



UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Scienze della Terra e del Mare		
ACADEMIC YEAR	2017/2018		
BACHELOR'S DEGREE (BSC)	NATURAL AND ENVIRONMENTAL SCIENCES		
SUBJECT	ENVIRONMENTAL ANALYTICAL CHEMISTRY		
TYPE OF EDUCATIONAL ACTIVITY	A		
AMBIT	50169-Discipline chimiche		
CODE	19285		
SCIENTIFIC SECTOR(S)	CHIM/01		
HEAD PROFESSOR(S)	PIAZZESE DANIELA	Professore Associato	Univ. di PALERMO
OTHER PROFESSOR(S)			
CREDITS	6		
INDIVIDUAL STUDY (Hrs)	98		
COURSE ACTIVITY (Hrs)	52		
PROPAEDEUTICAL SUBJECTS			
MUTUALIZATION			
YEAR	2		
TERM (SEMESTER)	2° semester		
ATTENDANCE	Not mandatory		
EVALUATION	Out of 30		
TEACHER OFFICE HOURS	PIAZZESE DANIELA Thursday 10:00 12:00 studio docente via archirafi 26 4° piano		

PREREQUISITES	Structure of the atom (general description and electronic structure); the chemical bonds; qualitative-quantitative aspects of chemical reactions: atomic and molecular weights, equations balance, nomenclature; mixtures and solutions: concentrations and their units, electrolytes, monoprotic acids and monoprotic bases; definition of buffer solutions.
LEARNING OUTCOMES	KNOWLEDGE AND ABILITY OF COMPREHENSION The course aims at providing the basic concepts for the definition of the composition and chemical characteristics of the aqueous natural systems, related to the chemical equilibrium concepts. The main abiotic parameters in environmental systems will be defined, together with their roles and interactions in environmental and natural processes. The course aims at providing the basic concepts for the definition of the basic concept of uncertainty in chemical measurements, and particular attention will be paid to the quality assurance procedure, and to instrumental analytical techniques, frequently used in environmental monitoring. CAPACITY TO APPLY KNOWLEDGE AND COMPREHENSION Ability to define the main chemical abiotic parameters and their roles and interactions in environmental and natural processes; ability to determine abiotic parameters using the instrumental techniques and to analytically evaluate the experimental data. MAKING JUDGMENTS Ability in identifying interactions between the basic concepts, in order to critically evaluate environmental equilibrium processes and provide solutions in analytical procedures. ABILITY OF COMMUNICATION Being able to explain the basic concepts with appropriate scientific language. LEARNING CAPACITY The student must be able to apply the concepts of environmental analytical chemistry, demonstrating the ability to synthesize and evaluate environmental issues, through the basic concepts of analytical chemistry,
ASSESSMENT METHODS	The final examination consists of one written test and in an oral examination. The test consists in solving exercises on the chemical equilibrium, and on statistical calculation. The oral examination allows us to verify the degree of knowledge of the teaching topics, the possession of the scientific language and the ability exposure. Different ranging of evaluation will be done based on the following considerations: 1) Basic knowledge of topics and ability in processing knowledge for application to Analytical Chemistry. Limited capacity of analysis and exposure of the proposed questions (rating 18-21) 2) Good knowledge of topics and ability in processing knowledge for application to Analytical Chemistry. Good capacity of analysis and exposure of the proposed questions (rating 22-24) 3) Very good knowledge of topics and ability in processing knowledge for application to Analytical Chemistry. Good capacity of analysis and exposure of the proposed questions (rating 25-27) 4) Excellent knowledge of the topics and prompt capacity of knowledge processing for application to Analytical Chemistry. Very good capacity of analysis and exposure of the proposed questions (rating 28-30) 5) Excellent knowledge of the topics, excellent and very smart capacity of processing in order to apply them to Analytical Chemistry. Excellent capacity of analysis and exposure of the proposed questions (rating 30 cum laude)
EDUCATIONAL OBJECTIVES	Applying the concepts of analytical chemistry to environmental systems
TEACHING METHODS	frontal lessons laboratory lessons and educational excursion
SUGGESTED BIBLIOGRAPHY	I seguenti testi sono consigliati in alternativa per tutti gli argomenti del corso: Skoog, West, Holler, Crouch. Fondamenti di Chimica Analitica – Edises – 3° ed. (2015) (cap. 5-11; 14, 15, 17-20) Harris – Fondamenti di Chimica Analitica – Zanichelli 1° ed. (2017) Per gli argomenti riguardanti la trattazione degli equilibri chimici in soluzione acquosa un testo alternativo è: Di Marco, Pastore, Bombi - Chimica Analitica – Edises

SYLLABUS

Hrs	Frontal teaching
5	Course Aims Errors in quantitative analysis: statistical calculations of mean, median, variance and standard deviation, types of error, propagation of errors, the distribution of repeated measurements and the Gaussian curve, significance test: comparison of two precisions (F test), comparison of two experimental averages and of an average value with a known value (T test), identification of outliers (Q test)
7	Quality assurance and validation methods: Accuracy, precision, sensitivity, detection and quantification limits; regression curve in the calibration procedure, method of least squares in ordinary linear regression, the method of standard addition and internal standards.
4	The chemical equilibrium in environmental systems: Chemical equilibrium and calculation of the equilibrium concentrations; the mass action law, equilibrium constants - mass and charge balance equations; definition of activity and ionic strength, water auto-protolysis
6	Equilibrium of monoprotic and polyprotic weak acids and bases, buffer solutions of monoprotic and polyprotic species
5	Complex formation equilibrium and the role of complex species in natural systems; redox equilibrium in natural aquatic systems, pE/pH diagrams.
5	Precipitation equilibrium - Effect of the ionic strength on the precipitation equilibrium ;effect of in common ions on the precipitation equilibrium
2	Chemical composition of natural waters, the carbonate systems
6	Electroanalytical techniques for the environmental monitoring (conductimetry, potentiometry, voltammetry) – Reference and measure Electrodes
Hrs	Workshops
6	Chemical experimental measurements of the main environmental and natural parameters (pH, pE, salinity)
Hrs	Others
6	Educational excursion to an environmental site with activities consistent with the environmental analytical chemistry concepts