

## 820010 - Q - Chemistry

Coordinating unit: 295 - EEBE - Barcelona East School of Engineering

Teaching unit: 713 - EQ - Department of Chemical Engineering

Academic year: 2019

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

ECTS credits: 6 Teaching languages: Catalan, Spanish, English

### Teaching staff

Coordinator: 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  
MANUEL RIVAS CAÑAS - T11, T12  
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

### Opening hours

Timetable: To be agreed with each teacher

### 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.

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### 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

Total learning time: 150h	Hours large group:	52h 30m	35.00%
	Hours medium group:	0h	0.00%
	Hours small group:	7h 30m	5.00%
	Guided activities:	0h	0.00%
	Self study:	90h	60.00%

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### Content

<p><b>CHAPTER 1- CHEMICAL EQUILIBRIUM</b></p>	<p>Learning time: 15h Theory classes: 6h Self study : 9h</p>
<p>Description:</p> <ol style="list-style-type: none"> <li>1. Concentration and stoichiometry</li> <li>2. Chemical equilibrium</li> <li>3. Enthalpy, entropy and free energy</li> <li>4. Equilibrium constant</li> <li>5. Le Chatelier Principle</li> </ol> <p>Specific objectives:</p> <ol style="list-style-type: none"> <li>1. To describe the concept of chemical equilibrium</li> <li>2. To describe the equilibrium constant</li> <li>3. To determine the variation of the equilibrium constant with variation in total pressure, volume or concentration</li> </ol>	
<p><b>CHAPTER 2- ACID-BASE EQUILIBRIA</b></p>	<p>Learning time: 25h Theory classes: 10h Self study : 15h</p>
<p>Description:</p> <ol style="list-style-type: none"> <li>1. Definition of acid and base. Brönsted and Lowry theory.</li> <li>2. Strength of acids and bases. pH.</li> <li>3. Determination of the pH of monoprotic or diprotic acids. Mass and charge balances. Logarithmic diagrams.</li> <li>4. Mixtures of acids and bases. Buffer solutions.</li> </ol> <p>Specific objectives:</p> <ol style="list-style-type: none"> <li>1. To identify when a chemical species is acidic or alkaline.</li> <li>2. To identify when an acid or a base is strong.</li> <li>3. To determine the pH of acids or bases by using mass and charge balances and logarithmic diagrams.</li> <li>4. To determine the pH of mixtures of acids and bases.</li> <li>5. To identify when a solution buffers the pH.</li> </ol>	

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<p>CHAPTER 3- SOLUBILITY</p>	<p>Learning time: 20h Theory classes: 8h Self study : 12h</p>
<p>Description:</p> <ol style="list-style-type: none"> <li>Solubility and solubility product</li> <li>Precipitation and fractional precipitation</li> <li>Common-ion solubility</li> <li>Solubility in the presence of acid-base parallel reactions</li> </ol> <p>Specific objectives:</p> <ol style="list-style-type: none"> <li>To identify the solubility of a solid</li> <li>To determine the solubility of non-soluble solids</li> <li>To determine the solubility of non-soluble solids if there is a common-ion effect</li> <li>To determine the solubility of non-soluble solids in systems with acid-base parallel reactions</li> </ol>	
<p>CHAPTER 4- REDOX REACTIONS</p>	<p>Learning time: 30h Theory classes: 12h Self study : 18h</p>
<p>Description:</p> <ol style="list-style-type: none"> <li>Semi-reactions and redox reactions</li> <li>Standard reduction potential, <math>p_e</math> and equilibrium constant</li> <li>Nernst equation</li> <li>Metals corrosion</li> <li>Latimer, Frost and Pourbaix diagrams</li> <li>Batteries and electrolysis</li> </ol> <p>Specific objectives:</p> <ol style="list-style-type: none"> <li>To identify oxidizing and reduction reactions as well as oxidizing and reducing species</li> <li>To determine equilibrium constants of redox reactions</li> <li>To calculate <math>p_e</math> values by using Nernst equation</li> <li>To draw and to interpret Latimer, Frost and Pourbaix diagrams</li> </ol>	

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<p><b>CHAPTER 5- ATOMIC STRUCTURE AND PERIODIC TABLE</b></p>	<p>Learning time: 22h 30m Theory classes: 9h Self study : 13h 30m</p>
<p>Description:</p> <ol style="list-style-type: none"> <li>1. Origin of the chemical elements</li> <li>2. Atomic number, Mass number, isotopes</li> <li>3. Schrödinger Equation. Quantic numbers. Electronic configuration. Pauli Exclusion principle, Aufbau Principle, Hund's Rule.</li> <li>4. Periodic table</li> <li>5. Oxidation state of the elements</li> <li>6. Periodic properties.</li> </ol> <p>Specific objectives:</p> <ol style="list-style-type: none"> <li>1. To deduce the electronic configuration of elements and ions</li> <li>2. To deduce the oxidation state of the elements from the electronic configuration</li> <li>3. To compare periodic properties from different elements</li> </ol>	
<p><b>CHAPTER 6- THE CHEMICAL BOND</b></p>	<p>Learning time: 18h 45m Theory classes: 7h 30m Self study : 11h 15m</p>
<p>Description:</p> <ol style="list-style-type: none"> <li>1. Lewis theory: the octet rule. Lewis structures. Lewis acids and bases</li> <li>2. Formal charge associated to an atom. Resonance.</li> <li>3. VSEPR theory</li> <li>4. Polarity of a bond and of a molecule</li> <li>5. Intermolecular forces</li> </ol> <p>Specific objectives:</p> <ol style="list-style-type: none"> <li>1. To determine the Lewis structure of a molecule, including the formal charge of the atoms</li> <li>2. To deduce the geometry of a molecule from the Lewis structure</li> <li>3. To deduce the polarity of a molecule depending on the different chemical bonds</li> </ol>	
<p><b>LABORATORY</b></p>	<p>Learning time: 18h 45m Laboratory classes: 7h 30m Self study : 11h 15m</p>
<p>Description:</p> <p>There will be three different laboratory activities, which will involve the concepts learned during the course</p>	

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### Qualification 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>)

### Regulations for carrying out activities

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:

Ralph H. Petrucci ... [et al.]. Química general : principios y aplicaciones modernas. 10a ed. Madrid [etc.]: Pearson Prentice Hall, cop. 2011. ISBN 9788483226803.

Aguilar Sanjuán, Manuel. Introducción a los equilibrios iónicos. 2ª ed. Barcelona [etc.]: Reverté, 1999. ISBN 8429175504.

Complementary:

Brown, Theodore L. Química : la ciencia central. 11ª ed. Mèxico [etc.]: Prentice Hall, cop. 2009. ISBN 9786074420210.

Casabó i Gispert, Jaume. Estructura atómica y enlace químico. Barcelona [etc.]: Reverté, cop. 1996. ISBN 8429171894.

Others resources:

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