UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Scienze e Tecnologie Biologiche, Chimiche e Farmaceutiche
ACADEMIC YEAR	2019/2020
MASTER'S DEGREE (MSC)	CHEMISTRY
SUBJECT	ENVIRONMENT AND CULTURAL HERITAGE CHEMISTRY
TYPE OF EDUCATIONAL ACTIVITY	C
AMBIT	20975-Attività formative affini o integrative
CODE	08443
SCIENTIFIC SECTOR(S)	CHIM/12
HEAD PROFESSOR(S)	ORECCHIO SANTINO Professore Associato Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	6
INDIVIDUAL STUDY (Hrs)	81
COURSE ACTIVITY (Hrs)	69
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	2
TERM (SEMESTER)	1° semester
ATTENDANCE	Mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**ORECCHIO SANTINO** Tuesday 08:00 10:00 Studio Prof. Orecchio, Ed. 17, Viale delle Scienze, Palermo

DOCENTE: Prof. SANTINO ORECCHIO

PREREQUISITES	Numerical calculations and stochiometry, laboratory experience
LEARNING OUTCOMES	Knowledge and ability to understand The knowledge and skills of understanding of Environmental and Cultural Heritage Chemistry students will be oriented to the acquisition of theoretical and experimental competences, with particular reference to environmental matrices (air, soil, sediments, etc.) and materials (pigments, ligands, siccative oils, etc) related to Cultural Heritage, analytical methods of environmental matrices and materials related to cultural heritage, interpretation and evaluation of data from monitoring and studies. In addition, the student must possess knowledge on integrated processes occurring in the environment and the influence that human activities exert on the different environmental matrices. Applying knowledge and understanding. The student, at the end of the course, will have to possess application competences for the monitoring of various environmental matrices by field and laboratory instruments; In particular, the student, based on specific acquired knowledge, integrated with experiences in the classroom and in laboratory, should be able to propose, chemical environmental monitoring plans and studies to identify the causes of deterioration of a material. In particular, the student must be able to define the major chemical characteristics of environmental matrices and materials related to cultural heritage. Making judgments The student will develop skills on scientific approach to sampling and monitoring, evaluation and interpretation of experimental data; safety in the laboratory and in the field; In particular, on the basis of knowledge acquired, supplemented by laboratory, the student must be able to carry out the evaluation of the quality of the environment and the characteristic of the materials and to coordinate the environmental monitoring of the main quality parameters and studies to identify the causes of deterioration of a material. Independent judgment is made through the experience achieved through exercises, the production of processed and reports, etc. Enable communication The student must be able to explain the basic concepts of Environmental and Cultural Chemistry, integrating them with the concept of the natural cycle (or biogeochemistry) and pollution of the various environmental compartments.
ASSESSMENT METHODS	The final exam consists of a written test containing 20 questions, some of which are multiple choice, in some are asked to discuss a topic treated during the course and some require the numerical solution of a problem, relating the learnig obiectivities. Ad each question is assigned a value (shown next to the question).The sum of the values of all questions is 30/30. In addition, the final vote will be assigned based on the valuation of classroom discussion of a topic agreed with the teacher during the course. To pass the exam you need to pass the written test with at least 18/30. The praise will be awarded if both the written assignment and the thesis have been evaluated 30/30.
EDUCATIONAL OBJECTIVES	The course is aimed to provide the basic concepts for the definition of the chemical composition and characteristics of natural ecosystems (water, air, soil, sediment, organisms) and on materials related to Cultural Heritage. The concepts will be developed in view of biogeochemical cycles, in order to define the environmental pollution processes. The course will provide the analytical basis for the monitoring of the different ecosystems and materials related to Cultural Heritage.
TEACHING METHODS	Lessons, numerical exercises, laboratory activity
SUGGESTED BIBLIOGRAPHY	Appunti di lezione; Autori vari, Chimica dell'Ambiente, (2006), Zanichelli; Autori Vari, Chimica per l'arte, (2007) Zanichelli

SYLLABUS

Hrs	Frontal teaching
6	Types of waters (surface, underground, marine, etc.), And their chemical and physical properties. Water chemistry. • Chemical and physical characteristics • Temperature, Salinity, Conductivity, pH, • Carbonates, Bicarbonates, calcium, magnesium, chlorides, sulfates, nitrates, nitrites, ammonia, dissolved oxygen; oxygen demand (BOD, COD, Kubel, TOC), oils and fats, surfactants.
2	Heavy metals
2	micro organic pollutants (PAHs, pesticides, etc.)
2	Analytical methods (volumetric, gravimetric and instrumental) for water, sediemnts, soils, air, etc
3	Water treatments
2	Chemist role in Cultural Heritage

SYLLABUS

Hrs	Frontal teaching
4	Material related to cultural heritage
3	Pollution and damnage to Cultural Heritage

Hrs	Workshops
4	laboratorie air analysis
4	Determination of dissolved oxygen
4	Organic matter analysis (Kubel)
20	Spectrophotometric determinations of nitrates, nitrites, ammonia, phosphates and active substances to the methylene blue.
4	Determination of trace of heavy metals in waste waters
6	synthesis of inorganic pigments
3	preparation of a fresco and evaluation of pigments behavior