ETE 604. Decay and Protection of Monuments

COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**ETE 604**	**SEMESTER**	**6**
COURSE TITLE	Decay and Protection of Monuments		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	3	3
Add rows if necessary. The organization of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialized general knowledge, skills development*	Specialized general knowledge
PREREQUISITE COURSES:	NO
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	-

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

The aim of the course is to provide students with a comprehensive understanding of:

1. The broader ethical considerations and fundamental principles of monuments' protection.
2. The basic physicochemical and physicomechanical properties of historical building materials, such as stone, mortars, and bricks.
3. The impact of environmental factors—particularly in the context of climate change—on the preservation state of the monuments.
4. The primary mechanisms and phenomena responsible for the deterioration and damage of historical building materials, as well as the pathology of monuments.
5. The materials and interventions used in the conservation and restoration of monuments.
6. The methodological approaches employed, including the analytical and non-destructive

techniques applied during both the diagnostic study and the evaluation of the compatibility and effectiveness of conservation and restoration interventions.

The course aligns with Level 6 (EQF) and focuses on the enhancement of the analytical and critical skills of the students in materials characterization, environmental impact assessment, and construction protection.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology	*Project planning and management*
Adapting to new situations	*Respect for difference and multiculturalism*
Decision-making	*Respect for the natural environment*
Working independently	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Team work	*Criticism and self-criticism*
Working in an international environment	*Production of free, creative and inductive thinking*
Working in an interdisciplinary environment	*……*
Production of new research ideas	*Others…*
	…….

- Search for, analysis and synthesis of data and information,
- Decision making,
- Autonomous work,
- Team work,
- Working in an interdisciplinary environment (Materials-Environment-Building Pathology),
- Respect for the natural environment,
- Production of free, creative and inductive thinking

(3) SYLLABUS

- General principles of conservation, restoration, and protection of monuments. Ethics and institutional framework: national, European, and international—UNESCO.
- Building materials of historical buildings and monuments: Properties and environmental impact assessment (chemical & mineralogical composition, petrography, microstructure, water absorption, color parameters, and mechanical properties for stones, bricks, and historical mortars of air-setting binders and hydraulic ones).
- Phenomena and mechanisms of decay and damage. Correlation of exogenous and endogenous factors. Pathology of monuments (micro-macro climate, crusts, capillary rise of moisture, salt crystallization, fire impact, dynamic stresses, cracks, and damages).
- Analytical and non-destructive methods for the characterization and mapping of building materials and decay/damage - Methodology of diagnostic study (application on monuments scale of non-destructive testing techniques such as infrared thermography, ultrasonic pulse velocity, drilling resistance, rebound (Schmidt) hammer, digital microscopy, and colorimetry; sampling strategy; application in the laboratory of techniques such as X-ray Diffraction, Optical Microscopy, Scanning Electron Microscopy with X-ray Microanalysis, Thermogravimetric and Differential Thermal Analysis, Fourier Transform Infrared Spectroscopy, Raman Spectroscopy, Mercury Intrusion Porosimetry, water absorption coefficient measurement, and sieve analysis of mortars).
- Materials and interventions for conservation and restoration (e.g., cleaning interventions, hydrophobicity protection, consolidation, antigraffiti protection, restoration mortars, and grouting). Advanced materials and new technologies. Criteria for selecting materials and planning of conservation and restoration interventions. Strategic planning.
- Analytical and non-destructive testing methods for the assessment and monitoring of the effectiveness and compatibility of materials and conservation/restoration interventions (techniques corresponding to those of the diagnostic study applied after the interventions, either in situ on monuments or in the laboratory).

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY Face-to-face, Distance learning, etc.</td><td>Lectures, face-to-face in class</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>Use of projection media to aid teaching.</td></tr>
<tr><td>TEACHING METHODS
The manner and methods of teaching are described in detail.
Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.
The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</td><td>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures</td><td>39</td></tr>
<tr><td>Team projects on case studies</td><td>10</td></tr>
<tr><td>Self-directed study, preparing for the course final exam</td><td>26</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>75</td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
Description of the evaluation procedure
Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other
Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</td><td>LANGUAGE OF EVALUATION: Greek

METHOD OF EVALUATION:
With written exams on the contents of the lectures,
• multiple-choice questions and
• Problem-solving without the use of notes or other aids
and/or presenting team projects based on case studies.</td></tr>
<tr><td></td><td></td></tr>
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(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

1. Lecture Notes
2. Siegesmund, S., & Snethlage, R. (Eds.). (2014). Stone in Architecture: Properties, Durability (5th ed.). Springer Berlin Heidelberg. doi.org/10.1007/978-3-642-45155-3
3. Camuffo, D. (2019). Microclimate for Cultural Heritage: Measurement, Risk Assessment, Conservation, Restoration, and Maintenance of Indoor and Outdoor Monuments (3rd ed.). Elsevier Science. Paperback ISBN: 9780444641069, eBook ISBN: 9780444641076
4. Válek, J., Hughes, J. J & Groot, C. J. W. P. (Eds.). (2012). Historic mortars: Characterisation, assessment and repair, Springer. doi.org/10.1007/978-94-007-4635-0, ISBN 978-94-007-4634-3