UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Fisica e Chimica - Emilio Segrè
ACADEMIC YEAR	2023/2024
MASTER'S DEGREE (MSC)	CULTURAL HERITAGE CONSERVATION AND RESTORATION
INTEGRATED COURSE	SCIENCE AND TECHNOLOGY OF MATERIALS
CODE	06328
MODULES	Yes
NUMBER OF MODULES	2
SCIENTIFIC SECTOR(S)	ING-IND/22
HEAD PROFESSOR(S)	MEGNA BARTOLOMEO Professore Associato Univ. di PALERMO
OTHER PROFESSOR(S)	MEGNA BARTOLOMEO Professore Associato Univ. di PALERMO
CREDITS	12
PROPAEDEUTICAL SUBJECTS	01900 - GENERAL AND INORGANIC CHEMISTRY
MUTUALIZATION	
YEAR	3
TERM (SEMESTER)	2° 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	Matter structure Chemical bonds: ionic, covalent, metallic Strenght, energy, pressure, laws of motion. Acqueous solution: pH, solubility, buffer solution, redox
LEARNING OUTCOMES	Knowledge and undestanding: knowing microscopical and macroscopical properties of different materials and understanding the connection between them. physico chemical analysis useful in defition of conservation state of the artwork understanding the possible results of analysis; compatibility criteria between different materials. Applying knowledge and understanding preparing a proper diagnostic plane by choosing the right analytical technique according to the conservation state; choose the right materials according to the conservation state and proposed restoration; Making judgements choosing the most suitable and cheap analysis to define the conservation state; choosing the right material according to the conservation state. Communication Ability in communicating with specialist in diagnostic and material decay. Using a proper language to describe decay phenomena, possible causes and solutions. Learning skills Learning from the scientific literature, conferences or courses and keep abreast of new analytical techniques. During the future professional activity going deeper in comprehension of interaction between environment and materials.
ASSESSMENT METHODS	Oral examination. The interview is aimed at determining the student's ability to process the knowledge gained by using them to solve proposed restoration issues and the ability to express the teaching content using a technically correct language. During the examination the student will discuss the materials properties as related to the interaction between different materials or between materials and environment. Moreover the student will discuss chemical analysis to be used to better understand the proposed restoration problem. The vote is expressed in thirtieths with possible laude according to the following scheme: 30 – 30 cum laudeExcellent knowledge of the topics and very good language skills. Good analytical skills. The student is able to use the knowledge he/she has acquired to solve problems. 26-29Good grasp of the topics. Sound language skills. The student is able to use the knowledge he/she has acquired to solve problems. 24-25Basic knowledge of the main topics. Fair language skills with limited ability to independently use the knowledge acquired to solve problems. 21-23The student lacks a firm grasp but has some knowledge of the main topics. Satisfactory language skills. Low ability to independently use the knowledge acquired. 18-20Minimum basic knowledge of the main topics and technical language. Very low ability to independently use the knowledge acquired. FailedThe student does not have an acceptable knowledge of the topics.
TEACHING METHODS	Multimedia presentation aided front lessons and observation of samples of the materials to be studied in the course. Observation of the instruments used for the studied physico chemical analysis. According to restorers involved in simultaneous practical restoration activity the studied analytical techniques will be applied to real samples from restorattion training activity. All the slides will be available in pdf format through elearning.unipa.it

MODULE
MATERIAL ANALYSIS - WORKSHOP

Prof. BARTOLOMEO MEGNA

SUGGESTED BIBLIOGRAPHY

Materiale fornito dal docente tramite il sito elearning.unipa.it in cui saranno disponibili le slide delle lezioni in formato pdf, una dispensa sulle tecniche analitiche e materiale di approfondimento.

I testi di seguito indicati costituiscono bibliografia di riferimento e la preparazione dell'esame non prevede lo studio integrale degli stessi. Gli studenti potranno scegliere tra i testi indicati in funzione delle proprie esigenze previo colloquio col docente.

Skoog Leary - Chimica Analitica Strumentale - EdiSES

Matteini Moles - La chimica nel restauro - Nardini Editore

Campanella et al. - Chimica per l'arte - Zanichelli

Volpin Apollonia - Le analisi di laboratorio applicate ai beni artistici policromi - Padova

Milazzo Ludwig - Misurare l'arte. Analisi scientifiche per lo studio dei beni culturali - Bruno Mondadori

Paolillo Giudicianni - La Diagnostica nei Beni Culturali. Moderni Metodi di Indagine - Loghia

Ciliberto Spoto - Modern Analytical Methods in Art and Archaeology - Intescience

Napoli A., Pelosi C., Vinciguerra V., Principi di analisi spettroscopia con applicazioni ai beni culturali, Aracne ed. ISBN 978-88-548-3344-9

AMBIT	50684-Scienze e tecnologie per la conservazione e il restauro
INDIVIDUAL STUDY (Hrs)	102
COURSE ACTIVITY (Hrs)	48

EDUCATIONAL OBJECTIVES OF THE MODULE

Knowing and understanding
Knowing the theoretical basis and practical approach to the most common analytical techniques used in the conservation of cultural heritage in order to understand the achievable results.
Knowing the mechanical behaviour of materials even by means of mechanical test.

Applying knowledges
Indicating the analysis to be provided in the restoration project.

Making judgements
Choosing the analysis that can be used to define the conservation state or the constitutive materials of a work of art. Be able in identifying the analysis used to go deeper in the knoledge of the object and the ones used to identify decay phenomena.

Communication
Ability in communicating with specialist in diagnostic and material decay.
Using a proper language to describe decay phenomena, possible causes and solutions.

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.

SYLLABUS

Hrs	Frontal teaching
4	Introduction: sampling methods, sample representativity, error theory, detection limit, resolution, sensitivity
10	Mechanical properties of materials and their measurement. Tension, compression, bending, impact and fatigue tests. Viscoelastic behaviour. Examples of application to materials od Cultural heritage: wood, artificial stones, paper, parchement, leather, textiles.
2	Thermal propreties of materials: heat capacity, thermal conductivity, linear thermal expansion, thermal induced stresses
2	Water vapour permeability, capillary absorption, capillary condensation.
4	Density and porosity: liquid and gas picnometry, mercury intrusion porosimetry, including a visit to the laboratory.
5	Optical microscopy: linear optics, lens properties, optical microscopy in polished cross sections and thin sections. Observations on students' samples of polished cross sections, wooden species and fibers.

3	Scanning electron microscopy, including a visit to the laboratory.
4	Ion chromatography and XRay diffractometry in the identification of soluble salts.
2	Thermogravimetric analysis, differential thermal analysis, differential scanning calorimetry.
2	Elemental spectroscopy: XRF, LIBS, EDS in cooperation with Laboratorio di Fisica e Tecnologie Relative
4	Molecular spectroscopy: FTIR, ATR, DRIFT, Raman, SERS
6	Esempi applicativi delle indagini a casi studio collegati al laboratorio di restauro

MODULE
SCIENCE AND TECHNOLOGY OF MATERIALS

Prof. BARTOLOMEO MEGNA

SUGGESTED BIBLIOGRAPHY

Materiale fornito dal docente tramite il sito elearning.unipa.it
Bertolini L., Gastaldi M., Introduzione ai materiali per l'architettura, UTET ed. 9788877509864
Palanti S., Durabilita' del legno, Dario Flaccovio ed. 9788857901435
Roberts The Chemistry of paper RSC paperbacks 085404518
Borgioli L. Polimeri di sintesi per la conservazione della pietra, Il Prato edizioni 9788887243383
Borgioli L., Cremonesi P., Le resine sintetiche usate nel trattamento di opere policrome, Il Prato ed. 978-8863362565
Mary-Lou E. Florian, Dale Paul Kronkright, and Ruth E. Norton The Conservation of Artifacts Made from Plant Materials disponibile all'indirizzo https://www.getty.edu/publications/resources/virtuallibrary/0892361603.pdf

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EDUCATIONAL OBJECTIVES OF THE MODULE

Knowing and understanding
Characteristics of materials used in artworks crafting, particularly wood, artificial stoney materials, textiles.
Characteristics of polymeric materals used in restoration intervention.
Understanding compatibility between materials and between materials and environment.

Applying knowledge
Choosing the right materials according to the intervention.
Identify the decay phenomena in realtion to material characteristichs.

Making judgements
Choose the right material understanding underlying compatibiity factors in order to achieve a better preventive conservation.

Communication
Using the proper language with materials science specialist.

Learning skills
Learning from the scientific literature, conferences or courses and keep abreast
of materials technology.
Going deeper in comprehension of material science to better understand
interaction between different materials, understanding the pros and cons of new materials.

SYLLABUS

Hrs	Frontal teaching
4	Introduction: pH, chemical equilibrium, solubility, relative and absolute humidity, simplified psychrometric chart.
10	Wood: origin, structure and ultrastructure of wood cell, chemical composition, wood species, orthotropy, relation with environmental humidity, decay factors, materials for wood consolidation.
3	Gypsum: production, properties and decay phenomena, water gypsum ratio.
8	Lime: ancient and modern production method, lime based products: lime putty, hydrated lime, milk of lime, nanolime. Lime based mortars: influence of aggregates and aerial limea based hydraulic mortars.
6	Hydraulic binders: hydraulic lime, roman cement, portland cement, pozzolanic cement. Decay phenomena in concrete sctructures. Fundamentals of geopolymers.
5	Decay phenomena in artificial stoney materials: water circulation within the walls, capillarity, freeze and thaw cycles, soluble salts.
2	Synthetic polymeric materials: thermo mechanical behaviour and classification of polymers.
2	Composite materials and natural fibrous polymer.
4	Organic and Inorganic consolidation materials.
4	Production technologies of paper, parchment, leather