PANGEA

Co-funded by the Erasmus+ Programme of the European Union

SYLLABUS

National and Kapodistrian University of Athens, NKUA
SECOND TERM
PANGEA TRACK/PROFILE: 2 – APPLIED PALAEONTOLOGY

TITLE OF UNIT: Climate Variability (paleoclimate) and climate change (anthropocene)

NUMBER of ECTS: 7

OPTIONAL or COMPULSORY (if applicable): **COMPULSORY**

PREREQUISITES (in term of either skills or knowledge or units to be validated before registration to this course):

MODE OF TEACHING (distance education, webinar, workshops, seminars, lectures, supervised projects, etc):

- **Face to face (lectures and seminars)**
- **Use of PC, tablets, smartphones and specialized software**
- **Access to databases and scientific libraries**
- **Demonstration of method and techniques used in Climatology and Palaeoclimatology**
- **Supervised Projects**
- **Possibility of distance learning (e-exercises) and communication (discussion areas, blogging, messages, etc.) via the electronic platform e-class o NKUA**: https://eclass.uoa.gr/courses/GEOL459/

Number of hours dedicated to lectures, practices, field-excursions, etc: **52 jours**

Personal workload (hours expected to be dedicated to, including supervised projects): **123 hours**

Description of the course

General aims

The aim of the course is to give an understanding of the processes that determine and change the Earth's climate system at different spatial and temporal scales by studying climate variability at different geological times and climate changes during the anthropocene.

Expected outcomes (knowledge)

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

- the key processes that determine the climate system of the earth and the main natural mechanisms of climatic variability
- how and why the earth's climate has changed in geological time

- the methods that identify the paleoclimate, to project their use and to describe their limitations
- the natural and anthropogenic mechanisms of global climate change

- the uncertainties associated with the future projections of global climate change
- the current scientific knowledge related to adaptation and mitigation strategies for climate change impacts

Expected outcomes (skills)

Students will be able to

- Identify and discuss global and regional climate factors, including the carbon cycle, tectonic changes, solar radiation, ocean-atmosphere interactions, anthropogenic influences
- Analyse paleoclimatic data, climatic data and climate simulation data to draw conclusions about the past, present and future climate and
- Generally communicate the climate history and the human role in the climate system and critically evaluate scientific information.

Content summary

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

- Components of the global climate system, distribution of basic climate data, natural climate variability in different space and time scales, atmospheric-ocean interaction, atmospheric oscillations (ENSO, MJO, NAO etc.), forcing and feedback mechanisms
- Greenhouse phenomena in paleo-ocean, the Paleocene–Eocene Thermal Maximum (PETM), the Mid- Miocene Climatic Optimum (MMCO) and the mid-Pliocene Warm Period (mPWP)
- Glacial periods of the Upper Cenozoic, sea level changes
- Isotopic archive and Milankovich circles, Dansgaard circles, Heinrich events
- Paleoclimate reconstruction methods with the use of palaeobiological data
- Observed signals of climate change in the anthropocene, factors of climate change (natural and anthropogenic)
- Basic principles of climate models, climate change scenarios and climate simulations, uncertainties related to future projections of global climate change
- Impact of climate change on the environment, human activities and health, adaptation strategies and mitigation of climate change impacts, sustainable development.

Person in charge of the unit (first and last name, e-mail)
Maria Hatzaki, marhat@geol.uoa.gr

EVALUATION MODE (final exam, oral defence, report...)	Ratio of the final grade
Oral defence	**70**
Supervised Projects	**30**

TITLE OF UNIT: Environmental Sedimentology and applications

NUMBER of ECTS: 8

OPTIONAL or COMPULSORY (if applicable): **COMPULSORY**

PREREQUISITES (in term of either skills or knowledge or units to be validated before registration to this course):

MODE OF TEACHING

- **Face to face (lectures and seminars)**
- **Use of PC, tablets, smartphones and specialized software**
- **Access to databases and scientific libraries**
- **Laboratory : method and techniques used in Environmental Sedimentology**
- **Field work: a case study**

Number of hours dedicated to lectures, practices, field-excursions, etc: **100 hours**

Personal workload (hours expected to be dedicated to, including supervised projects): **100 hours**

Description of the course

General aims

The content of this course provides graduate students with a working knowledge of environmental sedimentology: main concepts, issues and methods of the sedimentary systems imprinting environmental changes due to climatic/anthropogenic activities.

Expected outcomes (knowledge)

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

- Fully explain the fundamental concepts of environmental sedimentology
- Carry out studies in the sedimentary environments and to identify the present day environmental changes due to climatic/anthropogenic activities.
- Develop critical and creative thinking and communication skills related to environmental i
- Solve problems with the study of the potential imprint related to sedimentological research in all environments
- Produce, analyse and compare data with the use of reliable and applied technologies
- Identify, evaluate and make decisions on the right management of problems deriving from anthropogenic activity in urban sedimentary environments

Expected outcomes (skills)

Theoretical thinking and ability to convert theory into practice
Ability to solve environmental problems based on the study of sediments
Search, analysis and synthesis of data and information, using the necessary techniques
Decision making

- Autonomous work
- Teamwork
- Working in an interdisciplinary environment
- Respect and adopt in the ever evolving natural environment
- Promote free, creative and inductive thinking

Content summary

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

- Introduction on the impact of present day environmental change due to anthropogenic activities including modification of sedimentary systems. Response of ever evolving sedimentary systems to sediment budgets and pollution. Change and vulnerability of sedimentary environments due to climatic and direct anthropogenic impact on:
- Continental settings
- Coastal settings
- Open sea settings
- Synthetic Laboratory exercise on sedimentological environmental tracers
- Synthetic exercise presentation

Person in charge of the unit (first and last name, e-mail):
Professor Georgios Anastasakis, anastasakis@geol.uoa.gr

EVALUATION MODE (final exam, oral defence, report…)	Ratio of the final grade
- Examination through short essays / exercises during semester - Laboratory practices and reports	**0.3** **0.3**
- Final essay presentation on a topic chosen by the students with Academic guidance	**0.4**

TITLE OF UNIT: Quaternary Geoenvironments – Geoarcheology

NUMBER of ECTS: 7

OPTIONAL or COMPULSORY: **COMPULSORY**

MODE OF TEACHING: **lectures, laboratory practice, practices with microscopes and specialized software**

Number of hours dedicated to lectures, practices, field-excursions, etc: **48 hours**

Personal workload: **148 hours**

Description of the course

General aims

Understanding of the dynamics of Quaternary Geoenvironments and their intertemporal interaction with human societies. Comprehension of the Historic Landscape by studying the physical and human processes that have formed and altered the image of our planet.

Content summary

- Man and the geoenvironment, basic principles of Archaeology, Geoarchaeology.
- Dating methods in environments of archaeological interest: archaeological time, absolute dating, age modeling.
- Palaeogeography and Palaeoenvironment: methods, reconstruction, evolution. Methodologies of sampling and analysis, palaeoenvironment in sites of Archaeological interest. Contribution of fossil data in archaeological research and Quaternary palaeoenvironment interpretation.
- Quaternary sea level changes, sea level indicators. Mapping of the coastal zone using high-resolution multibeam systems. 3D morphology of the coastal zone using ROV.
- Historic Landscape, human /environment interactions, land use, climate instability and human societies.

Expected outcomes (knowledge)

Ability to comprehend the archaeological research environment, recognise interdisciplinary questions. Ability to combine knowledge from the entire spectrum of Geosciences in order to approach geoarchaeological questions.

Expected outcomes (skills)

Selection of the appropriate methodologies and application of the required sampling techniques or field data collection methods in order to address specific interdisciplinary questions. Processing, evaluation and synthesis of geoenvironmental data in order to address geoarchaeological questions. Communication of research results in an interdisciplinary audience.

Practices include a) processing of palaeobiological data to address geoarchaeological questions and b) processing and interpretation of sea level proxy and bathymetric data and creation of photomosaic. Case studies from Greece and the Eastern Mediterranean are discussed.

Person in charge of the unit (first and last name, e-mail)
Katerina Kouli, akouli@geol.uoa.gr

EVALUATION MODE (final exam, oral defence, report...)	Ratio of the final grade
Short individual practice exercises	**35**
Report	**50**
Oral defence	**15**

TITLE OF UNIT: Geographic Information Systems in Environmental Applications

NUMBER of ECTS: 8

OPTIONAL or COMPULSORY (if applicable):

PREREQUISITES (in term of either skills or knowledge or units to be validated before registration to this course):

MODE OF TEACHING (distance education, webinar, workshops, seminars, lectures, supervised projects, etc): **Lectures, Practical exercises**

Number of hours dedicated to lectures, practices, field-excursions, etc: **52 hours**

Personal workload (hours expected to be dedicated to, including supervised projects): **148 hours**

Description of the course

General aims: This course aims to a better understanding of Geographic Information Systems and its basic principles, and geographical data processing, as these are necessary tools for geosciences. The students will become familiar with Geographic Information Systems in a theoretical and practical level, using suitable software.

Expected outcomes (knowledge): By the end of the course students will be able to use GIS software for developing maps, building databases, developing processing and analysing data, modelling natural hazards, developing environmental maps

Expected outcomes (skills)

By the end of the course, students will have acquired the following skills:

- Search, analysis and composition of data and information by using the necessary technologies
- Theoretical thinking and ability to turn theory into practice
- Problem solving ability through application of knowledge
- Independent work
- Team work
- Work in interdisciplinary environment
- Respect of the natural environment
- Promotion of free, creative and inductive thinking

Content summary

Introduction to digital cartography, G.I.S. Theory, Introduction to ArcGIS, GIS operation method, Geo-reference, Digitization, Management of Geographical and Descriptive In-formation, Import Data: Vector and Raster, Data Analysis, Thematic Cartography, Map Composition, Digital

Elevation Models, GIS applications in Geosciences, Modelling erosion, flood risk and coastal erosion.

Person in charge of the unit (first and last name, e-mail)

Niki Evelpidou, evelpidou@geol.uoa.gr

EVALUATION MODE (final exam, oral defence, report...)	Ratio of the final grade
Performance during lectures and laboratory exercises	**50%**
Project in the end of semester - Oral defence	**50%**