



UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2019/2020
MASTER'S DEGREE (MSC)	BUILDING ENGINEERING
SUBJECT	BUILDING MATERIALS' DEGRADATION AND DIAGNOSTICS
TYPE OF EDUCATIONAL ACTIVITY	C
AMBIT	20915-Attività formative affini o integrative
CODE	18553
SCIENTIFIC SECTOR(S)	ING-IND/22
HEAD PROFESSOR(S)	MEGNA BARTOLOMEO Professore Associato Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	6
INDIVIDUAL STUDY (Hrs)	98
COURSE ACTIVITY (Hrs)	52
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	1
TERM (SEMESTER)	1° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	MEGNA BARTOLOMEO Monday 15:00 17:00 Stanza del docente, primo piano ed. 6, stanza 115

DOCENTE: Prof. BARTOLOMEO MEGNA

PREREQUISITES	Atomic structure, mole and equivalent, periodic table. Chemical bond: covalent, polar, ionic, metallic, coordinate covalent bonding. Intermolecular bonding: Van der Waals, hydrogen bond, dipole-dipole interaction. Constitutive materials for mortars and concrete: plaster, lime, portland cement. Binders technology: setting and hardening, water to binder ratio
LEARNING OUTCOMES	<p>Knowledge and understanding: decay factors for wood and stony materials; physico chemical analysis useful to verify quality and decay as related to materials' durability; understanding the possible results of physical chemical analysis.</p> <p>Applying knowledge and understanding in the frame of a recovery project prepare a proper diagnostic plan by choosing the right analytical technique according to the conservation state; design a proper intervention to reduce the decay factors identified.</p> <p>Making judgements choosing the most suitable and cheap analysis to define the conservation state; choosing the right material according to the conservation state.</p> <p>Communication Ability in communicating with specialist in diagnostic and material decay. Using a proper language to describe decay phenomena, possible causes and solutions.</p> <p>Learning skills Learning from the scientific literature, conferences or courses and keep abreast of new analytical techniques. Going deeper in comprehension of decay phenomena to better understand interaction between environment and materials.</p>
ASSESSMENT METHODS	<p>Oral examination. The interview is aimed at determining the student's ability to discuss decay phenomena and their causes for both stony materials and wood, and to indicate proper diagnostic analysis to describe conservation state. The ability to express the teaching content using a technically correct language, fit to cooperate with material's scientist, will be evaluated. The vote is expressed in thirtieths with possible praise, according to the scheme reported at the bottom of the degree program homepage, i.e. "Metodi di valutazione".</p>
EDUCATIONAL OBJECTIVES	<p>Knowing the most common decay phenomena for wood and stony materials; understanding relationship between environment and conservation state; Knowing the most common analytical techniques to be used to define the conservation state of a material. Using the acquired knowledges in order to identify threats for the materials and the proper analysis to characterize the acting decay phenomena.</p>
TEACHING METHODS	Multimedia presentation aided front lessons and exercises (all the powerpoint slides will be available in pdf format at this link: https://sites.google.com/site/bartolomegna/corsi-universitari/sistemi-edilizi) visits to the Laboratory of Materials for Restoration and Conservation of DICAM.
SUGGESTED BIBLIOGRAPHY	<p>Stampa delle presentazioni proiettate dal docente disponibile su https://sites.google.com/site/bartolomegna/corsi-universitari/sistemi-edilizi Dispense "Il Legno" e "Le tecniche analitiche" disponibili su https://sites.google.com/site/bartolomegna/dispense Betrolini L, Materiali da costruzioni. Vol. 2: Degrado, prevenzione, diagnosi, restauro. Citta' Studi ed.</p> <p>Approfondimenti: S. Palanti, Durabilita' del legno, Dario Flaccovio, 2009 Skoog, Holler, Crouch, Chimica Analitica Strumentale, EdiSes, 2009 Gennaro Tampone, Massimo Mannucci, Nicola Macchioni, Strutture di legno. Cultura conservazione restauro, De Lettera, Milano, 2002</p>

SYLLABUS

Hrs	Frontal teaching
2	Aggregation states: amorphous and crystalline solids. Relative humidity.
10	Wood: properties and structure. Tree species. Wood structures, ortotropy. Interaction wood humidity. Anatomical defects. Glulam and other wood based materials.
5	Decay phenomena in stony materials: capillarity, soluble salts, wash out, freeze and thaw.
2	Measures of density and porosimetry: helium and liquid porosimetry, mercury intrusion porosimetry.

SYLLABUS

Hrs	Frontal teaching
2	Optical and electronic microscopy: fundamentals of opticals properties of materials, polished cross sections, polished thin sections, SEM and ESEM.
2	Molecular (FTIR) and elemental (EDS, XRF) spectroscopies
2	X-Ray diffractometry
1	Theraml analysis: TGA, DTA, DSC
2	Chromatographic techniques: ionic chromatography and fundamentals of gas chromatography

Hrs	Practice
4	Chemical equilibrium, solution properties, water properties, pH.
3	Outline of binders technology
3	Errors: outlines of statistics; approximation error, random errors and propagation of uncertainty, detection limit, signal to noise ratio
2	Visit to the laboratory of ionic chromatography
2	Visit to the laboratory of X-Ray diffractometry
2	Visit to the laboratory of Simultaneous Theraml Analysis
4	Visit to the laboratory of optical and electronic microscopy
2	Visit to laboratory of Mercury Intrusion Porosimetry
2	Molecular (FTIR) spectroscopies