

Course guides

820010 - Q - Chemistry

Last modified: 19/06/2020

Unit in charge: Barcelona East School of Engineering
Teaching unit: 713 - EQ - Department of Chemical Engineering.

Degree: BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN MATERIALS ENGINEERING (Syllabus 2010). (Compulsory subject).
BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN BIOMEDICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN ENERGY ENGINEERING (Syllabus 2009). (Compulsory subject).

Academic year: 2020 **ECTS Credits:** 6.0 **Languages:** Catalan, English, Spanish

LECTURER

Coordinating lecturer: ANTONIO GÁMEZ LÓPEZ

Others:

Primer quadrimestre:

AURELIO CALVET TARRAGONA - M32, M41, M42, M61, M62, M82, T81, T91, T92
JOAN DE PABLO RIBAS - M31, M32
ANTONIO GÁMEZ LÓPEZ - M61, M62, M71, M81, M82, T91, T92
ORIOL GIBERT AGULLO - T81, T82
ESTHER ORTEGA ALVAREZ - M31, M32, M42, M71, M72, M82, T12, T81, T82
MANUEL RIVAS CAÑAS - T11, T12
VIRGINIA SAN ANTONIO BENITO - M12, M51, M52, M62, M72, M81, T11, T12, T91, T92
MARGARITA SÁNCHEZ JIMÉNEZ - M41, M71, M72
LLUIS SOLER TURU - M11, M12
XANEL VECINO BELLO - M41, M42, M51, M52, M61, T82
XAVIER VENDRELL VILLAFRUELA - M11, M51, M52

Segon quadrimestre:

LUIS JAVIER DEL VALLE MENDOZA - M11, M12
ADRIANA FARRAN MARSA - M21, M22, T11, T12
ANTONIO FLORIDO PEREZ - M21, M22
ANTONIO GÁMEZ LÓPEZ - M11, M12
MANUEL RIVAS CAÑAS - T11, T12
MARGARITA SÁNCHEZ JIMÉNEZ - M22

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

5. Understand the fundamental principles of general, organic and inorganic chemistry and apply them in engineering.

Transversal:

2. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 1. Planning oral communication, answering questions properly and writing straightforward texts that are spelt correctly and are grammatically coherent.

TEACHING METHODOLOGY

L'assignatura consta de classes en les que el professorat presenta els objectius d'aprenentatge relacionats amb els diferents continguts i posteriorment s'apliquen en la resolució d' exemples pràctics. S'afavoreix la participació activa de l'estudiantat durant la resolució dels casos pràctics, proposant un bon nombre de problemes numèrics i es motiva mitjançant propostes de casos reals relacionats amb l'àmbit de la química.

Durant el curs se'ls proporciona material i eines d'aprenentatge per tal d'orientar i guiar a l'alumnat en el seu procés d'aprenentatge i que pugui consolidar els coneixements sobre química que va assolint al llarg del curs.

LEARNING OBJECTIVES OF THE SUBJECT

Each student to acquire basic scientific knowledge on the subject of Chemistry.

Introduce students to the methodologies and tools necessary to achieve resolution of problems encountered in the various topics of the course.

That each student knows or problem solving exercises in all subjects of the course.

Educating students in the realization of a safe working in the laboratory.

Each student is able to work efficiently in the laboratory.

Educating students on the importance of independent work to assimilate concepts, solve exercises and critically analyze the result.

Know that each student seeking information, synthesize it, and assimilate concepts

STUDY LOAD

Type	Hours	Percentage
Hours small group	7,5	5.00
Hours large group	52,5	35.00
Self study	90,0	60.00

Total learning time: 150 h

CONTENTS

CHAPTER 1- CHEMICAL EQUILIBRIUM

Description:

1. Concentration and stoichiometry
2. Chemical equilibrium
3. Enthalpy, entropy and free energy
4. Equilibrium constant
5. Le Chatelier Principle

Specific objectives:

1. To describe the concept of chemical equilibrium
2. To describe the equilibrium constant
3. To determine the variation of the equilibrium constant with variation in total pressure, volume or concentration

Full-or-part-time: 15h

Theory classes: 6h

Self study : 9h



CHAPTER 2- ACID-BASE EQUILIBRIA

Description:

1. Definition of acid and base. Brønsted and Lowry theory.
2. Strength of acids and bases. pH.
3. Determination of the pH of monoprotic or diprotic acids. Mass and charge balances. Logarithmic diagrams.
4. Mixtures of acids and bases. Buffer solutions.

Specific objectives:

1. To identify when a chemical species is acidic or alkaline.
2. To identify when an acid or a base is strong.
3. To determine the pH of acids or bases by using mass and charge balances and logarithmic diagrams.
4. To determine the pH of mixtures of acids and bases.
5. To identify when a solution buffers the pH.

Full-or-part-time: 25h

Theory classes: 10h

Self study : 15h

CHAPTER 3- SOLUBILITY

Description:

1. Solubility and solubility product
2. Precipitation and fractional precipitation
3. Common-ion solubility
4. Solubility in the presence of acid-base parallel reactions

Specific objectives:

1. To identify the solubility of a solid
2. To determine the solubility of non-soluble solids
3. To determine the solubility of non-soluble solids if there is a common-ion effect
4. To determine the solubility of non-soluble solids in systems with acid-base parallel reactions

Full-or-part-time: 20h

Theory classes: 8h

Self study : 12h

CHAPTER 4- REDOX REACTIONS

Description:

1. Semi-reactions and redox reactions
2. Standard reduction potential. p_e and equilibrium constant
3. Nernst equation
4. Metals corrosion
5. Latimer, Frost and Pourbaix diagrams
6. Batteries and electrolysis

Specific objectives:

1. To identify oxidizing and reduction reactions as well as oxidizing and reducing species
2. To determine equilibrium constants of redox reactions
3. To calculate p_e values by using Nernst equation
4. To draw and to interpret Latimer, Frost and Pourbaix diagrams

Full-or-part-time: 30h

Theory classes: 12h

Self study : 18h



CHAPTER 5- ATOMIC STRUCTURE AND PERIODIC TABLE

Description:

1. Origin of the chemical elements
2. Atomic number, Mass number, isotopes
3. Schrödinger Equation. Quantic numbers. Electronic configuration. Pauli Exclusion principle, Aufbau Principle, Hund's Rule.
4. Periodic table
5. Oxidation state of the elements
6. Periodic properties.

Specific objectives:

1. To deduce the electronic configuration of elements and ions
2. To deduce the oxidation state of the elements from the electronic configuration
3. To compare periodic properties from different elements

Full-or-part-time: 22h 30m

Theory classes: 9h

Self study : 13h 30m

CHAPTER 6- THE CHEMICAL BOND

Description:

1. Lewis theory: the octet rule. Lewis structures. Lewis acids and bases
2. Formal charge associated to an atom. Resonance.
3. VSEPR theory
4. Polarity of a bond and of a molecule
5. Intermolecular forces

Specific objectives:

1. To determine the Lewis structure of a molecule, including the formal charge of the atoms
2. To deduce the geometry of a molecule from the Lewis structure
3. To deduce the polarity of a molecule depending on the different chemical bonds

Full-or-part-time: 18h 45m

Theory classes: 7h 30m

Self study : 11h 15m

LABORATORY

Description:

There will be three different laboratory activities, which will involve the concepts learned during the course

Full-or-part-time: 18h 45m

Laboratory classes: 7h 30m

Self study : 11h 15m

GRADING SYSTEM

The final mark will consist of three inputs:

- 1) Partial exam: EP
- 2) laboratory: Elab
- 3) Final exam: EF

The course is evaluated from:

$$NF = 0.15*Elab + 0.25*EP + 0.60*EF$$

Laboratory sessions are mandatory, in case of absence to any of the sessions, the final qualification of the course will be NP (not presented).

Re-evaluation exam will account for EP and EF

The students will be able to access the re-assessment test that meets the requirements set by the EEBE in its Assessment and Permanence Regulations

(<https://eebe.upc.edu/ca/estudis/normatives-academiques/documents/eebe-normativa-avaluacio-i-permanencia-18-19-aprovat-je-2018-06-13.pdf>)

EXAMINATION RULES.

In all the written exams will be necessary to bring a pocket calculator . In any case you can not have any electronic devices with capabilities to transfer data, neither notes not formulae summaries .

BIBLIOGRAPHY

Basic:

- Aguilar Sanjuán, Manuel. Introducción a los equilibrios iónicos. 2ª ed. Barcelona [etc.]: Reverté, 1999. ISBN 8429175504.
- Ralph H. Petrucci ... [et al.]. Química general : principios y aplicaciones modernas [on line]. 11ª ed. Madrid [etc.]: Pearson Prentice Hall, cop. 2017 [Consultation: 09/06/2020]. Available on: http://www.ingebook.com/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=6751. ISBN 9788490355343.

Complementary:

- Brown, Theodore L. Química : la ciencia central [on line]. 12ª ed. Mèxico [etc.]: Pearson, 2014 [Consultation: 29/04/2020]. Available on: http://www.ingebook.com/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=4690. ISBN 9786073222358.
- Casabó i Gispert, Jaume. Estructura atómica y enlace químico [on line]. Barcelona [etc.]: Reverté, cop. 1996 [Consultation: 29/04/2020]. Available on: http://www.ingebook.com/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=1455. ISBN 9788429193343.

RESOURCES

Other resources:

During the course, different documents related to the subjects will be found in the ATENEA platform.