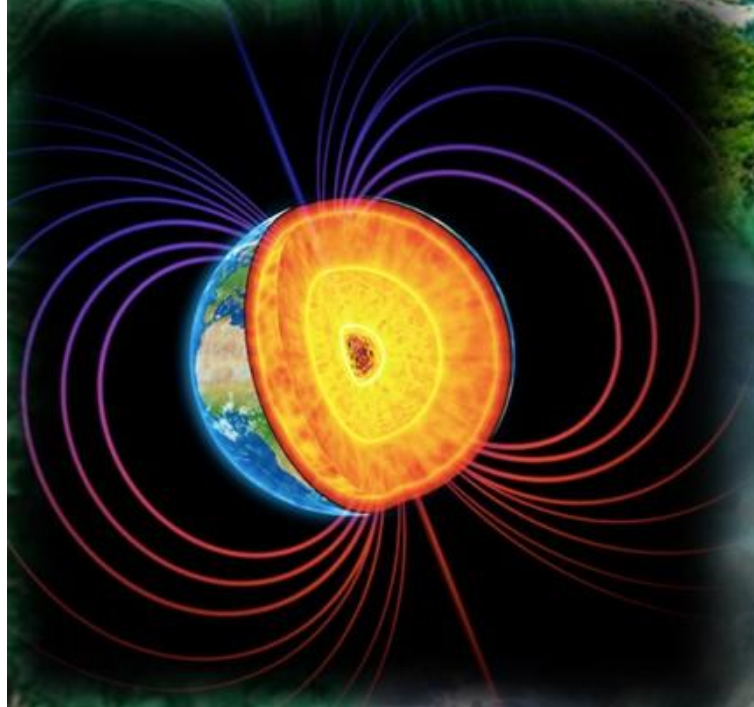
Your Guide for Our Geology School



Faculty of Science
Aristotle University of Thessaloniki

Aristotle University of Thessaloniki

Faculty of Science -School of Geology

STUDY GUIDE

1960-2020: Fossilized hominid cranium from the Petralona Cave-60 years since its discovery (September 16, 1960) -Museum of Geology-Paleontology-Paleoanthropology

Web site: www.geo.auth.gr

Thessaloniki, September 2025

The Petralona hominid skull, Homo heidelbergensis, 200.000 years old. It belongs to the Collections of the Museum of Geology-Palaeontology-Palaeoanthropology AUTH, since 1960. Photo: Stergiou I.

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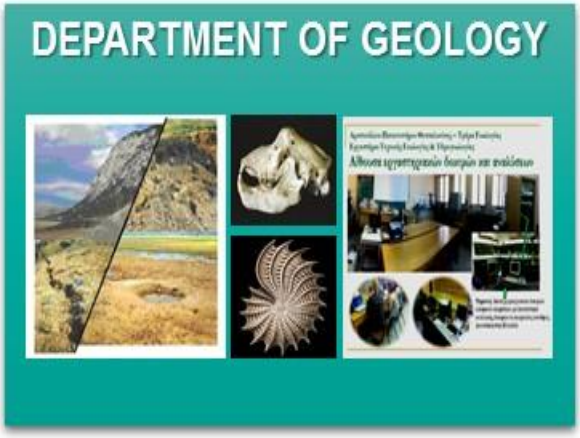
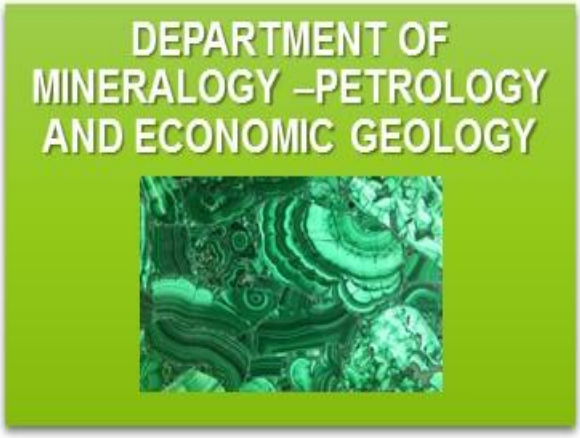
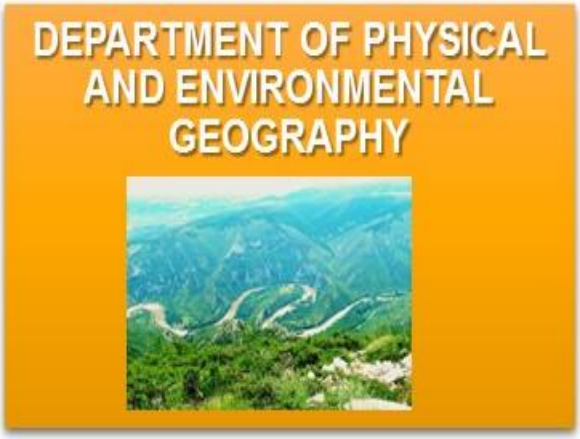
The study guide was edited by:

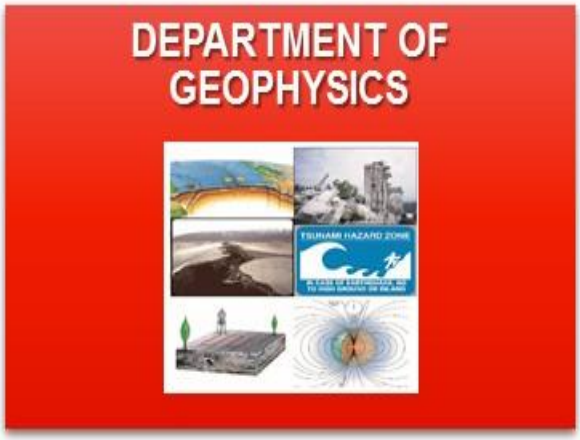
Prof. Konstantia Tolika, the members of the Committee «Study Guide – Teaching & Examination Program» coordinated by Prof. Christina Anagnostopoulou, the Head of the School of Geology, and the Personnel of the Administration Office.

DEPARTMENTS OF THE SCHOOL OF GEOLOGY









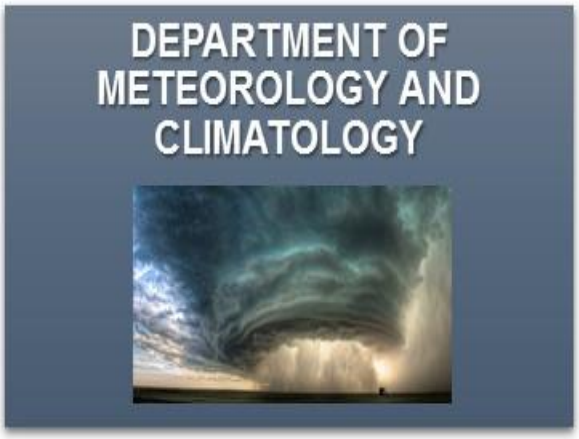


TABLE OF CONTENTS

A Welcome Message from the Head of the School of Geology

Dear students

On behalf of all the teaching, technical, and administrative staff of the School of Geology of Aristotle University of Thessaloniki, I am very glad to welcome you and I cordially wish you a creative, productive, and fulfilling student life.

I sincerely hope that your studies at our School will be an interesting journey into the world of Geology and Geosciences.

Geology is a classical natural science that studies a very important part of our natural world, the Earth, its composition, its structure, and the understanding of the natural processes that influence its historical evolution and its dynamic and continuous change. Geology as a distinct scientific discipline was established in the late 18th and early 19th centuries, although elements of geological thought have existed since ancient times. However, it remains a cutting-edge science, as the modern challenges we face are enormous, with natural disasters, climate change, the energy transition to green energy, and the strategic importance of rare earth elements in modern technology, as well as the need for rational use of natural resources and understanding of the natural phenomena that affect our planet. It is therefore a scientific field with a great academic tradition, social contribution, and ever-increasing importance for the environment.

A key feature of the undergraduate study program at School of Geology is that it covers a wide range of scientific fields in Earth Sciences. The undergraduate study program aims to train students to understand phenomena and processes in the lithosphere and the interior of the Earth, the hydrosphere and the atmosphere, as well as their relationship with humans and the environment in geological time. Our undergraduate study program has been recognized by external evaluators as being comparable in content with respective undergraduate programs at the most prestigious universities abroad and it ranks high in global university rankings in the field of Geology (ranked 151-200, QS ranking Geology). Furthermore, it has been evaluated with an excellent score, the highest among the Geology Schools in Greece. Of course, this multidimensional curriculum of the undergraduate study program is successfully implemented with the support of the school's human resources, its experienced teaching and research staff, and its highly trained technical and administrative staff.

In the School of Geology, you will have the opportunity to acquire solid scientific knowledge, become familiar with modern research methodologies, and develop skills that will prepare you for a wide range of career paths. At the same time, you will participate in

a dynamic and diverse academic environment that cultivates critical thinking, collaboration, and research curiosity. Do not hesitate to ask questions, participate, and get actively involved in academic and student life.

Your academic journey may not always be easy, but I want you to know that the teaching and administrative staff of the school will be there for you, ready to support your steps.

Prodromos Zanis
Professor
Head of the School of Geology

Introduction - Prologue

The ancient Greek writer Xenophanes the Colophonian (570-475 BC) was the first well-known poet and philosopher who studied geological phenomena, based on systematic and impressive geological observations. Several geological concepts and our initial knowledge about the Earth and its phenomena have their origin in the so-called pre-Socratic Greek philosophers: Thales, Heraclitus, Anaximander, Leucippus and Democritus, as well as Aristotle, Theophrastus, Epicurus, Strabo, and many other pioneers of human intellect. The oldest known book of "Geology" could be considered to the book "On Stones" by Theophrastus (371-287 BC), student and collaborator of Aristotle, "On Earth" by Apollodorus (180-110 BC) and 5 of the 37 books of "Natural History" (Naturalis Historia) by Pliny the Elder (Gaius Plinius Secundus 23-79 AD). However, the systematic study and clarification of many phenomena of the Earth began in the late 18th and especially during the 19th century, characterized as the heroic era of Geology.

The French naturalist Jean-Andre Deluc first used the term “Geology” in 1778. Geology explores the traces and information that rocks hide, always taking advantage of the possibilities provided by technology. The traces of nature are usually well hidden or misinterpreted, and the attempt to reconstruct the geological history is a difficult and fascinating study, as defined by the founder of modern Geology Charles Lyell (Sir Charles Lyell 1797-1875) in his book "Principles of Geology”.

The School of Geology, which belongs to the Faculty of Sciences of the Aristotle University of Thessaloniki, was founded by the Royal Decree 290/5-4-1973 and began to operate from the academic year of 1973-1974. It was created after the separation of the School of Natural Sciences of the former Faculty of Physical and Mathematical Sciences, into the School of Geology and the School of Biology. However, the roots of the School of Geology date back to the period of 1928-1929, with the establishment and operation of the Laboratory of Geology, Petrology and Mineralogy and the Laboratory of Meteorology and Climatology.

The School of Geology has been established with the aim of educating and training young scientists, who will deal with geological mapping, tectonics, mineralogy and petrology, exploration of mineral raw materials, geothermal, seismology and geophysics, hydrogeology, engineering geology, climatology and meteorology, environmental pollution, and many other topics related to geosciences. Particular emphasis is given to applications, without neglecting the basic theoretical training. The ultimate goal of the School, through geological and environmental education, is the contribution to the development of the national economy and the environmental protection, in order to improve the quality of life of the Greek people.

The multidimensional education, which the School of Geology provides to its graduates, equips them with a wide range of knowledge so that the search for career prospects or the continuation of their studies at postgraduate level in Greece or abroad, to be carried out with substantial supplies. The experienced teaching and research staff of the School of Geology and the highly trained technical and administrative staff, in combination with its equipped laboratories and the research programs carried out in it, are the guarantees for the fulfillment of its goals and aspirations.

The Study Guide that follows presents the basic information regarding organization of the undergraduate study program of the School of Geology, along with its courses and their content, study directions and other useful information. The aim of the Study Guide is to help the visiting students in their educational orientation, according to their own interest. We hope that it will become a valuable and helpful tool in their first steps in the Aristotle University.

1.The Importance of the Study Guide for Visiting Students

The English version of the Student's Guide provides the necessary information and instructions to foreign (non-Greek speaking) visiting students, that will facilitate them in the registration, selection, attendance and examination of the various undergraduate courses, as well as in the selection of field exercises and educational excursions. They will also find information about the staff of Departments and the Laboratories of the School of Geology. More specifically, the Student's Guide contains information for the following topics:

- Course registration procedure: The registration in courses - semesters, within deadlines determined and announced by the Administration Office, are electronically conducted (from the Internet Portal of AUTH https://students.AUTH.gr/), while the Administration Office handles special cases.
- Field Training, which takes place during the academic year, are compulsory for all students, who are required to participate in a certain number of single-day Field Trips. The multi-day Field Trips that take place at the end of the spring semester are part of the optional courses of the School of Geology.
- Information for the School's Administration Office, the Secretariats of the School's Departments and its Laboratories, where announcements are posted regarding the attendance of courses, laboratory courses, examinations, etc. Such information is also provided in the School's web page (http://www.geo.AUTH.gr) and the Facebook page of the School of Geology (https://www.facebook.com/GeologyAUTH/). Visiting students are required to follow the website and their academic e-mail on a daily basis, in order to ensure their timely information on various issues of the School.

Please notice that:

- Students must locate the areas of the Departments, the laboratory halls, the amphitheaters and the teaching personnel and student advisors offices, in order to move easily in the School premises.
- Traveling students can not choose the foreign language courses and therefore they should not be included in the learning agreement and the application of I.K.Y.

2. The School of Geology – A Short History

The School of Geology was established in 1973 from the former School of Natural Sciences, that split into the Schools of Geology and Biology. However, the School of Geology has a long history, dating back to 1928-29, when the Laboratories of Geology, Petrology and Mineralogy, along with the Laboratories of Meteorology and Climatology were initially established within the Aristotle University, forming parts of the School of Natural Sciences and Mathematics. In 1943-44, the Laboratory of Geology and the Laboratories of Petrology and Mineralogy were parts of the School of Natural Sciences. The Laboratories of Meteorology and Climatology joined the School of Physics in 1943-44 and became part of the School of Geology in 1982. The School of Natural Sciences covered fundamental research topics regarding Geology and Biology and in the following decades expanded significantly, encompassing the Laboratories of Physical and Environmental Geography and the Laboratory of Mineralogy and Petrology.

In 1983, the School of Geology was affiliated with the School of Natural Sciences and was structured into four Departments, namely the Department of Geology and Physical Geography, Mineralogy and Economic Geology, Geophysics and Geotectonics, and Meteorology. In 1984, except for the Department of Geology and Physical Geography, all Departments were renamed into Departments of Mineralogy-Petrology-Economic Geology, Geophysics, and Meteorology and Climatology, respectively. In 2001, the School also included the Department of Physical and Environmental Geography.

The School revamped the curriculum, introducing new courses that address key questions regarding the co-evolution of Earth and life, which have critical societal and economic implications. To match the ambitions of the undergraduate students, the School established new Laboratories, such as the Laboratories of Engineering Geology and Hydrogeology, Economic Geology, Geochemistry (substituting the Laboratory of Mineralogy-Petrology), Applications of Remote Sensing and Geographical Information Systems, and Applied Geophysics. Furthermore, the School's research and educational activities are supported by the Paleontological Museum, the Seismological Station of the Aristotle University of Thessaloniki (A.U.TH.) and the Mount Olympus Meteorological Center.

Currently, the School of Geology offers to the students a broad variety of scientific topics covering a diverse range of disciplines associated with Earth Sciences. The topics include, but are not limited to, Industrial Minerals and Rocks, Geographical Information Systems, Geothermal Energy, Geochemistry, Applied Geology, Applied Geophysics, Sedimentology, Stratigraphy, Sequence Stratigraphy, Paleontology, Meteorology, Climatology, Neotectonics, Tectonics, Economic Geology, Fossil Fuels, Mineralogy, Paleomagnetism, Environmental Geology and Geochemistry, Petrology, Engineering Geology, Engineering Seismology, Hydrogeology, Oceanography, Physical Geography, Physics of the Earth's Interior.

Theofrastus Library is attached to the School of Geology, offering studying spaces and a wealth of books and journal articles to the students. The Digital Theophrastus Library (TDL, http://geolib.geo.AUTH.gr/) holds a valuable digital archive, facilitating high quality research and education at an academic level. The Computer Room offers IT services, such as access to information resources, access to shared applications and data, enhancing the level of support for staff and students.

The curriculum offered by the School of Geology is associated with several scientific topics, aiming at understanding the Earth and its development through time. The enrollment of students in certain courses allows the preliminary specialization at the undergraduate level, facilitating the continuation towards graduate studies. The School has a long history in offering PhD Programs that dates back to the establishment of the School of Natural Sciences.

Since 1995, the School of Geology runs successfully postgraduate programs in geosciences that lead to the degree of Masters of Science (MSc). This academic year (2020-21) the School offers a range of Masters programs, including:

- "Applied and Environmental Geology" (http://pms.geo.AUTH.gr). This program includes three different areas of expertise (Applied Geophysics and Seismology, Mineral Resources and Environment, and, Engineering Geology and Environment)
- "Meteorology, Climatology and Atmospheric Environment" (http://meteo.geo.AUTH.gr/el/postgraduate).

The School of Geology coordinates the following Inter-Departmental and Inter-Institutional graduate programs:

- "Hydrocarbon Exploration and Exploitation" (http://hydrocarbons.geo.AUTH.gr). The School of Geology (AUTH) coordinates this program in association with the School of Mining and Metallurgical Engineering (National Technical Univ. of Athens), the School of Geology and Geoenvironment (National and Kapodistrian University of Athens), and the School of Economics (Democritus University of Thrace).
- "Paleontology-Geobiology" (www.geo.AUTH.gr/gr_postgrad_paleo.htm). The School of Geology (AUTH) coordinates this program in association with the School of Biology (AUTH), the Faculty of Geology and Geoenvironment (National and Kapodistrian University of Athens), the Department of Geology (University of Patras) and the Department of Geography (Aegean University of Greece).

Furthermore, the School of Geology participates in the following Inter-Departmental and Inter-Institutional postgraduate programs.

- Integrated Management of Drainage Basins and Coastal Zone (coordinator: School of Biology AUTH).
- Natural Hazards and Disaster Mitigation (coordinator: Department of Geography, University of the Aegean).
- Health and Environmental Factors (coordinator: School of Medicine AUTH).
- Networks and Complexity (coordinator: School of Economics AUTH).
- Natural and Chemical Methods for Diagnosing Material Deterioration in Cultural Heritage (coordinator: School of Chemistry AUTH).

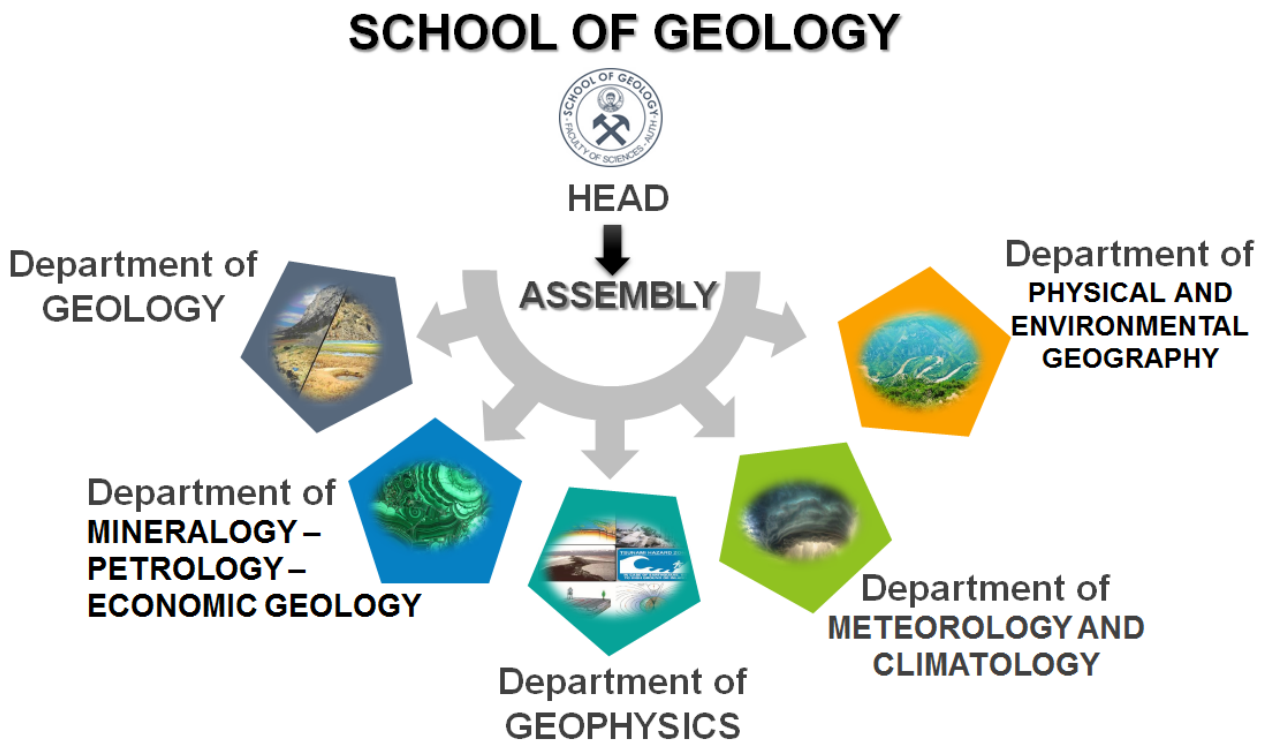
Additional information is provided in the following link: www.geo.AUTH.gr/gr_postgrad_pms.htm.

Academic staff and researchers in the School of Geology deliver high quality teaching, assisting students to develop the knowledge and practical skills for future work and research. Moreover, the staff members are using a combination of basic and applied research work on understanding the operation of the Earth systems and provide solutions to the complex environmental and geological/geographic challenges. This research is funded by the Hellenic Republic and through Departmental, Inter-Departmental and Inter-Institutional research projects submitted by the academic staff. The outcome of this research activity is represented by the numerous publications in high impact factor scientific journals, as well as the M.Sc. Theses and Ph.D. Dissertations (30-45 annually).

The School of Geology has a long standing tradition in teaching and research through the EU funding program for education, training, youth and sport Erasmus+, or through other inter-Institutional student exchange programs. In 2012, the School of Geology was evaluated by the Hellenic Quality Assurance and Accreditation Agency (H.Q.A.). Additional information about the results is provided in the following link: http://www.geo.AUTH.gr/grammateia/news/EEC_Dept_Geology_Final_Revised_11_July.pdf). The members of the assessment committee recognized that the School has established a good quality research and teaching program and certain areas/fields are commensurate with international standards. Moreover, the committee recognized the need for improvements, despite the well-grounded position in the realities of Hellenic Universities. The School has already taken actions to implement the suggestions made by the committee, especially regarding the new revised undergraduate curriculum that started in 2021-22.

3. Departments and Personnel

The School of Geology consists of **five Departments**. Each Department has specific educational and research activities. The main School governing bodies are: the Head of the School, elected annually from the Assembly of the Department, and the School Assembly, consisting of members from all Teaching and Research Faculty members of the five Departments, as well as representatives from the Laboratory and Teaching personnel (E.DI.P., E.T.E.P.), and the undergraduate and graduate students.
Furthermore, the School of Geology operates the **Museum of Geology – Paleontology – Paleoanthropology** (http://www.geo.AUTH.gr/museum/MuseumGeol_Paleont.htm), the **Mount Olympus Meteorological Center** and the **Aristotle University Seismological Network** (http://geophysics.geo.AUTH.gr/ss/station_index_en.html).



Additional information on the Departments and staff of the School of Geology can be found in the following web site: http://www.geo.AUTH.gr/en_deps.htm

4. School Administration Office (Secretariat)

The Administration Office in the School of Geology, which is a key facility of the Department, facilitating its smooth operation, has the following structure:

Head of the Administration Office (Secretary):

Baltadaki Venetia (Veni)

tel: **2310 998450**, E-mail:

Administration Office Personnel:

Kantouri Panagiota

tel: **2310 998480** E-mail: kantouri@geo.AUTH.gr

Theodoroudis Paschalis

tel: **2310 998460** E-mail: pasha@geo.AUTH.gr

Serafim Anastasia

tel: **2310 998470** E-mail: serafeia@geo.AUTH.gr

The Administration Office is open for students between 11:00 and 13:00 on working days

e-mail address: info@geo.AUTH.gr
web site: www.geo.AUTH.gr

5. Course Guide – Study Program - Undergraduate course program at a glance

Upon finishing their studies, students are awarded the B.Sc. in Geology after **they have completed at least 240 ECTS credits** from the available courses. One hundred and ninety (190) ECTS are credited from the compulsory courses, while the remaining 50 ECTS credits correspond to optional courses. Most single-Day Field Trips are compulsory courses and each student must complete field trips corresponding to at least 8 ECTS credits. The course "Field Mapping" (6th Semester, 4 ECTS credits) is compulsory for all students.

The Program of Study contains the following Degree Schemes (orientation topics):

- **Structural Geology and Stratigraphy**
- **Applied Geology**
- **Mineralogy - Petrology**
- **Economic Geology**
- **Geophysics**
- **Meteorology - Climatology**
- **Environmental Geography**

Students must select one of these schemes. For each scheme there is a list of relative optional courses. Students must complete a number of these courses corresponding to at least 35 ECTS. In addition, they can attend and complete courses belonging to other schemes. Several optional courses are common in more than one schemes. In this manner, students have wider option of choice. Moreover, they can change their scheme, if they wish, more easily.

Each course is assigned a code, consisting of 3 or 4 letters and 3 numbers. All 4-letter courses start with N, indicating the courses of the new (introduced in 2021-2022) undergraduate program. The next letter (G) indicates the School of Geology. The final two letters indicate the Department which provided the course. The first number indicates the semester and the remaining numbers correspond to the "serial number" of the course. The letters GGN indicate courses which are taught by the Faculty Members of other Schools or, which are taught by colleagues of different Departments of the School of Geology. Finally, each code is accompanied by the letter (Y) for compulsory or the letter (E) for optional courses, respectively.

Course Registration

Students are required to fill in and submit the online registration form to the School's Secretariat, within a specific date at the beginning of each semester through the web page https://students.AUTH.gr/. In this form students have to include the courses that they would like to attend, for which they will also be allowed to participate in the examination process. Each student should take courses that correspond to 30 ECTS in each semester.

The final course assessment is generally based on formal written examinations at the end of each semester. The method of assessment by mid-term exams and term papers is used in a number of courses; also, the combination of the two methods is not unusual.

The maximum number of courses that each student can register each semester is fourteen (14).

Course Program at a glance **NEW COURSE PROGRAM**

1st YEAR

1st Semester

NGGN 101Y **General Mathematics I** (Lec 4 Ex.0 Lab 0 ECTS 7)
NGGP 102Y **Physics** (Lec 3 Ex.0 Lab 0 ECTS 5)
NGGN 103Y **Chemistry** (Lec 3 Ex.0 Lab 0 ECTS 5)
NGGG 104Y **Introduction to Geology** (Lec 2 Ex.2 Lab 0 ECTS 8)
NGGN 105Y **Introduction to Computing** (Lec 4 Ex.0 Lab 2 ECTS 5)
NGGN 521E **Foreign LANGUAGE Geological Terminology** (Lec 2 Ex.0 Lab 0 ECTS 3)

2nd Semester

NGGN 201Y **Statistics** (Lec 2 Ex.2 Lab 0 ECTS 6)
NGGE 202Y **Geography and Digital Cartography** (Lec 2 Ex.0 Lab 2 ECTS 6)
NGGP 203Y **Physics of the Earth's Interior - Geodynamics** (Lec 3 Ex.0 Lab 0 ECTS 4)
NGG0 205Y **Mineralogy** (Lec 3 Ex.0 Lab 2 ECTS 7)
NGGG 206Y **Palaeontology** (Lec 3 Ex.0 Lab 2 ECTS 5)
NGMO 291E **Field Course 1** (Lec 0 Ex. 0 Lab 0 ECTS 2)
NGGN 623E **Foreign LANGUAGE Geological Terminology II** (Lec 2 Ex.0 Lab 0 ECTS 3)

2nd YEAR

3rd Semester

NGMO 301Y **Igneous Petrology** (Lec 3 Ex.0 Lab 2 ECTS 8)
NGMC 302Y **Meteorology** (Lec 2 Ex.1 Lab 0 ECTS 4)
NGGE 303Y **Physical Geography** (Lec 2 Ex.0 Lab 2 ECTS 6)
NGMO 304Y **Sediments and Sedimentary Rocks** (Lec 2 Ex.0 Lab 2 ECTS 7)
NGGP 305Y **Seismology** (Lec 2 Ex.0 Lab 2 ECTS 5)
NGGN 733E **History and Philosophy of Science** (Lec 2 Ex.0 Lab 0 ECTS 3)

4th Semester

NGMO 401Y **Petrology of Metamorphic Rocks** (Lec 2 Ex.0 Lab 2 ECTS 7)
NGMC 402Y **General Climatology – Introduction to Paleoclimatology** (Lec 3 Ex.1 Lab 0 ECTS 5)
NGGO 403Y **Geochemistry** (Lec 2 Ex.0 Lab 0 ECTS 3)
NGMC 502Y **Depositional Environments and Stratigraphy** (Lec 2 Ex.2 Lab 0 ECTS 6)
NGGP 405Y **Applied Geophysics** (Lec 2 Ex.0 Lab 2 ECTS 7)
NGGE 491E **Field Course 2** (Lec 0 Ex. 0 Lab 0 ECTS 2)
NGGO 492E **Field Course 3** (Lec 0 Ex. 0 Lab 0 ECTS 2)

Course Program in one glance

NEW COURSE PROGRAM

3rd YEAR

5th Semester

NGMO 501Y **Ore Deposits** (Lec 3 Ex.0 Lab 2 ECTS 8)
NGGG 503Y **Engineering Geology** (Lec 2 Ex.2 Lab 0 ECTS 7)
NGMO 522E **Geochronology** (Lec 2 Ex.0 Lab 0 ECTS 3)
NGGG 523E **Vertebrate Palaeontology - Palaeoanthropology** (Lec 2 Ex. 0 Lab 0 ECTS 4)
NGGN 524E **Analytical Chemistry** (Lec 2 Ex. 0 Lab 2 ECTS 5)
NGGE 525E **Geog. Information Systems (GIS) and Mangement of Geological Cartographic Data** (Lec 2 Ex. 0 Lab 2 ECTS 5)
NGGN 526E **General Mathematics II** (Lec 3 Ex. 0 Lab 0 ECTS 4)
NGGN 527E **Geological Data Analysis** (Lec 2 Ex. 2 Lab 0 ECTS 5)
NGMG 404Y **Structural Geology** (Lec 3 Ex.2 Lab 0 ECTS 8)

6th Semester

NGGG 601Y **Hydrogeology** (Lec 2 Ex.2 Lab 0 ECTS 7)
NGGG 602Y **Geological Mapping** (Lec 2 Ex.3 Lab 0 ECTS 8)
NGMO 621E **Igneous Petrogenesis** (Lec 2 Ex.0 Lab 0 ECTS 3)
NGMO 622E **Applied Environ. Geochemistry** (Lec 2 Ex.0 Lab 0 ECTS 3)
NGMO 624E **Ore Deposits of Greece** (Lec 2 Ex.0 Lab 2 ECTS 5)
NGGN 625E **Comp. Progr. in Earth Sciences** (Lec 2 Ex.0 Lab 0 ECTS 3)
NGGP 626E **Seismic Meth. of Geophys. Prospect** (Lec 2 Ex.2 Lab 0 ECTS 5)
NGMG 627E **Atmospheric Pollution** (Lec 2 Ex.0 Lab 0 ECTS 3)
NGGG 628E **Neotectonics** (Lec 2 Ex.0 Lab 0 ECTS 3)
NGGG 629E **Rock and Soil Mechanics** (Lec 2 Ex.2 Lab 0 ECTS 5)
NGGO 631E **Industrial Minerals and Rocks** (Lec 2 Ex.0 Lab 0 ECTS 3)
NGGE 632E **Speleology** (Lec 2 Ex.0 Lab 0 ECTS 3)
NGGG 633E **Micropaleontology- Invertebrate Palaeontology** (Lec 2 Ex.0 Lab 2 ECTS 5)
NGGE 832E **Natural and Anthropogenic Environment** (Lec 2 Ex.0 Lab 0 ECTS 3)
NGGG 691E **Field Course 4** (Lec 0 Ex.0 Lab 0 ECTS 2)

4th YEAR

7th Semester

NGGG 701Y **Geology of Greece** (Lec 3 Ex.2 Lab 0 ECTS 8)
NGMG 721E **Dynamic and Appl. Climatology** (Lec 3 Ex.0 Lab 0 ECTS 4)
NGMO 722E **Volcanology** (Lec 2 Ex.0 Lab 0 ECTS 3)
NGGG 723E **Didactics of Geology** (Lec 2 Ex.1 Lab 0 ECTS 4)
NGGE 724E **Remote Sensing in Geosciences** (Lec 2 Ex.2 Lab 0 ECTS 5)
NGMO 725E **Hydrocarbon Exploration and Exploitation** (Lec 2 Ex.1 Lab 0 ECTS 4)
NGGG 726E **Groundwater Exploitation and Management** (Lec 2 Ex.2 Lab 0 ECTS 5)
NGGN 727E **Practical Training** (Lec 0 Ex.3 Lab 0 ECTS 4)
NGMC 729E **Hydrometeorology** (Lec 3 Ex.0 Lab 0 ECTS 4)
NGGP 730E **Gravity and Mang. Methods of Geoph. Prospecting** (Lec 2 Ex.2 Lab 0 ECTS 5)
NGGP 731E **Seismotectonics** (Lec 2 Ex.2 Lab 0 ECTS 5)
NGMC 732E **Climate Change** (Lec 2 Ex.0 Lab 0 ECTS 3)
NGGG 734E **Drilling Methods** (Lec 2 Ex.0 Lab 0 ECTS 3)
NGGG 735E **Sedim. Basin analysis and sequence stratigraphy** (Lec 2 Ex.1 Lab 0 ECTS 4)
NGMO 736E **Lab. Methods for Minerals and Rocks** (Lec 2 Ex.0 Lab 1 ECTS 4)
NGGN 737E **Topics in Geology** (Lec 2 Ex.0 Lab 0 ECTS 3)
NGGN 739E **Crystallography - Crystal Structure** (Lec 2 Ex.0 Lab 2 ECTS 5)
NGGP 834E **Elect. And E/M Methods of Geophysical Prospecting** (Lec 2 Ex.2 Lab 0 ECTS 5)

8th Semester

NGGN 801Y **Bachelor Diploma Thesis I** (Lec 0 Ex.0 Lab 0 ECTS 8)
NGGN 802Y **Bachelor Diploma Thesis II** (Lec 0 Ex.0 Lab 0 ECTS 16)
NGMC 821E **Synoptic and Dynamic Meteorology** (Lec 3 Ex.0 Lab 0 ECTS 4)
NGMO 822E **Mineral and Raw Materials: Exploration - Sustainability - Environment** (Lec 2 Ex.0 Lab 0 ECTS 3)
NGMO 823E **Exploration and Exploitation of Solid Fuels** (Lec 2 Ex.0 Lab 0 ECTS 3)
NGGG 824E **Geothermal Energy** (Lec 2 Ex.0 Lab 0 ECTS 3)
NGGG 825E **Geological Design of Engin. Works** (Lec 2 Ex.0 Lab 0 ECTS 3)
NGGN 826E **Information and Communications Technologies (ICT) in Geological Education** (Lec 0 Ex.2 Lab 0 ECTS 3)
NGGN 727E **Practical Training** (Lec 0 Ex.3 Lab 0 ECTS 4)
NGGN 728E **Practical Educational Training** (Lec 0 Ex.3 Lab 0 ECTS 4)
NGGG 827E **Geotectonic evol. of Greece and Global Tectonics** (Lec 2 Ex.0 Lab 0 ECTS 3)
NGGG 828E **Environmental Hydrogeology** (Lec 2 Ex.0 Lab 0 ECTS 3)
NGMO 829E **Gemmology** (Lec 2 Ex.0 Lab 0 ECTS 3)
NGGG 830E **Field Geological Mapping** (Lec 1 Ex.2 Lab 0 ECTS 5)
NGGE 831E **Oceanography** (Lec 2 Ex.0 Lab 2 ECTS 5)
NGGE 833E **Geol. And Envir. Applic. of Geosp. Data Analysis** (Lec 0 Ex.2 Lab 0 ECTS 3)
NGGP 835E **Eng. Seismology** (Lec 2 Ex.2 Lab 0 ECTS 5)
NGGN 891E **Field Course 5** (Lec 5 Ex.0 Lab 0 ECTS 3)
NGGG 892E **Field Course 6** (Lec 6 Ex.0 Lab 0 ECTS 3)

6 Field Training

The Field Training courses of the School of Geology are include "**One-Day Field Training**" and "**Multi-day Field Training**". For the Old Study Program (*applicable for undergraduate students who have been enrolled up to the academic year 2019-20*) as a separate compulsory course "**Field Mapping**" is also included (in the new Undergraduate Study Program this course has been integrated in the course "**Geological Mapping**"). The "One-Day Training" courses are associated and integrated with the corresponding courses of the new Undergraduate Study Program (U.S.P.). The schedule for all Field Training activities is announced at the beginning of each academic semester.




For the Field Training courses students must wear clothes and shoes suitable for field work and carry with them notebooks and geological hammers. Usually, after the end of each field exercise, a report must be submitted to the Faculty member that coordinates the Training. All Filed Training courses are carried out according to the regulations found on the website of the School of Geology, AUTH, at the following link:

http://www.geo.AUTH.gr/yliko/undergrad/docs/2019-20/2019-20_KANONISMOS_ASKHSEWN_YPAI8ROY.pdf

7. Internship Program

Since 2016, the Internship Program is funded by the European Social Fund (ESF) and co-financed by National Resources through the Operational Program "Competitiveness, Entrepreneurship and Innovation" of the Partnership Agreement for the Development Framework 2014-2020, under the supervision of the Managing AUTHority of the Operational Program "Human Resources Development, Education and Lifelong Learning".
The students who participate in the Program benefit in the following ways:

- They familiarize themselves with the work environment, and they are offered the opportunity to fulfill tasks that are directly related to their field of study,
- They are acquainted with market trends and the skills required,
- They are given the opportunity to demonstrate and put into practice the skills and knowledge they have acquired during their studies,
- They begin to acclimate to the work environment and receive information necessary so that they make educated decisions both at a personal and professional level.

General information about the Student Internship Program:

- The program provides students with training for two (2) months, in private and public services that provide internship placements.
- The program provides for the payment of the wages of the interns, as well as for their monthly insurance contributions, covering health and accident compensation costs.
- The students who participate in the program can do their internship either in the city of Thessaloniki, or in any other city in Greece. It must be clarified that accommodation costs are not covered.
- Undergraduate students are entitled to participate in the program, provided they have successfully accomplish their studies the sixth semester of their studies and have acquired adequate knowledge to meet the demands of the internship.

Faculty member in charge of the program:
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8 Course Syllabus

NEW COURSE PROGRAM: ACADEMIC YEAR (2020-2021)

1st Semester:

NGGN 101Y General Mathematics I: 1) MATRIX THEORY, DETERMINANTS, SYSTEMS Matrices (operations, inverse, rank), determinants (calculation, properties), systems (linear 2x2, 3x3 and non-linear). 2) REAL FUNCTIONS Functions of one and multiple variables, derivatives, partial derivatives. 3) ANALYTICAL GEOMETRY Coordinate systems (cartesian, polar, spherical, logarithmic). Equations of plane, line, surfaces. 4) VECTOR CALCULUS Vectors in three-dimensional space. Operations of vectors (addition, scalar, vector and triple product, mean value). Vector functions of one and multiple variables. Derivatives and partial derivatives of vector functions. Gradient of scalar fields. 5) APPLICATIONS in Geosciences.

NGGP 102Y Physics: Mechanics *Units*, Physical Quantities, Vectors, Newton's Laws, Work and kinetic energy, D ynamic energy (gravitational, elastic), Stress, Deformation and elasticity measures, Elasticity and plasticity, Density, Hydrostatic pressure, Pascal's principle, Fluid Pressure Electromagnetism Electric Field and Electric Charge, Electric Potential, Electric potential energy, Current, Specific Electrical resistivity, Electrical resistivity, Magnetism and Magnetic Field Waves and optics Simple Harmonic Motions (Frequency, Period, Harmonic Oscillations), Harmonic Waves, Acoustic Waves, Acoustic Wave Speed, Sinusoidal Electromagnetic Waves, Electromagnetic Spectrum, Light (Nature of Light, Reflection and Refraction, Polarization)-.

NGGN 103Y Chemistry: Early quantum description of the atom. Electronic configuration of the atom, atomic orbitals. Periodic properties of the chemical elements. Covalent and ionic bond, formation and energetics, molecular orbitals. Atom hybridization, hybrid orbitals, correlation between hybridization and compound structure. Chemical reaction characterization, basic thermodynamics and kinetics. Electrolyte solutions, weak electrolyte dissociation, pH. Geological classification of the elements, isotopes and their applications. Physicochemical characteristics of water as solvent, water occurrence in chemical compounds.-.

NGGG 104Y Introduction to Geology: History and branches of Geology. Earth as a planetary body. Methods of geological research. The Earth's interior. • The rock cycle. Classification of rocks and their formation conditions. Age of Earth and dating geological events. Erosion, transport and deposition of sediments. Principles of stratigraphy and paleontology. Tectonic structures: faults, joints, folds. • Orogenic processes and principles of the Lithospheric Plate Theory. Geological systems. Applications of Geology.

NGGN 105Y Introduction to Computing: Matlab: Introduction to programming with Matlab. Numbers and variables. Algorithms. Reading input files. Creating plots. EXCEL: Introduction to spreadsheets. Data input. Use of functions. Calculations. Creating plots. More specifically: 1. Introduction to programming using Matlab. 2. Using the Matlab editor. Code compilation and execution. 3. Simple examples of scientific coding 4. Numbers, variables and structures in Matlab 5. Text and number format 6. Reading data with Matlab 7. Creating plots with Matlab 8. Excel spreadsheets 9. Inserting data to Excel 10. Using functions in Excel 11. Creating plots in Excel.

NGGN 521E Foreign Language Geological Terminology I: 1) The Earth, Geological time 2) Geological history 3) Paleontology 4) Hydrogeology 5) Glossary of Geomorphology 6) Glacial-Eolian Environments 7) Minerals 8) Rocks 9) Glossary of Seismology 10) Glossary of Geophysics 11) Atmospheric composition, Atmosphere Circulation, Atmospheric pollutants 12) Climatic system 13) Climate models.

2nd Semester:

NGGN 201Y Statistics: Introduction - variables: Continuous and discrete variables, Probability theory -distributions (Bernoulli, Binomial, Poisson, Normal, X2, t και F). Descriptive statistics: introduction, Frequency tables, boxplots, histograms. Basic statistics (mean, median, standard deviation, IQR). Scatter plots. Exercise Hypothesis testing: One sample t- Test, Tests for differences of mean value, test of Goodness of Fit (Chi Square test, F test), test Kolmogorov-Smirnov, Exercise, Analysis of two variables: Correlation, linear correlation, simple linear regression, non-linear correlation, Least squares, sampling error, ANOVA test, Exercise. Multiple variable analysis: Generalized correlation, multiple linear regression • Frequencies-Frequency Tables-Cumulative Frequencies • Classes-Frequency Distribution Table-SPSS examples • Descriptive Statistics - Data Analysis – Box plots - SPSS examples • Hypothesis testing - SPSS examples • Compute Variables - Scatter plots - SPSS examples • Linear Regression - Errors - SPSS examples • Least Square Regression - SPSS examples • Linear correlation - multipoint correlation - SPSS examples • Linear regression and ANOVA test – SPSS.

NGGE 202Y Geography and Digital Cartography: • Introduction. History of Geography. Branches of Geography. Geography and new technologies. • Fundamental geographical concepts (geospatial data and information, scale, measurements, accuracy and reliability of measurements, errors). • Earth as a celestial body. The shape and dimensions of the Earth. Earth's movements. Elements

of Geodesy. • Coordinate reference systems. Geodetic Reference Systems and Projections in Greece and worldwide. • Topographic maps. • Morphological sections. Cartometry. • Elements of Surveying. • Introduction to Cartography. • Digital Cartography. Digital topographic and geological maps, digital geological data. • Introduction to Geoscience and the applications of geospatial technologies (Geographic Information Systems / GIS, Remote Sensing, Global Navigation Satellite Systems / GNSS). • Digital Elevation Models (DEMs). • Environmental Geography).

NGGP 203Y Physics of the Earth's Interior – Geodynamics: 1) Earth and Solar System formation. Introduction to Radiometric dating- geochronology. 2) The Earth's gravity field. The shape of the Earth – Geoid, ellipsoid. 3) The Earth's magnetic field and its origin. Geomagnetic field variations. Paleomagnetism and its relation to Geodynamics. 4) Seismology and the internal structure of the Earth. Seismic wave propagation in the Earth. 5) Velocity structure, anisotropy. Crust, mantle and core of the Earth. Continental and ocean lithosphere. 6) Geodynamics: lithospheric plates and their kinematics. 7) Heat generation and conduction in the Earth.

NGGG 206Y Palaeontology:

1) History of Palaeontology and Sectors/Branches. 2) Excavation - Sampling - Basic taxonomy. 3) Theories of Creation of Life, the genesis of the Invertebrate and vertebrate world - Geological time - mass extinctions and their role. 4) Basic Biological Principles in Paleontology (evolution - species nomenclature etc.). 5) Basic anatomy-systematics of plants - how to study - Overall evolution of plants in geological time (lab examples). 6) Basic vertebrate morphology - basic systematics (at Order level or higher) – lab examples. 7) Evolution of invertebrates in geological time - characteristic fossils (lab examples). 8) Basic Morphology of Microfossils - Basic systematics (at Class level or higher) - method of study. 9) Evolution of Microfossils in geological time - characteristic fossils (lab examples). 10) Basic vertebrate anatomy - basic systematics (at Grade level or above) - method of study. 11) Brief evolution of vertebrates in geological time (lab examples). 12) Fossils and evolution

13 Fossils and environment

NGMO 205Y Mineralogy: 1) INTRODUCTION: Objective of Crystallography. Definition of a crystal. Anisotropic-Isotropic-Homogeneous bodies. Definition of crystal zone. Law of Constancy of Interfacial Angles. 2) TRANSFORMATIONS IN SPACE – CRYSTAL SYMMETRY: Simple symmetry operations. Symmetry axes, planes and centers. 3) CRYSTAL CLASSES: Simple and combined forms. Natural and apparent symmetry. Point symmetry. Geometrical laws applied to the crystals of the 32 crystal classes. Haüy's law or law of rational indices. 4) PLANE INDICES: Identifying axial intercepts and plane indices. 5) CRYSTAL SYSTEMS: Crystallographic axes. Crystals of the 7 crystal systems. Inversion axes and inversion planes. 6) CRYSTAL INTERGROWTH – TWINNING: Parallel intergrowth. Twinning and Polysynthetic twinning. Pseudosymmetry. Epitaxy-Topotaxy-Heterotaxy. 7) CRYSTAL LATTICE – ATOMIC STRUCTURE AND ARRANGEMENT: Lattice points, lattice planes, unit cell. Bravais lattices. Relationship between lattice and regular intergrowth. Determination of crystal structure by X-ray methods. 8) HISTORICAL BACKGROUND – MINERAL DEFINITION: Objective of Mineralogy. Association with other scientific fields. Historical background. Mineral definition. 9) SUBSTITUTION – SOLID SOLUTIONS – EXSOLUTION: Atomic substitutions. Definition of Solid Solution. Exsolution phenomena. 10) ISOMORPHISM – POLYMORPHISM – POLYTYPISM: Definition and examples of Isomorphism, Polymorphism, Polytypism. Mechanisms of Polymorphism. 11) MAGNETIC – ELECTRIC PROPERTIES: Piezoelectricity. Pyroelectricity. Radioactivity. 12) BASIC CONCEPTS OF PETROLOGY: Fundamentals of Petrography. Igneous rocks. Sedimentary rocks. Metamorphic rocks. 13) MINERAL CLASSIFICATION AND CHEMICAL FORMULA: Native elements. Sulfides. Oxides – Hydroxides. Halides – Sulfates. Carbonates. Silicates.

NGMO 291E Field Course 1: This field trip covers a variety of topics related to Introduction to Mineralogy and Introduction to Geology courses: • Rock identification in the field. • Classification of igneous, sedimentary and metamorphic rocks. • Identification of faults, joints and folds in the field. • Visit at an inactive marble quarry. • Contact metamorphism zone and its associated minerals. • Erosion, transport and deposition processes. • Use of geological compass to measure geometrical properties of geological surfaces.

NGGN 623E Foreign Language Geological Terminology II: 1) Tectonic plates 2) Tectonic deformation 3) Fresh Water of the Continents 4) Engineering Geology 5) Lacustrine Environments 6) Fluvial Environments 7) Ore Deposits 8) Metallogenesis 9) Seismology 10) Geophysics, Applied Geophysics 11) Climate change, Forecasts/Pojections 12) Hydrosphere 13) Energy balance.

3rd Semester:

NGMO 301Y Igneous Petrology: Introduction - Introduction to the subject of Petrology - Purpose - Research methods - Major groups of rocks Basic concepts of Optical Mineralogy Rock forming minerals Composition and Properties of Magma Origin of Magma Evolution of Magma Geochemistry of igneous rocks Magma chemistry and geotectonic environment Morphological types of igneous rocks Chemical classifications of igneous rocks Acid, intermediate, basic and ultrabasic rocks Foid bearing rocks - carbonatites - ophiolites – pyroclastic rocks.

NGMC 302Y Meteorology: 1) Introduction and structure of the atmosphere. Introduction to the subject of Meteorology. The atmosphere and its structure. Extent, composition and total mass of the earth's atmosphere. Vertical distribution of the atmosphere. The elliptical orbit of the earth around the sun. 2) Electromagnetic spectrum. Basic parameters of radiation. Radiation laws. Solar station. The solar radiation in the atmosphere. The intensity of solar radiation on the surface of the earth and the factors that affect it. Earth radiation. 3) Temperature of the atmosphere. Temperature measurement. Heating the atmosphere. Variation of air temperature with height. The greenhouse effect. 4) Humidity of the atmosphere. Hygrometric parameters. Humidity measurement. Dew-point temperature. Absolute humidity. Water vapor mixing ratio and specific humidity. Relative humidity. Precipitable water. 5) Atmospheric pressure. Hydrostatic equation. The change in atmospheric pressure with height. Isobars. Isopleths of height and thickness. Measurement of atmospheric pressure. Wind and wind measurement. Forces that regulate the wind. 6) Atmospheric thermodynamics. Thermodynamic systems. Thermodynamic characteristics of dry and wet air. Equation of state for dry and moist air. Specific air heat. The first law of thermodynamics. Non adiabatic and adiabatic changes. Poisson equation and potential temperature. Upward and downward movements in the atmosphere. 7) Static of the atmosphere. Sample method. Investigation of static equilibrium in the atmosphere. Stability and instability of unsaturated and saturated air. 8) Condensation - clouds - precipitation. Cloud classification. Cloud cover. Fog and fog categories. Dew and frost. Rain, snow and hail. Precipitation categories depending on the way the rain clouds form. Rain generation mechanisms. 9) Atmospheric depressions. Characteristics of air masses. Frontal surfaces and fronts - Weather systems. Depressions and categories of depressions. Cyclones and cyclogenesis. Anticyclones and types of anticyclones.

NGGE 303Y Physical Geography: • INTRODUCTION, Physical Geography of our Planet, Physical Geography and Environment • THE SHAPE OF THE EARTH, Earth's structure, Major Relief Features of the Earth's Surface, Lithospheric plate movements and Orogenesis • WEATHERING, Physical weathering, Chemical Weathering, Weathering process as Geomorphological Factor • GLOBAL CLIMATES AND GEOMORPHOLOGY, Climate Classification and types, Global Precipitation, the geomorphological evolution in different climates, the climate of Greece as a factor of geomorphological evolution. • ECOSYSTEMS OF THE EARTH • GLOBAL SOILS, The Nature of the Soil, Soil development, Soils of the world, Soil erosion • HYDROGRAPHY – HYDROLOGY, Groundwater, Surface water, Drainage networks, Lakes, Water as a Natural Resource • FLUVIAL GEOMORPHOLOGY, The Work of Streams and Stream Gradation, Base Level, Valley formation, Fluvial Landscapes. • LANDFORMS MADE BY VOLCANIC ACTIVITY, Stratovolcanoes, Shield volcanoes, Volcanic activity of the Earth, Denudation process on Volcanoes, Main volcanos of Greece. • GLACIAL GEOMORPHOLOGY, Formation of a Glacier, Glacier Classification, Alpine Glaciers, Ice sheets, Glacial movement, Periglacial phenomena, Pleistocene Ice Ages. • LANDFORMS AND GEOLOGICAL STRUCTURE, Landforms and rock resistance, Landforms of Horizontal Strata and Coastal Plains, Landforms of Warped Rock Layers, Landforms on other geological structures. • TECTONIC GEOMORPHOLOGY, Fault Landforms, Active tectonics control in fluvial systems and basins. • KARST GEOMORPHOLOGY, Chemical and mechanical action of water on carbonate rocks, Surface karst landforms, Underground karst landforms, Karst hydrology, Karst types and cycles. • Coastal Geomorphology, The work of waves, Types of Coastlines. • AEOLIAN GEOMORPHOLOGY, Geomorphological action of the wind, Aeolian Processes, Sand Dunes, Loess.

NGMO 304Y Sediments and Sedimentary Rocks: 1. Origin of sedimentary rocks and sedimentation processes Sedimentation rates and factors affect their rate. Processes of sedimentary rocks origin (physical, chemical, biological) and sediments genesis (weathering-transportation-deposition-diagenesis). Weathering factors, weathering and climate, weathering and clay minerals. Forms of diagenesis, late diagenesis transplantation and anchimetamorphosis. 2. Texture of the sedimentary rocks. Clastic sediments texture. Statistical parameters. Textural maturity. Mineralogical maturity. Orientation. Porosity-Permeability. Carbonate rocks texture. 3. Components of clastic sediments. Quartz, feldspars, rock or mineral fragments, heavy minerals, zeolites, chain silicates, organic matter and other constituents. Cement materials. Mineral and rock alterations and transformations. Chemical composition of sedimentary rocks. 4. Petrographic types of sedimentary rocks 4.1. Clastic sediments: Conglomerate and Breccia. Sandstones: Diagenesis, classification, petrographic types. Mudstones: Components, classification, petrographic types, sedimentary rocks rich in iron. Clays: Diagenesis and petrographic types. Residual weathering rocks: Laterites and bauxites. Soil: Components, textural classes and soil genesis. Flysch - Molasse. Volcanoclastic sediments and zeolitic sedimentary rocks. Clastic sedimentary rocks of Greece. 4.2. Chemical and Biological Sediments: Evaporites. Carbonate sediments: Carbonaceous sedimentation, mineral components, carbonate mud, sand and formations, diagenesis and classification and petrographic types of carbonate sediments. Silica sediments. Phosphorites. Carbonaceous sediments. Chemical and biogenic sedimentary rocks of Greece.

NGGP 305Y Seismology: 1) INTRODUCTION: Main target of the science of Seismology. Research methods in Seismology. Scientific and social importance of Seismology. Short history of Seismology. 2) PRINCIPLES OF ELASTICITY THEORY AND ELASTIC WAVES: Traction vectors at a point, stress tensor, equilibrium conditions, principal stresses, units and values of stress inside the Earth. Strain at a point of a body, normal and shear stresses, rotation, stress-strain relations, elastic

constants. Equation of motion, wave equation, equation of vector wave. Elastic body waves: Compressional and shear waves, reflection and refraction of body waves Snell's low. Surface waves: Rayleigh and Love waves, dispersion of surface waves. 3) INSTRUMENTS OF SEISMIC WAVE RECORDING: Basic principles of seismograph operation, eigen period of a pendulum and ways of changing it, attenuation of a pendulum motion. Theory of seismometers: Equation of motion of the pendulum of a seismometer, response of this motion to the seismic motion. Electromagnetic seismometers and their calibration, digital seismographs and broad-band seismometers. 4) SEISMIC WAVES AND THEIR PROPAGATION INSIDE THE EARTH: Earthquake foci, epicenter, time of origin, travel time curves of seismic body waves, seismic waves velocity versus depth. Seismic wave propagation in the Earth's crust, mantle and core. Surface wave propagation, free oscillations of the Earth. Attenuation of seismic waves. 5) SEISMOMETRY: Measurement of the arrival time and the period of seismic waves. Fourier spectrum of seismic waves. Particle motion. Travel time curves, estimation of the epicentral distance and the origin time of an earthquake. Estimation of the coordinates of the earthquake foci: Estimation of the epicenter applying the graphical method (travel time differences of P and S waves) using more than two stations, application of the Wadati method for the estimation of the focal depth. Magnitude of an earthquake, different magnitude scales, magnitude saturation, correlation between different magnitude scales. Seismic energy. 6) EARTHQUAKE GENERATION AND THEIR SPACE-TIME DISTRIBUTION: Models of shallow depth and deep focus earthquake generation. Asperity and barrier model of seismic faults. Time distribution of seismicity: The seismic cycle, seismic sequences, accelerating and decelerating seismicity, induced seismicity. Time independent and time dependent seismicity. 7) EARTHQUAKE PREDICTION: Long term earthquake prediction: Seismic cycle for slip and time predictable models, the methods of seismic gaps and static stress (Coulomb stress) change. Intermediate term earthquake prediction: Method od decelerating inside and accelerating outside seismic deformation. Short term earthquake prediction: Earthquake precursors and their physical explanation. Social impact of earthquake prediction. 8) MACROSEISMIC EFFECTS OF EARTQUAKES: Effects on the soil, the water ((Seiches), the sea (tsunamis), and the structures. Effects on the humans and the animals. Estimation of the macro seismic effects, seismic intensity scales, seismic intensity curves. 9) ANTHROPOGENIC QUAKES: Artificial laboratory shock waves. Microseismic noise. Nuclear explosions: energy and magnitude of nuclear explosions, detection of nuclear explosion and their discrimination from earthquakes. Shocks due to chemical explosions.

NGGN 733E History and Philosophy of Science: The problem of defining science. Science as a methodology, as organized knowledge, as a problem-solving tool, as a social issue. Scientific research, Scientific observations, Scientific deduction and induction. Science and technology. Science and the Society. The role of the scientist in the society. Historical evolution of scientific thought: In the prehistoric period, In the classic era, In the Hellenistic times, In the Middle Ages, In Renaissance and Enlightenment Until the twentieth century, The last century. Historical evolution of Geology. Basic epistemological issues.

4th Semester:

NGMO 401Y Petrology of Metamorphic Rocks: 1) INTRODUCTION: Definition of metamorphic rocks. Principal metamorphic modifications. General aspects of metamorphic rocks. Chemical composition classes of metamorphic rocks. Factors of metamorphism. 2) CONTACT METAMORPHISM: Definition of contact metamorphism. Factors that control the width of the contact aureole. Structures of metamorphic rocks. Rock types and mineral assemblages of metamorphic rocks. 3) REGIONAL OR OROGENIC METAMORPHISM: Definition of orogenic metamorphism. Prograde and retrograde metamorphism. Metamorphic fabrics. Structures of orogenic metamorphic rocks. Relationship between metamorphism and deformation. Pretectonic – syntectonic – posttectonic crystallization. Polymetamorphism. 4) CLASSIFICATION OF METAMORPHIC ROCKS: Macroscopic, structural and mineralogical characteristics of metamorphic rocks. 5) MINERAL ASSEMBLAGES OF METAMORPHIC ROCKS: Chemically equivalent assemblages. Compositional diagrams. 6) CHARACTERISTICS OF OROGENIC METAMORPHISM: Mineral zones and index minerals. Geothermal gradient. Isograds. Metamorphic facies. Reaction isograds. Petrogenetic grids. 7) MINERAL ASSEMBLAGES IN OROGENIC METAMORPHISM: Orogenic metamorphism of pelites, calcareous pelites and argillaceous carbonates, mafic, ultramafic and siliceous carbonates. Petrogenetic significance of aluminosilicate minerals. Sillimanite isograds. 8) GEOTECTONIC SETTING OF OROGENIC METAMORPHISM: Orogenic belts. Continental collision zones. Metamorphism at active continental margins. Metamorphism at subduction zones. Metamorphism at extensional zones. Migmatites. Ocean-floor metamorphism. Burial metamorphism. Dynamic metamorphism. 9) CONDITIONS OF METAMORPHISM: Low and high temperature and pressure limits of metamorphism. 10) METAMORPHIC REACTIONS: Principles of metamorphic reactions. Metamorphic processes. 11) MICROSCOPIC CHARACTERISTICS OF METAMORPHIC REACTIONS: Porphyroblast development. Recrystallization and annealing. Criteria of equilibrium.

NGMC 402Y General Climatology – Introduction to Paleoclimatology: Introduction: Weather and Climate,

Objectives and climatology sectors, Climate factors. Solar Radiation: Solar Energy, Energy and transportation, Atmosphere and soil interactions, Energy Balance, Solar duration. Temperature: Temperature parameters, Temperature earth distribution, Temperature distribution over the Mediterranean and Greek region, Solar and water Temperatures. Precipitation: Spatial distribution of Clouds and precipitation, physical factors of the precipitation distribution, daily and annual rainfall distribution, Geographical distribution of rainfall. General Atmospheric Circulation: Winds, Local winds, horizontal pressure distribution, horizontal pressure distribution, air masses, classification, main atmospheric systems. Climate description: Analysis and geographical distributions of the climates on a global scale. Different climatic areas and climates over the planet. Climatic classifications. Paleoclimatology: Geological centuries and climate evolution. Proxy data for climate reconstruction, dating methods. The main physical causes for climate change (continent movements, volcanos, Milankovitch circles, solar activity).

NGMO 403Y Geochemistry: Introduction- Subject of Geochemistry Goldschmidt Geochemical classification of the elements Chemical Bonds and their relationship with the composition and properties of minerals – Ionic radius – Coordination number and ionic radius ratio - Ionic substitution in crystals - Isomorfism, polymorfism and solid solutions Solar System Elements - Meteorites The evolution of the Earth's composition - The Earth's internal structure – Total composition of the Earth - The original geochemical differentiation of the proto-Earth - Formation and development of the Earth's solid crust Origin and crystallization of magmas Geochemical characteristics of primary magmas - Behavior of trace elements during fractional crystallization or partial melting of the rocks - Rare earth elements - Spider diagrams Geochemistry of sedimentary rocks Reactions in aqueous solutions - Water as a solvent - Acids and bases dissociation - Salt solubility - Solubility product - Saturation index - Solution and precipitation of calcium carbonate - Chemical weathering of silicate minerals Geochemistry of the metamorphic rocks Mobility of the elements during metamorphism Isotopic Geochemistry Elements Stable and radioactive isotopes, main radiochronological methods Use of isotopes to determine the source of magma.

NGGG 502Y Depositional Environments and Stratigraphy: •History of Stratigraphy. Interrelation between Sedimentology and Stratigraphy. •The concept of Accommodation Space. Base Level changes as driving force to the transport and deposition of sediments. Causes of Accommodation Space and Base Level change (Geotectonic, Isostatic, Climatic – Milankovich Cysles). •Sediment transport and depositional processes in humid and temperate environments [Alluvial fans, river deposits, lake deposits, deltaic and coastal deposits, mass flows, turbidites, contourites, carbonate sediments, red clays, Radiolarites]. •Sediment transport and depositional processes in arid environments [wadis, playas, dunes, Sabha zones, evaporites, carbonate sediments - coral reefs]. •Sediment transport and depositional processes in glacial environments [Ice cover sediments, alpine glacier sediments, river - lake and wind-blown sediments of glacial environments, Tilites, Loess, glacial sediments of Continental shelf and deep sea, dropstones]. •Facies Analysis [Lithofacies, Biofacies]. Paleo-environmental indicators, interpretation of past depositional environments. •Basic principles and Characteristics of sedimentary rocks: bedding – Bed, sedimentary Layers, sedimentary Contacts, Conformities – Unconformities, Types of Unconformities. •Laws - Principles of Stratigraphy (Superposition, Original Horizontality, Lateral Continuity, Cross-Cutting Relationship, Fossil Faunas Succession, Actualism). •Criteria for Identifying original place of Layered rocks (Upper-lower surface of a bed, Organic markers-Inorganic Structures, Indicators of original Horizontality). •Lithostratigraphy (Lithostratigraphic profiles, Description and recording of a field section and a borehole core, Lithostratigraphic Correlation, Lithostratigraphic Column, Examples). •Biostratigraphy (Stratigraphy and Fossils - Index Fossils, Biostratigraphic Units - Biozone Types, Biostratigraphic Correlation, Examples). •Chronostratigraphy - Geochronology (Relative and absolute dating methods, Geological time scale, subdivisions and Units, Examples). •Other stratigraphic methods (Magnetic stratigraphy, Seismic stratigraphy, Isotopic and chemical stratigraphy, Wire loggings, examples). •Filling of Accommodation Space (spatial and temporal, dimension geometry of depositional structures, General Concepts of Sequence Stratigraphy and Basin Analysis.

NGGP 405Y Applied Geophysics: 1) Introduction to Geophysics 2) Seismic methods: Refraction-Reflection, principles, measurements, applications, case studies, use of seismic methods to applied and theoretical research (i.e. structure of basins, geotechnical investigation etc.) 3) Gravimetric measurements: corrections of the gravity field. Bouguer anomalies in applied and theoretical research (isostasy, study of the Earth's crust, investigation for hydrocarbons, etc.) 4) Magnetic measurements: Principles, measurements, applications, case studies, use of magnetic methods to the applied and theoretical research. 5) Electrical and electromagnetic methods: Principles, measurements, applications, case studies, use of electrical and electromagnetic methods in mining exploration, hydrogeology, geotechnical and environmental investigations. 6) Well Logging and radiometric methods: Principles, measurements, applications, case studies Structure and contain of exercises Seismic refraction and reflection method. Basic data processing, identification of first arrivals of seismic waves and calculation of the seismic velocity of the geological strata. Interpretation of seismic sections. Gravity method: Basic processing and interpretation of gravity measurements, gravity anomalies of simple structures, gravitational maps. Magnetic method: Basic

processing and interpretation of magnetic data, magnetic anomalies of simple structures, magnetic maps. Electrical methods: Interpretation of electrical profiling and electrical tomography data. Electromagnetic methods: Interpretation of electromagnetic data from VLF profiles and Georadar sections. Well-logging data interpretation (resistivity and gamma logs) applied to hydrogeology. Field demonstration of basic applied geophysical Field demonstration at locations of the Univ. Campus of the application of applied geophysical methods. Location: Univ. Campus Content Field demonstration of the application of geophysical methods with the participation of students in groups that includes the collection of measurements in the field using the following geophysical techniques: seismic refraction, electrical Tomography, magnetic method, GPR Evaluation method for students (if done separately from the course). The students deliver a relevant report with the basic interpretation of the collected field data.

NGGE 491E Field Course 2: Day 1 Thessaloniki - Lamia Thessaloniki - Tempi - Larissa - Kalampaka - Xyniada Basin - Lamia Points of Interest along the way • Thessaloniki Plain, Brief History of the geomorophological evolution during the Holocene, Giannitsa Lake, Drainage Works of 1930's. • Litochoro, Mount Olympus alluvial fans, torrential incision, Mount Olympus uplift. • Pyrgetos, Fluvial Terraces of Pinios River, Pinios River Delta plain. Tempi, epigenetic valley, geomorphological evolution of the valley, river terraces, karst solution, karstic water table, karstic springs, freshwater invertebrates • Basin of Thessaly, Meteora, formation, sediment deposition, erosion Antinitsa Monastery Fossil Cretaceous limestones, shallow / deep sea sediments - Radiolarites • Road sections to Lamia, Ophioliths / adjacent deep sea sediments • Staying overninght in Lamia. Day 2 Lamia Lamia - Gorgopotamos - Thermopylae - Agia Paraskevi - Lamia • Lamia Archaeological Museum. Guided Tour - briefing on the presence of prehistoric man in the area. Panorama and geomorphology of the area. • Agia Paraskevi, Prehistoric Settlement, Geoarchaeological Research Methods, Holocene Stratigraphy, Paleontology, mollusks of fresh - brackish - marine waters, Paleogeographical - Paleoenvironmental evolution of the area. • Gorgopotamos, Gorge exit, Gorgopotamos railway bridge, Tectonic uplift of Mt. Oiti, channel incision. • Thermopylae, Thermal springs, Thermopylae – Sperchios falt zone, chemical deposits (travertine), modern sedimentation, Visit to the Thermopylae battlefield, Paleogeographic evolution of the area. • Return to Lamia • Staying overninght in Lamia Day 3 Lamia - Nea Kios Lamia - Arkitsa - Kastro - Kopaida - Aliartos - Thebes - Erythres - Mandra - Megara - Kakia Skala - Corinth Isthmus - Kechrees - Isthmia - Argos - Nea Kios Points of Interest along the way • Arkitsa, Falt Mirror • Kastro - Copaida - Aliartos, karstic geomorphology, Poljie, Ancient Minyans, Ancient Glas fortified Acropolis, drainage of Kopaida Lake, Karst phenomena, sinkholes. • Corinth Canal, canal construction, fossil geological layers, fossil collection and identification. • Posidonia, elevation of tectonic rocks. • Kechrees, Submerged ancient harbor due to active tectonics. • Arrival in Nea Kios. • Nea Kios Environmental Education Center, information on the educational activities of the center. • Staying overninght in Nea Kios. 4th day New Kios Nea Kios - Mycenae - Epidaurus Asklepieion - Ancient Theater – Ligourio Natural History Museum - Nea Kios • Nea Kios beach, sampling methods for the study of invertebrates and foraminifera, environmental - paleoenvironmental indicators • Mycenae, Mycenaean Dam, fluvial geomorphology • Mycenaean Acropolis, Lion Gate rift, Cyclopean walls construction materials. • Ligourio - Natural History Museum. • Epidaurus Asklepieion. Fossiliferous limestone with ammonites. • Return to Nea Kios. • Staying overninght in Nea Kios. 5th day Nea Kios - Mesolongi Nea Kios - Dervenakia - Corinth - Diakofto - Rack railway - Kalavryta - Diakofto - Rio Antirio Bridge - Antirrio - Mesolongi - Klisova - Mesolongi. • Dervenakia, narrow morphology, fossil limestones with Nummulites • Acrocorinth, morphology • Active tectonis and uplifted sediments of the Northern Peloponnese • Diakofto Village, Boarding on the rack railway, Route to the Vouraikos River Gorge, river incision, channel knick points. • Kalavryta - Diakofto, (by bus), Vouraikos valley morphology • Rio-Antirio Cable-stayed Bridge, Geological conditions and construction problems • Klisova Lagoon, importance – function of the lagoon, invertebrate fauna found. • Staying overninght in Mesolongi 6th day Mesolongi - Thessaloniki Messolongi - Amfilochia - Filippiada - Kokkinopilos - Agios Georgios - Louros River Valley - Ioannina - EGNATIA street - Thessaloniki • Aetoliko lagoon, lagoon circulation, anoxic conditions • Lakes Ozeros, Amvrakia • Amphilochia - Amvrakikos Bay, Beaches and Cliff coasts • Red-clay, Bad-lands • St. George, Karstic Springs, Roman Aqueduct of Nicopolis • Louros River Valley Arrival to Thessaloniki.

NGMO 492E Field Course 3: • Geology of the Circum Rodhope Zone, of the Serbian-Macedonian massif and the Rhodope massif • Mineralogy, petrography, age and origin of the plutonic rocks of Kavala, Philippi, Xanthi, Paranesti and the volcanic rocks of Sounio, Alexandroupolis, Ferres. • Metamorphic rocks of the Rhodope massif and Circum Rodhope Zone. • Sedimentary rocks of the Rhodope massif and Circum Rodhope Zone. • Discussion of individual petrological issues for each one of the magmatic rocks mentioned above (genesis, enclaves, xenoliths, alterations, contacts, country rocks, chemistry, Magma origin and evolution, geotectonic environment, etc.). • Discussion and summary of the origin of all magmatic rocks, as well as their relationship to metamorphism. • Discussion on the role of sedimentary rocks in understanding paleogeography and geotectonic evolution of the area. • Geodynamic setting of the Rhodope massif during the Eocene-Miocene period.

5th Semester:

NGMO 501Y Ore Deposits: 1. General principles and terminology 2. Processes of formation of ore minerals 3. Mineralizing fluids in the crust 4. Hydrothermal alterations 5. Classification of ore deposits 6. Geotectonic environment of formation, description and metallogenic models for the major types of ore deposits: 6.1. Magmatic-hydrothermal deposits 6.1.1. Deposits related with ultramafic and mafic rocks 6.1.2. Pegmatitic ore deposits 6.1.3. Skarn ore deposits 6.1.4. Intrusion related deposits 6.1.5. Replacement Pb-Zn deposits 6.1.6. Porphyry deposits 6.1.7. Epithermal deposits 6.1.8. Volcanogenic massive sulfide deposits 6.2. Lateritic residual processes (laterites, bauxites) 6.3. Supergene oxidized and enriched deposits 6.4. Sedimentary and karst deposits 6.5. Vein deposits in metamorphic terrains 6.6. Marble deposits.

NGGG 404Y Structural Geology: • Introduction το Structural Geology • Tectonic and atectonic structures • Orogenesis and continent formation • Structure of Earth's crust and fundamental principles of the plate tectonics theory • Rock deformation: strain ellipsoid, deformation types. • Tectonic structures: brittle tectonics (brittle deformation structures, stress field), ductile tectonics (folds, schistosity). • Tectonic lineaments. • Kinematic analysis. • Texture analysis: rose diagrams and stereographic projections. • Experimental structural geology. • Applications of structural geology. • Introduction to quantitative structural geology • Strike and dip direction rose diagrams • Orthographic projections of surfaces and lineaments • Densification of data in Schmidt networks • Solving of geological problems • Use of new technology in structural geology • Structural modelling.

NGGG 503Y Engineering Geology: - Introduction (Topics of Engineering Geology-The role of Engineering geology in engineering works) - Site investigation tools - Engineering geology of soils (consistence, soil description, Physical characteristics) - Engineering geology of soils (shear strength, Mohr-Coulomb failure criterion) - Engineering geology of rocks (Physical, Mechanical properties of rocks and discontinuities) - Rock mass strength-Geotechnical classification (GSI, RMR, Q) - Engineering Geology of Sedimentary, Igneous and Metamorphic rocks. - Landslides - Slope stability - Dams – Foundations. For every tutorial the associated exercise includes all data and geo- information, a presentation (PowerPoint) with all the necessary theoretical background and a supplementary assisting booklet with supporting information. The topics of the tutorials are: - The importance of the geological model in major construction projects. The consequences from its ignorance or misinterpretation. - Evaluation of site investigation program: Construction of geological and engineering geological sections from sampling boreholes, laboratory and in-situ tests - Geostatic stresses (Total and Effective stresses, Pore pressures) - Putting numbers to Geology I. Shear strength of soils. Mohr-Coulomb parameters, laboratory tests (triaxial, shear test, consolidation test) in soils. Total and effective stress, pore pressures. - Putting numbers to Geology II. Uniaxial compressive test of intact rock – UCS. Deformation modulus of intact rock (Ei). Rock mass strength (σcm). Hoek-Brown failure criteria and equivalent evaluation of cohesion and angle of friction with the use of rock mass classification GSI. Deformation modulus of the rock mass (Em). - Putting numbers to Geology III. Shear strength of rock joints (when the failure of the rock mass is controlled by them). Shear tests. Evaluation of angle of friction from the Barton – Bandis failure criterion. – Slope Cuts. Rock slope stability. Kinematic analysis. Definition of Factor of Safety. Groundwater effects. Rock slope support - Dams I. Selection of Dam axis location and Dam type. Dam axis and reservoir Permeability. Slope stability. Foundation problems and mechanisms of failures. The role of Geology. - Dams II. Permeability and seepage below the dam. Lugeon tests. Grout curtain against seepage and internal erosion - Tunnels. Evaluation of Engineering geological conditions along a tunnel. Behaviour types. Groundwater inflows. - Geotechnical classifications in tunneling. GSI, RMR and Q classifications - Seismotectonics and engineering projects. Evaluation of seismic hazard. Evaluation of liquefaction susceptibility of soil deposits.

NGMO 522E Geochronology: • Geology and time • Relative age determination • Absolute age determination • Atoms-Isotopes-Radioactivity • Methods of analysis-Mass spectrometer • Rb-Sr Method • K-Ar and Ar-Ar methods • U-Pb method • Sm-Nd method • C-14 method • Re-Os method • Case studies • Exercises.

NGGG 529E Vertebrate Palaeontology-Palaeoanthropology:

Paleontology and Evolutionary Biology of Fish, Amphibians, Reptiles, Birds, and Mammals. Importance - use of vertebrate fossils in the dating and reconstruction of the paleoenvironment. The Hellenic Fossil Archive. Primates (origin, general characteristics). Morphological characters. Physical Anthropology and skeletal material. Evolutionary trends in Primates. Cercopithecoidea. Miocene hominoids. Pliocene hominids. Australopithecians. Appearance and evolution of the genus Homo. Evolutionary stages of Homo habilis, Homo erectus, Homo heidelbergensis, Primitive Homo sapiens, Neanderthal, modern Homo sapiens. Taphonomy. Brain evolution. The Petralona (Chalkidiki) hominid skull. Paleoanthropological findings from famous sites and the Greek area.

NGGN 524E Analytical Chemistry: Basic principles of analytical chemistry and classical and instrumental chemical analysis techniques. Chemical reactions and chemical equations, solutions, solubility of substances and solution concentration, reaction rate and chemical equilibrium, equilibrium of weak acids and bases, heterogeneous chemical equilibrium and solubility product, complex ion equilibrium, statistical and experimental data handling, characterization and validation of analytical method. Analytical Chemistry laboratory safety, chemical reagents. Titration techniques. Major instrumental techniques of chemical analysis, such as: ultraviolet - visible molecular

absorption spectroscopy, atomic spectrometry, automatic chemical analysis techniques, chromatographic techniques.

NGGE 525E Geographical Information Systems (GIS) and Management of Geological Cartographic Data: •Introduction to Geographic Information Systems (GIS) •GIS Structure and Functions. GIS software •Categories and structure of GIS input data and metadata •Coordinate transformations and map georeferencing •Georeferencing and resampling of images •Creation/Digitization and management of data in vector format (points, polylines, polygons) •Geospatial databases •Conversion of geospatial data between different formats and reference systems •Recovery, access and processing of digital elevation models (DEM) •Extraction of morphological parameters from DEMs (slope, aspect, curvature etc.) •Spatial interpolation of vectordata •2D and 3D representation of geospatial information - Map composition - Map production •WebGIS and interactive maps Structure and material of laboratories / laboratory-tutorial exercises •GIS software •Categories and structure of GIS input data •Coordinate transformations •Georeferencing of maps •Digitization of point data •Digitization of linear data •Digitization of polygons •Georeferencing and resampling of images •Recovery, access and processing of digital elevation models (DEM) •Spatial interpolation of vector data •2D and 3D representation in a GIS •Map composition •Map production.

NGGN 526E General Mathematics II: 1) VECTOR CALCULUS Theory of curves in the three dimensional space (vector equation, parametric equations, tangent, perpendicular plane). Divergence and rotation of vector fields. 2) INTEGRAL CALCULUS Integrals of functions of one variable, line integral, conservative fields. 3) FIRST ORDER DIFFERENTIAL EQUATIONS Separation of variables, homogeneous, linear, Bernoulli, Riccati, exact, integrating factors. 4) APPLICATIONS in Geosciences.

NGGN 527E Geological Data Analysis: Course objectives-introduction, different types of geological data, geological data analysis process. Filtering procedures. Smoothing filters – differential filters. Filter class, application of moving filters, effect of filtering. Examples of application to noisy data, application to highlight changes. Polynomial fitting of geological data. Selection of the polynomial, fitting evaluation. Data isodistribution. Geostatistical data analysis. Basic statistical concepts. Spatial covariance and correlation. Interpolation in 1D. Interpolation techniques (nearest neighbor, linear, polynomial, spline etc.). Advantages and disadvantages, examples of application. Interpolation in two dimensions. Interpolation techniques, pros and cons. Using of covariance matrix to construct maps. Examples of application. Spectral analysis. Basic concepts, sampling frequency, power spectra. Application to geological. Design and application of spectral filters. Content The laboratory courses include application of the methods taught in theory by writing code in the Matlab programing language. Students are asked to write a Matlab code that actually analyzes geodata based on techniques taught in theory and also are asked to interpret the results. In particular, laboratories include the application of the following methods: Smoothing filters, differential filters, polynomial regression and data isodistribution, calculation of covariance and correlation, interpolation in one dimension, interpolation in two dimensions and map construction, spectral analysis (FFT) of data and application of spectral filters

NGGP 528E Seismotectonics: Stress & Strain (Stress, Stress tensor, Principal stresses, Maximum Shear Stress & Failure, Differential Stress, Equation of Motion, Strain, Constitutive equations, 1.9 Strain Energy) Earthquakes and Faulting – (Earthquake Generation, Crustal Faults, Fault Geometry, Elastic Dislocation and Seismic Cycle, Energy Release, Stress Drop and Seismic Moment, Stick Slip, Seismicity and Scaling Laws) Earthquake Source Models– (Point Source, Forces at the Earthquake Source – Double Couple, Shear Rupture & Dislocation, Point Shear Rupture, Geometry of shear rupture, far field displacement, Source representation on focal sphere, Source time function, Spectral properties of the source tine function, Seismic Energy Radiation) Point source mechanism – (Focal sphere, Fault plane solutions based on first arrivals, Waveform modeling) Rupture Kinematics & Propagation – (Source dimensions, Rectangular Fault –Haskell's model, Rupture Propagation, Corner Frequency, Directivity effects, Rupture initiation, propagation & termination) Finite Source – Simple Dynamic Models – (Waveform spectral analysis, Source Time Function, Slip distribution, Kinematic and dynamic models, Moving dislocation, Circular fault (static model, Brune's model), Energy release, Scaling Laws) Seismotectonics (Plate tectonics, Mid Oceanic Ridges, Subduction Zones, Intraplate Earthquakes (oceanic and continental), Rupture and Deformation) Active Tectonics in Greece and Surrounding Area.

NGGP 730E Gravity and Magnetic Methods of Geophysical Prospecting: Earth's gravity field. General relations of the gravity field, Newton's Law, basic principles of the gravity prospecting, density of rocks and minerals, gravity measurements and corrections, reductions of the readings and estimation of the free air and Bouguer anomalies, techniques for regional-residual separation, estimation of the density of the near surface strata of the Earth, processing and interpretation methods. Principles of the Magnetic Method of Geophysical Prospecting, quantities measured in magnetic surveying, magnetic susceptibility of rocks and minerals, instruments for magnetic surveying, design and conduct of a magnetic survey, processing and interpretation of the magnetic total field measurements or its first vertical difference, aeromagnetic surveying. Case studies of magnetic surveying in mineral exploration, in hydrocarbon reserves exploration, in studying and determining the Earth's geological and tectonic subsurface structure, in Archaeology and Environmental studies.

6th Semester:

NGGG 601Y Hydrogeology: • Introduction to the science of Hydrogeology (history, evolution), Statistical concepts in Hydrology. • The hydrologic cycle. River basin and its characteristics (shape, basin analysis, water divide, drainage network analysis). • Surface Hydrology. Hydrological balance and estimation of its parameters (precipitation, evapotranspiration, surface runoff, infiltration), Hydrologic balance in a river basin. • Flood Hydrograph, Estimation of peak flood. • Mechanical properties of water (density, viscosity, compressibility, capillary effect). Continuity principle and Bernoulli equation. • Storage of groundwater in geological formations, Porosity (total and effective porosity). Vertical distribution of groundwater, Divisions of groundwater (hygroscopic, gravitational, capillary), Specific yield and specific retention, Unsaturated (vadose) and saturated zone. The concept of permeability. • Aquifers, Types of aquifers (confined, unconfined, artesian). Properties of aquifers (storativity, homogeneity and isotropy). • Groundwater movement. The concept of hydraulic head. Hydraulic gradient. Darcy's Law and its limitations. Hydraulic conductivity and methods for its calculation. Aquifer transmissivity. Groundwater flows (laminar, turbulent). Forces on the porous medium (quick sand phenomena). • Groundwater level measurements, Isopiezometric maps and flow networks, Groundwater level fluctuations. Subsidence due to overexploitation. • Geological formations as aquifers: Porous aquifers in granular rocks, aquifers in fractured rocks, karst aquifers and their characteristics. • Springs: Types of springs, hydrograph, Karst springs. • Groundwater flow simulation. • Groundwater Quality-Hydrochemistry.

NGMO 621E Igneous Petrogenesis: Composition and physical properties of magma. Process of magma generation. Magma evolution processes. Behavior of the main elements, trace elements and radiogenic isotopes during the processes of magma generation and evolution. Mixing calculations. Use of the main elements and trace elements to simulate the processes of genesis and evolution in petrogenesis. Magma generation and geotectonic environment.

NGGG 602Y Geological Mapping: • Fundamental principles of geological maps. • Topography and its relationship to the geological structures. • Geological maps – 3D measurements. • Geological cross sections. • Identification of geological contacts. • Unconformities and their representation in geological maps. • Mapping deformational structures (faults and folds). • Geological mapping of special cases (igneous, metamorphic and diapiric rocks, deposits, tectonites). • Field geological mapping. • Hands-on training in the field on geological mapping. • Fieldwork safety. • Methods of geological work, use of compass and geological problems in the field. • Compilation of geological maps and cross sections in the field. • Compilation of a technical report annexed to the geological map.

NGMO 622E Applied-Environmental Geochemistry: • APPLIED GEOCHEMISTRY: Geochemical cycle, primary and secondary environment, pathfinder-indicator elements, geochemistry of rocks, geochemistry of soils, geochemistry of river/stream sediments, geochemistry of waters, vegetation geochemistry, gas geochemistry, prospecting of hydrocarbons. • ENVIRONMENTAL GEOCHEMISTRY: Ores and environment, energy raw materials and environment, trace elements and environment, environmental uses of industrial minerals and rocks. • ENVIRONMENTAL MINERALOGY: Asbestos, health effects due to the mineral constituents of the dust. • LEGISLATION AND ENVIRONMENT: Environmental studies, mineral raw materials and environmental impact study, national and European environmental legislation.

NGMO 624E Ore Deposits of Greece: A historical overview of the mining activity in Greece • Geotectonic evolution and metallogenesis in Greece • Classification of Greek deposits in different metallogenic provinces • Cr deposits and volcanogenic massive sulfides deposits of in Mesozoic ophiolitic complexes • Deposits associated with Cenozoic magmatism: porphyry and epithermal deposits, skarn deposits, carbonate replacement deposits, intrusion related systems • Deposits hosted in metamorphic rocks. • Lateritic residual deposits (laterites, bauxites) • Supergene oxidized Fe, Mn deposits enriched in Au • Karst-type deposits • Alluvial deposits • Submarine metal-rich hydrothermal fields in the South Aegean Volcanic Arc • Comparison between global and Greek deposits.

NGGN 625E Computer Programing in Earth Sciences: Introduction to programming using examples in the Geosciences. The course is designed to be accessible to Geoscience students in any field of science. Provides instruction in the techniques of upper-level languages such as Fortran and as well as an introduction to the programming techniques used in open source R. Includes strong component of visualization and graphing. • Variables - Fixed quantities. Integrated types of Fortran 95, Numeric operators. Price return command. Code writing rules. - Exercises • Built-in arithmetic functions. Exercises • Control commands - Logical expressions. Relational operators. Reasonable operators. Exercises • Commands - Repeat loops, Flow change commands. Exercises • Arrays, Built-in functions within arrays. Exercises • Introduction to R language - Basic concepts • Data objects in R language: Arrays and data frames • Mathematical calculations in R language- Graphs • Simple Programming in R language.

NGGP 626E Seismic Methods of Geophysical Prospection: Basic principles of the propagation of seismic waves, energy and attenuation. Seismic waves velocity. Relationship between geophysical-petrophysical and geological-geotechnical-environmental parameters. Velocity-density Relationship. Seismic Refraction: Study of

layered structures. General applications Seismic measurements in boreholes. Crosshole-downhole methods. Surface waves recording. The MASW method Seismic reflection. Basic pronciples. Reflection in layered structure. Migration. Stacking. Interpretation of seismic sections MASW applications and measurements in boreholes.

NGMC 627E Atmospheric Pollution: 1) Definition of air pollution. Historical aspects on air pollution. Chemical composition of the earth's atmosphere. The role of trace constituents. The evolution of the composition of the Earth's atmosphere. 2) Biogeochemical cycles of carbon, nitrogen and sulfur. 3) Introductory concepts in air pollution. Natural and man-made emissions. Primary and secondary pollutants. Dry and wet deposition. Chemical transformations. Lifetime of air pollutants. The cycle of air pollution. Classification of gaseous pollution at various spatial scales. 4) The main atmospheric pollutants, their sources and their effects on the environment. 5) Meteorological components for the study of air pollution. The atmospheric boundary layer. Physical processes in microclimate - atmospheric turbulence. Atmospheric diffusion and dispersion. 6) The role of atmospheric stability conditions in dispersion. Physical processes in local and meso-scale transport processes and their relation to air pollution levels. Physical processes in synoptic and global scale transport processes and their relation to air pollution levels. 7) Introduction to the fundamental air pollution problems. Urban and suburban pollution problems. Smog and photochemical smog. 8) Transboundary, hemispheric and global pollution problems. Acid deposition. Increase in tropospheric ozone. Stratospheric ozone depletion and the ozone hole. Enhancement of the greenhouse effect. Radiative forcing and global warming potential. 9) Analysis and measurement of atmospheric pollutants.

NGGG 628E Neotectonics: • Quantitative and qualitative neotectonics analysis • Analysis and relative dating of microstructures • Brittle tectonics (fault systems, segmentation, 3D structure) • Active faults • Morphotectonics • Paleoseismology and archeoseismology • Earthquake geology • Case studies of active fault zones worldwide • Neogene and Quaternary deformation stages in Greece • Neotectonic evolution of Greece and the broader Mediterranean area • Applied Neotectonics and neotectonics mapping • Exercises and applications of neotectonics in technical studies • Methods of faulting hazard assessment • Use of relevant computer applications.

NGGG 629E Rock and Soil Mechanics: 1. The goal of Soil and Rock Mechanics course is to provide the necessary knowledge to the students in order to compose geotechnical studies for the construction of civil works. 2. The content of this course is the following: A) Theory: 1) Physical and mechanical characteristics of the soil and classification of the it according to the procedures, 2) stresses distribution, 3) bearing capacity, 4) settlement and compactibility of soil, 5) earth pressure and retaining structures, 6) trench stability, 7) field tests, 8) Eurocodes, 9) geotechnical design 2) Qualitative description of rock, joints, rock mass. Physical and Mechanical characteristics of rocks. Shear strength of rock and rock mass. Rock deformability. Shear strength of rock joints. Failure criteria. Geotechnical classification of rock masses. Stability analysis of rock masses in slopes, tunnels and foundations. B) Laboratory experience: Practice on laboratory soil and rock tests, according - Normal characteristics and properties of soil - Grain size analysis - Atterberg limits - Oedoimetric compression test - Uniaxial compressive strength (UCS) - Proctor compaction test - Direct shear test - Triaxial test - Point load test.

NGGG 633E Micropalaeontology-Invertebrate Palaeontology: Introduction to Micropalaeontology, historical development of micropaleontology, collection and elaboration of samples, species and basic groups of microfossils, life cycle of microorganisms, evolution of microfossils over time. Foraminifera (benthic, planktonic), Ostracods, Coccolithophores, Radiolaria, Diatoms, Silicoflagellates, Dinoflagellates. Morphology and Classification. Invertebrate Palaeontology, Ichnology. Description and systematics of Sponges, Coelenterata, Bryozoans, Brachiopods, Vermes, Molluscs, Arthropods, Echinodermata, Grapholiths. Importance and application in Geology, Stratigraphy, and Paleoecology, Paleoenvironmental reconstruction, Paleogeography, Paleoclimatology. Modern research methods, Microscopy methods. 1) Daily Field Trip with the subject 'Micropaleontology and Invertebrate Paleontology' in an indicative area for the implementation of the field trip, Kassandra, Chalkidiki.2) Field Trip content: Visit to microfossil and invertebrate fossil sites, sample collection- correlation with the broader geological and stratigraphic context

NGMO 631E Industrial Minerals and Rocks: Classification of industrial minerals and rocks. o Genesis of industrial minerals and rocks deposits o Main applications of industrial minerals and rocks. Industrial minerals deposits: Asbestos, Quartz raw materials, Feldspars, Magnesite, Talc. Industrial rocks deposits: Perlite, Clays, other than bentonite and Kaolin, Bentonite, Kaolin, Phosphorites, Zeolitic tuffs and Marbles.

NGGE 632E Speleology: Speleogenesis in carbonate and non-carbonate rocks. Hydrologic, lithologic, tectonic and geomorphic control in speleogenesis. Cave morphology. Cave classification. Cave deposits, classic sediments, chemical sediments, ice. Cave geochemistry. Cave climate and paleoclimate. Cave paleontology. Protection and exploitation of caves. The caves of Greece.

NGGG 691E Field Course 4: Geology of the Rhodope massif and the Circum Rhodope belt in Thrace • Geotectonic evolution, Tertiary magmatism and metallogenesis in the Rhodope massif • Tectonics: Drama-Philippi basin, Maronia-Makri fault, Petrota basin • Ore deposits: K. Nevrokopi Mn-oxides deposit, Maronia porphyry Cu-Mo deposit, Perama epithermal high-intermediate sulfidation Au deposit, Xylagani VMS Fe-Cu-Au deposit • Hydrogeology: Springs of

river Aggitis (Maara) Drama, Spring of Aghia Varvara of Drama, Spring of Kefalari (Boirani), Marshes of Philippi.

NGGE 832E Natural and Anthropogenic Environment: Introduction - Historical recursion. Purpose and contents of the lesson, method and methodology, performance evaluation. • Project description. Selection, formulation and presentation of micro-teaching topics related to the environment, physical processes and anthropogenic action. • The concept of system, geomorphological systems. • Natural and anthropogenic environments in the light of climate change. • Inland and coastal waters. Wetland systems. Coastal environments, lagoons. Examples of anthropogenic interventions. • Inland and coastal waters. Streams, rivers, deltaic zones. Examples of anthropogenic interventions in Greece (Nestos, Strimonas rivers etc). • Inland and coastal waters. Lakes, reservoirs, natural habitat drainage. Examples of anthropogenic interventions in Greece. (lakes Lagada-Volvi, lake Karla, etc). • Inland and coastal waters. Examples of anthropogenic interventions in Greece. The Axios-Aliakmon system, the lakes and rivers of Western Greece. • Marine and ocean environment. Anthropogenic interventions and their impact. • Selection of main project on topics related to anthropogenic impacts on the environment, contemporary environmental problems, and more general issues related to Geosciences and the environmental education. • Anthropogenic. Residential areas and industrial areas, development projects etc. • Natural and man-made disasters (floods, erosion, landslides, fires, drought / desertification, permafrost, earthquakes, volcanic eruptions, tsunamis, hurricanes, tornadoes, snowstorms, solar storms).

7th Semester:

NGGG 701Y Geology of Greece: Greece in the frame of the world geotectonic system. •Geotectonic zones of Greece. •Detailed description (lithostratigraphy, magmatism, tectonic structure) of the Hellenic hinterland, the internal Hellenides zones and the external Hellenides zones. •Post-alpine formations of Greece. •Local geological subjects. •Geological cross sections of Greece. •General principles of Geodynamics – the geotectonic cycle. •Geotectonic evolution of the Tethyan orogenetic system in Greece.

NGMC 721E Dynamic and Applied Climatology: Atmospheric General Circulation: Introduction (Pressure Gradient – Thermal gradient – winds). zonal and meridional flow, westerlies and trade winds, Hadley cell, Ferrel and Polar cells. Polar Frond and Jetstreams. Thermal winds, katabatic winds, Fohn winds, Monsoons, Regional winds: Etesian and Libas Greek winds (Exercises) High- and low-pressure systems: Permanent Highs and Lows in North and South Hemisphere; Non-permanent Highs and Lows in North and South Hemisphere. The Intertropical Convergence Zone (ITCZ) (Exercises on analysis of Meteorological and climatological maps). Air Masses: Categories of air masses based on the source region (Arctic, Polar, Tropical and Equatorial), their moisture and thermal properties (Exercises on the classification of air masses using data of weather balloon) Teleconnection patterns: Description – Characteristics of the most well-known teleconnection Ptterns (El nino, NAO, etc) their impacts on the European Climate. Weather Types and Circulation Types: Classification and description of weather and Circulation types. Applied Climatology: The impact of Climate on human beings and environment Urban Climatology: Thermal heat island, topoclimatology of urban regions Agricultural Climatology, climate and plants, phototropism, optimum plant temperatures. Forest Climatology, the impact of climate on fire forest, Alarm climate Fire forest Indices.

NGMO 722E Volcanology: ERUPTION DYNAMICS: Volcano-tectonic environments. Spreading center volcanism. Subduction zone volcanism. Intraplate volcanism. Earth's internal heat energy and interior structure. Physicochemical controls. Variability of eruptions. Eruption model. VOLCANIC LANDFORMS: Volcano types. Scoria cones. Shield volcanoes. Stratovolcanoes. Calderas. Lava domes. ERUPTION PRODUCTS: Lava flow types. Flow features. Lava and water. Tephra and pyroclastic rocks. Pyroclastic flows. Lahars. Volcanic gases. Climate effects. ERUPTION TYPES: Fissure eruption. Hawaiian eruption. Strombolian eruption. Vulcanian eruption. Plinian eruption. Peléan eruption. Hydrovolcanic eruption. HISTORICAL ERUPTIONS: Krakatau. Mt. Pelée. Paricutin. Mt. St. Helens. Nevado del Ruiz. Lake Nyos. SANTORINI: Geological setting. Volcanic activity and origin. Minoan eruption. Post-minoan activity (Palea and Nea Kameni). Monitoring. Kolumbo submarine volcano. Atlantis legend. CENOZOIC VOLCANISM IN GREECE: Age. Volcanic provinces. Cenozoic magmatism. South Aegean volcanic arc. PLANETARY VOLC.: Silicate volcanism (Mercury, Venus, Mars, Moon, Io). Cryovolcanism (Enceladus, Titan, Triton, Europe).

NGGG 723E Didactics of Geology: Historical development of Geology. •Aims of Education and Science Teaching. The curriculum. •Learning Theories. •The Design of Instruction. Aims and Objectives of Teaching Geology. •Teaching Methodology of Geology. •Teaching Tools. •Rating - Educational Evaluation. •The experiment in Science Teaching. Examples of Teaching and Assessment Tests. • Microteaching.

NGGE 724E Remote Sensing in Geosciences: Introduction to Remote Sensing - Earth Observation. History and Physical Basis of Remote Sensing. The concept of analysis in Remote Sensing. • Optical Remote Sensing – Optical satellite imagery characteristics. • Microwave Remote Sensing. • Spaceborne and airborne Remote Sensing Systems. • Applications to Atmosphere-Cryosphere-Hydrosphere-Geosphere-Biosphere. • Georeferencing and orthorectification of satellite imagery. • DEM from satellite or other spaceborne remote sensing data. • Classification of satellite imagery. • Environmental change detection methods. • Radar interferometry and applications to

geosciences • Land and marine environment monitoring techniques (soil erosion, flooding, coastal bathymetry extraction, changes in natural and anthropogenic environment, etc.). • Terrestrial remote sensing systems. • The European Space Agency (ESA) and other Space Agencies. Current Earth Observation Programs. Introduction to Big Data analysis and applications.

NGMO 725E Hydrocarbon Exploration and Exploitation: • The basic introductory concepts of Petroleum Geology are presented together with the properties of the source rocks and "kerogen", the geochemical methods for determining their quality, the hydrocarbons migration, the characteristics of the reservoir rocks and especially their petrophysical properties (porosity, saturation, and permeability), the different cap rocks and the diagenetic phenomenon. • The term "hydrocarbon reserves ", the concepts of resources and reserves, and the distinction between proven reserves [1P], "probable reserves" and "possible reserves" are explained. The techniques for estimating and calculating the reserves are also presented. • Examples of the various types of hydrocarbon traps of the three major categories: Structural Traps, Stratigraphic Traps and Combined Traps are described and examined. • All techniques and activities for oil and gas exploration are presented. There are three (3) primary methodologies used to find hydrocarbons in the subsurface: Geophysical, Remote Sensing, and wildcatting (exploratory drilling). • The 'Mud Logging' practice, heavily related to the mud circulation system, is described in detail. 'Mud Logging' is the creation of a detailed record, the 'well log' of a borehole by examining the cuttings of rock brought to the surface by the circulating drilling mud. Information about the lithology and fluid content of the borehole while drilling is provided. Mud logging includes observation and microscopic examination of drill cuttings, and evaluation of gas hydrocarbon and its constituents, basic chemical and mechanical parameters of drilling mud, as well as compiling other information about the drilling parameters. • The different technologies for the extraction of samples, or "cores", from the formation using special bits or wireline-conveyed coring tools are presented. • Students are introduced to the different types of Reservoir Simulation Models and to hydrocarbons extraction models. • The geology of Prinos Oil field and South Kavala Gas field, discovered near Thassos Island in North Aegean Sea, are presented. Are also presented the geology and the hydrocarbon potential of the offshore and onshore sedimentary basins in Western Greece and Southern Crete. The active petroleum systems within the EEZ of Cyprus, the Levantine basin, and the SE Mediterranean area are presented. • The course provides a technical training for the E&P industry. The course includes introductory to advanced training in key disciplines including Geology, Geophysics, Petrophysics, Drilling, Reservoir, Production, Facilities, Management, and Economics using Schlumberger's software tools including Petrel, Techlog, GeoX, PetroMod, ECLIPSE, Merak, Petrel GPM Carbonate Simulator and Petrel GPM Clastic Simulator.

NGGG 726E Groundwater Exploitation and Management: Works of groundwater exploitation from antiquity to the present (springs, wells, qanat, boreholes). •Pumping tests (constant flow-Dupuit method, non-constant flow-Theis and Jacob methods), recovery test, Radius of influence. •Characteristics of a pumped borehole (characteristic curve, critical discharge, specific drawdown, linear and nonlinear aquifer losses). •Groundwater uses - Water needs assessment. •Natural Recharge - Groundwater Balance - Groundwater Reserves. •Artificial recharge of aquifers (purpose, hydrogeological conditions for the application of artificial recharge, methods, the clogging problem). •Coastal aquifers - Seawater Intrusion - Ghyben-Herzberg Law - Measures of protection. •Groundwater aquifers management (groundwater aquifer functions, renewable and non-renewable groundwater, over-extraction, groundwater exploitation, groundwater management). •Types of aquifers in Greece. •Pumping test analysis- (Steady flow) • Pumping test analysis- (Unsteady flow- Theis method) •Pumping test analysis- (Unsteady flow-Cooper-Jacob method) •Radius of influence- Recovery test •Characteristics of pumped borehole •Coastal aquifers-Interface fresh and seawater •Calculation of water needs •Groundwater reserves-Groundwater balance •Design of borehole Field Trip In the frame of the course, a one-day field trip takes place in the Axios River basin. The field trip includes pumping test of borehole with constant rate and recovery test.

NGGN 727E Practical Training: The students work together with and under the guidance of the supervisor of the host organization, either public or private, for a short stay of 2 months. In parallel, a member of the School of Geology supervises the internship work program, the progress and the final report.

NGGN 728E Practical Educational Training: The purpose of the teaching of sciences with emphasis on the courses "Geology-Geography", "Geology-Management of Natural Resources". • Brief principles for managing a school class and respecting diversity in education. • Practice in teaching methodology, design, organization and conduct of teaching. . • Educational activities. From theory to practice. • Course assessment guide. Student Assessment guide • Practical exercise in Secondary Schools (Gymnasiums and High Schools). Observation of pilot courses conducting by experienced teachers. Supervised teaching (a full course or micro-courses). As part of their practical exercise students will have the opportunity to talk with experienced teachers about designing and realization of a lesson, the courses assessment and the students assessment. • Participation in educational activities of the School of Geology for all levels of education, lifelong learning, and popularization of Geology. • Presentation by each student of his/her personal dossier that includes: • his/her notes from the pilot courses he/she attended, • the electronic file of his/her supervised teaching (a course or two micro-courses), • his/her assessment by the school teacher, • the activities of the Department in which he/she is participated.

NGMC 729E Hydrometeorology: The hydrologic cycle and its components. • Precipitation: causes of precipitation, measurement of precipitation (rain gages, types of rain gages) and data analysis. Rainfall distributions and return periods. Storm analysis. • Snow: snow water equivalent, snow characteristics, snowmelt modeling over a watershed, snow cover distribution, critical temperature for rain-snow transition. • Droughts: definition, types and timing of droughts. Drought indices. • Soil moisture: soil structure, soil classification, soil water relationships, factors affecting water movement into and through the soils. • Floods: flood analysis, hydrograms, extreme river flow analysis, rainfall-runoff relationships (crosscorrelation). Assessment of flood vulnerability. Plotting flood sensitivity maps: implementation at basin level.

NGMC 732E Climate Change: Changes in Earth's climate history due to natural causes. The impact of humans on the planet's climate. Description of Anthropocene. Greenhouse gases - greenhouse effect - relation to the present global warming. Present and future climate assessment tools. Introduction to Climate Models (Statistical and Dynamic downscaling - Evaluation methods, spatial and temporal model analysis) Climate scenarios (Their evolution through time). Future projections - estimates of key climate parameters in the region of Europe, the Mediterranean and Greece. Estimated climate change in extreme weather events. Introduction to the impacts of future climate change on humans, ecosystems, the environment and society.

NGGG 734E Drilling Methods: Introduction to drilling techniques (historic review, basic concept and principles) •Methods of drilling •Drilling planning for geotechnical purposes •Methods of sampling •Borehole logging •Evaluation of boreholes and in situ testing •Hydro mastic projects •Methods of Borehole/Well drilling •Borehole/Well completion •Borehole/Well development •Well logging.

NGGG 735E Sedimentary basin analysis and sequence stratigraphy: The state of the Lithosphere and its influence to Sedimentary Basin Formation •Pull-apart Basins – Lithospheric Stretching •Compressional Basins •Strike-slip Basins. •Other types of Basins, e.g., Lithospheric Sagging etc. •Interpretational tools in Sequence Stratigraphy •System Tracts •Recognition of Sequence Boundaries •Composition and Interpretation of Chronostratigraphic charts and Wheeler diagrams.

NGMO 736E Laboratory Methods for Minerals and Rocks: INTRODUCTION: Stages in the study of a mineral or a rock. Data we need to gather. Analytical methods that can be used. • PREPARATION OF THIN, POLISHED AND THIN-POLISHED SECTIONS: Types of thin sections. Sample cutting. Thin section laboratory preparation. Materials used in thin section preparation. • EXAMINATION OF THIN SECTIONS UNDER THE POLARIZING MICROSCOPE: Information received from each kind of thin section. • MINERAL STAINING: When is mineral staining used. Types of chemical stains. Staining of potassium feldspar and carbonate minerals. Identification of minerals by Fluorescence. • POINT COUNTING: Study of minerals under the polarizing microscope. Quantitative determination of mineral components in a thin section by point counting. • MINERAL SEPARATION: Mechanical separation by hand. Magnetic separation of minerals. Mineral separation based on density with the use of heavy liquids. Mineral separation by flotation. • MINERAL MICROANALYSIS (SEM-EDS, SEM-WDS): Operating principle and description of an electron microscope. Operating principle of a scanning electron microscope. Type of detectors. Sample preparation. Applications of SEM-EDS. • ATOMIC ABSORPTION SPECTROSCOPY: Operating principle of atomic absorption spectroscopy. Sample preparation. Applications of atomic absorption spectroscopy. • X-RAY DIFFRACTION (XRD): Operating principle of X-ray diffraction. Bragg's law. Sample preparation. Applications of X-ray diffraction. • X-RAY FLUORESCENCE (XRF): Operating principle of X-ray fluorescence. Sample preparation. Applications of X-ray fluorescence.

NGGN 737E Topics in Geology: Selection of Geology – Geography – Meteorology – Petrology - Seismology - Applied Geology – Applied Geophysics – Climatology - Ore Deposits topics • Special literature search tools, methods and search engines • Organize Subject and Content • Creating a Digital Presentation • Writing a Scientific Text - Practices and Rules • Presentation of a Scientific Topic - Practices and Rules • Evaluation – Self-evaluation.

NGGN 739E Crystallography-Crystal Structure: Difference of amorphous-crystalline materials. Elements of crystal structure and relation to physical properties. Symmetry (Point Symmetry Groups / Space Symmetry Groups), lattice, unit cell, Crystalline Systems, Bravais frameworks, Exercises. • Crystallographic planes, Crystallographic directions, Examples / Exercises on Miller Indexes. • X-ray sources, Linear and Continuous Spectrum, X-ray Absorption, X-ray Devices, Examples. • Scatter, Structure Factor, Subtractions, Examples of P, I, F framework types. • X-ray diffraction, Bragg Law, Exercises. • Data processing, phase separation, indexing, determination of crystalline constants. Phase Identification with PC Identification Programs, Databases (PDF) Applications / Exercises. Analysis of the powder pattern profile and determination of the crystalline structure. Rietveld method. Finding crystalline structure of unknown compounds. Crystallographic Softwares. • Exercises in Research X-ray Diffractometers (XRD), X-ray Photoelectron Spectroscopy (XPS).

NGGP 834E Electrical and Electromagnetic Methods of Geophysical Prospecting: Scope of the course and importance of electrical and electromagnetic geophysical techniques in geophysical investigations. Short introduction, field of applications through field examples. Electrical and electromagnetic properties of rocks, definitions and their relationship with the geological, hydrogeological, mining characteristics. Electrical properties of rocks, minerals and geological formations. Basic relations between electrical and other petpophysical properties. Field demonstration of electrical and electromagnetic methods Field demonstration at locations of the Univ. Campus of the application of electrical and electromagnetic methods. Content Field demonstration of the application of geophysical methods

with the participation of students in groups that includes the collection of measurements in the field using the following geophysical techniques: electrical profiling, electrical sounding, 2D electrical and IP tomography, self-potential, VLF and GPR Evaluation method for students (if done separately from the course). The students deliver a relevant report with the basic interpretation of the collected field data.

8th Semester:

NGGN 801Y Bachelor Diploma Thesis I: The Bachelor Diploma Thesis I aims at introducing the student to the scientific research and / or the scientific literature, by communicating their results, both in writing and orally, in accordance with the current practice of the international scientific community. The current course's main object is the review of the scientific literature and the presentation of its results related to a specific scientific object.

NGGN 802Y Bachelor Diploma Thesis II: The Bachelor Diploma Thesis II aims at introducing the student to the scientific research and / or the scientific literature, by communicating their results, both in writing and orally, in accordance with the current practice of the international scientific community. The current course's main object is to conduct scientific research in a selected topic and the presentation of its results.

NGMC 821E Synoptic and Dynamic Meteorology: 1) INTRODUCTION Definition and aim of Synoptic and Dynamic Meteorology, historical overview. Sources of data (meteorological observations, weather forecasts) and educational information in the internet. 2) SYNOPTIC METEOROLOGY Surface and upper air meteorological observations. Construction and analysis of surface and upper air weather charts, weather forecasting. Identification and analysis of cyclones, anticyclones, troughs, ridges, jet streams and fronts on weather charts. Rossby waves. Use of thermodynamic diagrams in weather analysis. 3) DYNAMIC METEOROLOGY Meteorological coordinate systems. Lagrangian and Eulerian time derivatives. The equations of motion in the atmosphere. Scale analysis. Balanced flow (geostrophic wind, gradient wind, cyclostrophic wind, thermal wind).

NGMO 822E Mineral Raw Materials: Exploration – Sustainability – Environment: Mineral Raw Materials and Classification according to the Greek Mining Code • Sustainability of mineral raw materials and their relationship to the evolution of culture • European Mineral Raw Materials Policy • High-tech metals (Critical Metals) • Mining of Conflict Minerals • Market and prices of mineral raw materials • Factors and parameters of economic evaluation and estimation of mineral deposits • Methods and stages of exploration with emphasis on geological and mineralogical methods • Sampling, preparation and processing of the samples • Reserves-resources of mineral raw materials • Environmental impact from the exploitation of mineral raw materials • Reuse of old mining wastes - Recycling of metals • Circular economy.

NGMO 823E Exploration and Exploitation of Solid Fuels: "EXPLORATION AND EXPLOITATION OF SOLID FUELS": How Coal Is Formed. The Chemistry of Coal. Understanding Coal Geology and Geological Structures. Coal Stratigraphy and Coal Petrography. Types of Coal deposits and depositional environments of Coal accumulations. Exploration and reserves calculation. Characteristics of the Coal deposits and Mining methods. Overview of the global Coal industry. Uses. Energy production from biomass. Detailed Course Content: The four main types of Coals [peat, lignite, bituminous coal, anthracite] are formed from the accumulation of plant debris, usually in a swamp environment. The rate of plant debris accumulation must be greater than the rate of decay. Once a thick layer of plant debris is formed, it is buried by sediments [mud, sand, etc]. These are typically washed into the swamp by a flooding river. The weight of these materials compacts the plant debris and aids in its transformation into coal. The process will take a long time. Peat is an organic sediment, soft, recently accumulated, partially carbonized. Burial, compaction, and coalification will transform it into coal. Coal properties are related to three independent geological parameters, namely: coal rank, which is the measure of the degree of organic metamorphism (coalification) of a coal, ranging from low-rank peat to high-rank meta-anthracite and can be determined through a number of chemical and physical parameters, the maximum temperature and the coal quality parameters including the impact of waste rock on the value of mining projects. The course introduces students to the notions of Bituminization and Coalification, as well as to the methods of determining the degree of Coalification. 'Coal petrology' which is a microscopic technique used to determine a coal's rank (degree of coalification) and type (amount and category of macerals), is also presented, together with GCV (gross calorific value) [which is the quantity of heat produced by combustion when the water produced by combustion is allowed to return to the liquid state] and NCV (net calorific value) [which is the quantity of heat produced by combustion when the water produced by combustion remains gaseous]. The course also covers the chemical and physical properties of coal, and their proximate and ultimate analysis. Exploration methods, drilling, borehole logging, deposit evaluation, and quality assessment are presented. Students are introduced to solid fuels production software programs and to the biomass energy production basics. Finally, all uses of coal and the related environmental issues from mining and exploitation are analyzed.

NGGG 824E Geothermal Energy: Introduction to geothermal energy (historic review, basic concept and principles) •The heat of the earth and heat flow •Favorable geothermal conditions (globally and locally) •Geothermal systems and fields – Natural processes •Classification of geothermal systems •Geothermal exploration methods and techniques •Chemical characteristics, quality and

classification of geothermal fluids •Exploitation of geothermal resources – Renewability and sustainability •Environmental impacts and technical problems regarding the use of geothermal energy •Benefits and advantages of geothermal energy •The geothermal status of Greece (exploration, legislation, identified geothermal fields) •Geothermal energy applications around the world •Geothermal energy use in Greece.

NGGG 825E Geological Design of Engineering Works: General principles – Guidelines of geological designs for engineering works and •Design and execution of site investigation program •Measurements and analysis of tectonic data •Rock mass classification •Design parameters – putting numbers in geology •Engineering geological design of roadworks •Engineering geological design of slope stability •Engineering geological design of foundations of embankments and bridges •Engineering geological design of tunnels •Engineering geological design of dams.

NGGN 826E Information and Communications Technologies (ICT) in Geological Education: • Digital representations. • The role of media in the creation of multiple representations and visualizations for teaching / learning. • Interactive environments. • The structure and role of interactive technological environments (simulation, microworld, modeler) in teaching / learning. • The model of inventive / exploratory learning. • Simulated experiments on computing environments. • Digital animation and interactive environments in Geology: Ways of using these technologies in the fields of geology, virtual laboratories and simulations in all branches of Geology. • Digital Geographical and Geospatial education – ICT in Geography education. • ICT in teaching Meteorology and Climatology. • ICT in the teaching of Mineralogy-Petrology-Mining/deposits exploration. • ICT in the teaching of Geology. • ICT for Earthquakes and Volcanoes.

NGGN 727E Practical Training: The students work together with and under the guidance of the supervisor of the host organization, either public or private, for a short stay of 2 months. In parallel, a member of the School of Geology supervises the internship work program, the progress and the final report.

NGGN 728E Practical Educational Training: The purpose of the teaching of sciences with emphasis on the courses "Geology-Geography", "Geology-Management of Natural Resources". • Brief principles for managing a school class and respecting diversity in education. • Practice in teaching methodology, design, organization and conduct of teaching. • Educational activities. From theory to practice. • Course assessment guide. Student Assessment guide• Practical exercise in Secondary Schools (Gymnasiums and High Schools). Observation of pilot courses conducting by experienced teachers. Supervised teaching (a full course or micro-courses). As part of their practical exercise students will have the opportunity to talk with experienced teachers about designing and realization of a lesson, the courses assessment and the students assessment. • Participation in educational activities of the School of Geology for all levels of education, lifelong learning, and popularization of Geology. • Presentation by each student of his/her personal dossier that includes: • his/her notes from the pilot courses he/she attended, • the electronic file of his/her supervised teaching (a course or two micro-courses), • his/her assessment by the school teacher, • the activities of the Department in which he/she is participated

NGGG 827E Geotectonic evolution of Greece and Global Tectonics: Geodynamic evolution of the Alpine system •Apline geotectonic cycle •Comparative orogenic evolution of the Hellenides •Theories and models for the evolution of the Hellenides in the broader Mediterranean region •Neotectonic evolution and active geotectonic status of Greece •Significant tectonic structures globally •Structure and geometry of active continental margins.

NGGG 828E Environmental Hydrogeology: Introduction to the basic concepts of Hydrogeology – Terminology •Soil properties•Groundwater quality •Evaluation of hydrochemical data-Hydrochemical types of groundwater •Interaction of water and environment •Pollution and contamination of groundwater •Pollution sources and transport of pollution (advection, diffusion, hydrodynamic dispersion) •Soil as recipient of solid wastes - Sanitary Landfill- Site selection •Vulnerability of aquifers to external pollution •Disposal of wastewater on land, Soil-Aquifer-Treatment •Salinity of groundwater due to seawater intrusion •Impacts of climate change on groundwater •Protection and remediation of aquifers

NGMO 829E Gemmology: 1. About gems - Historical background in their manufacture, uses, transportation and trade 2. Physical, chemical, optical properties - Cutting style of gems 3. Diamond (colorless and colored), Corundum (Ruby, Sapphire), Beryl (Emerald, Aqua Marina, Morganite, Heliodorus) 4. Quartz varieties (e.g. crystal quartz, amethyst, citrine, agate, onyx, carnelian), Jasper, Opal, Obsidian, Chrysoberyl (e.g. alexandrite), Zoisite (e.g. tanzanite), Spinel, Zircon, Topaz, Spodumene (e.g. kunzite) 5. Garnet (e.g. tsavorite, demantoid), Tourmaline (e.g. paraiba-type, rubellite), Olivine (Peridot), Lapis Lazuli, Turquoise, Jade (Nephrite and Jadeite), Feldspar (e.g. amazonite, labradorite, moonstone) 6. Gemstones with optical effects (e.g. color change, star-effect) 7. Organic Precious Materials (Pearl, Coral, Amber or Electro, Ivory, Jet, Nacre, Fossil Wood, Horn, Bone) 8. Geology of gems (e.g. primary deposits in kimberlite, pegmatite, marble, amphibolite, skarn; secondary deposits in alluvial depositions) - Organic gems growth 9. Gems' provenance - Gemstones of Greece 10. Gem Treatments (heat treatment, irradiation, clarity enhancement etc.) 11. Synthetic gems - Imitations 12. Classic gemological methods (e.g., microscope -inclusions, specific gravity, refractive index, fluorescence under UV lamps) - Grading 13. Application of non- or micro-destructive methods for gem analysis (e.g. spectroscopic and chemical methods).

NGGG 830E Field Geological Mapping: •Types of special geological mapping •Principles of large-scale geological mapping •Tectostratigraphy based on geological mapping •Identification of geological and tectonic structures in geological maps •Construction of detailed geological cross sections •Contribution of geological maps in understanding

the geotectonic structure and evolution •Technical specifications of geological mapping studies •Methods of digital field mapping •Large-scale field mapping of a specific area •Preparation of a digital geological map and drafting its accompanying technical report.

NGGE 831E Oceanography: • Introduction. History of Oceanography. The origin of the ocean water. • Geography of the hydrosphere. Oceans and seas. Geographical boundaries of the oceans. Dimensions of the ocean basins. Bathymetric characteristics. Definitions of underwater morphological characteristics. • Geomorphology of the Ocean Basins and Continental Margins and their relation to Geotectonics. • Physicochemical characteristics of water. Chemical composition of seawater. The Biogeochemical cycle. Seawater Temperature and Salinity. • The sound in the water. Propagation and attenuation of sound in water. Sounding Devices. • Light in water. Propagation of light in water. The sunlight in the sea. The color of the sea. Measurements of the optical characteristics of water. • The density of the seawater. International Equation of State of seawater. Ocean masses. • Ocean Circulation and Currents. Ocean Currents and Marine Sedimentation. • Waves. The Airy Theory. The Stokes' Theory. The Solitary Waves Theory. Wave Braking Theories. Wave refraction. • Tides. Tidal measurements. Practical environmental applications of tital and sea-lever monitoring. Daily Field Exercise on "Coastal Oceanography" • Exercise Implementation Area: Peraia Beach Thessaloniki. On this particular beach is a pier 150m long, reaching depths up to 4 m, acting as a safe and stable platform for instrumental measurements implementation with student groups. • Field Exercise Content: -Coastal Oceanography, equipment and tools used in coastal research and their applications, field measurements and sampling: • Use of instruments for Water Sampling, • Use of CTD (Conductivity-Temperature-Depth) instrument, • Use of Sonar for depth measurements and water-depth profiling, • Use of ROV for depth/underwater photography. -Demonstration of the use of instrumentation and software in coastal research. Most of the measured parameters are included in the context of Laboratory Exercises and the collected data are processed later in the class.

NGGE 833E Geological and Environmental Applications of Geospatial Data Analysis: • GIS Toolboxes • 3D representation and analysis of geospatial data • Imaging and spatial analysis of earthquake epicenters, other geological and GNSS data • Management of meteorological and climatic data • Extraction and classification of drainage basins and hydrographic networks from digital elevation models • Calculation of erosion / deposition rate in coastal areas • Calculation of perimeter, area, and volume of a water body • Assessment of susceptibility to landslides • Assessment of flood susceptibility, hazard and risk • Delineation of locations suitable for waste landfill sites • GIS and Remote Sensing synergies for quarry monitoring • GIS and Remote Sensing synergies for the detection and delimitation of oil spills • GIS and programming.

NGGP 835E Engineering Seismology: 1. INTRODUCTION – SEISMICITY MEASURES Seismology and society – strongest earthquakes globally and during the 20th century - Economic consequences of earthquakes. Most destructive earthquakes in Greece. Earthquake prediction. Early warning systems. Quantitative measurement of seismicity. Magnitude distribution of earthquakes (Gutenberg-Richter). The importance of b parameter for estimating the seismicity level. 2. GROUND MOTION MEASURES Accelerographs – accelerometers. Factors defining the strong motion (focus, magnitude, path, site). PGD, PGV, PGA. Duration and energy characteristics of strong motion. 3. ATTENUATION RELATIONSHIPS Seismic waves attenuation – Elastic medium: Geometric dispersion – anelastic attenuation – quality factor Q. Velocity and acceleration spectra – attenuation models, use in seismic hazard assessment. Use of GMPEs in seismic codes. Effect of path and local site effects. 4. SITE EFFECTS Definitions. Methods to evaluate site effects. a) Experimental – empirical: ambient noise (Kanai 1956), Spectral ratios over a reference station (SSR). Horizontal over vertical spectral ratio (HVSR). Coda waves technic b) Theoretical: simple models, analysis of ground response (1D or 2D). 5. MACROSEISMIC EFFECTS Macroseismic observations – macroseismic intensity. Isoseismal maps. Isotropic and anisotropic radiation. Relations connecting intensity with magnitude and distance for Greek earthquakes. Near real time shake maps after strong earthquakes. Epicenter and magnitude estimation based on macroseismic observations of historical earthquakes. 6. SEISMIC HAZARD Seismic hazard measurements: Maximum expected values of intensity, magnitude, PGA and PGV. Maximum and dominant values of expected ground motion. Probabilistic and deterministic methods of seismic hazard assessment. 7. STRUCTURES RESPONSE Structure motion equation (single degree of freedom oscillator). Technical structure parameters (oscillation period, damping factor and plasticity index). Elastic and inelastic response spectrum. Design ground motions. Seismic response and design spectra. Structured pseudospectra. Hellenic Seismic Code. Dynamic and static seismic response estimation. Soil classification. Seismic zones. 8. MICROZONATION STUDIES Detailed assessment of ground response for an area. Evaluation of required variables for earthquake planning. Calculation and representation of various parameters distribution at sub-zones of the study area. Seismic hazard scenarios. Composition of microzonation studies.

NGGN 891E Field Course 5: Geology of Attikocycladic zone. Geology of Cyclade Islands. • Pre-volcanic basement of Santorini • Minoan eruption phases, 1613 B.C. • Main phases of the Minoan eruption, Riva • Paleosoil • Rock slope stability of volcanic formations • Akrotiri volcanism, 2 Ma – 500 ka • Akrotiri faults • Scoria cones, 450 – 340 ka in Red Beach • Slope stabilty-hazard and risk assessment of rockfalls along Red Beach • Akrotiri Archeological Site • Vlihada (Minoaneruption, 1613 B.C., 4thphase) • Perissa- Pre-volcanic basement • Fira fault • Nea Kameni (Nea Kameni lavas, 1570 – 1950 A.D.) • Palea Kameni (Palea Kameni lavas, 47 B.C. – 726 A.D.) • Thirasia (Observations along caldera walls) • Oia (Observations along caldera walls) • Skaros

(Observations along caldera walls) • Seismicity of the broader area – Monitoring Network – The earthquake of 1956 • Stromatolites – Kolumbo • Mikros Profitis Ilias – Peristeria Volcano, 530 – 430 ka • Fault in gand the Kolumbo line • Megalo Vouno (Scoria cone, 60 – 40 ka) • Oia Ammoudi Red Ignimbrite, 40 ka, Riva – Lava – Scoriae • Oia Ammoudi– Rock slope stability measures • Oia (Goulas) – Undermining of old castle of Goulas foundation and slope stability of pyroclastic slopes • Kolumbo tephra 1650 A.D. • Kolumbo cape - Tuffrings, 60 – 40 ka, Stromatolites, faults.

NGGG 892E Field Course 6: Geological cross-section of NE-SW direction across the Hellenides in northern Greece, identification – study of the Hellenides geotectonic zones (composition, structure, evolution) and their geotectonic significance. Study of the engineering geological behavior of the Hellenides geologic formations in construction works (dams, tunnels, roadworks) failure phenomena and landslides. Exercises on the respective subjects handed in on site by the students. Indicative examples: hand in Road slope slide Stability analysis of cut slopes (measurements of discontinuities, mechanisms of failure) Rock mass classifications Tunnel failure mechanisms.

9. School of Geology: Location - Buildings

The School of Geology is located in the building of the **Faculty of Science (F.S.)**, in **the Biology Building**, with additional locations in the **Meteorological Center (Meteoroskopeio)** and the **Seismological Center**.

Department of Geology
F.S. – Ground Floor – West Ward & 2nd Floor – East Ward – New Wing

Department of Mineralogy-Petrology-Economic Geology
F.S.- 1st Floor – West Ward and Center & 2nd Floor – West Ward – New Wing

Department of Geophysics
F.S. -2nd Floor – West Ward (New Wing) & Seismological Center- *Kathigitou Vizoukidou 43, 40 Ekklisies*

Department of Meteorology and Climatology
Meteroskopeio & F.S. – New Wing

Department of Physical and Environmental Geography
F.S. – 2nd Floor – Center – New Wing

Administration Office
Biology Building - Gound Floor – Outer Entrance

Class Halls

ΠΑΑ Palaia Anatoliki Aithousa (Old Eastern Hall) 1st floor F.S.
ΠΔΑ Palaia Ditiki Aithousa (Old Western Hall) 1st floor F.S.
Δ22 Ground Floor Western Wing S.F.
ΑΜ Amfitheatro Meteoroskopeio "Basileios Kiriazopoulos", Meteoroskopeio
ΑΧ Amfitheatro in the Old Chemistry Building
ΑΝΧ Amfitheatro in the New Chemistry Building

Laboratory Halls/ Rooms

E01 Geology and Paleontology Lab Hall Ground Floor of the F.S. (Ioannis Melentis Hall)- Western Ward

E02 Lab Hall of Crystal Structure Ground Floor of the F.S – Eastern Ward

E11 Mineralogy Lab Hall - «Ilias Sapounitzis» First Floor of the F.S- Western Ward

E12 Microsopy Lab Hall « Petros Kokkoros» First Floor of the F.S-Western Ward

E21 Physical Geography Lab Hall - Second Floor of the F.S- Center

E22 Lab Hall of Metalographic Microscopy - Second Floor of the F.S-Western Ward

E23 Geophysics Lab Hall - Second Floor of the F.S- New Ward

E24 Engineering Geology Lab Hall - Second Floor of the F.S- Eastern Ward

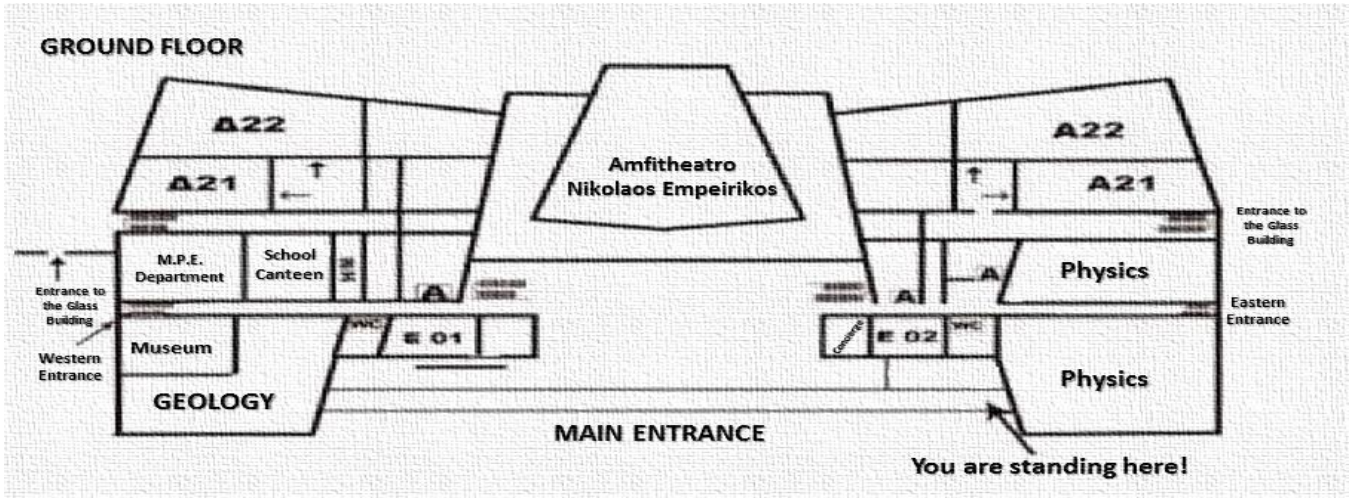
X11 Physics- Chemistry Lab Halls- Ground Floor Old Chemistry Building

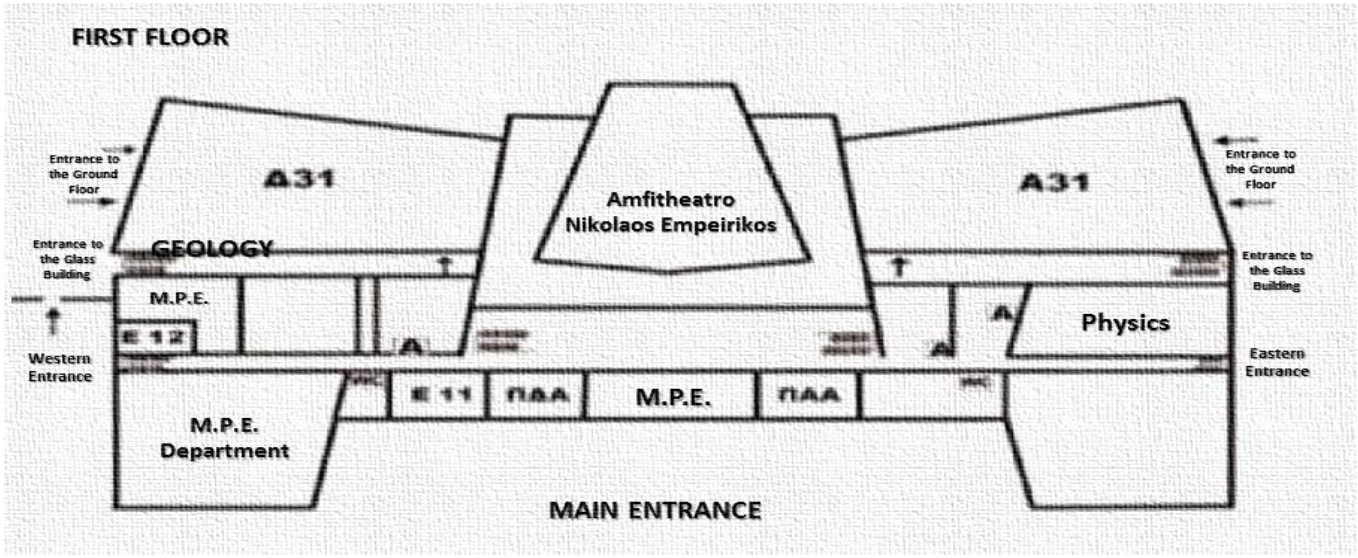
X21 Halls 420, 429-Lab of Inorganic Chemistry- Second Floor Old Chemistry Building

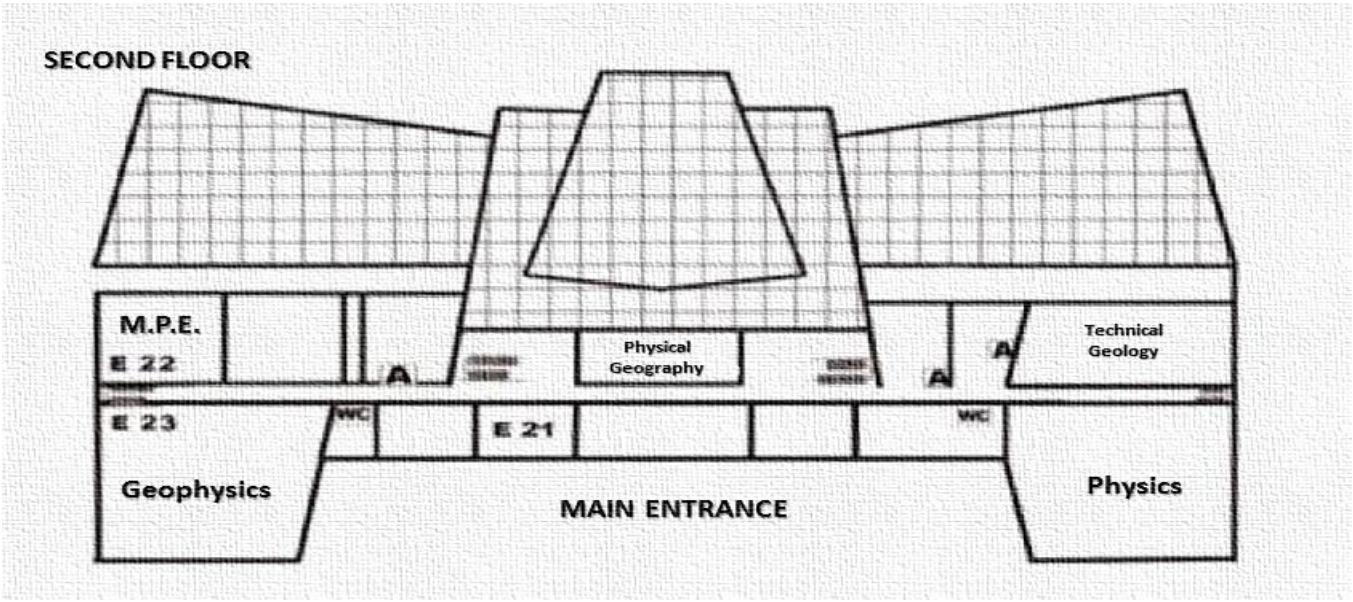
HALL B' Analytical Chemistry – Ground Floor New Chemistry Building

Computer Lab: Ground Floor Biology Building, Library of the School of Geology

10 Outline of the Building of the Faculty of Science







11. Useful Information and Student Services

EUROPEAN PROGRAMS "ERASMUS +"

Erasmus+ is a EU funding program for education and training, aiming at strengthening qualifications, skills and employability, as well as the modernization of the educational and life training systems. The basic action of the program is the students' and staff mobility between the EU and other collaborating countries for studies and training. The period abroad can range from a few days (for the staff), one or in some cases more semesters (for students). Erasmus+ has become international since 2015 (Erasmus+ International Credit Mobility Program), allowing for mobility from and to other countries of the world (Partner Countries).

The School of Geology has developed colaborations (agreements) with a large number of European and non–European Universities or Institutes in the framework of Erasmus+ program. Students can obtain all the necessary information from the coordinators of each agreement. The ERASMUS Program Coordinator for the School of Geology is Professor E. Papadimitriou (ritsa@geo.AUTH.gr).

Further information is available at the Department of European Educational Programs, Aristotle University of Thessaloniki. Tel. (+30 2310) 996727, http://www.eurep.AUTH.gr/index.php

EUROPEAN CREDID TRANSFER SYSTEM (ECTS)

The academic unit ECTS is a numerical value (between 1 and 60) applied to each course in order to describe the work-load required from each student to complete it. The ECTS units reflect the work quantity (measured in hours) necessary for each course in relation to the total work quantity for the fulfilment of a whole academic year (i.e. course attendance, laboratories, exercises, examinations, work for undergraduate thesis, etc.). For a successful completion of the School of Geology B.Sc. degree, a student must accumulate a minimum of 240 ECTS within a period of eight semesters, at the indicative rate of 30 ECTS credits per semester. The grading equivalence between the European and the Greek system is presented below:

European System		Performance	Greek System
A	**EXCELLENT**	Outstanding performance with minor errors	9-10
B	**VERY GOOD**	Above the average, with some errors	8
C	**GOOD**	Generally good performance with notable errors	7
D	**SATISFACTORY**	Fair but with significant errors	6
E	**SUFFICIENT**	Performance meets the minimum criteria	5
FX	**FAIL**	Additional work is required	<5
F	**FAIL**	Much more additional work is required	<5

ACADEMIC CALENDAR - HOLIDAYS

The academic year starts on September 1st every year and ends on August 31st of the following year. The educational work of every academic year is structured in two semesters, the fall semester and the spring semester, each of which comprises 13 weeks of teaching and two or three weeks of exams. Fall semester courses start in the last week of September and end in late January, followed by the first exam period of the fall semester. Spring semester courses start in mid-February and end at the end of May, followed by the first exam period of the spring semester. The exact dates are determined by the University Senate. In extraordinary cases, however, upon recommendation of the Senate, the start and end dates of the two semesters may be fixed by the Minister of Education, so as to ensure the required number of teaching weeks. Every semester has two exam periods:

Fall semester courses are examined during the exam period January-February and re-sit exams are held in September;

Spring semester courses are examined during the exam period of June and re-sit exams are held in September.

Neither courses, nor exams are held in July and August, the two months of summer holidays. Holidays also include:

Christmas Holidays: December 24 to January 7.

Carnival Holidays: from Thursday before Lent to the day after Lent Monday.

Easter Holidays: from the Monday of Easter Week to the Sunday after Easter Sunday.

October 26: Saint Dimitrios Day, Feast of the city's Patron Saint., Liberation of Thessaloniki from the Ottoman rule (National Holiday).

October 28: National holiday Commemoration of the "No" to Italian fascism.

November 17: Student's uprising in the National Technical University of Athens against the junta in 1973.

January 30: The Three Patron Saints of Education Day.

March 25: National Anniversary of the revolution of 1821 against the Turkish rule.

May 1: Labor Day.

Holy Spirit Day: Monday after Pentecost.

STUDENT ASSISTANCE AND HEALTH SUPPORT

All AUTH students have the opportunity to request the assistance, for a specific time period, of special University services in order to support or help them in problems they encounter during their studies. Moreover, they can volunteer themselves by offering their assistance to their colleagues / classmates who may are in need.

Social Policy and Health Committee (SPHC)

The Committee on Social Policy and Health aims to create conditions that will make the University Campus accessible to all its members, giving particular emphasis on people with special needs and/or disabilities, where the difficulty of accessibility in the space makes access to knowledge difficult.

For the students with vision problems and upon their request, printings of books and notes on Braille printers is provided, at the Central Library of AUTH.

There are also two buses available, for the service of students with mobility disabilities, in order to facilitate their transportation during the academic year and during the examination period.

Moreover, SPHC, a Voluntary Blood Donation at the Aristotle University of Thessaloniki has established, following the development of a Blood Bank at the AHEPA University hospital, while since May 2007 a Blood Bank was established at TEFAA Serres in collaboration with the EKPY and the General Hospital of Serres. The Voluntary Blood Donation takes place twice a year, during autumn and spring, at the Ceremony Hall of AUTH. The ultimate goal is to cover the needs for blood by the Voluntary Blood Donation, which currently covers about 40% of the total needs. Participation in blood donation, which is a safe procedure without complications, can be enjoyed by anyone over the age of 18 who does not have specific health problems.

Website: https://studentaid.AUTH.gr/
tel: 2310 999 888
E-mail: studentcare@AUTH.gr

Committee of Social Welfare, Psychological Support and Student Observatory - AUTH Counseling and Psychological Support Center.

The Committee of Psychological Support takes care of the operation of the university structures related to the psychological support and help for all AUTH students. Specifically, it suggests and leads actions for:

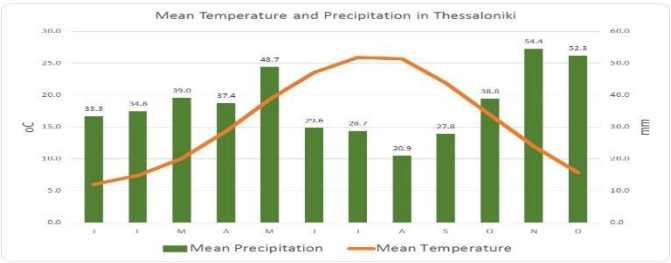
- ✓ The organization and improvement of the operation of the Counseling and Psychological Support Center (KESYPSY) that operates at the University, and
- ✓ The promotion and dissemination of the work of KESYPSY with the aim of informing about the services provided.

The Counseling and Psychological Support Center (KESYPSY) is a service of the Aristotle University of Thessaloniki that has been operating since 1999. It provides to the students of AUTH free counseling and psychological support services on issues that concern them, such as: anxiety, stress, difficulties in adapting to a new environment or in studies, family / personal difficulties, sexual issues, psychosomatic problems, etc., but also informative actions on issues relating to their academic and daily life. Advice and information seminars are also provided to faculty members and administrative staff on issues of students' concerns. The KESYPSY is located on the ground floor of the Lower University Student Club, in the area of the Health Service.

Website*: http://kesypsy.web.AUTH.gr*
tel.: 2310 992643 & 2310992621

12. Welcome to Thessaloniki – Our city

THE CLIMATE:



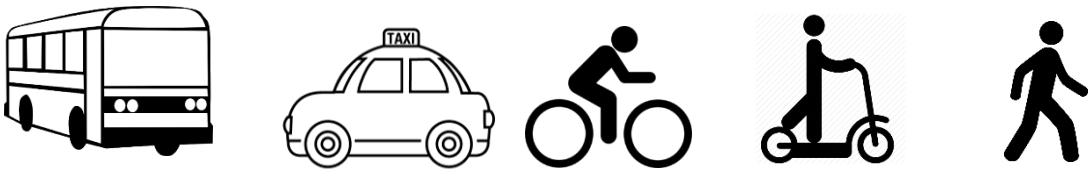
Winter average Tmean = **7.1°C**

Summer average Tmean = **25.1°C**

www.meteo.geo.AUTH.gr

WAYS TO MOVE AROUND THE CITY:

- By bus (http://m.oasth.gr/)
- By taxi (the taxi in Thessaloniki are blue!)
- By bike
- By electric scooter
- On foot



SPECIAL THESSALONIKI TRADITIONAL FOOD:

- Pita Gyros
- Koulouri
- Troureki
- Bougatsa
- Trigona Panoramatos

IT IS WORTH VISITING:

The **15 UNESCO MONUMENTS OF THE CITY** (Thessaloniki Tourism Organization: www.thessaloniki.travel) such as:

- The White Tower
- The Statue of Alexander the Great
- Rotonda
- Kapani Market

USEFUL TELEPHONE NUMBERS AND SITES:

EMERGENCY POLICE CALL 100
GENERAL POLICE DIRECTORATE Site: http://www.astynomia.gr/ 2310 388000, 2310 388006-7, 2310 388009
IMMEDIATE AID CENTER 166
ON DUTY DRUGSTORES 14944
ON DUTY HOSPITALS AND CLINICS 14944
MUNICIPALITY OF THESSALONIKI 2310 877777, 2310 877099
ARISTOTLE UNIVERCITY OF THESSALONIKI: 2310 996000
FIRE DEPARTMENT 199
UNIVERCITY GENERAL HOSPITAL AHEPA: 2313 303110-1, 2313 303310
Site: http://www.ahepahosp.gr/
THESSALONIKI AIRPORT | SKG 2310 985000, 2310 473212, 2310 473312, 2310 985177, 2310 98518
Site: http://www.thessalonikiairport.gr/

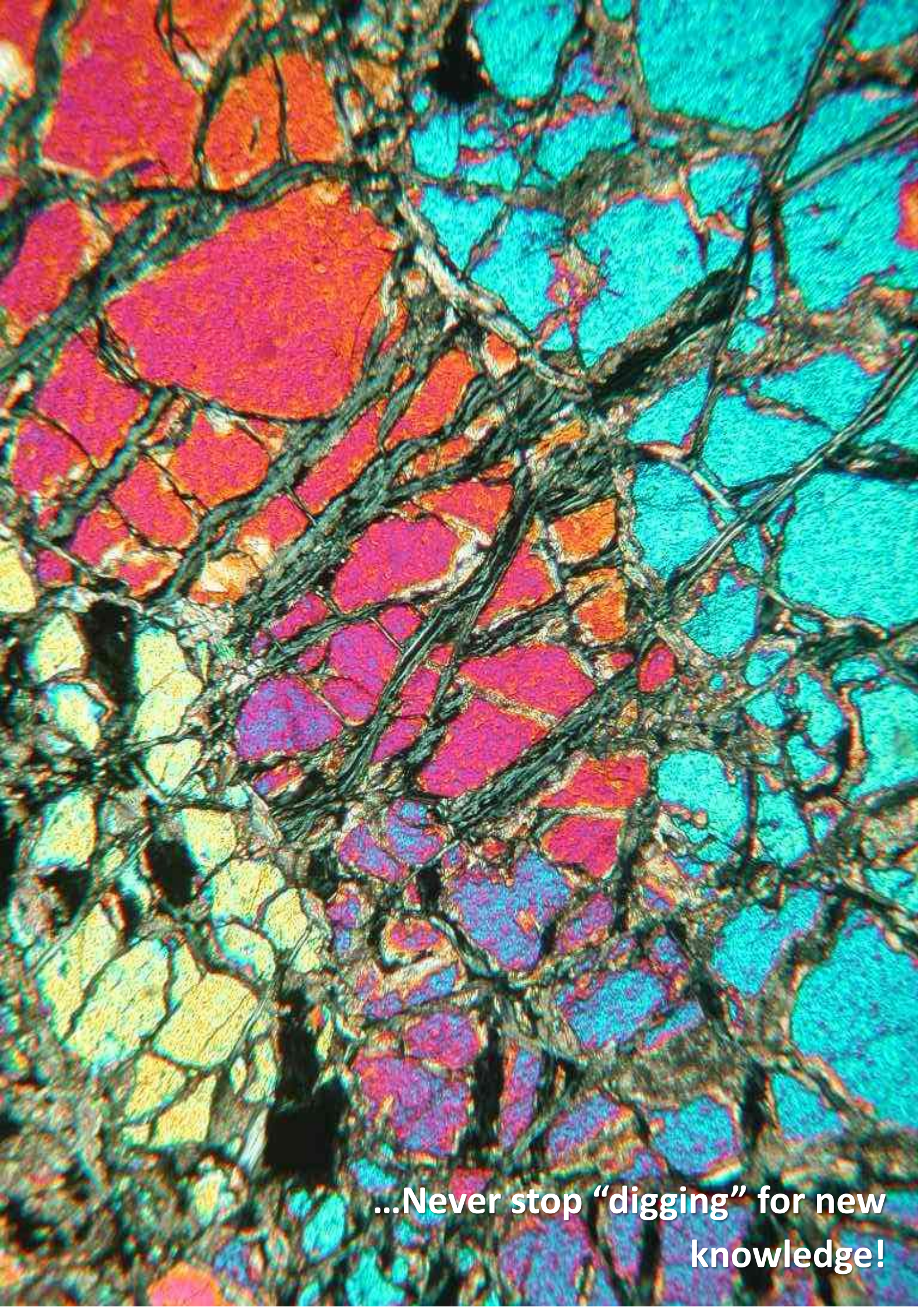
USEFUL GREEK PHRASES:

- Geia sas - Hello
- Efharisto – Thank you
- Parakalo – You are welcome/ Please
- Ti kanis? – How are you?
- Poso kostizei? – How much does it cost?
- Panepistimio – University
- Geologia - Geology

EXCURSIONS - ENTERTAINMENT

- Halkidiki – Pieria (with blue flagged beaches)
- Olympos Mountain
- Vergina Mouseum
- Interantional Film Festival
- Alexander the Great International Marathon and nigh half Marathon

And much more on the site of Thessaloniki Tourism Organization: www.thessaloniki.travel


…Never stop “digging” for new knowledge!