.
- Understanding of the physical principles that make it possible to image and study the interior of the Earth, and that the same principles can be applied to the study of the Earth's oceans and atmosphere, as well as to the remote observation of other planets
- Familiarization with the principles of the basic geophysical methods used in studying the interior of the Earth, and with the methods and techniques used in the quantitative interpretation of the corresponding geophysical (and other scientific) observations.
- Experience on how to combine, compare and critically appraise data and results from different lines of inquiry, (e.g. geological, petrological and geophysical), in order to extract

[1] I.S.: Incoming students (e.g. ERASMUS Student)

information about the structure and evolution of the interior of the Earth.
- Improved ability to compile and present scientific reports.
- A host of practical skills useful in their continued education and in the analysis of both academic and practical problems, (economic/mining, environmental, technical etc.), which can be addressed by Geophysics and a host of related earth-scientific disciplines.

Generic Competences:

- Ability to search for, process and analyse information using the necessary technologies
- Application of knowledge in practical situations
- Promotion of free, creative and inductive thinking
- Autonomous work
- Team work
- Oral and written communication of scientific matters
- Ability to plan and manage time

COURSE CONTENT:

A. Theoretical background (lectures).

- **Role and Contribution of Geophysical Sciences** in the study of the lithosphere and the interior of the Earth.
- **Formation, Structure and Composition of the Earth's Interior:**Formation and differentiation of the Planet. Shape, internal structure and composition. Distribution of temperature, pressure, density, mechanical and electrical properties in the interior of the Earth. Basic structure of the Earth's core, mantle and crust.
- **Heat of the Earth's Interior:**Origin, sources and distribution of heat. Natural radioactivity, distribution of radioactive elements and radioactive heating. Principles of heat diffusion and transfer, heat flow. Thermal convection in the Earth's core and mantle – consequences for the structure, dynamics and evolution of the lithosphere and the surface of the Earth.
- **Gravityand Gravity Exploration:**Gravity potential and the gravity field of the Earth. Shape of the Earth: the geoid and the ellipsoid. Isostasy. The concept of a "gravity anomaly" and its application to the exploration of the interior of the Earth: measurements, processing, analysis and interpretation. Elements of Geodesy and introduction to Satellite Geodesy.
- **Geomagnetism and Magnetic Exploration:**Elements of the Earth's magnetic field. Generation, changes and origin of changes in the Earth's main magnetic field; external fieldsof magnetospheric, ionospheric and atmospheric origin;importance and consequences on the surface of the Planet. Field reversals and their utilization – elements of Paleomagnetism. The concept of "magnetic anomaly" and its application to the exploration of the Earth's interior – measurements, analysis and interpretation.
- **Elements of Geo-Electromagnetism:**Electrical and magnetic properties of minerals and rocks. Electrical structure of the Earth. Natural EM fields (magnetospheric, ionospheric and atmospheric). Elements of EM theory: diffusion and propagation of EM waves in finite Earth structures and relevant Earth responsefunctions.
- **Electromagnetic Exploration:**Overview. Natural field exploration methods (Magnetotelluric, Magnetovariational/GDS). Elements of Controlled source exploration methods in the frequency and time domains. Data analysis and interpretation. Elements of Geoelectric exploration.
- **Seismic Exploration:**Stress and strain. Seismic wave propagation and attenuation. Seismic excitation sources. Seismic refraction and reflection methods.Seismic tomography. Measurements, processing, analysis and interpretation of seismic exploration data.
- **Introduction to the Earth System.** The physics Earth system and sub-systems and their interactions. The core – mantle – lithosphere system. The core – magnetosphere/ionosphere – lithosphere system. Crustal dynamic systems.
- Multi- and Trans-disciplinary geophysical investigation of the Earth's interior – structural and geodynamic analysis with geophysical methods: Examples and applications.

B. Practical Training: Data analysis and interpretation with specialized/dedicated software; compilation of technical reports.

- Introduction to the management and visualization of geophysical data.
- Introduction to the concept of "geophysical anomalies".
- Gravity anomaliesand their qualitative interpretation.
- Gravity anomalies" and their quantitative interpretation: Introduction to geophysical modelling of local and regional gravity anomalies.
- Magnetic anomalies and their qualitative interpretation.
- Magnetic anomalies and their quantitative interpretation: detection of buried structures and objects.
- Electromagnetic exploration of buried geological structures: Qualitative appraisal and interpretation of magnetotelluric soundings.
- Electromagnetic exploration of buried geological structures: Quantitative interpretation of magnetotelluric soundings/ introduction to the concepts of geophysical inversion.
- Geoelectric exploration: Familiarization with the relevant equipment. Field measurements. Processing, interpretation and appraisal of geoelectric soundings and ERT tomograms.
- Seismic exploration: Concepts, pprocessing and interpretation of seismic refraction and reflection data.
- Heat transfer and heat flow in the Earth: Concepts, quantitative analysis and interpretation.
- Multi-parametric exploration of the Earth's interior.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	52 hours
Practice exercises	26 hours
Fieldwork	-
Tutorials	-
Essey writing	16 hours
Autonomous study	34 hours
Final assessment preparation	22 hours
Total student's effort	**150** hours

ASSESSMENT METHODS AND CRITERIA:

The final grade is formed through a series of tests that include:

- **Written examinations:** The main examination (formative, summative) takes place at the end of the semester (June) and, in case of failure, an auxiliary examination takes place in September (also formative, summative). The written examination account for **50% of the final grade**.
- **Written reports:** These are prepared and submitted as part of the practical exercise program. (formative, summative). The mean grade of all reports accounts for **50% of the final grade**

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- Τζάνης Α., 2020. «Στοιχεία Γενικής και Εφαρμοσμένης Geophysicsς», Εκδόσεις Νέον, Αθήνα (Κωδ. ΕΥΔΟΞΟΣ: 94645607)
- Παπαζάχος Κ., Παπαζάχος Β., 2013. «Εισαγωγή στη Geophysics», Εκδόσεις ΖΗΤΗ, Θεσσαλονίκη (Κωδ. ΕΥΔΟΞΟΣ: 33093728)

II. ADDITIONAL READING

- W. Lowrie, 2007, Fundamentals of Geophysics Cambridge University Press
- Frank M. Stacey & Paul M. Davies, 2008, Physics of the Earth, 4th edition, Cambridge University Press
- C.M.R. Fowler, The Solid Earth: An introduction to Global Geophysics, Cambridge University Press.
- Alan Mussett & Aftab Khan, Looking into the Earth; Cambridge University Press.
- Λούης, Ι., 2004. «Εισαγωγικά Μαθήματα στην Διερευνητική Geophysics», ανέκδοτο βιβλίο, 245 σελ., [PDF].
- Παπαδόπουλος, Τ., 2010, «Εισαγωγή στη Geophysics», Εκδόσεις Νέων Τεχνολογιών, ISBN 978-960-6759-49-9, 2010, 249 σελ., (Κωδ. ΕΥΔΟΞΟΣ: 7969)
- Additional literature for further study is available in electronic form at: (e-Class NKUA | Y4202 - GEOPHYSICS | Optional Literature)

WEBPAGE (URL):

http://eclass.uoa.gr/courses/GEOL210

Y4203 GEOCHEMISTRY

Instructors:

Lectures: Prof. A. Argyraki - Assoc. Prof. Ch. Stouraiti – Assist. Prof. E. Kelepertzis

Lab. Training: Prof. A. Argyraki - Assoc. Prof. Ch. Stouraiti – Assist. Prof. E. Kelepertzis – Z. Kypritidou, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 4th

TYPE: **MANDATORY /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures-seminars & laboratory work and exercises, field-work.

4 hours of lecturing and 2 hours of practical exercises per week, 6 ECTS credits.

Prerequisites:

Y1203 Chemistry [recommended]

Y1205 **Error! Reference source not found.** [recommended]

Language of instruction and Assessment: Greek [1]

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

Upon successful completion of the course, the student is able to:

- • Identify and describe basic geochemical processes related to the occurrence and distribution of chemical elements within the Earth's interior and surface.
- • Apply the principles of chemistry to interpret geological processes that control the concentrations and distribution of chemical elements in magma and the primary rocks derived from it.
- • Predict the behaviour of chemical elements in the Earth's surface environment and the alteration of the chemical composition of geologic materials under conditions of chemical weathering.
- • Extend the applications of chemical methods to realistic scenarios of geological samples (in solid or liquid state) that deviate from the ideal behaviour.
- • Calculate critical geochemical parameters for solving geochemical problems related to the atmosphere, land, and oceans.
- • Use appropriate tools and laboratory instruments to carry out simple geochemical measurements.
- • Combine knowledge of geology, mineralogy, and chemistry to design work plans and make decisions regarding the exploration and exploitation of mineral resources and environmental protection.

I.S.: Incoming students (e.g. ERASMUS Student)

Generic Competences:

- Ability to apply knowledge in practical situations
- Promote free, creative and inductive thinking
- Ability to plan and manage time
- Ability to work in a team
- Oral and written communication of scientific issues
- Information and Communication Technology (ICT) skills

Commitment to conservation of the environment**COURSE CONTENT:**

A. Lectures

Unit 1: Geochemical Processes in the Earth's Interior

- Multi- and Trans-disciplinary geophysical investigation of the Earth's interior – structural and geodynamic analysis with geophysical methods: Examples and applications.
- Geochemistry in the curriculum. Subject of Geochemistry. Course content. Introduction to processes in the Earth's interior.
- Classification of elements. Chemical bonds & crystal structures.
- Principles of Cosmochemistry – Formation of planets – Formation and differentiation of the Earth.
- Ionic substitutions in crystals. Theory of the partition coefficient of trace elements.
- Geochemistry of igneous rocks.
- Geochemistry of magmas and geotectonic environment I.
- Geochemistry of magmas and geotectonic environment II.
- Geochemistry of radiogenic isotopes.
- Thermodynamics of geological systems. Activity, fugacity, chemical potential.

Unit 2: Geochemical Processes on the Earth's Surface

- Geochemistry of aqueous solutions – Chemical composition of natural waters.
- Processes of chemical weathering – Factors, chemical reactions, products.
- Redox geochemical processes.
- Elements of organic geochemistry – Geochemistry of fossil fuels and environmental impact.
- Processes in the 'critical zone' – Soil geochemistry.
- Enrichment factors of chemical elements in soil.
- Marine geochemistry.
- Geochemistry of hydrothermal solutions.

B. Laboratory Exercises

Laboratory Exercises are conducted in small groups of students and are graded at the end of the Laboratory session.

Exercise 1: Normalization of rock chemical composition – practice in processing geochemical data from the literature using a computer.

Exercise 2: Behaviour of trace elements in magmatic processes – calculation of partition coefficient.

Exercise 3: Geochronology – calculation of rock age using the Rb/Sr method.

Exercise 4: Geochemistry of continental waters – units of concentration in solutions, calculation of parameters characterizing the chemical composition of natural waters.

Exercise 5: Extraction of Cu from ore – conducting an experiment in the lab, balancing redox chemical reactions that occur in nature.

Exercise 6: Solubility of minerals – experimental determination of solubility product of minerals in the lab –taking laboratory measurements.

Exercise 7: Processing of laboratory measurements of mineral solubility using a computer – calculation of ionic strength of solution, ion activity coefficient, ion activity, mineral saturation index, and change in mineral solubility with temperature.

C. Field work

One-day fieldwork exercise in Lavrion: Training in soil, surface water, and rock sampling. Study of acid rock and acid mine drainage in the field.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	52 hours
Practice exercises	24 hours
Fieldwork	8 hours
Tutorials	-
Essey writing	20 hours
Autonomous study	36 hours
Final assessment preparation	10 hours
Total student's effort	**150** hours

ASSESSMENT METHODS AND CRITERIA:

The final grade of the course is formed by a series of tests that include:

I. Written Exams

- **Two optional progress exams** during the semester (participation percentage in the final grade **30% each**) (formative, summative) and/or **a final written exam** with short-answer questions (**60% of the final grade without participation in progress exams**) (formative, summative).

II. Laboratory Exercises

- Problem-solving during practical exercises, submission of laboratory assignments (reporting of completed tasks with calculations) (**25% of the final grade**) (formative, summative).

III. Active participation in the compulsory Fieldwork exercise

- (soil sampling, short-answer questions) (**15% of the final grade**) (formative, summative).

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- Εισαγωγή στη Γεωχημεία, Αρχές και Εφαρμογές., Kula C. Misra (επιμέλεια: Α. Αργυράκη, Χ. Στουραΐτη) [Κωδ. ΕΥΔΟΞΟΣ: 68406899]

II. ADDITIONAL READING

- Introduction to Geochemistry- Principles and Applications., Kula C. Misra Wiley- Blackwell
- Μαθήματα Γεωχημείας, Μητρόπουλος Π., Κελεπερτζής Α. [Κωδ. ΕΥΔΟΞΟΣ: 22771432]
- Γεωχημεία, Σ. Θεοδωρίκα [Κωδ. ΕΥΔΟΞΟΣ: 38144136]

III. RELATIVE JOURNALS

- Applied Geochemistry, Elsevier
- Journal of Exploration Geochemistry, Elsevier
- Geochimica et Cosmochimica Acta, Elsevier

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL103
http://opencourses.uoa.gr/courses/GEOL2/

Y4205 OCEANOGRAPHY

Instructors:

Lectures: Prof. S. Poulos - Prof. P. Nomikou

Lab. Training: Prof. S. Poulos - Prof. P. Nomikou – C. Angelopoulos, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 4th

TYPE: **MANDATORY /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures-seminars & laboratory work and exercises, optional fieldwork

3 hours of lecturing and 2 hours of practical exercises per week, 6 ECTS credits.

Prerequisites: NONE

Language of instruction and Assessment: Greek [1]
Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning outcomes:

On successful completion of the course the student:

- Defines and formulates the basic principles, methods and applications of the Science of Oceanography and its relationship with the other earth sciences
- Understand the basic principles of the 'functioning' of the ocean (physical properties, dynamics of marine masses)
- Identify the relationship between the above processes and the geological evolution of sea basins, the transport and deposition of sediments, as well as the formation of submarine and coastal topography, with particular reference to coastal geomorphs.
- An understanding of the interactive processes between the marine and atmospheric environment (e.g. wind waves, heat balance, thermoclines) and between the marine and terrestrial environment (e.g. the formation of coastal geomorphs such as river deltas) is attempted.
- It introduces the method(s) of data collection concerning the water column, the water surface and its sub-layers.
- Reference is made to human activities and interventions in the marine and coastal environment

Generic Competences:

- Theoretical thinking and the ability to apply knowledge to problem solving.
- Work in an interdisciplinary environment (individual and/or team)
- Respect for the natural marine environment
- Search, analysis and synthesis of data and information, including the use of appropriate technologies

I.S.: Incoming students (e.g. ERASMUS Student)

- Promotion of free, creative and deductive thinking

COURSE CONTENT:

A. Lectures

- Introduction to the science of Oceanography (historical development, present situation in Greece, research institutions and tools, economic dimension).
- Exchange of energy and matter between atmosphere - sea (e.g. water cycle) and sea - land (river inputs).
- Physical properties of seawater (temperature, salinity, density, dissolved gases, light and sound propagation) (2 lectures).
- Marine dynamics (waves, currents, tides) and its relation to coastal and submarine geomorphology (3 lectures).
- Basic principles and concepts of biological oceanography
- Basic principles of sedimentation (e.g. origin, size, sedimentation conditions) and distribution of sediments in marine basins.
- Geological, temporal and modern sea level changes
- Submarine geomorphological and morphodynamic evolution of the submarine relief and continental margins (continental shelf, shelf slope, trenches, mid-ocean ridge, abyssal fields).
- Basic principles of classification and types of coasts (e.g. primary, secondary, tectonic, volcanic, etc.) - Coastal sedimentary environments (deltas, coastal zones, curved headlands, island barriers, etc.).
- Principles of seismic (acoustic) survey of the seabed and its subsoil (methodology, instruments and equipment).

B. Lab exercises.

Laboratory Exercises are individual and are graded at the end of the Laboratory.

- Introductory Laboratory - Laboratory Regulations - Units of Measurement
- Oceanographic Research Instruments and Instruments
- Thermal and Hydrological Balance of marine basins (e.g. Aegean Sea)
- Temperature - Salinity - Density of seawater
- Marine Primary Production
- Astronomical tides
- Waves (anemogenic) of the open sea
- Offshore currents and coastal currents (of wave origin)
- Ocean geography and morphological characteristics of the seabed
- Coastal Geomorphology (landforms)
- Coastal sediments - Changes in bathymetry
- Acoustic (seismic) survey of the seabed

C. Fieldwork

C1. One-day field exercise in the area of Chalkida. Oceanographic measurements and observations at the Evripos Strait, Liani Ammos beach (intertidal zone) and coastal landslide (location: Exo Panagitsa).

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	39 hours
Practice exercises	26 hours
Fieldwork	8 hours
Tutorials	-
Essey writing	13 hours
Autonomous study	40 hours
Final assessment preparation	16 hours
Total student's effort	**150** hours

ASSESSMENT METHODS AND CRITERIA:

I. LECTURES (60**%**)

- Written examination of 2 hours during the examination period of the semester (formative, summative). The examination includes extended or short answer questions..

II. LAB EXERCISES (**40%**)

- Grading of each exercise at the end of the Workshop (formative, deductive) and a 1-hour written examination with multiple questions and/or exercise solution (deductive).

III. FIELDWORK (10%)

- .Oral examination in the countryside with evaluation of the countryside test booklet

Supplementary material for the exams (questions, exercises etc.) is posted on **e-Class** platform

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- S. Poulos. Introduction in Oceanography or Oceanology, DISIGMA Publising, (EUDOXUS code: 102076267), in Greek.

II. ADDITIONAL READING

- S.. Leontaris. Introduction to Oceanography, SYMMETRIA Publications [Ref.]
- A. Theodorou. Oceanography: Introduction to the Marine Environment, ATH. STAMOULIS

III. RELATIVE JOURNALS

- Mediterranean Marine Science
- Oceanology
- J. Marine Systems
- J. Marine Geology
- J. GeoMarine Letters

WEBPAGE (URL):

(including Course Notes in .pdf files)

http://eclass.uoa.gr/courses/GEOL293

Y4206 SEDIMENTARY ENVIRONMENTS AND PROCESSES

Instructors

Lectures: Prof. C. Drinia – Assoc. Prof. J. Panagiotopoulos - G. Kontakiotis, Laboratory Teaching Staff –P. Makri, Laboratory Teaching Staff –E. Mpesiou, Laboratory Teaching Staff

Lab. Training: Prof. C. Drinia – Assoc. Prof. J. Panagiotopoulos - G. Kontakiotis, Laboratory Teaching Staff - E. Stathopoulou, Laboratory Teaching Staff - O. Koumoutsakou, Laboratory Teaching Staff – P. Makri, Laboratory Teaching Staff –E. Mpesiou, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 4th

TYPE: **MANDATORY /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures-seminars & laboratory work and exercises, optional fieldwork

3 hours of lecturing and 2 hours of practical exercises per week, 6 ECTS credits.

Prerequisites: NONE

Language of instruction and Assessment: Greek [1]

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

On successful completion of the course, the students::

- **Understand** and **apply** the basic principles of sedimentology, particularly those related to laboratory techniques for sample processing and interpretation of paleoenvironmental sedimentation.
- **Define** the basic characteristics and categories of sedimentary environments.
- **Understand** the processes of sedimentary layer formation and modelling.
- **Identify** the different types of sediments and the conditions that favour their formation.
- **Apply** methods and techniques for the study and analysis of sedimentary environments.
- **Formulate** hypotheses on the evolution and changes in sedimentary systems.
- **Combine** data from different sources for a comprehensive understanding of sedimentary processes.
- **Determine** the relationship between sedimentary processes and environmental factors.
- **Assess** the impacts of anthropogenic activities on sedimentary environments.

Generic Competences:

- Ability to apply knowledge in practical situations
- Promote free, creative and inductive thinking
- Ability to search for, process and analyse information with the use of necessary technologies
- Ability to be critical and self-critical
- Oral and written communication of scientific issues
- Decision making
- Information and Communication Technology (ICT) skills

COURSE CONTENT:

A. Lectures.

- Introduction - Basic concepts of sedimentology,
- Physical Sedimentology - Mechanisms of sediment transport - Basic types of deposition - Sediment classification.
- Sedimentary Structures
- Sedimentary environments and sedimentary facies
- Continental Sedimentary Environments (a) glacial, (b) aeolian, (c) alluvial, (d) fluvial and (e) lacustrine
- Marginal marine/transitional sedimentary environments (a) deltas, (b) lagoons, (c) coastal marshes, (d) barrier islands, (e) tidal flats, and (f) estuaries/floodplains.
- Marine sedimentary environments (shelf environments, submarine fans and pelagic depositional environments).
- Volcaniclastic sedimentation.
- Carbonate sedimentation.
- Basic principles of Sequence Stratigraphy

B. Practical and Laboratory Exercises

The laboratory examination is integrated into the written examination of the course and includes questions covering the theoretical and practical knowledge acquired during the laboratory exercises. These questions represent 30% of the total course grade.

EXERCISE 1: Granulometric analysis - Physical properties of sediments
EXERCISE 2: Granulometric analysis - Physical properties of sediments
EXERCISE 3: Physical and hydraulic characteristics of sediments.
EXERCISE 4: Triangular diagrams - Sedimentary environments
EXERCISE 5: Sedimentary Structures
EXERCISE 6: Paleocurrent analysis
EXERCISE 7: Carbonate sedimentation - Components and Classification of carbonate sequences,
EXERCISE 8: Carbonate Sedimentation - Microfacies
EXERCISE 9: Sediment dating methods and sedimentation rate calculation.

C. One-day fieldwork in Alepochori

Neogene sediments in the Megara basin, stratigraphic column of the Neogene marine, lagoonal and alluvial sedimentary phases, collection of samples, recording of on-site observations on sediments and construction of a lithostratigraphic column, and interpretation of the paleo-sedimentary environment.

[1] I.S.: Incoming students (e.g. ERASMUS Student)

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY
– Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES
– Use of ICT in teaching (lectures, lab exercises, fieldwork).
– Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	39 hours
Practice exercises	18 hours
Fieldwork	15 hours
Tutorials	- hours
Essey writing	- hours
Autonomous study	43 hours
Final assessment preparation	35 hours
Total student's effort	**150** hours

ASSESSMENT METHODS AND CRITERIA:

I. LECTURES (**60%**)
- Final written examinations of two hours at the end of the semester (Formative, Conclusive)

Written exams include multiple-choice questions to assess understanding of key concepts, short-answer questions for specific knowledge, developmental questions to develop and explain topics in depth, and matching questions to connect concepts. In addition, true/false questions to evaluate key facts, problems or exercises requiring the application of theoretical knowledge, and diagrams or figures to interpret and analyze graphical information are included..

II. LAB EXERCISES (**30%**)
- Weekly assessment of lab exercises (formative, summative).

or/and
- Written final examination (summative).

III. FIELDWORK (**10%**)
- Oral examination in the field (formative, summative).

Supplementary material for the exams (questions, exercises etc.) is posted on **e-Class** platform (https://eclass.uoa.gr/courses/GEOL199).

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL
- Drinia H. & Avrakidis P. 2023. Sedimentology - Sendimentary Environments. https://repository.kallipos.gr/handle/11419/9642 [EUDOXUS CODE 122074375] (in Greek).

II. ADDITIONAL READING
- Leeder M., 2011. Sedimentology and Sedimentary Basins: From Turbulence to Tectonics, 784 ps, Wiley- Blackwell, ISBN: 978-0-632-03627-1
- Reading H. G., (Editor), 1996. Sedimentary Environments, Facies and Stratigraphy, 704 pp, Wiley, ISBN: 978-0-632-03627-1.
- Nickols G., 2009. Sedimentology and Stratigraphy, 432 pp Wiley-Blackwell, ISBN-13:978-1405135924, ISBN-10:1405135921.
- Catuneanu O., 2006. Principles of Sequence Stratigraphy, 1st Edition. Elsevier: The Netherlands
- Flügel, E. Microfacies Analysis of Carbonate Rocks; Springer Verlag: Berlin, Germany, 2010; 745 pp.
- Selley R. C., 2000. Applied Sedimentology. Elsevier. https://doi.org/10.1016/B978-0-12-636375-3.X5001-0
- McLane M., 1995. Sedimentology. Oxford University Press. 448 pp.

III. RELATIVE JOURNALS
- Sedimentology (IAS), Wiley-Blackwell
- Journal of Sedimentary Environments, Springer, Brazil, Online ISSN 2447-9462

WEBPAGE:

http://eclass.uoa.gr/courses/GEOL199

Y5201 GEOMORPHOLOGY

Instructors

Lectures: Prof. N. Evelpidou - Assoc. Prof. E. Vassilakis – Assist.Prof. M. Diakakis - A. Karkani, Laboratory Teaching Staff

Lab. Training: Prof. N. Evelpidou - Assoc. Prof. E. Vassilakis – Assist.Prof. M. Diakakis - A. Karkani, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / E'

TYPE: **MANDATORY /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures & laboratory work and exercises, fieldwork

3 hours of lecturing and 2 hours of practical exercises per week, 6 ECTS credits.

Prerequisites: NONE

Language of instruction and Assessment: Greek [1]

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

Upon completion of the course the student will:

- **Identify** and **describe** the interactions of the lithosphere, hydrosphere and atmosphere in the creation and formation of the terrestrial landscape,
- **Recognize** and **identify** the different landforms on the Earth's surface, both today and in its recent past,
- **Comprehend**, **distinguish** and **interpret** the geomorphological processes that affect the development and evolution of landforms in different environments and different climatic zones,
- **Apply** geomorphological analysis and research methods
- **Classify** the geomorphological characteristics of the terrestrial landscape
- **Calculate** the morphological parameters of the landforms,
- **Collect**, **analyze**, **combine** and **compose** geomorphological data and related literature, in the construction of geomorphological maps, in the evolution of landforms in time and space and in the identification of geomorphological hazards,
- **Compare** and **evaluate** data using geomorphological research methods to solve problems such as: spatial and temporal evolution of the landscape, the assessment of environmental and morphological changes, the environmental impact of human activities on the landscape.

Generic Competences:

- Ability to apply knowledge in practical situations
- Promote free, creative and inductive thinking
- Ability to plan and manage time
- Ability to work in a team
- Ability to search for, process and analyse information with the use of necessary technologies
- Adapt to and act in new situations and cope under pressure
- Commitment to conservation of the environment

COURSE CONTENT:

A. Lectures

- Earth relief. Endogenous - exogenous processes. Landforms and factors that control them
- Modern directions of geomorphology
- Geomorphological maps, geomorphological mapping
- Research issues in Geomorphology
- Structure shapes (sedimentary - horizontal - single - folded - crystalline)
- Landforms of metamorphic rocks
- Volcanoes
- Faults, fault lines, cliffs
- Weathering, erosion, deposition
- Active, inactive landforms
- Gravity Movements
- Hydrological cycle
- Fluvial cycle, hydrographic networks
- Geomorphic environments: Fluvial Geomorphology
- Geomorphology of slopes
- Aeolian Geomorphology
- Karstic Geomorphology
- Tectonic Geomorphology
- Morphometric indicators
- Coastal Geomorphology
- Glacial Geomorphology
- Geomorphological risks and environmental impacts.

B. Practical Exercises:

- Fluvial Geomorphology
- Watershed Sketching
- Quantitative analysis of hydrographic network (drainage basin mean slope calculation, drainage frequency, drainage density through GIS)
- Terraces
- Hydrology
- Geomorphology of slopes
- Aeolian Geomorphology
- Karstic Geomorphology
- Morphometric indicators
- Coastal Geomorphology
- Coastal erosion
- Coastal cliffs
- Coastal deposition
- Glacial Geomorphology
- Geomorphological mapping

C. Field Trips

Daily field trip in Corinth (Geomorphological mapping, coastal landforms, morphotectonics, erosion, sea level changes, sampling).

3-hour field trip in Kaisariani (Identification and mapping of fluvial terraces, calculations and measurements of their morphometric characteristics, their lithological and sedimentological composition with specialized instruments).

[1] I.S.: Incoming students (e.g. ERASMUS Student)

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY
- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES
- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	39 hours
Practice exercises	26 hours
Fieldwork	33 hours
Tutorials	-
Essey writing	15 hours
Autonomous study	20 hours
Final assessment preparation	17 hours
Total student's effort	**150** hours

ASSESSMENT METHODS AND CRITERIA:

Lectures (50%) the grade is based on examination during the semester and at the end of the semester in one of the following ways (summative):
- Oral or
- Written, with short-answer questions and multiple choice or
- Written with extended-answer questions

Laboratory exercises (50%) the score is distributed as follows:
- **10%** by the weekly participation in the exercises done in the classroom (formative)
- **30%** in the final exams (summative)
- **10%** from the reports done, from the field activities. (formative)

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL
- Evelpidou N., 2018. Geomorphology Laboratory Exercises. Academic Publishing, p. 300. [Book website] [Code Eudoxus: 77117790]
- Evelpidou N., 2020. Geomorphology. Tziola Publishing, Athens. ISBN: 978-960-418-605-1(Book website) [Code Eudoxus : 86054269]
- Pavlopoulos K., 2011. Geomorphology, Introduction to Geosciences, (Book website)[Code Eudoxus : 12777167]

II. ADDITIONAL READING
- Pavlopoulos K., Evelpidou N., Vassilopoulos A., 2009, 'Mapping Geomorphological Environments', published by Springer, ISBN: 978-3-642-01949-4, p.235. (Book website)

III. RELATIVE JOURNALS
- Geomorphology
- Continental Shelf Research
- Geologica Acta
- GeoMarine Letters
- Global and Planetary Change
- Holocene
- International Journal of Earth Science
- Journal of Coastal Research
- Marine Geology
- Quaternary International
- Quaternary Science Reviews

WEBPAGE (URL):

http://eclass.uoa.gr/courses/GEOL121
https://eclass.gunet.gr/courses/OCGU161/

Y5202 STRATIGRAPHY

Instructors

Lectures: Prof. M. Triantaphyllou - Prof. C. Drinia - G. Kontakiotis, Laboratory Teaching Staff - N. Tsaparas, Laboratory Teaching Staff

Lab. Training: Prof. M. Triantaphyllou - Prof. C. Drinia - Prof. A. Antonarakou - Assist. Prof. T. Tsourou - G. Kontakiotis, Laboratory Teaching Staff - N. Tsaparas, Laboratory Teaching Staff - E. Besiou, Laboratory Teaching Staff - E. Stathopoulou, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 5th

TYPE: **MANDATORY /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures and Laboratory Exercises

3 hours of lecturing and 2 hours of practical exercises per week, (4 τμήματα), 6 ECTS credits.

Prerequisites: Basic principles knowledge of

Y2205 Macropalaeontology
Y3205 Biogeosciences-Principles of Micropaleontology
Y4206 Sedimentary Environments and Processes
Y3205Tectonic Geology

Language of instruction and Assessment: Greek [1]
Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

Upon successful completion of the course the student:

- Comprehends the basic principles of Stratigraphy and in particular the handling of methods and knowledge related to laboratory techniques of observation and processing of field data
- Combines and evaluates field rock and fossil samples and prepares them for further laboratory analyses, as well as to interpret the final laboratory results
- Synthesizes all the data in order to interpret the paleogeographic evolution of the study area
- Comprehends the basic principles of identification, description, identification and classification of pre-orogenic, syn-orogenic and post-orogenic formations of an area
- Clarifies the stratigraphic and tectonic structure of an area and its paleogeographic integration into various environments through geological time
- Defines the relative age of geological formations using micro- and macro-fossils in order to recognize the isochronous formations of an area, as well as the relationship between them in space and time
- Estimates the absolute age of geological formations using biostratigraphic indices and correlation with the International Chronostratigraphic Chart and the Astronomical Time Scale
- Combines and evaluates the relevant literature
- Comprehends and recognizes the major stages of Earth's history

Generic Competences:

- Ability to apply knowledge in practical situations
- Promote free, creative and inductive thinking
- Ability to plan and manage time
- Ability to work in a team
- Oral and written communication of scientific issues
- Autonomous work
- Information and Communication Technology (ICT) skills
- Commitment to conservation of the environment
- Ability to work in an interdisciplinary context

COURSE CONTENT:

A. Lectures

- Definition of Stratigraphy, its role and importance on Earth-sciences
- Traditional and modern stratigraphic methods
- Lithostratigraphy and facies relationships; Biostratigraphy; Chronostratigraphy; Geochronology; Isotopic Stratigraphy; Astrochronology
- Chemostratigraphy and paleoclimatic stratigraphic indices
- Sequence Stratigraphy and sea level change; transgressions, eustatism
- Magnetotratigraphy, Seismic Stratigraphy, sedimentary basins
- Depositional environments, Paleogeography
- Historic Geology, Precambrian, Paleozoic, Mesozoic, Cenozoic
- Stratigraphic outcrops of various geological time periods in Greece

B. Practical and Laboratory Exercises

Exercise 1 Construction and lithostratigraphic correlation of stratigraphic columns and stratigraphic sections. Fossil content and relative datings. Construction of synthetic stratigraphic column

Exercise 2 Preparation for the fieldtrips. Basic principles of stratigraphic methods-sampling-stratigraphic sections and columns. Absolute ages based on biostratigraphic indices and corellation with the International Chronostratigraphic Chart and the Astronomical Time scale.

Exercise 3 Stratigraphic sequences & tectonism

Exercise 4 Neritic alpine sequences / tectonism and flysch. Discontinuities in the stratigraphic sequence: unconformities, normal and reverse faults, thrusts

Exercise 5 Pelagic alpine sequences / tectonism and flysch. Discontinuities in the stratigraphic sequence: unconformities, normal and reverse faults, thrusts

Exercise 6 Transitional sequences / tectonism and flysch. Discontinuities in the stratigraphic sequence: unconformities, normal and reverse faults, thrusts

Exercise 7 Lateral transgressions/basin rifting

Exercises 8-9 Identification of stratigraphic and tectonic formations, tectonic relationships based on stratigraphic and

I.S.: Incoming students (e.g. ERASMUS Student)

sedimentological data, palaeogeographical inclusion in the geotectonic units of the Greek area.

Exercise 10 Postalpine formations and stratigraphic correlations.

C. Fieldwork

Two one-day fieldtrips: determination of alpine formations and geotectonic units (neritic, pelagic and transitional facies), based on lithologic, biostratigraphic, sedimentary and tectonic features. Recognition of unconformities and tectonic contacts. Sampling of alpine and postalpine deposits, sampling techniques in the field: sample collection and coding. Construction of stratigraphic columns and stratigraphic sections.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

– Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

– Use of ICT in teaching (lectures, lab exercises, fieldwork).
– Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	39 hours
Practice exercises	26 hours
Fieldwork	14 hours
Tutorials	-
Essey writing	20 hours
Autonomous study	18 hours
Final assessment preparation	33 hours
Total student's effort	**150** hours

ASSESSMENT METHODS AND CRITERIA:

For the lab:

- Lab essays 20% (formative, summative)
- Written final examination during the last (13) week of semester (30%) (summative)
- concerning the recognition of stratigraphic characteristics of certain paleogeographic regimes and the tectonic impact on the stratigraphic sequences. Recognition of various paleogeographic regimes and geological units.

For the theoretical part:

- written assessment and multiple choice exercises (35%) (summative)
- questions concerning the topics discussed in the fieldwork (**15%**) (summative)

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- Karakitsios, V., 2001. Stratigraphy, ASTARTI Publications, 503 pp, ISBN 960-263-095-7. [Code EUDOXUS: 4869]
- Κουφός, Γ.Δ., 2008, Μαθήματα Στρωματογραφίας, ISBN: 9789601217567, [Code EUDOXUS: 17383]"

II. ADDITIONAL READING

- Brookfield, M., 2004. Principles of Stratigraphy. Blackwell Publishing Ltd, 340 p.
- Doyle, P., Bennett M., 1998. Unlocking the Stratigraphical Record: Advances in Modern Stratigraphy. J. Wiley & Sons Ltd, 532 p.
- Nichols G., 2009, Stratigraphy: Concepts and Lithostratigraphy. Wiley-Blackwell, 397 p.
- Wicander R., Monroe , J., 1993. Historical Geology: Evolution of the Earth and Life through Time. West Publishing Company, 640 p.
- Schoch, R., 1989, Stratigraphy: Principles and Methods. Van Nostrand Reinhold (New York), 375 p.

III. RELATIVE JOURNALS

- Episodes, Online ISSN: 2586-1298
- Newsletter on Stratigraphy, Online ISSN: 2363-6122

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL188

Y5203 ENGINEERING GEOLOGY

Instructors

Lectures: Prof. M. Stavropoulou

Lab. Training: Prof. M. Stavropoulou –Assist. Prof. K. Soukis– I. Bantekas, Laboratory Technical Staff- E. Andreadakis, Laboratory Technical Staff – V. Antoniou, Laboratory Teaching Staff – C. Filis, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 5th

TYPE: **MANDATORY /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Lab exercises

4 hours of lecturing and 2 hours of practical exercises per week, (3 τμήματα), 6 ECTS credits.

Prerequisites: NONE

Language of instruction and Assessment: Greek [1]

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

Upon successful completion of the course, the student:

- **Understands and interprets** the role of geo-material as a carrier, a loading element, and a construction material.
- **Assesses and determines** the geotechnical conditions as well as the general behavior of the geological environment in relation to the impact of man-made interventions and catastrophic phenomena.
- **Combines and evaluates** details and data from geotechnical field and laboratory research. **Performs** geotechnical classification of soil and rock formations and **determines** the geotechnical parameters of the design of a project.
- **Interprets** the mechanisms and factors that contribute to the occurrence of landslides. **Applies** basic principles of slope stability and familiarizes with their protection and restoration measures.
- **Applies** the techniques of engineering geology in the various stages of design and construction of important engineering projects. (tunnels, dams, foundations, etc).

Generic Competences:

- Ability to search for, process and analyze information with the use of necessary technologies.
- Autonomous work.
- Ability to apply knowledge in practical situations.
- Work in a team.
- Decision making.
- Ability to plan and manage time.
- Information and Communication Technology (ICT) skills.

[1] I.S.: Incoming students (e.g. ERASMUS Student)

COURSE CONTENT:

A. Lectures

- INTRODUCTION TO ENGINEEIRING GEOLOGY (Role and main branches of engineering geology, engineering projects and geology).
- PHYSICAL AND MECHANICAL PROPERTIES OF GEOMATERIALS (Composition and structure, Physical and mechanical properties of rocks, Stress and strain- geostatic stresses, strength and mechanical behavior of rocks , Discontinuities and mechanical behavior of rock masses, Geo-technical classification of rock mass, Estimation of geotechnical design parameters, Physical properties of soils, Classification of soils, Shear strength, Mechanical parameters).
- GEOTECHNICAL SITE INVESTIGATION (Study stages of the various engineering projects and designs, Engineering geological-geotechnical maps, sampling, in-situ testing: SPT Standard Penetration Test, CPT Cone Penetration Test, Pressure Meter Test, Cross-hole test, permeability tests).
- GROUND IMPROVEMENT (compactions, preloading, drainage and dewatering, excavation and replacement, grouting methods, geosynthetics in various ground improvement problems),
- FOUNDATIONS (General principles of engineering project foundations, Shallow and deep foundations, Design parameters).
- LANDSLIDES – SLOPE STABILITY (Classification of landslides, Landslides causes, Stability analysis of soil and rock slopes, slope stability under seismic loading, Protection and rehabilitation measures, Landslides monitoring systems).
- UNDERGROUND STRUCTURES (Influence of geological conditions on the choice of slotting in the design and construction of underground structures, classification systems of tunnels and empirical design methods, mechanisms of failure and deformation, tunnel construction methods, NATM and support systems).
- DAMS (Types of dams, selection of a dam location, tightness of dams, related and accompanying projects, design criteria, geo-technical requirements , construction methods).

B. Lab Exercises

Practice exercises are taught in small groups of students and are graded at the end of the exercise.

Exercise 1. Rock drilling and sampling. Determination of Rock Quality Designation (RQD) of Rock Cores.

Exercise 2. Classification and characterization of rock masses.

Exercise 3. Soil drilling and sampling – Soil classification exercise (Unified Soil Classification System USCS).

Exercise 4. In situ tests: Standard Penetration Test (SPT).

Exercise 5. Soil classification and geotechnical parameter estimation – Creation of Geotechnical cross-section.

Exercise 6. In-situ Permeability Tests - MAAG, LEFRANC.

Exercise 7. In-situ Permeability Tests LUGEON.

Exercise 8. Rock slope stability problems – wedge failure.

Exercise 9. Rock slope stability problems – plane failure.

Exercise 10. Rock slope stability problems – toppling.

Exercise 11. Soil slope stability analysis by limit equilibrium methods.

Exercise 12. Geological and geotechnical considerations for tunnel construction sites.

Exercise 13. Geological and geotechnical considerations for dam construction sites.

C. Fieldwork

C1. One day field excursion in the dam of Ladonas, Arcadia. Stages of construction and operation of the dam, basic components and accompanying constructions, geological and tectonic structures, hydrology of the wider and narrow area of the project.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY
- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES
- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	52 hours
Practice exercises	26 hours
Fieldwork	12 hours
Tutorials	- hours
Essey writing	13 hours
Autonomous study	23 hours
Final assessment preparation	24 hours
Total student's effort	**150** hours

ASSESSMENT METHODS AND CRITERIA:

The assessment process is conducted with the final examination of the entire course material which includes:

I. LECTURES (**50%**)
- Written Exam with Short Answer Questions and Multiple Choice Test (summative)

and/or
- Written Exam with Extended Answer Questions (summative).

II. LAB EXERCISES (**50%**)
- Weekly assessment of lab exercises (formative, summative).

and
- Written final examination (summative).

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL
- Stournaras G., Stavropoulou M. 2010, **Engineering Geology,** Publisher Tziola, 428 p. [EUDOXUS code: 18549027], in Greek.

II. ADDITIONAL READING
- Luis Gonzalez de Vallejo, Mercedes Ferrer. 2011. **Geological Engineering**, Publisher CRC Press.
- F G Bell. 2007. **Engineering Geology**, 2nd Edition. EButterworth-Heinemann, Oxford.
- Hoek E. 2007. Practical Rock Engineering,

III. RELATIVE JOURNALS
- ENGINEERING GEOLOGY - Title: Engineering Geology, Publisher: Elsevier BV, Editors in chief: G.B. Crosta, R.J. Shlemon, Frequency: 7 Volumes Annually
- NATURAL HAZARDS - Title: Natural Hazards, Publisher: Springer, Editors in chief: T. Glade, T,S. Murty, V. Schenk, Frequency: Monthly, Frequency: Monthly
- LANDSLIDES - Title: Landslides, Publisher: Springer, Editor in chief: K. Sassa, Frequency: Quarterly
- BULLETIN OF ENGINEERING GEOLOGY AND THE ENVIRONMENT - Title: Bulletin of Engineering Geology and the Environment, Publisher: Springer, Editor in chief: A. B. Hawkins, Frequency: Quarterly
- GEOTECHNICAL AND GEOLOGICAL ENGINEERING - Title: Geotechnical and Geological Engineering, Publisher: Springer, Editor in chief: T.B. Edil, P.G. Marinos, Frequency: Bimonthly

WEBPAGE (URL):

http://eclass.uoa.gr/courses/GEOL205

Y5204 GEOLOGY OF GREECE

Instructors

Lectures: Assist. Prof. K. Soukis - Assist. Prof. E. Skourtsos

Lab. Training: Assist. Prof. E. Skourtsos - Assist. Prof. K. Soukis– D. Theocharis, Laboratory Teaching Staff – I. Bantekas, Laboratory Technical Staff –C. Filis, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / E'

TYPE: **MANDATORY /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Practical exercises, Fieldwork

3 hours of lecturing and 4 hours of practical exercises per week, (4 τμήματα), 6 ECTS credits.

Prerequisites: [recommended]

Y3205 STRUCTURAL GEOLOGY AND TECTONICS

Since it is a synthesis course, the basic knowledge acquired by students after successfully attending the compulsory courses of the 2nd, 3rd and 4th semester is necessary

Language of instruction and Assessment: Greek [1]

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences: It is a synthesis course in which the students are introduced to the geotectonic units and the geotectonic structure of Greece. Furthermore, they learn about the different views on the paleogeographic organization and evolution of the units of Greece and the orogenic cycles that shaped the present-day geological structure.

With the practical exercises, students construct cross-sections based on excerpts from the 1:50.000 geological maps of the Geological Survey of Greece.

Upon successful completion of the course, the student is able to:

- Recognize assign and describe the geotectonic units of Greece
- Describe their geotectonic evolution, as reflected in their stratigraphic column the structural position and the deformation and/or metamorphic history.
- Understand, describe and interpret the processes through which the rocks and the geotectonic units of the Hellenides were formed and evolved, as well as the geological structure of the regions of Greece.
- Read and analyze a geological map and clarify the structure.
- Construct geological cross-sections that depict the geological structure of an area
- Apply the basic technics of analysis and synthesis and define the history and evolution of the deformation through the geological time.
- Evaluate the geological structure of an area, compare and correlate with other areas and compose the overall geological structure and evolution.

Generic Competences:

- Ability to apply knowledge in practical situations
- Promote free, creative and inductive thinking
- Ability to plan and manage time
- Oral and written communication of scientific issues
- Decision making
- Ability to undertake research at an appropriate level
- Autonomous work

COURSE CONTENT:

A. Lectures

- INTRODUCTION TO THE GEOTECTONIC FRAME OF GREECE. Greece within the alpine orogenic system of Tethys. Organization and evolution of the alpine system of Tethys. Orogenetic mechanisms – shallow and deep geodynamic phenomena.
- THE HELLENIC ARC. The current geodynamic -geotectonic regime in the Hellenic arc.
- POST_ALPINE AND MOLASSIC SEDIMENTS OF GREECE (Mollasic formations, age and evolution. Post-alpine basins and formations).
- THE HELLENIDES Alpine and Pre-alpine formations of the Hellenic Arc. Description of Tectonostratigraphic domains and geotectonic units of Greece.
- SYNTHESIS. Models of Paleogeographical Organization of the Greeks. Orogenic circles. Orogenetic evolution of the Hellenides.Basic concepts and methods.

B. Lab exercises

Lab exercises are taught in small groups of students and are graded at the end of the exercise.

PART A: Geological formations, geotectonic units of the External Hellenides, stratigraphic and tectonic structures. Stratigraphic columns. Construction of geological cross-section in excerpts of 1:50,000 geological maps Greek Geological Survey. Geotectonic evolution (5-6 weeks).

PART B: Geological formations, geotectonic units of the Internal Hellenides, stratigraphic and tectonic structures. Stratigraphic columns. Construction of geological cross-section in excerpts of 1:50,000 geological maps Greek Geological Survey. Geotectonic evolution (5-6 weeks).

PART C: Construction of geological cross-section and stratigraphic columns on 1: 50,000 scale maps of the Geological Survey of Greece. (1-2 weeks).

C. Fieldwork exercises

Field Exercises (Outdoor): TWO SINGLE-DAY FIELD EXERCISES in selected areas of Greece: Geological Formations, Geotectonic Units, Structures, and Evolution.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

[1] I.S.: Incoming students (e.g. ERASMUS Student)

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

– Use of ICT in teaching (lectures, lab exercises, fieldwork).
– Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	39 hours
Practice exercises	52 hours
Fieldwork	19 hours
Tutorials	- hours
Essey writing	- hours
Autonomous study	10 hours
Final assessment preparation	30 hours
Total student's effort	**150** hours

ASSESSMENT METHODS AND CRITERIA:

The assessment process is conducted, either with progressive exams in separate sections of the course content or with the final examination of the entire course material which includes:

I. LECTURES (**50%**) (summative)

- Oral exams or
- Written Exam with Short Answer Questions and Multiple Choice Test and/or

II. LAB EXERCISES (**40%**) (formative, summative)

Written exam with Solving Exercises and Problems

II. FIELD EXERCISES (**10%**) (formative, summative)

- Oral examination in the field and with evaluation of required Report or Essay

The evaluation criteria of the course and the participation rates are described in the Chapter «3.3 Evaluation Criteria» of this syllabus and student handbook.

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- Papanikolaou D.J., (2015) The Geology of Greece, 443pp Patakis Publications

II. ADDITIONAL READING

- Katsikatsos, G.,. 1992. Geology of Greece, Papasotiriou Publications, 451 pp.
- Koukouvelas Ioannis Geology of Greece Liberal Books, 368pp.
- Mountrakis D.M., (2010), Geology and Geotectonic evolution of Greece, University Studio Press, 373 pp.

III. RELATIVE JOURNALS

- International Journal of Earth Sciences, Springer
- Tectonophysics, Elsevier
- Tectonics, AGU Publications
- Geological Society of London Special Publications

WEBPAGE (URL):

http://eclass.uoa.gr/courses/GEOL113
http://opencourses.uoa.gr/courses/GEOL14/

Y6201 APPLIED AND ENGINEERING SEISMOLOGY

Instructors

Lectures: Prof. N. Voulgaris - Assoc. Prof. G. Kaviris - K. Pavlou, Laboratory Teaching Staff

Lab. Training: K. Pavlou, Laboratory Teaching Staff, - Prof. N. Voulgaris - Assoc. Prof. G. Kaviris -

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 6th

TYPE: **MANDATORY /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Practical Exercises & Laboratory work and exercises

2 hours of lecturing and 2 hours laboratory work, exercises and field exercises per week, 6 ECTS credits.

Prerequisites:

Y1202 Physics [recommended]
Y3203 Seismology [recommended]
Y4202 Geophysics [recommended]

Language of instruction and Assessment: Greek [1]
Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

Upon successful completion of the course, the student:

- **Recognizes** the importance of seismological research as a basic tool for investigating the structure of the earth's crust, seismic planning and seismic risk mitigation.
- **Describes** the basic principles of Engineering Seismology.
- **Distinguishes** the basic methods that compose modern seismological research.
- **Applies** modern methodologies for collecting, managing, processing, analyzing and evaluating seismological data in order to maximize their utilization.
- **Calculates** all the seismic parameters that characterize an earthquake, while quantifying and minimizing the errors.
- **Evaluates** the different methods of seismic hazard assessment and acquires the necessary knowledge to select the best one per case.
- **Distinguishes** the applications of Engineering Seismology in the fields of seismic design, prevention and minimization of impacts, given the high seismicity of Greece.

Generic Competences:

- Ability to apply knowledge in practical situations
- Ability to plan and manage time
- Ability to search for, process and analyse information with the use of necessary technologies
- Oral and written communication of scientific issues

[1] I.S.: Incoming students (e.g. ERASMUS Student)

- Ability to undertake research at an appropriate level
- Autonomous work
- Information and Communication Technology (ICT) skills

COURSE CONTENT:

A. Lectures

- Basic principles for the design of seismic networks and arrays.
- Digital data acquisition and archiving.
- Processing and analysis of digital waveforms.
- Design, compilation and implementation of filters.
- Spectral analysis, calculation of seismic moment. Seismic source time function, rupture modes and seismic radiation.
- Calculation of seismic parameters and velocity models. Basic principles of passive seismic tomography.
- Seismotectonic analysis.
- Recording instruments and strong motion ground characteristics.
- Analysis of accelerograms. Calculation of maximum and spectral ground parameters.
- Seismic Hazard. Vulnerability. Seismic Risk. Seismic hazard assessment methodologies.
- Antiseismic regulations.
- Estimation of soil response to strong seismic motion. Local site conditions.
- Objectives, Content and Methodologies for the elaboration of Microzonation studies.
- Basic stages of seismological studies (Seismic Hazard Studies – Microzonation Studies).

B. Practical Exercises (include data analysis and interpretation using specialized computer software and, preparation of a report).

PART A': Processing of digital seismograms (correction of zero level, application of bandpass filter) for the calculation of basic seismic parameters (arrival times, epicentral distance, back-azimuth, origin time). Compilation of travel time curves and Wadati diagram to determine the apparent velocity of P and S waves, Vp/Vs ratio and Poisson's ratio

PART B': Determination of microseismic hypocenter using the HYPO algorithm (Geiger method).

PART C': Computer -aided spectral analysis and calculation of earthquake magnitude.

PART D': Computer -aided determination of earthquake focal mechanism.

PART E': Determination of the Gutenberg–Richter relationship constants by the use of extreme values method.

PART F': Determination of the response of surface soil formations, through microtremor using the Horizontal to Vertical Spectral Ratio method.

PART G': Analysis of accelerograms

PART H': Management and Visualization of Seismological Data in ArcGIS

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	26 hours
Practice exercises	26 hours
Fieldwork	-
Tutorials	-
Essey writing	26 hours
Autonomous study	52 hours
Final assessment preparation	20 hours
Total student's effort	**150** hours

ASSESSMENT METHODS AND CRITERIA:

The assessment process is conducted in Greek (there is the possibility of examination in English for Erasmus students),.

The final grade is formed by a series of tests which include:

I. THEORY: **50% of the total grade**

- **Final written examination** (**50% of the total grade**) (summative).

II. PRACTICE EXERSISES: **50% of the total grade**

- A. **Written assignments/activity reports** on practice exercises. (formative)
- B. **Final written exam** on practice exercises at the end of the semester consisting of a mixture of multiple-choice and short answer questions. (summative)

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- General seismology vol. B, A. Tselentis [Code EUDOXUS: 77118155], in Greek
- Introduction to seismology. Papazachos B.C., G.F. Karakaisis, P.M. Chatzidimitriou. [Code EUDOXUS: 11254], in Greek

II. ADDITIONAL READING

- I I. Kassaras and G. Kaviris, 2017. Laboratory Seismology, 268 pp., Athens. Available in e-class, in Greek
- Bormann, P. (Ed.) (2012). New Manual of Seismological Observatory Practice (NMSOP-2), IASPEI, GFZ German Research Centre for Geosciences, Potsdam; http://nmsop.gfz-potsdam.de; DOI:10.2312/GFZ.NMSOP-2 urn:nbn:de:kobv:b103-NMSOP-2

III. RELATIVE JOURNALS

- Bulletin of the Seismological Society of America, SSA Journals
- Geophysical Journal International, Oxford University Press
- Journal of Geophysical Research, AGU Publications
- Physics of the Earth and Planetary Interiors, Journal, Elsevier
- Tectonophysics, Journal, Elsevier

WEBPAGE (URL):

http://eclass.uoa.gr/courses/GEOL233

Y6202 HYDROGEOLOGY

Instructors

Lectures: Assist. Prof. E. Skourtsos

Lab. Training: Assist. Prof. E. Skourtsos – E. Andreadakis, Laboratory Technical Staff – E. Kapourani, Laboratory Technical Staff – C. Filis, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 6th

TYPE: **MANDATORY /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Lab exercises, Fieldwork

2 hours of lecturing and 4 hours of practical exercises per week, 6 ECTS credits.

Prerequisites:

Y5204 Geology of Greece [recommended]

Language of instruction and Assessment: Greek [1]

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences: It is the basic course that negotiates the appearance, flow, storage, exploitation, management and protection of groundwater as well as its connection with surface water. After the successful completion of the course, laboratory exercises and field trips, the student:

- Understands the Water Cycle and determines the parameters involved in the equation of the Hydrological Balance that quantifies the water cycle (atmospheric precipitation, evapotranspiration, surface runoff, infiltration).
- Describes and classifies rocks and geological formations related to their permeability and the ability to store and transmit groundwater.
- Understands, defines and formulates what aquifers are, the types of aquifers, the basic hydraulic properties of aquifers (porosity, effective porosity hydraulic head, hydraulic conductivity, transmitivity, storage coefficient), and the laws of groundwater flow.
- Applies basic techniques for calculating hydraulic parameters and understands their importance for solving various hydrogeological problems.
- Understands everything related to and affects the quality of groundwater, determines the chemical composition of groundwater, evaluates its quality and applies techniques and methodologies for assessing and presenting the quality characteristics of water and its suitability for various uses.
- Collects, combines and evaluates a series of geological, hydrogeological, structural, hydrological, geophysical data and data related to the qualitative characteristics of water, the change in groundwater level, test pumps, and synthesizes the data and observations with the aim of understanding the hydrogeological conditions of an area and solving hydrogeological problems.

With all the above, the student now acquires all the knowledge that allows him to satisfactorily answer the following questions:

- What is the purpose of Hydrogeology
- Where there is underground water
- What is its quantity
- What is its quality
- How both the quality and quantity of groundwater can be preserved
- How the "wise" management of water resources is done

Generic Competences:

- Ability to search for, process and analyse information with the use of necessary technologies
- Ability to apply knowledge in practical situations
- Promote free, creative and inductive thinking
- Ability to plan and manage time
- Autonomous work and ability to work in a team
- Decision making
- Information and Communication Technology (ICT) skills

COURSE CONTENT:

A. Lectures

1. Purposes and objects of hydrogeology. Hydrological cycle (Water Cycle). Analysis of the parameters of the Water Cycle (Atmospheric precipitation. Runoff, Evaporation, Evapotranspiration, Infiltration).
2. Hydrogeological behavior of geological formations. Types of aquifers. Hydraulic head - hydraulic conductivity. Darcy's law. Storage and Trasmitivity of aquifers. Piezometric maps.
3. Pumping works – Pumping wells
4. Flow of groundwater in the pumping wells. Pumping Tests: their interpretations and methodologies for calculating hydraulic parameters.
5. Hydrogeological balance.
6. Springs. Thermometallic springs and hydrothermal fields. Karst springs and coefficient of sterilization.
7. Surface and underground hydrogeological research.
8. Basic concepts of hydrochemistry. Quality of groundwater. Pollution of groundwater. Penetration of seawater. Artificial enrichment of aquifers.
9. Principles of rational management of groundwater.
10. Basic concepts of karst hydrogeology, Isotopic hydrology and traces.
11. Computers and their use in Hydrogeology.

B. Lab Exercises

- Exercises for calculating the parameters of the hydrological balance equation
- Exercises for calculating water infiltration from atmospheric precipitation into the aquifers
- Exercises to understand Darcy's law, hydraulic gradient, hydraulic conductivity and the flow rate of groundwater
- Exercises for calculating the hydraulic parameters of aquifers by processing, (using different methodologies and for different conditions) data derived from pumping tests

[1] I.S.: Incoming students (e.g. ERASMUS Student)

- Exercises related to the analysis of the geological structure of an area and the understanding of the mechanism of operation of the springs
- Exercises to assess the Hydrogeological balance, groundwater reserves and inventory management
- Synthetic exercises of geological and hydrogeological interest
- Exercises related to the assessment of groundwater quality and the presentation and interpretation of hydrochemical analyses

C. Field exercises:

- One-day field trip in areas of Central and Eastern Peloponnese, (Environmental hydrogeology – Modern and ancient hydraulic works for water supply – Karst – Springs, coastal brackish springs – Measurement of spring flow – on-site collection of hydrochemical parameters using portable instruments and devices – contribution of geological structure to the movement and storage of groundwater – applications of isotopic hydrology).
- Where appropriate, monitoring of drilling operations for water boreholes.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	26 hours
Practice exercises	52 hours
Fieldwork	12 hours
Tutorials	hours
Essey writing	20 hours
Autonomous study	20 hours
Final assessment preparation	20 hours
Total student's effort	**150** hours

ASSESSMENT METHODS AND CRITERIA:

The assessment process is conducted, either with progressive exams in separate sections of the course content or with the final examination of the entire course material which includes:

I. LECTURES (**40%**)

- Oral Examination (formative, summative)and/or
- Written Exam with Short Answer Questions and Multiple Choice Test (formative, summative) and/or
- Written Exam with Extended Answer Questions

II. LAB EXERCISES (**50%**)

- Written exam with Solving Exercises and Problems (formative, summative)

III. FIELD EXERCISES (**10%**)

- Oral examination in the field and with evaluation of deliverables of required Work or Report (formative, summative)

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- Voudouris Kostas S., 2016, Environmental Hydrogeology. Groundwater and Environment, [Ref. EUDOXUS: 18549069]
- Voudouris Kostas S., 2017, Exploitation & Management of Groundwater, [Ref. EUDOXUS: 112690244]

II. ADDITIONAL READING

- Appelo J. A. C. & Postma D., 2005, Geochemistry, Groundwater and Pollution, 2nd ed., by A.A. Balkema Publishers, Netherlands, ISBN: 04 1536 428 0Bonacci O.: Karst Hydrology with special reference to the Dinaric Karst, 1987, by Springer-Verlag, Berlin, ISBN 3-540-18105-9
- Driscoll G. F., 1989, Groundwater and Wells, 2ed ed., by Jonson Filtration Systems Inc, ISBN: 0-9616456-0-1
- Fetter C. W., 2001, Applied Hydrogeology, 4th ed., by Prentice-Hall, Inc. Upper Saddle River, New Jersey 07458, ISBN: 0-13-088239-9
- Freeze R. A. @ Cherry A. J., 1979, Groundwater, by Prentice-Hall, Inc. London, ISBN: 0-13-365312-9
- Hounslow W. A., 1995, Water Quality Data, Analysis and Interpretation, by CRC Press, Taylor & Francis, ISBN: 978-0-87371-676-5
- Kallergis A. G., 1999, Applied - Environmental Hydrogeology. Second edition, TEE Publications, Athens, Volume A and B., ISBN: 960-7018-70-2
- Kresic N & Stevanovic Z. 2010, Groundwater Hydrology of Springs, by Elsevier Inc. ISBN:978-1-85617-502-9
- Kruseman P.C. @ N. A. de Ridder, 1994, Analysis and Evalyation of Pumping Test Data. 2nd ed., by International Instsitute for Land Reclamation and Improvement, Netherlands, ISBN: 90 70754207
- Lekkas S. & Ap. Alexopoulos, 2009: Introduction to Hydrogeology. Student notes of the University of Athens
- Todd K. D. @ Mays W. L., 2005, Groundwater Hydrology, 3nd ed., by Jon Wiley & Sons, ISBN: 0-471-45254-8
- U.S. Department of the Interior, 1981, Ground Water Manual, U.S Government Printing Office

III. RELATIVE JOURNALS

- Hydrogeology Journal, Official Journal of the International Association of Hydrogeologists
- Groundwater
- Water
- Water Resources Research

- Hydrogeology Journal, Official Journal of the International Association of Hydrogeologists
- Groundwater
- Water
- Water Resources Research

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL147

Y6203 GEOLOGICAL MAPPING - FIELD COURSE

Instructors:

Field course: Prof. S. Lozios – Assoc. Prof. H Kranis – Assoc. Prof. E. Skourtsos – Assist. Prof. K. Soukis – Assoc. Prof. E. Vassilakis – Prof. Emeritus Ap. Alexopoulos – Prof. M. Triantaphyllou – Prof. I. Alexopoulos – Assoc. Prof. M. Hatzaki – V. Antoniou, Laboratory Teaching Staff – E. Scamba, Laboratory Teaching Staff – Ch. Filis, Laboratory Teaching Staff – E. Moustaka, Laboratory Teaching Staff – I. Megremi, Laboratory Teaching Staff – E. Andreadakis, Laboratory Technical Staff – E. Kapourani, Laboratory Technical Staff – D. Theocharis, Laboratory Teaching Staff – I. Bantekas, Laboratory Technical Staff.

Lab training and Lectures: Prof. S. Lozios – Assoc. Prof. H Kranis – Assoc. Prof. E. Skourtsos – Assist. Prof. K. Soukis – Assoc. Prof. E. Vassilakis – Prof. Emeritus Ap. Alexopoulos – Prof. M. Triantaphyllou – Prof. I. Alexopoulos – Assoc. Prof. M. Hatzaki – V. Antoniou, Laboratory Teaching Staff – E. Scamba, Laboratory Teaching Staff – E. Moustaka, Laboratory Teaching Staff.

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 6th

TYPE: **MANDATORY /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Practical exercises, Fieldwork (*The weekly teaching hours include 9-day fieldwork training with 10-hour work per day)

2 hours of lecturing and 2 hours of practical exercises per week, 9-ήμερη άσκηση υπαίθρου, 6 ECTS credits.

Prerequisites:

Y2201 Introduction to Geology
Y3205 Structural Geology and Tectonics
Y5204 Geology of Greece
Y3206 Biogeosciences-Principles of Micropalaeontology
Y5202 Stratigraphy
Y3202 Petrology Of Sedimentary Rocks
Y4201 Petrology of Metamorphic Rocks
Y3201 Igneous Rocks-Magmatic Processes
Y2204 GIS and Introduction to Remote Sensing

Language of instruction and Assessment: Greek
Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences: It is a synthetic inter-disciplinary course that deals with field work and the techniques of Geological Mapping and the necessary procedures for the composition of a typical geological map, or a specialized type. Upon suceesful completion of the course the student is able to:

- Understand and apply the methods of safe field work and safely use all the necessary equipment.
- Recognize and describe the natural relief and correlate it with the topographic map.
- Recognize, describe, and classify the various rock and formation types, based on their identifiable characteristics in the field (i.s. paleontological, stratigraphic, sedimentological, mineralogical, petrological, etc.)
- Recognize, describe, and classify the various types of geological contacts, based on their identifiable characteristics in the field.
- Recognize and describe the 3D geological structure and relationship among cartographic units, geological formations, and geotectonic units.
- Recognize, describe, determine, and classify the brittle or ductile deformational structures formed during crustal / lithospheric deformation, at all outcrop scales (micro- to macro-scale).
- Understand, interpret, and explain, in space and time, the geotectonic processes and mechanisms responsible for rock deformation and the present configuration of the geological structures (geological history and evolution).
- Comprehend and apply the methods for field data collection (e.g., structural measurements, sample collection) for further laboratory analysis.
- Understand and apply the methods of field data collection and recording on the field notebook and on the available topographic information (i.e., maps, etc.).
- Comprehend an apply the techniques of geological mapping (both traditional; and digitally-assisted) with or without the use of electronic devices (smartphones, tablets, UAVs) and
- Compose the geological map, by overlaying all necessary geological structural, etc. data on the available topographic background (i.e. map, satellite imagery, etc.).
- Collect, combine, apply, correlate, and evaluate all the collected field data required in various applied geological topics, such as hydrogeology, oil and gas exploration, ore geology, technical works, all of which demand the composition of a detailed geological map.

Generic Competences:

- Ability to search for, process and analyse information with the use of necessary technologies
- Autonomous work
- Oral and written communication of scientific issues
- Ability to work in an interdisciplinary context
- Ability to apply knowledge in practical situations
- Ability to work in a team
- Promote free, creative and inductive thinking
- Adapt to and act in new situations and cope under pressure
- Commitment to conservation of the environment
- Ability to plan and manage time

COURSE CONTENT:

A. Lectures, accompanied by Practice Exercises

I.S.: Incoming students (e.g. ERASMUS Student)

- GEOLOGICAL MAPPING OUTLINE (Field work and geological mapping; map and observation scales, the geological map: types and categories.
- FIELD WORK EQUIPMENT, ORGANIZATION, SAFETY AND CONDUCT (Equipment necessary for field work, topo maps, satellite images, aerial photographs; field notebook. Health, Safety and Environment (HSE) issues during field work.
- THE FIELD NOTEBOOK AND THE GEOLOGICAL MAP (Field observations; structure and layout of field notebooks; types and categories of geological maps; traditional field notebook vs. tablet PC).
- THE USE OF GEOLOGICAL COMPASS (Types of compasses, settings, measurements of geological and morphological items, hits and tips, Apps, and smartphones vs traditional geological compass).
- TOPOGRAPHC MAPS AND LANDFORMS (Introduction to topography; the topographic map, relief terminology).
- FIELD RECOGNITION OF ROCK TYPES AND GEOLOGICAL FORMATIONS (Rock types, formations, cartographic units).
- THE METAMORPHIC ROCKS OF THE MAPPING AREAS.
- IDENTIFYING FOSSILS, AGES, DEPOSITION ENVIRONMENTS AND FACIES IN THE FIELD.
- RECOGNITION AND MAPPING OF GEOLOGICAL BOUNDARIES (Types of geological boundaries and contacts; field-based recognition of the geometry of geological boundaries; Mapping techniques; Use of satellite and aerial imagery.
- FIELD RECOGNITION OF FAULTING STRUCTURES (Criteria of fault detection, recognition and mapping, fault kinematic criteria.
- FIELD RECOGNITION OF FOLDING STRUCTURE (Types of macro-folds; open, tight, isoclinal recumbent).
- RECOGNITION AND VISUALISATION OF STRUCTURAL DATA AND FORMS (Primary and secondary structures, visualization of structure on maps).
- GROLOGICAL STRUCTURE OF ANO DOLIANA AND MT HYMETTOS AREAS – REPRESENTATIVE GEOLOGICAL CROSS-SECTIONS.
- FIELD SAMPLE COLLECTION (Sampling strategy, equipment, sample collection, recording, transport – safety and limitations).
- DATA EVALUATION AND COMPOSISITION OF A GEOLOGICAL MAP (data evaluation, petrographic analyses and sample determination, final synthesis, and map composition.
- MODERN (DIGITAL) TECHNOLOGY IN GEOLOGICAL MAPPING (Geographical Information Systems, Digital Map composition, digitally-assisted fieldwork).
- GEOLOGICAL MAPPING – GEOLOGICAL STRUCTURE AND HYDROGEOLOGICAL CONDITIONS.
- GEOPHYSICAL INVESTIGATIONS AND GEOLOGICAL STRUCTURE DETERMINATION.
- TECHNICAL REPORTS (City planning, technical works, environmental remediation).
- NATURAL RESOURCES, PETROLOGICAL DETERMINATIONS AND CHEMICAL ANALYSES DATA.
- CLIMATE CRISIS, RES AND ENVIRONMENTAL PROBLEMS.

B. Field course:

9-DAY FIELD COURSE ANO DOLIANA, ARCADIA, CENTRAL PELOPONNESE (or at MT HYMMETOS, ATTICA), including daily field work and roundup evening discussions and assessment (up to 10 hrs/day); field data evaluation and laboratory analyses.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	20 hours
Practice exercises	14 hours
Fieldwork	80 hours
Tutorials	- hours
Essey writing	15 hours
Autonomous study	10 hours
Final assessment preparation	11 hours
Total student's effort	**150** hours

ASSESSMENT METHODS AND CRITERIA:

The assessment process is conducted, either with progressive exams in separate sections of the course content or with the final examination of the entire course material which includes:

I. LECTURES (**10%**)

- Oral Examination (formative, summative)

II. LAB EXERCISES (**10%**)

- Written exam with Solving Exercises and Problems (formative, summative)

II. FIELD EXERCISES (**80%**)

- Oral examination in the field and with evaluation of deliverables of required Work or Report (formative, summative)

Auxiliary material (questions, exercises, etc.) for the exams is posted on the online **e-Class** platform (https://eclass.uoa.gr/courses/GEOL146/).

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- LOZIOS, S., SOUKIS, K. & ANTONIOU, V., 2015, **Geological Mapping and Field Exercises**, Academic textbooks (Kallipos), Hellenic Academic Libraries, 280 p. (**e-book:** PDF, e-pub, in Greek)[EUDOXUS code: 320091].

II. ADDITIONAL READING

- BENNISON, M., G., OLVER, A., P. & MOSELEY, A., K., C., 2011, **Introduction to Geological Structures and Maps**, 168p., Routlege.
- COE, L. A. (editor), ARGLES, W. T., ROTHERY, A. D., SPICER, A. R., 2010, **Geological Field Techniques**, 323p., Wiley-Blackwell.
- FRY, N., 1997, **The Field Description of Metamorphic Rocks**, 128p., John Wiley & Sons.
- JERAM, D. & PETFORD, N., 2011, The Field Description of Igneous Rocks (Geological Field Guide), 238p., Wiley-Blackwell.
- LISLE, J. R., BRABHAM, P., BARNES, J., 2011, **Basic Geological Mapping**, 217p., Wiley-Blackwell.

- Mc CLAY, K., 1991, **The Mapping of Geological Structures**, 168p., Wiley-Blackwell.
- TRANOS, M., 2011, Geological Mapping – Geological Maps and Geological Cross-Sections, 306 p., University Studio Press. (In Greek)
- TUCKER, E. M., 2011, Sedimentary Rocks in the Field: A Practical Guide (Geological Field Guide), 275p., Wiley-Blackwell.

III. RELATIVE JOURNALS

- Journal of Maps, Online ISSN: 1744-5647, Taylor & Francis Group.

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL146

http://opencourses.uoa.gr/courses/GEOL100/

Y6205 GEOLOGY OF MAGMATIC AND HYDROTHERMAL ORE DEPOSITS

Instructors

Lectures: Prof. S. Kilias –Assoc. Prof. H. Vasilatos

Lab. Training: Prof. S. Kilias –Assoc. Prof. H. Vasilatos – A. Papoutsa, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 6th

TYPE: **MANDATORY /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Lab exercises, Fieldwork

2 hours of lecturing and 2 hours of practical exercises per week, 6 ECTS credits.

Prerequisites: [recommended]

Y2201 Introduction to Geology -
Y2202 Systematic Mineralogy - Mineral Identification
Y3201 Igneous Rocks-Magmatic Processes
Y3202 Petrology Of Sedimentary Rocks
Y4201 Petrology of Metamorphic Rocks
Y4203 Geochemistry
Y5202 Stratigraphy

Language of instruction and Assessment: Greek [1]
Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

By the end of the course, the student will be able:

- To **define** the fundamental concepts of the occurrence of non-exploitable mineralization and the exploitable deposit, and the classification criteria into deposit types.
- To **describe** the most important magmatic and hydrothermal deposits worldwide and in Greece.
- To **apply** the principles of General Geology, Mineralogy, Petrology, and Geochemistry to understand the space-time distribution in the crust, and the genetic processes and mechanisms for "Magmatic", "Magmatic-Hydrothermal" and "Hydrothermal" deposit types (MAGM/HYDRO).
- To **collect, interpret** and **evaluate** macroscopic and microscopic characteristics of samples.
- To **select** and **apply** the appropriate laboratory methods for the solution of deposit-related problems, and the formulation of genetic models, of magm/hydro deposits.
- To **combine** and **evaluate** the mineralization data for decision-making regarding the exploration and exploitation of mineral raw materials, taking in account the protection of the environment and the sustainable development.

In addition:

[1] I.S.: Incoming students (e.g. ERASMUS Student)

- **Realize** the importance and impact of the exploitation of mineral resources to the society, economic growth and sustainability.

Generic Competences:

- Ability to search for, process and analyse information with the use of necessary technologies
- Autonomous work
- Oral and written communication of scientific issues
- Ability to apply knowledge in practical situations
- Ability to undertake research at an appropriate level
- Promote free, creative and inductive thinking
- Commitment to conservation of the environment

COURSE CONTENT:

A. Lectures.

Lectures are divided in three thematic entities:

- **Non-economic mineralization, and economic ore deposits.** Definition of Reserves and Classification systems. Importance of ore deposits in the world economic and cultural evolution, and mineral industry in everyday life and modern technologies. Legal distinction of types of deposits based on Greek legislation. Geologic and geotectonic environment of ore deposits formation and their distribution in the earth's crust. Genetic models, value chains and stages of mineral exploration programs for ore deposits.
- **"Magmatic Ore deposits" - Genetic Models.** Fundamental petrologic and geochemical formation processes of magmatic ore deposits. Chromite ore deposits. Ni–Cu sulphide deposits in basic and ultrabasic rocks. Platinum group metal (PGM) ore deposits. Magmatic and hydrothermal rare earth element (REE) ore deposits. Ore deposits of hydrothermal magnesite in ultrabasic rocks.
- **"Magmatic-Hydrothermal" and "Hydrothermal Ore Deposits" - Genetic Models.** Fundamental hydrothermal processes. Genesis of Magmatic-hydrothermal and Hydrothermal ore deposits formed around igneous centres: Skarn-type and carbonate-replacement ores. Porphyry-Cu systems and porphyry-type Cu-Au-Mo ores. High sulfidation and low-sulfidation, epithermal Cu-Au–Ag, and Au–Ag, ore deposits. Genesis of ore deposits on the seafloor: Fundamental principles of hydrothermal seafloor metallogeny.

B. Lab exercises:

A: Metallographic microscopy of sulphide minerals.
B: Macroscopic study, identification and description of hand specimens from magmatic and hydrothermal ores.
C: Combined exercises of macroscopic and microscopic investigation of ores and host-rocks.
D: Correlation between geologic, mineralogical, petrological and geochemical features of magm/hydro deposit types, and their host-rocks.

C. Fieldwork

One-day exercise in the field: (1) Skarn-type metal-sulphide and Fe-oxide mineralization, Porphyry-type Mo mineralization, carbonate-replacement Pb-Zn-Ag ore deposits in the Lavrion area. Identification and analysis of Metallogenic Characteristics (MC), i.e., lithologic, tectonic, morphologic, mineralogic characteristics, ores, gangue minerals. Written Report on the detailed description of the MC, and formulation of the genetic model of the ores in the visited area, with the aid of data from the literature.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

– Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

– Use of ICT in teaching (lectures, lab exercises, fieldwork).
– Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	24 hours
Practice exercises	24 hours
Fieldwork	12 hours
Tutorials	–
Essey writing	–
Autonomous study	48 hours
Final assessment preparation	42 hours
Total student's effort	**150** hours

ASSESSMENT METHODS AND CRITERIA:

I. LECTURES, LABORATORY & FIELD EXERCISES (**60%**) (Summative)

- **Oral Examination of the Syllabus and Practical Examination of Hand Specimens**

  A variety of evaluation techniques are used:

  - **Questions covering the entire curriculum:** The achievement or not of the learning objectives and especially the effort made by the student to achieve them is evaluated
  - **Judgement questions**: The ability of students to think, organize, connect knowledge and express themselves in their own words is evaluated, always using the appropriate scientific terminology.
  - **True or false**: To increase the credibility of this type of question, students are asked to explain and justify their answer. Supporting material (questions, exercises, etc.) for the exams is posted on the electronic platform e-Class (https://eclass.uoa.gr/courses/GEOL543/).

Possible questions or topics for oral examination are analyzed in detail to students during lectures, laboratory exercises or outdoor exercises.

Auxiliary material for the examinations is posted on the electronic platform e-Class

(https://eclass.uoa.gr/courses/GEOL543/).

II. LAB EXERCISES (**20%**) (Formative, Summative)

- Short written examination at the end of each laboratory module (10%).
- Elaboration of projects based on the material of the Laboratory (10%).

III. FIELD EXERCISES (**20%**) (Summative)

- Evaluation of the field notes and individual field report.

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- F. Pirajno, 2009. **Hydrothermal Processes and Mineral Systems**, [EUDOXUS code: 73241410]
- W. L. Pohl, 2011. **Economic Geology – Principles and Practice,** Willey - Blackwell. [EUDOXUS code: 80504203]
- R. Taylor, 2009. **Ore Textures**, Springer [EUDOXUS code: 73249091, electronic resource PDF]

II. ADDITIONAL READING

- J. Ridley, 2013. **Ore Deposit Geology,** Cambridge University Press
- L. Robb, 2004. **Ore Forming Processes,** Blackwell Publishing
- A. M. Evans, 1995. **Introduction to Mineral Exploration,** Blackwell Science

III. RELATIVE JOURNALS

- Economic Geology Journal, Society of Economic Geologists
- Mineralium Deposita-International Journal for Geology, Mineralogy and Geochemistry of Mineral Deposits-Springer Link
- Ore Geology Reviews, Elsevier
- Ore and Energy Resource Geology, Elsevier

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL543

Y7201 ENVIRONMENTAL GEOLOGY

Instructors

Lectures: V. Antoniou, Laboratory Teaching Staff – Retired Prof. E. Lekkas –Assist. Prof. E. Kelepertzis– E. Andreadakis, Laboratory Technical Staff

Lab. Training: V. Antoniou, Laboratory Teaching Staff – Retired Prof. E. Lekkas –E. Andreadakis, Laboratory Technical Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 7th

TYPE: **MANDATORY /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Practical exercises, Fieldwork

2 hours of lecturing and 2 hours of practical exercises per week, (1 τμήμα), 6 ECTS credits.

Prerequisites: [recommended]
Y2201 Introduction to Geology
Y6203 Geological Mapping - Field Course

Language of instruction and Assessment: Greek [1]
Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

The course covers the basic principles of environmental geology and its applications to solve important environmental problems of the planet. On completion of the course the student will have the following learning outcomes defined in terms of knowledge and skills:

- **distinguish** the philosophical, theoretical, and practical approaches for the subject of Environmental Geology,
- can **recognize**, **describe**, **identify** and **classify** the geo- as well as the anthropogenic environment,
- **summarize** basic principles of environmental law and international environmental policies.
- can **collect**, **compare**, **combine**, **apply**, **synthesize** and **evaluate** the data required for the various environmental issues, and **use** the necessary technologies,
- can **combine** data, **evaluate** and **communicate** possible solutions to environmental problems,
- **understand** the multi-thematic dimension of the subject.
- **identify** and **resolve** problems in real time in areas of high environmental

Generic Competences:

- Ability to search for, process and analyse information with the use of necessary technologies
- Autonomous work

[1] I.S.: Incoming students (e.g. ERASMUS Student)

- Ability to apply knowledge in practical situations
- Decision making
- Promote free, creative and inductive thinking
- Commitment to conservation of the environment
- Information and Communication Technology (ICT) skills

COURSE CONTENT:

A. Lectures

Philosophical Principles/Fundamental Concepts about the Environment: Environmental ethics - economic and political systems - aesthetic preference and judgment - impact of religion - the earth as a closed system – earth's limited resources - intensity and frequency of natural processes - natural disasters - land use and water resources planning - importance of geosciences

Institutional framework - Environmental management / licensing (authorisation): Institutional / Legislative framework - Waste management institutional framework - Water institutional framework - Atmospheric pollution - Natural Environment protection - Environmental licensing of infrastructure projects.

Disposal – Waste management: Waste management - hazardous chemical waste management - radioactive waste management - ocean disposal.

Assessment of natural environment - Land Uses: Land use planning - geoenvironmental mapping - emergency response planning - environmental impact study - zoning - landscape aesthetics.

Energy and the environment: Lignite - oil and natural gas - non-renewable fuels - nuclear energy - geothermal energy - renewable energy sources - energy and water requirements – hydrogen.

Water resources management: History of water management - Sustainable development and introduction to water resources management - Water pollution and monitoring - Water resources protection.

Impact of Disasters on the Environment: Introduction to the theory of Disaster Management: Basic Terminology, Hazard, Vulnerability, Risk, the Cycle of Disaster Management, Disaster Classification - Manmade disasters and environmental impact: Environmental Impact of human activity, environmental impact of manmade disasters (Technological disasters etc) - Natural disasters and environmental impact: Geological disasters, Hydrometeorological disasters, Biological threats, NaTech - Emergency management and Environmental Impact Assessment.

Soil pollution: Soil as a natural resource – soil loss – soil contamination by potentially toxic elements – natural and anthropogenic sources of elements

Water system pollution: Water pollution – point and diffuse sources of pollution – anthropogenic sources of pollution – water pollutants – acid drainage – eutrophication – water salinization - hexavalent chromium.

Air pollution: Structure and composition of atmosphere – air pollutants and classification – particulate matter – sources of aerosols – SO_2 – NO_x – Chemistry of rainwater – acid rain - photochemical smog – greenhouse gases.

Environmental Risk Assessment: Methodology – Risk characterization – Human health risk assessment - Consequence of pollutants on human health.

B. Practical Exercises

- Environmental quality of water systems
- Environmental soil quality
- Air pollution
- Human health risk assessment
- Tracing the origin of open water pollution in the Evrotas river
- Impact distribution in Vrisa Lesvos from the earthquake of 12-6-2017
- Simulation of an industrial accident in Bhopal
- Risk assessment - Environmental rehabilitation of Uncontrolled Waste Disposal Areas
- Zonation of Sanitary Burial Areas
- Energy and Climate Change
- Environmental Permission: Mining Drilling Case

C. Fieldwork

- Identification of geographical, geological, climatic, hydrological and hydrogeological characteristics of the area, identification of land uses, approximation of water-irrigation needs.
- Overview of environmental pressures on the atmosphere, soil, and water element as well as identification of natural and man-made hazards.
- Group work with the aim of collecting rural data through the recording of the flood risk in a riverbed with anthropogenic interventions. Development of dynamic discussion among groups.
- Visit to waste disposal and wastewater treatment sites to determine environmental pressures.
- Evaluation of the knowledge acquired through a questionnaire on the e-class platform.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	26 hours
Practice exercises	26 hours
Fieldwork	12 hours
Tutorials	- hours
Essey writing	- hours
Autonomous study	48 hours
Final assessment preparation	38 hours
Total student's effort	**150** hours

ASSESSMENT METHODS AND CRITERIA:

The assessment process is conducted in Greek (there is the possibility of examination in English for Erasmus students), as follows:

I. LECTURES (**50%**) (summative)

- Written Exam with Short Answer Questions and Multiple Choice Test and/or
- Written Exam with Extended Answer Questions

II. LAB EXERCISES (formative)

The final grade for the practical exercises is determined at the end of the semester and includes:

- Questionnaires or small essays to evaluate the exercises carried out during the semester, **at a rate of 40%**.
- **Questionary** to evaluate fieldwork activities, **at a rate of 10%**.

In the case of an unsuccessful result (<5), the students have the possibility to attend the Semester's period exercises.

Auxiliary material (questions, exercises, etc.) for the exams is posted on the online **e-Class** platform (https://eclass.uoa.gr/courses/GEOL132/).

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

II. ADDITIONAL READING

- Lekkas E. (1998) Geology and the Environment. ISBN 960-90329-2-3, 274p. (in Greek). pdf
- Lekkas, E., Andreadakis, E. & Kapourani, E. (2015). Natural and Technological Disasters Impact on the Environment.235p. (in Greek). pdf
- European Environment Agency (2020). The European environment — state and outlook 2020/Knowledge for transition to a sustainable Europe. ISBN 978-92-9480-090-9, doi: 10.2800/96749, 496 p.

III. RELATIVE JOURNALS

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL132

Y7203 APPLIED GEOPHYSICS

Instructors

Lectures: Prof. I. Alexopoulos - Prof. A. Tzanis - Prof. F. Vallianatos

Lab. Training: Prof. I. Alexopoulos - Prof. A. Tzanis - Prof. F. Vallianatos - V. Sakkas, Laboratory Teaching Staff – S. Vassilopoulou, Laboratory Teaching Staff - S. Chailas, Laboratory Technical Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 7th

TYPE: **MANDATORY /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Practical exercises, Fieldwork

3 hours of lecturing and 2 hours of practical exercises per week, (3 τμήματα), 6 ECTS credits.

Prerequisites: [recommended]

Y1202 – Physics
Y3205 - Structural Geology and Tectonics
Y4202 – Geophysics
Y3205 - Engineering Geology
Y6203 - Hydrogeology

Language of instruction and Assessment: Greek

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

Through the successful completion of this lesson, the trainee:

- **Reproduces** the necessary knowledge and skills regarding the different methods of subsurface geophysical investigation applied nowadays.
- **Lists** examples for the identification of several targets (e.g. ores, hydrocarbons, subsurface water) or for technical-geological issues (determination of the mechanical properties of surface geological formations for construction purposes), or even for investigating complex geological structures and geoenvironmental issues.
- **Defines** the conditions, **plans** the geophysical experiment by choosing the appropriate method and **estimates** the expected results.
- **Describes** the basic instrumentation and acquisition field procedures.
- **Applies** the main geophysical methods and techniques for data processing.
- **Discovers** the subsurface "targets", after **corelating** their lithological/geological/geophysical characteristics.
- **Concentrates** on the "discreet resolution" of the geophysical method/technique, since he/she **examines** the dimensions of the target and **adjusts** it with the acquisition procedure.
- **Handles** the combination of geophysical and geological data, **evaluates** and **interprets** the results.

Generic Competences:

- Ability to work in an interdisciplinary context
- Ability to apply knowledge in practical situations
- Decision making
- Ability to search for, process and analyse information with the use of necessary technologies
- Information and Communication Technology (ICT) skills
- Ability to undertake research at an appropriate level
- Ability to be critical and self-critical

COURSE CONTENT:

A. Lectures/seminars

Introduction, basic principles of geophysical prospecting.

Seismic methods. Theory of seismic refraction, reflection, seismic tomography and surface seismic waves. Measurements, processing, evaluation and interpretation. Applications and examples on geoenviromental and geotechnical problems, oil investigation and geodynamics.

Geo-electrical methods. Principles, theory. Vertical and lateral distribution of the electrical resistivity, geoelectrical tomography. Measurements, processing, evaluation and interpretation. Applications and examples on geoenviromental and geotechnical problems etc.

Geo-electromagnetic methods. Propagation and attenuation of electromagnetic fields. EM methods of controlled sources, methods of frequency domain (VLF, HLEM), time-domain (TDEM), Geo-Radar. Measurements, processing, evaluation and interpretation. Applications and examples.

Well-logging. Methodologies, acquisition techniques, processing, evaluation and interpretation. Applications and examples.

Nuclear magnetic resonance method. Principles, theory. Instruments, arrays, data acquisition and processing. Applications and examples.

B. Practical Exercises

Practice exercises are taught in small groups of students and are graded at the end of the exercise. Including processing, evaluation and interpretation of geophysical data with specialized software and report analysis. The trainees present and support assigned projects of engineering and environmental geophysics.

Exercise 1. Transient electromagnetic sounding.
Exercise 2. Ground conductivity.
Exercise 3. Vertical Electrical sounding.
Exercise 4. Geoelectrical profile.
Exercise 5. Electrical resistivity tomography.
Exercise 6. Seismic refraction.
Exercise 7. Seismic refraction tomography.
Exercise 8. Seismic reflection.
Exercise 9. Seismic test in borehole (down-hole, cross-hole).
Exercise 10. Well logging.

C. Fieldwork

Exercise 11. One-day field exercise. It involves demonstration of the geophysical instrumentation and field geophysical measurement techniques and their qualitative processing and interpretation

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

– Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

– Use of ICT in teaching (lectures, lab exercises, fieldwork).
– Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	39 hours
Practice exercises	22 hours
Fieldwork	6 hours
Tutorials	-
Essey writing	-
Autonomous study	44 hours
Final assessment preparation	39 hours
Total student's effort	**150** hours

ASSESSMENT METHODS AND CRITERIA:

The students are evaluated in Greek language (in English for the Erasmus students).

The final degree is based on:

The **written examination** (summative) at the exam periods, regarding the

- (a) theoretical knowledge,
- (b) Laboratory work
- (c) the fieldwork,

With **50%** percentage of the **final degree**, from short-answer questions.

All the **written reports/homework essays of the practical exercises**, with **50% percentage** of the **final degree** (formative, summative).

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- Applied Geophysics, Tselentis Akis, Paraskeyopoulos P. [Κωδ. ΕΥΔΟΞΟΣ: 50659068]
- Papazachos K.,Papazachos V., 2013. «Introduction to Applied Geophysics» [Κωδ. ΕΥΔΟΞΟΣ: 11261]

II. ADDITIONAL READING

- Everett, M.K., 2013. *Near-surface Applied Geophysics*, Cambridge University Press
- Milsom J. & Eriksen A., 2011. *Field Geophysics*, Vol. 36, Wiley - John Wiley & Sons, 287p. ISBN: 978-0-470-74984-5
- Reynolds, J, M., 2011. *An Introduction to Applied and Environmental Geophysics*, 2nd Edition, ISBN: 978-0-471-48535-3.
- Telford, W.M., Geldart, L.P. and Sheriff, 1990, R.E., *Applied Geophysics*, 2nd Edition, Cambridge University Press.

III. RELATIVE JOURNALS

- Geophysics Online ISSN: 1942-2156, Print ISSN: 0016-8033, SEG
- Geophysical Prospecting Online ISSN: 1365-2478, Print ISSN: 0016-8025, EAGE
- Reviews of Geophysics Online ISSN: 1944-9208, Print ISSN: 8755-1209, AGU

- Surveys in Geophysics Online ISSN: 1573-0956, Print ISSN: 0169-3298, Springer

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL249

Y7204 GEOLOGY OF SEDIMENTARY AND SUPERGENE DEPOSITS

Instructors

Lectures: Prof. S. Kilias –Assoc. Prof. H. Vasilatos

Lab. Training: Prof. S. Kilias –Assoc. Prof. H. Vasilatos – A. Papoutsa, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 7th

TYPE: **MANDATORY /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Lab. exercises, Fieldwork

2 hours of lecturing and 2 hours of practical exercises per week, (3 τμήματα), 6 ECTS credits.

Prerequisites: [recommended]

Y2201 Introduction to Geology
Y2202 Systematic Mineralogy - Mineral Identification
Y3201 Igneous Rocks-Magmatic Processes
Y3202 Petrology Of Sedimentary Rocks
Y3205 Tectonic Geology
Y4201 Petrology of Metamorphic Rocks
Y4203 Geochemistry
Y5202 Stratigraphy
Y6205 Geology of Magmatic and Hydrothermal Ore Deposits

Language of instruction and Assessment: Greek [1]
Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

By the end of the course, the students will be able:

- To **describe** the most important sedimentary and supergene deposits worldwide and in Greece.
- To **apply** the principles of General Geology, Mineralogy, Petrology, and Geochemistry to understand the space-time distribution in the crust, and the genetic processes and mechanisms for sedimentary and supergene deposit types.
- To **collect appropriate** samples and to **interpret** and **evaluate** their macroscopic and microscopic characteristics.
- To **select** and **apply** the applicable laboratory methods to resolve deposit-related issues, and to formulate the genetic models for sedimentary and supergene deposits.
- To **combine** and **evaluate** the mineralization data for decision-making regarding the exploration and exploitation of mineral raw materials, taking in account the protection of the environment and the sustainable development.

In addition:

I.S.: Incoming students (e.g. ERASMUS Student)

- **they will have realize** the importance and impact of the exploitation of mineral resources to the society, the economic growth and the sustainability.

Generic Competences:

- Ability to search for, process and analyse information with the use of necessary technologies
- Autonomous work
- Oral and written communication of scientific issues
- Ability to apply knowledge in practical situations
- Ability to undertake research at an appropriate level
- Promote free, creative and inductive thinking
- Commitment to conservation of the environment

COURSE CONTENT:

A. Lectures

Course content consists of the following thematic units:

- **Deposit characteristics and models of sedimentary deposits.** Chemical sedimentation – Banded iron formations (BIF). Clastic sedimentation and concentration of heavy minerals – alluvial deposits (placer). Deposits of Evaporites. Brines. Magnesite deposits
- **Deposit characteristics and Genetic Models of Residual Deposits.** Surface and supergene processes – Fundamental chemical weathering processes. Lateritic deposits Ni-Fe(–Co). Bauxite deposits-Karst Bauxites. The creation and deposit significance of Gossans.
- **Models of Genesis of Industrial Mineral Deposits**. Geology and Genesis of Industrial Minerals Deposits: Perlite, Bentonite, Zeolites, Phosphorites.

B. Lab Exercises:

A: Metallographic microscopy of oxide and hydroxide minerals.
B: Macroscopic study, identification and description of hand specimens from sedimentary and supergene ores.
C: Combined exercises of macroscopic and microscopic investigation of ores and host-rocks.
D: Correlation between geologic, mineralogical, petrological and geochemical features of sedimentary and supergene deposit types, and their host-rocks.

C. Fieldwork

One-day field exercise on Lateritic Ni-Fe–Co) deposits and Bauxite deposits-Karstic Bauxites. Identification and description of metallogenic characteristics (MC) in the field, i.e., lithologic, tectonic, morphologic, mineralogic characteristics of ores – gangue minerals. Written Report on the detailed description of the MC, and formulation of the genetic model of the ores in the visited area, with the aid of data from the literature.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

– Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

– Use of ICT in teaching (lectures, lab exercises, fieldwork).
– Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	24 hours
Practice exercises	24 hours
Fieldwork	12 hours
Tutorials	–
Essey writing	–
Autonomous study	48 hours
Final assessment preparation	42 hours
Total student's effort	**150** hours

ASSESSMENT METHODS AND CRITERIA:

I. LECTURES, LABORATORY & FIELD EXERCISES (**60%**) (Summative)

- **Oral Examination of the Syllabus and Practical Examination of Hand Specimens**

  A variety of evaluation techniques are used:
  - **Questions covering the entire curriculum:** The achievement or not of the learning objectives and especially the effort made by the student to achieve them is evaluated
  - **Judgement questions**: The ability of students to think, organize, connect knowledge and express themselves in their own words is evaluated, always using the appropriate scientific terminology.
  - **True or false**: To increase the credibility of this type of question, students are asked to explain and justify their answer. Supporting material (questions, exercises, etc.) for the exams is posted on the electronic platform e-Class (https://eclass.uoa.gr/courses/GEOL543/).

The possible questions or topics for oral examination are analyzed in detail to students during lectures, laboratory exercises or outdoor exercises.

Auxiliary material for the examinations is posted on the electronic platform e-Class (https://eclass.uoa.gr/courses/GEOL544/).

II. LAB EXERCISES (**20%**) (Formative, Summative)

- Short written examination at the end of each laboratory module (10%).
- Elaboration of projects based on the material of the Laboratory (10%).

III. FIELD EXERCISES (**20%**) (Summative)

- Evaluation of the field notes and individual field report.

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

▪

II. ADDITIONAL READING

▪

III. RELATIVE JOURNALS

▪

In addition to the bibliography posted on the special website of the course,

SUGGESTED LITERATURE:

- Pohl, Economic Geology – Principles and Practice. Willey - Blackwell 2011. [Κωδ. ΕΥΔΟΞΟΣ: 80504203]

- John Ridley Ore deposit geology Cambridge University press 2013
- Lawrence Robb Ore forming processes Blackwell publishing 2004
- Anthony M.Evans Introduction to mineral exploration Blackwell Science 1995
- Taylor R., Ore Textures. Springer Berlin 2009 [Κωδ. ΕΥΔΟΞΟΣ: 73249091, electronic resource PDF]

RELATED SCIENTIFIC JOURNALS:

- Economic Geology Journal GeoScience World
- Mineralium Deposita-International Journal for Geology, Mineralogy and Geochemistry of Mineral Deposits-Springer Link
- Ore Geology Reviews, Elsevier
- Ore and Energy Resource Geology, Elsevier

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL544

Y8202 DISSERTATION-RESEARCH

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 8th

TYPE: **MANDATORY /** Scientific Area,

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

1. Subject and methodology analysis, bibliographic information.
2. Guidance from the supervisor.
*3. Field work and data collection (sampling, instrumental measurements, mapping, etc.) *.*
4. Processing and analysis, in the laboratory of fieldwork samplings and/or laboratory-research material (sample or data preparation, laboratory analyses, laboratory determinations, statistical analysis, simulations, analogue or numerical models, computational processing, etc.).
5. Writing of diploma thesis and compilation of maps, tables, diagrams, etc.
**** if applicable***
20 ECTS credits.

Prerequisites: All courses (compulsory or elective) that support the subject of the dissertation.

Language of instruction and Assessment: Greek or English (at the student's choice) (Ε.Φ. [1]

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences: The elaboration and writing of the diploma thesis represents a typical project that a graduate Geologist will need to compile, in the fields of basic or applied research.

The intended result is that the student is able to cope with all the stages required for the thesis to be qualified for either published in a journal or presented at a conference. Thus, through this process, the following outcomes are expected:

- Understanding of the research subject and the methodology required to achieve it
- Clear definition of the research objective in the field and specialization chosen by the trainee; which should cover a subject of modern research fields
- Ability to search, find, understand and evaluate available bibliographic data
- Familiarization with fieldwork (if applicable) and application of all required techniques and methodologies, depending on the various research subjects. Where appropriate, the trainees become familiarized with: a) the way they should proceed on research, use the equipment with safety during geological work in a rural environment, b) the identification and mapping of geological data and structures that interest them, c) the way they should organize and plan the information col-

[1] I.S.: Incoming students (e.g. ERASMUS Student)

lected in the Fieldwork notebook, d) the procedures and techniques required for sampling from rocks, soils, water or air, e) the use of specialized instruments and devices and the instrumental measurements procedure and f) the use of electronic devices and the specialized software that accompanies them.
- Adaptation with the techniques and methodologies applied, related to the laboratory processing and analysis of all data (either collected in the field or already available for processing), as well as with the use of all available laboratory devices and instruments together with the appropriate specialized software. On a case-by-case basis, the trainee becomes familiar with: a) the preparation of samples and their analysis in the appropriate laboratory device, b) the processing of measurements and other data and the construction of appropriate tables, diagrams, c) the digital mapping and organization of data on maps, in databases, etc., d) statistical analyses, computer simulations and construction of analogue or numerical models and e) the use of necessary specialized software required.
- Development of the trainee's competence to combine, synthesize, compare and evaluate all available data and results, which have emerged from the previous stages, in order to reach solid scientific conclusions, highlighting the project's contribution in the geological sciences.
- Complience with the scientific writing technique (structure, bibliography evaluation, definition of research objective, methodology analysis, evaluation of primary data and data collected or resulting from processing, discussion-conclusions), so that it can be published in a journal or presented at a conference.

Generic Competences:

- Ability to apply knowledge in practical situations
- Promote free, creative and inductive thinking
- Ability to plan and manage time
- Ability to work in a team
- Ability to search for, process and analyse information with the use of necessary technologies
- Adapt to and act in new situations and cope under pressure
- Ability to be critical and self-critical
- Oral and written communication of scientific issues
- Decision making
- Ability to undertake research at an appropriate level
- Autonomous work
- Information and Communication Technology (ICT) skills
- Ability to work in an international context
- Commitment to conservation of the environment
- Ability to work in an interdisciplinary context

COURSE CONTENT:

The content of this "course" (Diploma Thesis) varies and depends on the scientific field and specialization chosen by the trainee and corresponds to the content of the compulsory courses and elective courses related to it.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY
- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES
- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student's effort
Subject and methodology analysis, bibliographic information.	75 hours
Fieldwork and data collection (sampling, instrumental measurements, mapping, etc.)	75 hours
Processing and analysis, in the laboratory of fieldwork samplings and/or laboratory-research material (sample or data preparation, laboratory analyses, laboratory determinations, statistical analysis, simulations, analogue or numerical models, computational processing, etc.)	150 hours
Guidance from the supervisor and self-dependent study.	100 hours
Writing of Diploma Thesis and compilation of maps.	100 hours
Total student effort	**500** hours

ASSESSMENT METHODS AND CRITERIA:

The evaluation process takes place continuously at all stages of the preparation and writing of the thesis (formative), based on the student's response to the supervisor's guidance and instructions, as well as the student's initiatives for the successful thesis completion.

The synthesis of all the data collected, the accurate research results, but also the success of the final venture, i.e. the correct and complete writing of the Diploma Thesis, are of great importance (summative). The acceptance for either presentation of the thesis at a conference or publication in a journal also plays an important role.

The evaluation process is conducted in Greek, while the language of writing can be Greek or English. For Erasmus students, guidance and assessment is in English.

RECOMMENDED BIBLIOGRAPHY

The recommended bibliography varies depending on the subject, specialization and subject area of the dissertation, covering all courses of the Undergraduate Studies Program.

Y8203 DISSERTATION-LITERATURE REVIEW

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 8th

TYPE: **MANDATORY /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

1. *Subject and methodology analysis, bibliographic information, identification of scientific questions.*
2. *Guidance from the supervisor*
3. *Literature review and data collection*
4. *Theoretical data processing, critical review of methods, presentation of a new method and/or theory, critical study.*
5. *Writing of diploma thesis*

12 ECTS credits.

Prerequisites: All courses (compulsory or elective) that support the subject of the dissertation

Language of instruction and Assessment: Greek or English (at the student's choice) (Ε.Φ. [1]

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences: The elaboration and writing of the diploma thesis represent a typical project that a graduate Geologist will need to compile, in the fields of basic or applied research.

The intended result is that the student is able to cope with all the stages required for the thesis to be qualified for either published in a journal or presented at a conference. Thus, through this process, the following outcomes are expected:

- Understanding of the research subject and the methodology required to achieve it
- Clear definition of the research objective in the field and specialization chosen by the trainee; which should cover a subject of modern research fields
- Ability to search, find, understand and evaluate available bibliographic data
- Familiarization with critical literature review. The trainees become familiarized with: a) bibliographic research in various bibliographic databases, b) select proper publications concerning the inquired scientific topic, c) the way they should organize and plan the information collected.
- Development of the trainee's competence to combine, synthesize, compare and evaluate all available data and results, which have emerged from published research, in order to reach solid scientific conclusions, highlighting the project's contribution in the geological sciences.
- Compliance with the scientific writing technique (structure, bibliography evaluation, definition of research objective, methodology analysis, evaluation of primary data and data collected or resulting from processing, discussion-conclusions), so that it can be published in a journal or presented at a conference.

Generic Competences:

- Ability to apply knowledge in practical situations
- Promote free, creative and inductive thinking
- Ability to plan and manage time
- Ability to work in a team
- Ability to search for, process and analyse information with the use of necessary technologies
- Adapt to and act in new situations and cope under pressure
- Ability to be critical and self-critical
- Oral and written communication of scientific issues
- Decision making
- Ability to undertake research at an appropriate level
- Autonomous work
- Information and Communication Technology (ICT) skills
- Ability to work in an international context
- Commitment to conservation of the environment
- Ability to work in an interdisciplinary context

COURSE CONTENT:

The content of this "course" (Diploma Thesis) varies and depends on the scientific field and specialization chosen by the trainee and corresponds to the content of the compulsory courses and elective courses related to it.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

– Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

– Use of ICT in teaching (lectures, lab exercises, fieldwork).
– Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student's effort
Subject and methodology analysis, bibliographic update.	75 hours
Bibliographic data collection	50 hours
Critical study, data evaluation.	50 hours
Guidance from the supervisor	50 hours
Writing of Diploma Thesis	75 hours
Total student effort	**300** hours

ASSESSMENT METHODS AND CRITERIA:

The evaluation process takes place continuously at all stages of the preparation and writing of the thesis (formative), based on the student's response to the supervisor's guidance and instructions, as well as the student's initiatives for the successful thesis completion.

The synthesis of all the bibliographic data collected, but also the success of the final venture, i.e. the correct and complete writing of the Diploma Thesis, are of great importance (summative). The acceptance for either presentation of the thesis at a conference or publication in a journal also plays an important role.

I.S.: Incoming students (e.g. ERASMUS Student)

The evaluation process is conducted in Greek, while the language of writing can be Greek or English. For Erasmus students, guidance and assessment is in English.

RECOMMENDED BIBLIOGRAPHY

The recommended bibliography varies depending on the subject, specialization and subject area of the dissertation, covering all courses of the Undergraduate Studies Program.

E8206 DIDACTICS OF GEOLOGY AND ENVIRONMENTAL SCIENCES

Instructors

Lectures: Prof. A. Antonarakou - Prof. C. Drinia - Assoc. Prof. G. Lyras - O. Koumoutsakou, Laboratory Teaching Staff – A. Mpakopoulou, Laboratory Teaching Staff

Lab. Training: Prof. A. Antonarakou - Prof. C. Drinia - Assoc. Prof. G. Lyras - O. Koumoutsakou, Laboratory Teaching Staff – A. Mpakopoulou, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 8th

TYPE: **MANDATORY /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, experiential workshops, presentation of projects

2 hours of lecturing and 2 hours of practical exercises per week, 6 ECTS credits.

Prerequisites: NONE

Language of instruction and Assessment: Greek [1]

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

It is the main course in the teaching of geology and environmental sciences in order to train young scientists in learning theories, teaching practice, and the use of appropriate methods for the design and integration of teaching interventions. In particular, at the end of the semester, students will be able to:

- distinguish the basic definitions of Didactics
- recognise and summarise the different theories of learning
- formulate and classify teaching aims and objectives
- compare and select different teaching approaches
- distinguish and use different teaching techniques
- formulate lesson plans
- plan activities for group work in the classroom
- prefer and adopt experiential teaching
- organise and develop different forms of assessment

Generic Competences:

- Ability to apply knowledge in practical situations
- Ability to work in a team
- Oral and written communication of scientific issues
- Adapt to and act in new situations and cope under pressure
- Ability to undertake research at an appropriate level
- Promote free, creative and inductive thinking
- Autonomous work

I.S.: Incoming students (e.g. ERASMUS Student)

COURSE CONTENT:

A. Lectures of the course:

- History of Geology
- General concepts of teaching of science and Curricula
- Learning theories
- Good Practices in the Teaching of Earth Sciences I
- Good Practices in the Teaching of Earth Sciences II
- Behaviourism, Cognitivism learning theory
- Socio-cognitive learning theory and Humanistic learning theory
- Theories of Jarvis, Mezirow, and Illeris
- Lave & Wenger theory, Kegan theory
- Theories of Kolb & Fry, Engestrom, Erikson
- Assessments
- Presentation of lesson plans

B. Experiential Workshops:

- Getting to know each other and creating a positive atmosphere, defining groups and drafting the class contract
- Use of imagination in education, evaluation fo teachers by students: Who is the ideal teacher?
- group dynamics, group role-playing, role-playing conflict resolution using role-playing
- Introduction to Communication Science: Theory and Practice
- Techniques of Brainstorming, Jigsaw Puzzle, Peer to peer teaching
- Monologue, Interviewing, questions and answers, discussion, debate
- Brainstorming and concept mapping techniques
- Experiments and simulations on geoscience topics, 6 thinking hats technique
- Field study and environmental trail
- Education through art, role play, drama
- Gamification and play-based learning
- Case studies, project method and evaluation

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	26 hours
Practice exercises	26 hours
Fieldwork	6 hours
Tutorials	–
Essey writing	30 hours
Autonomous study	42 hours
Final assessment preparation	20 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

The evaluation process with a final examination in the entire material includes:

I. Lectures and experiential workshops (**33,3%**)

- Written examination with short-answer, extended-answer and problem-solving questions and objective-type questions. (formative, summative)

II. DELIVERY OF A WRITTEN ASSIGNMENT WITH A COMPLETE COURSE OUTLINE (66,6 %) (**66,6%**) (formative, summative)

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- Geoscience Teaching and Learning 122339309, https://repository.kallipos.gr/handle/11419/10589

II. ADDITIONAL READING

- https://opencourses.uoa.gr/modules/document/file.php/MATH18/Διδακτικό%20Πακέτο/Ενότητα%20Γ/Παρουσιάσεις/Θεωρίες%20μάθησης.pdf
- https://www.nu.edu/blog/theories-of-learning/
- https://geography.org.uk/ite/initial-teacher-education/geography-support-for-trainees-and-ects/learning-to-teach-secondary-geography/students-learning-in-geography/learning-theories-and-geography/
- https://adulteduc.gr/wp-content/uploads/attachments/koulaouzidis.pdf
- https://adulteduc.gr/wp-content/uploads/attachments/mm_aisthitiki_empeiria-7.pdf

III. RELATIVE JOURNALS

- Διάλογοι! Θεωρία και Πράξη στις Επιστήμες Αγωγής και Εκπαίδευσης

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL289

B. ELECTIVE COURSES

E3202 ROCK-FORMING MINERALS

Instructors

Lectures: Prof. A. Godelitsas - Prof. P. Voudouris - Assoc. Prof. D. Kostopoulos

Lab. Training: Prof. A. Godelitsas - Prof. P. Voudouris - Assoc. Prof. D. Kostopoulos

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 3rd

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Practical exercises, Fieldwork

2 hours of lecturing and 2 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: [recommended]

Y1205 Mineralogy-Crystallography

Y2202 Systematic Mineralogy - Mineral Identification

Language of instruction and Assessment: Greek [1]

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

Specialized Mineralogy courses with emphasis to rock-forming minerals and their formation processes.

On successful completion of the course the student:

- **Defines** and **Describes** rock-forming minerals processes, their structure and chemical composition
- **Comprehends** and **distinguishes** solid-solutions, isomorphism, polymorphism, exsolution using optical microscopy, X-ray techniques, and spectroscopic methods.
- **Combines** and **evaluates** structure and chemical composition for the characterization of most rock-forming minerals and their formation processes

Generic Competences:

- Ability to apply knowledge in practical situations
- Ability to work in a team
- Ability to search for, process and analyse information with the use of necessary technologies
- Oral and written communication of scientific issues
- Ability to undertake research at an appropriate level

COURSE CONTENT:

A. Lectures

Nucleation and crystal growth of minerals; growth of mineral crystals from magma/melt cooling & hydrothermal fluids (igneous minerals), effect of pressure (metamorphic minerals & deep minerals), sedimentary minerals; Silicates (olivine, SiO_2-polymorphs, feldspars, pyroxenes, amphiboles, phyllosilicates) and carbonate minerals (calcite, aragonite, dolomite); Crystal structure, defects-color, solid-solutions, isomorphism, polymorphism, allotropy, polytypism; epitaxy, topotaxy, exsolution, phase diagrams; study of rock-forming minerals by microscopic techniques (optical microscopy & petrographic microscope, SEM, TEM, AFM); basic principles of instrumental characterization & analyses of rock-forming minerals (X-rays, e^-, p^+, Laser, MS, ion-beams).

B. Lab exercises

The laboratory exercises include mineral identification under the microscope, as well as determination of structure and composition of solid solutions and exsolution processes using optical and spectroscopic techniques (microscopes, SEM-EDS, XRD), and processing results using necessary software and technologies.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

– Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

– Use of ICT in teaching (lectures, lab exercises, fieldwork).

– Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student's effort
Lectures	26h (2h x 13w)
Laboratory work and/or exercises	26h (2h x 13w)
Unguided Study	20h
Preparation for final Assessment	28h
Total student effort	**100** hours

Activity	Student effort
Lectures	26 hours
Practice exercises	26 hours
Fieldwork	-
Tutorials	-
Essey writing	-
Autonomous study	20 hours
Final assessment preparation	28 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

The assessment process is conducted in Greek (there is the possibility of examination in English for Erasmus students). The final grade of the course is formed by a series of tests that include:

I. Exams on the theoretical part

- Written or Oral Exams (**60% of the final grade**).

II. Laboratory Exams (**40% of the final grade**).

[1] I.S.: Incoming students (e.g. ERASMUS Student)

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

II. ADDITIONAL READING

- ΘΕΟΔΩΡΙΚΑΣ Σ.Σ.: Ορυκτολογία-Πετρολογία, Εκδόσεις Μέλισσα., 4η Έκδοση, Θεσσαλονίκη 2017.
- ΚΟΚΚΟΡΟΣ Π.: Γενική Ορυκτολογία, Εκδόσεις Δ.Ν. Παπαδήμα, Έκδοσις Θ, Αθήνα 1987.
- ΧΡΙΣΤΟΦΙΔΗΣ Γ, ΣΟΛΔΑΤΟΣ Τ. Οπτική Ορυκτολογία, Εκδόσεις Γιαχούδη, Θεσσαλονίκη 2013.
- DYAR M.D. et al.: *Mineralogy and Optical Mineralogy*, MSA, Chantilly 2008.
- GAINES R.V. et al.: *Dana's New Mineralogy*, J.Wiley & Sons Inc. 1997.
- HIBBARD M.J. and HIBBARD M.: *Mineralogy: A Geologist's Point of View*, McGraw-Hill Science/Engineering/Math, 1st Ed. 2001.
- KLEIN C. and HURLBUT C.S.Jr.: *Manual of Mineralogy* (after J.D. Dana), J.Wiley & Sons, revised 21st Edition 1999.
- ZUSSMAN J et al. (Eds.): **Introduction to the Rock-Forming Minerals**, Mineralogical Society of Great Britain and Ireland; 3rd ed. edition, 2013.
- PERKINS D.: *Mineralogy*, Prentice Hall, 2nd Ed. 2001.
- WENK H.R, BULAKH A.: *Minerals, their constitution and origin*. Cambridge University Press 2004.

III. RELATIVE JOURNALS

WEBPAGE (URL):

http://eclass.uoa.gr/courses/GEOL231

E4201 MATHEMATICAL METHODS IN GEOSCIENCES

Instructors

Lectures: Prof. A. Tzanis – Assoc. Prof. M. Hatzaki

Lab. Training: Prof. A. Tzanis - Assoc. Prof. M. Hatzaki – V. Sakkas, Laboratory Teaching Staff - S. Chailas, Laboratory Technical Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 2nd

TYPE: **ELECTIVE /** Background

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Practical exercises

2 hours of lecturing and 2 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: [recommended]
Y1204 Introduction to Differential and Integral Calculus and Statistics

Language of instruction and Assessment: Greek [1]
Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

Earth Science is required to address a variety of complex problems with profound effects on society by providing **answers technically robust and quantitatively accurate**. Accordingly, on successful completion of the Course, the students should have acquired:

- Dexterity in using and programming scientific computing engines (MATLAB and OCTAVE) and their toolboxes.
- Dexterity in the spectral analysis and information extraction from spatio-temporal scientific data.
- Familiarization with the basic concepts of Linear Algebra and metric spaces.
- Dexterity in the numerical simulation/modelling and interpretation of simple natural or artificial phenomena, e.g. by using general least squares.
- Comprehension of the evolutionary dynamics of systems and phenomena through familiarization with first and second order differential equations.
- Basic skills in common techniques of manipulating/processing and displaying scientific data and images.
- Introduction to the theory and practice of fundamental data analysis techniques such as (linear) filtering and numerical interpolation.
- Familiarization with critical appraisal of data and results.
- Comprehension of the capabilities and constraints of analytical methods and software, so as to be able to select and apply the more suitable of those.

[1] I.S.: Incoming students (e.g. ERASMUS Student)

- Dexterities necessary in addressing different practical problems related to data analysis and interpretation (economic, environmental, technical etc.)

Generic Competences:

- Ability to search for, process and analyse information using appropriate technologies
- Ability to apply knowledge in practical situations
- Promote free, creative and inductive thinking
- Autonomous work
- Oral and written communication of scientific issues

COURSE CONTENT:

Combination of theoretical introductions (lectures) and practical training with scientific computing engines (MATLAB or OCTAVE) and their associated signal, modeling and statistical analysis toolboxes.

- Introduction to MATLAB/OCTAVE with parallel review of the principles of Linear Algebra.
- Fourier analysis, Fourier series and the Fourier transform. Power spectra and their physical interpretation. Concepts of sampling and digitization. The z-transform. Correlation and Convolution. Fast Fourier Transforms. Examples and applications in the analysis of natural phenomena.
- Coordinate systems, vector spaces and metric spaces. Matrices and their properties. Metric tensors: concepts, properties and utilization. Eigenvalue/eigenvector decomposition, singular value decomposition and their physical interpretation. Applications to the analysis of matrices and images; applications to geophysical and geotechnical problems – analysis of the stress, strain and impedance tensors.
- Solution of linear systems of equations with applications to earth-scientific problems.
- Simulation and modelling of data and physical processes: Linear, general and non-linear least squares. Multiple Linear Regression and applications. Non-linear least-squares inversion theory and applications.
- Linear Filters and Systems. Transfer functions and causality. Wavelets and wavelet transforms. Applications to the description of physical systems, time series, maps and images. Data smoothing and accentuation; application to time series, maps and images.
- Interpolation and extrapolation in one dimension (interpolating polynomial, linear and non-linear interpolation techniques). Interpolation in two and three dimensions with introduction to the concepts of triangulation and tessellation. Geostatistical interpolation methods (e.g. Kriging).
- Introduction to fractals and fractal objects. Fractal distributions and fractal clustering. Dynamic systems and self-organized criticality – introduction to the non-extensive statistical mechanics. Examples from the Earth Sciences (terrain, drainage systems, coastlines, fragmentation and porosity, faulting and tectonics, seismicity and seismogenesis, etc.).
- Simple differential equations: concept and solutions. Examples and applications (radioactive decay, remanent magnetization, geothermal gradient).
- Non-linear differential equations: basic concepts and applications.
- Partial differential equations (Laplace, diffusion, wave): Concepts and solution. Examples and applications (e.g. static potentials, hear transfer, wave diffusion and propagation).
- Numerical solution of partial differential equations – the finite difference approach with examples and applications.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	26 hours
Practice exercises	26 hours
Fieldwork	-
Tutorials	-
Essey writing	8 hours
Autonomous study	30 hours
Final assessment preparation	10 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

- Students are evaluated by a formative assessment process in Greek. Foreign students from European Union countries (e.g. attending through the Erasmus programme) are evaluated by the same process in English.
- The final grade is the arithmetic mean of the grades of all reports prepared and submitted as part of the practical training program.

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- Μαθηματικές Μέθοδοι Φυσικής Τόμος Ι, Βεργάδος Ι., Πανεπιστημιακές Εκδόσεις Κρήτης, [Κωδ. ΕΥΔΟΞΟΣ: 230]
- Μάθετε το MATLAB 7, D. Hanselman, B. Littlefield [Κωδ. ΕΥΔΟΞΟΣ: 13789]

II. ADDITIONAL READING

- Trauth, M.H., «MATLAB® Recipes for Earth Sciences», Springer, 2007.
- Snieder, R., 1997, "A guided tour of Mathematical Physics", Samizdat Press [PDF]
- Βέργαδος, Ι., «Μαθηματικές Μέθοδοι Φυσικής», Τόμος ΙΙ Πανεπιστημιακές Εκ-δόσεις Κρήτης.
- Τραχανάς, Σ., «Διαφορικές Εξισώσεις, Τόμος Ι Συνήθεις Διαφορικές Εξισώσεις»
- Τραχανάς, Σ., «Μερικές Διαφορικές Εξισώσεις»
- Arfken, G.B and Weber, H.J., 2005. Mathematical Methods for Physicists, 6th Edition, Elsevier.
- Scales, J.A. et al., 2001. Introductory Geophysical Inverse Theory, Samizdat Press. (PDF)
- Claerbout, J., 1976. Fundamentals of Geophysical Data Processing, Samizdat Press.
- Claerbout, J., 1996, Imaging the Earth's Interior, Samizdat Press.

- Turcotte, D.L., 1997. Fractals and Chaos in Geology and Geophysics, Cambridge University Press.

WEBPAGE (URL):

https://eclass.uoa.gr/courses/GEOL386

E4202 DYNAMIC GEOLOGY

Instructors

Lectures: Assist. Prof. E. Skourtsos

Lab. Training: Assist. Prof. E. Skourtsos – D. Theocharis, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 4th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Lab exercises, Fieldwork

2 hours of lecturing and 1 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: NONE

Language of instruction and Assessment: Greek [1]

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences: Dynamic Geology deals with the deformation of Earth's solid crust and large-scale tectonic structures associated with it. In other words, it deals with the deformation at the scale of Tectonic Plates, examining both the auttoalistic patterns that operate today on the planet, as well as the orogenetic zones, continents, and oceans, which give us data on the distribution and movement of plates, in older geological periods.

Upon successful completion of the course the student is able to:

- Describes Plate Tectonics basic elements and identifies the various forms of evidence from different branches of Geology that can be used to understand the movement of lithospheric plates in different geological periods.
- Describes and analyzes the importance of the mid-ocean ridges in the formation of oceanic crust and in the spread of the ocean floor and the zonal form of magnetism in the oceanic crust, describes the importance of the lithosphere and the asthenosphere in the movement of lithospheric plates, explains the distribution of earthquakes and volcanoes, the formation and the location of large mountain ranges and how those distributions are evidence for the theory of Plate Tectonics.
- Analyzes and describes the basic types of plate margins and how they interact at the triple junctions.
- Apply the techniques of analysis and synthesis with the aim of determining the history and evolution of a sequence of rocks in geological time and space and in various geotectonic environments (orogenetic systems, tectonic basins, active areas, etc.).

[1] I.S.: Incoming students (e.g. ERASMUS Student)

- Collects, combines, applies, synthesizes, compares and evaluates data from various branches of Geology, using the theory of Plate Tectonics, to solve geological problems related hydrocarbon exploration, exploration of deposits, active faults, earthquake generation, natural disasters, etc.

Generic Competences:

- Ability to apply knowledge in practical situations
- Promote free, creative and inductive thinking
- Ability to search for, process and analyse information with the use of necessary technologies
- Ability to undertake research at an appropriate level
- Autonomous work

COURSE CONTENT:

A. Lectures

The main fields presented and developed during the course are the following:

Introduction to Geotectonics (Continental Crust, Oceanic Crust, Lithosphere and Asthenosphere, etc). Oceanic Basins, Precambrian Shields, Phanerozoic Regions. Introduction to Lithospheric Plate Tectonics Divergent Margins, passive margins. Transform Faults. Convergence Margins. Subduction Zones, island arcs and active continental margins. Collision, Orogenesis – Anatomy of Orogenetic Zones. Structure of the Main Orogenetic Chains. Old Orogens, Young Orogens.

B. Lab Exercises

Exercises for the construction of geological cross-sections and the determination of geotectonic integration and evolution in terms of Lithospheric Plate Tectonics, from geological maps with various geotectonic environments

C. Field Exercises (Outdoors)

ONE-DAY FIELD TRIP IN CORINTHIA – ARGOLIDA: (Ophiolites, alpine rocks, interpretation of deposition environment, evolution in terms of Plate Tectonics)

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

– Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

– Use of ICT in teaching (lectures, lab exercises, fieldwork).
– Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	26 hours
Practice exercises	13 hours
Fieldwork	10 hours
Tutorials	- hours
Essey writing	16 hours
Autonomous study	20 hours
Final assessment preparation	15 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

The assessment process is conducted, either with progressive exams in separate sections of the course content or with the final examination of the entire course material which includes:

I. LECTURES (**50%**) (formative, summative)
- Oral Examination and/or
- Written Exam with Short Answer Questions and Multiple Choice Test and/or
- Written Exam with Extended Answer Questions

II. LAB EXERCISES (**35%**) (formative, summative)
- Written exam with Solving Exercises and Problems

III. FIELD EXERCISES (**15%**) (formative, summative)
- Oral examination in the field and with evaluation of required Report or Essay

The evaluation criteria of the course and the participation rates are described in the Chapter «3.3 Evaluation Criteria» of this syllabus and student handbook.

Auxiliary material (questions, exercises, etc.) for the exams is posted on the online e-Class platform

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

II. ADDITIONAL READING

- Lekkas, S. Lozios, S & Skourtsos E., Introduction to Geotectonics, 332 pages. University of Athens (in Greek).
- Allen, A. P. and Allen, R. J. 2004. Basin Analysis. Principles and Applications. Oxford: Blackwell Scientific Publications.
- Moores, M. E. and Twiss, J. R. 1995. Tectonics. New York: W. H. Freeman and Company.
- Olsen H. K. (Editor). 1995. Continental Rifts. Evolution, Structure, Tectonics. Publication No. 264 of the International Lithosphere Program. Amsterdam: Elsevier Science B. V.
- Pluijm, van der A. B. and Marshak S. 1997. Earth Structure. An Introduction to Structural Geology and Tectonics. U.S.A.: McGraw-Hill Companies, Inc.
- Davies, F. G. 1999. Dynamic Earth. Plates, Plumes and Mantle Convection. Cambridge: Cambridge University Press.
- Frisch W., Meschede M. & Blakey R., 2011. Plate Tectonics. Continental Drift and Mountain Building. Springer.

III. RELATIVE JOURNALS

- Tectonics
- Journal of Geodynamics

WEBPAGE (URL):

http://eclass.uoa.gr/courses/GEOL170

http://opencourses.uoa.gr/courses/GEOL101/

E4203 EXPLORATION OF THE EARTH'S INTERIOR

Instructors

Lectures: Prof. F. Vallianatos - Prof. A. Tzanis - Assoc. Prof. G. Kaviris

Lab. Training: Assoc. Prof. G. Kaviris - Prof. A. Tzanis - Prof. F. Vallianatos - S. Chailas, Laboratory Technical Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 4th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Practical exercises, Laboratory exercises

2 hours of lecturing and 1 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: Y3203 Seismology [recommended]

Language of instruction and Assessment: Greek [1]

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

On successful completion of the course, the student:

- **Identifies** discontinuities and **describes** the layers of the Earth's interior.
- **Distinguishes** the differences between various methods of exploring the Earth's interior, and **selects** appropriate methods according to the needs of the research.
- **Calculates**, through data analysis, the parameters used in each method of exploring the Earth's interior.
- **Identifies** seismic phases and **calculates** their propagation velocity.
- **Combines** different methods that have been applied in typical case-studies.
- **Interprets** seismic tomography results on global, regional and local scales.
- **Evaluates** the results of studies published in international journals and **concludes** whether the exploration methods are applicable, and in which cases.

Generic Competences:

- Ability to apply knowledge in practical situations
- Promote free, creative and inductive thinking
- Ability to search for, process and analyse information with the use of necessary technologies
- Ability to be critical and self-critical
- Oral and written communication of scientific issues

COURSE CONTENT:

A. Lectures

- Introduction to the exploration of the Earth's interior: basic concepts, historical review of the evolution of knowledge about the Earth's structure.
- Propagation of elastic seismic waves in the Earth's interior: elasticity theory, types and properties of seismic waves, wavefronts, seismic ray theory, Fermat's principle, Snell's law, Huygens' principle, reflection, refraction, diffraction, head-waves, ray parameter, polarization of particle motion, wave transformations.
- Identification of discontinuities in the Earth's interior: seismic wave travel-time curves, phase triplication effect, caustics, low-velocity zone, Earth's core shadow zone.
- Structure of the Earth: distinction of crustal types (continental, oceanic), lithosphere, asthenosphere, upper/lower mantle, transition zone, D" layer, outer/inner core, one-dimensional models of the Earth for seismic wave propagation velocities, changes in physical properties and mineral composition with depth, nomenclature of major discontinuities, nomenclature of seismic phases.
- Rayleigh and Love surface waves: propagation and properties of surface waves, phase and group velocity, dispersion effect, methods of measuring phase/group velocities, construction of 1D shear-wave velocity models from dispersion curves, global propagation of surface waves.
- Seismic tomography: categorization by data type and study scale, the forward and inverse problems, parameterization of tomographic inversion, synthetic tests, reliability assessment of results, construction of 3D velocity models.
- Interpretation of tomographic models: identification of velocity anomalies at global, regional and local scales, interpretation of velocity anomalies as a function of depth, mantle tomography, mid-ocean ridges, subducting plates, hot spots/mantle plumes, tomography in fault zones, tomography in volcanic environments, evaluation of the resolution of tomographic models.
- Surface wave tomography: the cross-correlation function, waveform stacking, Eikonal tomography (apparent phase velocity), multi-pathing effects, Helmholtz tomography (structural velocity), ambient noise tomography, examples of applications.
- Seismic anisotropy: physical causes of seismic anisotropy, shear-wave splitting (SWS) effect, methods of measuring the splitting parameters in S and SKS waves, anisotropy in the upper crust, anisotropy in the upper mantle, relation between SWS parameters and mantle flow.
- The D" layer: lower mantle tomography, large low velocity shear-wave velocity provinces (LLSVP), ultra-low velocity zones (ULVZ), anisotropy and scattering phenomena at the base of the lower mantle, methods of structure determination in the D" layer, interpretation of observations.
- Receiver functions method: convolution and deconvolution, the H-k stacking method (crustal thickness and Vp/Vs velocity ratio), back-projection of receiver functions at depth, common conversion point stacking technique, applications to determine the depth of major discontinuities (Moho discontinuity, lithosphere-asthenosphere boundary, discontinuities in the transition zone, discontinuities related to subducting plates).
- Velocity spectrum analysis (vespagrams), brief introduction to seismic arrays, detection of weak amplitude seismic phases.

[1] I.S.: Incoming students (e.g. ERASMUS Student)

B. Practical and Laboratory Exercises :

- Applications of Snell's law, calculation of critical angle, angle of reflection, angle of refraction, ray parameter for P, SV and SH waves.
- Calculation of epicentral distances, arrival times and propagation velocity of direct, reflected and refracted body-waves and layer thickness; triplication phase imaging.
- Trajectories of global surface waves, calculation of arrival times, travel-time curves, apparent propagation velocity of Rayleigh waves.
- Construction and interpretation of tomographic models.
- Calculation of Rayleigh wave group velocity dispersion curves using time-variable Gaussian filters.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

– Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

– Use of ICT in teaching (lectures, lab exercises, fieldwork).
– Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	26 hours
Practice exercises	13 hours
Fieldwork	-
Tutorials	-
Essey writing	26 hours
Autonomous study	13 hours
Final assessment preparation	22 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

The assessment process is conducted in Greek (there is the possibility of examination in English for Erasmus students), with the final examination on the entire course material and, presentation of individual essay on a specific methodology on Earth's interior exploration and includes:

I. LECTURES (**50%**)

- Individual report and oral presentation per student (formative, summative)

II. PRACTICE EXERCISES (**50%**)

- Problem solving during the Practice Exercises, Delivery of Laboratory reports
- Written exam with Solving Exercises and Problems (formative)

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- General seismology vol. A, A. Tselentis [Code EUDOXUS: 59395397], in Greek
- Introduction to seismology. Papazachos B.C., G.F. Karakaisis, P.M. Chatzidimitriou. [Code EUDOXUS: 11254], in Greek

II. ADDITIONAL READING

- Bormann, P. (Ed.), 2012. New Manual of Seismological Observatory Practice (NMSOP-2), Potsdam : Deutsches GeoForschungszentrum GFZ; IASPEI.
- Dziewonski, A.M., Romanowicz, B.A., 2007. Seismology and the Structure of the Earth, Treatise on Geophysics. ISBN 978-0-444-51929-0.
- Lin, F.-C., Ritzwoller, M.H., Yang, Y., Moschetti, M.P., Fouch, M.J., 2011. Complex and variable crustal and uppermost mantle seismic anisotropy in the western United States. Nat. Geosci. 4, 55–61. https://doi.org/10.1038/ngeo1036
- McNamara, A.K., 2019. A review of large low shear velocity provinces and ultra low velocity zones. Tectonophysics 760, 199–220. https://doi.org/10.1016/j.tecto.2018.04.015
- Piromallo, C., Morelli, A., 2003. P wave tomography of the mantle under the Alpine-Mediterranean area. J. Geophys. Res. Solid Earth 108. https://doi.org/10.1029/2002JB001757
- Romanowicz, B., 2011. Surface Waves. In: Gupta, H.K. (eds) Encyclopedia of Solid Earth Geophysics. Encyclopedia of Earth Sciences Series. Springer, Dordrecht. https://doi.org/10.1007/978-90-481-8702-7_143
- Shearer, P.M., 1999. Introduction to Seismology, Cambridge University Press, September 1999, pp. 272. ISBN 0521660238.
- Stein, S. and M. Wysession, 2003. An Introduction to Seismology, Earthquakes and Earth Structure, Blackwell Publishing Ltd., Hoboken.

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL244

E5201 SEISMOLOGY OF GREECE - PLATE TECTONICS

Instructors

Lectures: Assoc. Prof. G. Kaviris - Prof. F. Vallianatos - K. Pavlou, Laboratory Teaching Staff

Lab. Training: Assoc. Prof. G. Kaviris - K. Pavlou, Laboratory Teaching Staff - S. Vassilopoulou, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 5th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Laboratory exercises`

2 hours of lecturing and 1 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: Y3203 Seismology [recommended]

Language of instruction and Assessment: Greek

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

On successful completion of the course, the student:

- **Names** and **categorizes** the major and minor tectonic plates of the Earth.
- **Distinguishes** the types of tectonic plate boundaries, and **describes** their relative and absolute motions.
- **Identifies** and **explains** the causes and characteristics of high seismic activity in the different regions of the Earth in relation to plate tectonics theory (interplate and intraplate earthquakes).
- **Identifies** the main tectonic structures of Greece and **describes** the distribution of seismicity in Greece in relation to the tectonic plates involved.
- **Calculates** the parameters of earthquake focal mechanisms and **relates** the rupture types and principal stress axes to the different types of tectonic plate boundaries.
- **Describes** the stress field in Greece and **relates** it to the focal mechanisms in each region.
- **Identifies** the types of forces acting on tectonic plates and **deduces** the causes that shape the modern form of the Earth.

Generic Competences:

- Ability to apply knowledge in practical situations
- Promote free, creative and inductive thinking
- Ability to search for, process and analyse information with the use of necessary technologies
- Ability to be critical and self-critical
- Oral and written communication of scientific issues

I.S.: Incoming students (e.g. ERASMUS Student)

COURSE CONTENT:

A. Lectures

- Introduction to lithospheric plate tectonics, historical background, global fracture zones.
- Paleomagnetism, polar wander, geomagnetic pole reversal, age of the oceanic lithosphere.
- Earth's structure, seismic discontinuities.
- Lithospheric plates: plate composition, types of boundaries, categories, nomenclature.
- Relative and absolute motions of lithospheric plates, geodetic observations, reference frames, Euler axes and poles.
- Triple junctions, velocity diagrams, types of triple junctions, stability of triple junctions.
- Forces on tectonic plates: thermal convection currents, driving forces, drag forces.
- Subduction zones: Wadati-Benioff zones, stresses in subducting plates, degree of plate coupling, seismic tomography in subduction zones.
- Earthquake focal mechanisms, rupture types, stress field, relationship between focal mechanisms and plate boundaries.
- Tectonics of the Eastern Mediterranean.
- Seismicity in Greece, Aegean microplate, Anatolian microplate, Hellenic arc.
- Seismotectonics of Greece, major tectonic structures.
- Stress field in Greece, distribution of focal mechanisms.
- Hot spots, mantle plumes, seismic tomography of the mantle.
- Island arcs, types of subduction zones, accretionary prism, gravity anomalies, volcanism.
- Earthquakes at divergent and convert plate boundaries, earthquakes on transform faults.
- Intraplate seismicity, passive margins of lithospheric plates, induced seismicity.

B. Practical and Laboratory Exercises:

- Collection of data on recent strong earthquakes, description of their main characteristics and their correlation with lithospheric plate boundaries.
- Calculation of linear velocity of lithospheric plate motion.
- Calculation of relative plate motions at triple junctions, boundaries' geometry, characterization of triple junction stability.
- Estimation of seismicity characteristics of the Greek region.
- Identification of focal mechanisms and their correlation with lithospheric plate boundaries.
- Characterization of focal mechanisms on lithospheric plate boundaries
- Construction and interpretation of seismic tomograms in subduction zones.
- Calculation of absolute plate motion velocity from the age of submarine mountains in hotspot trails.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	26 hours
Practice exercises	13 hours
Fieldwork	-
Tutorials	-
Essey writing	13 hours
Autonomous study	33 hours
Final assessment preparation	15 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

The student evaluation includes:

I. LECTURES (**50%**)

- Oral examination with essay development (for the characterization of seismicity and seismotectonic characteristics, type and characteristics of plate motion with emphasis on the Greek area) (formative, summative)

II. PRACTICE EXERCISES (**50%**)

- Presentation of individual essay (formative)

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- Δελήμπασης Ν.Δ. Εισαγωγή στην τεκτονική των λιθοσφαιρικών πλακών, [Κωδ. ΕΥΔΟΞΟΣ: 11257] (in Greek)

II. ADDITIONAL READING

- Bird, P., 2003. An updated digital model of plate boundaries, Geochem. Geophys. Geosyst., 4, 1027.
- Cox, A., and Hart, R.B., 1986. Plate tectonics: How it works. Blackwell Scientific Publications, Palo Alto.
- Frisch, W., Meschede, M., Blakey, R., 2011. Plate tectonics: Continental drift and mountain building, Plate Tectonics: Continental Drift and Mountain Building. Springer Berlin Heidelberg, Berlin, Heidelberg.
- Makropoulos K., G. Kaviris and V. Kouskouna, 2012. An updated and extended earthquake catalogue for Greece and adjacent areas since 1900. Nat. Hazards Earth Syst. Sci., 12, 1425-1430.

III. RELATIVE JOURNALS

- Bulletin of the Seismological Society of America, SSA Journals
- Geophysical Journal International, Oxford University Press
- Journal of Geophysical Research, AGU Publications
- Tectonophysics, Journal, Elsevier

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL139

E5202 QUATERNARY GEOLOGY AND ARCHAEOGEOMORPHOLOGY

Instructors

Lectures: Prof. N. Evelpidou - A. Karkani, Laboratory Teaching Staff

Lab. Training: Prof. N. Evelpidou - A. Karkani, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 5th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Practical exercises

2 hours of lecturing and 1 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: NONE

Language of instruction and Assessment: Greek [1]

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

Upon successful completion of the course students will:

- **Identify** and **describe** climate change during the Quaternary period,
- **Understand**, **distinguish** and **interpret** the natural processes that have taken place during the last geological period and their effects on the evolution of the earth's relief and in the wider area's archeological sites,
- **Calculate** the morphometric parameters of the Quaternary erosional and depositional landforms, as well as the changes of the sea level
- **Apply** methods and techniques of geomorphological analysis, for the determination of environmental - morphological changes in terrestrial and aquatic environment and in archaeological sites,
- **Collect** and **analyze** the literature related to the course contents
- **Combine** and **compose** examples of studies that have been done internationally and in Greece,
- **Explain**, **collect**, **compare** and **evaluate** data in problem solving such as finding, promoting and protecting archaeological sites in relation to erosional or depositional processes
- Use geomorphological methods and modern technologies in locating archaeological sites.

Generic Competences:

- Ability to search for, process and analyse information with the use of necessary technologies
- Oral and written communication of scientific issues
- Ability to undertake research at an appropriate level

[1] I.S.: Incoming students (e.g. ERASMUS Student)

- Autonomous work
- Ability to work in an interdisciplinary context

COURSE CONTENT:

A. Lectures

Quaternary Geology:

- Quaternary climate change and its impact on environment and relief.
- Glacial - Interglacial periods and their relation to sea level changes.
- Holocene transgression and impacts on the coastal environment.
- Sea level changes and Sea level indicators: archaeological, biological, geomorphological. Accuracy of each category.
- Present-day trends of sea level change.
- Chronostratigraphy and lithostratigraphy of Quaternary deposits.
- Quaternary deposits in Greece and wider Mediterranean region and their particular characteristics.
- Sampling-analysis of sediments and geomorphological and environmental changes.
- Basic methods of geochronology.
- Karstic & coastal landforms and their role in Quaternary Geology.

Archaeogeomorphology:

- Contribution of geomorphological analysis to the understanding of the evolution of the landscape of the wider area of archaeological sites and determination of environmental - morphological changes in a) coastal environments, b) fluvial environments, c) desert environments, d) lakes etc.
- Geoarchaeological analysis of ancient harbors of the Mediterranean and examples from Greece and internationally.
- Sea level changes and coastal geoarchaeology.
- Examples of archaeogeomorphological studies in Greece and the wider Mediterranean region.
- Problems of finding, promoting and protecting archaeological sites in relation to erosional or depositional processes.
- Use of modern methods and new technologies in locating archaeological sites.

B. Practical and Laboratory Exercises :

The exercises are the continuation and practice based on the course lectures. They include exercises with maps, satellite images, aerial photographs, as well as calculations, measurements, questionnaires and special tasks for:

- the determination of sea level changes,
- identification and interpretation of biological, archaeological and geomorphological indicators of sea level change
- the geomorphological processes of coastal evolution of geoarchaeological sites
- geomorphological and environmental changes
- the basic methods of geochronology
- identification and mapping of Quaternary deposits,
- solving problems of finding, promoting and protecting archaeological sites in relation to processes of erosion or deposition
- methods of research of palaeogeographical evolution and evolution archeological sites
- research methods of geoarchaeological studies in ancient harbors

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	26 hours
Practice exercises	13 hours
Fieldwork	-
Tutorials	-
Essey writing	20 hours
Autonomous study	21 hours
Final assessment preparation	20 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

I. LECTURES (**50%**) (summative)

- Presentation of a topic selected by a list

II. PRACTICE EXERCISES (**50%**) (formative)

- Delivery, through the eclass, of assignments that included solving problems during laboratory execrises.

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- Evelpidou, N., 2019. Sea level changes. Da Vinci, Athens. ISBN: 9789609732321. (book website) [Code Eudoxus: 86054068] (in Greek).
- Evelpidou, N., Karkani, A., 2024. Quaternary Geology and Archaeogeomorphology. Kallipos, Open Academic Publishing. https://dx.doi.org/10.57713/kallipos-255 [Code Eudoxus: 122074392]

II. ADDITIONAL READING

- Bailey, G., Galanidou, N., Peeters, H., Jöns, H., & Mennenga, M. (Eds.). (2020). The Archaeology of Europe's Drowned Landscapes (Vol. 35). Springer International Publishing. https://doi.org/10.1007/978-3-030-37367-2
- Ehlers, J., & Gibbard, P. L. (2004). Quaternary glaciations-extent and chronology: part I: Europe. Elsevier.
- Elias, S.A., 2007. Encyclopedia of Quaternary Science. Elsevier
- Menzies, J., & Van der Meer, J. (Eds.). (2018). Past Glacial Environments. Elsevier. https://doi.org/10.1016/C2014-0-04002-6

III. RELATIVE JOURNALS

- Geoarchaeology
- Journal of Quaternary Science
- Oxford Journal of Archaeology
- Palaeogeography Palaeoclimatology Palaeoecology
- Quaternary International
- Quaternary Perspectives
- Quaternary Research
- Quaternary Science Reviews

- Radiocarbon
- The Holocene
- Geosciences

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL118
https://eclass.gunet.gr/courses/OCGU158/

E5203 VOLCANOLOGY

Instructors

Lectures: Prof. P. Pomonis

Lab. Training: Prof. P. Pomonis - E. Moustaka, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 5th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Laboratory exercises

2 hours of lecturing and 1 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: NONE

Language of instruction and Assessment: Greek [1]
Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

On successful completion of the course the student:

- **Comprehens** the basic petrological concepts, the rock-forming minerals and the methods of petrological research (from sampling to preparation).
- **Explains** the mechanism of different types of volcanic eruptions and **interprets** volcanic deposits and their stratigraphic succession.
- **Analyzes** petrological data to interpret the magma fragmentation processes leading to the formation of volcanic ash.
- **Assesses** the degree of volcanic hazard in order to take the necessary precautionary measures.
- **Approaches** the modelling of volcanic eruptions with a view to managing emergencies and crises and minimising the impact on people and the environment.

Generic Competences:

- Ability to apply knowledge in practical situations
- Promote free, creative and inductive thinking
- Information and Communication Technology (ICT) skills
- Ability to work in a team
- Ability to search for, process and analyse information with the use of necessary technologies

COURSE CONTENT:

Theory:

– **Fundamentals -** in-depth knowledge of the terms of volcanology. The basic principles of volcanology: basic knowledge of volcanoes. Distribution of recent and current volcanic activity on the earth's surface.

[1] I.S.: Incoming students (e.g. ERASMUS Student)

- **Classification of volcanoes -** based on the geotectonic characteristics of volcanoes and their petrographic features,
- **Volcanic series -** understanding the physicochemical characteristics of the lavas.
  The importance and role played by parameters such as temperature-pressure-viscosity-flow velocity and lava form).
- **Lithospheric plates and volcanoes -** evolution of volcanism on a global scale according to the theory of lithospheric plate motion in time and space.
- **Mechanism of volcanic eruptions -** Mechanisms of magma ascent in the interior of the earth. The disruption of the equilibrium of volcanic systems is considered. Mechanisms of magma rupture and formation of explosive columns.
- **Types of volcanic eruptions -** A detailed description is given of the types of volcanic eruptions, taking into account various qualitative and quantitative criteria such as the mode of ejection of volcanic products, the dimensions and shape of the volcanic edifice, the rate of volcanic eruption and the degree of hazard.
- **Post-volcanic phenomena -** The types of volcanic products emanating from volcanoes such as steam, fumaroles, solfatars and thermometallic vents.
- **Types of volcanic products -** Morphological characteristics of lavas. Pyroclastic products (classification, transport and deposition).
- **Space volcanism.** Cases of volcanism on other planets. Cryovolcanism and comparative study with terrestrial volcanism.
- **Volcanism and Ecology -** The relationship of volcanism with humans, culture and the environment.
- **Volcanic hazards -** examples of volcanic areas and the degree of risk they pose. Ways of managing and dealing with any form of volcanic hazard.
- **Volcanoes as a source of energy -** areas of geothermal interest, how they are created and the extent to which they can be exploited.
- **Volcanoes in Greece -** A detailed description of volcanic centres in various regions of Greece. Volcanic centres in continental and marine environments - Volcanism older than the Miocene - Recent volcanism Active volcanic arc of the South Aegean (Methana-Susaki, Milos, Santorini and Kos-Nisyros volcanoes.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student's effort
Activity	Student effort
Lectures	26 hours
Practice exercises	13 hours
Fieldwork	10 hours
Tutorials	-
Essey writing	13 hours
Autonomous study	18 hours
Final assessment preparation	20 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

- Written examination (**80%**) (summative)
- Development/examination of the topic of the individual project (**20%**) (formative)

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

II. ADDITIONAL READING

- Textbooks and notes uploaded on the electronic platform **e-class**.
- Peter Francis & Clive Oppenheimer (2004). Volcanoes. Oxford University Press.
- Robert W. Decker & Barbara B. Decker (1992). Mountains of Fire. The nature of volcanoes. Cambridge University Press

III. RELATIVE JOURNALS

- Bulletin of Volcanology, Springer Nature.
- Journal of Applied Volcanology, Springer Nature.
- Journal of Volcanology and Geothermal Research, Elsevier
- Journal of Petrology, Oxford University Press.

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL223

E5205 SOIL AND ROCK MECHANICS

Instructors

Lectures: Prof. M. Stavropoulou

Lab. Training: Prof. M. Stavropoulou

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 6th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Laboratory exercises

2 hours of lecturing and 1 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: NONE

Language of instruction and Assessment: Greek [1]

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences: Upon successful completion of the course, the student:

- **Acquires knowledge** and **becomes familia**r with the control and testing of the physical and mechanical properties of soils and rocks.
- **Understands** the mechanical behavior of geo-materials at different scales and under different loadings.
- **Applies** the methodologies for calculating the physical and mechanical properties of soils and rocks based on laboratory tests.
- **Applies** the results of laboratory tests in the context of a geotechnical investigation and study of an engineering project.
- **Applies** elements of soil mechanics and rock mechanics to solve basic engineering problems.

Generic Competences:

- Ability to apply knowledge in practical situations
- Ability to search for, process and analyse information with the use of necessary technologies
- Ability to undertake research at an appropriate level
- Autonomous work
- Ability to work in an interdisciplinary context

COURSE CONTENT:

A. Lectures

- PHYSICAL CHARACTERISTICS OF THE SOIL (Origin and nature of soil, Phase diagram, Physical properties of soils, relative density , Particle size analysis, Classification of soils, Compaction)
- STRESS AND STRAIN (Definition of stress and strain, Geostatic stress, Effective stress principle).
- SHEAR STRENGTH OF SOILS (Mohr's circle representation of stresses, Stress –strain relationships at failure, Direct shear test, Triaxial test).
- STRESS-STRAIN RELATIONS OF SOIL MATERIALS (Linear isotropic elasticity, Non-linear stress-strain relations, Compressibility: consolidation settlement, time rate consolidation- consolidation test).
- MECHANICAL BEHAVIOR OF INTACT ROCK (Rock strength, Elastic properties, Uniaxial compression test, Point load strength index, Tensile strength, Shear strength (Mohr-Coulomb and Hoek and Brown failure criterions).
- MECHANICAL BEHAVIOR OF ROCKMASS (Rock mass discontinuities: geometrical and mechanical characteristics and their influence on the behavior of the rock mass, Shear strength of discontinuities).

B. Lab Exercises

PART A': Physical properties of soils
PART B': Stress distribution in soil
PART C': Shear strength of soil
PART D': Compressibility and Consolidation of soil
PART E': Characterization of Rock Mechanical Properties Using Lab Tests

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	26 hours
Practice exercises	13 hours
Fieldwork	- hours
Tutorials	- hours
Essey writing	21 hours
Autonomous study	24 hours
Final assessment preparation	16 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

The assessment process is conducted, either with progressive exams in separate sections of the course content or with the final examination of the entire course material which includes:

I. LECTURES (**50%**)

- Written Exam with Short Answer Questions and Multiple-Choice Test (summative)

II. LAB EXERCISES (**50%**)

- Weekly assessment of lab exercises (formative, summative)

and

- Written exam with Exercises and Problems Solving

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

[1] I.S.: Incoming students (e.g. ERASMUS Student)

- Barnes G. 2005. **Soil Mechanics: Principles and Practice**. Publisher Klidarithmos [EUDOXUS code: 33153307], in Greek.

II. ADDITIONAL READING

- Kavvadas M. 2009. **Principles of Soil Mechanics**, in Greek. http://users.ntua.gr/kavvadas/Books/books.htm .
- Hoek E. 2007. **Practical Rock Engineering** https://www.rocscience.com/learning/hoek-s-corner/books
- Braja M. Das. 2019. **Advanced Soil Mechanics,** Fifth Edition 5th Edition. Publisher CRC Press.

III. RELATIVE JOURNALS

- International Journal of Rock Mechanics and Mining Sciences, Publisher: Elsevier BV
- Rock Mechanics and Rock Engineering, Publisher: Springer
- Géotechnique, Publisher: CE Publishing
- Journal of Geotechnical and Geoenvironmental Engineering, Publisher: American Society of Civil Engineers

WEBPAGE (URL):

http://eclass.uoa.gr/courses/GEOL171

E5207 KARST GEOMORPHOLOGY-PRINCIPLES OF SPELAEOLOGY

Instructors

Lectures: Assoc. Prof. E. Vassilakis

Lab. Training: Assoc. Prof. E. Vassilakis

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 5th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Lab Exercises and Fieldwork

2 hours of lecturing and 1 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: NONE

Language of instruction and Assessment: Greek [1]

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

On successful completion of the course the student:

- **Recognizes** the karst relief,
- **Understands** the processes that affect the generation and evolution of karst formations and caves,
- **Apply** techniques for classifying geomorphological features in stages of evolution
- **Composes** and **constructs** digital maps using remote sensing data as a basic cartographic background
- **Detects** the environmental degradation of karst cavities

Generic Competences:

- Ability to apply knowledge in practical situations
- Ability to search for, process and analyse information with the use of necessary technologies
- Autonomous work
- Commitment to conservation of the environment

COURSE CONTENT:

A. Lectures

- Introduction to the concept of karst, processes, surface forms, evolution stages
- Karst processes, conditions, effects on the creation and formation of karst: lithology, stratigraphy, tectonics, eustatism, climate, paleogeography and human activities
- Karst and climate zones. Global spread of karst.
- Karst landforms, surface and underground karst forms, correlation with stages of evolution
- Principles of speleology, types of caves, speleogenesis, cave deposits, cave microclimate

[1] I.S.: Incoming students (e.g. ERASMUS Student)

- Mapping methods, 3D visualization, new technologies and equipment in cave research
- Cultural value of the caves. Management, protection and sustainable development (Geotourism,, legislation-studies, preliminary studies, monitoring conditions during operation)

B. Lab Exercises

The Practice Exercises are carried out using printed maps, and/or digital aerial photographs-satellite images displayed on the screens of the Department's PC Lab, mostly individually and graded at the end of the Laboratory.

Exercise 1. Identification of karst fields on paper maps (ideon Andron)

Exercise 2. Analysis of digital survey data. Mapping and quantification of cave deposits (Koutouki)

Exercise 3. Identification of karst fields on satellite images and DEMs (part I) (Parnassos, Ghiona)

Exercise 4. Identification of karst fields on satellite images and DEMs (part II) (Parnassos, Ghiona)

C. Fieldwork

C1. One full day field exercise at a show cave. Optional visit on a Sunday with a guided tour from an experienced speleologist.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	26 hours
Practice exercises	13 hours
Fieldwork	6 hours
Tutorials	- hours
Essey writing	26 hours
Autonomous study	21 hours
Final assessment preparation	8 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

I. Course theory (**60%**)

- Multiple choice online exams (Summative)

II. Laboratory Exercises (**40%**)

- Evaluation of each exercise at the end of the class (Formative).
- Supplementary material for the exams (questions, exercises etc.) is posted on **e-Class** platform http://eclass.uoa.gr/courses/GEOL124

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- Miliana Goloubovic-Deligianni, 2019, Environmental Karst Geomorphology, [EVDOXOS: 77120352]

II. ADDITIONAL READING

- Bogli, A., 1980. Karst hydrology and physical speleology. Springer-Verlag, p. 284.
- Derek, F. & Williams, P., 2007. Karst Hydrogeology and Geomorphology, John Wiley & Sons, p. 562.
- Gillieson, D., 1996. Caves: Processes development and management, Blackwell Oxford, p. 324p
- Gunn, J., 2004. Encyclopedia of Caves and Karst Science, Taylor and Francis, p. 928.

III. RELATIVE JOURNALS

- Geomorphology
- Acta carsologica
- Journal of Cave and Karst Studies
- Cave and Karst Science
- International Journal of Speleology

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL124

E5208 APPLIED AND ENVIRONMENTAL OCEANOGRAPHY

Instructors

Lectures: Prof. S. Poulos - Prof. P. Nomikou

Lab. Training: Prof. S. Poulos - Prof. P. Nomikou – C. Angelopoulos, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 5th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Lab Exercises and Fieldwork

2 hours of lecturing and 1 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: NONE

Language of instruction and Assessment: Greek [1]

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

On successful completion of the course the student:

- Defines and formulates the basic concepts and applications of oceanography in the coastal and marine environment
- Understand the processes underlying coastal hydrodynamics with emphasis on wave transformation processes and the generation of coastal currents
- Understand the basic 'operating' principles governing the formation of marine depositional coasts (with emphasis on coastal zones) in relation to coastal hydrodynamics.
- To address specific issues through the acquisition of applied knowledge and methodologies, on coastal erosion issues and in particular coastal zones.
- Identify the relationship between the above processes and the geological evolution of sea basins, the transport and deposition of sediments, as well as the formation of submarine and coastal relief, with particular reference to coastal geomorphs.
- Become familiar with issues related to the management of the coastal marine environment (natural processes, human intervention, institutional framework)
- Reference is made to human activities and interventions in the marine and coastal environment (renewable energy sources).
- Introduce the way (methods) of collecting data related to the coastal zone (e.g. satellite data).
- processes between the marine and atmospheric environment (e.g. wind waves, heat balance, thermoclines) and between the marine and terrestrial environment (e.g. shaping of coastal geomorphs such as river deltas).
- Introduction to the basic concepts of marine pollution by human factors (e.g. oil spills)
- Understanding of the basic principles of the International Law of the Sea

Generic Competences:

- Theoretical thinking and the ability to apply knowledge to problem solving.
- Work in an interdisciplinary environment (individual and/or team)
- Respect for the natural marine environment
- Search, analysis and synthesis of data and information, including the use of appropriate technologies
- Promotion of free, creative and deductive thinking

COURSE CONTENT:

A. Lectures

- Introductory concepts in environmental oceanography and the methodology (means and instruments) of coastal research (e.g., coordinate systems, hydrographic charts, topography, ship positioning methods, satellite systems)
- Coastal hydrodynamics with emphasis on the coastal zone: Coastal wave conditions, coastal currents of wave origin. Example of application of a coastal hydrodynamic model.
- Dynamic Sedimentology - morphodynamics: Sediment characteristics, dynamics (movement) of bottom sediments, stereotransport, morphodynamic characteristics of coastal zones, coastal engineering investigation of coastal engineering projects related to protection against erosion and enrichment of coastal zones.
- Applied Submarine Sedimentology and Morphology: Methods for mapping of bottom geometry, bottom morphology and identification of bottom habitats, geophysical investigations of the geological infrastructure of the seabed. Application/ Link to the labour market: Geotechnical studies of foundation works, submarine volcanoes, cables and pipelines, shipwrecks, ancient monuments.
- Satellite Oceanography: Marine remote sensing, principles and methods of processing satellite telescopic imagery, uses and applications in the marine environment. Application/ Linking DE4 to the labour market: Use of Satellite Imagery in the coastal system.
- Marine Pollution: sources of pollutants in the marine environment, classification of pollutants, impact of pollutants on the marine environment, pollution response, sediment loading. Application/ with labour market: Examples of marine pollution/ examples of marine pollution/ decontamination studies from the Greek and global area.
- Marine resources: Categories of Natural Resources, Geographical distribution of resources, Exploitation of the marine environment, Global stock status. Application: Example of Natural Resource Exploitation in the Greek Area.
- Uses of the Ocean: Shipping, security, marine facilities, marine engineering works, waste disposal, military use.
- International Maritime Law: International Conventions (UNCLOS), Maritime Zones, Seabed. Example of EEZ delimitation.

[1] I.S.: Incoming students (e.g. ERASMUS Student)

– Integrated Coastal Zone Management - European and Greek Legislation. Implementation: Examples of implementation or non-implementation of the legislation in the Greek Area.

B. Lab exercises.

Laboratory Exercises are individual and are graded at the end of the Laboratory.

- Hydrographic Chart Reading, Length and Speed Units, Course Plotting, Position and Depth Determination
- Coastal hydrodynamics
- Granular Analysis of Marine Sediments
- Sediment dynamics (sedimentation, resuspension, sediment transport in the marine environment, interpretation of coastal hydrodynamic model results)
- Morphodynamic characteristics and calculation of longitudinal coastal sediment transport
- Application of Satellite Imagery in Oceanographic Research
- Sea Level Change
- Marine water and sediment quality related to pollution
- Preparation of a response study in case of widespread pollution of the marine environment
- Draft environmental impact assessment of coastal areas of special interest in cases such as highly eroded, with cultural heritage, protected area (NATURA).
- Work Plan: Economic Exploitation of the Marine Environment (e.g. EEZ delimitation dispute, case of exploitation of a deposit).

C. Fieldwork

C1. Visit to Research Vessel AEGAIO.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

– Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

– Use of ICT in teaching (lectures, lab exercises, fieldwork).
– Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	26 hours
Practice exercises	13 hours
Fieldwork	6 hours
Tutorials	-
Essey writing	13 hours
Autonomous study	22 hours
Final assessment preparation	20 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

I. LECTURES (**60%**)

- Written examination of 2 hours during the examination period of the semester (formative, summative). The examination includes extended or short answer questions.
  Exams include short or extended answer questions, multiple choice tests, simplified sketches and drawings, simplified cross-sections and maps and stereographic projections.

II. LAB EXERCISES (**40%**)

- Grading of each exercise at the end of the Workshop (formative, deductive) or 1 hour written examination with multiple questions and/or exercise solution (deductive).

III. FIELDWORK

Supplementary material for the exams (questions, exercises etc.) is posted on **e-Class** platform

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- S. Poulos and A. Karditsa. Applied and Environmental Oceanography, (EUDOXUS code: 102072814), in Greek.

II. ADDITIONAL READING

- Velegrakis A., 2016. Coastal Geology. Department of Marine Sciences, University of the Aegean (in Greek)
- Ferentinos G., 2002. Ocean Engineering. Department of Geology, University of Patras. Department of Marine Sciences, University of the Aegean (in Greek).

III. RELATIVE JOURNALS

- J. Applied Oceanography
- J. Coastal Management
- J. Marine Policy
- J. Coastal Research
- J. Coastal Engeenering

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL296

E5209 ENVIRONMENTAL GEOCHEMISTRY

Instructors

Lectures: Assist. Prof. E. Kelepertzis– Prof. A. Argyraki - Assoc. Prof. Ch. Stouraiti – Z. Kypritidou, Laboratory Teaching Staff

Lab. Training: Assist. Prof. E. Kelepertzis– Prof. A. Argyraki - Assoc. Prof. Ch. Stouraiti– Z. Kypritidou, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 5th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Practical exercises, Laboratory exercises.

1 hours of lecturing and 2 hours of practical exercises per week, 4 ECTS credits.

Prerequisites:

Y4203 - Geochemistry [recommended]

Language of instruction and Assessment: Greek [1]

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

On successful completion of the course the student will be able to:

- Recognize and understand the geochemical interaction processes between anthropogenic activities and natural environment of our planet.
- Define the environmental behaviour of potentially toxic elements and compounds in the rock – soil – water – atmosphere system.
- Determine the dissolution methods of environmental solid samples and establish the linkage with the release of trace elements to the environment.
- Describe the sources, release and dispersion of harmful chemical elements in the environment, focusing on the life cycle of trace elements and nutrients (C, N, P).
- Apply geochemical methods for the research and solving of environmental problems, mainly in the urban environment.
- Treat in the lab soil samples in order to perform basic soil measurements (pH, organic carbon) and chemical analyses of elements.
- Write a comprehensive report of environmental characterization of soil samples including sampling, laboratory analysis, treatment of geochemical data and conclusions.

Generic Competences:

- Ability to apply knowledge in practical situations
- Ability to work in a team
- Ability to search for, process and analyse information with the use of necessary technologies
- Ability to undertake research at an appropriate level
- Autonomous work

COURSE CONTENT:

A. Lectures.

- Introduction, understanding of the subject of the course, environmental sampling media, environmental geochemistry and health.
- Geochemical analysis of solid samples - Dissolution methods.
- Urban geochemistry issues.
- Geochemistry of acid mine drainage.
- Treatment of environmental geochemical data – Instructions for writing of the report from the practical exercise of soil sampling and analyses.
- Geochemical cycles of N-P-C
- Geochemical mapping.

B. Lab exercises

- Concentration units in environmental geochemistry.
- Transport of N and P in surface water systems.
- pH as controlling factor of dissolved C species in natural waters.
- Statistical treatment of geochemical data - Geochemical mapping.

C. Practical exercise of sampling, laboratory treatment and analyses of urban soil samples

- Collection of soil samples from various locations within the Athens urban environment.
- Laboratory preparation of the samples (sieving, weighing, production of geochemical solutions).
- pH and organic carbon measurements.
- Dissolution with appropriate chemical reagents and geochemical determination of elements by atomic absorption spectroscopy.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	18 hours
Practice exercises	21 hours
Fieldwork	-
Tutorials	-
Essey writing	25 hours
Autonomous study	20 hours
Final assessment preparation	16 hours
Total student's effort	**100** hours

I.S.: Incoming students (e.g. ERASMUS Student)

ASSESSMENT METHODS AND CRITERIA:

The assessment process is conducted in Greek (there is the possibility of examination in English for Erasmus students). The final grade of the course is formed by a series of tests that include:

I. **Writing of a comprehensive essay** of the practical exercise of soil sampling and analysis including abstract, introduction, materials and methods, results, discussion, conclusions and reference list (formative, summative) (**60 % of the final grade**)

II. Laboratory exercises: Solving handout exercises and problems during the class (formative) (**30 % of the final grade**)

III. Evaluation test with multiple choices questions regarding the geochemical cycles of N-P during the semester (formative) (**10% of the final grade)**

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- Eby, N. G., 2011, Principles of Environmental Geochemistry/ ISBN 9789609985864, [EUDOXUS code: 77115198], in Greek.

II. ADDITIONAL READING

- Plumlee, G. S. and Ziegler, T. L. (2007). The Medical Geochemistry of Dusts, Soils, and Other Earth Materials. Treatise on Geochemistry Volume 9, Chapter 9.07. pp. 1-61.
- Adamo, P., Agrelli, D., Zampella, M., 2018. Chemical speciation to assess bioavailability, bioaccessibility and geochemical forms of potentially toxic metals (PTMs) in polluted soils. Chapter, 9. In De Vivo B., Belkin, H.E., Lima, A., (Eds.). Environmental Geochemistry: site characterization, data analysis and case histories, pp. 153-194.

III. RELATIVE JOURNALS

- Science of The Total Environment, Elsevier
- Applied Geochemistry, Elsevier
- Environmental Pollution, Elsevier
- Journal of Geochemical Exploration, Elsevier
- Environmental Geochemistry and Health, Springer

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL106
http://opencourses.uoa.gr/courses/GEOL1/

E5210 PALAEOBOTANY - CLIMATE RECONSTRUCTION TECHNIQUES

Instructors

Lectures: Prof. K. Kouli - Assoc. Prof. M. Hatzaki

Lab. Training: Prof. K. Kouli - Assoc. Prof. M. Hatzaki

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 5th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Practical exercises, Fieldwork

1 hours of lecturing and 2 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: Basic knowledge of Y2205 Paleontology and, Y3206 Climatology

Language of instruction and Assessment: Greek [1]

Το μάθημα προσφέρεται σε φοιτητές Erasmus και Civis: ΝΑΙ

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences: Upon successful completion of the course, students will be able to:

- Define and formulate the basic principles of the evolution and dispersal of plants in geological space and time
- describe various fossil plant and classify them into the major taxonomic categories
- Select appropriate sampling techniques, laboratory processing and study methods for plant fossils from different geological periods and depositional environments
- Process palaeobotanical databases, considering and combining data
- Calculate basic climatic parameters on the basis of palaeobotanical data
- Examine and synthesise the results of laboratory and analytical methods using specialised software
- Apply the scientific knowledge acquired to the measurement and assessment of environmental parameters

Generic Competences:

- Ability to apply knowledge in practical situations
- Information and Communication Technology (ICT) skills
- Ability to work in a team
- Commitment to conservation of the environment

COURSE CONTENT:

An interdisciplinary course designed to offer insights to the study of fossiled plant remains and introduce students to paleoclimate restoration techniques using plant fossils. Plants, as multicellular organisms composed of a significant number of differ-

[1] I.S.: Incoming students (e.g. ERASMUS Student)

ent parts, produce a large number of fossils of varying size, composition and form, which are excellent witnesses both to paleovegetation and to the environmental and climatic conditions that prevailed in the past. In addition, plant fossils are among the most important bioproxy data for the quantitative reconstruction of paleoclimatic parameters. The course includes practical exercises in the preparation laboratory, using microscopes, computers and specialized software (R, C2, Tilia).

A. Lectures:

Introduction to the study of fossil plants:

- structure, systematics, fossils and fossilization processes, peat and coal deposits, petrified forests, methods of fossil collection.

Plant evolution:

- origins, land colonization, evolution mechanism and characteristics, Paleozoic-Mesozoic-Cenozoic plant diversity. Fossil plants of Greece.
- Paleobotanic methodology, contribution to stratigraphy and paleogeography.

Palynology:

- pollen, spores and NPP analysis and their significance in the geoenvironmental research.

Climatic variability and vegetation:

- Quaternary long paleovegetation records, persistent populations, refugia.
- Vegetation history of the Mediterranean region.
- Reconstruction of past climate variables from fossil pollen records - Pollen-climate modelling techniques

B. Practical:

1. Pollen and NPPs identification methodology;
2. Practical exercise in the Laboratory;
3. CLAMP - Climatic reconstitution based on fossilized leaf concentrations
4. Introduction to the programming language and the R environment
5. Quantitative climate reconstruction with the MAT technique (using R).

C. Fieldwork

Field training on Mt Hymettus Aesthetic forest

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	13 hours
Practice exercises	26 hours
Fieldwork	4 hours
Tutorials	- hours
Essey writing	20 hours
Autonomous study	30 hours
Final assessment preparation	7 hours

Total student's effort	100 hours

ASSESSMENT METHODS AND CRITERIA:

Assessment language: Greek / English for Easmus or Civis students

- Practical exercises -2 in small groups and 2 individual during the semester (**20%**) (formative)
- Practical exam with PC in the lab (**25%**) (formative)
- Field work assessment (**5%**) (formative)
- Final written essay / oral presentation of the selected subject (**50%**) (formative, summative)

All above information are available in e-class.

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

II. ADDITIONAL READING

- Bradley, Raymond S. 2015 Paleoclimatology Reconstructing Climates of the Quaternary, Elsevier
- Taylor E., Taylor T., Krings M. 2009. Paleobotany (2nd ed.). Elsevier Science
- Willis K. J., McElwain J. C. 2014. The Evolution of Plants. Oxford University Press.

III. RELATIVE JOURNALS

- Review of Palaeobotany and Palynology
- Journal of Quaternary Science
- Palaeogeography Palaeoclimatology Palaeoecology
- The Holocene

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL158

E5211 ANALYTICAL METHODS OF ROCKS AND ORES - FLUID INCLUSIONS

Instructors

Lectures: A. Papoutsa, Laboratory Teaching Staff –Prof. A. Godelitsas

Lab. Training: A. Papoutsa, Laboratory Teaching Staff –Prof. A. Godelitsas

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 5th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Lab exercises and Fieldwork.

2 hours of lecturing and 1 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: [recommended]

Y1203 - Chemistry

Y2202 - Systematic Mineralogy-Mineral Identification

Y4203 - Geochemistry.

Language of instruction and Assessment: Greek [1]

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

On successful completion of the course, the student will be able to:

- **Define** and **apply** the principles of the studied analytical techniques, to determine whole-rock geochemistry, of rocks and ores, in solid or liquid samples.
- **Define** the appropriate sample preparation procedure according to the selected analytical technique.
- **Identify** main minerals in host-rocks and ores with the use of petrographic and metallographic microscope, Raman spectroscopy and X-ray diffraction.
- **Define** and **apply** the appropriate analytical methods used for mineral characterization in rocks and ores.
- **Identify** and **characterize** fluid inclusions with the use of petrographic microscope.
- **Describe** the basic principles of microthermometric analysis of fluid inclusions, **interpret** and **evaluate** the obtained data.
- **Combine** theoretical and applied knowledge to solve complex problems and **evaluate** the appropriate analytical methods to be used for rock/ore characterization.
- **Apply** the appropriate working procedures in the environment of the geochemistry lab, as well as the safety and health rules.

Generic Competences:

- Ability to apply knowledge in practical situations.
- Ability to search for, process and analyze information with the use of necessary technologies.
- Decision making.
- Autonomous work.
- Information and Communication Technology (ICT) skills.

COURSE CONTENT:

A. Lectures.

- Introduction, sampling and sample preparation for analysis.
- Principles of Optical Microscopy and description of rocks and ores.
- Principles of Electron Microscopy.
- Principles and applications of X-Ray Diffraction.
- Principles and applications of Raman Spectroscopy.
- Geochemical analytical techniques for rocks and solutions.
- Evaluation and selection criteria of analytical methods.
- Introduction to Fluid Inclusions and their importance in mineral exploration.
- Principles and methods of Microthermometric Analysis and optical identification of Fluid Inclusions.
- Interpretation of data from Microthermometric analysis.

B. Lab Exercises

Practice exercises are conducted either individually or in small groups of students and are graded at the end of the exercise.

Exercise 1. Observation and identification of mineral ores under a reflected light microscope.

Exercise 2. Processing of mineral chemical data from an Electron Microprobe and analysis of back-scattered electron images (BSE) using the ImageJ software.

Exercise 3. Processing and evaluation of X-ray diffraction data.

Exercise 4. Processing and evaluation of Raman spectra using Crystal Sleuth software.

Exercise 5. Method of sample preparation with aqua regia and determination of chemical composition by atomic absorption.

Exercise 6. Identification of fluid inclusions under a transmitted light microscope.

Exercise 7. Analysis of fluid inclusions using a microthermometric heating-cooling microscope stage.

Exercise 8. Evaluation of microthermometric analysis results with special software (BULK), and geological interpretation.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	20 hours
Practice exercises	19 hours
Fieldwork	–
Tutorials	–

I.S.: Incoming students (e.g. ERASMUS Student)

Essey writing	13 hours
Autonomous study	28 hours
Final assessment preparation	20 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

LECTURES **(70%)**

- Written examination in the whole syllabus (formative)

The exams include extended or short answer questions, and multiple-choice tests.

II. LAB EXERCISES **(30%)**

- Grading of each exercise at the end of the Lab (formative, summative).
- Written exercise (summative).
- Written examination in all the material covered in the laboratory exercises (summative).

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- Harris D.C. & Lucy C.A., **Αναλυτική Χημεία**, [EUDOXUS code: 94644882], in Greek.

II. ADDITIONAL READING

- Οικονομου, Μ., 2000. **Μέθοδοι ανάλυσης μεταλλευμάτων**. ΕΚΠΑ, Αθήνα, in Greek.
- Κίλιας, Σ., 2016. Ρευστά εγκλείσματα: Εισαγωγή στη θεωρία και τις βασικές αρχές μικροθερμικής ανάλυσης ρευστών εγκλεισμάτων. Σημειώσεις μαθήματος, ΕΚΠΑ, Αθήνα, in Greek.

III. RELATIVE JOURNALS

- Analytical Methods, Royal Society of Chemistry
- Ore Geology Reviews, Elsevier
- Trends in Analytical Chemistry Articles, Elsevier

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL288

E6201 RENEWABLE ENERGY RESOURCES: SOLAR AND WIND ENERGY - GEOTHERMY

Instructors

Lectures: Prof. P.T. Nastos - Prof. A. Tzanis

Lab. Training: Assoc. Prof. K. Eleftheratos – Prof. A. Tzanis – V. Sakkas, Laboratory Teaching Staff – S. Vassilopoulou, Laboratory Teaching Staff -S. Chailas, Laboratory Technical Staff – V. Nikolis, Laboratory Technical Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 6th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Laboratory exercises

2 hours of lecturing and 1 hours of practical exercises per week, 4 ECTS credits.

Prerequisites:

Y1202 Physicsς [recommended]
Y2203 Climatology and Climate Changes [recommended]

Language of instruction and Assessment: Greek [1]
Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

On successful completion of the course the student:

- **Defines** and **describes** the different categories of renewable energy resources.
- **Comprehends** the physical processes that determine the production of energy from the various examined sources.
- **Comprehends** the usefulness and contribution of renewable energy resources to the daily energy human needs, protecting the natural environment by reducing the emission of greenhouse gases from the burning of fossil fuels, that are linked to modern climate change.
- **Evaluates** the key parameters used in studies for the correct installation of power plants and **understands** their results.
- **Combines** theoretical and practical knowledge obtained from lectures, laboratory exercises and fieldwork and **answers** environmental issues on all fields of Geology and Geoenvironment.

Generic Competences:

- Ability to apply knowledge in practical situations
- Promote free, creative and inductive thinking
- Oral and written communication of scientific issues
- Autonomous work
- Information and Communication Technology (ICT) skills
- Commitment to conservation of the environment

I.S.: Incoming students (e.g. ERASMUS Student)

COURSE CONTENT:

A. Lectures

The content of the course is structured in the following thematic sections:

a) Basic concepts of Meteorology: Execution and utilization of observations. Basic knowledge in weather map analysis. Introduction to weather forecasting, with emphasis on wind and solar potential.

b) Wind Energy: Forces acting on an air mass to move. Introductory concepts for wind (gradient wind, geostrophic wind, wind characteristics). Wind measurements instruments, advantages and disadvantages of wind energy. Calculation of wind power. Representative types of wind turbines. Power generated by a wind turbine. Territorial suitability for the installation of a wind turbine. Utilization of wind systems in Greece.

c) Solar Energy: Introductory concepts for solar radiation (total, direct and diffuse). Instruments for measuring solar radiation (pyranometers, pyrheliometers). Factors affecting solar radiation. Basics on Photovoltaic Cells. Advantages and disadvantages of solar energy. Solar radiation utilization systems. Utilization of solar systems in Greece.

d) Geothermy: Basic geothermal concepts, as well as the contribution of Applied Geophysics to the research and identification of geothermal fields and includes: Geothermal parameters: Temperature, heat, enthalpy, thermal gradient, thermal flow, thermal properties of rocks. Geothermal energy: Heat sources, geothermal gradient, change of heat release with depth, distribution of geothermal potential areas. Geothermal field: Structure model. Classification of geothermal fields. Surface incidence of geothermal fields: Geothermal fluids, geothermometers. Geothermal research: Research strategy (identification, geological and hydrogeological research), Geochemical research, Geophysical research (methods of detection and localization of geothermal fields), measurements and tests within drillings, temperature and pressure charts. Evaluation of geothermal potential. Exploitation of geothermal fields.

B. Laboratory Exercises:

The laboratory exercises include the education of the students in the following subjects:

Exercise 1. Utilization of wind elements of a region for the installation of wind turbines
Exercise 2. Calculation of wind energy
Exercise 3. Utilization of solar radiation elements
Exercise 4. Calculation of electric energy from solar systems
Exercise 5. Definition of obstacle for the suitability of a wind turbine installation location
Exercise 6. Calculation of the maximum available wind power
Exercise 7. Analysis of solar radiation changes
Exercise 8. Effect of aerosols and clouds on solar radiation
Exercise 9. Geothermal field study
Exercise 10. Classification of geothermal fields

C. Fieldwork

One-day field exercise. Visit to the CRES Demonstration Wind Park. The main objective is to understand the use of wind turbines with different operating principles, in conditions of complex topography, which are the main wind turbine installation sites in Greece.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	27 hours
Practice exercises	12 hours
Fieldwork	8 hours
Tutorials	-
Essey writing	24 hours
Autonomous study	21 hours
Final assessment preparation	8 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

The assessment process is conducted, either with progressive exams in separate sections of the course content or with the final examination of the entire course material which includes:

I. LECTURES (**50%**)

Written Exam with Short Answer Questions and Multiple-Choice Test and/or Extended Answer Questions (summative)

II. PRACTICE EXERCISES (**50%**)

Written Essays for every Practical Exercise and evaluation (formative, summative).

Auxiliary material (questions, exercises, etc.) for the exams is posted on the online **e-Class** platform (https://eclass.uoa.gr/courses/GEOL142/).

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- Λιώκη-Λειβαδά Ηρώ,Ασημακοπούλου Μαργαρίτα, 2008, Αιολική και Άλλες Ανανεώσιμες Πηγές Ενέργειας, Βιομάζα - Γεωθερμία, [Κωδ. ΕΥΔΟΞΟΣ: 45451]
- Γεωθερμία, Φυτίκας Μ., Ανδρίτσος Ν. [Κωδ. ΕΥΔΟΞΟΣ: 122074535]
- Ήπιες Μορφές Ενέργειας, Κανελλοπούλου Ε. [Κωδ. ΕΥΔΟΞΟΣ: 45440]
- Ανανεώσιμες Πηγές Ενέργειας, Μπιτζιώνης Β., Μπιτζιώνης Δ. [Κωδ. ΕΥΔΟΞΟΣ: 45440]

II. ADDITIONAL READING

- Twidell, J., 2022, **Renewable Energy Resources**, Fourth Edition, Routledge, [ISBN: 9780415633581].

III. RELATIVE JOURNALS

- Applied Energy, Online, Elsevier
- Solar Energy, Online Elsevier
- Wind Energy, Online, Wiley
- Wind Energy Science, Online, European Academy of Wind Energy

- Geothermal Energy, Online, Springeropen

Additional Reading Material

- Teachers' notes, presentations of the lectures and exercise material posted on the e-Class platform of the course.

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL142

E6202 MACROSEISMOLOGY

Instructors

Lectures: Prof. N. Voulgaris

Lab. Training: Prof. N. Voulgaris - Assoc. Prof. G. Kaviris - K. Pavlou, Laboratory Teaching Staff - S. Vassilopoulou, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 6th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Laboratory exercises, Fieldwork

2 hours of lecturing and 1 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: Although no typical admission requirements, students are expected to have mastered knowledge of Seismology covered by the courses
Y3203 Seismology
Y5203 Engineering Seismology

Language of instruction and Assessment: Greek Oral and written summary in English for visiting students

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences: It is the only elective course providing knowledge of seismology and engineering for the characterization, according to international practices, of building seismic damage and vulnerability according to EMS98. The methodologies of Macroseismology for the study of recent and historical earthquakes and the inversion of intensity distribution for the calculation of macroseismic parameters are thoroughly presented.

On successful completion of the course the student will be able to:

- Identify and describe the level of earthquake damage or the felling of shaking.
- Distinguish and explain the differences between buildings of different vulnerability.
- Calculate macroseismic parameters by analysing macroseismic data.
- Quantify the descriptions of earthquake effects.
- Synthesize intensity distributions.
- Estimate and evaluate the seismic risk with Macroseismology approach.

Generic Competences:

- Search, analysis and synthesis of data and information, using the necessary technologies
- Adaptation to new situations
- Autonomous work
- Respect for the natural environment
- Teamwork
- Work in an international environment
- Work in an interdisciplinary environment

- Ability to apply knowledge to problem solving
- Decision making
- Promotion of free, creative and inductive thinking

COURSE CONTENT:

A. Lectures

- Introduction – historical overview
- Macroseismic effects (on people, objects, constructions, the natural environment)
- Macroseismic intensity - scales
- Collection of macroseismic data - questionnaires
- Evaluation of macroseismic intensity
- Intensity – Acceleration – Earthquake velocity
- Destructive intensity
- Macroseismic intensity attenuation relations - isoseismals
- Historical earthquakes – calibration methods
- Macroseismic intensity distributions
- Determination of macroseismic parameters using the inversion method
- Earthquake catalogs – Databases of macroseismic intensities
- Seismic hazard and macroseismic intensity
- Vulnerability of structures – vulnerability curves
- Seismic risk
- Early warning systems – Seismic crisis management
- Large earthquakes

B. Practical Exercises

- Macroseismic intensity assessment from earthquake effects on people, objects, the natural environment and structures
- Overall assessment of macroseismic intensity of historical and modern earthquakes
- Calculation of macroseismic parameters.
- Vulnerability assessment of buildings.
- Construction of isoseismals
- Calculation of macroseismic epicenter, magnitude and depth of an earthquake

C. Fieldwork

One day field trip at areas recently affected by natural disaster(s) that provides insight to the identification and mapping of natural hazards, vulnerability, risk, and analysis of pre- and post-disaster phases and is followed by the writing of a short essay – report.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student's effort
Lectures	26 hours
Laboratory work and/or exercises	13 hours
Unguided Study	43 hours
Preparation for final Assessment	18 hours
Total student effort	**100** hours

Activity	Student effort
Lectures	XX hours
Practice exercises	XX hours
Fieldwork	XX hours
Tutorials	XX hours
Essey writing	XX hours
Autonomous study	XX hours
Final assessment preparation	XX hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

The assessment process is conducted in Greek (possibility of examination in English for Erasmus students), as follows:

I. LECTURES (**50%**) (formative, summative)

- Written Exam with Short Answer Questions and Multiple Choice Test and/or
- Written Exam with Extended Answer Questions

II. FIELDWORK EXERCISES (**50%**) (formative, summative)

- Short essay writing for each exercise and for field work activities

In the case of an unsuccessful result (<5), the students have the possibility to repeat the exercises.

Auxiliary material (questions, exercises, etc.) for the exams is posted on the online **e-Class** platform (http://eclass.uoa.gr/courses/GEOL138).

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- Kouskouna V. Macroseismology [EUDOXUS code: 86378564]

II. ADDITIONAL READING

- Kouskouna, V., Chailas, S., Makropoulos, K.C., Michalopoulou, D. & J. Drakopoulos, 1996. Simulation of macroseismic field in Central Greece. ESC XXIV General Assembly, Athens, September 19-24, 133 (abstr.), ext. abs. 1681-1683, 'Annali di Geofisica', XXXIX/5, 1115-1124.
- Kouskouna, V. & N. Malakatas, 2000. Correlation between EMS98 with damage reported of the earthquake of 7th September 1999. Annales Géologiques des Pays Helléniques, XXXVIII/B, 187-196.
- Kouskouna, V. & K. Makropoulos, 2004. Historical earthquake investigations in Greece: a journey through time. Investigating the records of past earthquakes. Annals of Geophysics, 47/2-3, 723-731.
- Kouskouna V. & G. Sakkas, 2013. The University of Athens Hellenic Macroseismic Database (HMDB.UoA): Historical Earthquakes. Journal of Seismology, 17/4, 1253—1280.
- Kouskouna V, Kaperdas V, Sakellariou N (2020). Comparing calibration coefficients constrained from early to recent macroseismic and instrumental earthquake data in Greece and applied to eighteenth century earthquakes. JSeismol https://doi.org/10.1007/s10950-019-09874-7
- Kouskouna, V. Updating the macroseismic intensity database of 19th century damaging earthquakes in Greece: a case study

in Samos Island. Acta Geophys. 69, 1101–1111 (2021). https://doi.org/10.1007/s11600-021-00608-3.
- Kouskouna, V., Ganas, A., Kleanthi, M. et al. Evaluation of macroseismic intensity, strong ground motion pattern and fault model of the 19 July 2019 Mw5.1 earthquake west of Athens. J Seismol 25, 747–769 (2021). https://doi.org/10.1007/s10950-021-09990-3.
- Stucchi M., A. Rovida, A.A. Gomez Capera, P. Alexandre, T. Camelbeeck, M.B. Demircioglu, P. Gasperini, V. Kouskouna, R.M.W. Musson, M. Radulian, K. Sesetyan, S. Vilanova, D. Baumont, H. Bungum, D. Fäh, W. Lenhardt, K. Makropoulos, J.M. Martinez Solares, O. Scotti, M. Živčić, P. Albini, J. Batllo, C. Papaioannou, R. Tatevossian, M. Locati, C. Meletti, D. Viganò & D. Giardini, 2013. The SHARE European Earthquake Catalogue (SHEEC) 1000–1899. Journal of Seismology, 17/2, 523-544.

III. RELATIVE JOURNALS
- Bulletin of the Seismological Society of America, SSA Journals
- Geophysical Journal International, Oxford University Press
- Journal of Geophysical Research, AGU Publications
- Physics of the Earth and Planetary Interiors, Journal, Elsevier
- Tectonophysics, Journal, Elsevier

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL138

E6203 COASTAL AND SUBMARINE GEOMORPHOLOGY AND COASTAL ZONE MANAGEMENT

Instructors

Lectures: Prof. N. Evelpidou - Prof. S. Poulos - Prof. P. Nomikou

Lab. Training: Prof. S. Poulos - Prof. N. Evelpidou - Prof. P. Nomikou – C. Angelopoulos, Laboratory Teaching Staff - A. Karkani, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 6th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Practical exercises

2 hours of lecturing and 1 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: NONE

Language of instruction and Assessment: Greek [1]
Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

Upon the completion of the course, the student:

- **Understand** the factors contributing to coastal geomorphology.
- **Classify** and **describe** the coasts and coastal landforms.
- **Classify** and **describe** underwater units (ditches, deep basins, straits)
- **Describe** the legal context for Greece regarding the coastal zone (definition of foreshore, coast based on the wave regime and old foreshore)
- **Comprehend** the main concepts of coastal zone management.
- **Apply** DPSIR tools for the management of the coastal zone.
- **Combine** and **evaluate** coastal landforms and coastal morphodynamics to identify erosion causes of the coasts.

Generic Competences:

- Ability to apply knowledge in practical situations
- Promote free, creative and inductive thinking
- Ability to search for, process and analyse information with the use of necessary technologies
- Ability to undertake research at an appropriate level
- Commitment to conservation of the environment

COURSE CONTENT:

A. Lectures

– Factors shaping coastal geomorphology - coastal classification.
– Sea level change and coastal landforms as indicators.

[1] I.S.: Incoming students (e.g. ERASMUS Student)

- Coastal hydrodynamic conditions (waves, coastal currents, tidal currents).
- Coastal zones (morphology, hydrodynamics and morphodynamics).
- Coastal terraces
- Coastal dunes (morphology, development)
- River delta
- Lagoons and coastal lakes (formation process, description)
- Coastal cliffs - Marine notches
- Beachrocks
- Underwater relief (landforms, mapping techniques).
- Underwater relief of Greece (in relation to its geodynamic evolution).
- Basic concepts of coastal zone management. Institutional framework (DPSIR Tools)
- Foreshore Law (causes of erosion, protection projects)

B. Practical Exercises:

- Characterization of landforms and their classification. Application along the Antirrio - Eratini coastline
- Development of underwater relief for different sea levels during the Flemish trangression (e.g. 18,000, 10,000, 6,000 years). Application in the Saronic Gulf and/or in the Cyclades
- Granulometry
- Calculation of coastal sediment transport (with calculation of wind waves)
- Coastal terraces, identification, mapping, examples from N. Peloponnese and Rhodes
- Morphological study of the sand dune system of the central Gulf of Kyparissia (calculation of the moving sand amount)
- Delta Classification, based on the wave regime and the fluvial runoff.
- Formation and evolution of the lagoon of Korissia (palaeodunes, modern coastal barrier)
- Formation and evolution of the coastal zone of Agios Georgios - Naxos (palaeodunes, beachrocks, closure of a lagoon, modern tombolo, evolving dune fields)
- Use of data from shallow core sampling for the palaeogeographical evolution of the coastal area. Examples from Samos and Paros.
- Exercise with 3D seabed illustration
- Morphological characterization of underwater units (ditches, deep basins, straits)
- Exercise of coastal vulnerability due to sea level rise
- Development of a coastal erosion model with logical rules
- Definition of the boundaries (foreshore, coast based on the wave regime (based on Greek law) and old foreshore

C. Field Trips

Optional field activities

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	26 hours
Practice exercises	13 hours
Fieldwork	10 hours
Tutorials	-
Essey writing	-
Autonomous study	29 hours
Final assessment preparation	22 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

I. LECTURES (**50%**) (summative)

the grade is based on examination at the end of the semester:

- Oral or
- Written with questions of short answer and multiple choice or
- Written with questions of extended answer

II. PRACTICE EXERCISES (**50%**) (summative)

The laboratory is evaluated as follows:

- **20% through participation in weekly exercises in the classroom and/or the fieldwork**
- **30%** in final exams

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

II. ADDITIONAL READING

III. RELATIVE JOURNALS

Suggested Bibliography

- Evelpidou N., 2019. Sea level changes. Da Vinci, Athens (in Greek). ISBN: 9789609732321. (Book website) [Code Evdoxos: 86054068]
- Karymbalis E., 2010. Coastal geomorphology. ION editions, Athens [Code Evdoxos: 122081526]
- Additional bibliographical sources are available via this course webpage (e-class notes-exercises).

Related scientific Journals

- Continental Shelf Research
- GeoMarine Letters
- Journal of Coastal Research
- Marine Geology

WEBPAGE OF THE COURSE:

https://eclass.uoa.gr/courses/GEOL398/

E6204 APPLIED GEOMORPHOLOGY – URBAN GEOMORPHOLOGY

Instructors

Lectures: Prof. N. Evelpidou - A. Karkani, Laboratory Teaching Staff

Lab. Training: Prof. N. Evelpidou - A. Karkani, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 6th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Practical exercises

2 hours of lecturing and 1 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: NONE

Language of instruction and Assessment: Greek [1]

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

Upon successful completion of the course student will:

- **Identify** and **describe** the principles of applied geomorphology in hydrological, coastal zone and land use studies,
- **Comprehend**, **distinguish** and **interpret** the effects of urbanization and human interventions on changes in the geomorphological environment, on the alteration of the terrain and their effects on the occurrence of natural hazards such as floods, landslides, subsidence, erosion,
- **Calculate** physical parameters for the design technical works such as torrent arrangements, dams, roads, settlements as well as factors affecting manifestation of earth movements, floods, erosion, etc.
- **Apply** methods of applied geomorphology in the design of technical projects and in the assessment of geomorphological hazards,
- **Collect** and **analyze** literature on topics related to applied geomorphology
- **Combine** and **compose** examples of studies that have been done internationally and in Greece,
- **Explain**, **collect**, **compare** and **evaluate** data in problem solving such as natural hazard assessment (floods, landslides, falls, subsidence, erosion), human interventions, land uses, selection of settlement location based on geomorphological and environmental characteristics, development, planning and management of urban environments.
- **Apply** models for natural hazard assessment, such as floods or coastal erosion.

Generic Competences:

- Ability to apply knowledge in practical situations
- Ability to search for, process and analyse information with the use of necessary technologies
- Oral and written communication of scientific issues
- Ability to undertake research at an appropriate level
- Commitment to conservation of the environment

COURSE CONTENT:

A. Lectures

Lectures include:

- Difference between theoretical and applied geomorphology.
- Applications of geomorphology in hydrological studies and in the coastal zone (surface and groundwater, hydrographic networks, deltaic areas, sea level changes).
- Geomorphology and land uses.
- Urbanization and changes in the geomorphological environment.
- Anthropogenic interventions and landscape alteration.
- Geomorphology and design of technical projects (torrent arrangements, dams, roads, town planning etc.).
- Landslides, effect of landslides in an area (landslide zone mapping, landslide classification: frequency, amplitude).
- G.I.S. and applied geomorphology.
- Examples from Greece.
- Technical and environmental issues of urban areas such surface water management, assessment of natural hazards (floods, landslides, falls, subsidence, erosion), development design and urban management.
- Neocatastrophism in the Mediterranean and tsunami.

B. Practical and laboratory exercises

Laboratory exercises are the continuation and practice based on the course lectures. They include Exercises with maps, satellite images, aerial photographs, as well as calculations, measurements and questionnaires for:

- landslide identification, mud flows,
- flood mapping,
- land use mapping,
- runoff erosion,
- landslide modeling and risk assessment
- flood risk modeling and assessment,
- modeling of runoff erosion,
- selection of dam location and settlement location
- sea level indicators and future coastal hazards
- retreat of coastal cliffs,
- study of palaeo-tsunamis

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	26 hours
Practice exercises	13 hours

[1] I.S.: Incoming students (e.g. ERASMUS Student)

Fieldwork	-
Tutorials	-
Essey writing	20 hours
Autonomous study	41 hours
Final assessment preparation	-
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

I. LECTURES (**50%**) (summative)
- oral presentation of a subject selected through a list

II. PRACTICE EXERCISES (**50%**) (formative)
- Individual reports of laboratory exercises delivered via e-class

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL
- Evelpidou, N., 2018. Geomorphology: Laboratory Exercises. [Code Eudoxus: 77117790]
- Karkani, A., & Evelpidou, N., 2023. Applied and Urban Geomorphology. Kallipos, Open Academic Publications. https://dx.doi.org/10.57713/kallipos-350. [Code Eudoxus: 124292406]

II. ADDITIONAL READING
- Evelpidou, N., Tzouxanioti, M., Karkani, A., 2023. Geographic Information Systems from theory to Practice: Use of ArcGIS Pro. Kallipos, Open Academic Publications. https://dx.doi.org/10.57713/kallipos-367 [Κωδ. ΕΥΔΟΞΟΣ: 127532912]
- Panizza, M., 1996. Environmental Geomorphology. Elsevier.
- Vieira, A., & Oyguc, R. (Eds.), 2024. Current Perspectives on Applied Geomorphology. IntechOpen.

III. RELATIVE JOURNALS
- Geomorphology
- Land

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL119
https://eclass.gunet.gr/courses/LABGU358/

E6205 REMOTE SENSING - PHOTOGEOLOGY - MATHEMATICAL GEOGRAPHY

Instructors

Lectures: Assoc. Prof. E. Vassilakis - Prof. N. Evelpidou

Lab. Training: Assoc. Prof. E. Vassilakis - Prof. N. Evelpidou

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 6th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Lab Exercises and Fieldwork

2 hours of lecturing and 1 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: Y2204 GIS and Introduction to Remote Sensing [recommended]

Language of instruction and Assessment: Greek [1]
Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

On successful completion of the course the student:

- • **Understands** the mechanisms of the electromagnetic radiation recordings from sensors placed on various platforms (airborne, satellite, etc.)
- • **Recognizes** structures and textures in earth surface relief, through observation of remote sensing data on a PC and by using a stereoscope
- • **Apply** remote sensing data processing techniques with earth observation tools and digital raster data analysis
- • **Composes** and **constructs** digital maps using remote sensing data as a basic cartographic background
- • **Interprets** cartographic composites with false color band combinations of remote sensing data
- • **Evaluates** the new technologies related to the extraction of geo-information about the surface of the earth, from a distance, either long range (satellite images, aerial photographs) or close range (UAS, laser scanner)

Generic Competences:

- Ability to search for, process and analyse information with the use of necessary technologies
- Ability to work in a team
- Autonomous work
- Decision making
- Information and Communication Technology (ICT) skills

COURSE CONTENT:

A. Lectures

– Basic principles of Remote Sensing

[1] I.S.: Incoming students (e.g. ERASMUS Student)

- Electromagnetic spectrum
- Sensors, Satellites, Orbits
- Types of resolutions
- Spectral analysis
- Band ratios
- Data corrections
- Image processing
- Histograms
- Multi-temporal observation
- GNSS data processing
- Unmanned Aerial System data acquisition and Photogrammetric processing
- LiDAR data acquisition and basic processing
- Analog aerial photographs
- Stereoscopy
- Photo-geological interpretation

B. Lab Exercises

The Practice Exercises are mostly carried out individually on the Department's PC Lab and are graded at the end of the Laboratory.

Exercise 1. Find specifications of a given satellite platform and its data

Exercise 2. Determination of objects/areas reflectivity and spectral signatures

Exercise 3. Calculation of spectral indices

Exercise 4. Construction of false color composites

Exercise 5. Photogrammetric Processing of aerial photographs acquired from UAS

Exercise 6. Processing point clouds acquired from Terrestrial Laser Scanner

Exercise 7. Creating a map from photointerpretation of aerial photographs using a stereoscope (part I)

Exercise 8. Creating a map from photointerpretation of aerial photographs using a stereoscope (part II)

C. Fieldwork

C1. Three-hour field exercise within the University Campus. Planning and flight of a UAS, after the establishment of Ground Control Points with RTK-GNSS equipment.

C2. Three-hour field exercise within the University Campus. Acquire point clouds using a terrestrial laser scanner and measure Bases and Control Points with RTK-GNSS equipment.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	26 hours
Practice exercises	13 hours
Fieldwork	6 hours
Tutorials	-
Essey writing	24 hours
Autonomous study	23 hours
Final assessment preparation	8 hours

Total student's effort	100 hours

ASSESSMENT METHODS AND CRITERIA:

I. Course theory (**60%**)

- Multiple choice online exams (Summative)

II. Laboratory Exercises (**40%**)

- Evaluation of each exercise at the end of the class or after it is sent either digitally (remote sensing) or analog (photogeology) to the teachers (Formative).

Supplementary material for the exams (questions, exercises etc.) is posted on **e-Class** platform (http://eclass.uoa.gr/courses/GEOL126).

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- LIU JIAN GUO & MASON PHILIPPA, 2023. Image processing and GIS in Remote Sensing, Ed. DISIGMA / 9786182021576, [EUDOXUS code: 122088888]
- Kartalis K.., & Fidas Ch., 2012. Principles and Applications of Satellite Remote Sensing, Ed. TZIOLA & Sons S.A / 9789604184019, [EUDOXUS code: 22767582]

II. ADDITIONAL READING

- Jensen J., 2015. Environmental Remote Sensing, pp.680.
- Hatzopoulos I., 2020. Geospatial-informational topography, pp.704.
- Parcharidis I., 2016 Principles of Satellite Remote Sensing, [EUDOXUS code: 320339]

III. RELATIVE JOURNALS

- Remote Sensing (ISSN 2072-4292)
- International Journal of Remote Sensing (ISSN: 1366-5901)
- Journal of Applied Remote Sensing (ISSN: 1931-3195)

Additional Reading Material

- Additional bibliographic resources and lecture contents are available to students participating in the course through the relevant course website (e-class).

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL126

E6206 INDUSTRIAL MINERALS

Instructors

Lectures: Assoc. Prof. H. Vasilatos – Z. Kypritidou, Laboratory Teaching Staff

Lab. Training: Assoc. Prof. H. Vasilatos – Z. Kypritidou, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 6th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Lab Exercises and Fieldwork.

1 hours of lecturing and 2 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: [recommended]

Y2202 Systematic Mineralogy-Mineral Identification,
Y3202 Petrology Of Sedimentary Rocks,
Y3201 Igneous Rocks-Magmatic Processes and
Y4203 Geochemistry.

Language of instruction and Assessment: Greek [1]
Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

Upon successful completion of the course the student will be able to:

- **identify** and **describe** the most common industrial minerals, their properties, applications and the methods for their exploration, characterization and evaluation.
- **combine** and apply all the knowledge acquired during his/her studies for the exploration, evaluation and utilization of industrial minerals and rocks.
- **combine** knowledge for the synthesis of work plans and decision-making on exploration and exploitation of industrial minerals and rocks, taking in account the protection of the environment and the sustainable development.

Furthermore:

- the student **will be aware of** the importance of the exploitation and utilization of industrial minerals and rocks to the society, the economic growth and the sustainability.

Generic Competences:

- Ability to search for, process and analyse information with the use of necessary technologies
- Oral and written communication of scientific issues
- Ability to apply knowledge in practical situations
- Promote free, creative and inductive thinking
- Commitment to conservation of the environment
- Information and Communication Technology (ICT) skills

COURSE CONTENT:

A. Lectures.

- Commodities & Specialties Industrial minerals and rocks. Genesis of deposits, properties, industrial apllications.
- Methods of sampling, mineral exploration, extraction, and processing.
- Exploitation of industrial minerals and impact on the environment
- White carbonates & talc. Fire retardant materials. Vitreous & zeolite tuffs, diatomites. Fly ash. Phosphorites, industrial clays, ways of creation, enrichment, industrial uses, exploration, and mining. Milos, the island of minerals/description of the main industrial minerals of the island: perlite, bentonite, kaolin, poszolans, diatomites. Evaporites, borates, sulfates, and carbonates of sodium, celestine. Ways of formation, methods of research, industrial uses. Quartzofeldspathic. Garnets-Walllastonite. Specialized building materials.
- Cement and concrete raw materials, Green cement.
- Seafloor mining of industrial minerals.
- New trends in the exploration and exploitation of industrial minerals.

B. Lab Exercises:

- White carbonate rocks of Hymettus area.
- Asbestos, talc, onyx, slates-marbles of Hymettus
- Study of geological maps 1: 50,000 of IGME
- Neogene rocks of the island of Aegina
- Development of lightweight Aggregates (Lightweight Aggregates LWA) for use in lightweight concrete (Lightweight Concrete LWC), soil projects and agricultural applications.
- Enrichment of depleted kaolinite deposits. Perlite-vermiculite swelling.
- Determination of CEC.
- Macroscopic identification & description of industrial minerals & rocks

C. Fieldwork

C1. Fieldtrip in Hymettus Mt: Practice in the identification, assessment, mapping and sampling of Industrial Minerals and Rocks

C2. Fieldtrip in a quarry area or in an area of mining interest for industrial minerals: Practice in the identification, first assessment, mapping and sampling of Industrial Minerals and Rocks

C3. Fieldtrip at the Archaeological site of Eleusis: Practice in the recognition of construction materials in antiquity.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	12 hours

I.S.: Incoming students (e.g. ERASMUS Student)

Practice exercises	24 hours
Fieldwork	14 hours
Tutorials	–
Essey writing	–
Autonomous study	26 hours
Final assessment preparation	24 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

The final grade results by a series of tests which include:

I. Report and Public Presentation (**50%**) (Summative)

- Writing a report in the form of a review on issues related to Industrial Minerals and Rocks and its public presentation before all students attending the course.

II. Laboratory exercises (**30%**) (Formative)

- Problem solving and writing relevant reports during laboratory exercises

III. Active participation in field exercises and reporting (**20%**) (Formative, Summative)

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- Παπούλης Δ, Λαμπροπούλου Π., 2016, **Ορυκτολογία: Συστηματική ταξινόμηση των ορυκτών**, [EUDOXUS code: 77112087]

II. ADDITIONAL READING

- Ciullo A.P., 1996. Industrial minerals and their uses. A Handbook & Formulary. Elsevier, 647 pages
- Ι.Γ.Μ.Ε., 2011. Ελληνικός Ορυκτός Πλούτος – Νέες αναπτυξιακές δυνατότητες για βιώσιμες και παραγωγικές επενδύσεις
- Stamatakis M, 2017: Laboratory booklet for the course "Industrial Minerals and Rocks", (in Greek).
- Stamatakis M. and Katerinopoulos A., 1995. Applied Mineralogy – Petrology. Industrial minerals and rocks and their uses in Greek
- Τσιραμπίδης Α., 2005. **Ο ορυκτός πλούτος της Ελλάδος**. Εκδόσεις Γιαχουδη Ι.Κ.Ε.

III. RELATIVE JOURNALS

- Industrial Minerals,
- Cement and concrete composites, Elsevier
- Clays and clay minerals, Elsevier
- International Journal of Mineral Processing, Elsevier
- Economic Geology, Society of Economic Geologists (SEG)

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL212

E6209 PETROGENESIS OF IGNEOUS ROCKS AND OPHIOLITHIC COMPLEXES

Instructors

Lectures: Prof. P. Pomonis - Assoc. Prof. D. Kostopoulos

Lab. Training: Prof. P. Pomonis - Assoc. Prof. D. Kostopoulos

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 6th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

2 hours of lecturing and 1 ώρα εργαστ. ασκήσεων την εβδομάδα, 4 ECTS credits.

Learning Outcomes/Subject Specific Competences:

On successful completion of the course the student:

- **Comprehens in depth** the processes that govern the formation and evolution of magmas.
- **Interprets** phase diagrams and **uses** them to construct hypothetical liquid lines of descent.
- **Calculates** simple equations to predict the behaviour of trace elements during partial melting and fractional crystallisation.
- **Enlarges** his experience of igneous rock types and ophiolitic rocks, **identifies** them in thin section and **deduces** their tectonic association and mode of origin.

Generic Competences:

- Ability to apply knowledge in practical situations
- Promote free, creative and inductive thinking
- Ability to plan and manage time
- Ability to work in a team
- Ability to search for, process and analyse information with the use of necessary technologies
- Adapt to and act in new situations and cope under pressure
- Ability to be critical and self-critical
- Oral and written communication of scientific issues
- Decision making
- Ability to undertake research at an appropriate level
- Autonomous work
- Information and Communication Technology (ICT) skills
- Ability to work in an international context
- Commitment to conservation of the environment
- Ability to work in an interdisciplinary context

COURSE CONTENT:

Περιεχόμενο:

– Phase Diagrams in Geology - Study of phase equilibrium in one, two, three and four component diagrams as a function of pressure, temperature and water (use of petrology software).
– Petrogenetic processes in the lithosphere and asthenosphere - Partial melting in the crust and mantle - Mantle heterogeneity - Xenoliths and their relationship to the surrounding volcanic rocks - Methodology for studying xenoliths for petrogenetic inference.

- Formation and evolution of magmas - Classes of magmas and their origin - Magma composition - Magma differentiation, fractional crystallization, contamination, magma mixing .
- Introduction to the relationship between magmatism and global tectonics - igneous rocks of mid-ocean ridges, island and continental arcs, back-arc basins, fault zones, etc.)
- Types and members of ophiolite complexes - Tectonites - Cumulate rocks – Isotropic gabbros - Sheeted dyke complex - Basaltic pillow lavas - Ophiolitic mélange. Nomenclature and classification of rocks that make up ophiolitic complexes based on geochemical criteria - Differences and similarities between ophiolitic sequences of divergent and convergent plate boundary environments.
- Lithospheric plate theory and ophiolites - Earliest historical milestones in the development of ideas about the formation and emplacement of ophiolitic complexes - Modern definition of an ophiolitic complex - Current theories of lithospheric plate behaviour and their relationship to ophiolite complexes - Mechanisms controlling ophiolite emplacement - Magmatic processes in back-arc and fore-arc environments.
- Description of the main petrogenetic processes for the formation of ophiolite complexes – Mantle source composition - Formation of primary basaltic magma - Primary magma - Differentiation processes - Geotectonic environment of formation - Petrogenetic modelling (Estimation of degree of partial melting for the creation of primary magma using geochemical data and use of modern petrogenetic methods) - Estimation of physico-chemical conditions (examples of geothermal barometry, ways of calculating oxygen fugacity) - The importance of the presence of primary amphiboles - Conditions of metamorphism and metasomatism of the ocean floor - Phenomena of hydrothermal alteration, rodingitization and carbonation - The role of water and CO2 in metasomatic processes - Serpentinization in subduction zones, relation to volcanism and metasomatism.
- Processing of geochemical models and use of mineral chemical data to determine the geotectonic environment of ophiolite formation - Interpretation of normalized rare earth diagrams and multi-element diagrams - Use of geochemical diagrams for geotectonic classification - Determination of the geotectonic environment using mineral chemical data - Isotopic data as tools for determining the geotectonic environment.
- Description of the main Greek ophiolitic bodies - Examples from the ophiolites of Vourinos, Pindos, Koziakas, Othrys, Euboea, Gevgeli, Halkidiki, Soufli, Samothrace, Lesvos, Cyclades and Crete - Distinguishing the Greek ophiolitic deposits on the basis of their geotectonic environment of formation.
- Reference to typical occurrences of ophiolite complexes in the world - Examples from the Troodos (Cyprus), Mirdita (Albania), Semail (Oman), Liguria (Italy), Western Alps, Nicoya (Costa Rica), Teitao (Chile), Smartville (California, U.S.A.), Smartville (California, U.S.A. (California, USA), Betts Cove (Canada), Zambales (Philippines) - Classification based on their formation environment.

Mineralization in ophiolitic rocks

- Mineralization of PGE group.
- Fe-Cu-Ni-Co sulphide deposits
- Podiform chrome deposits - their relationship to the geotectonic environment of genesis, nickel laterite deposits, talc-magnesite deposits, zinc and tin deposits and their relationship to ocean floor hydrothermal veins.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	26 hours
Practice exercises	13 hours
Fieldwork	8 hours
Tutorials	
Essey writing	
Autonomous study	33 hours
Final assessment preparation	20 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

- Written examination (**80%**) (summative)
- Development/examination of the topic of the individual project (**20%**) (formative)

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

II. ADDITIONAL READING

- Igneous and Metamorphic Petrology (Myron G. Best – 2002)
- Μαγματικά Πετρώματα (Κοκκινάκης Ανδρέας , Πανεπιστημιακές Σημειώσεις – 2002)
- Ophiolite Concept and the Evolution of Geological Thought (Yildirim Dilek, Sally Newcomb – 2003– GSA Special Paper 373)
- Ophiolites, Arcs, and Batholiths (James Earl Wright, John W. Shervais – 2008 – GSA Special Paper 438)

III. RELATIVE JOURNALS

- Lithos (Elsevier)
- Journal of Petrology (Oxford University Press)
- European Journal of Mineralogy,
- Contributions to Mineralogy and Petrology (Springer Link)

WEBPAGE OF THE COURSE:

WEBPAGE (URL): http://eclass.uoa.gr/courses/GEOL222

E6210 MICROTECTONICS AND STRUCTURAL ANALYSIS

Instructors

Lectures: Assist. Prof. K. Soukis

Lab. Training: Assist. Prof. K. Soukis

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 6th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Lab Exercises and Fieldwork

1 hours of lecturing and 2 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: NONE

Language of instruction and Assessment: Greek [1]

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences: It is a specialized course that deals with the study, analysis, and interpretation of tectonic structures and deformation at the small scale of observation, i.e., from the scale of a few meters (layer/fracture level), to the microscopic scale (mineral or mineral assemblage level). The main field of Microtectonics focuses on studying thin sections under the microscope, which are also an essential source of information.

Upon successful completion of the course, the student is able to:

- Understand, describe, and analyze the concepts of flow and deformation, the deformation mechanisms at the microscopic scale (level of mineral or aggregates of minerals and crystal lattice, and the relationship between deformation and metamorphism.
- Recognize, describe, and analyze the primary and secondary foliations and lineations,
- Recognize, describe, and analyze the particular types of rocks microstructures and kinematic indicators associated with faults, fault zones and shear zones in the lithosphere.
- Recognize, analyze and classify microstructures such as porphyroblasts, veins, pressure shadows, pressure fringes, and boudins.
- Process and and combine the data and define the geometric, dynamic kinematic, and temporal analysis of deformation.

Generic Competences:

- Ability to apply knowledge in practical situations
- Ability to search for, process and analyze information with the use of necessary technologies
- Oral and written communication of scientific issues
- Ability to undertake research at an appropriate level
- Autonomous work

COURSE CONTENT:

A. Lectures

- **Basic concepts and methods**. The working framework of Microtectonics.
- **Flow and deformation**. Brittle, plastic and ductile deformation. Stress and strain.
- **Deformation mechanisms**. Pressure solution, Grain Boundary sliding Subgrain rotation, Grain Boundary migration.
- **Foliations**. Primary and secondary foliations observed in rocks. Bedding, Cleavage, Schistocity, Gneissic foliation.
- **Lineations**. Stretcing, intersection and crenulation lineation
- **Fault Rocks**. Classification of fault rocks based on descriptive criteria. Cataclasites, Mylonites, Gneisses
- **Shear zones**. Definition, Geometry and kinematics of shear zones.
- **Structures in dilation sites**. Porphyroblasts Veins, pressure shadows, pressure fringes, boudins.
- **Sampling** How to sample rock specimens and construct thin sections for a microscopic scale study.

B. Laboratory Exercises

Part I Identification, description and analysis of structures from petrological samples of various types of deformed rocks (2 weeks).

Part B Identifying, describing and analyzing microstructures from thin sections under the microscope. Deformation phases and metamorphic events (9-10 weeks)

Part C Exercises with tectonic maps. Microstructures and structural analysis (1-2 weeks)

C. Field (Outdoor) Exercises

ONE DAY FIELD EXCERCISES: Identification, description and analysis of microstructures and elements of tectonic fabric in the countryside. Taking and processing measurements of structural elements. Taking oriented samples to construct thin sections and study them under the microscope. Construction of geological - tectonic map.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Lectures	13 hours
Practice exercises	26 hours
Fieldwork	10 hours
Tutorials	- hours
Essey writing	15 hours
Autonomous study	16 hours
Final assessment preparation	20 hours
Total student's effort	**100** hours

[1] I.S.: Incoming students (e.g. ERASMUS Student)

ASSESSMENT METHODS AND CRITERIA:

The assessment process is conducted either with progressive exams in separate sections of the course content or with the final examination of the entire course material, which includes:

I. LECTURES (**50%**) (formative, summative)
- Oral Examination and/or
- Written Exam with Short Answer Questions and Multiple Choice Test and/or
- Written Exam with Extended Answer Questions

II. LABORATORY EXERCISES (**40%**) (formative, summative)
- Written exam with Solving Exercises and Problems(summative)

III. FIELD EXERCISES (**15%**) (formative, summative)
- Oral examination in the field and with evaluation of required Report or Essay

The evaluation criteria of the course and the participation rates are described in the Chapter «3.3 Evaluation Criteria» of this syllabus and student handbook.

Additional material (questions, exercises, etc.) for the exams is posted on the online e-Class platform (https://eclass.uoa.gr/courses/GEOL143/).

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

II. ADDITIONAL READING

- LOZIOS S and SOUKIS K., 2014. Introduction to Microtectonics, 158 pp (In Greek).
- N.J. Price & J.W. Cosgrove. Analysis of Geological Structures. Cambridge University Press, 1994.
- S. Sengupta. Evolution of Geological Structures in Micro- to Macro-scales. Chapman & Hall. 1997.
- T. Blenkinsop. Deformation Microstructures and Mechanisms in Mineral and Rocks. Kluwer Academic Publishers 2000.
- R. H. Vernon. A practical guide to Rock Microstructure. Cambridge Univ. Press. 2004.
- C.W. Passchier & R.A.J. Trouw. Microtectonics. Springer-Verlag Berlin Heidelberg 2005.
- G. H. Davis & S. J. Reynolds. Structural Geology of Rocks and Regions. John Wiley 7 Sons, Inc. 2012.
- H. Fossen. Structural Geology. Cambridge Univ. Press. 2016.

III. RELATED JOURNALS

- Journal of Structural Geology, Online ISSN: 1873-1201, Print ISSN: 0191-8141, Elsevier.
- Tectonics, Online ISSN:1944-9194, Print ISSN:0278-7407, AGU Publications.

WEBPAGE (URL):

http://eclass.uoa.gr/courses/GEOL143
http://opencourses.uoa.gr/courses/GEOL102/

E6213 ANALYTICAL AND ISOTOPIC GEOCHEMISTRY

Instructors

Lectures: Assoc. Prof. Ch. Stouraiti – Prof. A. Argyraki - Assist. Prof. E. Kelepertzis – Z. Kypritidou, Laboratory Teaching Staff

Lab. Training: Assoc. Prof. Ch. Stouraiti – Prof. A. Argyraki - Assist. Prof. E. Kelepertzis – Z. Kypritidou, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 6th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Practical exercises, Laboratory exercises, Fieldwork.

1 hours of lecturing and 2 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: Y1203 Chemistry [recommended]
Y4203 Geochemistry [recommended]

Language of instruction and Assessment: Greek [1]
Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

On completion of the course the student should have the following learning outcomes defined in terms of knowledge, skills and general competence:

- Apply the basic knowledge of analytical chemistry methods to the analysis of geological samples.
- Implements a rock, soil and water sampling plan and can select appropriate chemical analysis techniques on a case-by-case basis.
- Analyses the results of experiments and applies quality control principles to his/her work
- Selects the appropriate spectroscopic technique for on-site analysis in geological research and analyses spectral data
- Selects the appropriate dating method according to the geological problem and calculates the age of rocks and minerals
- uses isotopic ratios of stable and radioactive isotopes as tools for understanding the origin of hydrothermal fluids, magmas and hydrothermal alteration conditions of mineralised rocks

Generic Competences:

- Ability to apply knowledge in practical situations
- Promote free, creative and inductive thinking
- Ability to work in a team
- Ability to search for, process and analyse information with the use of necessary technologies
- Communication (written or oral) of scientific issues

[1] I.S.: Incoming students (e.g. ERASMUS Student)

- Oral and written communication of scientific issues

COURSE CONTENT:

A. Lectures.

Methods and Techniques for the Analysis of Geochemical Samples

- Sampling methods for geochemical surveys
- Introduction to spectrometric techniques; solution analysis (AAS, ICP-AES, NAA, ICP-MS).
- The analytical procedure - Geochemical measurement systems
- Quality assurance and calibration methods.
- Quality control of sampling and chemical analysis steps
- Spectrometric techniques for the analysis of solid samples (XRF, XRD)
- Modern portable spectroscopic techniques for on-site analysis (pXRF, pLIBS, pRAMAN, pWNIR-SWIR)
- Mass spectrometry (TIMS, SIMS)

2. Principles and applications of Isotopic Geochemistry

- Geochronology - Radioactive isotopes (Rb-Sr, Sm-Nd, Lu-Hf, U-Pb decay series)
- Applications of isotope ratios in tracing the origin of magmas and hydrothermal fluids
- Common stable isotopes (O, C, H, S) - Isotope fractionation in geological processes
- Applications of stable isotopes in ore geology
- Applications of stable isotopes in paleothermometry

B. Practice and Laboratory Exercises

- Full hands-on practice in the sampling and analysis of geochemical samples in the chemical laboratory, followed by interpretation of the results and report writing.
- Practical exercises are done as part of each course and are graded at the end of the course. In addition, students hand in two assignments in order to make a final assessment of their performance.
- 1st Assignment. Evaluation of Environmental Geochemistry statistical data - The importance of sampling.
- 2nd Assignment. Applications of radioactive and stable isotope systems in the petrogenesis of igneous rocks and metallogenesis.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	26 hours
Practice exercises	13 hours
Fieldwork	-
Tutorials	-
Essey writing	30 hours
Autonomous study	31 hours
Final assessment preparation	-
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

The assessment process is conducted in Greek (there is the possibility of examination in English for Erasmus students). The final grade of the course is formed by a series of tests that include:

I. ASSIGNMENTS FOR THE COURSE EXAM (**75%**)

- Completion of two assignments corresponding to the two teaching parts of the course

II. PRACTICAL EXERCISES (**25%**)

- Grading of each exercise at the end of the class (formative, deductive).
- Supporting material (questions, exercises, etc.) for the exam is posted on the e-class platform

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- K.C. MISRA. Introduction to Geochemistry (translated in Greek), Scientific Editing by A. Argyraki and C. Stouraiti, PEDIO Publishing, p. 576 [Code no. "EUDOXUS": 68406899].
- D.C. Harris, C.A. Lucy. Analytical Chemistry, Broken Hill Publishers (translated in Greek) Scientific editing of the Greek edition: A. Anthemidis, G. Zacahariadis, Ch. Kokkinos, A. Oikonomou, M. Prodromidis, K. Stalikas, M. Fousaki, N. Chaniotakis, Th. Christopoulos. p. 1104., [Code no. "EUDOXUS": 94644882].

II. ADDITIONAL READING

- Gill, G. Modern Analytical Geochemistry. 1997. Taylor and Francis, p. 317.
- Geiger, C. An introduction to spectroscopic methods in the mineral sciences and geochemistry, EMU Notes in Mineralogy, Vol. 6 (2004), Chapter 1, 1–42, https://doi.10.1180/EMU-notes.6.1
- Eby, G. N. Αρχές Περιβαλλοντικής Γεωχημείας (Μετάφραση Λιοδάκης, Δ. Πεντάρη) Εκδόσεις Κωσταράκη, Αθήνα. 2011 [Κωδ. ΕΥΔΟΞΟΣ: 77115198]
- Α. Αργυράκη (2013) Σημειώσεις Αναλυτικής Γεωχημείας, ΕΚΠΑ Αθήνα.
- Allégre, C. J. Isotope Geology. Cambridge University Press, 2008, 1st edition, 512 p.
- Leary, E. P., Crocombe, R. A., Kammrath, B. W. (2021). Introduction to Portable Spectroscopy. Portable Spectroscopy and Spectrometry, –. doi:10.1002/9781119636489. chapter 1

III. RELATIVE JOURNALS

- Applied Geochemistry, Elsevier
- Geochemistry, Exploration, Environment, Analysis, Geosciences World
- Geostandards and Geoanalytical Research, Wiley
- Chemical Geology, Elsevier

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL104

http://opencourses.uoa.gr/courses/GEOL103/

E6214 PETROGENESIS OF SEDIMENTARY ROCKS

Instructors

Lectures: Assist. Prof. M. Kati

Lab. Training: Assist. Prof. M. Kati - I. Megremi, Laboratory Teaching Staff - E. Moustaka, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 6th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Practical exercises, Laboratory exercises

2 hours of lecturing and 1 hours of practical exercises per week, 4 ECTS credits.

Prerequisites:

Y2202 Systematic Mineralogy-Mineral Identification [recommended]

Y3202 Petrology Of Sedimentary Rocks [recommended]

Language of instruction and Assessment: Greek [1]

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

On successful completion of the course the student:

- **Uses** and **applies** the methodology of petrographic analysis in the study of sedimentary rocks.
- **Becomes familiar** with specialized techniques used in laboratory research of sedimentary rocks (staining, impregnation, point-counting, mineral separation, etc.)
- **Discriminates** on a microscopic scale, and record the primary and authigenic components, textures, structures and particular petrological characteristics of the main types of sedimentary rocks.
- **Classifies** and **determines** the main petrological types/ lithotypes by petrographic and chemical methods.
- **Applies** the petrofacies/microfacies analysis to the recognition and interpretation of sedimentary depositional processes and environments.
- **Recognizes** and **describes** diagenetic products and interpret their diagenetic mechanisms and environments.
- **Constructs** paragenetic sequences and describes the evolution of porosity of siliciclastic and carbonate rocks.
- **Combines** the depositional and diagenetic characteristics with geochemical data to conduct petrogenetic conclusions of sedimentary rocks.
- **Comprehends** and **evaluates** the role of sedimentary rocks in the study of the paleoenvironments of the Earth's surface, in the research and exploitation of fossil fuels (especially of hydrocarbons) but also in their use in a wide range of chemical and industrial applications.

Generic Competences:

- Ability to search for, process and analyse information with the use of necessary technologies.
- Autonomous work.
- Ability to apply knowledge in practical situations.
- Work in a team.
- Promote free, creative, and inductive thinking.
- Ability to plan and manage time.
- Information and Communication Technology (ICT) skills.

COURSE CONTENT:

The course is a basic and essential complement to the knowledge of sedimentary petrology, with further deepening in the types and nature of physicochemical and biological processes that are responsible for the formation of sedimentary rocks, as well as the composition of surface-subsurface fluids in which the diagenetic alterations take place, after the deposition, during burial, until final uplift of the rocks. At the same time, it plays a crucial role in the design of a study in the research and exploitation of energy- and mineral resources -which sedimentary rocks themselves may constitute or even host- but also in their various industrial uses and applications.

A. Lectures

- Sedimentary rock-forming minerals (chemistry, physicochemical and optical properties, forms and occurrence).
- Depositional (primary) and diagenetic (secondary) textures and features of sedimentary rocks.
- Diagenetic realms – stages and processes.
- Types and composition of diagenetic fluids and modifications of pore fluids. Solubility and stability fields of the main authigenic minerals.
- Diagenetic sequences – paragenesis (order of diagenetic events in time).
- Evolution of porosity (types, origin, and diagenetic modifications)
- External factors controlling deposition and diagenesis (tectonic setting, climate, sea level changes).
- Petro- / microfacies analysis and depositional environments.
- Depositional and diagenetic models of siliciclastic rocks.
- Methods of study for provenance and tectonic setting of the detrital components of coarse siliciclastic rocks with emphasis on their heavy mineral content.
- Crystal structure, composition, origin, diagenesis, paleoclimatic and economic importance of clay minerals.
- Black shales (formation, distribution, paleogeographical and economic importance).
- Origin, depositional and diagenetic processes, and tectonic settings of volcaniclastic deposits.
- Depositional and diagenetic models of limestones.
- Dynamics of carbonate depositional systems and tectonic settings of carbonate platforms.
- Petrogenesis of dolomites (dolomitization processes, conditions, and models).
- Evaporites (primary and secondary evaporites, mechanisms, and genetic models).

[1] I.S.: Incoming students (e.g. ERASMUS Student)

- Cherts (origin of the source, and diagenesis of SiO2, conditions and depositional environments of bedded cherts)
- Phosphorites (Textural/petrographic classification – conditions, processes, and environments of their formation).
- Occurrence, genetic characteristics and tectonic settings of the most widespread sedimentary rocks and formations of Greece.

B. Practical and Laboratory Exercises:

Part A: Optical properties and distinctive characters of sedimentary rock-forming minerals. Methodology of petrographic analysis and basic principles of other laboratory methods and techniques.

Part B: Petrographic study of sedimentary constituents (grains/crystals, matrix, cements, authigenic minerals). Depositional textural features and structures. Diagenetic processes (cementation, dissolution, replacement, compaction, recrystallization, transformation, etc.) and their products. Classification, types and modifications (creation-destruction) of porosity.

Part C: Petrographic classifications and nomenclature (determination of lithotypes, and petrofacies/microfacies).

Part D: Geochemical criteria for origin, deposition and diagenesis of sedimentary rocks.

Part E: Application of petro-/microfacies analysis to the interpretation of mechanisms and environments of deposition and diagenesis. Interpretation of the nature and order of diagenetic events (diagenetic history). Depositional and diagenetic patterns.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	21 hours
Practice exercises	18 hours
Fieldwork	-
Tutorials	-
Essey writing	11 hours
Autonomous study	20 hours
Final assessment preparation	30 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

I. LECTURES (40%)

- Oral final examination (summative).

or

- Written examination with **short answer questions and multiple choice tests (**summative**).**

II. PRACTICE EXERCISES (60%)

- Written examination through microscopic study of selected thin sections of sedimentary rocks (summative).

or

- Oral examination of essays on topics given in the laboratory exercises (formative, summative).

Supplementary material (tables, exercises, guides, etc.) for the exams of the course is posted on **e-Class** platform (https://eclass.uoa.gr/courses/GEOL229/).

ΒΙΒΛΙΟΓΡΑΦΙΑ

I. ADDITIONAL READING

- M. Kati, **Petrogenesis of Sedimentary Rocks** (Course text, in Greek).
- Burley, S.D. & Worden, R.H., 2003, **Sandstone diagenesis: Recent and Ancient,** IAS Reprint Series Vol. 4, Blackwell, 649 p.
- Flügel, E., 2004, Microfacies of Carbonate Rocks: Analysis, Interpretation and Applications, Springer, 976 p.
- Moore, C.H. & Wade, W.J., 2013, Carbonate Reservoirs - Porosity and Diagenesis in a Sequence Stratigraphic Framework, Elsevier, 374 p.
- Scholle, P.A. & Ulmer-Scholle, D.S., 2003, **A Color Guide to the Petrography of Carbonate Rocks,** AAPG Memoir 77, 474 p.
- Ulmer-Scholle, D.S., Scholle, P.A., Schieber J. & Raine R., 2014, **A Color Guide to the Petrography of Sandstones, Siltstones, Shales and Associated Rocks,** AAPG Memoir 109, 526 p.

II. RELATIVE JOURNALS

- Journal of Sedimentary Research, Online ISSN: 1938-3681, Print ISSN: 1527-1404, SEPM.
- Sedimentary Geology, Online ISSN: 1879-0968, Print ISSN: 0037-0738, Elsevier.
- Sedimentology (IAS), Online ISSN: 1365-3091, Print ISSN: 0037-0746, IAS, Wiley.
- American Association of Petroleum Geologists Bulletin, Online ISSN: 1558-9153, Print ISSN: 0149-1423, AAPG.

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL229

E7201 NATURAL DISASTERS

Instructors

Lectures: V. Antoniou, Laboratory Teaching Staff –Retired Prof. E. Lekkas - Assoc. Prof. H. Kranis - Prof. N. Evelpidou - Prof. P. Nomikou - Prof. N. Voulgaris - E. Andreadakis, Laboratory Technical Staff – E. Kapourani, Laboratory Technical Staff

Lab. Training: V. Antoniou, Laboratory Teaching Staff – Retired Prof. E. Lekkas - Prof. N. Voulgaris - E. Andreadakis, Laboratory Technical Staff – E. Kapourani, Laboratory Technical Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 7th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Practical exercises, Fieldwork

1 hours of lecturing and 3 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: Although no typical admission requirements, students are expected to have mastered knowledge of natural phenomena covered by previous obligatory and/or elective courses

Y2201 Introduction to Geology
E5203 Volcanology
Y3203 Seismology
Y5203 Engineering Geology

Language of instruction and Assessment: Greek [1]
Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences: The course covers the fundamental principles of natural disasters study and management, both in national and global level. On completion of the course the student is able to:

- distinguishe the different aspects of natural disasters management in national and global level,
- recognize, describe and classify the types and scales of natural disasters
- clarify the relation between natural and technological disasters and the environment.
- research, analyze, combine, compare and evaluate all data and information relevant to the estimation of risk of any given natural hazard,
- summarize the principles of the environmental legislation and International Policies for disaster management.
- manage and communicate the risks of natural disasters
- apply technological tools that assist in the prevention of natural disasters

Generic Competences:

- Ability to search for, process and analyze information with the use of necessary technologies
- Autonomous work
- Ability to apply knowledge in practical situations
- Decision making
- Information and Communication Technology (ICT) skills

COURSE CONTENT:

A. Lectures

- Introduction to Natural Disasters: The problem on a local, national and international level - social and economic impact - types of Natural Disasters
- Technological and NaTech Disasters: Basic terms and principles
- Flood Hazard: Description – management steps – action and intervention by step – national and international management framework – the role of International Organizations and NGOs
- Seismic Hazard: Description – damage distribution zones - management steps – action and intervention by step – national and international management framework – the role of International Organizations and NGOs
- Landslide (mass movement) Hazard: Description – damage distribution zones - management steps – action and intervention by step – national and international management framework – the role of International Organizations and NGOs
- Wildfire Hazard: Description – damage distribution zones - management steps – action and intervention by step – national and international management framework – the role of International Organizations and NGOs
- Volcanic Hazard: Description – damage distribution zones - management steps – action and intervention by step – national and international management framework – the role of International Organizations and NGOs
- Desertification Hazard: Description – damage distribution zones - management steps – action and intervention by step – national and international management framework – the role of International Organizations and NGOs

B. Practical Exercises

The students work on a GIS platform to determine the vulnerability factors and the natural disaster(s) risk(s) of a given Greek Municipality. Specifically, they determine the disaster risk of

- flooding,
- mass movement phenomena,
- an earthquake,
- a volcanic eruption,
- wildfires and
- desertification.

C. Fieldwork

One day field trip at areas recently affected by natural disaster(s) that provides insight to the identification and mapping of natural hazards, vulnerability, risk, and analysis of pre- and post-disaster phases and is followed by the writing of a short essay – report.

[1] I.S.: Incoming students (e.g. ERASMUS Student)

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY
- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES
- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	13 hours
Practice exercises	39 hours
Fieldwork	12 hours
Tutorials	- hours
Essey writing	- hours
Autonomous study	20 hours
Final assessment preparation	16 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

The assessment process is conducted in Greek (there is the possibility of examination in English for Erasmus students), as follows:

I. LECTURES (**50%**) (summative)
- Written Exam with Short Answer Questions and Multiple Choice Test and/or
- Written Exam with Extended Answer Questions

II. LAB EXERCISES (**50%**) (formative)
- Short essay writing for each exercise and for field work activities

In the case of an unsuccessful result (<5), the students have the possibility to repeat the exercises.

Auxiliary material (questions, exercises, etc.) for the exams is posted on the online **e-Class** platform (https://eclass.uoa.gr/courses/GEOL175/).

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL
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II. ADDITIONAL READING
- Lekkas, E. (2000). Natural and Technological disasters. ISBN 960-90329-0-7, 278p. (in Greek)

III. RELATIVE JOURNALS
-

WEBPAGE (URL):

http://eclass.uoa.gr/courses/GEOL175

E7202 SATELLITE TECHNIQUES AND GIS IN GEOSCIENCES

Instructors

Lectures: V. Sakkas, Laboratory Teaching Staff - Prof. I. Alexopoulos - S. Vassilopoulou, Laboratory Teaching Staff

Lab. Training: S. Vassilopoulou, Laboratory Teaching Staff – Prof. I. Alexopoulos - V. Sakkas, Laboratory Teaching Staff - V. Nikolis, Laboratory Technical Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 7th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Lab Exercises and Fieldwork

2 hours of lecturing and 1 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: NONE

Language of instruction and Assessment: Greek
Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

On successful completion of the course the student

- **Define** and **formulate** the basic satellite techniques used in Geosciences
- **Describe** and **determine** the main characteristics and principles of the new satellite based techniques.
- **Define** the type of satellite data that can be used in different geological environments and applications
- **Define** and **describe** how to process satellite data using Geographical Information Systems (GIS)
- **Apply** new processing techniques to analyze satellite Radar Interferometic and geodetic GNSS data
- **Combine** and **evaluate** various satellite and ground-based data to interpret different geological and tectonic characteristics and address modern geological, environmental and technical issues

Generic Competences:
- Ability to apply knowledge in practical situations
- Promote free, creative and inductive thinking
- Decision making
- Ability to undertake research at an appropriate level
- Information and Communication Technology (ICT) skills
- Ability to work in an interdisciplinary context

COURSE CONTENT:

A. Lectures.
- Satellite systems for Earth Observations (EO): Historical review and basic concepts of space based EO systems

- Elements of the EM theory, atmospheric effects on the radiation, Energetic and passive EO satellite recording systems, Characteristics of satellite images
- Earth Observation Satellite Systems: Orbit and satellite characteristics; Spatial, temporal, spectral discrete analysis; Type of sensors
- Processing and analysis of satellite images, type of corrections.
- Satellite Images photo-interpretation – tectonic, geological, geomorphological and other data recognition.
- Interpretation of satellite data with open source software packages (i.e. interpretation of optical images LANDSAT, IKONOS, QUICKBIRD, SPOT etc.)
- Geographical Information Systems (GIS) and Web GIS in geological and geophysical research and geoenvironmental problems – natural hazards. Data base organization and processing of geodata, thematic layers, maps and diagrams creation. Time series creation.
- Digital Elevation Models and terrain analysis data. Uses in geological and geophysical research as well as in geoenvironmental problems – natural hazards.
- Satellite Radar Systems. Basic principles of satellite Synthetic Aperture Radar (SAR) Interferometry. Techniques of processing satellite radar images (ie Differential interferometry, Permanent Scatterer interferometry). Applications of radar interferometry for ground deformation observations caused by natural and anthropogenic processes, and mapping flood areas.
- Global Navigation Satellite System (GNSS/GPS): basic principles; type of GNSS constellations; type of measurements; processing of raw data, error reduction, processing strategies, data collection and data management, use of commercial and open-source s/w to process raw GNSS data.

B. Lab exercises.

Practice exercises are taught in small groups of students using s/w packages

Exercise 1. Introduction to the use and display of digital satellite data. (ArcGIS PRO / Image Analysis)

Exercise 2. Satellite images processing, image classification & photo-interpretation (ArcGIS PRO / Image Analysis).

Exercise 3. Managing and geo-processing geodata in ArcGIS PRO. Digital elevation models and terrain analysis data creation using ArcGIS PRO and specific s/w GENIMA.

Exercise 4..Map composition, formation of diagrams etc using database organization on GIS environment, practice with ArcGIS PRO

Exercise 5. Web GIS – data processing – web maps – web applications (ArcGIS Online).

Exercise 6. Processing GNSS data using Leica – Infinity s/w. Part 1. Importing raw data to the s/w, downloading and incorporate supplementary data and files on the s/w

Exercise 7. Processing GNSS data using Leica – Infinity s/w. Part 2. Processing GNSS data, ambiguity strategies. Compilation of GNSS products. Processing GNSS data from the field campaign

Exercise 8. Processing Satellite Radar Interferometric data using the open source s/w SNAP of European Space Agency (ESA). Part1: Downloading and processing radar interferometic data to calculate ground deformation. Differential Interferometry (DInSAR)

Exercise 9. Processing Satellite Radar Interferometric data using the open source s/w SNAP of European Space Agency (ESA). Part 2: Mapping flood areas.

Exercise 10 .Downloading, understanding and using interferometric products from the European Ground Motion Service.

C. Fieldwork

C1. One day field excursion collecting GNSS data on the broad area of the University campus .

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	26 hours
Practice exercises	10 hours
Fieldwork	3 hours
Tutorials	-
Essey writing	20 hours
Autonomous study	20 hours
Final assessment preparation	21 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

I. LECTURES (**20%**)

- Short oral or written test at the end of each lecture (formative).

Exams include short or extended answer questions, and/or multiple choice tests.

II. LAB EXERCISES (**20%**)

- Weekly assessment of lab exercises (formative, summative). or/and
- Written examination by solving a specific problem (summative).

II. FINAL WRITTEN ESSAY (**60%**)

- Final written essay presenting processing and interpretation results (formative, summative).

Supplementary material for the exams (questions, exercises etc.) is posted on **e-Class** platform (https://eclass.uoa.gr/courses/GEOL313/).

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- GPS and Geodetic Applications. Fotiou AI, Pikridas Ch. [EUDOXUS code: 22768688], in Greek.
- Applications of Geographic Information systems and Remote Sensing in Geological and Geo-Environmental Studies. S. Vassilopoulou (e-book: pdf) [EUDOXUS code:: 33239672], in Greek.

II. ADDITIONAL READING

- GPS Theory and practice» Hofmann-Wellenhof, Lichtenegger H., Collins J., Springer
- Sattellie InSAR Data, Reservoir monitoring from Space», Ferretti, A., EAGE, ISBN 978-90-73834-71-2
- InSAR Principles: Guidelines for SAR Interferometry Processing and Interpretation» E-book, European Space Agency, https://esamultimedia.esa.int/multimedia/publications/TM-19/TM-19_InSAR_web.pdf

III. RELATIVE JOURNALS

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WEBPAGE (URL):

http://eclass.uoa.gr/courses/GEOL313

E7203 EARTHQUAKE PREDICTION

Instructors

Lectures: Assoc. Prof. G. Kaviris – Prof. F. Vallianatos

Lab. Training: Assoc. Prof. G. Kaviris – Prof. F. Vallianatos - K. Pavlou, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 7th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Practical exercises, Laboratory exercises

2 hours of lecturing and 1 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: [recommended]

Y3203 Seismology

Y6201 Applied and Engineering Seismology

Language of instruction and Assessment: Greek

Το μάθημα προσφέρεται σε φοιτητές Erasmus:NO

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

On successful completion of the course the student:

- **Identifies** and **describes** the applicable earthquake prediction method.
- **Distinguishes** and **explains** the differences between the different earthquake prediction methods.
- **Classifies** the earthquake prediction methods as long-term, medium-term, and short-term.
- **Calculates** by data analysis the parameters used in the earthquake prediction methods.
- **Combines** different methods that have been applied in successful earthquake prediction case studies.
- **Composes** and **suggests** which earthquake prediction method(s) is (are) appropriate, depending on the available data.
- **Evaluates** the results of studies published in international scientific journals and **concludes** whether the earthquake prediction methods are applicable and in which cases.

Generic Competences:

- Ability to apply knowledge in practical situations
- Ability to search for, process and analyse information with the use of necessary technologies
- Ability to undertake research at an appropriate level
- Autonomous work
- Ability to work in an international context

COURSE CONTENT:

A. Lectures:

– Long-term, medium-term and short-term earthquake prediction. Minimization of effects and protection measures.
– Earthquake Early Warning Systems.

- Seismic cycle. Statistical forecast and estimation of the probability of occurrence of a strong earthquake. Precursory phenomena, mechanisms of deformation of the Earth's crust – dilatation theory.
- Seismic zones, extreme values method, seismic gaps (type A and B), seismic quiescence, chaos theory.
- Seismic anisotropy and temporal changes of shear-wave splitting parameters in tectonic and volcanic environments.
- Foreshocks, migration of seismic activity, variations of the seismic wave's velocity.
- Ground deformation maps, tsunamis, groundwater level and temperature changes, electromagnetic field fluctuations, chemical changes and radon release.
- Changes in seismic activity in space and time, methods of estimating static stress changes, models of decelerating - accelerating seismicity.
- Application of earthquake prediction methods in volcanic environments.

B. Practical and Laboratory Exercises:

PART A: Seismotectonic analysis exercises in active areas of Greece

PART B: Exercises for determining the constants a and b of the Gutenberg-Richter law using the entire earthquake catalogue and the extreme values method, using the least squares method.

PART C: Exercises for calculating the probability of occurrence of a future earthquake and determination of ground deformation.

PART D: Stress transfer determination exercises (static Coulomb stress changes).

PART E: Estimation of earthquake occurrence by means of shear-wave splitting

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	26 hours
Practice exercises	13 hours
Fieldwork	-
Tutorials	-
Essey writing	26 hours
Autonomous study	20 hours
Final assessment preparation	15 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

The assessment process is conducted in Greek with a final examination of the entire syllabus and presentation of individual work on a specific earthquake forecasting methodology and includes:

I. LECTURES (50%)

- Individual Report and Oral Presentation per Student (formative, summative)

II. PRACTICE EXERCISES (50%)

- Written exam with Solving Exercises and Problems (formative)

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- Introduction to seismology. Papazachos B.C., G.F. Karakaisis, P.M. Chatzidimitriou. [Code EUDOXUS: 11254], in Greek
- General seismology vol. A, A. Tselentis [Code EUDOXUS: 59395397], in Greek

II. ADDITIONAL READING

- G. Kaviris, P. Papadimitriou, Ph. Kravvariti, V. Kapetanidis, A. Karakonstantis, N. Voulgaris and K. Makropoulos, 2015. A detailed seismic anisotropy study during the 2011-2012 unrest period in the Santorini Volcanic Complex. Physics of the Earth and Planetary Interiors, 238, 51-88
- S. Wiemer and M. Wyss, 1994. Seismic Quiescence before the Landers (M = 7.5) and Big Bear (M = 6.5) 1992 Earthquakes. Bulletin of the Seismological Society of America, Vol. 84, 3, 900-916.

III. RELATIVE JOURNALS

- Bulletin of the Seismological Society of America, SSA Journals
- Geophysical Journal International, Oxford University Press
- Journal of Geophysical Research, AGU Publications
- Physics of the Earth and Planetary Interiors, Journal, Elsevier
- Tectonophysics, Journal, Elsevier

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL234

E7206 EVOLUTIONARY PALAEONTOLOGY - PALAEOANTHROPOLOGY

Instructors

Lectures: Assoc. Prof. S. Roussiakis – Assoc. Prof. G. Lyras - E. Besiou, Laboratory Teaching Staff

Lab. Training: Assoc. Prof. S. Roussiakis – Assoc. Prof. G. Lyras - E. Besiou, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 7th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Laboratory exercises

2 hours of lecturing and 2 hours of practical exercises per week, 4 ECTS credits.

Prerequisites:

(Y2205) Macropalaeontologyς [recommended].

Language of instruction and Assessment: Greek

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

On completion of the course the student:

- Shall have understood the evolutionary theory of Darwin, the mechanisms of natural selection and the Neodarwinian theory.
- Shall have understood the cladistic methodology and use it to arrive on phylogenetic results.
- Shall have the ability to recognize microevolutionary and macroevolutionary events that occurred in the past.
- Analyzing available data, shall synthesize and interpret the evolutionary history of a taxonomic group.
- Shall have understood the phylogenetic relationships between the various primate groups, their evolutionary history, and shall have the ability to recognize the taxonomic group where a fossil primate belongs and its biostratigraphic significance.
- Shall have the knowledge for the interpretation of the osteological characters of the primates, especially those that are related with the bipedal locomotion.
- Shall have the knowledge of the basic methodology for the recognition of the sex on a human skeleton and the age estimation based on morphometric parameters.

Generic Competences:

- Autonomous work
- Ability to apply knowledge in practical situations
- Promote free, creative and inductive thinking
- Ability to search for, process and analyse information with the use of necessary technologies
- Information and Communication Technology (ICT) skills

COURSE CONTENT:

A. Lectures:

- Basic principles of the Darwinian theory, natural selection.
- Basic principles of the Neodarwinian theory (Evolutionary Synthesis).
- What is Phylogeny, methodology of the cladistics, cladograms.
- Events and trends in the evolutionary lines.
- Speciation and species concepts.
- Evolutionary changes, rate of evolution, models and results of the natural selection.
- The fossil record, microevolution and macroevolution.
- The primates in the evolutionary frame. Taxonomy of the primates. "Lower" and "higher" primates, haplorrhines, catarhines.
- Hominidae. Most important stages of the hominid evolution (early Hominini, australopithecines,).
- Introduction to the human osteology, adaptations for bipedalism.
- The evolution of *Homo.*
- *Homo neanderthalensis*.
- The evolution of *Homo* in islands.

B. Practical and Laboratory Exercises:

- Cladistic analysis based on palaeontological morphometric data. Application of cladistics methodology for the interpretation of phygenetic relationships. Recognition of characters (derived characters, synapomorphies, apomorphies, autoaapomorfies, convergent evolution), recognition of sister taxa.
- The evolutionof the Equidae through the study of their dentions. Measurements, making diagrams, interpretation of the diagrams relative to geographic and temporal history of the Equidae, interpretation relative to the environment and possible climatic changes.
- Convergence evolution based on examples in the evolutionary history of carnivores.
- Island Evolution.
- Introduction to the human anatomy. Recognition of the sex and the age.
- Exercises based on the specimens of the Museum and recognition of the most important primate groups.
- Lemurs and tarsiers, Platyrhines, Catarhines.
- Australopithecines
- *Homo*

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	26 hours
Practice exercises	26 hours
Fieldwork	-
Tutorials	-

Essey writing	16 hours
Autonomous study	16 hours
Final assessment preparation	16 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

I. THEORETICAL PART (summative)
- Oral or written examination (**60%**).

II. LABORATORY PART (formative, summative)
- At the practical examination the students are evaluated according to their results on the laboratory exercises and according to their results (**40%**).

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

II. ADDITIONAL READING

- Ankel-Simons F. (2007). Primate Anatomy. An Introduction. Elsevier.
- Delson E., Tattersall I., Van Couvering J. A. & Brooks A.S. (2000). Encyclopedia of human evolution and prehistory. Garland Publishing.
- Fleagle J.G. (1998). Primate adaptation and evolution. Academic Press, 1-595.
- Futuyma D.J. (2005). Evolution. Sinauer Associates, 1-603.

III. RELATIVE JOURNALS

- Journal of Human Evolution, Online ISSN: 0047-2487
- American Journal of Physical Anthropology, Online ISSN: 1096-8644
- International Journal of Primatology, Online ISSN: 0164-0291

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL297

E7207 VERTEBRATE PALAEONTOLOGY

Instructors

Lectures: Assoc. Prof. S. Roussiakis – Assoc. Prof. G. Lyras - E. Stathopoulou, Laboratory Teaching Staff

Lab. Training: Assoc. Prof. S. Roussiakis – Assoc. Prof. G. Lyras – E. Stathopoulou, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 7th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Laboratory exercises

2 hours of lecturing and 1 hours of practical exercises per week, 4 ECTS credits.

Prerequisites:

Y2205 Macropalaeontology [recommended]

Language of instruction and Assessment: Greek
Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

On completion of the course the student:

- Shall have the ability to define and understand the position of the Vertebrates in the animal kingdom and describe the basic characters of the Chordata and Vertebrata, the relationships between the Invertebrates and Vertebrates and the mechanism of Vertebrate origin.
- Shall have developed the ability to recognize and describe the more important diagnostic characters of the various Vertebrate groups (Fishes, Amphibians, Reptiles, Mammals, Birds), elucidate and analyze their adaptive significance depending their living environment.
- Shall have recognized and classified (in family/generic level) the most common fossils of the Greek fossil record.
- Shall have developed the ability to infer about the relative geological age based on the fossils.
- Based on the characters of a vertebrate palaeofauna shall be deduce about the palaeoenvironment.
- Can interpret possible relationships between vertebrate faunas of different geographic areas and infer about the palaeogeography, interpreting relative bibliography.
- Shall have the ability to work with the bibliography.

Generic Competences:

- Autonomous work
- Ability to apply knowledge in practical situations
- Work in a team
- Promote free, creative and inductive thinking
- Ability to search for, process and analyse information with the use of necessary technologies

COURSE CONTENT:

A. Lectures:

- Introduction to the most important subject of Vertebrate Palaeontology.
- Relationship between Invertebrates and Vertebrates, origin of the Vertebrates, anatomical features of the Vertebrates.
- Taxonomy of the Vertebrates, Fishes, Amphibians, Reptiles, Mammals, Birds. Phylogenetic relationships between the Birds and the Reptiles especially the dinosaurs.
- Evolutionary radiation of the Vertebrates. Major features of the various phylogenetic groups of vertebrates.
- Major events to the Vertebrate evolution. Evolution of the skeleton, the fins, theories about the evolution of the jaws, evolution of the teeth, evolution of the limbs, etc.
- The transition from the sea to the land, from the land to the air. The first amphibians, the first flying vertebrates.
- Anatomical adaptations for the life in the water, on the land, on the air.
- General anatomical characters of the tetrapods. The skeleton of the tetrapods, the cranial of the cranium, the axial skeleton, the appendicular skeleton (with emphasis on the Mammals).
- The Greek fossil record of Vertebrates. The faunal synthesis of the most important vertebrate fossiliferous localities of Greece, biostratigraphy, palaeoenvironment.
- Geographical distribution of the past vertebrates and its relation with the palaeogeography, with emphasis to the palaeogeography of the Aegean.
- Introduction to the excavational methodology and preservational practices.

B. Practical and Laboratory Exercises :

- Familiarity with the basic anatomy of the vertebrates, practice on skeletons of living vertebrates as well as on fossils.
- Practice on the osteological characters of amphibians, reptiles, birds and mammals.
- The skeleton of Mammals. The osteological characters of the most important mammalian groups for Greece. Recognition of such groups from their fossil remains based on their anatomical characters. From the anatomy of the modern groups to that of the fossil ones. Application of statistical software on the determination.
- Odontology of the most important mammalian groups (Hyracoidea, Proboscidea (Deinotheres, Elephants, Gomphotheres), Tubulidentata, Rodentia, Primates, Carnivora, Equidae, Rhinocerotidae, Ancylopoda, Bovidae, Suidae, Cervidae, Giraffidae, Hippopotamidae).
- Introduction to Ecomorphology. Inferring the mode of life from the anatomical characters of the vertebrates.
- Essay writing.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	26 hours
Practice exercises	13 hours
Fieldwork	-
Tutorials	-
Essey writing	20 hours
Autonomous study	21 hours
Final assessment preparation	20 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

I. THEORETICAL PART (summative)

- Oral or written examination (**50%**).

II. LABORATORY PART (summative)

- At the practical examination the students are evaluated on exams where they have to recognize vertebrate skeletal parts and recognize/classify vertebrate fossils and infer their relative geological age (**40%**).
- Additionally, they are evaluated according to their results on the laboratory exercises and bibliographical exercises (**10%**).

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

II. ADDITIONAL READING

- Benton M.J. (2005). Vertebrate Palaeontology. Blackwell Publishing, 1-455.
- Kardong K.V. (1995). Vertebrates. Comparative Anatomy, Function and Evolution. Wm. C. Brown, Dubuque, 1-777.
- Kemp T.S. (2005). The Origin and Evolution of Mammals. Oxford University Press.
- Prothero D.R. (2022). Vertebrate Evolution. From Origins to Dinosaurs and Beyond. C.R. Press, 1-448.
- Rose K.D. (2006). The Beginning of the Age of Mammals. The John Hopkins University Press, Baltimore, 1-431.
- Schmid E. (1972). Atlas of Animal Bones. Elsevier Publishing Company, Amsterdam, 1-159.

III. RELATIVE JOURNALS

- Journal of Vertebrate Paleontology, Online ISSN: 1937-2809, Print ISSN: 0272-4634.
- Geobios, Online ISSN: 1777-5728, Elsevier.
- Quaternary, Online ISSN: 2571-550X.

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL216

E7208 MARINE GEOLOGY

Instructors

Lectures: Assoc. Prof. J. Panagiotopoulos - Prof. A. Antonarakou - G. Kontakiotis, Laboratory Teaching Staff - P. Makri, Laboratory Teaching Staff

Lab. Training: Assoc. Prof. J. Panagiotopoulos - Prof. A. Antonarakou - G. Kontakiotis, Laboratory Teaching Staff - P. Makri, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 7th
TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS
Lectures, Laboratory exercises
2 hours of lecturing and 1 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: NONE

Language of instruction and Assessment: Greek
Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

On successful completion of the course the student:

- **Is aware of** the fundamental concepts of Marine Geology.
- **Fully understands** the outstanding contribution of Marine Geology to the Earth Sciences during the last and current century as well as all revolutionary research achievements of this continuously evolving dynamic scientific field, which have been greatly providing a better knowledge of the advancing geomorphological, geodynamic and geoenvironmental processes on our planet.
- **Is sufficiently qualified to deal with** the basic acoustic and visual inspection methods/techniques that are widely used for the collection, processing and interpretation of the Marine Geology data. The relevant data are commonly obtained from the performance of shallow- and deep-water geophysical surveys (which mainly include bathymetric/geomorphological mapping, seismic-reflection sub-bottom profiling, side-scan sonar mosaicing of the seabed and visual inspections using autonomous or remotely-operated underwater vehicles) as well as from sampling of seabed sediments using piston or gravity corers and grab samplers
- **Comprehends** the major submarine geomorphological, geodynamic and sedimentological processes, which determine the seabed structure and affect the physical, chemical and biological composition of bottom sediments.
- **Conceives** the dominant processes of marine sediment transport and deposition on the continental shelf, continental slope and abyssal plain as well as the natural factors that influence them, such as geodynamics, climatic trends and regional/global oceanographic processes.
- **Compares** and **correlates** past and modern sedimentary sequences.
- **Identifies** distinct geomorphological, tectonic and sedimentological surface and sub-surface features of the seabed.
- **Integrates** geophysical and sedimentological data in order to interpret the evolution of submarine paleoenvironments in the geological time scale and the evolutionary stages of analogous modern depositional systems in the near and distant future.

General Competences:

- Ability to apply knowledge in practical situations.
- Promote free, creative and inductive thinking
- Autonomous work.
- Ability to search for, process and analyse information with the use of necessary technologies.
- Ability to undertake research at an appropriate level.

COURSE CONTENT:

A. Lectures

- Characteristic geomorphological structures of the seafloor - Structure of oceanic crust and sedimentary cover - Submarine modern tectonic processes - Active and Passive continental margins - Types of submarine basins.
- Sedimentation processes in marine environments - Modern distribution of clastic, biogenic and chemical sediments on the seafloor - Variability of lithostratigraphy in the oceans.
- Milankovich cyclicity - Sea level changes and their impact on marine sedimentation.
- Extreme oceanographic events and sedimentation.
- Paleomagnetic stratigraphy in marine sediments.
- Biostratigraphy and methods of isotope stratigraphy.
- Methods of geochronology and correlation of marine sedimentary sequences.
- Ocean circulation.
- Marine geology of the Aegean Sea: Bottom geomorphology - Tectonic evolution and deformation - Sea level changes - Prehistoric relief.
- Marine geology of the Red Sea: Brine lakes.
- Methodology and description of the main instrumentation for submarine geophysical surveys.
- Methodology and description of the equipment for bottom sediment sampling.
- Methodology and description of the main instrumentation for the measurement of physical, chemical and biological parameters of the seawater column.

B. Laboratory Exercises

Practice exercises are taught to each individual student and are graded prior to the start of the next Laboratory.

Exercise 1, 2. Origin-morphology of ocean basins.
Exercise 3. Origin-morphology of ocean margins.
Exercise 4, 5. Impacts of waves and currents on seabed sediments.
Exercise 6, 7. Seabed geophysical exploration techniques: Identification of representative geomorphological, tectonic and sedimentological features from the analysis of bathymetric data.
Exercise 8, 9. Seabed geophysical exploration techniques: Identification of representative geomorphological, tectonic

and sedimentological features from the analysis of seismic-reflection sub-bottom profiling.

Exercise 10, 11. Seabed geophysical exploration techniques: Identification of representative geomorphological, tectonic and sedimentological features from the analysis of side-scan sonar data.

Exercise 12, 13. Macroscopic description of sediment cores and performance of magnetic susceptibility measurements along the cores.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

– Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

– Use of ICT in teaching (lectures, lab exercises, fieldwork).
– Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	26 hours
Practice exercises	13 hours
Fieldwork	–
Tutorials	–
Essey writing	15 hours
Autonomous study	30 hours
Final assessment preparation	16 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

I. THEORETICAL PART (**60%**)

- The student's evaluation is based on the preparation of a selected topic for presentation, related to the coastal and submarine geological processes (Formative, Summative).
  or
- Oral/written final examination (Summative).

II. PRACTICAL PART (**40%**)

- The student's evaluation is accomplished through weekly exercises concerning the understanding of the topics taught. These topics may include the origin-morphology of ocean basins, the origin-morphology of ocean margins, the influence of wave-currents on the sedimentary seabed, the identification of geomorphological, tectonic and sedimentological micro- and macro-structures via the analysis of geophysical data and sedimentary facies (Formative, Summative).

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

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II. ADDITIONAL READING

- Harff J., Meschede M., Petersen S., Thiede J. (2016). Encyclopedia of Marine Geosciences. Springer: Netherlands.
- Kennett J.P. (1981). Marine Geology. Prentice Hall: New Jersey, USA.
- Seibold E., Berger W. (2017). An Introduction to Marine Geology, 4th Edition. Springer International Publishing: Switzerland.

III. RELATIVE JOURNALS

- GeoMarine Letters, ISSN: 02760460, 14321157, Springer Verlag.
- Marine Geology, ISSN: 00253227, Elsevier.
- Marine and Petroleum Geology, ISSN: 02648172, 18734073, Elsevier.

WEBPAGE OF THE COURSE:

https://eclass.uoa.gr/courses/GEOL315/

E7209 PETROGENESIS OF METAMORPHIC ROCKS AND ELEMENTS OF THERMODYNAMICS

Instructors

Lectures: Assoc. Prof. D. Kostopoulos

Lab. Training: Assoc. Prof. D. Kostopoulos

Lab. Co-assistance: E. Moustaka, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 7th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Practical exercises, Laboratory exercises

2 hours of lecturing and 1 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: [recommended]

Y2202 Systematic Mineralogy - Mineral Identification
Y3201 Igneous Rocks - Magmatic Processes
Y3202 Petrology Of Sedimentary Rocks
Y4201 Petrology of Metamorphic Rocks

Language of instruction and Assessment: Greek
Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

On successful completion of the course the student:

- rigorously **describes** the mechanisms of metamorphic mineral genesis within the Earth when physical and chemical conditions change.
- **evaluates** the consequences of metamorphic reactions on magmatism, seismicity, and ore deposit formation in different geological environments.
- accurately **calculates** the temperature and pressure conditions of rock metamorphism within the Earth and the times required for metamorphic events to take place at both macro (e.g., orogenic) and micro (e.g., chemical zoning in minerals) scales.
- **combines** physicochemical information from subducted lithospheric plates and proposes their spatiotemporal evolution, **argues** for the possibility of volatile recycling, earthquake genesis and magmatism generation, **supports** his arguments, **revises** current views, and generate new knowledge.
- **evaluates** the diamond potential of kimberlite provinces.

Generic Competences:

- Ability to apply knowledge in practical situations
- Promote free, creative and inductive thinking
- Ability to work in a team
- Information and Communication Technology (ICT) skills
- Ability to search for, process and analyse information with the use of necessary technologies

COURSE CONTENT:

A. Lectures:

The content of the lectures includes five thematic units:

- HEAT FLOW IN THE EARTH (Heat sources in the crust and mantle, heat transfer mechanisms, heat flow-Fourier's law, heat production from radioactive isotope decay, mantle adiabat, continental and oceanic crustal geotherms, surface heat flow and Moho temperature as functions of crustal and lithospheric thickness, lithostatic pressure, thermodynamic pressure and tectonic overpressure, spatial distribution of pressure and temperature in crustal shear zones, mineral stratification in the upper mantle, geotectonic environments and geothermal gradients, heat transfer during continental collision and thermal evolution of thickened crust, migmatite genesis).
- INTRACRYSSTALINE ION DIFFUSION, CLOSURE TEMPERATURE AND COOLING RATES OF OROGENS (Fick's laws, diffusivity, concentration gradients, hierarchy of diffusivities in metamorphic minerals, effect of mineral chemical composition and oxygen fugacity on diffusivity, chemical zoning and elemental maps of minerals, evaluation of the potential of minerals in geochronology and trace-element thermometry, closure temperature and cooling rates of orogens).
- OCEANIC LITHOSPHERE SUBDUCTION ZONES (young vs. old lithosphere, fast vs. slow subduction, dry/humid/wet rheology, spatial distribution of isotherms, global water flow rates, metamorphic facies and parageneses in dry/hydrated/enriched/depleted mantle peridotite, hydrothermally altered volcanics, pelitic/quartzose/carbonaceous sediments; dehydration reactions and melting, mantle-wedge metamorphism and electrical conductivity, spatial distribution of metamorphic facies, density and seismic wave propagation velocities).
- APPLICATIONS OF THERMODYNAMICS TO PETROLOGY (laws of thermodynamics, enthalpy, entropy, heat capacity, compressibility, expansivity, chemical potential, Gibbs and Helmholtz free energy, constitutive equations, Clausius-Clapeyron equation, excess free energy, thermodynamic models of minerals, boundaries of metamorphic reactions, equilibrium constant, water phase diagram, density and relative dielectric constant of water under geological conditions, metamorphic reactions as geological thermometers and barometers).

B. Practice Exercises

The content of the practice exercises includes four thematic modules:

PART A. Heat flow in the crust and mantle. Calculation of radiogenic heat production rate and radioactive isotope content in the crust and mantle, calculation of mantle adiabat, calculation of oceanic lithosphere geotherms, calculation of steady-state continental lithosphere geotherms as a function of surface heat flow.

PART B. Intracrystalline ion diffusion and closure temperature. Effects of mineral geometry and chemical composition, oxygen fugacity and orogenic cooling rate. Calculation of chemical zoning in minerals and investigation of the suitability of minerals as chronometers and thermometers.

PART C. Thermodynamics. Calculation of metamorphic reaction boundaries (ideal endmembers and solid solutions, water-absent and water-present reactions, investigation of

the importance of compressibility and heat capacity in the calculations), aluminosilicate boundaries and triple point, upper mantle facies boundaries, high – ultrahigh-pressure metamorphism boundary, applications of geothermobarometers in the crust and mantle.

C. Laboratory Exercises

Application of transmitted/polarized light optical microscopy methods for the identification of metamorphic minerals and metamorphic rocks of Greece and the Scottish Highlands derived from different igneous and sedimentary protoliths.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY
- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES
- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	26 hours
Practice exercises	9 hours
Laboratory exercises	4 hours
Tutorials	
Essey writing	
Autonomous study	31 hours
Final assessment preparation	30 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

I. LECTURES (**40%**) (summative)
- Oral Examination and/or
- Written Exam with Short Answer Questions and Multiple Choice Test and/or
- Written Exam with Extended Answer Questions

II. PRACTICE EXERCISES AND FIELD EXERCISES (**60%**) (summative)
- Written exam with Solving Exercises and Problems in the Practice Exercises (**40%**) and
- Oral examination Laboratory exercises (**20%**)

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL
-

II. ADDITIONAL READING

- Frank S. Spear, 1993. Metamorphic Phase Equilibria and Pressure-Temperature-Time Paths. Monograph, Mineralogical Society of America
- Anthony R. Philpotts & Jay J. Ague, 2009. Principles of Igneous and Metamorphic Petrology (2nd Edition) Cambridge University Press
- John D. Winter, 2014. Principles of Igneous and Metamorphic Petrology (2nd Edition) Pearson Education Limited
- Jibamitra Ganguly, 2008. Thermodynamics in Earth and Planetary Sciences. Springer-Verlag
- Roger Powell, 1978. Equilibrium thermodynamics in Petrology. An introduction. Harper & Row Ltd.

III. RELATIVE JOURNALS
- Journal of Petrology (Oxford University Press)
- Journal of Metamorphic Geology (Wiley)
- Lithos (Elsevier)
- Contributions to Mineralogy and Petrology (Springer Link)

WEBPAGE (URL):

http://eclass.uoa.gr/courses/GEOL378

E7210 NEOTECTONICS

Instructors

Lectures: Assoc. Prof. H. Kranis

Lab. Training: Assoc. Prof. H. Kranis – D. Theocharis, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 7th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Lab exercises, Fieldwork

2 hours of lecturing and 1 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: [recommended]

Y3205 Structural Geology and Tectonics

Y3203 Seismology

Y5201 Geomorphology

Language of instruction and Assessment: Greek

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences: The main course objectives are the understanding of the deformation of the earth's crust that has been taking place with the Current Tectonic Regime. On completion of the course the student should have the following learning outcomes defined in terms of knowledge, skills and general competence. Specifically, the student is able to:

- recognize and describe the main elements of neotectonic structure, the elements of a neotectonic map, and the controlling mechanisms of the tectonically-controlled landforms
- understand, interpret and explain the controlling mechanisms
- determine and classify the dynamic parameters of neotectonic and active faults.
- combine, compare and assess the tectonic elements and data, through neotectonic analysis, of applied geological problems, such as natural disasters, earthquake planning, assessment of earthquake fault potential, natural resources, response of earth relief to tectonic activity, etc.

Generic Competences:

- Ability to search for, process and analyse information with the use of necessary technologies
- Autonomous work
- Oral and written communication of scientific issues
- Ability to apply knowledge in practical situations
- Ability to undertake research at an appropriate level

COURSE CONTENT:

A. Lectures

- **Methods of neotectonic research**: Descriptive (geometrical), Dynamic, Kinematic and temporal analysis of neotectonic structures.
- **Tectonic Geomorphology**: presentation, analysis and description of morphotectonic relief-evolution indices
- **Active Tectonics, Earthquake Geology and Palaeoseismology**: Neogene and Quaternary deformation rates- Active faulting and earthquake geology – trenching and dating of deformed quaternary strata.
- **Neotectonics of Greece**: Main neotectonic structures of the Hellenic territory – Neotectonic basins and marginal faults – Kinematic and deformational models of the Greek territory – Submarine/offshore neotectonic structures in the Aegean and the Eastern Mediterranean.
- **Case studies**: The Gulf of Corinth Rift, the North Aegean Basin, the Peloponnese and Ionian Islands, the Neogene-Quaternary terrestrial basins of central and NW Greece.

B. Laboratory Exercises

Part A': Study and analysis of neotectonic maps.
Part B': Descriptive, kinematic and dynamic analysis of neotectonic structures.
Part C': Tectonic Geomorphology.
Part D': Palaeoseismology and Quaternary dating methods.

C. Fieldwork

ONE-DAY FIELD TRIP IN CORINTH – ARGOLIS AREA: Neotectonic-active structures of eastern Corinthian Gulf

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	26 hours
Practice exercises	13 hours
Fieldwork	12 hours
Tutorials	-
Essey writing	12 hours
Autonomous study	15 hours
Final assessment preparation	22 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

The assessment process is conducted, either with progressive exams in separate sections of the course content or with the final examination of the entire course material which includes:

I. LECTURES (**45%**) (formative, summative)

- Oral Examination and/or
- Written Exam with Short Answer Questions and Multiple Choice Test and/or
- Written Exam with Extended Answer Questions

II. LAB EXERCISES (**45%**) (formative, summative)

- Written exam with Solving Exercises and Problems

III. FIELD EXERCISES (**10%**) (formative, summative)
- Oral examination in the field and with evaluation of required Report or Essay

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

II. ADDITIONAL READING

- ΠΑΥΛΙΔΗΣ, Σ., 2007. Γεωλογία των σεισμών. University Studio Press, 380 σ.
- BULL, W., 2009, Tectonically active landscapes, Wiley-Blackwell.
- BURBANK, D., ANDERSON, R., 2001. Tectonic Geomorphology, Blackwell
- DAVIS, G. H., REYNOLDS, S. J. & KLUTH, Ch. F., 2011, Structural Geology of Rocks and Regions, Wiley, 839 p.
- FOSSEN, H., 2016, Structural Geology, Cambridge, 510 p.
- McCALPIN, J. 2009. Paleoseismology, Academic Press
- ΚΙΛΛΙΑΣ, Α., 2009, Εισαγωγή στην Τεκτονική Γεωλογία, http://www.geo.auth.gr/537/

III. RELATED JOURNALS

- Tectonophysics, Online ISSN: 1879-3266, Print ISSN: 0040-1951, Elsevier.
- Geomorphology, Online ISSN: 1872-695X, Print ISSN: 0169-555X
- Earth-Surface Dynamics, eISSN: ESurf 2196-632X, ESurfD 2196-6338, EGU publication –open access
- Journal of Structural Geology, Online ISSN: 1873-1201, Print ISSN: 0191-8141, Elsevier.
- Tectonics, Online ISSN:1944-9194, Print ISSN:0278-7407, AGU Publications.
- Solid Earth, eISSN: SE 1869-9529, SED 1869-9537, EGU publication –open access

WEBPAGE (URL):

http://eclass.uoa.gr/courses/GEOL133

E7213 GROUND HYDRAULICS

Instructors

Lectures: Assist. Prof. E. Skourtsos - E. Andreadakis, Laboratory Technical Staff – Prof. Emeritus Ap. Alexopoulos

Lab. Training: Assist. Prof. E. Skourtsos – E. Andreadakis, Laboratory Technical Staff – E. Kapourani, Laboratory Technical Staff – C. Filis, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 7th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Practical Exercises, Fieldwork

2 hours of lecturing and 1 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: Y6202 Hydrogeology [recommended]

Language of instruction and Assessment: Greek

Availability to Erasmus+ Students: NO

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

Groundwater Hydraulics is an advanced course that negotiates the flow of groundwater: a) in saturated zones, b) towards pumping works, c) towards springs and d) in coastal aquifers. After the successful completion of the course, the exercises, and the field trip, the student:

- Creates, describes, analyzes and evaluates flow nets and evaluate leakages and water pressures under various structures,
- Recognize, describe and apply a variety of methodologies for processing test pumping data and chooses the most appropriate methodology for a wide range of conditions that can be found in a hydrogeological basin,
- Determines discharge of springs, and generally utilizes and interprets hydrographs of springs, calculates important hydraulic parameters and the water resources in karst systems, and interprets the mechanisms of manifestation and discharge of springs,
- Analyzes, interprets and evaluates complex graphs of the change in the groundwater level as a function of the time logarithm and draw conclusions about the presence of hydraulic boundaries, source areas, and generally identify the causes responsible for changing the rate of level drop in an aquifer system,
- Identifies and defines the relationships between sea water and the groundwater in coastal aquifers.

Generic Competences:

- Ability to apply knowledge in practical situations
- Promote free, creative and inductive thinking

- Ability to search for, process and analyse information with the use of necessary technologies
- Autonomous work and ability to work in a team
- Decision making

COURSE CONTENT:

A. Lectures of the course

1. The porous media, fractured media, karstic media.
2. The flow in porous media. Darcy Law and Laplace Equation.
3. Flow to pumping wells.
4. Hydraulic parameters and characteristics, head losses and test pumps.
5. Flow nets.
6. Hydraulics of pumping works in a fractured media.
7. The karstic media (flow, hydraulics, karstic models, pumping works).
8. Hydrodynamic analysis of springs discharges. Time series and hydrograms. Maillet, Tison, etc. equations.
9. Hydraulic models. Hydraulics of the salinization fronts. Hydraulic of two-phase flows (hot springs).
10. Draining, pumping, reconfigurations, combined water management.

B. Lab Exercises

- Lab exercises and problems aimed at consolidating concepts taught in lectures: Application of Darcy Law, Construction of Flow Nets, Test pumps and calculation of hydraulic parameters of aquifers, Time series and hydrograms of spring discharges, hydrograms of karst springs
- Processing of data collected from field work.

C. Field Exercises (Outdoors)

Monitoring of test pumps in a location in Attica.
Practice in the on-site measurement of springs, gutters, pumped boreholes, and data collection for their processing in the Practice Exercises.
Where appropriate, monitoring of drilling works.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY
- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES
- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	26 hours
Practice exercises	13 hours
Fieldwork	10 hours
Tutorials	4 hours
Essey writing	12 hours
Autonomous study	20 hours
Final assessment preparation	15 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

The assessment process is conducted in Greek, either with progressive exams in separate sections of the course content or with a final examination of the entire syllabus and includes:

I. LECTURES (**45%**) (formative, summative)
- Oral Examination and/or
- Written Exam with Short Answer Questions and Multiple Choice Test and/or
- Written Exam with Extended Answer Questions

II. LAB EXERCISES (**45%**) (formative, summative)
- Written exam with Solving Exercises and Problems

III. FIELD EXERCISES (**10%**) (formative, summative)
- Oral examination (in-situ) and by evaluating deliverables of compulsory Assignment or Report

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL
- Voudouris Kostas S., 2016, Technical Hydrogeology, [Ref. EUDOXUS: 112690244]
- Voudouris Kostas S., 2017, Exploitation & Management of Groundwater, [Ref. EUDOXUS: 102070929]

II. ADDITIONAL READING
- Batu V., 1998: Aquifer Hydraulics: A quifer Comprehensive Guide to Hydrogeologic Data Analysis, by John Wiley & Sons, Inc. ISBN: 978-0-471-18502-4
- Driscoll G. F.: Groundwater and Wells, 2ed ed. 1989, by Jonson Filtration Systems Inc, ISBN: 0-9616456-0-1
- Dawson J. K. & Istok D. J., 1991, Aquifer Testing, Design and Analysis of Pumping and Slug Tests, by Lewis Publisher, Inc., ISBN: 0-87371-501-2
- Kresic N & Stevanovic Z.: Groundwater Hydrology of Springs, 2010, by Elsevier Inc. ISBN:978-1-85617-502-9
- Kruseman P.C. @ N. A. de Ridder: Analysis and Evalyation of Pumping Test Data. 2nd ed., 1994, by International Instsitute for Land Reclamation and Improvement, Netherlands, ISBN: 90 70754207
- Stallman, R.W., 1968, Aquifer-test design, observation and data analysis: U.S. Geological Survey Techniques of Water-Resources Investigation of the United States Geological Survey
- Lekkas S. & Ap. Alexopoulos: Introduction to Hydrogeology. 2009, Student notes of the University of Athens

III. RELATIVE JOURNALS
- Water Resources Research
- Hydrogeology Journal, Official Journal of the International Association of Hydrogeologists
- Groundwater

WEBPAGE (URL):

http://eclass.uoa.gr/courses/GEOL129

E7214 GEOPHYSICAL FLUIDS AND INDUCED SEISMICITY

Instructors

Lectures: Prof. F. Vallianatos - Assoc. Prof. G. Kaviris - K. Pavlou, Laboratory Teaching Staff

Lab. Training: Prof. F. Vallianatos - Assoc. Prof. G. Kaviris - K. Pavlou, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 7th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Practical exercises, Laboratory exercises

3 hours of lecturing and 1 hours of practical exercises per week, 4 ECTS credits.

Prerequisites:

Y1202 Physics
Y4202 Geophysics [Knowledge of Basic Principles]
Y3203 Seismology [Knowledge of Basic Principles]

Language of instruction and Assessment: Greek
Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

Through the successful completion of this lesson, the trainees will be able to:

- Obtain the necessary knowledge and skills regarding fluid diffusion in the lithosphere.
- Study induced seismicity and how impoundment of dams could trigger it
- To calculate shear wave splitting parameters
- To evaluate fluids influence on shear wave splitting parameters
- Analyze microseismic observations related with hydraulic fracture
- To evaluate scientific results on the connection of seismicity with fluids diffusion on geoenergy resources fields

Generic Competences:

- Ability to apply knowledge in practical situations
- Ability to search for, process and analyse information with the use of necessary technologies
- Oral and written communication of scientific issues
- Ability to undertake research at an appropriate level
- Autonomous work
- Ability to work in an interdisciplinary context

COURSE CONTENT:

A. Lectures/seminars

- An introduction to linear elasticity, seismic waves and microseismicity
- Linear elasticity and seismic waves
- Geomechanics and Seismicity (fractures in Solids)
- Microseismicity monitoring
- Principles of linear poroelasticity
- Fractures and Fluids
- Fluids and poroelasticity
- Elements of non linear effects in poroelesticity
- Seismicity and fluids diffusion
- KTB drilling project as a case study
- Pore pressure relaxation
- Seismic front waves and poroelasticity
- Seismicity , fluids and inhomogeneous media
- Seismicity and impoundment of dams
- Fluids and seismic anisotropy
- Basic principles of seismic anisotropy and shear-wave splitting
- Measuring shear waves splitting parameters
- Effects of fluids to shear-wave splitting parameters
- Variability of shear-wave splitting parameters

B. Practical and Laboratory Exercises

PART A: Spatiotemporal analysis of microseismic observations
PART B: Seismicity and fluid diffusion
PART C: Fluids and seismic anisotropy
PART D: Seismicity and hydraulic fracture

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	39 hours
Practice exercises	13 hours
Fieldwork	-
Tutorials	-
Essey writing	-
Autonomous study	44 hours
Final assessment preparation	4 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

The assessment process is conducted in Greek (there is the possibility of examination in English for Erasmus students) with the final examination of the entire course material and presentation of individual work in a specific case study:

I. LECTURES (**50%**) (formative)

- Written Exam with Short Answer Questions and
- Written Essay

II. PRACTICE EXERCISES (**50%**) (formative)

- Written exam with Solving Exercises and Problems

The evaluation criteria of the course and the participation rates are described in the Chapter «3.3 Evaluation Criteria » of this syllabus and student handbook.

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- Α. Τσελέντης, Σύγχρονη σεισμολογία, [Κωδ. ΕΥΔΟΞΟΣ: 9774]
- Β. Κ. Παπαζάχος, Γ.Φ. Καρακαΐσης, Π. Μ. Χατζηδημητρίου, Εισαγωγή στη σεισμολογία, [Κωδ. ΕΥΔΟΞΟΣ: 11254]

II. ADDITIONAL READING

- S. Shapiro, 2015. Fluid-Induced Seismicity. Cambridge: Cambridge University Press, doi : 10.1017/CBO9781139051132
- D. J. Furbish, 1997. Fluid Physics in Geology. Oxford University Press
- H.K. Gupta and B.K. Rastogi, 1976. Dams and earthquakes. Elsevier Scientific Publishing Co., 229.
- H.K. Gupta, 2018. Review: Reservoir Triggered Seismicity (RTS) at Koyna, India, over the Past 50 Yrs, Bull. Seism. Soc., 108 (5B): 2907-2918.
- G. Michas , F. Vallianatos Modelling earthquake diffusion as a Continuous-Time Random Walk with Fractional Kinetics: The case of the 2001 Agios Ioannis earthquake swarm (Corinth Rift), Geophysical Journal International 215(1), 2018 , DOI: 10.1093/gji/ggy282
- G. Michas, F. Vallianatos, Scaling properties and anomalous diffusion of the Florina micro-seismic activity: Fluid driven?, Geomechanics for Energy and the Environment, 2019, doi : 10.1016/j.gete.2019.100155
- G. Kaviris, I. Spingos, V. Kapetanidis, P. Papadimitriou, N. Voulgaris and K. Makropoulos, 2017. Upper crust seismic anisotropy study and temporal variations of shear-wave splitting parameters in the western Gulf of Corinth (Greece) during 2013. Physics of the Earth and Planetary Interiors, 269, 148–164.
- G. Kaviris, C. Millas, I. Spingos, V. Kapetanidis, I. Fountoulakis, P. Papadimitriou, N. Voulgaris and K. Makropoulos, 2018. Observations of shear-wave splitting parameters in the Western Gulf of Corinth focusing on the 2014 Mw=5.0 earthquake. Physics of the Earth and Planetary Interiors, 282, 60-76. doi: 10.1016/j.pepi.2018.07.005
- K. Pavlou, G. Kaviris, K. Chousianitis, G. Drakatos, V. Kouskouna and K. Makropoulos, 2013. Seismic hazard assessment in Polyphyto Dam area (NW Greece) and its relation with the “unexpected” earthquake of 13 May 1995 (Ms = 6.5, NW Greece). Nat. Hazards Earth Syst. Sci., 13, p. 141–149.
- K. Pavlou, Drakatos G, Kouskouna V, Makropoulos K, Kranis H., 2016. Seismicity study in Pournari reservoir area (W. Greece) 1981-2010. J Seismol. 2016;DOI:10.1007/s10950-016-9552-1.
- K. Pavlou, 2019. Relationship between Observed Seismicity and Water Level Fluctuations in Polyphyto Dam Area (North Greece). Journal of Geography, Environment and Earth Science International, 1-10.
- I. Spingos, G. Kaviris, C. Millas, P. Papadimitriou and N. Voulgaris, 2019. Pytheas: An open-source software solution for local shear-wave splitting studies. Computers & Geosciences, in press. https://doi.org/10.1016/j.cageo.2019, 104346.

III. RELATIVE JOURNALS

- Bulletin of the Seismological Society of America, SSA Journals
- Geophysical Journal International, Oxford University Press
- Journal of Geophysical Research, AGU Publications
- Physics of the Earth and Planetary Interiors, Journal, Elsevier
- Tectonophysics, Journal, Elsevier

WEBPAGE (URL):

http://eclass.uoa.gr/courses/GEOL517

E7215 HYDROGEOCHEMISTRY

Instructors

Lectures: Prof. A. Argyraki - Assoc. Prof. Ch. Stouraiti – Assist. Prof. E. Kelepertzis

Lab. Training: Prof. A. Argyraki - Assoc. Prof. Ch. Stouraiti – Assist. Prof. E. Kelepertzis – Z. Kypritidou, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 7th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Practical exercises, Laboratory exercises, Fieldwork.

1 hours of lecturing and 2 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: Y4203 - Geochemistry [recommended]

Language of instruction and Assessment: Greek

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

Upon successful completion of the course, the student will be able to:

- Designs and organizes the process of sampling and chemical analysis of natural waters in terrestrial and marine environments.
- Uses and applies chemical analysis methods to determine the major elements and compounds in the composition of natural waters.
- Uses and applies quality control methods for the results of water chemical analysis.
- Combines knowledge of geochemistry, hydrology, and hydrogeology to interpret the qualitative characteristics of natural waters in relation to the lithological characteristics of the aquifer.
- Prepares a technical report on the processing and interpretation of the results of water chemical analysis.

Generic Competences:

- Ability to apply knowledge in practical situations
- Ability to plan and manage time
- Ability to work in a team
- Ability to search for, process and analyse information with the use of necessary technologies
- Oral and written communication of scientific issues

COURSE CONTENT:

Lectures and practical exercises in the laboratory and on computers.

– Units of measurement in hydrogeochemistry
– Chemical analysis of water in the laboratory
– Water sampling - Chemical analysis of water in the laboratory
– Chemical analysis of water in the laboratory
– Processing - Interpretation of chemical analysis data
– Controlling factors on the chemical composition of water systems
– Interpretation of chemical analysis data - Case study of acid mine drainage
– Principles of hydrogeochemical modeling with the open software aqion
– Processing of hydrogeochemical data with the open software aqion
– Nanomaterials in the marine environment

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

– Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

– Use of ICT in teaching (lectures, lab exercises, fieldwork).
– Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	13 hours
Practice exercises	24 hours
Fieldwork	03 hours
Tutorials	-
Essey writing	30 hours
Autonomous study	30 hours
Final assessment preparation	-
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

The final grade is determined by a series of assessments which include:

I. REPORT WRITING (Summative)

- Preparation of a comprehensive technical report presenting and evaluating the results of water chemical analysis (**70% of the final grade**)

II. LABORATORY EXERCISES (Formative)

- Active participation in the process of collecting and chemically analyzing water samples and performing calculations (**30% of the final grade**)

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- Eby, G. N. Αρχές Περιβαλλοντικής Γεωχημείας (Μετάφραση Λιοδάκης, Δ. Πεντάρη) Εκδόσεις Κωσταράκη, Αθήνα. 2011 [Κωδ. ΕΥΔΟΞΟΣ: 77115198] (***σύγγραμμα μαθήματος***)

II. ADDITIONAL READING

- Aquatic Chemistry, chemical equilibria and rates in natural waters. Stumm & Morgan, 1996, John Wiley and Sons
- Broder J. Merkel • Britta Planer-Friedrich Authors Groundwater Geochemistry A Practical Guide to Modeling of Natural and

Contaminated Aquatic Systems Edited by Darrell Kirk Nordstrom 2nd Edition, 2008 Springer

III. RELATIVE JOURNALS

- Applied Geochemistry, Elsevier
- Geochemistry, Exploration, Environment, Analysis, Geosciences World
- Geostandards and Geoanalytical Research, Wiley

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL141

E7216 ATMOSPHERIC POLLUTION

Instructors

Lectures: Assoc. Prof. K. Eleftheratos

Lab. Training: Assoc. Prof. K. Eleftheratos

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 7th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Laboratory exercises

2 hours of lecturing and 1 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: [recommended]

Y1202 Physics

Y2203 Climatology and Climate Changes

Language of instruction and Assessment: Greek

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

On successful completion of the course the student:

- **Defines** and **describes** the basic principles and phenomena of atmospheric pollution.
- **Comprehends** the factors that shape the quality of the atmospheric environment and the ways to protect it.
- **Comprehends** and **interprets** the human impact on air pollution and the ways with which air pollution and particles affect various sectors such as the environment, health, agriculture, aquatic and terrestrial ecosystems, energy, etc.
- **Combines** the acquired knowledge and critically **evaluates** the problems to which Atmospheric Pollution is called upon to respond.
- **Applies** the specialized techniques used by Atmospheric Pollution.
- **Combines** theoretical and practical knowledge and answers environmental issues in all fields of Geosciences.

Generic Competences:

- Ability to apply knowledge in practical situations
- Promote free, creative and inductive thinking
- Oral and written communication of scientific issues
- Autonomous work
- Information and Communication Technology (ICT) skills
- Commitment to conservation of the environment

COURSE CONTENT:

A. Lectures:

– The layers of the Earth's atmosphere.
– Factors and mechanisms shaping atmospheric air quality.
– Sources, types, measuring methods of atmospheric pollutants and their effects on health.
– Air pollution units and standards.
– Effect of air pollution on the microclimate of an area.

– The atmospheric dispersion cycle and dispersion scales.
– The role of meteorology in air pollution.
– Self-cleaning mechanisms of the atmosphere.
– Control techniques to combat air pollution.
– Air pollution models.
– Pollution of the upper atmosphere and the greenhouse effect.

B. Laboratory Exercises:

The laboratory exercises include the education of the students in the following subjects:

Exercise 1. Sulfur oxide pollution – acid rain
Exercise 2. Particulate pollution – smog
Exercise 3. Carbon dioxide pollution – greenhouse effect
Exercise 4. Nitrogen oxides pollution – photochemical smog
Exercise 5. The role of wind in the distribution of air pollution concentrations
Exercise 6. The vertical structure of the atmosphere and its role in the distribution of pollutants
Exercise 7. Influence of topographic and other factors on the distribution of pollution of the lower atmosphere
Exercise 8. Air pollution models

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

– Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

– Use of ICT in teaching (lectures, lab exercises, fieldwork).
– Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	27 hours
Practice exercises	12 hours
Fieldwork	-
Tutorials	-
Essey writing	24 hours
Autonomous study	25 hours
Final assessment preparation	12 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

The assessment process is conducted, either with progressive exams in separate sections of the course content or with the final examination of the entire course material which includes:

I. LECTURES (**50%**)

Written Exam with short Answer Questions and Multiple-Choice Test and/or Extended Answer Questions (summative).

II. PRACTICE EXERCISES (**50%**)

Written Essays for every Practical Exercise and evaluation (formative, summative).

Auxiliary material (questions, exercises, etc.) for the exams is posted on the online **e-Class** platform https://eclass.uoa.gr/courses/GEOL536.

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- Ατμοσφαιρική Ρύπανση, επιπτώσεις, έλεγχος και εναλλακτικές τεχνολογίες, Ι. Γεντεκάκης, [κωδ. ΕΥΔΟΞΟΣ: 28017]
- Ατμοσφαιρική Ρύπανση με Στοιχεία Μετεωρολογίας, Μ. Λαζαρίδης, [κωδ. ΕΥΔΟΞΟΣ: 18548841]
- Αέρια Ρύπανση, Α. Τριανταφύλλου, [κωδ. ΕΥΔΟΞΟΣ: 68396375]
- Ρύπανση και τεχνολογίες προστασίας περιβάλλοντος, Τ. Αλμπάνης, [κωδ. ΕΥΔΟΞΟΣ: 18548776]
- Περιβαλλοντική Μηχανική, Α. Κούγκολος, [κωδ. ΕΥΔΟΞΟΣ: 94688998]
- Περιβαλλοντική Επιστήμη, Miller G. T., Spoolman E. S., (Επιμέλεια: Π. Δημητρακόπουλος, Κ. Γαβριλάκης), [κωδ. ΕΥΔΟΞΟΣ: 59386824]

II. ADDITIONAL READING

- Jacobson, M. Z., 2012, **Air Pollution and Global Warming: History, Science, and Solutions**, Second Edition, Cambridge University Press, [ISBN: 9781107691155].
- Tiwary, A. Williams, I., 2019, **Air Pollution: Measurement, Modelling and Mitigation**, Fourth Edition, [ISBN: 9781498719452].

III. RELATIVE JOURNALS

- Atmospheric Chemistry and Physics, Online, European Geosciences Union.
- Atmospheric Environment, Online, Elsevier.

Additional Reading Material

- Teachers' notes, presentations of the lectures and exercise material posted on the e-Class platform of the course.

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL536

E7217 MINERAL RESOURCES AND ENERGY TRANSITION

Instructors

Lectures: Assoc. Prof. H. Vasilatos

Lab. Training: Assoc. Prof. H. Vasilatos

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 7th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Lab Exercises and Fieldwork

2 hours of lecturing and 2 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: [recommended]

Y2202 Systematic Mineralogy-Mineral Identification
Y3202 Petrology Of Sedimentary Rocks
Y4203 Geochemistry.
Y3201 - Igneous Petrology.

Language of instruction and Assessment: Greek [1]

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

Upon successful completion of the course the student will be able to:

- **identify** and **describe** energy mineral resources (EMR), their properties and characteristics, their uses as well as research methods to identify and evaluate them.
- **combine** and **use** all the knowledge acquired during his/her studies for the exploration, evaluation and utilization of EMR.
- **estimate** the environmental footprint of the exploitation of energy mineral deposits.
- **combine** knowledge for the synthesis of work plans and decision-making on research and sustainable exploitation of the EMRs during the Energy Transition in harmony with environmental protection

Furthermore,

- **will be aware** of the importance and impact of the utilization of the renewable energy resources for the Energy Transition, the economic development, the environment and the sustainability.

Generic Competences:

- Ability to search for, process and analyse information with the use of necessary technologies
- Oral and written communication of scientific issues
- Ability to apply knowledge in practical situations
- Promote free, creative and inductive thinking
- Commitment to conservation of the environment

COURSE CONTENT:

A. Lectures.

- Introduction to international energy resources. What is the situation in Greece. Definitions and terminology.
- Energy Raw Materials and Energy Metals. Energy Transition and zero CO2 balance.
- Energy raw materials and changes in the exploitation of mineral resources after the Energy Transition.
- Coal. Coal exploration. Lignite genesis in Greece. Inorganic & organic constituents in coals. Gases in coal. Desulfurization. CCS technologies. Composition & evaluation of sterile materials and coal-burning by-products.
- Hydrocarbons. Structure of oil industry. Oil Genesis and migration. Geological features of oil basins. Reservoirs of oil and gas. Hydrocarbon exploration in Greece. Shale-derived oil and gas. Oil sands.
- Deposits and exploitation of radioactive ores - Occurrences of radioactive minerals in Greece.
- Exploration, evaluation and exploitation of geothermal fields. Geochemistry of geothermal fluids. Geothermal energy in Greece.
- Large and small hydroelectric projects and reservoirs.
- The role of Geology in the energy utilization of Biomass.
- Blue, brown and green hydrogen – Fuel cells
- Requirements of Renewable Energy Sources in Mineral Raw Materials.
- The geology of energy metal deposits.
- Environmental issues of Renewable Energy Resources and social acceptance.

B. Laboratory Exercises:

Exercises on: the calculation of the reserves of deposits; the determination of the potential of the exploitation of an energy mineral deposit; the design of deposit sections based on geological data; the determination of areas for exploration based on geological criteria; the macroscopic identification of various types of coal; the identification and possible applications lignite mining by-products, as well as its combustion by-products: fly ash and synthetic gypsum; mass calculations of wastes; desulphurisation and CCS; geochemical methods in hydrocarbon exploration.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	26 hours
Practice exercises	26 hours
Fieldwork	-
Tutorials	
Essey writing	-

[1] I.S.: Incoming students (e.g. ERASMUS Student)

Autonomous study	20 hours
Final assessment preparation	28 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

The final grade is formed by a series of tests which include:

I. REPORT AND PUBLIC PRESENTATION (**50%** of the final grade)

- Writing a report in the form of a review on issues related to Industrial Minerals and Rocks and its public presentation before all students attending the course. (Summative)

II. LABORATORY EXERCISES (**50%** of the final grade)

- Problem solving and writing relevant reports during laboratory exercises. (Formative, Summative)

RECOMMENDED BIBLIOGRAPHY

I.EUDOXUS PORTAL

- Πολυζάκης Απόστολος, 2020, Ενέργεια, Περιβάλλον και Αειφόρος Ανάπτυξη, [EUDOXUS code: 94645312]
- Friedrich-W. Wellmer, Peter Buchholz, Jens Gutzmer, Christian Hagelüken, Peter Herzig, Ralf Littke, Rudolf K. Thauer, 2019, Raw Materials for Future Energy Supply, [EUDOXUS code: 91693780]
- Jaime Klapp, Jorge L. Cervantes-Cota, José Federico Chávez Alcalá, 2007, Towards a Cleaner Planet, [EUDOXUS code: 179867]

II. ADDITIONAL READING

- Cassedy S.E., Grossman Z.P. Introduction to Energy: Resources, Technology, and Society (3rd Edition) 386 pages (2017)
- Hanjalić K., Van de Krol R. Lekić A. Sustainable Energy Technologies. 386 pages, Springer (2008)
- Stamatakis M. & Vasilatos C. Laboratory Guide for the course Energy Resources (2017).

III. RELATIVE JOURNALS

- Fuel, Elsevier
- Energy, Elsevier
- International Journal of Coal Geology, Elsevier
- International Journal of Coal Geology, Elsevier

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL534

E7218 APPLIED AND ENVIRONMENTAL MINERALOGY AND PETROLOGY

Instructors

Lectures: Prof. P. Voudouris - Prof. A. Godelitsas – Prof. P. Pomonis - Assist. Prof. M. Kati – I. Megremi, Laboratory Teaching Staff

Lab. Training: Prof. P. Voudouris - Prof. A. Godelitsas – Prof. P. Pomonis - Assist. Prof. M. Kati – I. Megremi, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 7th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Practical exercises, Fieldwork

2 hours of lecturing and 1 hours of practical exercises per week, 4 ECTS credits.

Prerequisites:

Y1205 Mineralogy-Crystallography [recommended]
Y2202 Systematic Mineralogy-Mineral Identification [recommended]

Language of instruction and Assessment: Greek [1]
Availability to Erasmus+ Students: YES in English Προφορική και γραπτή σύνοψη στην Αγγλική, Γαλλική, Γερμανική, Ισπανική

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

On successful completion of the course the student:

- **Define** and **formulate** the basic principles, methods and applications of Applied and Environmental Mineralogy and Petrology.
- **Classify** and **describe** minerals as carriers of critical metals, gemstones, hydrothermal alteration minerals, industrial minerals and rocks, their formation conditions and uses, as well as minerals related to the environment, ecosystems, microbes and the human organism.
- **Comprehend** the applications and uses of minerals and rocks, and the interaction between minerals and the natural environment and living organisms.
- **Apply** the techniques of Mineralogy-Petrology, and of optical microscopy with the aim of developing mental and practical skills that include identification of minerals and rocks used in construction, road construction, industry, jewelry, technology, and in commerce, both macro- and microscopic, as well as using free software for the classification of minerals and rocks from their chemical analyses. The visit to the Lithos center and the field exercise carried out are aimed at identifying minerals and rocks in the field.

Generic Competences:

[1] I.S.: Incoming students (e.g. ERASMUS Student)

- Ability to search for, process and analyze information with the use of necessary technologies.
- Autonomous work.
- Ability to apply knowledge in practical situations.
- Work independently.
- Promote free, creative, and inductive thinking.
- Ability to plan and manage time.
- Information and Communication Technology (ICT) skills.

COURSE CONTENT:

A. Lectures

- Metallic minerals as carriers of critical metals. Mineralogy, Mineral-Chemistry, depositional environment, application. Occurences in Greece and elsewhere.
- Introduction to Gemology. Gemstones, Categories of Gemstones, mineral-chemistry and formation conditions. Gemstones in Greece –Crystallization environments.
- Hydrothermal alterations – Zones of hydrothermal alteration, Mineralogy/Mineral-Chemistry – Conditions of formation and occurences in Greece – Uses of hydrothermal alteration minerals (alunite, alumino-phosphate-sulfate minerals, kaolinite, smectite, zeolites, borates, etc.)
- Limestones, Marbles and Granites as structural and decorative stones. – Inert materials – Archaeometry and Petrology.
- Classifying minerals and rocks by use (filtration, ceramics and refractory materials, abrasives, fertilizers, single crystals, insulating materials, additives, binding materials - powders, glassmaking). Formation of minerals deposits and exploitation areas of industrial minerals and rocks in Greece.
- Introduction to Environmental and Medical Mineralogy. Minerals and mineraloids in living organisms.
- Minerals and natural ecosystems (soils, waters). Biomineralogy. Mineralogy of anthropogenically modified environment.
- Minerals and Environmental Pollution in mining areas.

B. Lab exercises.

Practice exercises are taught in small groups of students and are graded at the end of the exercise.

Exercise 1. Macroscopic and microscopic identification of critical metal bearing minerals (I).
Exercise 2. Macroscopic and microscopic identification of critical metal bearing minerals (I).
Exercise 3. Macroscopic and microscopic identification of hydrothermal alteration minerals (I).
Exercise 4. Macroscopic and microscopic identification of hydrothermal alteration minerals (II).
Exercise 5. Macroscopic and microscopic identification of gemstones (I).
Exercise 6. Macroscopic and microscopic identification of gemstones (II).
Exercise 7. Macroscopic and microscopic identification and properties of industrial minerals (asbestos, feldspar, graphite, sulfur, kyanite, magnesite, garnet, micas, olivine, talc, fluorite, barite, quartz).
Exercise 8. Macroscopic and microscopic identification and properties of industrial rocks (limestone, marble, granite, bauxite, evaporite, perlite, emery).
Exercise 9. Visit to the Lithos Center and to a factory of processing and sale of structural/decorative stones.
Exercise 10. Visit to the Mineralogy-Petrology Museum of NKUA and identification of critical metal bearing minerals.
Exercise 10. Visit to the Mineralogy-Petrology Museum of NKUA and identification of industrial minerals.
Exercise 12. Visit to the Mineralogy-Petrology Museum of NKUA and identification of industrial rocks.
Exercise 13. Fieldtrip to Lavrion area and recognition of hydrothermal alteration zones in the field.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	26 hours
Practice exercises	13 hours
Fieldwork	9 hours
Tutorials	–
Essey writing	–
Autonomous study	37 hours
Final assessment preparation	18 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

I. LECTURES (**60%**)

- Oral or written final examination (summative).

Exams include short or extended answer questions, multiple choice tests.

II. LAB EXERCISES (**40%**)

- Written final examination of classification of minerals and rocks by uses. Macroscopic and microscopic identification of hydrothermal alteration minerals and critical metals bearing minerals (summative).

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

II. ADDITIONAL READING

- Godelitsas, A. & Papoulis, Δ., 2021, **Nanogeosciences**, Publ. Gotsi.
- Collins, T., 2023, **Applied Mineralogy Handbook**, ISBN-10: 1641167920, CALLISTO REFERENCE.
- Dixon, J.B. & Schulze, D.G., 2018, **Soil Mineralogy with Environmental Applications**, ISBN: 978-0-891-18891-9, Wiley.
- Götze, J. & Göbbels, M., 2023, **Introduction to Applied Mineralogy**, Springer.
- Voudouris, P., Karampelas, S., Melfos, V. & Graham, I., 2020, **Mineralogy and Geochemistry of Gems**. Minerals MDPI, 528p, https://doi.org/10.3390/books978-3-03928-077-3 2020

- Wenk, H.R, Bulakh, A., 2004, **Minerals, their constitution and origin**. Cambridge University Press.

III. RELATIVE JOURNALS

- American Mineralogist, Online ISSN: 1945-3027, Print ISSN: 0003-004X, Mineralogical Society of America.
- Mineralogical Magazine, Online ISSN: 1471-8022, Print ISSN: 0026-461X, Mineralogical Society of Great Britain and Ireland.
- European Journal of Mineralogy, Online ISSN: 1617-4011, Print ISSN: 0935-1221, DMG-SEM-SIMP-SFM.
- Minerals, Online ISSN: 2075-163X, MDPI.

WEBPAGE (URL):

http://eclass.uoa.gr/courses/GEOL232

E7219 APPLIED CLIMATOLOGY

Instructors

Lectures: Assoc. Prof. M. Hatzaki – Assoc. Prof. K. Eleftheratos

Lab. Training: Prof. P.T. Nastos – Assoc. Prof. M. Hatzaki – Assoc. Prof. K. Eleftheratos

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 7th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Laboratory exercises

2 hours of lecturing and 1 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: [recommended]

Y1202 Physics

Y2203 Climatology and Climate Changes

Language of instruction and Assessment: Greek [1]

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

Upon completion of the course, the student:

- **Defines** and **describes** specific climatic parameters
- **Understands** and **interprets** the ways in which climate affects different sectors of human activity such as agriculture, forestry, hydrology, human health, transport, energy, etc,
- **Distinguishes** and **explains** the impact of human activity on climate
- **Combines** the knowledge acquired and critically evaluate the issues addressed by applied climatology
- **Applies** the specialised techniques used in applied climatology
- **Combines** theoretical and practical knowledge and **answers** to environmental issues in the field of earth sciences

Generic Competences:

- Ability to apply knowledge in practical situations
- Oral and written communication of scientific issues
- Autonomous work
- Information and Communication Technology (ICT) skills
- Commitment to conservation of the environment

COURSE CONTENT:

A. Lectures

– Climate data processing.
– Climate Classifications.
– Climate indicators.
– Climate impact on humans and bioclimatic indicators.

[1] I.S.: Incoming students (e.g. ERASMUS Student)

– Climate and hydrology, soils, agriculture, forestry, energy.
– Methods of climate modification.
– Climatic elements and natural disasters.
– Climate change and impact assessment.
– Climate Models and Future Projections..

B. Laboratory exercises:

Laboratory exercises are conducted in class and individual assignments are submitted weekly.

Exercise 1. Regression, correlation and trend of climate time series
Exercise 2. Smoothing and interpolation of climate data
Exercise 3. Evapotranspiration and surface water balance
Exercise 4. Recurrence intervals of extreme hydrological events and probabilities of exceeding thresholds
Exercise 5. Climatogram & Thermohyetogram
Exercise 6. Precipitation climate maps
Exercise 7. Estimating rainfall in catchments (Thiessen method)
Exercise 8. Köppen climate classification
Exercise 9. Bioclimatic indicators
Exercise 10. Use of dendroclimatological data to reconstruct climate time series

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

– Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

– Use of ICT in teaching (lectures, lab exercises, fieldwork).
– Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	27 hours
Practice exercises	12 hours
Fieldwork	-
Tutorials	-
Essey writing	24 hours
Autonomous study	25 hours
Final assessment preparation	12 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

The assessment process is conducted, either with progressive exams in separate sections of the course content or with the final examination of the entire course material which includes:

I. LECTURES (**50%**)

Written Exam (summative)

The exams include Short and Extended Answer Questions and Multiple Choice Test

II. PRACTICE EXERCISES (**50%**)

Written Essays for every Practical Exercise (formative, summative)

Supplementary material (questions, exercises, etc.) for the exams is posted on the online **e-Class** platform https://eclass.uoa.gr/courses/GEOL542.

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- Kanellopoulou E., **Applied Climatology,** Symmetria [EUDOXUS Code:45439] in Greek
- Ahrens Donald, Henson Robert, **Meteorology Today**, 13th ed., Floca Helena, Anagnostopoulou C., Tolika K., Hatzaki M. (Scientific editors), Tziolas [EUDOXUS Code:102072114] in Greek

II. ADDITIONAL READING

- **Perry A., Thompson R., 1997, Applied Climatology: Principles and Practice, Routledge, 384 p.**
- **Hobbs J.E., 1980, Applied Climatology: A Study of Atmospheric Resources, Elsevier**

III. RELATIVE JOURNALS

- **Nature Climate Change, Online ISSN** 1758-678X, Springer Nature
- **Journal of Climate, Online** eISSN: 1520-0442, Print: ISSN: 0894-8755; American Meteorological Society
- **International Journal of Climatology, Online ISSN:1097-0088, Print ISSN:0899-8418, Royal Meteorological Society**
- **Theoretical and Applied Climatology Print** ISSN: 0177-798X, Springer

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL542

E7220 ENVIRONMENTAL MICROPALAEONTOLOGY - PALAEOCLIMATOLOGY

Instructors

Lectures: Prof. M. Triantaphyllou - Prof. A. Antonarakou - Assoc. Prof. M. Dimiza - Assoc. Prof. M. Hatzaki - Assist. Prof. T. Tsourou - E. Besiou, Laboratory Teaching Staff – E. Skampa, Laboratory Teaching Staff

Lab. Training: Prof. M. Triantaphyllou - Prof. A. Antonarakou - Assoc. Prof. M. Dimiza - Assoc. Prof. M. Hatzaki - Assist. Prof. T. Tsourou - E. Besiou, Laboratory Teaching Staff – E. Stathopoulou, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 7th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Laboratory exercises

2 hours of lecturing and 1 hours of practical exercises per week, 4 ECTS credits.

Prerequisites:

(Y3206) Micropalaeontology [recommended]

Language of instruction and Assessment: Greek [1]

Το μάθημα προσφέρεται σε φοιτητές Erasmus και Civis: ΝΑΙ

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

Upon successful completion of the course the student:

- Describes, analyses and correlates rocks from the stratigraphic sequences of the Hellenides
- Comprehends the lithological, biostratigraphical and sedimentological features of the stratigraphic sequences as well as their development in space and time
- Inserts the stratigraphic sequences within the geodynamic context of the orogenic cycles
- Combines stratigraphic, paleontological and sedimentological data for the interpretation of depositional environments and the related paleoenvironmental evolution
- Synthesizes the paleogeography of the Hellenides, in correlation with molassic and postalpine sequences

Generic Competences:

- Ability to apply knowledge in practical situations
- Promote free, creative and inductive thinking
- Ability to work in a team
- Ability to search for, process and analyse information with the use of necessary technologies
- Decision making
- Autonomous work
- Ability to work in an international context
- Ability to work in an interdisciplinary context

[1] I.S.: Incoming students (e.g. ERASMUS Student)

COURSE CONTENT:

A. Lectures:

Environmental Micropaleontology- applications in environmental research

- Aims and basic principles
- Qualitative and quantitative methods and tools of Industrial and Environmental Micropaleontology
- Case Studies

Paleoceanographic-Paleoclimatic micropaleontological applications

- Aims and basic principles
- Qualitative and quantitative methods and tools of Micropaleontology paleoceanographic and paleoclimatic applications
- Case Studies

Paleoclimatology

- Paleoclimatic indices
- Paleoclimatic data (proxy data).
- Physical methods of paleoclimatic data determination

B. Practical and Laboratory Exercises :

Laboratory Exercises 1-2. Calcareous nannofossils. Biostratigraphic analysis of geological samples under polarizing microscope. Analysis of micropaleontological range charts from drilling datasets and developing skills for biostratigraphic estimations.

Laboratory Exercises 3-4. Benthic foraminifera. Data processing and analysis, structure and composition of the assemblages and developing skills for the application of bioindices a) for the assessment of water quality in the context of environmental monitoring of coastal marine ecosystems, b) for estimation of paleo-productivity and oxygen content at the bottom water-sediment interface, widely applied in paleoceanographic/paleoclimatic research.

Laboratory Exercises 5-6. Planktonic foraminifera. Applications in paleoceanographic/paleoclimatic research

Laboratory Exercises 7-8. Spectral analysis techniques in Paleoclimatology - Age-depth modelling

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	26 hours
Practice exercises	13 hours
Fieldwork	8 hours
Tutorials	-
Essey writing	21 hours
Autonomous study	16 hours
Final assessment preparation	16 hours

Total student's effort	100 hours

ASSESSMENT METHODS AND CRITERIA:

For the lab:

- Lab essays with bibliographic or practical objectives (**50%**) (formative, summative)

For the theoretical part:

- written team work essays assessment and oral presentation (**50%**) (formative, summative)

RECOMMENDED BIBLIOGRAPHY

EUDOXUS PORTAL

- Malinverno, E., Dimiza, M.D., Triantaphyllou, M.V., Dermitzakis, M.D., Corselli, C., 2008. Coccolithophores of the eastern Mediterranean Sea: a look into the marine micro world. ION Publications, Athens, 188, (ISBN 97-960411-660-7).

II. ADDITIONAL READING

- Triantaphyllou M.V., Dimiza M.D., 2012. Micropaleontology and Geoenvironment. ION Publications, 168 pp., ISBN 978-960-508-058-7.
- Aubry, M.-P. (1984-1999). Handbook of Cenozoic Calcareous Nannoplankton, Book 1-4, Micropaleontology Press American Museum of Natural History, New York.
- Cimerman, F., Langer, M.R., 1991. Mediterranean foraminifera. Academia Scientarium et Artium Slovenica, Dela, Opera 30, Classis IV, Historia Naturalis, 118 pp.
- Sgarrella, F., Moncharmont Zei, M. 1993. Benthic foraminifera of the Gulf of Naples (Italy): systematics and autoecology. Bollettino della Società Paleontologica Italiana, 32: 145–264.
- Milker, Y., Schmiedl, G. 2012. A taxonomic guide to modern benthic shelf foraminifera of the western Mediterranean Sea. Palaeontologia Electronica, 15(2), 16A: 134 pp.
- Murray, J., 2006. Ecology and Applications of Benthic Foraminifera. Cambridge University Press, p. 426.
- Dermizakis, M.D., Georgiades-Dikaioulia, E., 1985, Introduction to Marine Micropaleontology. 720 pp., Eptalofos Publications, Athens.
- Zambetakis-Lekkas, A., Antonarakou, A.,Drinia, H., Tsourou, Th., Di Stefano, A., Baldassini, N. 2015. Micropaleontology and applications (e-book: pdf, e-pub) [Eudoxus code: 320254]

III. RELATIVE JOURNALS

- **Marine Micropaleontology,** Online ISSN: **1872-6186**
- **BioGeosciences,** Online ISSN: 1726-4189
- **Revue de Micropaleontologie,** Online ISSN: 1873-4413

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL253

E7221 GEOTECHNICAL PROJECTS

Instructors

Lectures: Prof. M. Stavropoulou

Lab. Training: Prof. M. Stavropoulou

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 7th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Practical exercises, Fieldwork

2 hours of lecturing and 1 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: NONE

Language of instruction and Assessment: Greek [1]

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

Upon successful completion of the course, the student:

- **Knows** the different stages of engineering structures studies.
- **Analyses, ccombines and applies** the essential geological and geotechnical criteria for construction feasibility and selecting the best design.
- **Acquires skills** in planning and executing geological and geotechnical investigations and evaluating geo-research programs for assessing geotechnical parameters for the design of engineering structures.
- **Becomes familiar** with preparing geotechnical maps and geotechnical models in the context of designing engineering structures.
- **Acquires specialized knowledge** in the calculations of: slopes stability, underground excavations and ground support design and bearing capacity of foundations.
- **Comprehends** the various types of settlement of a structure and **applies** methods to estimate them
- **Knows** the role of geomaterials as a construction material and their improvement techniques.

Generic Competences:

- Ability to apply knowledge in practical situations
- Ability to work in a team
- Ability to search for, process and analyse information with the use of necessary technologies
- Oral and written communication of scientific issues
- Decision making

COURSE CONTENT:

A. Lectures

[1] I.S.: Incoming students (e.g. ERASMUS Student)

- TUNNELS (Geotechnical site investigation, Rock Mass Classification systems, Design principles and construction methods – NATM and TBM, Ground support methods, Stability analysis, Ground support interaction analysis, Design in special situations, Monitoring systems, Failures and emergency measures).
- UNDERGROUND AND SURFACE MINING (Underground and Surface Mines, Quarries, Mining Methods, Geotechnical factors in the design of underground and surface mining projects).
- TRANSPORTATION INFRASTRUCTURE – ROAD CONSTRUCTION (Geotechnical site investigation and reports, Pavements, Embankments, Cut&Covers, Retaining walls, Bridges).
- SLOPES (Soil and rock slope stability analysis using PC: plane and wedge failure, rockfall, methods of slices, probabilistic analysis, stability of slopes under seismic loading, Design considerations for slopes, Technologies for slope stabilization, Monitoring systems).
- FOUNDATIONS (Foundations: functions and requisites, shallow and deep foundations, choice of foundation type, general principles of design, Bearing capacity of shallow foundations: types of failures, bearing capacity analysis, shallow foundation design using Eurocode 7, Settlement analysis, Deep foundations: type of piles, load carrying capacity of single piles and pile groups, settlement of single piles and pile groups).
- EARTH STRUCTURES (Embankments, Compaction, Preloading, Soil reinforcement, Geosynthetics).

B. Lab Exercises

PART A: Site investigation including evaluation of soil and rock mass properties for design.
PART B: Ground support interaction analysis for tunnel design.
PART C: Rock and soil slope stability analysis.
PART D: Bearing capacity of shallow foundations.
PART E: Settlement analysis of shallow foundations.
PART F: Individual project writing and presentation

C. Fieldwork

Visit to important engineering projects in progress.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	26 hours
Practice exercises	13 hours
Fieldwork	8 hours
Tutorials	- hours
Essey writing	21 hours
Autonomous study	16 hours
Final assessment preparation	16 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

The assessment process is conducted, either with progressive exams in separate sections of the course content or with the final examination of the entire course material which includes:

I. LECTURES (**50%**)

- Written Exam with Short Answer Questions and Multiple Choice Test (summative)

and/or

- Written Exam with Extended Answer Questions (summative).

II. LAB EXERCISES (**50%**)

- Weekly assessment of lab exercises (formative, summative) (**25%**)

and

- Individual Project Evaluation (formative, summative) (**25%**).

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- Kostopoulos S. 2008. **Geotechnical Constructions, Vol. I.** Publisher ION [EUDOXUS code: 122079916],in Greek.

II. ADDITIONAL READING

- Καββαδάς Μ. 2009. Σημειώσεις Σχεδιασμού Υπογείων Εργων. http://users.ntua.gr/kavvadas/Books/books.htm.
- Hoek E. 2007. Practical Rock Engineering https://www.rocscience.com/learning/hoek-s-corner/books
- Braja M. Das. 1983. Principles of Foundation Engineering Publisher: Cengage Learning (7th edition, 2010).

III. RELATIVE JOURNALS

- Géotechnique, Publisher: CE Publishing
- Soils and Foundations, Publisher: Elsevier BV.
- Journal of Geotechnical and Geoenvironmental Engineering, Publisher: American Society of Civil Engineers
- International Journal of Rock Mechanics and Mining Sciences, Publisher: Elsevier BV.
- Rock Mechanics and Rock Engineering, Publisher: Springer.
- Tunnelling and Underground Space Technology, Publisher: Elsevier BV.
- Journal of Geotechnical and Geoenvironmental Engineering, Publisher: American Society of Civil Engineers.

WEBPAGE (URL):

http://eclass.uoa.gr/courses/GEOL539

E8201 ENGINEERING AND ENVIROMENTAL GEOPHYSICS

Instructors

Lectures: Prof. I. Alexopoulos - Prof. N. Voulgaris - Prof. A. Tzanis - Prof. F. Vallianatos

Lab. Training: Prof. I. Alexopoulos - V. Sakkas, Laboratory Teaching Staff – S. Chailas, Laboratory Technical Staff – V. Nikolis, Laboratory Technical Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 8th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Practical exercises, Fieldwork

2 hours of lecturing and 1 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: Recommended knowledge of:

Y3205 - Structural Geology and Tectonics
Y4202 - Geophysics
Y5203 - Engineering Geology
Y6202 - Hydrogeology
Y6203 - Geological mapping-Field course
Y7201 - Environmental Geology
Y7203 - Applied Geophysics

Language of instruction and Assessment: Greek [1]
Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

Through the successful completion of this lesson, the trainee:

- **Reproduces** the necessary knowledge and skills for the connection of geophysics-engineering structures-geoenvironment.
- **Distinguishes** the basic geophysical terminology of investigating geotechnical and geoenvironmental issues.
- **Summarizes** the basic geophysical instrumentation and field measurement techniques
- **Discriminates** the physical parameters and techniques for their application on geotechnical and geoenvironmental issues.
- **Combines** geophysical, geological/lithological and geotechnical data.
- **Adjusts** the procedure of planning – execution – processing – presentation of a geotechnical-geoenvironmental research, according to international standards.
- **Evaluates** and **justifies** the results.

Generic Competences:

- Ability to work in an interdisciplinary context
- Ability to apply knowledge in practical situations
- Ability to search for, process and analyse information with the use of necessary technologies
- Information and Communication Technology (ICT) skills
- Decision making

COURSE CONTENT:

A. Lectures/seminars

- **Seismic methods:** Seismic tomography, mapping fault zones and bedrock, correlation of seismic velocities-elastic constants-density and geotechnical indices in geotechnical research, geotechnical soil characterization. Seismic method in boreholes: Techniques, application and examples in engineering. Applications and examples.
- **Resistivity methods:** Electrical resistivity tomography, mapping fault zones and bedrock, mapping polluted areas and industrial pollution, determination of water-saturated zones, landslides, locating fractures and caves, investigation and evaluation of aquifer zones, mapping of industrial pollution, subsurface water flow adumbration. Applications and examples.
- **Electromagnetic methods:** Frequency methods, time-domain methods. Ground Penetrating Radar. Detection of buried objects, fractures, bedrock identification, mapping polluted areas, archaeology etc. Applications and examples.
- **Geophysical tests in boreholes: Cross-hole, up-hole, down-hole, cross-hole & electrical resistivity tomography tests. Application and examples.**
- **Well logging.** Near surface methodologies, acquisition techniques, processing, evaluation and interpretation. **Application and examples**.

B. Laboratory work

- Including processing, evaluation and interpretation of geophysical data with specialized software and report analysis.
- The trainees present and support assigned projects of engineering and environmental geophysics.

C. Fieldwork

One-day field exercise. Field exercises at locations of geoenvironmental and geotechnical interest.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	26 hours
Practice exercises	13 hours
Fieldwork	8 hours
Tutorials	-
Essey writing	13 hours
Autonomous study	25 hours
Final assessment preparation	15 hours
Total student's effort	**100** hours

[1] I.S.: Incoming students (e.g. ERASMUS Student)

ASSESSMENT METHODS AND CRITERIA:

The assessment process is conducted in Greek (there is the possibility of examination in English for Erasmus students.

The final grade is based on:

I. LECTURES (**50%**) (Summative)
- Oral examination

II. LABORATORY WORK (**50%**)
- Oral examination for supporting their assigned projects (formative, summative)

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL
- Tselentis, G.-A. & Paraskeyopoulos P., Applied Geophysics, [Κωδ. ΕΥΔΟΞΟΣ: 50659068]

II. ADDITIONAL READING
- Everett, M.K., 2013. *Near-surface Applied Geophysics*, Cambridge University Press
- Milsom J. & Eriksen A., 2011. *Field Geophysics*, Vol. 36, Wiley - John Wiley & Sons, 287p. ISBN: 978-0-470-74984-5
- Reynolds, J, M., 2011. *An Introduction to Applied and Environmental Geophysics*, 2nd Edition, ISBN: 978-0-471-48535-3.
- Telford, W.M., Geldart, L.P. and Sheriff, 1990, R.E., *Applied Geophysics*, 2nd Edition, Cambridge University Press.

III. RELATIVE JOURNALS
- Near-Surface geophysics, Online ISSN: 1873-0604, Print ISSN: 1569-4445, EAGE
- Journal of Environmental & Engineering Geophysics, Online ISSN: 1943-2658, Print ISSN: 1083-1363, EEGS
- Journal of Geophysics and Engineering, Online ISSN: 1742-2140, Print ISSN: 1742-2132, Oxford Academic
- Journal of Applied Geophysics, Online ISSN: 1879-1859, Print ISSN: 0926-9851, Elsevier

WEBPAGE (URL):

http://eclass.uoa.gr/courses/GEOL184

E8203 STRATIGRAPHY AND PALAEOGEOGRAPHY OF GREECE

Instructors

Lectures: Prof. M. Triantaphyllou - Assist. Prof. T. Tsourou – E. Skampa, Laboratory Teaching Staff - N. Tsaparas, Laboratory Teaching Staff

Lab. Training: Prof. M. Triantaphyllou - Assist. Prof. T. Tsourou – E. Skampa, Laboratory Teaching Staff - N. Tsaparas, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 8th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Practical exercises

2 hours of lecturing and 1 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: [recommended]
Y5202 Stratigraphy
Y4206Sedimentary Environments and Processes

Language of instruction and Assessment: Greek [1]
Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences: The course covers topics on analytic description and detailed knowledge of the stratigraphy of the Hellenides and the correlation of the stratigraphic sequences with the associated depositional environments, aiming to the paleogeographic reconstruction during various geological periods.

On completion of the course the student will have the following learning outcomes:

- describe, analyze and correlate rocks from the stratigraphic sequences of the Hellenides
- understand the lithological, biostratigraphical and sedimentological features of the stratigraphic sequences as well as their development in space and time
- insert the stratigraphic sequences within the geodynamic context of the orogenic cycles
- combine stratigraphic, paleontological and sedimentological data for the interpretation of depositional environments and the related paleoenvironmental evolution
- synthesize the paleogeography of the Hellenides, in correlation with molassic and postalpine sequences

Generic Competences:

- Ability to apply knowledge in practical situations
- Promote free, creative and inductive thinking
- Ability to plan and manage time
- Ability to work in a team

[1] I.S.: Incoming students (e.g. ERASMUS Student)

- Ability to search for, process and analyse information with the use of necessary technologies
- Adapt to and act in new situations and cope under pressure
- Ability to be critical and self-critical
- Oral and written communication of scientific issues
- Decision making
- Ability to undertake research at an appropriate level
- Autonomous work
- Information and Communication Technology (ICT) skills
- Ability to work in an international context
- Commitment to conservation of the environment
- Ability to work in an interdisciplinary context

COURSE CONTENT:

A. Lectures:

Methods of description and analysis of stratigraphic sequences. Pre-alpine, alpine and post-alpine deposits. Paleogeographic integration of the stratigraphic sequences of the Hellenides, in the margins and in the oceanic areas of Tethys. Stratigraphy and Tectonics. Paleogeographic evolution of the Hellenides. Evolution of facies in the geological time. Identification of units from the study of the evolution of their sedimentary sequences. Integration of Hellenides into the alpine system. Paleogeographic models of the evolution of Hellenides.

B. Practice exercises:

Laboratory preparation of samples from the stratigraphic series of the Hellenides. Microscopic study of characteristic facies from the sedimentary sequences of the various units of the Hellenides. Characteristic biofacies and lithofacies of the various series - determination of age and paleoenvironment, construction of lithostratigraphic columns from geological maps, deepening the knowledge of the Stratigraphy of Hellenides and development of digital skills. Critical study of the original bibliographic sources.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

– Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

– Use of ICT in teaching (lectures, lab exercises, fieldwork).
– Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student's effort
Lectures	26 hours
Laboratory exercises	13 hours
Study and analysis of papers	15 hours
Short individual practicing essays	10 hours
Preparation of recapitulation of the knowledge of the semester	18 hours
Preparation for final Assessment	18 hours
Total student effort	**100** hours

Activity	Student effort
Lectures	XX hours
Practice exercises	XX hours
Fieldwork	XX hours
Tutorials	XX hours
Essey writing	XX hours
Autonomous study	XX hours
Final assessment preparation	XX hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

I. THEORETICAL PART: (formative, summative)

grading is based on the written group essay and presentation (**50%**)

II. PRACTICAL PART: (formative, summative)

individual assignments with bibliographic or laboratory topics (**50%**)

The criteria are presented and explained to students during the first lesson (introduction)

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

II. ADDITIONAL READING

III. RELATIVE JOURNALS

Suggested Bibliography:

- Renz, C.Stratigraphie Griechenlands
- Jacobshagen V., Geologie von Griechenland. Berlin, Stuttgart (Gebruder Borntraeger), 363 p.
- Κατσικάτσος Γ., 1992. Γεωλογία της Ελλάδας. Πανεπιστήμιο Πάτρας, Οργανισμός Εκδόσεως Διδακτικών Βιβλίων, 451 σ.
- Μουντράκης Δ., 2010. Γεωλογία και γεωτεκτονική εξέλιξη της Ελλάδας. University studio press, Θεσσαλονίκη, 373 σ.
- Παπανικολάου, Δ., 2015. Γεωλογία της Ελλάδας. Εκδόσεις Πατάκη, 443 σ.
- Καρακίτσιος Β., 2017. Stratigraphy και Παλαιογεωγραφία Ελλάδος. Εκδόσεις ΕΚΠΑ.

Additional bibliographic resources and lecture contents are available to students participating in the course through the relevant course website in (e-class) platform.

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL310

E8207 MINERAL RESOURCES AND THE ENVIRONMENT

Instructors:

Lectures: Z. Kypritidou, Laboratory Teaching Staff –Prof. A. Argyraki

Lab. Training: Prof. A. Argyraki – Z. Kypritidou, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 7th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures and Lab Exercises

2 hours of lecturing and 1 hours of practical exercises per week, 4 ECTS credits.

Prerequisites:

Y6205 Geology of Magmatic and Hydrothermal Ore Deposits

Y4203 Geochemistry

Language of instruction and Assessment: Greek

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

On successful completion of the course the student will be able to:

- **Comprehend** the environmental challenges arising from the exploitation of mineral resources
- **Identify** and **describe** the environmentally friendly technologies of mineral resources utilization
- **Evaluate** the environmental issues that are associated with the mining sector
- **Compare** and **propose** new technologies for the exploitation of mineral resources
- **Search for** the current mining and environmental legislative framework

Generic Competences:

- Ability to be critical and self-critical
- Oral and written communication of scientific issues
- Ability to apply knowledge in practical situations
- Work in a team
- Promote free, creative and inductive thinking

COURSE CONTENT:

A. Lectures

- Introduction to mineral resources and sustainability. The United Nations Framework for Mineral Resources Categorization (UNFC). Geoethics in mining sector.
- Legislative framework regarding the exploration and exploitation of mineral resources. Hellenic Mining Activities Code. Environmental impact studies. Exploitation in Natura 2000 areas.
- Mining methods, type of mining wastes and environmental impacts.
- Mineral processing methods, types of wastes and environmental impacts.
- Utilization of mining wastes in cyclic economy and sustainable development. Secondary resource of mineral resources.
- Remediation and rehabilitation of mining sites, and management of mining wastes of historical mining activities.
- Sea-bed mining and blue development. New challenges in the exploitation of mineral resources and their environmental consequences.
- Green minerals. Introduction. Environmental applications.
- Mineral resources and Renewable Energy Sources. Environmental challenges.

B. Lab exercises.

- Pen-and-paper exercises in class
- Laboratory exercise using green minerals in the treatment of monometallic aqueous solutions.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	24 hours
Practice exercises	15 hours
Fieldwork	-
Tutorials	-
Essey writing	11 hours
Autonomous study	20 hours
Final assessment preparation	30 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

I. LECTURES (**80%**)

- Oral final examination by presentation of a scientific topic (summative).
- Participation of students in the discussion of the lecture topics (formative).

II. LAB EXERCISES (**20%**)

- Problem solving during practice exercises, delivery of laboratory report in the form of activity reports with calculations (summative).

Supplementary material for the exams (questions, exercises etc.) is posted on **e-Class** platform (https://eclass.uoa.gr/courses/GEOL504/).

I.S.: Incoming students (e.g. ERASMUS Student)

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- Eby, G. N. **Principles of Environmental Geochemistry**, 500 p. [EUDOXUS code: 77115198], in Greek.

II. ADDITIONAL READING

- Lottermoser B., 2003, **Mine Wastes**, Springer, 280 p.
- Marker, B.R., Petterson, M.G., McEvoy, F., Stephenson, M.H., 2005, **Sustainable Minerals Operations in the Developing World**, Geological Society, London, Special Publication, 250 p.

III. RELATIVE JOURNALS

- Elements, Online ISSN: 1811-5217, Print ISSN: 1811-5209, Mineralogical Society of America
- Waste management, Online ISSN: 1879-2456, Print ISSN: 0956-053X, Elsevier B.V.
- Applied Geochemistry, Online ISSN: 1872-9134, Print ISSN: 0883-2927, Elsevier B.V.

WEBPAGE OF THE COURSE:

https://eclass.uoa.gr/courses/GEOL504/

E8211 GEOLOGY OF EUROPE

Instructors

Lectures: Assist. Prof. K. Soukis – V. Antoniou, Laboratory Teaching Staff

Lab. Training: Assist. Prof. K. Soukis – V. Antoniou, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 8th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Lab exercises

2 hours of lecturing and 1 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: Basic knowledge from Structural Geology and Tectonics - Y3205 and Dynamic Geology - E4202 [recommended]

Language of instruction and Assessment: Greek [1]

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences: It is a specialized course that offers students a basic knowledge of the geological structure and evolution of the European continent, particularly the orogenies that shaped it in geological time.

With the lab exercises, students construct geological maps depicting the basic geological units involved in the orogenies of the European continent. Overall, the final aim is for the student to understand the European geotectonic structure.

Upon successful completion of the course, the student is able to:

- Distinguish, recognize and comprehend the orogenic episodes that led to the assembly of the European continent and describe their geotectonic evolution.
- Analyze and evaluate of the lithospheric-scale structure of an orogenic domain, compare and correlate with other examples
- Analyze and interpret a continental scale geological map and construct geological cross-sections that depicts the geological structure.
- Compare and correlate the geological units and paleogeographic domains of Greece to neighboring domains and identify the geological units as parts of the Variscan and the Alpine cycle.
- Comprehend In-depth the Wilson cycle, the orogenic processes and the mechanisms of continent accretion and the creation and demise of oceans.

Generic Competences:

[1] I.S.: Incoming students (e.g. ERASMUS Student)

- Promote free, creative and inductive thinking
- Ability to plan and manage time.
- Oral and written communication of scientific issues
- Autonomous work
- Information and Communication Technology (ICT) skills

COURSE CONTENT:

– BASIC CONCEPTS AND METHODS. The geographical and geological dimension of Europe. Early views on the geology of Europe. Tectonic plates theory and the structure of Europe.
– TYPICAL POST-OROGENIC BASINS OF EUROPE. Description of the post-organic basin from the Russian platform to the Pannonian basin.
– ARCHEAN EUROPE: Baltic Shield and Fennoscandia, Karelian, Sveconorwegian, Svecofennian, Timanides.
– PALEOZOIC EUROPE: Scandinavian and British Caledonides.
– VARISCAN EUROPE: Variscides, Variscan (Paleotethyan) Hellenides, Uralides.
– ALPINE EUROPE: Betics, Pyrenees, Alps, Carpathians, Balkanides, Apennine, Dinarides, Albanides, Hellenides, Caucasus, Pontides Taurides Anatolides.

B. Lab Exercises

- Construction of simplified and relatively complex maps depicting the large-scale structure of specific areas of Europe. Construction of a Geological map of the entire European continent using ArcGIS Pro.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

– Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

– Use of ICT in teaching (lectures, lab exercises, fieldwork).
– Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	26 hours
Practice exercises	13 hours
Fieldwork	- hours
Tutorials	- hours
Essey writing	25 hours
Autonomous study	11 hours
Final assessment preparation	25 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

The assessment process is conducted, either with progressive exams in separate sections of the course content or with the final examination of the entire course material which includes:

I. LECTURES (**50%**) (summative)

- Oral Examination and/or
- Written Exam with Short Answer Questions and Multiple Choice Test and/or
- Written Exam with Extended Answer Questions

Questions are based on course lectures deliveries

II. LAB EXERCISES (**50%**) (formative, summative)

- Construction of segments of the Geological Map of Europe and submission of the final map by the end of the semester

The evaluation criteria of the course and the participation rates are described in the Chapter «3.3 Evaluation Criteria» of this syllabus and student handbook.

Auxiliary material (questions, exercises, etc.) for the exams is posted on the online e-Class platform (https://eclass.uoa.gr/courses/GEOL252/).

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

II. ADDITIONAL READING

- Sideris Ch., (2004), Geology of Europe, 96p. (In Greek)
- AGER, D. (1980): The Geology of Europe. McGraw – Hill Book Company Ltd, 527 pp.
- TORSVIK T.H., and COKS L.R.M., (2017). Earth History and Palaeogeography. Cambridge University Press 332 pp.
- ZWART H.J. et al., (1973): Geological Map of Europe 1:2.500.000 (13 sheets), UNESCO.

III. RELATIVE JOURNALS

- Gondwana-Research,Online ISSN: 1878-0571, Print ISSN: 1342-937X, Elsevier.
- Tectonics, Online ISSN:1944-9194, Print ISSN:0278-7407, AGU Publications.
- International Journal of Earth Sciences Electronic ISSN 1437-3262, Print ISSN 1437-3254, Springer

WEBPAGE (URL):

http://eclass.uoa.gr/courses/GEOL252

E8215 APPLIED GEOPHYSICS IN GEOLOGY

Instructors

Lectures: Prof. I. Alexopoulos

Lab. Training: Prof. I. Alexopoulos - V. Nikolis, Laboratory Technical Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 8th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Practical exercises

2 hours of lecturing and 1 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: Recommended knowledge of

Y3205 - Structural Geology and Tectonics
Y4202 - Geophysics
Y4202 – Hydrogeology
Y6203 - Geological Mapping - Field Course
Y6205 - Geology of Magmatic and Hydrothermal Ore Deposits
E7203 - Applied Geophysics

Language of instruction and Assessment: Greek [1]
Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

Through the successful completion of this lesson, the trainee:

- **Defines** the appropriate approach of a geological problem with the contribution of applied geophysics, starting from the understanding of the issue.
- **Recognizes** and **distinguishes** the different geophysical approaches of subsurface investigation used for applied geological examines (gravity, magnetics, electromagnetic, resistivity, seismic methodologies and techniques).
- **Mentions** the correct and safe acquisition procedure.
- **Implements** qualitatively and quantitatively processing of geophysical data.
- **Plans** a geophysical research and **chooses** the appropriate method.
- **Combines** and **correlates** geological and geophysical data.
- **Predicts** and **solves** any problems during the geophysical field acquisition procedure.
- **Judges** the quality of the field data.
- **Evaluates** and **interprets** the combination of geophysical and geological data.
- **Selects** and **proposes** a complete study for solving geological problems based on the application of geophysical methods.

Generic Competences:

- Ability to apply knowledge in practical situations
- Promote free, creative and inductive thinking
- Ability to plan and manage time
- Ability to work in a team
- Ability to search for, process and analyse information with the use of necessary technologies
- Adapt to and act in new situations and cope under pressure
- Ability to be critical and self-critical
- Oral and written communication of scientific issues
- Decision making
- Ability to undertake research at an appropriate level
- Autonomous work
- Information and Communication Technology (ICT) skills
- Ability to work in an international context
- Commitment to conservation of the environment
- Ability to work in an interdisciplinary context

COURSE CONTENT:

A. Lectures/seminars

- **The role and applications of applied geophysics** in geology and geoenvironment. Presentation of geological issues that geophysics can contribute to their investigation.
- **Data acquisition**. Presentation of portable instruments, appropriate acquisition procedure for qualitative data, depending on the method and study area. Safety rules, solving problems.
- **Correlation** of geological-lithological formations/properties with measured physical parameters. Examples and analysis of the variation of the physical properties based on local geological characteristics. Geologically calibrating the measured physical parameters.
- **Choosing** the appropriate geophysical method/technique. Principles and restrictions of geophysical techniques. Representative examples for solving geological issues.
- **Processing, evaluation and presentation** methods of the geophysical results, depending on the geological problem. Evaluating the data quality.
- **Case studies:** Presenting geophysical research applied on geological problems, analyzing and evaluating the applied methods, processing, evaluation and presentation of the data and corresponding results.
- **Examples** of **combining and correlating** the application of geophysical techniques. Combined and comparative geological approach and interpretation of different geophysical parameters. Selection of the most suitable data and geophysical methods for the best result.

B. Laboratory work

Including processing, evaluation and interpretation of geophysical data with specialized software, combined interpretation based on geophysical and geological data and report analysis.

C. Fieldwork

One-day field exercise. Field exercise at locations of geological interest.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

[1] I.S.: Incoming students (e.g. ERASMUS Student)

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

– Use of ICT in teaching (lectures, lab exercises, fieldwork).
– Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	26 hours
Practice exercises	13 hours
Fieldwork	8 hours
Tutorials	-
Essey writing	13 hours
Autonomous study	25 hours
Final assessment preparation	15 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

The assessment process is conducted in Greek (there is the possibility of examination in English for Erasmus students.

The final grade is based on:

- Written exams, **50% of the final grade** (formative, summative)
- Laboratory work, oral examination for supporting the application of geophysical methods for geological purposes, **50% of the final grade** (formative, summative)

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

II. ADDITIONAL READING

III. RELATIVE JOURNALS

Suggested Bibliography:

- Everett, M.K., 2013. *Near-surface Applied Geophysics*, Cambridge University Press
- Fairhead J.D., 2015. *Advances in Gravity and Magnetic Processing and Interpretation*. EAGE Publications, The Netherlands, 338p. ISBN 978-94-6282-175-0
- Hinze, W.J., Von Frese, R.R., Saad, A.H., 2013. *Gravity and Magnetic Exploratio*n, Cambridge University Press.
- Milsom J. & Eriksen A., 2011. *Field Geophysics*, Vol. 36, Wiley - John Wiley & Sons, 287p. ISBN: 978-0-470-74984-5
- Reynolds, J, M., 2011. *An Introduction to Applied and Environmental Geophysics*, 2nd Edition, ISBN: 978-0-471-48535-3.
- Telford, W.M., Geldart, L.P. and Sheriff, 1990, R.E., *Applied Geophysics*, 2nd Edition, Cambridge University Press.
- Tselentis, G.-A. & Paraskeyopoulos P., *Applied Geophysics*, [Κωδ. ΕΥΔΟΞΟΣ: 50659068]

Optional literature for further study: All books are accessible in the Library of the School of Sciences, or available in electronic form:

- Long L.T. & Kaufmann R.D., 2013. *Acquisition and Analysis of Terrestrial Gravity Data*. Cambridge University Press, 169p. ISBN: 978-1-107-02413-7
- Lowrie, W., 2007, *Fundamentals of Geophysics* Cambridge University Press.

WEBPAGE (URL):

http://eclass.uoa.gr/courses/GEOL533

E8216 VOLCANIC SEISMOLOGY

Instructors

Lectures: Assoc. Prof. G. Kaviris

Lab. Training: Assoc. Prof. G. Kaviris

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 8th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Practical exercises

2 hours of lecturing and 1 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: The standard knowledge obtained by the courses of
Y3203 Seismology
Y6201 Applied and Engineering Seismology and
Y4202 Geophysics
are necessary to follow the course

Language of instruction and Assessment: Greek [1]
Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

On successful completion of the course, the student:

- **Categorizes** and **describes** the different types of seismic signals of tectonic/volcanotectonic earthquakes (VT-A, VT-B), volcanic tremors and other signals related to the stages of the evolution of the paroxysmal phase of a volcano (LP, VLP, DLP, hybrid earthquakes, tornillos), volcanic eruptions and associated phenomena (e.g. lahars, pyroclastic flows, landslides), through spectral analysis of seismic recordings.
- **Describes** how the stages of a volcanic crisis evolve through a series of physical processes associated with the ascent of magma from a deep magmatic chamber to the surface.
- **Distinguishes** the stage of activity of a volcanic center through seismicity patterns and seismic signals, based on established empirical models.
- **Identifies** alterations in the physical properties around a volcanic center associated with magmatic intrusion, through local changes in stresses and seismic wave propagation velocities.
- **Interprets** the Earth's structure in volcanic environments through tomographic images of seismic velocities and damping.
- **Correlates** changes in the spatio-temporal evolution of seismicity, seismic noise level, focal mechanisms, seismic anisotropy, seismic wave propagation velocities and other parameters, with the probability of a volcanic eruption.
- **Combines** and **evaluates** results of studies on volcanic seismology published in international scientific journals.

Generic Competences:

- Ability to search for, process and analyse information with the use of necessary technologies
- Ability to apply knowledge in practical situations
- Ability to be critical and self-critical
- Ability to undertake research at an appropriate level
- Information and Communication Technology (ICT) skills

COURSE CONTENT:

A. Course Lectures

- Introduction to Volcanic Seismology.
- Spatio-temporal patterns of seismicity in volcanic environments.
- Spectral analysis of seismic signals from tectonic and volcanic environments.
- Classification of volcanic seismic signals based on waveforms and frequency content.
- Differentiations between open and closed volcanic systems.
- Stress field variations in volcanic environments.
- Focal mechanisms in volcanic environments (ISO, CLVD).
- Seismic anisotropy in volcanic environments.
- Fundamentals of seismic tomography (data selection, parameterization, evaluation, interpretation).
- Applications of passive seismic tomography in volcanic environments.
- Time-varying (4D) seismic tomography in volcanic environments.
- Seismic wave attenuation tomography.
- Methods of volcanic crisis prediction and management.
- Early warning systems and their integration in an operational context.

B. Practice exercises

- Relations between seismicity and active volcanoes in the Pacific Ocean, Atlantic Ocean and Indonesia.
- Relations between seismicity and active volcanoes in the Central and Eastern Mediterranean.
- Analysis of seismological data with the SeisGram2K software.
- Analysis of signals from volcanic and tectonic environments.
- Identification of volcanic seismic signals based on their frequency content and focal depth.
- Interpretation of seismic tomograms in volcanic environments.
- Monitoring, analysis and categorization of current seismic activity in volcanic centers.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY
- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES
- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	26 hours

I.S.: Incoming students (e.g. ERASMUS Student)

Practice exercises	13 hours
Fieldwork	-
Tutorials	-
Essey writing	26 hours
Autonomous study	13 hours
Final assessment preparation	22 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

The assessment process is conducted, either with progressive exams in separate sections of the course content or with the final examination of the entire course material which includes:

I. LECTURES (**50%**)

- Individual Report and Oral Presentation per Student (formative, summative)

II. PRACTICE EXERCISES (**50%**)

- Written exam with Solving Exercises and Problems (formative)

RECOMMENDED BIBLIOGRAPHY

I. ADDITIONAL READING

- Chouet, B., 2003. Volcano Seismology. Pure Appl. Geophys. 160, 739–788.
- Gasparini, P., Scarpa, R., Aki, K. (Eds.), 1992. Volcanic Seismology, IAVCEI Proceedings in Volcanology. Springer Berlin Heidelberg, Berlin, Heidelberg.
- Gudmundsson, A., 2020. Volcanotectonics, Volcanotectonics. Cambridge University Press.
- Wassermann, J., 2012. Volcano Seismology. In: Bormann, P. (Ed.), New Manual of Seismological Observatory Practice 2 (NMSOP-2), Potsdam : Deutsches GeoForschungsZentrum GFZ, 1-77.
- Zobin, V.M. (2003), Introduction to Volcanic Seismology. Amsterdam: Elsevier Science.

II. RELATIVE JOURNALS

- Bulletin of the Seismological Society of America, SSA Journals
- Physics of the Earth and Planetary Interiors, Journal, Elsevier
- Tectonophysics, Journal, Elsevier
- Journal of Volcanology and Geothermal Research, Elsevier
- Volcanica, Presses universitaires de Strasbourg.

WEBPAGE (URL):

http://eclass.uoa.gr/courses/GEOL532

E8217 NEW VENTURE CREATION

Instructor: Assist. Prof.A. Livieratos

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 8th

TYPE: **ELECTIVE /** Skills Developement

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Practical exercises, Case studies

2 hours of lecturing and 0 hours of practical exercises per week, 2 διδακτικές μονάδες, 4 ECTS credits.

Prerequisites: NONE

Language of instruction and Assessment: Greek

Availability to Erasmus+ Students:NO

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences: The aim of the course is to provide students with the necessary knowledge to create new businesses (startup). The course offers a comprehensive approach on how to turn an idea into a product and in turn a product into a sustainable business, based on the lean startup methodology. The goal is for students to embrace an entrepreneurial mindset as a key element in creating a new business, in addition to developing entrepreneurial skills. More specific, in the framework of the course, students will:

- gain basic knowledge about forming an entrepreneurial team
- be able to recognize and develop a business model
- create Minimum Viable Products (MVPs) and in turn conduct “real life experiments"
- be able to capture their entrepreneurial idea in a coherent and well-documented business plan
- be able to communicate their business idea in the form of an elevator pitch to investors.
- As part of the course, students will be divided into groups and will work on their own business ideas. It should be noted that the course will also be offered in other departments of NKUA. The aim is for the groups to be created to have an interdisciplinary character.

Generic Competences:

- Ability to work in a team
- Ability to make reasoned decisions
- Ability to design and manage projects Ability to adapt to in new situations
- Ability to search for, analyze and synthesize data and information Ability for free, creative and inductive thinking
- Ability to be critical and self-critical
- Work in an interdisciplinary environment

COURSE CONTENT:

A. Lectures.

1. Introduction to lean startup methodology.
2. The entrepreneurial idea (ideation workshop)

3. The business model (the business model canvas, business model innovation).
4. Customer discovery I (defining the problem, analyzing competition, and selecting the target market – beachhead market).
5. Customer discovery II (customer profiles, problem interviews, and identifying customer needs)
6. The entrepreneurial team (team development and communication, forming teams, and team manifesto).
7. Customer discovery III (defining the solution, creating an MVP (Minimum Viable Product), executing real-life experiments).
8. Business plan basics
9. Business plan financials
10. Presentation skills for startups (elevator pitch)
11. Start-up funding (bootstrapping, Friends, family and fools, business angels, venture capital/corporate venture capital, crowdfunding, initial coin offerings).

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY
– Face-to-face lectures

USE OF INFORMATION AND COMMUNICATION TECHNOLOGY
– E-class
– Kanbanflow cooperation programmes
– Rapid prototyping techniques/technologies

PLANNED LEARNING ACTIVITIES

Activity	Student's effort
Lectures	39 hours
Elaboration and presentation of study deliverables	70 hours
Independent Study	41 hours
Total student effort	**150** hours

Activity	Student effort
Lectures	XX hours
Practice exercises	XX hours
Fieldwork	XX hours
Tutorials	XX hours
Essey writing	XX hours
Autonomous study	XX hours
Final assessment preparation	XX hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

Students will be divided into groups of 3-5 people. Each group will work on its own business idea. In the context of developing their business idea, groups will have to mature their entrepreneurial idea through the application of tools and techniques taught in the course. The final grade is formed by a series of exercises/deliverables that will be submitted gradually throughout the semester. Specifically, the grade will be formed as follows:

- **5%** Three similar offers
- **8%** Competitive analysis
- **10%** Business model canvas
- **15%** Report from the findings of problem interviews
- **10%** Minimum Viable Product design
- **15%** Report from the findings of experiments based on the MVP
- **22%** Business plan
- **15%** Elevator Pitch (Final presentation)

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

II. ADDITIONAL READING

- Bill Aulet, B. (2021) Επιχειρηματικότητα με Αρχές, Εκδόσεις Utopia
- Osterwalder, A. Pigneur, Y. (2017) Ανάπτυξη Επιχειρηματικών Υποδειγμάτων, Εκδόσεις Broken Hill
- Ρις, Ε. (2013) Λιτή επιχειρηματική εκκίνηση, Αθήνα, Εκδόσεις Λιβάνη
- Livieratos, A. (ed) 2017. Saint Startup: From the idea to the market. Berlin: Pubbuh publications (ελεύθερη πρόσβαση στο internet)
- Λιβιεράτος, Α. (2013) Οδηγός καινοτομίας για μικρές επιχειρήσεις, Αθήνα, ΙΜΕ ΓΣΕΒΕΕ
- Kawasaki, G. (2015). The art of the start 2.0: the time-tested, battle- hardened guide for anyone starting anything Portfolio; Revised edition
- Maurya A., (2012) Running Lean: Iterate from Plan A to a Plan That Works, O'Reilly Media; 2nd edition
- Osterwalder A., Pigneur Y., Bernarda G., and Smith A., (2015) Value Proposition Design How to Create Products and Services Customers Want, Wiley; 1st edition
- Aulet, B.(2013), Disciplined Entrepreneurship: 24 Steps to a Successful Startup. 1. Hoboken: Wiley.
- Horowitz, B. (2014) The Hard Thing About Hard Things, HarperCollins Publishers Inc

III. RELATIVE JOURNALS

- Harvard Business Review
- Sloan Management Review
- Entrepreneurship, Theory and Practice
- Journal of Business Venturing
- Strategic Entrepreneurship Journal

WEBPAGE (URL):

http://eclass.uoa.gr/courses/BA118/

E8218 PALAEOECOLOGY

Instructors

Lectures: Prof. C. Drinia- Prof. E. Koskeridou - Assoc. Prof. G. Lyras - Assist. Prof. T. Tsourou – E. Mpessiou, Laboratory Teaching Staff - E. Stathopoulou, Laboratory Teaching Staff

Lab. Training: Prof. C. Drinia- Prof. E. Koskeridou - Assoc. Prof. G. Lyras - Assist. Prof. T. Tsourou - E. Mpessiou, Laboratory Teaching Staff - E. Stathopoulou, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 8th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Laboratory exercises

3 hours of lecturing and 1 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: [recommended]

Y2205, Macropalaeontology
Y3206 Micropalaeontology
E7207 Vertebrate Palaeontology
Y4206 Sedimentary Environments and Processes

Language of instruction and Assessment: Greek [1]
Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

Upon successful completion of the course the students:

- **Define** the basic concepts and terms of paleoecology.
- **Understand** the methods and techniques used in palaeoecology to study palaeoecosystems.
- **Identify** the characteristics of paleoecological data and their sources.
- **Apply** analytical methods to reconstruct paleoecosystems and climate conditions.
- **Formulates** hypotheses and theories about the evolution of ecosystems through geological time.
- **Combines** information from a variety of sources and disciplines for a comprehensive understanding of paleoecological phenomena.
- **Determines** the relationship between environmental changes and evolutionary processes in past organisms.
- **Evaluates** the effects of natural and anthropogenic factors on changes in paleoecological conditions and ecosystems

Generic Competences:

- Ability to apply knowledge in practical situations
- Promote free, creative and inductive thinking
- Ability to search for, process and analyse information with the use of necessary technologies
- Oral and written communication of scientific issues
- Decision making

COURSE CONTENT:

A. Lectures:

Marine Paleoecology

- Introduction to Marine Paleoecology - Applied Marine Paleoecology
- Paleoclimatic indices in marine deposits
- The benthic foraminifera as paleoecological indices
- Ostracodes as paleoecological indices
- Paleoecological indices-quantitative analysis / management of assemblages
- Paleoecology of invertebrate fauna

Terrestrial Paleoecology

- Island Ecology and Biogeography
- Ecomorphology of carnivorous mammals
- Ecological predators guilds
- Ecology and nutrition
- Introduction to Taphonomy
- Taphonomic processes
- Bone and tooth diagenesis I and II

B. Practicals

Marine Paleoecology

Exercise 1 Palaeobathymetric analysis
Exercise 2 Estimation of paleotemperatures using stable oxygen and trace element isotopes
Exercise 3 Paleoenvironmental evolution of a semi-enclosed marine basin using paleoecological indicators: Benthic Foraminifera
Exercise 4 Paleoenvironmental evolution of a semi-enclosed marine basin using paleoecological indicators: Ostracodes
Exercise 5 Paleoenvironmental evolution of a semi-enclosed marine basin using paleoecological indicators: Synthesis
Exercise 6 Marine invertebrate benthic biocommunities - Paleoenvironmental indicators

Terrestrial Palaeoecology

Exercise 1 Calculation of vertebrate body weight. Application of values to the island rule
Exercise 2 Calculation of craniodental characteristics of carnivorous mammals
Exercise 3 Calculation of changes in mammalian carnivore guilds during the Cenozoic
Exercise 4 Measurement of primate brains and estimation of required feeding time
Exercise 5 Application of taxonomic analysis
Exercise 6 Study of fine bone-tooth sections

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

I.S.: Incoming students (e.g. ERASMUS Student)

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	39 hours
Practice exercises	13 hours
Fieldwork	-
Tutorials	-
Essey writing	18 hours
Autonomous study	20 hours
Final assessment preparation	10 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

EVALUATED:

small individual practice projects (**20%**) (formative, summative) as well as the submission-presentation of two major compositional assignments:

- one on marine ecosystems (**40%**) (formative, summative) and
- one on terrestrial ecosystems (**40%**) (formative, summative)

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- Triantaphyllou M.V. & Dimiza M.D. 2012. Micropaleontology and Geoenvironment. ION, ISBN 978-960-508-058-7. [EUDOXUS CODE: 22769096]
- Zampetaki Lekka A., Antonarakou A., Drinia H., Tsourou T., Di Stefano A., & Baldassini N. 2015. Micropaleontology and its applications [Undergraduate textbook]. Kallipos, Open Academic Editions. (e-book: pdf, e-pub) (EUDOXUS CODE 320254)

II. ADDITIONAL READING

- Murray, J., 2006. Ecology and Applications of Benthic Foraminifera. Cambridge University Press, p. 426.
- Boudagher-Fadel, M.K., 2008. Evolution and geological significance of larger benthic foraminifera. Elsevier B.V., p. 540.

III. RELATIVE JOURNALS

- Frontiers in Ecology and Evolution, Frontiers, Online ISSN 2296-701X
- Journal of Paleontology, Paleontological Society, Online ISSN 1937-2337
- Palaeogeography, Palaeoclimatology, Palaeoecology, Elsevier, ISSN: 0031-0182

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL200

E8219 OIL EXPLORATION - SEDIMENTARY BASINS AND PETROLEUM SYSTEMS

Instructors

Lectures: Assoc. Prof. H. Kranis - Assoc. Prof. J. Panagiotopoulos - G. Kontakiotis, Laboratory Teaching Staff - P. Makri, Laboratory Teaching Staff

Lab. Training: Assoc. Prof. H. Kranis - Assoc. Prof. J. Panagiotopoulos - G. Kontakiotis, Laboratory Teaching Staff - P. Makri, Laboratory Teaching Staff - V. Lianou, Laboratory Technical Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 8th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Laboratory exercises

2 hours of lecturing and 1 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: [recommended]

Y3205 Tectonic Geology
Y4206 Sedimentary Environments and Processes
Y7203 Applied Geophysics

Language of instruction and Assessment: Greek [1]
Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

On successful completion of the course the student:

- **Identifies** and **describes** the components of petroleum systems and petroleum plays.
- **Integrates** surface, subsurface and remote sensing data in order to **evaluate** geological formations with respect to their involvement in petroleum plays.
- **Organizes**, **synthesizes** and **assesses** data, which can lead to a viable plan for the exploration and potential exploitation of an oil/gas field and to a decision-making process regarding the stages of exploration, assessment and development of a hydrocarbon reservoir.
- **Describes** the stratigraphic and tectonic structure of a sedimentary basin as well as the stages of its evolution, which are responsible for the formation of parent rocks, reservoirs, caprocks and hydrocarbon traps.
- **Classifies** the hydrocarbon source rocks according to the type of organic material and the degree of its maturity.
- **Interprets** and **explains** the causes of the accumulation and preservation of organic material necessary for the formation of hydrocarbons.
- **Understands** the concept of the unconventional hydrocarbon reservoirs (e.g., tight sandstone oil/gas, shale oil/gas, gas hy-

[1] I.S.: Incoming students (e.g. ERASMUS Student)

drates) and their importance in the global hydrocarbon reserves.
- **Integrates** all available data and **interprets** the stages of evolution of a sedimentary basin with the ultimate aim of estimating its oil/gas potential.

General Competences:

- Ability to apply knowledge in practical situations.
- Promote free, creative and inductive thinking.
- Autonomous work.
- Ability to search for, process and analyse information with the use of necessary technologies.
- Ability to undertake research at an appropriate level.

COURSE CONTENT:

A. Lectures

- The crucial role of Sequence Stratigraphy in the oil/gas exploration.
- Introduction to the value chain in the exploration and exploitation of hydrocarbons - The role and involvement of the Petroleum Geologist in the stages of exploration, appraisal, development, production, reserve addition and growth.
- Introduction to the concept of the petroleum play and petroleum system.
- Research and exploration methods and tools: Remote sensing data, geophysical survey techniques (e.g., stratigraphy using seismic data), exploration well loggings, core and cuttings logging, mapping.
- Introduction to unconventional hydrocarbon reservoirs: Types, reserves, prospects, environmental impact of exploitation.
- Hydrocarbon formation and accumulation.
- Parent/source rocks: Maturation time and associated processes.
- Reservoir rocks (e.g., sandstones, carbonate rocks).
- Caprocks.
- Primary and secondary migration, migration pathways, accumulation and trapping of hydrocarbons in the reservoir rock.
- Types of hydrocarbon traps: Stratigraphic, tectonic, mixed traps and traps associated with salt tectonics (diapirism).
- The importance of maturation time of the parent/source rock in relation to the time of trap formation.
- Hydrocarbon exploration in Greece and, generally, in the Eastern Mediterranean Basin.

B. Laboratory Exercises

Practice exercises are taught to each individual student and are graded prior to the start of the next Laboratory.

Exercise 1, 2, 3. Study of geological maps in order to estimate the hydrocarbon potential of a region. Identification and assessment of parent/source rocks, reservoirs, caprocks, traps and potential hydrocarbon accumulations.
Exercise 4, 5. Subsurface geology: Construction of subsurface tectonic maps and their interpretation.
Exercise 6, 7, 8. Well logs: Spontaneous potential, Gamma-Ray, resistivity, porosity, density, dipmeter logs.
Exercise 9, 10, 11. Interpretation of geological structures via the analysis of geophysical data.
Exercise 12, 13. Reserve estimation: Economic analysis and investment viability study - Estimation of return on investment.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY
- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES
- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	26 hours
Practice exercises	13 hours
Fieldwork	–
Tutorials	–
Essey writing	15 hours
Autonomous study	30 hours
Final assessment preparation	16 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

I. THEORETICAL PART (**50%**)
- Oral/written final examination (Summative).
  or
- Written test on a part of the syllabus with short-answer questions and a multiple-choice test (Formative, Summative)
  or/and
- Written test on a part of the syllabus with extended-answer questions (Formative, Summative).
  or
- Presentations, by groups of three students, of synthetic topics of oil interest from the Mediterranean Region (Summative).

II. PRACTICAL PART (**50%**)
- Written examination with solving exercises and problems (Formative, Summative).
  or
- Individual practice assignments and group work/presentations (Formative, Summative).

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL
- ----------

II. ADDITIONAL READING
- Bjorlykke K. (2010). Petroleum Geoscience: From Sedimentary Environments to Rock Physics. Springer Verlag: Berlin, Heidelberg.
- Gluyas J., Swarbrick R. (2004). **Petroleum Geoscience**. Blackwell Publishing: Oxford, UK.

III. RELATIVE JOURNALS
- Bulleting of the American Association of Petroleum Geologists , ISSN: 01491423, AAPG.
- Basin Research, ISSN: 0950091X, 13652117, John Wiley and Sons Inc.
- Oil and Gas journal, ISSN: 00301388, PennWell Corporation.
- Marine and petroleum geology, ISSN: 02648172, 18734073, Elsevier.

- Journal of Petroleum Science and Engineering, ISSN: 09204105, Elsevier.
- Mediterranean Geoscience Reviews, ISSN: 2661863X, 26618648, Springer Nature.
- Journal of Petroleum Exploration and Production Technology, ISSN: 21900558, 21900566, Springer Verlag.
- Journal of Petroleum Geology, ISSN: 01416421, 17475457, John Wiley and Sons Inc.

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL250

E8220 GEOLOGICAL HERITAGE AND GEOCONSERVATION

Instructors

Lectures: Prof. C. Drinia- Prof. E. Koskeridou - Prof. M. Tri-antaphyllou - Assoc. Prof. G. Lyras - Prof. P. Nomikou

Lab. Training: Prof. C. Drinia- Prof. E. Koskeridou - Prof. M. Tri-antaphyllou - Assoc. Prof. G. Lyras - Prof. P. Nomikou

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 8th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Laboratory exercises

2 hours of lecturing and 1 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: NONE

Language of instruction and Assessment: Greek [1]
Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences: Upon successful completion of the course students will be able to:

- **define** geotopes and geological monuments and categorize them according to their importance
- **know** the institutional framework for their protection
- **determine** the conditions for the recognition of a Geopark
- **identify** the geotourism potential of a geotope
- **plan** and **propose** ways of tourist exploitation of a geotope
- **plan** geographical routes in areas of interest
- **assess** the value of geotopes
- **support** the promotion and protection of geotopes
- **cultivate** a sense of protection of geological monuments

Generic Competences:

- Ability to apply knowledge in practical situations
- Promotion of free, creative and inductive thinking
- Searching, analysing and synthesising data and information, using the necessary technologies
- Decision-making
- Ability to conduct research at an appropriate level

COURSE CONTENT:

A. Lectures

– Introduction to Geological Heritage - Institutional Framework - Geoethics

[1] I.S.: Incoming students (e.g. ERASMUS Student)

- Natural Monuments and Geological Heritage – Classification of Geotopes - Geotope Assessment Systems
- Design and Operation of Geoparks
- Basic principles of Geoconservation-inventory, conservation and protection of the Geological Heritage -Conservation methods and promotion
- Basic principles of Geotourism
- Environmental education and training.

B. Practicals

- Geotrail Layout
- Determining a Geotrail in a Geopark

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

Activity	Student effort
Lectures	26 hours
Practice exercises	13 hours
Fieldwork	-
Tutorials	-
Essey writing	24 hours
Autonomous study	24 hours
Final assessment preparation	13 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

The assessment of students is performed through:

- Laboratory Projects **(30%)** (formative, summative)
- Presentation of group projects **(30%)** (formative, summative)
- Written Assignments, Reports **(40%)** (formative, summative)

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

II. ADDITIONAL READING

- Zafeiropoulos G., Drinia H., Antonarakou A., Zouros N. 2021. From Geoheritage to Geoeducation, Geoethics and Geotourism: A Critical Evaluation of the Greek Region. Geosciences 11(9), 381.
- Zouros N. 2004. The European Geoparks Network. Episodes 27, 165–171
- Dowling R., Newsome D. (Eds.) 2006. Geotourism; Elsevier/Heineman: Oxford, UK.
- Gray, M. 2004. Geodiversity: Valuing and Conserving Abiotic Nature; John Wiley: Chichester, UK.
- Sharples C. 2002. Concepts and Principles of Geoconservation. Tasmanian Parks and Wildlife Service. Available online: http://www.dpipwe.tas.gov.au/Documents/geoconservation.pdf
- Reynard E., & Brilha, J. 2018. Geoheritage : assessment, protection, and management. Elsevier. https://search.ebscohost.com/login.aspx?direct=true&scope=site&db=nlebk&db=nlabk&AN=1497565

III. RELATIVE JOURNALS

- Geoheritage, Springer, Online ISSN 1867-2477
- International journal of geoheritage, Online ISSN 2310-3388
- International journal of geoheritage and Parks, Online ISSN: 2577-445X

WEBPAGE OF THE COURSE:

http://eclass.uoa.gr/courses/GEOL183

E8221 METHODS IN MINERAL EXPLORATION

Instructors

Lectures: A. Papoutsa, Laboratory Teaching Staff – Prof. S. Kilias - Prof. A. Argyraki - Prof. A. Tzanis – Assoc. Prof. H. Vasilatos

Lab. Training: A. Papoutsa, Laboratory Teaching Staff – Prof. S. Kilias - Prof. A. Argyraki - Prof. A. Tzanis – Assoc. Prof. H. Vasilatos

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 8th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Lab Exercises and Fieldwork

2 hours of lecturing and 1 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: [recommended]

E6205 Geology of Magmatic and Hydrothermal Ore Deposits

Y7204 Geology of Sedimentary and Supergene Deposits

Y4203 Geochemistry

Language of instruction and Assessment: Greek [1]

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

On successful completion of the course the student will be able to:

- **Define** the economic, social and environmental factors and modern applications of raw materials that determine their demand and exploitability.
- **Describe** the investments required for the exploitation of ore deposits, for their rational evaluation and their sustainable exploitation planning.
- **Define** and **formulate** the stages required for the exploitation of mineral resources from the identification of the deposit to the development planning of the mining/quarrying operations.
- **Define** and **describe** the research methodology for the identification of deposits, **combine** and **evaluate** the techniques required at each stage of exploration and their data.

Generic Competences:

- Team-working
- Ability to search for, process and analyse information with the use of necessary technologies.
- Oral and written communication of scientific issues
- Decision-making
- Commitment to the sustainable development

[1] I.S.: Incoming students (e.g. ERASMUS Student)

COURSE CONTENT:

A. Lectures.

- Introduction, raw materials exploitability factors, definitions.
- Economic evaluation of mineral resources, stages of mineral exploration.
- Satellite Remote Sensing in mineral exploration.
- Aerial and in situ geophysical surveys in mineral exploration.
- Introduction to geochemical environments, geochemical processes of metal dispersion.
- Geochemical prospecting methods in mineral exploration.
- Statistical analysis and processing of geochemical data - Data Mining.
- Principles and applications of geochemical mapping in mineral exploration.
- Petrographic survey and methods of core logging.
- Mineralogical prospecting and the importance of mineralogy in the identification and evaluation of mineral resources.
- Geological modelling applications in mineral exploration.
- International Reference Codes for mineral exploration results (CRIRSCO, UNFC).

B. Laboratory Exercises:

The Laboratory Exercises are carried out individually or in small groups of students and are graded at the end of the Lab.

Exercise 1. Exercises for the calculation of economic indices for the evaluation of mining investment (Net Smelter Return- Net Present Value).

Exercise 2. Processing of satellite data from Sentinel 2 using SNAP and ArcMap software and construction of a pseudo-color map of spectral ratios in hydrothermal deposits to detect alterations and mineralization.

Exercise 3. Construction of a geophysical map using ArcMap with aerial magnetic prospecting data in an area of magmatic-hydrothermal deposits and comparison with satellite data.

Exercise 4. Statistical processing of geochemical data and determination of geochemical background values, threshold values, determination of geochemical anomalies and geochemical trackers.

Exercise 5. Construction of a geochemical map using ArcMap, determination of distribution of geochemical trackers and evaluation of possible mineralization sites in magmatic hydrothermal-REE-Y-U systems.

Exercise 6. Observation of textural changes and alteration under a petrographic microscope of transmitted/reflected light in host rocks and Skarn mineralization samples.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	24 hours
Practice exercises	15 hours

Fieldwork	–
Tutorials	–
Essey writing	20 hours
Autonomous study	31 hours
Final assessment preparation	10 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

I. LECTURES (**80%**)

- Group written assignment in a topic related to mineral prospecting and oral presentation at the end of the semester (summative).

II. LAB EXERCISES (**20%**).

- Application of analytical methods and completion of relevant exercises during the semester (formative, summative).

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- S. Decree & Robb, L. (2019). **Ore Deposits: Origin, Exploration, and Exploitation**. Wiley, ISBN 978-1-119-29055-1. [EUDOXUS code: 91721713]
- R. Marjoribanks, (2010). **Geological Methods in Mineral Exploration and Mining** [electronic resource]. Springer, ISBN 978-3-540-74370-5. [EUDOXUS code: 73239486]

II. ADDITIONAL READING

- F.W. Wellmer, M. Dalheimer, &M. Wagner (2008). **Economic evaluation in exploration**-By -Springer 2nd edition
- M. Bustillo Revuelta (2018). Mineral Resources from Exploration to Sustainability Assessment, Springer

III. RELATIVE JOURNALS

- Minerals & Energy,Taylor and Francis Online
- Ore Geology Reviews, Elsevier
- Remote Sensing, MDPI
- Journal of Applied Geophysics, Elsevier

WEBPAGE OF THE COURSE:

https://eclass.uoa.gr/courses/GEOL387

E8222 WATER RESOURCES MANAGEMENT - VULNERABILITY

Instructors

Lectures: Assist. Prof. E. Skourtsos – C. Filis, Laboratory Teaching Staff – E. Andreadakis, Laboratory Technical Staff – Prof. Emeritus Ap. Alexopoulos

Lab. Training: Assist. Prof. E. Skourtsos – E. Andreadakis, Laboratory Technical Staff – Prof. M. Stavropoulou - C. Filis, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 8th

TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Lab exercises, Fieldwork

2 hours of lecturing and 2 hours of practical exercises per week, 4 ECTS credits.

Prerequisites: Y6202 Hydrogeology [recommended]

Language of instruction and Assessment: Greek

Availability to Erasmus+ Students: Yes (in Greek)

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

The course "Water Resources Management - Vulnerability" is an advanced (specialized) course that deals with issues of "wise" water resource management, pollution, and decontamination of aquifers, the assessment, with various methodologies, of the susceptibility to pollution (vulnerability) of formations hosting groundwater and the assessment of the risk against pollution.

- Prepares, evaluates and review in collaboration with other scientists Drainage Basin Management Plans, as required by European (Directive 2000/60) and Greek law,
- Designs and executes in collaboration with other scientists aquifer decontamination projects,
- Evaluates vulnerability with different methodologies for different types of aquifers, constructs vulnerability maps and calculates the risk from pollution of aquifers.

Generic Competences:

- Ability to apply knowledge in practical situations
- Promote free, creative and inductive thinking
- Ability to work in a team
- Ability to search for, process and analyse information with the use of necessary technologies
- Ability to undertake research at an appropriate level
- Commitment to conservation of the environment
- Ability to work in an interdisciplinary context

COURSE CONTENT:

A. Lectures of the course

1) Water Resources Managemen

Basic concepts and definitions related to management. Legislative framework for water resources management in the European Union and Greece. Water resources and water districts of Greece. Water and its relationship with the environment, urban development, energy and sustainable development, spatiotemporal distribution of supply (availability) and demand. Water supply, water demand, water demand management. Combined management of surface and groundwater resources. Water resources management plans. Decision support systems in water resource management problems. Water resources development projects. Processing of used water, desalination.

2) Vulnerability

1. The aquatic environment. Fluctuations in the level of surface water and groundwater. Combined water management (in general, parameters of the problem, fundamental principles, general planning of water development).
2. Changes in the quality of water bodies. Water receivers. Anthropogenic burdens on water recipients.
3. Mechanisms for the transfer of pollutants. Mechanisms for dealing with pollutants.
4. The vulnerability of water bodies. Internal and Special Vulnerability. Vulnerability assessment and mapping.
5. Water abstraction protection zones.
6. Greek, European, and Global legislation and practice

B. Lab Exercises

- Part A: Laboratory exercises and solving exercises and problems aimed at consolidating concepts taught in lectures (lectures).
- Part B: Execution of software programs and training of mathematical models using computers
- Processing of data collected from field (field) work.

C. Field Exercises (Outdoors)

Field exercise, usually going to areas of Attica or the Tripoli Plateau, or the industrial zone of Oinofyta, for the understanding of the concepts and the work that must be done in order to draw up the Drainage Basin Area Management Plans, in accordance with Directive 2000/60 of the European Union and national legislation and for the collection of data to be used to assess the vulnerability and risk of degradation of the groundwater quality.

This is followed by processing of the collected data in the Practice Exercises

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

– Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

– Use of ICT in teaching (lectures, lab exercises, fieldwork).
– Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	13 hours
Practice exercises	26 hours
Fieldwork	10 hours
Tutorials	- hours
Essey writing	16 hours
Autonomous study	20 hours
Final assessment preparation	15 hours
Total student's effort	**100** hours

ASSESSMENT METHODS AND CRITERIA:

The assessment process is conducted in Greek, either with progressive exams in separate sections of the course content or with the final examination of the entire course material which includes:

I. LECTURES (**45%**) (formative, summative)
- Oral Examination and/or
- Written Exam with Short Answer Questions and Multiple Choice Test and/or
- Written Exam with Extended Answer Questions

II. LAB EXERCISES (**45%**) (formative, summative)
- Written exam with Solving Exercises and Problems

III. FIELD EXERCISES (**10%**) (formative, summative)
- Oral examination in the field and evaluation of required report.

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

- Voudouris K., 2016, Environmental Hydrogeology. Groundwater and Environment, [EUDOXUS Code: 18549069] (in Greek)
- Voudouris K., 2017, Groundwater Exploitation & Management, Voudouris K., 2015, Exploitation and management of Groundwater. Tziola Publications, ISBN: 978-960-418-469-9 [EUDOXUS Code: 112690244] (in Greek)

II. ADDITIONAL READING

- Chapelle H. F., 1992, Ground-Water Microbiology and Geochemistry, by John Wiley & Sons, Inc., New York., ISBN:0-471-52951-6
- Domenico A. P. & Scbwartz W. F., 1998, Physical and Chemical Hydrogeology, second ed., by John Wiley & Sons, Inc., New York, ISBN: 0-471-59762-7
- Driscoll G. F.: Groundwater and Wells, 2ed ed. 1989, by Jonson Filtration Systems Inc, ISBN: 0-9616456-0-1
- Fetter C. W.: Applied Hydrogeology, 4th ed. 2001, by Prentice-Hall, Inc. Upper Saddle River, New Jersey 07458, ISBN: 0-13-088239-9
- Hem J. D.,1985, Study and intepretation of the chemical characteristics of natural water. U. S. Geological Survey Water-Supply Paper 1473
- Hounslow W. A., 1995, Water Quality Data, Analysis and Interpretation, by CRC Press, Taylor & Francis, ISBN: 978-0-87371-676-5
- Kallergis A. G., 1999,: Applied - Environmental Hydrogeology. Second edition, TEE Publications, Athens, Volume B., ISBN: 960-7018-70-2 (in Greek)
- Kresic N., 2007 Hydrogeology and Groundwater Modeling, second ed. by CRC Press and Taylor & Francis. ISBN: 978-0-8493-3348-4
- Lamb C. J., 1985, Water Quality and its control, by John Wiley & Sons, Inc., New York., ISBN: 0-471-83735-0
- Richter C. B. & Kreitler W. C., 1993, Geochemical Techniques for Identifying Sources of Ground-Water Salinization, by C. K. Smoley, CRC Press, Inc.

- Zaporozec A. & Vrba J., 1994, Guidebook on Mapping Groundwater Vulnerability. International Association of Hydrogeologists, V.16.
- Various Directives of the European Union concerning the protection of water resources

III. RELATIVE JOURNALS

- Water
- Hydrogeology Journal
- Groundwater
- Water Resources Reseach

WEBPAGE (URL):

http://eclass.uoa.gr/courses/GEOL251

ΠΑ001 INTERNSHIP

TEACHING ACTIVITIES - HOURS/WEEK - ECTS
8 ECTS credits.

Instructors: Prof. P. Pomonis- V. Lianou, Laboratory Technical Staff

Informations: praktiki@geol.uoa.gr

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 7th & 8th
TYPE: **ELECTIVE /** Scientific Area

TEACHING ACTIVITIES - HOURS/WEEK - ECTS
Internship
8 ECTS credits.

Prerequisites: NONE

Language of instruction and Assessment: Greek
Availability to Erasmus+ Students: NO

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

On completion of the internship, the student:

- **Understands** the range of options for planning his educational or professional career, starting from his undergraduate studies.
- **Applies** the knowledge and skills developed while studying to the workplace.
- **Evaluates** whether the subject of his work placement is a possible career choice.
- **Estimates** his knowledge, skills and general education in relation to the professional field in which he is trained.

Generic Competences:

- Ability to apply knowledge in practical situations
- Promote free, creative and inductive thinking
- Ability to plan and manage time
- Ability to work in a team
- Ability to search for, process and analyse information with the use of necessary technologies

COURSE CONTENT:

This course includes a 2-month work placement in institutions/companies relevant to the subjects taught in the Department. Students are free to choose the institution (located anywhere in the country) where they would like to do their placement. They will be given specific tasks and responsibilities by their assigned Supervisor at the institution/company. Internship hours are full-time, aligned with the Host Institution's working hours. The internship provides students with the opportunity to experience the modern working environment and to apply their scientific knowledge in a real-world setting. It also helps them to enhance their scientific training by acquiring professional skills and qualifications. In addition, the internship provides network-

ing opportunities with institutions/companies and executives, allowing students to gain valuable professional experience.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

– Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

– Use of ICT in teaching (lectures, lab exercises, fieldwork).
– Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student's effort
Internship (assignment of work by the Host entity)	2 Months (Full time job)
Total student effort	**2** Months

ASSESSMENT METHODS AND CRITERIA:

Language of Evaluation: greek.

Student deliverables:

- Detailed activity report
- Daily attendance and activity schedule of the student trainee
- Certificate of Completion of the Student Activity and Activity Report of the Host Organisation
- Student Performance Report from the Student Work Supervisor at the Host Organisation.

The final mark is determined by the Student Performance Report. However, it will not be taken into account for the final grade of the degree.

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

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II. ADDITIONAL READING

- Internship Regulation of the Department of Geology and Geoenvironment (in greek)
- Guide and answers to frequently asked questions (in greek)
- Internship Guide 2023-2024 (in greek)
- Indicative index of organisations/companies to search for placements

III. RELATIVE JOURNALS

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WEBPAGE (URL):

https://www.geol.uoa.gr/foitites/praktiki_aksisi/

https://eclass.uoa.gr/courses/GEOL457/

C. SEMINARS

ΣΜ001 SEMINAR COURSES 1: GETTING ACQUAINTED WITH GEOSCIENCE

Instructors: Prof. S. Lozios - Prof. I. Alexopoulos - Prof. M. Triantaphyllou - Prof. A. Argyraki - Prof. P. Pomonis - Assoc. Prof. H. Kranis - Assist. Prof. E. Skourtsos - Assist. Prof. K. Soukis - Dr. Ch. Karageorgou, MSc.

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 1st

TYPE: **MANDATORY / SEMINAR /** Skills development

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Practical exercises

1 hours of lecturing per week, 1 διδακτικές μονάδες, 2 ECTS credits.

Prerequisites: NONE

Language of instruction and Assessment: Greek

Availability to Erasmus+ Students: NO

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

After the successful completion of the seminar and the field trip the newly admitted students:

- know how to be creative and efficient in the academic environment.
- know what the capabilities are offered by his student status.
- have a basic knowledge and handle properly of the essential equipment for the geological activities.
- know and be able to apply the safety rules that govern the geological fieldwork.
- know and be able to safely apply first aid procedures in case of emergency or accident.

Generic Competences:

- Ability to plan and manage time
- Ability to work in a team
- Autonomous work
- Commitment to conservation of the environment
- Ability to work in an interdisciplinary context

COURSE CONTENT:

The purpose of these seminars is to inform and educate the students in:

- the cognitive subjects of the Department of Geology and Geoenvironment,
- the actions, organizing and operating issues regarding the educational process,
- the capabilities and offers of the Erasmus programm,
- the capability to participate in the student internship in the public or private sector,
- the regulations of use and safety for the lab apparatus and lab materials,
- the measurements and data obtained by instruments,
- the object and practices for fieldwork and field training,
- the necessary equipment used by field geologists with emphasis to the correct and safe use,
- the safety rules, rules of behavior and contact during fieldwork,
- the presentation and preservation of geological heritage,
- the first aid application in case of emergency or accident during fieldwork or in the lab.

Field Trip

Daily field trip to Mountain Hymittos. A short field trip for the students to comprehend basic concepts and to get familiar with fieldwork, field measurements in accordance with safety rules and best practices for the preservation of the geological heritage.

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	12 hours
Practice exercises	12 hours
Essey writing	14 hours
Autonomous study	12 hours
Total student's effort	**50** hours

ASSESSMENT METHODS AND CRITERIA:

Oral questions during the seminar. (formative, summative)

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

LOZIOS, S., SOUKIS, K. & ANTONIOU, V., 2015, **Geological Mapping and Field Exercises**, Academic textbooks (Kallipos), Hellenic Academic Libraries, 280 p. (**e-book:** PDF, e-pub, in Greek)[EUDOXUS code: 320091].

II. ADDITIONAL READING

- ROB BUTLER, 2006, **Teaching Geoscience through Fieldwork**, GEES Learning and Teaching Guide, 56 p.

III. RELATIVE JOURNALS

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WEBPAGE (URL):

http://eclass.uoa.gr/courses/GEOL248

ΣΜ002 SEMINAR COURSES 2: INFORMATICS

Instructors: V. Sakkas, Laboratory Teaching Staff - S. Vassilopoulou, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 1st

TYPE: **ELECTIVE / SEMINAR /** Skills development

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

Lectures, Practical exercises

2 hours of lecturing per week, 2 διδακτικές μονάδες, 2 ECTS credits.

Prerequisites: NONE

Language of instruction and Assessment: Greek [1]

Availability to Erasmus+ Students: YES in English

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

On successful completion of the course the student will be able to:

- **Define** the basic concepts on management and response of seismic disasters.
- **Describe** and define the man-made disasters.
- **Analyse** how local, state, national and global institutions respond to the needs created during natural disasters.
- **Analyse** how political, economic and cultural factors are involved in dealing with a natural disaster.
- **Comprehend** and **analyse** specific international issues in relation to natural disasters, proposes and evaluates responses.
- **Define** how each national and international organization respond to the call for assistance during natural hazards
- **Analyze** specific international issues related to natural disasters and propose and evaluate responses
- **Identify** appropriate immediate responses to natural disasters
- **Implement** a disaster response program within 24 hours
- **Define** and **describe** the basic concept of script languages
- **Know** and **apply** the basic commands, and make simple programs on C and C++
- **Create** simple maps using the open source s/w GMT (Generic mapping tool)
- **Apply** processing techniques to process geodata using open source s/w

Generic Competences:

- Decision making
- Ability to work in a team
- Autonomous work
- Ability to search for, process and analyse information with the use of necessary technologies
- Information and Communication Technology (ICT) skills
- Ability to work in an interdisciplinary context
- Ability to apply knowledge in practical situations

[1] I.S.: Incoming students (e.g. ERASMUS Student)

COURSE CONTENT:

A. Lectures

- Introduction to Seismic Disasters: concepts, management and response - Computational tools for real-time impact identification and assessment.
- Definitions for natural and man-made disasters. Description of local, state, national and global institutions respond to natural disasters. The role of local, state and international organisations such as the EU, the United Nations, the World Health Organization and NGOs during natural hazards. Evaluation of each organization's response to the call for help.
- Civil Protection plans for the effective response to catastrophic phenomena and the protection of life, health and property of citizens, as well as the natural environment in Greece, the EU and the USA
- Simulation of natural and man-made disasters (Professor P. Bodelson, StCloud State University, MN, USA).
- Seismic disaster management and response are foreseen, as well as screenings of relevant documentaries and films.
- Familiarization with the tools available for the identification of seismic parameters and the distribution of strong ground motion in direct time will take place in the computing machines of the Department of Geophysics-Geothermal. Use open source software to identify open population gathering places and health units and to map out escape routes in an urban environment.
- Simulation of earthquake disaster management in an urban environment. Virtual simulation of an earthquake disaster in an urban environment, in which each student has a distinct role. The community simulation to be attended by other members of the university for the recognition of the students' work.
- Introduction to programming language C++. Object orientated programming, parameter definition, basic commands.
- Writing simple programs to C and C++
- Introduction to t map projection systems and digital data objects.
- Organization and structure of the GMT system – similarities and differences between the Windows and Linux realizations of the GMT.
- Construction of simple graphs and maps from the command line.
- Construction of composite/multi-thematic graphs and maps with macro-instruction assemblies (batch files for Windows, shell scripts for Linux).
- Specialized applications in geology and geophysics (e.g. cross sections, incorporation of geological symbols, visualization of faults, earthquake fault-plane solutions etc.).

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	12 hours
Practice exercises	16 hours
Fieldwork	-
Tutorials	–
Essey writing	8 hours
Autonomous study	10 hours
Final assessment preparation	4 hours
Total student's effort	**50** hours

ASSESSMENT METHODS AND CRITERIA:

Students are evaluated according to their performance in Practical Training. (formative, summative)

- Short test at the end of each lab exercise (formative)

A course grade is issued.

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

II. ADDITIONAL READING

- Hanselman, D. and Littlefield, B., «Μάθετε το MATLAB 7», [Κωδ. Ευδόξου: 13789]
- Wessel P. And Smith, W.H.F., «The generic mapping tools v4.5.18", (PDF).
- Sylves, Richard.2008. Disaster Policy and Politics. Congressional Quarterly: Washington, DC.
- https://www.civilprotection.gr/el/seismoi
- "The Generic Mapping Tools Cookbook", (PDF
- Moller, C., «Numerical computing with MATLAB», MathWorks Inc., 2004 (PDF)
- Trauth, M.H., «MATLAB® Recipes for Earth Sciences», Springer, 2007.
- «The Generic Mapping Tools Cookbook», (PDF)
- Detailed Instructors' Notes (over 140 pages) and, exercise material posted on e-Class platform

WEBPAGE (URL):

http://eclass.uoa.gr/courses/GEOL563

ΣΜ003 SEMINAR COURSES 3: PROGRAMMING-APPLICATIONS IN GEOSCIENCE

Instructors: Assoc. Prof. G. Kaviris - S. Vassilopoulou, Laboratory Teaching Staff

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 4th

TYPE: **ELECTIVE / SEMINAR /** Skills development

TEACHING ACTIVITIES - HOURS/WEEK - ECTS

PART A: Data Analysis with Python (12 hours) Lectures, Practical exercises, Laboratory exercises

PART B: The specific software "G.EN.I-MA" (Geo-Environmental Information Management) and the "G.EN.I-MA web" presentation (8 hours) Lectures, Practical exercises, Laboratory exercises

2 hours of lecturing per week, 2 διδακτικές μονάδες, 2 ECTS credits.

Prerequisites: Y1204 Introduction to Differential and Integral Calculus and Statistics

Language of instruction and Assessment: Greek

Availability to Erasmus+ Students: NO

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

PART A: Data analysis with Python (12 hours)

On successful completion of the seminar course the student::

- **Composes** algorithms for mathematical calculations.
- **Calculates** basic statistical quantities.
- **Analyzes** data and results of their processing, in various ways of visualization (such as scatter charts and histograms).
- **Develops** scripts.

PART B: The specific software "G.EN.I-MA" (Geo-Environmental Information Management) and the "G.EN.I-MA web" presentation (8 hours).

Upon successful completion of the course, students will be able to:

- **Analyzes** geological and geoenvironmental problems
- **Composes** specific Tools for Geodata Processing on a GIS / web GIS environment or a stand-alone application.
- **Develops** web maps, websites & web applications

GIS/Web GIS environment or a stand-alone application etc.

Generic Competences:

- Ability to apply knowledge in practical situations
- Ability to plan and manage time
- Ability to search for, process and analyse information with the use of necessary technologies
- Autonomous work
- Information and Communication Technology (ICT) skills

COURSE CONTENT:

Part A: Data analysis with Python

Duration: 12 hours

A. Lectures

- Data types (strings, numbers, Boolean, sequences).
- Workflows and conditionals.
- Basic functions.
- File management.
- Numerical operators and algorithm implementation with NumPy.
- Data visualization with Matplotlib.
- Management and statistical processing of dataframes with Pandas.
- Examples of Python applications in geosciences.

B. Practical Exercises and Laboratory Exercises:

A1 Reading and handling files.
A2 Basic functions and data types.
B1 Data analysis and visualization I.
B2 Data analysis and visualization II.
C1 Statistical processing.

PART B: The specific software "G.EN.I-MA" (Geo-Environmental Information Management) and the "G.EN.I-MA web" presentation.

Duration: 8 Hours

A. Lectures

- The structure of the stand-alone specific Tool for the data processing and diagrams creation "The Time Series of Displacement for each GPS station" (python script (Pandas, Date) / HTML / Javascript)
- The structure of the specific Tool for the Ground Deformation Maps production (ArcGIS/Model Builder/Python)
- The Specific Tool for Terrain Analysis (Data processing, DEM and terrain analysis data creation (morphological slopes and the aspect of the slopes, morphological discontinuities etc).
- The Website development for the specific software representation:
  - Web Static Generator Framework HUGO / Markdown / HTML / JavaScript and ATOM environment.
  - Website Navigation - Applications in Geological and Geophysical research (http://users.uoa.gr/~vassilopoulou/genima)

B. Practical and Laboratory Exercises:

A. Geoprocessing – Geodata management - thematic & synthetic layers creation (Python & ArcGIS)
B. Specific Tools creation for thematic layers production (ArcGIS PRO / Model Builder / Python) – Export code to Python file.
C. Web Applications (HTML/CSS/HUGO/MARKDOWN/ATOM)
D. Web GIS & Web GIS Applications (ArcGIS Online)

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

- Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

- Use of ICT in teaching (lectures, lab exercises, fieldwork).
- Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student effort
Lectures	12 hours
Practice exercises	12 hours
Fieldwork	-
Tutorials	-
Essey writing	-
Autonomous study	26 hours
Final assessment preparation	-
Total student's effort	**50** hours

ASSESSMENT METHODS AND CRITERIA:

In order to successfully complete the course, the student must have attended:

- At least 10 hours of ώρες lectures and practical exercises from Part A: Data Analysis with Python (Formative)

or/and

- at least 6 hours of lectures and practical exercises from Part B: The specific software "G.EN.I-MA" (Geo-Environmental Information Management) and the "G.EN.I-MA web" presentation. (Formative)

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

II. ADDITIONAL READING

III. RELATIVE JOURNALS

Suggested Bibliography:

WEBPAGE (URL):

http://eclass.uoa.gr/courses/GEOL541

ΣΜ004 SEMINAR COURSES 4: ESSAY WRITING

Instructors Prof. K. Kouli – Prof. S. Kilias - Prof. S. Lozios - Prof. M. Stavropoulou

LEVEL / SEMESTER: EQF level 6; NQF of Greece level 6 / 4th
TYPE: **ELECTIVE / SEMINAR /** Skills development

TEACHING ACTIVITIES - HOURS/WEEK - ECTS
1 hour of lecturing per week, 0,5 ECTS credits.

Prerequisites: NONE

Language of instruction and Assessment: Greek
Availability to Erasmus+ Students: NO

LEARNING OUTCOMES

Learning Outcomes/Subject Specific Competences:

Upon completion of this seminar course, students will be able to:

- search for references and use bibliographic references correctly in essays
- understand the principles of scientific ethics, evaluate and apply them in the writing of scientific texts
- comprise the structure of a work and deal with difficulties that arise during its writing
- prepare technical geological reports
- write scientifically sound texts, developing the subject comprehensively and taking into account the existing knowledge
- present the results of their work or study to a scientific or general public.

Generic Competences:

- Oral and written communication of scientific issues
- Information and Communication Technology (ICT) skills
- Ability to work in an international context
- Ability to work in an interdisciplinary context
- Autonomous work

COURSE CONTENT:

The aim of this seminar course is to familiarize students with the scientific methodology focusing on the search and use of scientific literature, the writing of scientific papers and technical reports and the techniques of presenting scientific results. The seminar includes the following thematic topics:

Collection, study and use of bibliography

– Scientific bibliography / large bibliographic databases
– Scientific journals / bibliographic indicators
– Scientific databases / open access science
– Use of references in essays / bibliographic reference systems / bibliographic reference management software
– Accurate use of scientific literature / Plagiarism

Writing assignments

– bibliographic and research essays
– Stages of essay writing
– Structure of scientific essays
– Technical issues: writing style, language, text setting

Writing geological reports

– Studies of technical projects
– Urban planning studies
– Studies to avoid effects on water
– Studies to avoid environmental impact

Scientific Presentations: dissemination and communication of science

LEARNING ACTIVITIES - TEACHING METHODS

MODE OF DELIVERY

– Face to face.

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES

– Use of ICT in teaching (lectures, lab exercises, fieldwork).
– Use of ICT in communication with students.

PLANNED LEARNING ACTIVITIES

Activity	Student's effort
Seminars	10 hours
Essay writing	5 hours
Total student effort	**15** hours

ASSESSMENT METHODS AND CRITERIA:

Small individual or group essays during the semester related to the topics of the Seminar. (formative)

RECOMMENDED BIBLIOGRAPHY

I. EUDOXUS PORTAL

▪

II. ADDITIONAL READING

▪ Government Gazette volumes: 1902Β/2007, 838Δ/1998, 35 Β/1999, 678Β/1990, 29Β/1986, 1016Β/1997, 1595Β/2004, 820Β/1980, 552Β/2003.

III. RELATIVE JOURNALS

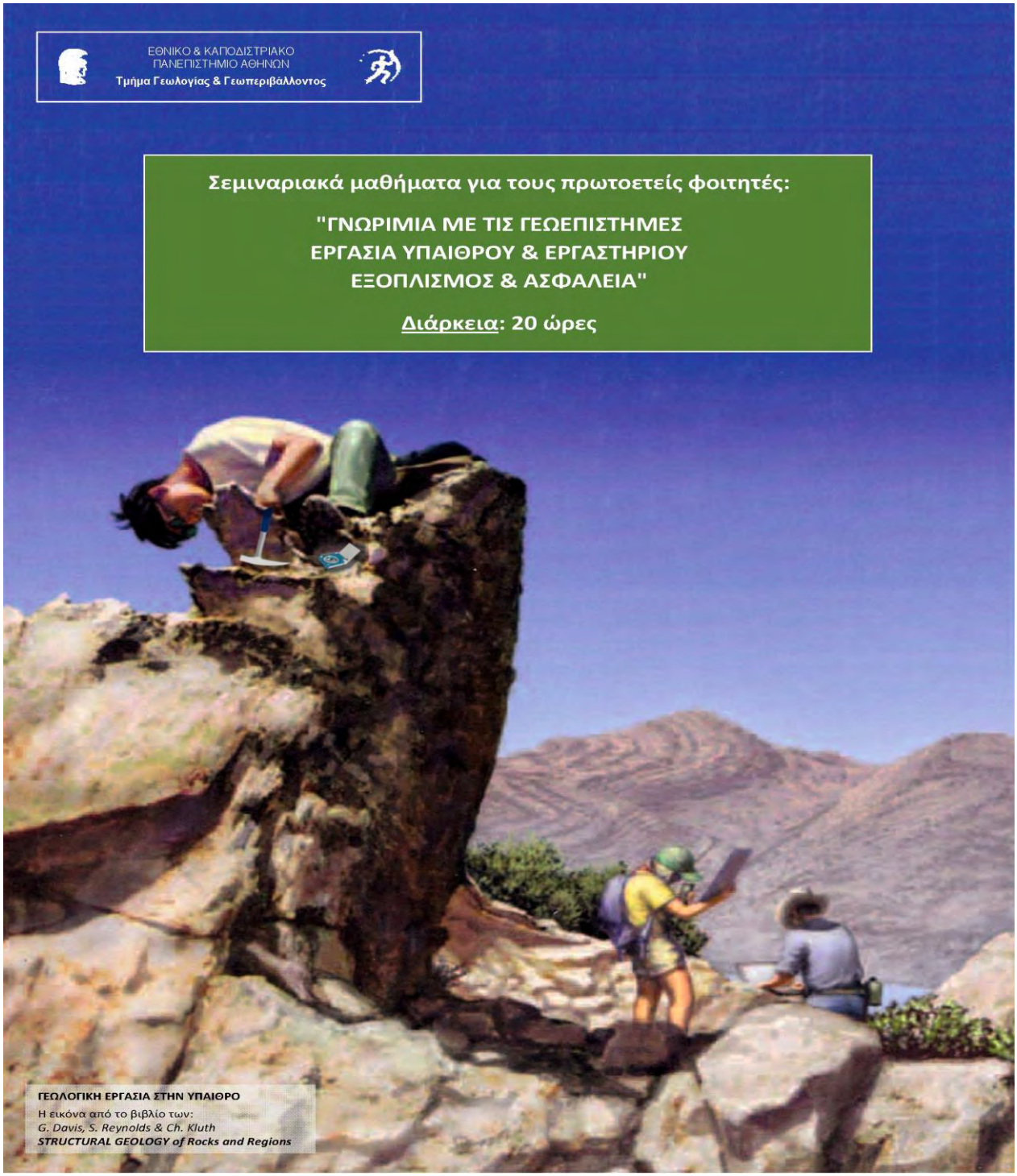
▪

WEBPAGE (URL):

http://eclass.uoa.gr/courses/GEOL546

3.3 EVALUATION CRITERIA

Βαθμ. Κλίμακα 0-10	Κριτήρια που πρέπει να ικανοποιούνται
10 8.6	• Under appropriate circumstances the work would be worthy of publication. • Learning advanced methods and techniques at a level beyond this is explicitly taught. • Ability to compose and adopt in an original way ideas from the whole range of the subject. • Excellent control of critical analysis and judgment. • Excellent presentation of the material. • In teamwork, there is evidence of outstanding individual contribution.
8,5 7,1	• Excellent breadth and depth of achievement of the intended learning outcomes. • Knowledge of a wide range of methods and techniques. • Evidence of study and originality clearly beyond the limits of what has been taught. • Ability to control critical analysis and judgment. • Excellent presentation of the material. • In teamwork, there is evidence of outstanding individual contribution.
7 6,1	• Full achievement of all predicted learning outcomes. • Ability to make good use of a range of methods and techniques to reach conclusions. • Proof of study, understanding, and synthesis beyond the boundaries of what has been explicitly taught. • Ability to use critical analysis and judgment. • Very good presentation of the material. • Where teamwork is involved, there is evidence of productive individual contribution.
6 4,1	• Some limitations in achieving the expected learning outcomes, but it has been possible to understand most of the learning objectives. • Ability to use most of the methods and techniques taught. • Evidence of study and understanding of what has been taught. • Partial understanding of the topics and concepts underlying the techniques and materials taught. • Appropriate presentation of the material. • Where teamwork is involved there is evidence of positive individual contribution.
4 3.1	• Limited achievement of expected learning outcomes. • Ability to use a percentage of the basic methods and techniques taught. • Evidence of study and understanding of what has been taught, but understanding remains insecure. • Some understanding of the topics and concepts underlying the techniques and materials taught but is weak and incomplete. • Poor presentation of material.
3 2.1	• Achieve only a minority of learning outcomes. • Ability to demonstrate a clear but limited use of some of the basic methods and techniques taught. • Weak and imperfect understanding of what has been taught. • Incomplete understanding of the topics and concepts underlying the techniques and materials taught. • Inadequate presentation of material.
2 1.1	• Inadequate achievement of almost all expected learning outcomes. • Lack of ability to use any or the correct methods and techniques taught. • Totally incomplete understanding of what has been taught. • Lack of understanding of the topics and concepts underlying the techniques and material taught. • Inadequate and incoherent presentation of material.
1 0	• Absence of significantly evaluable material, absence, or evaluation that lacks a "must pass" element. • This category includes papers/reports/writings with evidence of passive or active violation of the rules of University honesty (e.g. cases of copying, plagiarism, etc.)


ΕΘΝΙΚΟ & ΚΑΠΟΔΙΣΤΡΙΑΚΟ
ΠΑΝΕΠΙΣΤΗΜΙΟ ΑΘΗΝΩΝ
Τμήμα Γεωλογίας & Γεωπεριβάλλοντος
Σεμιναριακά μαθήματα για τους πρωτοετείς φοιτητές:
"ΓΝΩΡΙΜΙΑ ΜΕ ΤΙΣ ΓΕΩΕΠΙΣΤΗΜΕΣ
ΕΡΓΑΣΙΑ ΥΠΑΙΘΡΟΥ & ΕΡΓΑΣΤΗΡΙΟΥ
ΕΞΟΠΛΙΣΜΟΣ & ΑΣΦΑΛΕΙΑ"
Διάρκεια: 20 ώρες
ΓΕΩΛΟΓΙΚΗ ΕΡΓΑΣΙΑ ΣΤΗΝ ΥΠΑΙΘΡΟ
Η εικόνα από το βιβλίο των:
G. Davis, S. Reynolds & Ch. Kluth
STRUCTURAL GEOLOGY of Rocks and Regions

Fieldwork exercises are an important part of the training of Geologists. It is easy to understand that the object of interest of Geology lies "somewhere out there", in the mountains, plains, coasts, even at the bottom of the sea. No matter how much theoretical knowledge someone acquires, he will neither understand it substantially nor consolidate it if he does not have experience from the practical application of Geology in the countryside. No matter how many images and shapes the rocks and geological structures describe to him, nothing compares to the image and what he sees, touches and studies on the spot in the countryside. No matter how much theoretical knowledge he acquires about instrumental measurements, they can in no way replace the practical application of the correct use of instruments in the open air.

All Geology specializations require specialized work, which takes place in the countryside. Tasks such as:

- **geological mapping** (and all its specializations), for mapping the geological formations and other geological characteristics of the solid crust and the seabed,
- **the collection of samples** (from rocks, soils and waters) for stratigraphic, paleontological, petrological, mineralological, geochemical, deposit, tectonic, hydrogeological, geotechnical and oceanographic analyses and laboratory tests,
- The **collection of instrumental measurements**, either with a simple geological compass, or with specialized instruments, devices and equipment, such as seismographs, geophysical instruments, geodetic devices, oceanographic equipment, geotechnical instruments, deformation measuring devices, etc. and
- **drilling** for hydrogeological, geotechnical, geomorphological, oceanographic surveys

and many more that you will hear about and be informed about in the lessons, are the main body of outdoor work that a Geologist will deal with.

Working in the countryside and the **experience** that a trainee must acquire is treated in a very serious way by most educational institutions abroad. For example, the Geological Society of the United Kingdom requires 70-102 days of outdoor training for four-year undergraduate studies in Geology Departments. At the Department of Geology and Geoenvironment of the National and Kapodistrian University of Athens, outdoor exercises are an **essential** and **integral** part of the training that takes place in the amphitheaters and laboratories.

In most **compulsory courses**, but also in many of the elective courses, there is at least **one compulsory one-day field exercise** outside Athens. Fieldwork exercises also take place in the countryside around the University Campus at the foot of Mount Hymettus, where many subjects and specializations can be covered.

Course: Geological Mapping - Field Course

Course: Geological Mapping - Field Course

Course: Petrology

Course: Geological Mapping - Field Course Geophysics Διασκόπηση

Course: Tectonic Geology & Micropalaeontology

Seminars, courses for first-year students:

"Acquaintance with geosciences - OUTDOOR & LABORATORY WORK, equipment & safety"

The Seminar is addressed to newly admitted students of the Department of Geology & Geoenvironment. Its purpose is to **inform** and **educate** them on issues related to the necessary **equipment** and its proper use, the **safety rules** governing **geological work** and **exercise in the countryside**, as well as the provision of **First Aid** in case of emergency or accident.

It takes place during the first week of their studies (before the start of the course). The duration of the seminar is approximately **14 hours** and takes place in the afternoon at **A13**, according to the schedule attached and at times to be announced at the beginning of the course and **includes three parts**.

In the **first part**, information is provided: i) on the subjects of the Department of Geology & Geoenvironment, ii) on the actions, organizational and operational issues related to the educational process, and iii) on the possibilities of the Erasmus program, and the practical training of students in public and private bodies.

The top outdoor exercise of the Department is represented by the exercise that takes place within the framework of the interdisciplinary course of **Geological mapping**, which takes place for ten days in the mountainous area of Ano Doliana, Arcadia. The exercise includes daily hiking and outdoor work, as well as data processing in the late afternoon at the accommodation, with the participation of faculty members from all specialties, who train students in all subjects required by this interdisciplinary course.

Fieldwork exercises participate with a significant percentage in the **final grade** of most courses, ranging from **10%** to **30%**. An exception is the interdisciplinary course of Geological Mapping, where the participation rate is 100%, since it takes place exclusively in the countryside, with of course the appropriate preparation and information of students before it is conducted.

Working outdoors does not require special physical skills, it requires basic **equipment** and **information** on its proper and **safe use**, as well as basic knowledge for **first aid**. It also requires students to present some medical examinations confirming that there is no reason for their safe participation in fieldwork exercises, something similar to what is required for their participation in any common sport. For this reason, a short compulsory Seminar is held for first-year students, for which information follows below.

Course: Tectonic Geology & Micropalaeontology

In the **second part** they become:

- Information on the subject and practices of laboratory exercises and geological work and exercise in the countryside, with emphasis on: i) the necessary equipment, ii) safety regulations, iii) rules of behavior in the countryside and iv) the protection of geological heritage. Information on instrumental measurements and data. Equipment and safe use.
- Information on instrumental measurements and data. Equipment and safe use.

Fieldwork exercise in the area of Hymettus, applying in practice what was taught in the second part.

In the **third part**, students are informed and trained on issues related to the provision of First Aid, in order to deal with emergencies during work in the countryside. It includes:

- First Aid Courses. Introduction and update.
- First Aid Courses. **Practical training** in basic issues of First Aid, in groups.

The **attendance of the Seminar** and the presentation of the **medical examinations** that will be requested are **mandatory** in order to be able to ensure his/her **participation** in the (compulsory) **fieldwork exercises** (which take place in most courses of the curriculum), but also to prepare his/her diploma thesis, which in the majority of cases includes field work.

Information (dates, educational material, etc.) is done **through the** e-Class and for this reason all students must register, just like for the rest of the courses.

For any information, question or clarification you can contact the Prof. Stelios Lozios

(mailto: slozios@geol.uoa.gr , 6946 46 33 30).

WEBPAGE (URL): http://eclass.uoa.gr/courses/GEOL248

Course: Κοιτασματολογία

Course: Mineralogy

Course: Geology of Greece

Chapter 4

STUDENT CARE AND OTHER BENEFITS

4.1. SUSTENANCE

All students are entitled to sustenance at the Campus Refectory (tel. 210-72774443 και 210-7277734), which operates in the premises of the School of Philosophy, at approximately 10 minutes walking distance from The Department. Sustenance is subsidised and provided at particularly low prices. The Refectory is open daily, between 12:00 – 16:00 and 18:-21:00, except for a 15-day break during the Christmas and Easter holidays. Students are also entitled to special low-price sustenance at all other refectories of the NKUA, as well as and at the University Club.

European Union students who meet the requirements of the Law with respect to (low) family income are entitled to free sustenance up to the day of their graduation. If students entitled to free sustenance decide to suspend their studies, the benefit is accordingly suspended but can be reinstated once they resume their studies.

Information can be sought in phone (landline) numbers 2103688216, 2103688252 and 2103688230, as well as at the Student Club, (Hippocrates 15 St., 5th floor, daily between 09:00 and 12:00.

4.2. HEALTH CARE

Subject to the limitations specified in Section 3.6 of the present Guide, students are entitled to free and comprehensive health and medical care for the duration of their studies and up to the 31st of December of the year of their graduation. Health care is provided at the numerous facilities of the University and at the clinics and hospitals of the School of Medicine. In special cases, or under special circumstances, care can be provided in facilities outside of the University. It includes in or out of hospital care, all types of medical tests, medication, child birth services, dental care, physical therapy, orthopaedic care and social services.

For students who decide to suspend their studies, medical and health care benefits are accordingly suspended. The benefits are reinstated once they resume their studies and up to their completion (also see Section 3.6 of the Guide).

If a student is entitled to the benefits of a third party health care provider, he/she has the right of choice between the services provided by the University or the services of the third party. If a student decides on third party care, all expenses will be reclaimed from his/her provider. However, if the student's health care provider may cover only part of these expenses, (e.g. only a percentage of hospital costs), the University will supplement the costs to their full extent.

TheHealthServicesoftheUniversityarelocatedin the 1st floor of the University Club; the landline of the secretariat is 210 3688218. Services include:

- Medical examinations (tel. 2103688208)
- Hospitalcare(tel. 2103688208, 2103688218)
- Pharmaceutical care (tel. 2103688208, 2103688241, 2103688243, 2103688210)
- Paraclinical examinations (tel. 2103688208, 2103688241, 2103688243, 2103688210)
- Examinations at home (tel. 2103688208, 2103688243)
- Physical therapy (tel. 2103688208, 2103688241, 2103688243)
- Dental care (tel. 2103688210)
- Orthopedic articles (tel. 2103688208, 2103688241, 2103688243)

Clinics operate at the University Club and the University Campus (Panepistimiopoli) as follows:

UNIVERSITYCLUB 1stFLOOR

- **Internal Medicine** (tel. 2103688241 and 2103688243): daily Monday to Friday between 8:00 and 14:00.
- **Gynecology** (tel. 2103688242) Tuesday and Thursday 10:30 - 12:45 and Friday 10:30 - 15:00.
- **Dermatology** (tel. 2103688209) Tuesday and Thursday 12:00 - 14:30.
- **Radiology laboratory** (tel. 2103688212), daily 8:00 - 13:30.
- **Dentist** (tel. 2103688210), daily 8:30 - 13:00.
- **Social and Psychological Support** (tel. 2103688226, 2103688282, 2103688209), daily 08:00 – 14:00.

UNIVERSITY CAMPUS (PANEPISTIMIOPOLI) –BUILDING A'

- **Internal Medicine** (tel. 2107275567): daily, Monday to Friday, 9:00 - 13:30.
- **Dermatology** (tel. 210 7275582) Monday and Wednesday 12:00 - 14:30.
- **Social and Psychological Support** (tel. 2107275580, 2103688282, 2103688209), daily 08:00 – 14:00.

UNIVERSITY CAMPUS – SCHOOL OF PHILOSOPHY (GROUND FLOOR)

- **Internal Medicine**(tel. 2107277873): daily,8:30 - 14:00.

UNIVERSITY CAMPUS–SCHOOL OF SCIENCES

- **First aid services** (tel 2107274391): daily, Monday to Friday, 8:00 – 20:30.

4.3. DISCOUNT IN TRANSPORTATION FARES

Students are entitled to 50% discount in Public Transportation fares (bus/trolley-bus, subway, tram and suburban railway) operating in the Metropolitan area of Athens and 25% discount in the fares of Public Transportation in other Greek cities. Students permanently residing in cities other than Athens are also entitled to a 50% discount in bus and railway fares to and from their city of residence.

The right to reduced student fares is effective immediately upon matriculation and holds until the day of graduation. Students are supplied with a special ID card which they must produce when they buy a reduced fare ticket; the card is strictly personal and non-transferable. If lost, it can be replaced but only following a tedious process which may take a minimum of two months to complete.

For students who decide to suspend their studies (Section 3.6), the right to reduced fares is accordingly suspended and the ID cards are returned to the Secretariat. The benefit is reinstated once studies are resumed.

Further information can be sought in the Secretariat as well as at Academic Identity Card Online Service - Informational Portal (minedu.gov.gr) or in telephone numbers801-11-31400 and 210-7724375.

Detailed step-by-step instructions can also be found in the manual: AcademicID_Students_Manual_eng.pdf

4.4 Other Facilities and Contact Information

4.4.1. Foreign Languages

SeeSection 1.3.1

4.4.2. Accessibility Unit for Students with Disabilities

The mission of the Accessibility Unit for Students with Disabilities is ***to actively realize coequal access to academic studies for students with different abilities and needs, through built environmental modifications, Assistive Technologies and access services.***

The Unit provides students with disabilities with:

- Access to interpersonal communication with members of the academic community.
- Access to the built environment of the University including transportation services.
- Access to printed or electronic educational Matterial.
- Access to classroom Matterial and presentations.
- Assistance in note keeping, course and laboratory work and access to written examinations.
- Access to information, Internet content and applications of Information Technology.

Tel: 210 7275687

FAX: 210 275193

E-mail: access@uoa.gr

WEBPAGE (URL): https://access.uoa.gr/en/

4.4.3. Student Relief Fund

ProvidesMatterialandmoralsupportinextraordinarycases or extenuating circumstances. TheserviceislocatedattheUniversityClub, 3rdfloor; Tel: 2103688221; WEBPAGE (URL): .http://tafpa.uoa.gr/.

4.4.4. Student Counceling Centre

Open Monday to Friday, 10:00 - 16:00. Tel.: 2107277554; Website http://www.cc.uoa.gr/skf/

4.4.5. Student Ombudsman

The Student Ombudsman endeavours to:

- review complaints pertaining to problems with the academic and administrative services and seek their solution;
- facilitatethe interaction of the students with the Institution and administrative services;
- review complaints related to violations of laws and regulations, as well as academic and professional ethics;
- inform the students about their rights and obligations as members of the University Community

Address: University Club Building (15, Ippokratous st., 1stfloor) – open every Wednesday, hours: 14:00 - 15:30 p.m.

Telephone:210 368 8274

e-mail:sinigorosfititi@uoa.gr

4.4.6. Sports Facilities

Tel: 2107275554, 2107275551, 2107275556, 2107275549.

Web: http://www.lesxi.uoa.gr/foithtiki-merimna/panepisthmiako-gymnastirio.html.

ACADEMIC CALENDAR 2024 – 2025

ACADEMIC CALENDAR 2024 – 2025

1) Fall semester:

a) Courses start after the end of the September exam period.

b) Lecturing period: September 30th, 2024 - January 10th, 2025

Fieldwork Exercises: October 18th, 2024 – October 25th, 2024

c) Fall semester exam period: January 20th, 2025 - February 14th, 2025

d) Official Holidays:

- National holiday: October 28th, 2024
- Holiday for Educational Institutions: November 17th, 2024
- Christmas holidays: December 23th, 2024 - January 3th, 2025

2) Spring semester:

a) Lecturing period: February 17th, 2025 – June 6th, 2025

Gelological Mapping Field Course and Fieldwork Exercises (are planned for):
May 17th, 2025 – May 30th, 2025
(Period is not fixed yet due to fiscal arrangements policy. It might suffer a few days shift)

b) Spring semester exam period: June 10th, 2025 – July 5th, 2025

c) Official Holidays:

- Educational holiday (no courses or exams are held): February 21st, 2025
- Shrove Monday, moveable Holiday: March 3rd, 2025
- National holiday: March 25th, 2025
- Easter Holidays, moveable Holidays: April 14th - April 25th, 2025
- Labor Day: May 1st, 2025
- Holy Spirit Day, moveable Holiday: June 9th, 2025

d) Interruption of courses on the day of the student elections and the day after.

3) Summer period:

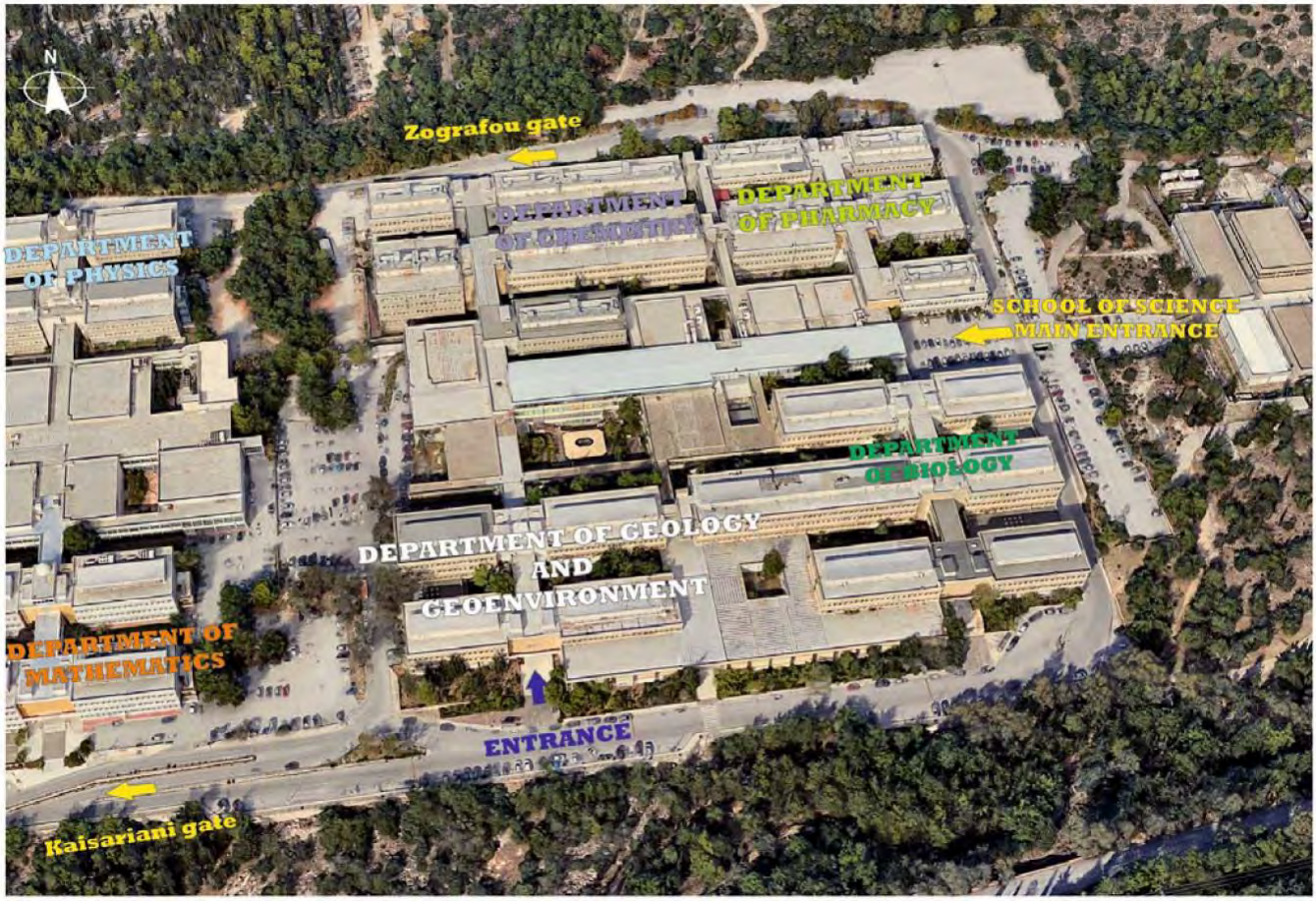
Vacation period: July 5th, 2025 - August 31st, 2025

4) September 2025 exam period:

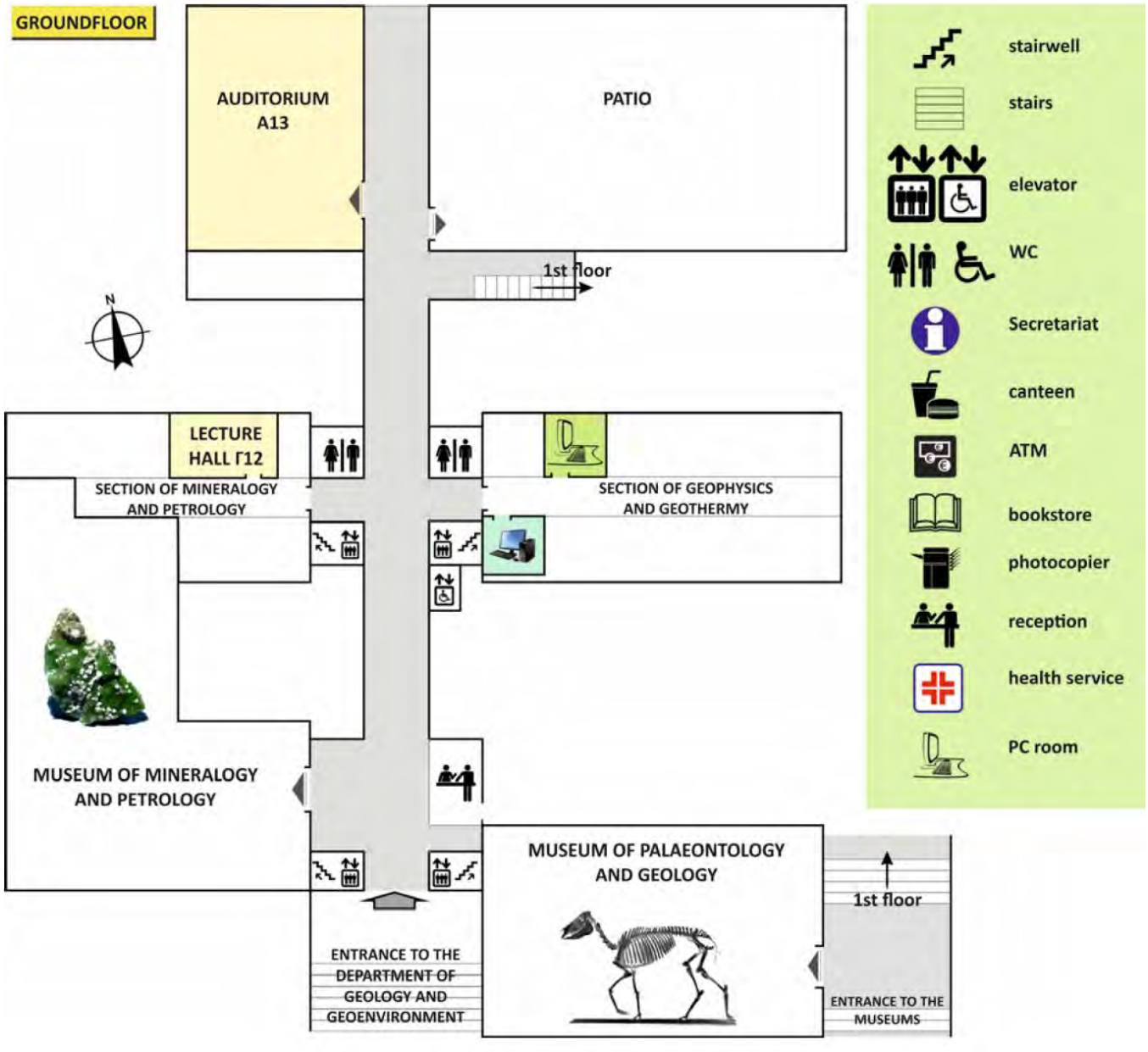
September exam period (re-sit): September 1st, 2025 - September 26th, 2025

AERIAL VIEW OF THE SCHOOL OF SCIENCE- NKUA.

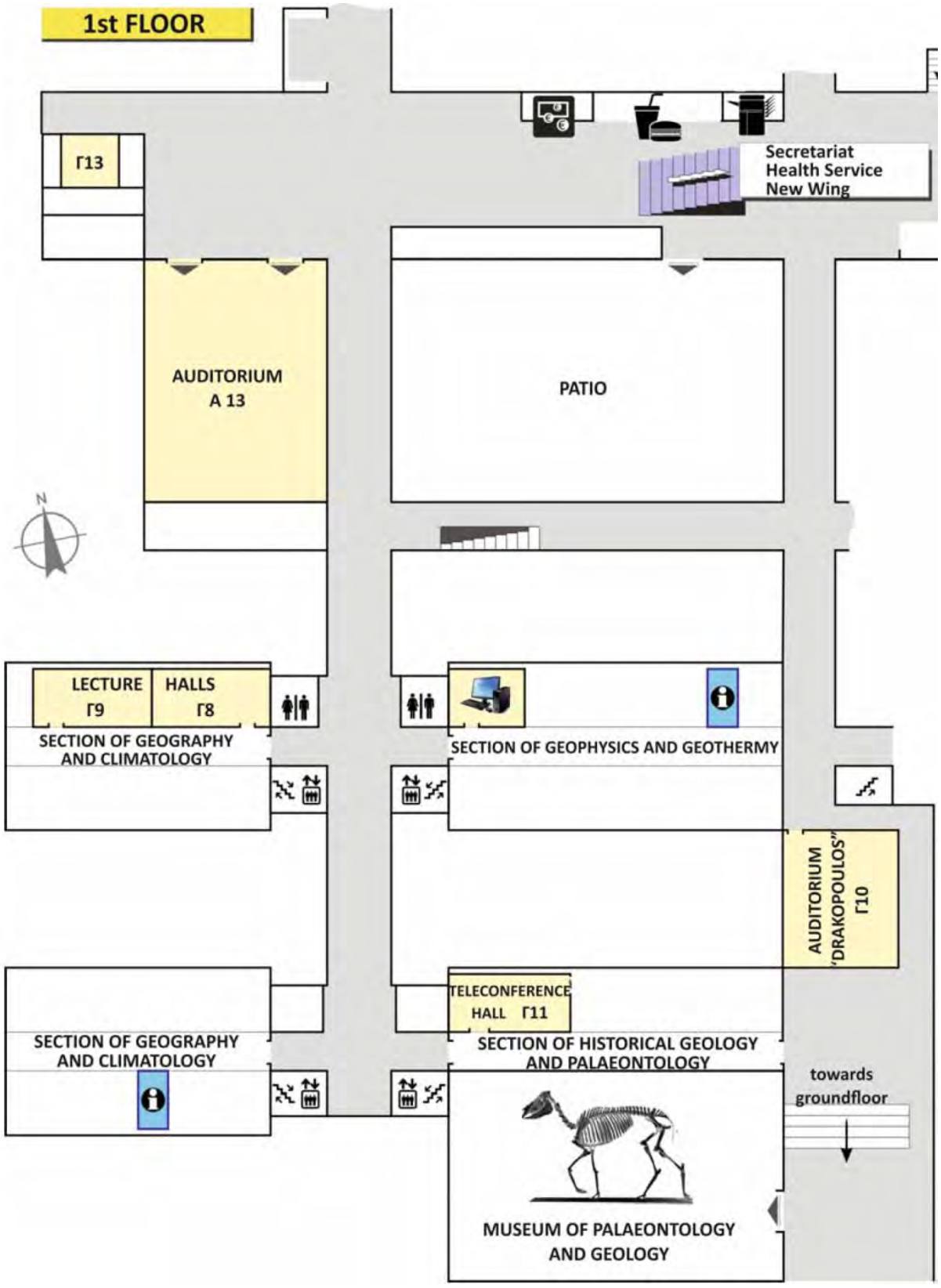
NKUA on theMap: http://maps.uoa.gr



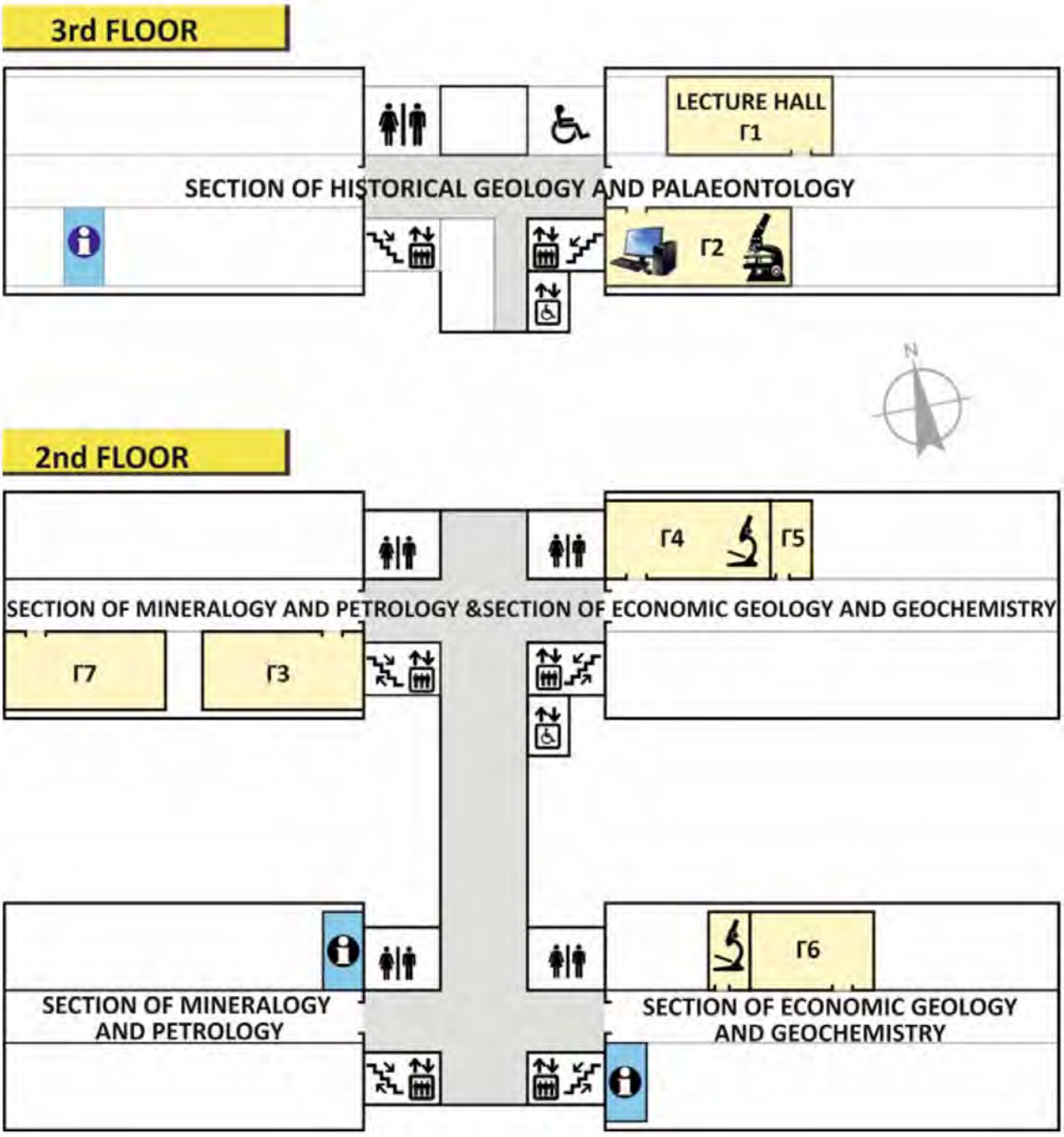
PLOT OF GROUNDFLOOR



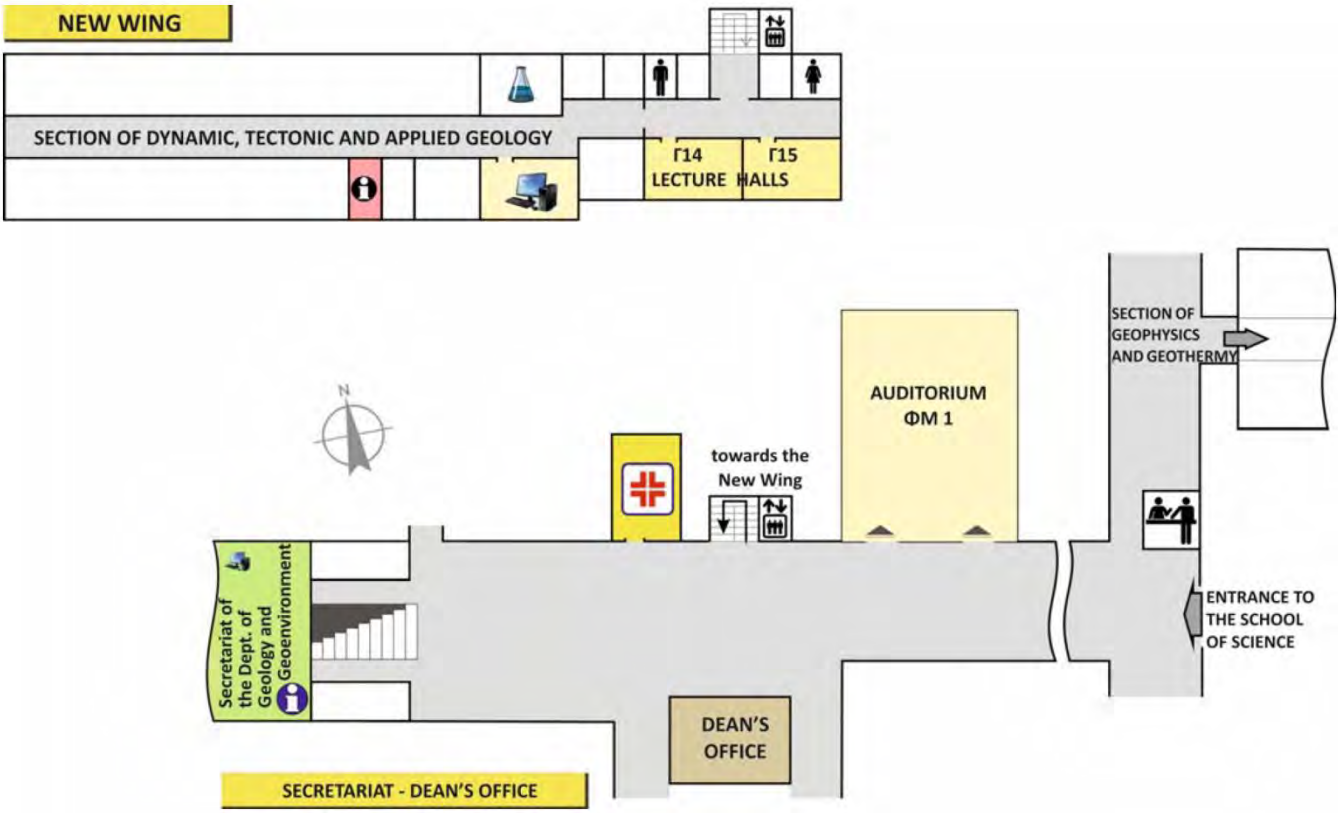
PLOT OF FIRST FLOOR



PLOT OF SECOND & THIRD FLOOR



PLOT OF NEW WING, SECRETARIAT & DEAN'S OFFICE



ANNEX – ALPHABETIC LIST OF MODULES

Course Catalog .....(Outline in Page)