UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Scienze della Terra e del Mare
ACADEMIC YEAR	2016/2017
MASTER'S DEGREE (MSC)	ENVIRONMENTAL SCIENCES
SUBJECT	ENVIRONMENTAL CHEMISTRY
TYPE OF EDUCATIONAL ACTIVITY	B
AMBIT	50571-Discipline chimiche
CODE	17207
SCIENTIFIC SECTOR(S)	CHIM/12
HEAD PROFESSOR(S)	MACCOTTA ANTONELLA Ricercatore 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	**MACCOTTA ANTONELLA** Tuesday 13:30 15:30 Via Archirafi, 20 - V piano

DOCENTE: Prof.ssa ANTONELLA MACCOTTA

PREREQUISITES	For this course the prerequisites are the competencies of Chemistry acquired in First Cycle studies, in particular fundamental concepts of General Chemistry and Organic Chemistry.
LEARNING OUTCOMES	Knowledge and undestanding - At the end of the course the student must know the basic concepts for the definition of natural ecosystems (water, air, soil) with specific reference to their composition and their chemical characteristics and understand the main processes of environmental pollution. Applying knowledge and understanding - The student, at the end of the course, will have acquired ability in multidisciplinary application that will allow it to define the main chemical characteristics of a natural ecosystem in terms of composition and reactivity. Making judgements - The student must be able to evaluate and interpret the experimental laboratory data, to identify the interactions between the different environmental compartments, especially contributions due to anthropogenic factors with particular reference to the concept of pollution. Communication skills - The student must be able to communicate and express issues concerning environmental chemistry both in oral and written form by demonstrating mastery of language, accessible to a non-expert public. Learning skills - The student must have developed adequate capacity for independent study and acquisition of additional skills through consultation of scientific literature. You must also have the ability to follow second level master, in-depth courses, specialized seminars in the field of environmental chemistry.
ASSESSMENT METHODS	The exam consists of a written test lasting 2 h with 10 open questions. Consulting textbooks or notes is not permitted. An oral integration may be required. Each answer will be marked with a rating between 0 (missing or wrong) and 3 (correct). The exam is passed with a final score of 18/30.Laboratory reports must be delivered before the examination.
EDUCATIONAL OBJECTIVES	The course aims to provide knowledge about chemical processes occurring in the environment both in natural conditions and in those altered by pollution and degradation. In fact the knowledge and understanding of the chemical aspects in the environmental field are fundamental both for the evaluation of the quality of the environment for both the control and the environmentally friendly land management.
TEACHING METHODS	Lectures (40 hours) and laboratory (12 hours)
SUGGESTED BIBLIOGRAPHY	Colin Baird, Michael Cann - Chimica ambientale - Zanichelli Stanley E. Manahan - Chimica dell'Ambiente - Piccin

SYLLABUS

Hrs	Frontal teaching
2	Introduction to Environmental Chemistry. Concepts and definitions. Sustainable development and role of Chemistry. Environmental compartments and their interactions.
6	Atmosphere: regions and composition - Radiative balance of the earth-atmosphere system - Ozone - Interaction of radiation with matter - Absorption spectra - Photochemistry principles - O3 formation and destruction - Chapman mechanisms - Chemicals that cause ozone destruction.
2	Tropospheric pollution - Concentration Units for Atmospheric Pollutants - OH radical - Photochemical smog: NOx, VOC, Organics, O3 - Catalytic converters.
2	Acid rain - Mechanisms of acid rain formation - SO2 sources - Effects on soils and water bodies - Particulates: subdivision and sources - Sulphate aerosols formation - Indoor pollutants - Asbestos.
4	Greenhouse effect and global warming - Earth's energy balance - Energy absorption by greenhouse gases - Thermal IR radiation emitted by earth's surface - Greenhouses: sources, residence times and sinks - Radiation-particle interaction - Aerosols and global warming.
2	Energy reserves - Fossil-fuel: coal, petroleum and natural gas - Sequestration of CO2.
2	Renewable energy: hydroelectric power, wind energy, biomass, geothermal, wave and tidal power, solar - Thermal conversion and photoconversion - Solar cells - Alcohols as alternative fuels - Biodiesel - Hydrogen as fuel.
4	Toxic organic compounds: pesticides - Classification - POP - Organochlorine insecticides - Bioconcentration and biomagnification - Principles of toxicology - Organophosphate and carbamate insecticides.
2	Toxic organic compounds: dioxins, furans, and PCBs - PCB contamination by furans - PAH: molecular structure, sources and toxicity - Transport of atmospheric pollutants - Other toxic compounds of environmental concern.
4	Chemistry of natural waters - Exchange and redox reactions - BOD and COD - pE-pH diagrams - Sulfur compounds in natural waters - Nitrogen compounds in natural waters - The CO2-carbonate system - Ion concentrations in natural waters and drinking water - Hardness index for natural waters - Pollution and purification of water - Disinfection techniques - Groundwater - Treatment of wastewater and sewage.
4	Heavy metals - Mercury, lead, cadmium, arsenic, chromium - Characteristics and toxicity - Natural and anthropogenic sources - Water contamination - Environmental analytical techniques.
2	Radioactivity - Isotopes - Decay and half-life -Ionizing radiations - Radon - Environmental radioactivity in Italy - Health effects - Nuclear reaction: fission and fusion.

SYLLABUS

Hrs	Frontal teaching
2	Waste - Composition and disposal - Landills - Stages in the decomposition of garbage in a landfill - Biogas and leachate - Incinerators - Recycling.
2	Soil - Composition: mineral and organic components - Clays - Porosity - Humic substances - Interaction with metal ions - Acidity and cation-exchange capacity of soil - Salinity - Sediments - Heavy metals in solis and sediments - Remediation.

Hrs	Workshops
2	Techniques used in laboratory: UV-vis spectrophotometry, potentiometric pH measurement, and conductivity measurements.
4	Spectrophotometric determination of Fe(III) concentration, calibration curve.
6	Weak acid-strong base potentiometric titration of a weak acid with a strong base - Determination of conducibility in different kind of water.