

Chemical basis of engineering

Academic Year: (2024 / 2025)

Review date: 04-02-2025

Department assigned to the subject: Materials Science and Engineering and Chemical Engineering Department

Coordinating teacher: GONZALEZ BENITO, FRANCISCO JAVIER

Type: Basic Core ECTS Credits : 6.0

Year : 1 Semester : 2

Branch of knowledge: Engineering and Architecture

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Chemistry (High school)

SKILLS AND LEARNING OUTCOMES

RA1.1: Knowledge and understanding of the scientific and mathematical principles underlying their branch of industrial engineering.

RA2.1: The ability to apply their knowledge and understanding to identify, formulate and solve engineering problems using established methods.

RA4.2: The ability to design and conduct appropriate experiments, interpret the data and draw conclusions.

RA4.3: Workshop and laboratory skills.

RA5.1: The ability to select and use appropriate equipment, tools and methods.

RA5.2: The ability to combine theory and practice to solve engineering problems.

CB1: Students have demonstrated possession and understanding of knowledge in an area of study that builds on the foundation of general secondary education, and is usually at a level that, while relying on advanced textbooks, also includes some aspects that involve knowledge from the cutting edge of their field of study.

CB2: Students are able to apply their knowledge to their work or vocation in a professional manner and possess the competences usually demonstrated through the development and defence of arguments and problem solving within their field of study.

CG1: Ability to resolve problems with initiative, creativity decision-making and critical reasoning skills, and to communicate and transmit knowledge, skills and abilities in the Industrial Engineering area.

CG10: Capacity to design and carry out experiments and to analyze and interpret data obtained.

CG14: Ability to understand and apply the principles of basic knowledge of general chemistry, organic and inorganic chemistry and applications in engineering.

OBJECTIVES

After finishing this subject, students should be able to have:

1. Knowledge and understanding of the chemical basis, organic and inorganic applied chemistry underlying the branch of industrial engineering;
2. The ability to apply their knowledge and understanding to identify, formulate and solve problems of chemical basis, organic and inorganic applied chemistry using established methods;
3. The ability to design and conduct appropriate experiments of chemistry, interpret the data and draw conclusions;
4. Workshop and laboratory skills in chemistry.
5. The ability to select and use appropriate equipment, tools and methods to solve problems of chemical basis, organic and inorganic applied chemistry;
6. The ability to combine theory and practice to solve of chemical basis, organic and inorganic applied chemistry.
7. The ability to function effectively both individually and as a team.

DESCRIPTION OF CONTENTS: PROGRAMME

- Topic 0. Introduction to Chemistry, Preliminary concepts
- Topic 1. The Atomic Structure. Periodic Properties
- Topic 2. Chemical Bonding
- Topic 3. States of Matter (I): Gases, Liquids and Solids
- Topic 4. States of Matter (II): Solutions: Colligative properties
- Topic 5. Thermochemistry
- Topic 6. Chemical equilibrium
- Topic 7. Acid-base and solubility equilibria
- Topic 8. Red-Ox equilibrium and Electrochemistry
- Topic 9. Chemical kinetics
- Topic 10. Introduction to Chemical Engineering
- Topic 11. Introduction to Organic Chemistry. Organic Functions and reactivity

LEARNING ACTIVITIES AND METHODOLOGY

Theoretic lessons

Lesson dedicated to solving problems and exercises

Individual and collective tutorial sessions.

Material with solved and unsolved problems (but with solutions) with the aim of directing the personal work of the student.

Laboratory practical sessions

- Before accessing the laboratories, all students should watch some videos on safety in chemistry laboratories and, after that, they have to pass some virtual questionnaires (Aula Global) in order to demonstrate the contents of the videos are understood.

- Before each laboratory practice, students must view the corresponding experiment through a SPOC (Chemistry Laboratory) course accessible through the university website.

ASSESSMENT SYSTEM

% end-of-term-examination:	55
% of continuous assessment (assignments, laboratory, practicals...):	45

Continuous evaluation (45 %):

- Continuous evaluation will be based on class attendance and assessed tests performed in class (35%).

- Carrying out quiz about every experiment and attendance to practical sessions of laboratory and laboratory reports assessment (10%).

Final exam (55%).

Laboratory practices are mandatory for being assessed.

For being averaged with the continuous assessment, marks higher than 4.0 must be obtained in the final exam.

BASIC BIBLIOGRAPHY

- Javier González Benito Química Básica y Directa, Ediciones Pirámide, 2023
- K. HEINZ BÜCHNER, HANS-HEINRICH MORETTO, P. WODITSCH, Industrial Inorganic Chemistry, Wiley-VCH; 2000..
- K. WEISSERMEL, HANS-JÜRGEN ARPE, Industrial Organic Chemistry, 4th Edition, Wiley & Sons; 1997..
- P.W. ATKINS, L. JONES. Chemical Principles, W H Freeman & Co, 2001.
- R. CHANG. Chemistry,, McGraw-Hill Science, 2006..