Course guide
2500204 - QUIMICA1 - Chemistry I

Last modified: 01/10/2023

Unit in charge: Barcelona School of Civil Engineering
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering.

Degree: BACHELOR'S DEGREE IN ENVIRONMENTAL ENGINEERING (Syllabus 2020). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** Spanish

LECTURER

Coordinating lecturer: IGNACIO SEGURA PEREZ

Others: IGNACIO SEGURA PEREZ

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
14445. Recognize the biological bases and foundations of the plant and animal field in engineering: notions of genetics, biochemistry and metabolism, physiology, organisms and environment, population dynamics, flows of matter and energy and changes in ecosystems, biodiversity, principles of the kinetics of microbial growth and reactor theory.
14446. Solve mathematical problems that may arise in engineering by applying knowledge about: linear algebra, geometry, differential geometry, differential and integral calculus, optimization, ordinary differential equations.
14447. Obtain basic knowledge about the use and programming of computers, operating systems, databases and basic numerical calculation and applied to engineering.
14448. Manage the basic concepts about the general laws of mechanics and thermodynamics, concept of field and heat transfer, and apply them to solve engineering problems.
14449. Apply the basic principles of general chemistry, organic and inorganic chemistry and their applications in engineering.
14450. Describe the global functioning of the planet: atmosphere, hydrosphere, lithosphere, biosphere, anthroposphere, biogeochemical cycles (C, N, P, S), soil morphology and apply it to problems related to geology, geotechnics, edaphology and climatology.

Generical:
14440. Identify, formulate and solve problems related to environmental engineering.
14441. Apply the functions of consulting, analysis, design, calculation, project, construction, maintenance, conservation and exploitation of any action in the territory in the field of environmental engineering.

TEACHING METHODOLOGY

The course consists of 4 hours a week of face-to-face classes in the classroom. Throughout the course, these sessions can be divided into general theoretical sessions (large group) and sessions with half the students (medium group). Medium group sessions are not taught every week and will be notified in advance by the teacher responsible for the subject.

The general theoretical classes (large group) are dedicated to the presentation of the basic concepts and materials of the subject, presentation of examples and carrying out exercises.

The mediated group sessions are dedicated to problem solving and directed activities (project work) with greater interaction with students. Practical exercises are carried out in order to consolidate the general and specific learning objectives.

Likewise, hours of work are carried out in the laboratory, which complement the theoretical sessions. These laboratory sessions allow the student to see in a practical way some of the aspects developed in the theoretical sessions, in relation to the properties and characterization of the materials most used in construction.

Support material is used in the format of a detailed teaching plan through the ATENEA virtual campus: contents, programming of evaluation and directed learning activities and bibliography.

Most of the classes will be taught in Spanish. The hours of exercises may be taught in Spanish or Catalan, as well as the practices, depending on the associate professor who collaborates at that time.

Although most of the sessions will be given in the language indicated, sessions supported by other occasional guest experts may be held in other languages.

To do the laboratory practices you need the following personal protective equipment (PPE):
* Chemical Kit (white lab coat + protection gloves + safety glasses)

LEARNING OBJECTIVES OF THE SUBJECT

Composition and structure of matter. Atomic structure. Periodic table. Chemical bond. Equilibrium. Le Chatelier principle. Concentration. Equilibrium constant. Acid-base equilibrium. The concept of pH. Alkalinity. The carbonate system. - RedOx reactions and potential.

1. Know the atom and the structure of matter.
2. Understand the bases of thermodynamics and chemical equilibrium.
3. Understand oxidation-reduction reactions and chemical kinetics.

Chemistry I. Foundations for addressing issues relevant to studies of the natural environment: the atom and the structure of matter, thermodynamic concepts and balance, oxidation-reduction reactions and chemical kinetics.

STUDY LOAD

Type	Hours	Percentage
Hours small group	15,0	10.00
Hours medium group	15,0	10.00
Self study	90,0	60.00
Hours large group	30,0	20.00

Total learning time: 150 h

CONTENTS

The atom

Description:
Introduction to the Chemistry course. The Importance of Chemistry in Environmental Engineering Studies
Light-particle duality of light. Wave-particle duality of matter. Schrödinger equation
Energy levels and wave functions of the hydrogen atom. Multielectronic atoms
Exercises

Full-or-part-time: 14h 23m
Theory classes: 4h
Practical classes: 2h
Self study : 8h 23m

Chemical bond and structure

Description:
The Periodic Table and periodic properties of the elements
Ionic and covalent bond. Intermolecular forces
Introduction to Lewis structures. Byte rule
Exercises
Geometry of molecules: the VSEPR theory
Molecular orbital theory. Orbital hybridization
Exercises

Full-or-part-time: 31h 12m
Theory classes: 9h
Practical classes: 4h
Self study : 18h 12m

Laboratories

Description:
Laboratory session to verify the practical application of the knowledge of the topics
Laboratory session to verify the practical application of the knowledge of the topics

Full-or-part-time: 24h
Laboratory classes: 10h
Self study : 14h

Evaluation

Full-or-part-time: 9h 36m
Laboratory classes: 4h
Self study : 5h 36m

Thermodynamics and Chemical Equilibrium

Description:
Enthalpy of reaction. Gibbs free energy. Entropy
Exercises
Chemical equilibrium. Principles of Le Chatelier
Solubility and acid-base balance
Exercises
Saline and regulatory solutions
Acid-base titrations
Exercises

Full-or-part-time: 38h 24m
Theory classes: 10h
Practical classes: 6h
Self study : 22h 24m

Oxidation-reduction processes and chemical kinetics

Description:
Oxidation-reduction. Nernst equation
Electrochemical and redox cells in environmental processes
Exercises
Introduction to chemical kinetics. Arrhenius equation. Catalysts
Nuclear chemistry and chemical kinetics
Exercises

Full-or-part-time: 26h 24m
Theory classes: 7h
Practical classes: 4h
Self study : 15h 24m

GRADING SYSTEM

The qualification of the course is obtained from the continuous assessment qualifications and the corresponding laboratory and / or computer room qualifications.

The continuous evaluation will consist of the delivery of exercises at the end of each topic and the realization of a work in installments throughout the course.

The qualification of the laboratory activities is carried out based on the delivery of reports of the practices carried out in the laboratory.

The evaluation tests (2) consist of a part with questions about concepts associated with the learning objectives of the subject in terms of knowledge or understanding, and a set of application exercises.

The final grade for the course corresponds to 70% of the objective evaluation tests, 20% of the directed activities (delivery of exercises and work of the subject) and 10% of the laboratory practices.

Qualification and admission criteria for reevaluation: Students who have been suspended in the ordinary evaluation and who have regularly taken the evaluation tests for the suspended subject will have the option of taking a reevaluation test in the period set in the academic calendar.

Attendance at practices and delivery of the laboratory report is an essential requirement for the evaluation of the subject, in ordinary or extraordinary call

Students who have already passed it or students classified as not presented will not be able to take the re-evaluation test of a subject.

The maximum grade in the case of taking the reevaluation exam will be five (5.0).

The non-attendance of a student summoned to the reevaluation test, held in the set period, may not lead to the completion of another test with a later date.Extraordinary evaluations will be carried out for those students who, due to accredited force majeure, have not been able to take any of continuous assessment tests.

These tests must be authorized by the corresponding head of studies, at the request of the professor responsible for the subject, and will be carried out within the corresponding academic period.

EXAMINATION RULES.

If any of the evaluation activities are not carried out in the scheduled period, the qualification of that activity will be reconciled as zero.

The essential requirement to be evaluated in the course is to attend the laboratory practices and have delivered the corresponding report.

BIBLIOGRAPHY

Basic:

- Petrucci, R.H. Química general: principios y aplicaciones modernas [on line]. 11a ed. Madrid: Pearson Prentice Hall, 2017 [Consultation: 09/12/2020]. Available on: http://www.ingebook.com/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=6751. ISBN 9788490355336.
- Baird, C.; Cann, M. Química ambiental. 2a ed. Barcelona: Reverté, 2014. ISBN 9788429179156.
- Domènech, X. Fundamentos de química ambiental. Madrid: Síntesis, 2014. ISBN 9788490770573.
- Peterson, W.R. Fundamentos de nomenclatura química [on line]. Barcelona: Reverté, 2012 [Consultation: 26/02/2021]. Available on: https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=3430484. ISBN 9788429175745.