Bachelor in Industrial Electronics Engineering

Course information

Year 2020-21

GENERAL SPECIFICATIONS				
English name				
Chemistry				
Spanish name				
Química				
Code		**Type**		
606610103		Basic		
Time distribution				
	Total	**In class**	**Out class**	
Working hours	150	60	90	
ECTS: 6				
Standard group	**Small groups**			
	Classroom	**Lab**	**Practices**	**Computer classroom**
3.15	1.85	1	0	0
Departments		**Knowledge areas**		
QUÍMICA PROFESOR JOSÉ CARLOS VÍLCHEZ MARTÍN		Química Inorgánica Química Analítica		
Year		**Semester**		
1º		1º		

TEACHING STAFF			
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SPECIFIC INFORMATION OF THE COURSE
1. Contents description
1.1. In English:
Basic principles of general chemistry and applications in engineering.
1.2. In Spanish
Principios básicos de la química general y su aplicaciones en la ingeniería.
2. Background
2.1.Situation within the Degree:
This subject is taught in the first course of this degree. The principal aim is to provide the knowledge of basic concepts of Chemistry, that also will facilitate the understanding of other related concepts in other subjects. In addition, the subject will allow students to acquire knowledge of the practical applications of Chemistry of interest for their further career development.
2.2. Recommendations:
It is highly desirable that pre-universitary studies in chemistry, physics and mathematics had been taken.

3. Objectives (as result of teaching):

The main objectives of this subject are:
- Perceive a general overview of chemistry.
- Understand the most important concepts and models used by those who work with them.
- Develop the necessary capacity to correctly apply the facts, concepts and models of chemistry to different situations in this and other disciplines.
- Know the numerous applications of chemistry in our society and in our environment.

4. Skills to be acquired

4.1. Specific Skills:

B04: Ability to understand and apply the principles of basic knowledge of general chemistry, chemistry organic and inorganic and their applications in engineering.

4.2. General Skills:

CB5: Acquire the necessary skills to undertake further studies with a high degree of autonomy.
G01: Be able to solve problems.
G04: Be able to apply knowledge in practice.
G07: Capacity for analysis and synthesis.
G16: Sensitivity for environmental issues.
G17: Capacity for critical reasoning.
T02: Knowledge and improvement in the field of information and communication technologies.

5. Training Activities and Teaching Methods

5.1. Training Activities:

- Theory Sessions
- Problem Solving sessions.
- Practical sessions in Laboratory.
- Field sessions to approach the industrial environment.
- Activities Academically Directed by the Faculty: seminars, conferences, work development, debates, collective tutorials, evaluation activities and self-evaluation.

5.2. Teaching Methods:

- Master class.
- Laboratory practices of small groups.
- Problem solving and practical exercises.
- Evaluations and Exams.

5.3. Development and Justification:

- Academic sessions of theory. Resources such as blackboard and computer presentations will be used to display figures, diagrams and tables. The classes will be developed interactively with the students, discussing the aspects that are difficult or especially interesting of each topic.
- Sessions of small groups, problems will be solved and some work made by the students will be presented and discussed.
- Working groups will be organized. Students will help each other to overcome difficulties in the resolution of theoretical issues and problems. Thus, the student will be encouraged to achieve the following objectives: understand and assimilate basic concepts, easily move from theory to practice, work in groups and be competitive.
- Practical laboratory sessions. The students will apply what they have learned in the theoretical classes. The practical utility of the previously acquired knowledge will be discussed.

6. Detailed Contents:

UNIT 1.

· Lesson 1. Atomic structure.

The atom: historical background and first models. Bohr atomic model. The mecano-cuantic approach. The hydrogen atom. The wave function: radial and angular contributions. Many electron atoms. Penetration and shielding. The building-up principle. Electronic configurations.

· Lesson 2. The Periodic Table.

The classification of the elements. Atomic parameters. Magnetic properties. Relationship between some periodic properties. Metals and non-metals and their ions.

· Lesson 3. Molecular Structure and Bonding I.

Ionic versus covalent character. The ionic bond. Reticular energy. The covalent bond. Lewis structures. The octet rule. Resonance.

· Lesson 4. Molecular Structure and Bonding II.

Molecular geometry. The VSEPR model. Polarity of molecules. Valence bond theory. Molecular orbital theory. The structure of simple solids. Close packing of spheres.

· Lesson 5. States of Matter; Liquids and Solids.

Comparison of gases, liquids, and solids. Intermolecular forces. Properties of liquids: surface tension and viscosity. Changes of state. Phase transitions. Phase diagrams.

· Lesson 6. Solutions and Gases.

Units of concentration. Formation of a dissolution and equilibrium. Colligative properties. Gases: volume, amount of matter and temperature, pressure. Boyle's law, Charles's law and Avogadro´s law. Ideal gas law. Mixtures of gases. Partial pressures and molar fractions. Real gases. Deviation from ideal behavior.

· Lesson 7. Thermodynamics.

Thermodynamics. Principles of heat transfer. State properties. Heat flow. Enthalpy. First Law of thermodynamics. Spontaneity of the chemical reactions. Entropy. Gibbs energy.

UNIT 2.

· Lesson 8. Chemical equilibrium

Introduction. Equilibrium constant (K): reaction quotient, applications of K, equilibrium characteristics, K as a function of pressure. Relation among the different ways of expressing K. Relation between K and dissociation degree. Factor affecting the equilibrium: Le Chatelier law. Heterogeneous equilibriums.

· Lesson 9. Reactions in aqueous solution

Introduction. General remarks. Water as solvent. Solvation. Types of reactions: acid-base, redox, complexation and precipitation.

· Lesson 10. Acid-base aqueous reactions

Introduction. Acid-base theories. Acid-base properties of water. Ionic product (Kw) of water. Scale of pH. Strength of acids and bases: ionization constants. Conjugate acids and bases. Acid-base properties of salts. Common ion effect. Buffer solutions.

· Lesson 11. Redox and precipitation aqueous reactions

Introduction. Electrochemical cell. Potential of a cell: reference electrode and electrode potential. Oxidants and reductants. Spontaneity of a reaction. Nernst equation. Solubility and precipitation equilibrium. Factors affecting solubility of ionic compounds. Relationship between solubility and solubility product. Factors affecting the solubility of precipitates: common ion effect, acidity, formation of stable complex, influence of a redox process.

7. Bibliography

7.1. Basic Bibliography

- CHEMISTRY, 10th ed. Raymond Chang, McGraw-Hill, 2010.
- GENERAL CHEMISTRY, 9th ed., Ebbing · Gammon, Houghton Mifflin Company, 2009.
- PRINCIPLES OF GENERAL CHEMISTRY, 2nd ed., Silberberg, McGraw-Hill, 2010.
- Laboratory Manual for Principles of General Chemistry, 9th ed., J. A. Beran, John Wiley & Sons, Inc., 2009.

7.2. Additional Bibliography:

- General Chemistry: Principles and Modern Applications, 10th ed., Petrucci, Prentice Hall, 2010.
- The Foundations of Chemistry Featuring MeasureNet, 2nd ed., Stanton · Zhu · Atwood, Brooks/Cole, Cengage Learning, 2010.

8. Systems and Assessment Criteria

8.1. System for Assessment:

- Theory / problems exam
- Individual Student Tracking
- Exam of practices

8.2. Assessment Criteria and Marks:

According to the Regulation of Evaluation Regulations for Bachelor and Master of the University of Huelva, the evaluation can be continuous evaluation or final unique evaluation. To take the final unique evaluation, the student must write and inform the teacher responsible for the subject during the first two weeks of course or during two weeks after the enrollment.

Continuous Assessment.
First Call.
The final grade of the subject will be a three-part compendium:
1. The final exam will suppose **80%** of the qualification of the subject. The exam will consist of theoretical-practical questions. A minimum grade of 4 will be necessary in order to add the qualifications obtained in sections 2 and 3. This will evaluate the generic / transversal competences G01, G07 and G17, knowledge B04 and O01 to O06.
2. The qualification obtained in the accomplishment of laboratory practices will suppose a **10%** of the final note, being indispensable assistance to them. The attitude and aptitude of the student in the laboratory will be evaluated and one exam of practices on the official date of the final exam of the subject. With this, the competences will be evaluated generic / transverse G01, G04, G05 and G16, the knowledge C03 and O01 to O06.
3. The qualification obtained by carrying out individual activities proposed by the teacher for the follow-up continuous student will account for **10%** of the final grade. This will evaluate the generic / transversal competences G01, G05, G07 and G17, the knowledge B04 and O01 to O06.

After adding the marks of sections 1, 2 and 3, only those students with a **5** or higher will pass. The respect by the student of the basic rules of behavior and functioning of the university community of ETSI will be taken into account in the final mark of the subject.
Second Call.
The call for September and in the Extraordinary calls, 100% of the final grade will be the result in the UNIQUE EXAM where the theory (40%), problems (50%) and practices (10%) of the subject will be evaluated., as well as the part of the practices of the subject. To pass the course is a must to obtain a minimum mark of 5/10.

Final Unique Assessment.
In all the calls (including the Extraordinary ones) the completion of 100% of the final mark will be obtained in the FINAL EXAM where the theory (40%), problems (50%) and practices (10%) of the subject will be evaluated. To pass the course is a must to obtain a minimum mark of 5/10.