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)
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
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

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
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

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group: 52h 30m</th>
<th>35.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group: 0h</td>
<td>0.00%</td>
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<tr>
<td></td>
<td>Hours small group: 7h 30m</td>
<td>5.00%</td>
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<tr>
<td></td>
<td>Guided activities: 0h</td>
<td>0.00%</td>
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<tr>
<td></td>
<td>Self study: 90h</td>
<td>60.00%</td>
</tr>
</tbody>
</table>
# Content

## CHAPTER 1 - CHEMICAL EQUILIBRIUM

<table>
<thead>
<tr>
<th>Learning time: 15h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 6h</td>
</tr>
<tr>
<td>Self study : 9h</td>
</tr>
</tbody>
</table>

**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

## CHAPTER 2 - ACID-BASE EQUILIBRIA

<table>
<thead>
<tr>
<th>Learning time: 25h</th>
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</thead>
<tbody>
<tr>
<td>Theory classes: 10h</td>
</tr>
<tr>
<td>Self study : 15h</td>
</tr>
</tbody>
</table>

**Description:**
1. Definition of acid and base. Brönsted and Lowry theory.
2. Strength of acids and bases. pH.

**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.
<table>
<thead>
<tr>
<th>CHAPTER 3- SOLUBILITY</th>
<th>Learning time: 20h</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Theory classes: 8h</td>
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<tr>
<td></td>
<td>Self study: 12h</td>
</tr>
<tr>
<td>1. Solubility and solubility product</td>
<td></td>
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<tr>
<td>2. Precipitation and fractional precipitation</td>
<td></td>
</tr>
<tr>
<td>3. Common-ion solubility</td>
<td></td>
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<tr>
<td>4. Solubility in the presence of acid-base parallel reactions</td>
<td></td>
</tr>
<tr>
<td><strong>Specific objectives:</strong></td>
<td></td>
</tr>
<tr>
<td>1. To identify the solubility of a solid</td>
<td></td>
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<tr>
<td>2. To determine the solubility of non-soluble solids</td>
<td></td>
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<tr>
<td>3. To determine the solubility of non-soluble solids if there is a common-ion effect</td>
<td></td>
</tr>
<tr>
<td>4. To determine the solubility of non-soluble solids in systems with acid-base parallel reactions</td>
<td></td>
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</tbody>
</table>

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<tr>
<th>CHAPTER 4- REDOX REACTIONS</th>
<th>Learning time: 30h</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Theory classes: 12h</td>
</tr>
<tr>
<td></td>
<td>Self study: 18h</td>
</tr>
<tr>
<td>1. Semi-reactions and redox reactions</td>
<td></td>
</tr>
<tr>
<td>2. Standard reduction potential, $p_e$ and equilibrium constant</td>
<td></td>
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<tr>
<td>3. Nernst equation</td>
<td></td>
</tr>
<tr>
<td>4. Metals corrosion</td>
<td></td>
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<tr>
<td>5. Latimer, Frost and Pourbaix diagrams</td>
<td></td>
</tr>
<tr>
<td>6. Batteries and electrolysis</td>
<td></td>
</tr>
<tr>
<td><strong>Specific objectives:</strong></td>
<td></td>
</tr>
<tr>
<td>1. To identify oxidizing and reduction reactions as well as oxidizing and reducing species</td>
<td></td>
</tr>
<tr>
<td>2. To determine equilibrium constants of redox reactions</td>
<td></td>
</tr>
<tr>
<td>3. To calculate $p_e$ values by using Nernst equation</td>
<td></td>
</tr>
<tr>
<td>4. To draw and to interpret Latimer, Frost and Pourbaix diagrams</td>
<td></td>
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</tbody>
</table>
CHAPTER 5- ATOMIC STRUCTURE AND PERIODIC TABLE

**Description:**
1. Origin of the chemical elements
2. Atomic number, Mass number, isotopes
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

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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

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LABORATORY

**Description:**
There will be three different laboratory activities, which will involve the concepts learned during the course
The final mark will consist of three inputs:
1) Partial exam: EP
2) Laboratory: Elab
3) Final exam: EF

The course is evaluated from:
\[ NF = 0.15 \times Elab + 0.25 \times EP + 0.60 \times EF \]
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:**


**Complementary:**


**Others resources:**

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