# COASTAL AND MARINE BIOLOGY AND ECOLOGY (LM51)

(Lecce - Università degli Studi)

## Teaching ENVIRONMENTAL CHEMISTRY

GenCod A006032

**Owner professor** Alessandra GENGA

**Teaching in italian** ENVIRONMENTAL CHEMISTRY

**Teaching** ENVIRONMENTAL CHEMISTRY

**Course year** 1

**Language** ENGLISH

**SSD code** CHIM/12

**Curriculum** Curriculum E-Biodiversity and Ecosystem Sciences

**Reference course** COASTAL AND MARINE BIOLOGY AND ECOLOGY

**Course type** Laurea Magistrale

**Location** Lecce

**Credits** 6.0

**Semester** First Semester

**Teaching hours** Front activity hours: 50.0

**Exam type** Oral

**For enrolled in** 2020/2021

**Assessment** Final grade

**Taught in** 2020/2021

**Course timetable** https://easyroom.unisalento.it/Orario

BRIEF COURSE DESCRIPTION

Introduction to environmental chemistry. Chemical physical properties of the water molecule; structure of water molecule, ipolimnio, thermoclinio, epilimnio. Stratification of waters, density as function of salinity, temperature and pressure. Dissolved oxsigen in waters ,Oxygen Demand: biological and chemical decomposition of organic matter in water. Sulfur compounds in natural waters, acid mine drainage. pE scale. pE-pH diagram of Fe and of N.CO2 dissolved in waters. CO2-carbonate system. Water in equilibrium with solid calcium carbonate: first and second approximation. Water in equilibrium with both CaCO3 and atmospheric CO2. Chemical composition of natural water. Alkaline index. Hardness index. Composition of the Major Components of Seawater: The Concept of Salinity, Clorinity. Composition and Stoichiometry of Average Seawater. Causes of the Major Components Not Being Conservative: examples (estuaries, anoxic basin, evaporation in isolated basin, admixture with brines, precipitation and dissolution, submarine vulcanism, vent, interstitial waters, exchange between atmosphere and sea). Phosphate, soaps. Nitrate, perchlorate, organic solvent in water.

Introduction to the atmosphere. Stratification of the atmosphere. Stratosferic chemistry: the ozone layer. Absorption of light by molecules. Creation of ozone in the stratosphere. Destruction of stratospheric ozone. Catalitic processes of ozone destruction. The ozone holes. CFC. CFC replacement.
The chemistry of ground level air pollution. The chemical fate of trace gases in air.. Urban ozone: the photochemical smog process Nitrogen oxide. Sulfur dioxide and hydrogen sulfide sources and abatement. Particulate air pollution.
Introduction to soil. Minerals. Cation and anion exchange.
Organic molecula of environmental interest. Pesticides. Dioxine. PAH. Furan.
Determination of ammonia in water sample. Determination of major ions in water sample. Determination of heavy metals in water sample.

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| REQUIREMENTS | - Elementary functions. Solution of simple algebraic equations<br>- Knowledge of the main physical law, main units of measurement.<br>- Chemical reactions and their balance. The equation of state of perfect gases - The meaning of pressure and temperature of a gas - Gas mixtures - Partial pressures - Dalton's law. Mole- Avogadro number. Balances in solution- Ionic product of water- pH- Definitions of acids and bases- Solutions of strong acids and bases and their pH- Solutions of weak acids and bases and the pH- Polyprotic acids- Hydrolysis of salts and pH- Buffer solutions . Solubility of ionic solids.<br>- Classification of organic compounds (including natural organic compounds: proteins, sugars, fatty acids, etc.).<br>- Thermodynamic knowledge applicable to systems of chemical interest in equilibrium conditions. Phase equilibria in single-component and multi-component systems. The ideal gas state law. Molar fraction and partial pressure. First and second principles of thermodynamics. Physical transformations of pure substances. Principles of photochemistry and radical reactions. Data analysis and problem solving skills. |
| COURSE AIMS | At the end of the course, the student has the basic knowledge of the processes in the various environmental sectors (air, water, soil, natural and anthropic level). The student also acquires basic knowledge of the main sources of pollution, knows and understands the mobility of pollutants and their reactions, the fundamental chemical and physical principles necessary to know and understand their impact in the environment. The student acquires knowledge and understanding of the chemical and chemical-physical parameters that concern the environment and the chemistry of pollution. The student will acquire the ability to evaluate the presence and distribution of pollutants in environmental matrices. The student will acquire an aptitude for scientific reasoning and will develop critical skills in analyzing chemical phenomena and solving problems. The student will acquire skills characterized by clarity and language properties, correctly exposing definitions and fundamental concepts. The student will have the ability to study in-depth topics and issues related to the discipline, will be able to understand and describe environmental problems, translate them into chemical terms and relate them to other disciplines. |
| TEACHING METHODOLOGY | The topics of the course will be treated with the help of a blackboard, Power Point presentations. |
| ASSESSMENT TYPE | The achievement of the credits attributed to the course includes an oral test with a final mark. The exam will allow the student to verify the acquisition of the knowledge and the expected skills and the learning outcomes achieved through two or three questions on the topics covered. The ability to translate environmental and problem solving problems into chemical terms will be evaluated. During COVI-19 time the exams will be held on Microsost TEAM |

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| FULL SYLLABUS | Introduction to environmental chemistry. Chemical physical properties of the water molecule; structure of water molecule, ipolimnio, thermoclinio, epilimnio. Stratification of waters, density as function of salinity, temperature and pressure. Dissolved oxsigen in waters ,Oxygen Demand: biological and chemical decomposition of organic matter in water. Sulfur compounds in natural waters, acid mine drainage. pE scale. pE-pH diagram of Fe and of N.CO2 dissolved in waters. CO2-carbonate system. Water in equilibrium with solid calcium carbonate: first and second approximation. Water in equilibrium with both CaCO3 and atmospheric CO2. Chemical composition of natural water. Alkaline index. Hardness index. Composition of the Major Components of Seawater: The Concept of Salinity, Clorinity. Composition and Stoichiometry of Average Seawater. Causes of the Major Components Not Being Conservative: examples (estuaries, anoxic basin, evaporation in isolated basin, admixture with brines, precipitation and dissolution, submarine vulcanism, vent, interstitial waters, exchange between atmosphere and sea). Phosphate, soaps. Nitrate, perchlorate, organic solvent in water.<br><br>Introduction to the atmosphere. Stratification of the atmosphere. Stratosferic chemistry: the ozone layer. Absorption of light by molecules. Creation of ozone in the stratosphere. Destruction of stratospheric ozone. Catalitic processes of ozone destruction. The ozone holes. CFC. CFC replacement.<br>The chemistry of ground level air pollution. The chemical fate of trace gases in air.. Urban ozone: the photochemical smog process Nitrogen oxide. Sulfur dioxide and hydrogen sulfide sources and abatement. Particulate air pollution.<br>Introduction to soil. Minerals. Cation and anion exchange.<br>Organic molecula of environmental interest. Pesticides. Dioxine. PAH. Furan.<br>Determination of ammonia in water sample. Determination of major ions in water sample. Determination of heavy metals in water sample. |
| REFERENCE TEXT BOOKS | S.E. Manahan " Environmental Chemistry " CRC Press<br>C. Baird, M. Cann "Environmental Chemistry" Palgrave Macmillan Ed. |