UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Fisica e Chimica - Emilio Segrè
ACADEMIC YEAR	2017/2018
MASTER'S DEGREE (MSC)	CULTURAL HERITAGE CONSERVATION AND RESTORATION
SUBJECT	GEOMATERIALS FOR CULTURAL HERITAGE
TYPE OF EDUCATIONAL ACTIVITY	B
AMBIT	50684-Scienze e tecnologie per la conservazione e il restauro
CODE	16595
SCIENTIFIC SECTOR(S)	GEO/09
HEAD PROFESSOR(S)	MONTANA GIUSEPPE Professore Associato Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	6
INDIVIDUAL STUDY (Hrs)	102
COURSE ACTIVITY (Hrs)	48
PROPAEDEUTICAL SUBJECTS	01900 - GENERAL AND INORGANIC CHEMISTRY
MUTUALIZATION	
YEAR	2
TERM (SEMESTER)	1° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**MONTANA GIUSEPPE** Monday 15:00 17:00 Studio docente in Via Archirafi 26 (piano 3)

DOCENTE: Prof. GIUSEPPE MONTANA

PREREQUISITES	Students must be endowed with the fundamental concepts of some basic disciplines followed during the first year of the degree course (Physics, General and Inorganic Chemistry) .
LEARNING OUTCOMES	KNOWLEDGE AND CAPACITY OF COMPREHENSION Acquire essential knowledge to understand the nature of the minerals and rocks (natural and processed geomaterials) in order to be able to address, at least by means of a general outline, a macroscopic mineral/rock recognition linked to the specific lithogenetic process. Ability to use a specific technical language being appropriate to the considered discipline. Development of basic knowledges concerning the main typologies of building stone and the most common stone materials used in the Mediterranean area, and in particular in Sicily, in the monumental architectural/archaeological heritage. To be able to develop a suitable systematic knowledge background and an appropriate technical-scientific language. CAPACITY TO APPLY KNOWLEDGE AND UNDERSTANDING Capacity to recognize autonomously the most common magmatic, metamorphic and sedimentary as well as the so-called rock-forming minerals, or be able to indicate diagnostic tests suitable for the same purpose. Capacity to recognize and distinguish on site the main types of natural and processed geomaterials according to their macroscopic characteristics. Being able to suggest and require selective and functional laboratory procedures for diagnostic purposes. AUTHONOMY IN JUDGEMENT Being able to evaluate the benefits arising from the main methods of analysis of natural and processed geomaterials, with particular reference to: X-ray powder diffraction (XRPD), polarized light optical microscopy (PLM), scanning electron microscopy (SEM-EDS), chemical analysis by X-ray fluorescence spectrometry (XRF). Ability to assess the relevance of analytical mineralogical-petrographic or physical-mechanical data according to the different diagnostic or conservative work. Ability to judge different methodological assumptions according to the problems faced in the specific case study. COMMUNICATION SKILLS Capacity to expose the results of characterization studies of natural or processed geomaterials as well as the corresponding forms of alteration and degradation. Being able to highlight the importance and the positive impact of early detection in the field of restoration of stone materials, especially during the first planning phase. Acquisition of ability at specialist level in exposing the results arising from the macroscopic recognition and compositional characterization of the stone materials object of interest. Being able to point out the entities relapse resulting from the diagnostic study, both in the planning phase and in the execution of the restoration. Be able to suggest appropriate procedures to evaluate, even at a preventive level, the effects of the conservative intervention on the stone material. LEARNING SKILLS Ability to upgrade the professional level with consultation of scientific publications of the field of petrography/mineralogy and, in particular, the various applications of both disciplines to the field of Cultural Heritage. Ability to follow profitably, using the knowledge acquired in the course, specialized seminars in the field of conservation and restoration of natural and processed geomaterials. Ability to upgrade the professional level by consulting specialized scientific publications in the field of stone materials (characterization, diagnosis of degradation, restoration). Ability to use this knowledge to follow up appropriately Masters and/or PhD courses.
ASSESSMENT METHODS	Oral examination. The evaluation of the examination will be based on the student's skills in expressing the topics of the followed course through an adequate technical language. The aptitude to critically examine any conceptual content through reasoning by relevant and interdisciplinary links will be appreciated. Timeliness in centering the topic and predisposition to make synthesis will be positively evaluated as well. Consequently, the minimum requirements for passing the examination are: (1) basic knowledge on crystallography, X-ray diffraction techniques, optical crystallography, systematic classification of minerals, main lithogenetic processes; (2) petrographic description (chemical and mineralogical composition, texture) of the main magmatic, sedimentary and metamorphic rocks; (3) criteria for the recognition of the principal lithotypes used in monumental complexes and sculptural works; (4) basic knowledge of the different categories of processed and artificial aggregates studied in the course (mortars, stucco, majolica, bricks); (5) a proper and sufficiently detailed description of the main processes leading to the alteration/degradation of the natural and/or processed geomaterials taken into account during the course; (6) basic knowledge of techniques for the mineralogical, petrographic and chemical analysis of natural and/or processed geomaterials taken into account within the course and their alteration and degradation products. Quantity and quality of the learned notions will be positively considered in incremental way, as well as the fluency of expression, the level of technical language, the ability to reasoning linking various subjects,

	the synthesis skills. The final evaluation of the course will be expressed by a grade on a scale of thirtieths. The student will passe the exam if he has obtained at least a score of 18/30. The evaluation will be formulated as follows: 1) Sufficient knowledge of the topics covered and limited ability to elaborate acquired knowledge, correlation with specific application aspects within the field of conservation and restoration of cultural heritage. Sufficient ability to analyze the topics presented. Limited autonomy for judging and showing the procedures followed (rating 18-21) 2) Good knowledge of the topics covered and good skills in compiling the acquired knowledge, correlating with specific application aspects within the field of conservation and restoration of cultural heritage.. Good ability to analyze the topics presented. Good autonomy for judging and showing the procedures followed (rating 22-24) 3) Extensive knowledge of the topics covered and more than good skills in the processing of acquired knowledge, correlation with specific application aspects within the field of conservation and restoration of cultural heritage.tage. Good analysis of the arguments presented. Autonomy of judgment and exposure of the procedures followed more than good (rating 25-27). 4) Excellent knowledge of the topics covered, excellent skills in compiling the acquired knowledge, correlation with specific application aspects within the field of conservation and restoration of cultural heritage other than those of teaching. Excellent ability to analyze the phenomena presented. Excellent autonomy for judging and showing the procedures followed (rating 28-30) 5) Excellent knowledge of the topics covered, excellent ability to compile acquired knowledge, correlation with specific application aspects within the field of conservation and restoration of cultural heritage other than those of teaching. Excellent ability to analyze the phenomena presented. Excellent autonomy for judging and showing the procedures followed (vote 30 and praise).
EDUCATIONAL OBJECTIVES	The Course of Geomaterials for Cultural Heritage, at first, is intended to provide basic knowlwdges essential to understand the nature of minerals and rocks in order to make students able to address, at least for general lines, their characterization (both at macroscopic and through laboratory diagnosis). They will be given background information on the main analytical techniques designed for the compositional analysis of minerals and rocks (XRPD, PLM, XRF, SEM-EDS). In addition, the course aims to provide specialized expertise on major natural and processed geomaterials used in Italy and Sicily, in past centuries for the production of items of significant archaeological and architectural interest. The student must be able to recognize macroscopically such materials, describing them in sufficient detail and be able to select a suitable conservative procedure.
TEACHING METHODS	Frontal lessons.
SUGGESTED BIBLIOGRAPHY	1) Dispense fornite dal docente. 2) L. Morbidelli. Le rocce e i loro costituenti. Bardi Editore (Roma), 2003. 3) L. Lazzarini. Pietre e Marmi antichi. Cedam (Padova), 2004. 4) R. Alaimo, R. Giarrusso, G. Montana. I materiali lapidei dell'edilizia storica di Palermo. Ilion Books (Enna), 2008. 5) G. Montana (a cura di). Le "argille ceramiche" della Sicilia occidentale e centrale. Ilion Books, Enna, 2011. 6) C. Klein, A. Philipotts Earth Materials. Introduction to Mineralogy and Petrology. Cambridge University Press, 2nd Edition, 2017.

SYLLABUS

Hrs	Frontal teaching
2	General statements on the applications of mineralogy and petrography to valorization and preservation of the stone made Cultural Heritage. The geomaterials.
2	Definition of mineral and crystalline state. Anisotropy and isotropy. Concept of symmetry. Law of 'index' rationality (Haüy Law).
2	Symmetry operations in the continuous. Schematic overview of the 7 crystalline systems and of the 32 crystalline classes.
2	Sketch on the physical properties of minerals.
2	Elementary notions about the polymorphism and isomorphism processes.
4	Use of X-rays in Mineralogy (Bragg's equation). analytical techniques for the characterization and study of geomaterials and their alteration and degradation products: XRPD; XRF; optical microscopy under transmitted light polarized (PLM); SEM-EDS.
4	The double refraction in minerals. Use of the polarizing microscope (orthoscopic observations).
4	Notions of systematic mineralogy: silicates (nesosilicate, tectosilicates, inosilicates, phyllosilicates, anhydrous carbonates).
2	Outline of lithogenetic processes: the genesis of magmatic, sedimentary and metamorphic rocks.
2	Structural and compositional classification of the intrusive and effusive magmatic rocks.
2	Structural and compositional classification of sedimentary rocks.

SYLLABUS

Hrs	Frontal teaching
2	Structural and compositional classification of metamorphic rocks.
2	The ordinary building stone, the calcarenites: distribution in the territory; compositional and petro-physical characteristics; alteration/degradation phenomena. Outline of stone materials used in old buildings of Trapani, Catania, Syracuse and the baroque towns of the Hyblean territory.
2	Degradation mechanisms involving the cyclical crystallization of soluble salts.
3	Precious 'marbles' used in the architectural decoration (distribution in the territory, on site recognizing criteria , imported materials).
3	Mortars, plasters and stucco: raw materials; compositional characterization; phenomena of alteration and degradation.
2	Compositional and textural characterization of 'ceramic clays'. Production cycle and ethno-archaeometrical investigations
2	Archaeometric analysis of ceramic artefacts. Degradation mechanisms of archaeological pottery: examination of case studies.
4	Experiences of "urban petrography": Field survey through the streets of the historic center of Palermo concerning buildings and churches, aimed at the recognition of the main varieties of ordinary and precious stones used in local historical building practice and architectural decoration. Examination of the alteration and degradation forms and mechanisms.