NATIONAL UNIVERSITY OF ENGINEERING
COLLEGE OF SCIENCES
CHEMISTRY PROGRAM

CQ571 – ENVIRONMENTAL CHEMISTRY

I. GENERAL INFORMATION

CODE	:	CQ571 – Environmental Chemistry
SEMESTER	:	7
CREDITS	:	05
HOURS PER WEEK	:	07 (Theory – Practices – Laboratory)
PREREQUISITES	:	CQ381 Statistical Treatment in Analytical Chemistry I
CONDITION	:	Mandatory

II. COURSE DESCRIPTION

The course develops topics oriented to the understanding of water, air and soil chemistry, related to the natural environment and the impact of anthropogenic activities that lead to pollution, analyzing the mechanisms through which it occurs. It also analyzes the legislation by which the maximum values allowed in the standards are established.
The content of this course will allow the student to acquire knowledge to handle the responsibility of preserving, restoring, conserving and sustainably using existing environmental resources focused on all kinds of activities, natural and industrial.

III. COURSE OUTCOMES

a) Generic Outcomes

By the end this course the student will have the:

- Capacity for abstraction, analysis and synthesis.
- Ability to apply knowledge in practice.
- Ability to organize and plan time.
- Oral and written communication skills.
- Skills to search, process and analyze information from different sources.
- Ability to identify, formulate and solve problems.
- Ability to work in a multidisciplinary team.
- Commitment to preserving the environment.

b) Specific Outcomes

By the end this course the student will:

- Relate the origin, behavior and chemical destination of the pollutants in the atmosphere, water and soil (abiotic components) and the toxicity in living beings (biotics), with the effects they produce in the environment. As well as the effect on energy.

- Describe the general principles of hazardous waste management, as well as the basis for the chemical treatment of some samples.

- Define concepts applied to the basic principles of environmental science.

- Develop capacities to interpret environmental legislation, choose the best solution for an environmental problem and to exercise good environmental control in industrial processes.

- Learn about international documents and agreements on environmental management in the world.

- Know what an environmental management system is.

- Apply the methodologies and instruments for an EMS implementation.

- Analyze the how and why of the Environmental Management processes.

- Know the basic principles of environmental management.

- Know the instruments of environmental management.

- Analyze the application mechanisms of each of them.

IV. LEARNING UNITS

1. INTRODUCTION TO ENVIRONMENTAL CHEMISTRY / 4 HOURS

Environmental Sciences: Environmental Chemistry / Definitions: Ecology - Ecosystem - Ecosphere: Hydrosphere, Atmosphere / Lithosphere and Biosphere / Most important biogeochemical cycles / Homeostasis / Resilience.

2. WATER CHEMISTRY / 10 HOURS

Hydrosphere. Hydrological cycle / Sources and water supply / Natural and residual waters - Physical-chemical characterization of water / Natural and anthropogenic contamination / Toxicity criteria. Pollutants classification / Chemical-analytical methods for the determination of some pollutants. Water purification: Water treatment (for consumption) / Waste water.

3. AIR CHEMISTRY / 10 HOURS

Atmosphere: Definition and Importance / Physical-chemical characterization of the air / Meteorology principles: Wind, direction and speed / Temperature, investments. Precipitation / Relative humidity / Concentration models of air pollutants / Natural and anthropogenic contamination / Sampling and analysis of pollutants: gases, particles, aerosols.

4. SOIL CHEMISTRY / 10 HOURS

Soil science / Soil definition / Soil profile / Classifications / Physical, chemical and biological properties. Uses and sustainability / Natural and anthropogenic contamination / Soil characterization / Chemical extraction procedures for characterizing soil components / Geochemical prospection / Traditional techniques for recovering contaminated soils (physical and chemical, electrochemical) / Soil bioremediation techniques.

5. ENVIRONMENTAL LEGISLATION / 10 HOURS

Definition and Origin: Global Meetings on Environment / Stockholm Convention / Magna Carta of Environmental Law / Sustainable Development. UNEP: Information. Environmental Policy and Management / Entities that accredit good management / National and international environmental regulations / Environmental impacts. Environmental protection tools. Quality: Organizations / Quality Management, Quality and analytical laboratory / Validation and Accreditation.

6. ENVIRONMENTAL MANAGEMENT / 12 HOURS

Generalities. Regulatory system of environmental management / Environmental policies and management systems / Instruments of environmental management / Study of the activity and its environment / EIA Evaluation. Preventive and corrective environmental management instruments. Strategic environmental planning. / Standardization system and environmental management quality / ISO 14000.

V. LABORATORIES AND PRACTICAL EXPERIENCES

Practice 1: Classroom practice.

Practice 2 - Laboratory: Determination of the water characteristic parameter.

Practice 3: Field practice or visit

Practice 4 - Laboratory: Determination of components or pollutant in air.

Practice 5: 1st Qualified Practice

Practice 6 - Laboratory: Soil physicochemical properties.

Practice 7: Field practice or visit

Practice 8 - Laboratory: Solid waste

Practice 9: Classroom practice

Practice 10: 2nd Qualified Practice

Visits: Atarjea plant, CITRAR - FIA - UNI, SENAMHI.

VI. METHODOLOGY

The subject is developed in theory and laboratory sessions. The techniques used are; expository, dialogue, individual and group work. The strategies that are used are; the modality of master class, guided and experimental laboratory practices, expositions, and field practices that help the understanding of the theoretical topics. Cases discussion using as reference research articles, problem-based learning; the resources used are multimedia and virtual platform. Individual and team work is carried out, propitiating the use and application of their knowledge. University texts and scientific research articles are studied, for its use in real situations that require real and professional solutions.

VII. EVALUATION FORMULA

Calculation of the final grade (FG):

$$FG = \frac{1 * PE + 2 * FE + 1 * PA}{4}$$

PE: Partial Exam (Weight 1)
FE: Final Exam. (Weight 2)
PA: Practices Average (Weight 1)

To calculate the practices average:

$$\frac{QP_1 + QP_2 + L_1 + L_2 + L_3 + L_4 + L_5 + L_6}{8}$$

The course has (02) Qualified Practices (QP), and (08) Laboratory Practices (L), two of them, with the lower grades will as be eliminated.

VIII. BIBLIOGRAPHY

- Baird C., Química Ambiental, Editorial Reverté. 2001.
- Bornemisza, E., Introducción a la Química de Suelos, 1982.
- Carranza, R., Medio Ambiente, Universidad Nacional del Callao, Perú, 2001.
- Spiro – Stigliani, Química Ambiental, Editorial Pearson - Prentice Hall, 2ª Edición, 2003.
- Tan, Kim H., Introducción a la Química de Suelos. Serie Química, Monografía Nº 25 – Ed. OEA, 1998