CultTech

MSc Cultural Heritage Materials & Technologies

STUDENT GUIDE

Partner institutions:
University of the Peloponnese
National Centre for Scientific Research “Demokritos”
National Observatory of Athens

Duration: 3 semesters
Tuition fees: 4,000 €
Location: Kalamata, Greece
Language: English
ECTS: 90 credits

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1. Cross-Institutional Master of Science in “Cultural Heritage Materials and Technologies”

The Master’s Programme **Cultural Heritage Materials and Technologies (CultTech)** was founded in 2015 (Government Gazette 3181/B΄/02.08.2015) and renewed in 2018 (Government Gazette 4975/B΄/08.11.2018, according to Law 4485/2017) as a cross-institutional programme involving three partner institutions: The University of the Peloponnese (Department of History, Archaeology, and Cultural Resources Management), The National Centre for Scientific Research “Demokritos”, and the National Observatory of Athens.

Studies in the interdisciplinary field of Archaeological Science aim to bridge the gap between Archeology and the Natural Sciences. MSc CultTech is designed to provide broad yet detailed theoretical knowledge and practical experience in the main applications of science in Archaeology.

Courses taught focus on all the main directions of Archaeological Science, such as archaeological materials, dating, geoarchaeology, field research, 3D imaging and reconstruction, etc. Theoretical courses in Landscape Archeology and Cultural Heritage Management the aim to provide students with the necessary historical background.

MSc CultTech is orientated towards hands-on research, offering extensive laboratory training in small groups. Furthermore, students are given the possibility to prepare an original thesis that is closely related to or within ongoing research projects.

2. Collaborating institutions

2.1 The University of the Peloponnese (Department of History, Archaeology, and Cultural Resources Management)

The University of the Peloponnese was founded by Presidential Decree 13/01-02-2000 and began operating in 2002. Based in Tripoli, UoP has campuses in the five capitals of the Peloponnesian prefectures. Its human resources include 350 professors, 100 technical and administrative employees, and more than 6,000 undergraduate and postgraduate students are enrolled.

The Department of History, Archeology, and Cultural Resources Management was founded in 2003 (Presidential Decree 118/2003, Official Gazette 102/5.5.2003, vol. A) and began operating during the academic year 2003-2004. Together with the Department of Philology, it belongs to the School of Humanities and Cultural Studies, which is based in Kalamata. As the first university Department nationwide to combine History and Archeology with Cultural Resources Management at the undergraduate level, it emphasis on interdisciplinarity with a focus on sustainable management of cultural resources and cultural heritage.

The Department pioneering character is further enhanced by its three laboratories: the Laboratory of Archaeometry, Laboratory of Maritime Archeology, and Laboratory of Modern and Contemporary History. The Department also features an Archaeological Museum with casts and a pottery teaching collection.

2.2 National Centre for Scientific Research “Demokritos”

The National Centre for Scientific Research “Demokritos” was founded in 1961 as the Centre for Nuclear Research ""Demokritos”. Today, it is the largest interdisciplinary research centre in Greece, with approximately 180 researchers and specialist functional scientists and more than 500 research staff employed in projects financed by state funds, the European Union, international organizations, and the industry. The NCSR “Demokritos” operates five independent institutes focusing on different scientific fields. It is managed by a Board of Directors and supervised by the General Secretariat of Research and Innovation of the Hellenic Ministry of Development.

2.2.1 Institute of Nanoscience and Nanotechnology (INN)

The Institute of Nanoscience and Nanotechnology (INN) of the NCSR “Demokritos” was established from the merger of the Institutes of Materials Science, Microelectronics, and Physical Chemistry. The INN efficiently organizes and integrates most of the top research and human resources available in Greece to address innovation challenge and increase the country’s competitiveness in Key Enabling Technologies (KETs), such as nanotechnology, micro- and nanoelectronics, advanced materials, biotechnology, and photonics. INN provides a unique environment to promote and support world-class multidisciplinary basic and applied research, while forging ties with the industry and SMEs promotes the transfer of innovation to the market.

The INN’s RTD activities are structured in five programmes:

- Chemical Sciences for Nanostructures and Biological Applications
- Cultural Heritage
- Magnetism and Superconductivity: Advanced Materials and Applications
- Nanochemistry and Nanomaterials
- Nanoelectronics, Photonics, and Microsystems.

2.2.2 Institute of Nuclear and Particle Physics (INPP)

The Institute of Nuclear and Particle Physics (INPP) of the NCSR “Demokritos” conducts experimental and theoretical research aiming at scientific excellence and innovation in High-Energy Physics, Nuclear Physics, and Astro-Particle Physics, as well as their applications in line with the National Research and Innovation Strategy for Smart Specialization. The experimental and theoretical research in High Energy Physics focuses on the study of elementary particles and their interactions. The INPP participates in the CMS and ATLAS experiments of the LHC at CERN. The Detector Instrumentation Laboratory (DIL) and the Data Acquisition, Monitoring, and Analysis Laboratory (DAMA) of the INPP develop innovative detector technologies and instrumentation along with applications in science and innovation.

Nuclear Physics research focuses on Nuclear Structure, Nuclear Reactions, Nuclear Astrophysics, and the study of interactions of X-rays with matter. The INPP hosts a 5.5. MV Tandem accelerator, a unique research infrastructure in Greece, open to external users from Greece and abroad. The Tandem accelerator laboratory is an interdisciplinary open-access research infrastructure with innovative applications covering the fields of cultural heritage, environment, energy, human health, and the development and testing of advanced materials and detectors. The XRF laboratory focuses on cultural heritage, environmental monitoring, and biomedicine, and offers technology transfer and on-site analytical services to museums, archaeological sites, and other institutions.

The Astro-Particle Physics group participates in the development, deployment, data acquisition, and data analysis of the kilometer cube underwater neutrino telescope in the Mediterranean, KM3. The INPP hosts the Laboratory of Assembly, Testing, and Calibration of the Digital Optical Modules, the basic units of the KM3 telescope. The INPP also supports the Deep-Sea Technology and Astro-Particle Physics Research Infrastructure in South-West Peloponnese (Kalamata, Pylos, Methoni).

2.3 National Observatory of Athens

The National Observatory of Athens is a research center operating under public law rules and procedures and is supervised by the General Secretariat for Research and Technology of the Ministry of Development and Investments. Established in 1842, it features highly skilled human resources and important infrastructure and plays an important role in research in the fields of Astronomy, Astrophysics, Space Applications, Environment, Energy and Meteorology, Seismology, and Geodynamics, at a European and international level.

2.3.1 Institute for Environmental Research and Sustainable Development (IERSD)

The Institute for Environmental Research and Sustainable Development (IERSD) is one of the three Institutes of the National Observatory of Athens. Originally named Meteorological Institute (MI), it was established in 1846. The IERSD holds the longest and most complete climatological records in Greece, spanning a 150-year period. It constituted the first official Meteorological Service of Greece, operating almost all meteorological stations of the existing network until 1931, when the National Meteorological Service was founded. In addition to climatic records, the IERSD holds a historical record of atmospheric ozone data, monitored from 1900 to1940, which is unique for Southeastern Europe. The IERSD has been monitoring atmospheric pollution long before it became evident in Athens, through the systematic monitoring of classical pollutants by a network of six stations. The network passed to the Ministry of the Environment in 1984 and formed the basis of the National Network for Monitoring Atmospheric Pollution.

3. Facilities and infrastructure

3.1 General

MSc CultTech is hosted at UoP's School of Humanities and Cultural Studies Campus in Kalamata. Kalamata is the southernmost city of continental Greece and second largest city in the Peloponnese. With a spectacular coastline towered over by Mount Taygetos, it is a vibrant city with a student population of approx. 8,000 and a long-standing cultural tradition (more recently as the national capital of contemporary dance thanks to the International Kalamata Dance Festival).

The School of Humanities and Cultural Studies Campus comprises two historic buildings with offices classrooms, video conference rooms, an auditorium, and library, as well as several annexes housing its laboratories, museum, staff offices, and student restaurant.

All classrooms are equipped with computers and audiovisual equipment. Facilities include an auditorium as well as a video conference room for distance learning sessions. Two PC rooms available to students are equipped for office applications, application development, web page creation, image processing and graphics creation, systems analysis and modeling applications, and mathematical calculation applications.

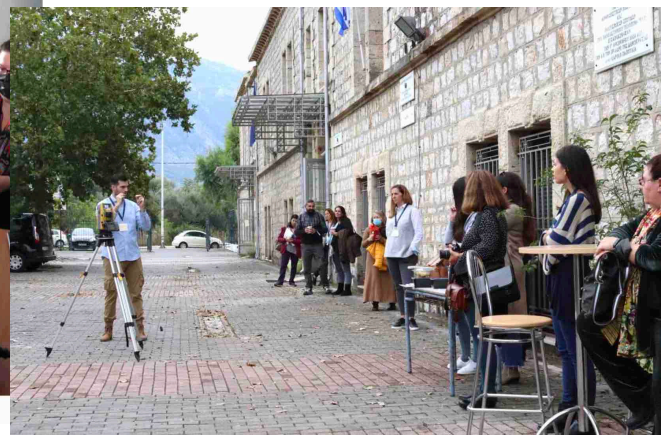
School of Humanities and Cultural Studies Campus

3.2 Laboratory of Archaeometry

The Department of History, Archaeology, and Cultural Resources Management operates three laboratories. Of these, the Laboratory of Archaeometry is the backbone of MSc CultTech's laboratory facilities, as it provides students with hands-on practice in state-of-the-art infrastructure for the development of their skills.

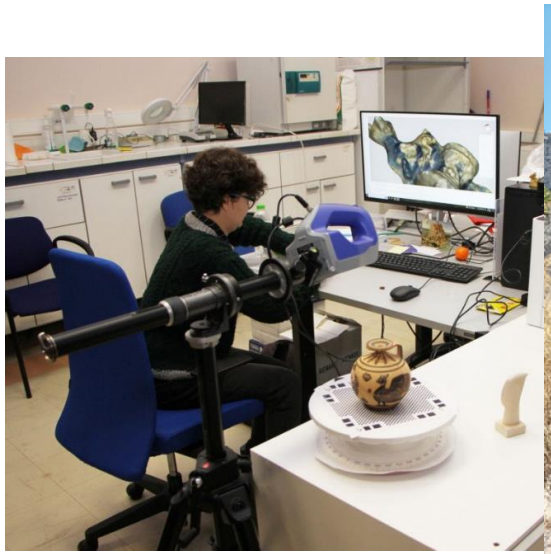
Founded in 2007 and operating since 2010, the Laboratory of Archaeometry is one of the best-equipped Archaeometry laboratories in Greece, with a focus on analytical non-destructive techniques for archaeological collections, absolute dating, digital applications, and paleoenvironmental reconstruction projects. The Laboratory of Archaeometry operates with 16 researchers (Scientific Director, 5 post-doctoral, and 11 doctoral researchers) and cooperates with academics and research institutions, both Greek and foreign, as well as the Greek Archaeological Service.

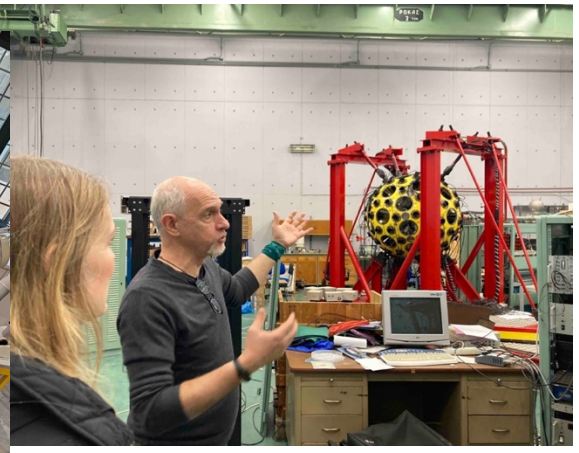
The Laboratory of Archaeometry's infrastructure in analytical techniques lends itself to the analysis of a wide range of archaeological materials (ceramics, glass, metals, mortars, stone, pigments) to investigate raw materials, provenance, and production technology. Emphasis is placed on non-destructive and in-situ analysis techniques (portable microscopy, p-XRF), as well as the use of advanced Electron Microscopy techniques (SEM, TEM) to investigate complex research questions.



Digital Applications include spatial analysis and survey (using GNSS Geodetic Receiver and Geodetic Station) and recording monuments and archaeological sites (using unmanned aerial vehicles and software to produce high-resolution orthophotomosaics, digital terrain models, 3D prints, etc.). The Laboratory's research staff is highly trained and experienced in applying these techniques to Cultural Heritage materials and monuments.

The Laboratory of Archaeometry has been organizing the ARCH_RNT (Archaeological Research and New Technologies) International Symposia since 2008 and organized the 41st International Symposium on Archaeometry (15-21 May 2016). It is a member of the Navarino Environmental Observatory and a key participant in the organization of COSTA NAVARINO International Archaeometry Award.





3.3 Other facilities

During their final thesis project, students can use the facilities and laboratories of all collaborating partners, including those of the Institute of Nuclear and Particle Physics and Institute of Nanoscience and Nanotechnology of the NCSR “Demokritos” (Athens) and of the Institute for Environment and Sustainable Development Research of National Observatory of Athens (Athens).

CultTech

4. Curriculum Structure

4.1 Objectives of the curriculum

The Cross-Institutional Master's Programme **Cultural Heritage Materials and Technologies (CultTech)** aims to:

- Provide an inspiring, compelling, and fruitful learning experience
- Develop knowledge and skills in the interdisciplinary field of Archaeological Science
- Provide students with the knowledge and skills necessary for them to develop into competent scholars who can formulate scientifically based solutions to Archeological science problems
- Familiarize students with the most recent and innovative scientific developments in the interdisciplinary field of Archaeological Science
- Prepare students for further research and work in academic research bodies engaged in Cultural Heritage.

4.2 Learning outcomes of the curriculum

Upon completion of their studies, the graduates of MSc CultTech:

- Are familiar with the principles of analytical techniques, digital applications, environmental conditions, and parameters governing artifacts and monuments of Cultural Heritage
- Can assess the feasibility of technical solutions and sustainability of ventures
- Can recognize the tools and techniques that are appropriate for solving specific problems in order to successfully handle complex projects
- Can conduct experiments involving tests and measurements as well as they will analyze, interpret and present the results produced
- Can undertake and complete projects both as individuals and as members of an interdisciplinary team
- Can work effectively within a team to manage, design, test, and certify ongoing research projects
- Can identify, formulate, and solve problems related to the planning, management, and effectiveness of studies and research programmes
- Can understand scientific and technical publications and form an opinion about their significance and consequences.
- Can identify and use bibliographic resources, standards, and regulations related to scientific topics, products, and systems
- Can form integrated opinions taking into account the scientific, social, and ethical aspects of an issue and are aware of ethical issues related to professional, research, and development activity
- Can present problems, ideas, solutions, and technical information in an effective and productive manner, both in writing and orally, to both specialist and non-specialist audiences
- Can produce technical reports on the activities they carried out and present summaries of the main results in groups
- Demonstrate insight into potential limitations of technology, the role it plays in society, and individual responsibility for its use, including social, economic, environmental and occupational aspects.

4.3 Curriculum outline

The MSc CultTech begins in the fall semester of each academic year. To obtain the Masters Diploma students must successfully complete all eight (8) courses of the study programme – four courses (4) in the fall semester (Semester A) and four courses (4) in the spring semester (Semester B) – and successfully defend their postgraduate thesis (for a total of 90 credits/ECTS). Each teaching semester includes 13 teaching weeks.

4.4 Requirements for obtaining the Master's Diploma

The requirements for obtaining the MSc CultTech diploma are the following:

- Completion of 30 ECTS credits per semester
- Completion of the required number of courses
- Completion of the Master's Thesis
- Full payment of the tuition fees

The final grade of each course results from the total of the student's performance in specific areas (e.g. assignments, exams, student's participation in the educational process, etc.) outlined in the course description.

The grading scale for the student's overall performance ranges from zero (0) to ten (10). For a student to successfully complete a course the minimum required score is 5.

- Excellent: 8.50–10
- Very Good: 6.50–8.49
- Good: 5–6.49

If a student fails a course, they may be re-examined during the re-examination period in September. In the event of cheating, plagiarism, or any other form of falsifying the results of exams, no score is announced, and, regardless of the possible imposition of disciplinary penalties, the student either fails the specific exam or is referred to a repeat exam in a manner and at a time determined by the Postgraduate Studies Committee.

The postgraduate thesis is examined and grades by a three-member examination committee. The minimum required score is 5.

The final grade of the Postgraduate Diploma is calculated as follows:

- Degree Grade = (Course 1 Grade × Course 1 ECTS + Course 2 Grade × Course 2 ECTS + …+ Thesis Grade × Thesis ECTS) / Total number of ECTS.

Students who do not obtain a minimum grade of 5 in (a) their overall score, (b) the score of each course, and (c) their thesis do not graduate and repeat their examination in those courses or are required to make the necessary corrections to their thesis.

4.5 Course Schedule

The following courses are offered per semester:

SEMESTER A			
COURSE CODE	**COURSE TITLE**	**COURSE TYPE**	**ECTS**
A1	Cultural Landscape and Materials	Compulsory	7
A2	Archaeometry I: Archaeological and Cultural Heritage Materials	Compulsory	8
A3	Archaeometry II: Innovative Techniques for Cultural Heritage Analysis	Compulsory	8
A4	Laboratory Training and Chemometrics	Compulsory	7
TOTAL NUMBER OF CREDITS			**30**

SEMESTER B			
COURSE CODE	**COURSE TITLE**	**COURSE TYPE**	**ECTS**
B1	Cultural Heritage Management and Information Communication Technologies	Compulsory	8
B2	Climate Change and Environmental Studies for Cultural Heritage	Compulsory	8
B3	Geoarchaeology and Computing Technologies for Cultural Heritage	Compulsory	7
B4	Computing Applications: GIS, Photogrammetry & Computer Aided Design	Compulsory	7
TOTAL NUMBER OF CREDITS			**30**

SEMESTER C			
COURSE CODE	**COURSE TITLE**	**COURSE TYPE**	**ECTS**
C1	THESIS	Compulsory	30
TOTAL NUMBER OF CREDITS			**30**

4.6 Course and thesis language

All courses and laboratories are taught, and theses are written in English. The thesis must include an extensive summary in Greek.

5. Course description

A1. CULTURAL LANDSCAPE AND ARCHAEOMATERIALS

LECTURE • WEEKLY TEACHING HOURS: 3 • ECTS: 7 • NO PREREQUISITES • IN PERSON LEARNING • USE OF ICT IN TEACHING AND COMMUNICATION WITH STUDENTS • STUDENT EVALUATION: WRITTEN EXAM (30%) AND 3000-WORD WRITTEN ESSAY (70%)

This course is an introduction to the archaeology of ancient landscapes and material culture (with a focus on ceramics, metal, and stone). The course begins with an overview of Landscape Archaeology and its focus: settlement establishment and distribution, transformation of the rural landscape, communication and interaction, the role of landscape in the construction of social identities and ideology, the formation of symbolic landscapes. Case studies are drawn from Aegean Prehistory and ancient Greece (Iron Age to Hellenistic). The second part of the course addresses the production, economic role, and social significance of ceramics, metals, and stone in the Prehistoric, Greek (Archaic to Hellenistic), and Late Roman to Byzantine periods in the Aegean and the Eastern Mediterranean.

Upon successfully completing the course, students are able to:

- define Landscape Archaeology and describe its scope and perspectives
- analyze the effect of external natural factors on the shaping of the landscape
- evaluate the combined effect of natural and cultural factors in shaping the archaeological record based on case studies
- understand the technology and explain how pottery, metal and stone artefacts are made
- evaluate the economic, social and political role of pottery, metal and stone artefacts

Syllabus:

- Lecture 1. Introduction to Landscape Archaeology
- Lecture 2. Interpreting Cultural Landscape I: The Material Space
- Lecture 3. Interpreting Cultural Landscape II: The Social Space
- Lecture 4. Interpreting Cultural Landscape III: The Symbolic Space
- Lecture 5. Archaeomaterials: Pottery I – Prehistory
- Lecture 6. Archaeomaterials: Pottery II – Historical period
- Lecture 7. Archaeomaterials: Pottery III – Late Roman and Medieval
- Lecture 8. Archaeomaterials: Metal I – Prehistory
- Lecture 9. Archaeomaterials: Metal II – Historical period
- Lecture 10. Archaeomaterials: Metal III – Late Roman and Medieval
- Lecture 11. Archaeomaterials: Stone I – Prehistory
- Lecture 12. Archaeomaterials: Stone II – Historical period
- Lecture 13. Archaeomaterials: Stone III – Late Roman and Medieval

A2. ARCHAEOMETRY I - ARCHAEOLOGICAL AND CULTURAL HERITAGE MATERIALS

LECTURE • WEEKLY TEACHING HOURS: 3 • ECTS: 8 • NO PREREQUISITES • IN PERSON LEARNING • USE OF ICT IN TEACHING AND COMMUNICATION WITH STUDENTS • STUDENT EVALUATION: WRITTEN EXAM (30%) AND 3000-WORD WRITTEN ESSAY (70%)

This course provides an overview of the current state of research on archaeological and geo-archaeological materials (pottery, glass, stone, mortar, metals, organics). Emphasis will be given on issues of production, manufacturing technology, use and provenance. Additionally, the most significant techniques of Absolute Dating and Isotopic Studies in Archaeology and Cultural Heritage will be discussed. Finally, basic theoretical information on Statistical Evaluation of Analytical Data / Chemometrics will be provided, to enable students to deal with the large data sets produced by analytical and dating techniques.

Upon successfully completing the course, students:

- Understand archaeometrical principles and theories
- Comprehend the nature and properties of materials utilized in Cultural Heritage
- Can use analytical techniques to investigate production/manufacturing technology, use, provenance and to conserve/restoration heritage materials and works of art
- Can devise conservation strategies for heritage sites and monuments
- Can analyze and interpret data obtained from physicochemical techniques in archaeology
- Can apply statistical methods using various commercial and open-source software
- Can identify and address current issues, problems, and advancements in the field of archaeometry
- Can research, analyse, and synthesise data and information using the necessary technologies

Syllabus:

- Lecture 1: Ceramics 1. Clay Sources and Ceramic Production
- Lecture 2: Ceramics 2. Provenance and Technology of Archaeological Ceramics
- Lecture 3: Ceramics 3. Mechanical and Thermal Performance of Archaeological Pottery
- Lecture 4: Statistical Approaches in Archaeological Science
- Lecture 5: Glass and Glazes
- Lecture 6: Organic Remains of Archaeological Origin
- Lecture 7: Molecular Analytical Methods for the Characterization of Organic Archaeological
- Remains
- Lecture 8: Archaeometallurgy I
- Lecture 9: Archaeometallurgy II
- Lecture 10: Technology of Mortars and Plasters
- Lecture 11: Characterisation of Mortars
- Lecture 12: Isotopic Studies

A3. ARCHAEOMETRY II - INNOVATIVE TECHNIQUES FOR CULTURAL HERITAGE ANALYSIS

LECTURE • WEEKLY TEACHING HOURS: 3 • ECTS: 8 • NO PREREQUISITES • IN PERSON LEARNING • USE OF ICT IN TEACHING AND COMMUNICATION WITH STUDENTS • STUDENT EVALUATION: WRITTEN EXAM (30%) AND 3000-WORD WRITTEN ESSAY (70%)

This course discusses the most significant techniques applied for the analysis of Cultural Heritage materials. Emphasis will be given on non-destructive and state-of-the-art techniques. For each technique, up-to-date applications in the field of Cultural Heritage will be discussed (namely: X-Ray Fluorescence Analysis, Portable and Handheld XRF Analyzers, MicroXRF Analysis of Ancient Metal Alloys, In-situ XRF Analysis of Ancient Pigments and Wall Paintings, Synchrotron Radiation Techniques, Analytical Applications and Advanced Topics to Ion Beam Technology, Spectroscopic and Laser Analytical Techniques, UV-Vis-IR, Imaging and Spectroscopy Techniques).

Upon successfully completing the course, students:

- Can apply modern and innovative technologies in the study of Cultural Heritage
- Understand non-destructive and portable devices, synchrotron techniques, ionic techniques, laser techniques and analytical UV-visible-infrared spectroscopy devices in the study, protection and enhancement of cultural heritage
- Understand and apply invasive/non-invasive, destructive/non-destructive methods of analysis, methods of information visualization
- Can use analytical archaeometric techniques in archaeological research
- Can use and apply scientific methods for the diagnostic investigation, conservation, and restoration of artefacts, monuments, and works of art.
- Can monitor and develop conservation strategies for heritage sites and monuments
- Can critically analyze and interpret data obtained from non-destructive and portable devices, sychrotron techniques, ionic techniques, laser techniques and UV-visible-infrared spectroscopy analytical devices
- Can evaluate and interpret the results of archaeometric analysis techniques

Syllabus:

- Lecture 1: Introductory course
- Lecture 2: X-ray Fluorescence Analysis (XRF): A versatile and multipurpose analytical tool for the analysis of Cultural Heritage materials
- Lecture 3: Introduction to Synchrotron Radiation Techniques for an integrated analytical characterization of Cultural Heritage materials
- Lecture 4: Portable and handheld XRF analyzers applied in the field of Cultural Heritage
- Lecture 5: Micro-XRF Analysis of ancient metal alloys and analytical characterization of their corrosion products and finishing techniques
- Lecture 6: In-situ XRF analysis of ancient pigments
- Lecture 7: Introduction to Ion Beam Technology and analytical methodologies
- Lecture 8: Ion Beam analysis techniques for art and archaeology
- Lecture 9: Spectroscopic techniques in Cultural Heritage materials analysis
- Lecture 10: Laser analytical techniques in Cultural Heritage
- Lecture 11: Integrated imaging and analytical techniques for the study of painted works of art I
- Lecture 12: Integrated imaging and analytical techniques for the study of painted works of art II
- Lecture 13: Review lesson

A4. LABORATORY TRAINING AND CHEMOMETRICS

LECTURE • WEEKLY TEACHING HOURS: 3 • ECTS: 7 • NO PREREQUISITES • IN PERSON LEARNING • USE OF ICT IN TEACHING AND COMMUNICATION WITH STUDENTS • STUDENT EVALUATION: WRITTEN EXAM (30%) AND 3000-WORD WRITTEN ESSAY (70%)

This lab course aims to provide students with a solid practical know-how on the use of the most common analytical techniques in the field of Cultural Heritage Analysis (Stereo Microscope, FOM, Petrography, RAMAN, SEM, p-XRF, XRD). Additionally, practical training will be provided on the Statistical Evaluation of Analytical Data / Chemometrics, which is necessary to evaluate the large data sets produced by analytical techniques.

Upon successfully completing the course, students:

- Understand and use the various analytical techniques applied in Cultural Heritage
- Understand physicochemical techniques, optical and electron microscopy for Cultural Heritage, statistical analysis and data visualization of archaeological materials
- Are proficient in the use of analytical techniques and methods for the characterization, provenance, conservation, and restoration of heritage materials and works of art
- Can critically analyze and interpret data obtained from analytical techniques used for archaeological materials
- Can apply statistical methods using commercial and open-source software to understand the economic and socio-political organization of past societies
- Can identify and address current issues, problems, and advancements in the field of archaeometry.
- Can evaluate archaeometrical data in archaeological contexts
- Can search, analyse, and synthesise data and information using the appropriate technologies
- Can adapt to new situations, make decisions, work autonomously and within a team in an interdisciplinary environment, plan and manage projects.

Syllabus:

- Laboratory 1: Mineralogy
- Laboratory 2: Petrography
- Laboratory 3: XRF
- Laboratory 4: Raman
- Laboratory 5: Statistics I
- Laboratory 6: Statistics II
- Laboratory 7: SEM I
- Laboratory 8: SEM II
- Laboratory 9: Microscopic Analysis Artwork
- Laboratory 10: Spectroscopic Analysis Artwork
- Laboratory 11: Metals
- Laboratory 12: XRD
- Laboratory 13: Corrosion

B1. CULTURAL HERITAGE MANAGEMENT AND INFORMATION COMMUNICATION TECHNOLOGIES FOR CULTURAL HERITAGE

LECTURE • WEEKLY TEACHING HOURS: 3 • ECTS: 8 • NO PREREQUISITES • IN PERSON LEARNING • USE OF ICT IN TEACHING AND COMMUNICATION WITH STUDENTS • STUDENT EVALUATION: WRITTEN EXAM (30%) AND 3000-WORD WRITTEN ESSAY (70%)

This course introduces students to the theoretical and practical framework of a cutting-edge field: the application of information and communication technologies in Cultural Heritage Management. It provides an overview on issues of Cultural Heritage Management and discusses the most significant Information Communication Technologies applied in the field of Cultural Heritage: sustainable heritage management, interpreting heritage, enhancing visitor experience (e.g. at archaeological sites, museums, etc.), digital and multimedia applications in the field of Cultural Heritage, digitization of Cultural Heritage, creation and management of digital repositories, research, management, and promotion of Cultural Heritage through digital applications, development of synergies, digital integration of Cultural Heritage in the urban landscape.

Upon successfully completing the course, students can:

- describe ways of highlighting Cultural Heritage through technology and specific tools
- complete a scientific field observation and record an observation log
- analyze visitor, venue, and technology characteristics to recommend the most appropriate technology for different venues and visitors
- design technological solutions based on prerequisites of use
- evaluate technological applications for cultural heritage
- analyze and synthesize data and information using appropriate technologies, work within a team, work in an interdisciplinary environment, generate new research ideas

Syllabus:

- Lecture 1: Overview
- Lecture 2: Sustainable Heritage Management
- Lecture 3: Interpreting Heritage.
- Lecture 4: Enhancing visitor experience
- Lecture 5: Visitor requirements for technology design
- Lecture 6: Digital presence I
- Lecture 7: Digital presence II
- Lecture 8: CH and multimedia applications I
- Lecture 9: CH and multimedia applications II
- Lecture 10: Digitization and management
- Lecture 11: Synergies
- Lecture 12: Cultural Heritage in the city
- Lecture 13: Building on existing technologies

B2. CLIMATE CHANGE AND ENVIRONMENTAL STUDIES FOR CULTURAL HERITAGE

LECTURE • WEEKLY TEACHING HOURS: 3 • ECTS: 8 • NO PREREQUISITES • IN PERSON LEARNING • USE OF ICT IN TEACHING AND COMMUNICATION WITH STUDENTS • STUDENT EVALUATION: WRITTEN EXAM (30%) AND 3000-WORD WRITTEN ESSAY (70%)

This course discusses issues of climate, weather and climate change, highlighting the vulnerability of Cultural Heritage to climate change impact. It also provides an overview on Environmental Studies for Cultural Heritage (basics of environmental Chemistry and Physics, societal and cultural dimension of climate variability, impacts of air pollution on cultural heritage, introduction to environmental measurements and techniques). Finally, it addresses the basics of Geochronology. More specifically, the course examines basic theory behind environmental chemistry and physics, reviews dating techniques for Cultural Heritage materials with the aim to reconstruct sites and landscapes, discusses the impact of air pollution and climate change on Cultural Heritage materials and sites, examines environmental sampling and measurement techniques, presents the theoretical approach and application of the main techniques used for archaeological material studies within the context of environmental studies (e.g. SEM, XRF, Raman, atomic absorption, chromatography), and investigates the parameters and processes describing climate change and weather, along with the societal and cultural dimensions of climate variability.

Upon successfully completing the course, students:

- Have a solid understanding of issues relating to: chronological studies for historical and archaeological environments, environmental chemistry and physics, air pollution, archaeological material degradation chemistry, environmental measurements and techniques, climate change and its impact on materials and the economy sector, climate and weather from global to local scales, cocietal and cultural dimensions of climate variability
- Can analyze and synthesize data and information using appropriate technologies, work within a team, work in an interdisciplinary environment, generate new research ideas.

Syllabus:

- Lecture 1: Chronological Studies for Historical and Archaeological Environments
- Lecture 2: Basics of Environmental Chemistry and Physics: Major Environmental Challenges for the Analysis of Cultural Heritage Materials
- Lecture 3: Basics of Environmental Chemistry and Physics: Biogeochemical Cycles
- Lecture 4: Impacts of Air Pollution on Cultural Heritage I
- Lecture 5: Impacts of Air Pollution on Cultural Heritage II
- Lecture 6: Introduction to Environmental Measurements and Techniques I
- Lecture 7: Introduction to Environmental Measurements and Techniques II
- Lecture 8: Climate Change
- Lecture 9: Vulnerability of Cultural Heritage to Climate Change Impacts
- Lecture 10: Climate and Weather: From Planetary to Local Scales
- Lecture 11: Societal and Cultural Dimension of Climate Variability

B3. GEOARCHAEOLOGY AND COMPUTING TECHNOLOGIES FOR CULTURAL HERITAGE

LECTURE • WEEKLY TEACHING HOURS: 3 • ECTS: 7 • NO PREREQUISITES • IN PERSON LEARNING • USE OF ICT IN TEACHING AND COMMUNICATION WITH STUDENTS • STUDENT EVALUATION: WRITTEN EXAM (30%) AND 3000-WORD WRITTEN ESSAY (70%)

This course discusses Geoarchaeology and the most significant Computing Technologies employed in Cultural Heritage (field prospection techniques, GIS, UAV for Cultural Heritage, monitoring Cultural Heritage from space, Data, Information Visualization for the Environment, reconstructing archaeological objects and sites, structural modelling of archaeological materials). The course consists of two major teaching units: (A) survey methodologies (geophysical, remote sensing, unmanned aerial vehicles, and geographic information systems) for subsurface and terrain mapping and (B) techniques for visualizing information, reconstructing spaces, and reconstructing-modeling objects through computer systems and software.

Upon successfully completing the course, students:

- Understand field prospection techniques, GIS, UAV for Cultural Heritage, monitoring Cultural Heritage from space, data visualization, archaeological site reconstruction, and structural modelling of archaeological materials
- Can evaluate and select appropriate research methodologies within a multidisciplinary context
- Can use natural sciences methods for the diagnostic investigation, conservation, and restoration of heritage assets and works of art
- Are proficient in archaeological survey techniques and can use remote sensing tools for archaeological purposes
- Can monitor and devise conservation strategies for heritage sites and monuments
- Can analyze and interpret data obtained from GIS, spatial analysis, spatial statistics, and computational modeling in archaeology
- Can apply computational methods using commercial and open-source software to understand the economic and socio-political organization of past societies
- Can identify and address current issues, problems, and advancements in the field of Digital Humanities.

Syllabus:

- Lecture 1: UAV for Cultural Heritage.
- Lecture 2: Introduction to visualization
- Lecture 3: Digital preservation of archaeological objects and sites
- Lecture 4: Remote sensing monitoring heritage from the sky
- Lecture 5: Geophysical prospection: from the detection & imaging of buried antiquities to the contribution in protecting and preserving monuments
- Lecture 6: Resistance mapping processing of electric data
- Lecture 7: Magnetic prospection and magnetic data processing
- Lecture 8: Ground Penetrating Radar
- Lecture 9: Climate and methods of palaeoenvironmental reconstruction
- Lecture 10: Climate change in antiquity (Pleistocene-Holocene): its impact on the evolution of human civilization
- Lecture 11: Applied statistics of analytical data
- Lecture 12: Data and culture
- Lecture 13: Use of data and culture

B4. COMPUTING APPLICATIONS: GIS, PHOTOGRAMMETRY & COMPUTER AIDED DESIGN

LABORATORY • WEEKLY TEACHING HOURS: 3 • ECTS: 7 • NO PREREQUISITES • IN PERSON LEARNING • USE OF ICT IN TEACHING AND COMMUNICATION WITH STUDENTS • STUDENT EVALUATION: WRITTEN EXAM (30%) AND 3000-WORD WRITTEN ESSAY (70%)

This lab course aims to provide students with a solid practical know-how on the most significant computing applications applied in the field of Cultural Heritage: GIS, Photogrammetry, CAD, 3D Scanning applications, 3D printing applications, Multimedia Application Development, Visualization & Modelling Practices. The course is structured around two major teaching units, offering a comprehensive exploration of computing applications in spatial analysis and design: (A) Spatial analysis and mapping methodologies [survey methodologies integral to spatial analysis and mapping, emphasizing Geographic Information Systems (GIS) and photogrammetry for data acquisition and visualization] and (B) Information visualization and reconstruction techniques (advanced visualization techniques and spatial modeling using software tools). This course teaches students to reconstruct spatial environments and model objects for comprehensive visualization.

Upon successfully completing the course, students:

- Have the theoretical foundation, necessary skill set, and comprehensive knowledge of the application of computing technologies in spatial sciences
- Can use GIS and photogrammetry in spatial analysis, mapping, and visualization
- Can apply photogrammetry techniques for image-based modeling and measurement
- Can use software tools for reconstructing spatial environments and object modeling
- Interpret and analyze spatial data effectively using GIS and photogrammetry tools
- Can create detailed 3D models and visual representations for analysis and presentation
- Can apply computing applications in real-world scenarios for spatial analysis and visualization.

Syllabus:

- Lecture 1: Digital Applications in Archaeology
- Lecture 2: Introduction to 3D Modelling
- Lecture 3: 3D Modelling with Open-Source Software - Blender
- Lecture 4: Introduction to Photogrammetry
- Lecture 5: Introduction to 3D Scanning
- Lecture 6: LiDAR Scanning and Terrestrial Laser Scanning in Archaeology
- Lecture 7: Introduction to GIS
- Lecture 8: GIS: Spatial Analysis
- Lecture 9: GIS II: Lab course 1 - Introduction to GIS Mapping
- Lecture 10: GIS II: Lab course 2 - Georeferencing and Editing in GIS
- Lecture 11: GIS II: Lab course 3 – Spatial Analysis
- Lecture 12: GIS II: Lab course 4 – Creating Surfaces
- Lecture 13: Coding Lab course

C1. THESIS

THESIS • ECTS: 30 • STUDENT EVALUATION: WRITTEN REPORT, RESULTS PRODUCED, PUBLIC PRESENTATION • SUGGESTED LENGTH: 15,000-20,000 WORDS (INCLUDING REFERENCES, TABLES, DIAGRAMS, AND APPENDICES)

The written thesis provides students with theoretical and practical knowledge in a cutting-edge subject in the field of Cultural Heritage. Students who have successfully completed their thesis can:

- Search, analyze, and synthesize data and information, using the necessary technologies
- Work autonomously, in an interdisciplinary environment
- Generate new research ideas.

Scope and aims of thesis research:

- The thesis consists of a scientific project related to the fields covered in the MSc CultTech. It must be original in that it produces new data and/or applies critical thinking for the analysis of scientific issues. During their thesis research, students demonstrate and enhance their research skills.
- Likely aims of thesis research:
  - review and critical analysis of existing data and information
  - description and interpretation of a scientific issue
  - application of theoretical and practical methodologies, techniques, and tools
  - formation of new theoretical and practical methodologies, techniques, and tools.

Suggested main components of thesis:

- Introduction: Detailed description of the research question and its significance within the current scientific framework, highlighting the originality and utility of the project.
- Bibliographic overview: Overview and critical discussion of the available bibliographic references related to the main research question of the thesis (from a theoretical, methodological and analytical point of view).
- Methodology: Description of the methodology applied during the research, including all techniques used for the acquisition, analysis and interpretation of data.
- Analysis of results: Synthesis and discussion of the main findings of the research.
- Conclusions: Discussion of the overall conclusions drawn from the research project, taking into consideration the theoretical framework described in the introductory sections of the thesis and suggestions for future research are provided.

6. Course coordinators and teaching staff

A1	A2	A3	A4
Cultural Landscape and Archaeomaterials	**Archaeometry I - Archaeological and Cultural Heritage Materials**	**Archaeometry II - Innovative Techniques for Cultural Heritage Analysis**	**Laboratory Training and Chemometrics**
M. XANTHOPOULOU	V. KILIKOGLOU	A. KARYDAS	E. ZIMI
E. Banou, H. Thliveri, M. Xanthopoulou, E. Zimi	S. Boyiatzis, G. Fakorellis, A. Hein, A. Karatasios, V. Kilikoglou, N. Nerantzis, A. Oikonomou	D. Anglos, A. Karydas, A. Lagogiannis, A. Kouloumpi	E. Mantzana, A. Oikonomou, E. Palamara

B1	B2	B3	B4
Cultural Heritage Management and Information Communication Technologies for Cultural Heritage	**Climate Change and Environmental Studies for Cultural Heritage**	**Geoarchaeology and Computing Technologies for Cultural Heritage**	**Computing Applications: GIS, Photogrammetry & Computer Aided Design**
A. ANTONIOU	N. MICHALOPOULOS	E. GERASOPOULOS	E. ZIMI
A. Antoniou, A. Kamara, M. Kouri, G. Tzedopoulos	K. Eleutheriadis, D. Founta, E. Gerasopoulos, C. Giannakopoulos, E. Liakakou, N. Michalopoulos	V. Poulopoulos, E. Theodorakopoulou, K. Vassilakis	G. Malaperdas, V. Panagiotidi

Director of Graduate Studies: Maria Xanthopoulou

Course coordinators: Maria Xanthopoulou (A1) Vasilis Kilikoglou (A2), Andreas Karydas (A3), Eleni Zimi (A4), Angeliki Antoniou (B1), Nikolaos Michalopoulos (B2), Evangelos Gerasopoulos (B3), Eleni Zimi (B4)

Teaching staff:

- Demetrios Anglos, Professor, University of Crete, Laser Spectroscopic Techniques
- Angeliki Antoniou, Assistant Professor, University of West Attica, Adaptive Educational Technologies in Cultural Information
- Emilia Banou, Professor, University of the Peloponnese, Prehistoric Archaeology: Bronze Age in Mainland Greece
- Stamatios Boyatzis, Associate Professor, University of West Attica, Structure and Characterization of Materials in Cultural Heritage
- Konstantinos Eleftheriadis, Research Director, NCSR Demokritos, Physicochemical Aerosol Characterization
- Yorgos Facorellis, Professor, University of West Attica, Chemical Analysis and Dating of Archaeological Materials
- Dimitra Founda, Research Director, National Observatory of Athens, Meteorology and Climate Change
- Evangelos Gerasopoulos, Research Director, National Observatory of Athens, Atmospheric Physics and Chemistry
- Christos Giannakopoulos, Research Director, National Observatory of Athens, Atmospheric Chemistry and Climate Change
- Anno Hein, Senior Researcher, NCSR Demokritos, Ceramic Technology
- Afroditi Kamara, Historian and Cultural Heritage Consultant, Time Heritage LTD, Cultural Heritage Management
- Ioannis Karatasios, Senior Researcher, NCSR Demokritos, Historic Mortars Technology

- Andreas Karydas, Research Director, NCSR Demokritos, X-ray Fluorescence
- Vasilis Kilikoglou, Research Director, NCSR Demokritos, Ceramics and Composite Materials
- Maria Kouri, Assistant Professor, University of the Peloponnese, Cultural Administration: Organization of cultural institutions and development of local communities
- Anastasios Lagoyannis, Research Director, NCSR Demokritos, Ion-beam-Based Nuclear Analytical Techniques
- Eleni Liakakou, Senior Researcher, National Observatory of Athens, Atmospheric Chemistry
- George Malaperdas, Post Doctoral Researcher, University of the Peloponnese, Geoinformatics, GIS
- Nikolaos Mihalopoulos, Professor, University of Crete, Environmental Chemistry
- Nerantzis Nerantzis, Post Doctoral Researcher, University of the Peloponnese, Archaeometallurgy
- Eleni Palamara, Post Doctoral Researcher, University of the Peloponnese, Archaeological Glass
- Vayia Panagiotidis, Post Doctoral Researcher, University of the Peloponnese, Digital Application Development in Cultural Heritage
- Vasilis Poulopoulos, Assistant Professor, University of the Peloponnese, Big Data in Cultural Informatics
- Katerina Theodorakopoulou, Post Doctoral Researcher, University of Thessaly, Geoarchaeological Techniques and Dating of Archaeological Sites
- Hara Thliveri, Special Teaching Staff, University of the Peloponnese, Classical Archaeology
- Yorgos Tzedopoulos, Research Associate, Academy of Athens, Digital Humanities
- Costas Vassilakis, Professor, University of the Peloponnese, Information Systems
- Maria Xanthopoulou, Assistant Professor, University of the Peloponnese, Byzantine Archaeology
- Eleni Zimi, Associate Professor, University of the Peloponnese, Classical Archaeology

Associates:

- Vasiliki Katsichti, Doctoral Researcher, University of the Peloponnese
- Anastasios Kazolias, Doctoral Researcher, University of the Peloponnese
- Stelios Kesidis, Doctoral Researcher, University of the Peloponnese
- Nelly Kladouri, Doctoral Researcher, University of the Peloponnese
- Angeliki Kompoti, Doctoral Researcher, University of the Peloponnese
- Gavriela Logothetou, Doctoral Researcher, University of the Peloponnese
- Elisavet Mantzana, Doctoral Researcher, University of the Peloponnese
- Dimitris Mitsos, Doctoral Researcher, University of the Peloponnese
- Elena Triantafyllidi, Doctoral Researcher, University of the Peloponnese
- Vasiliki Valantou, Doctoral Researcher, University of the Peloponnese