

**COURSE: Chemical Basis of Engineering**

**DEGREE: Bachelor Degree in Aerospace Engineering**

**YEAR: 1**

**TERM: Second**

WEEKLY PLANNING								
WEEK	SESSION	DESCRIPTION	TEACHING (mark X)		SPECIAL ROOM FOR SESSION (Computer class room, audio-visual class room)	WEEKLY PROGRAMMING FOR STUDENT		
			L E C T U R E S	S E M I N A R S		DESCRIPTION	CLASS HOURS (1,66=50+50 min)	HOMEWORK HOURS (Max. Estim. 6,5h)
1	1	Introduction to the Course. General Course structure. Presentation of the syllabus, regulations and gradings. Topic 0. Introduction to Chemistry. Topic 01. Introduction to Atomic Structure.	X		NO	Work on the concepts taught in class in Topic 0. Basics of the atomic structure. Atomic number, mass number and isotopes. Introduction to the periodic table. Atoms, molecules and ions. The international system of units. Chemical Equations. Stoichiometry.	1,66	6,5
	2	Exercises on Topic 0		X	NO	Chemical Equations. Stoichiometry.	1,66	
2	3	Topic 01. Atomic Structure and Periodic Properties	X		NO	Basics of the Quantum theory. The periodic table. Periodic properties of the elements. (Atomic Radius, Ionic Radius, Ionization Energy, Electron Affinity, Electronegativity).	1,66	6,5
	4	Exercises on Topic 01		X	NO	Practice on exercises in Electronic Structure and Periodic Properties of the elements.	1,66	
3	5	Topic 02. Chemical Bonding.	X		NO	Basic Concepts. The Ionic Bond. The Covalent Bond. Valence-Shell Electron-Pair Repulsion Models. Valence Bond Theory. Hybridization of Atomic Orbitals.	1,66	6,5

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	6	Exercises on Topic 02		X	NO	Worked examples and recommended readings on the concepts taught in this topic.	1,66	
4	7	Topic 02. Chemical Bonding. Topic 03. States of Matter (I)	X		NO	TOPIC 2. Molecular orbital theory. The Metallic Bond. Intermolecular Forces. TOPIC 3. General properties of the different states of matter. Gases Laws. Ideal Gas Equation. Real Gases. General properties of liquids. Solubility. Vapor Pressure. Clausius Equation.	1,66	6,5
	8	Exercises on Topic 02 and Topic 03.		X	NO	Use of Gases Laws. Vapor Pressure and Clausius Equation.	1,66	
5	9	Topic 03. States of Matter (II). Liquids. Colligative Properties of Solutions.	X		NO	Phase diagrams (One or Two components). Colligative Properties of Solutions.	1,66	6,5
	10	Exercises on States of Matter (II).		X	NO	Exercises on Binary Phase diagrams and Colligative Properties of Solutions.	1,66	
6	11	Topic 04. Thermochemistry (I)	X		NO	Some terminology. State functions. Pressure-Volume Work. The First Law of Thermodynamics. Enthalpy and chemical reactions. Hess's Law. Heat Capacity. Exercises on the First Law of Thermodynamics.	1,66	6,5
	12	LABORATORY SESSION 1. P1. Separation of a Mixture of Solids. Assessment Exercise 1. (*)			1.0.E02		1,66	
7	13	Topic 04. Thermochemistry (II)	X		NO	The Second Law of Thermodynamics: Entropy and order Spontaneous changes, reversibility and chemical equilibrium. Entropy and the Third law of thermodynamics. Spontaneous change: Free energy.	1,66	6,5

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7	14	Topic 04. Worked examples and Exercises in class		X	NO	Exercises on Thermochemical cycles and their use in Chemical Reactions. Calculations of enthalpy, entropy and Gibbs free energy in chemical reactions. Effect of temperature. Spontaneity of chemical processes.	1,66	0,5
8	15	Topic 05. Chemical Equilibrium.	X		NO	Introduction and concept of Chemical Equilibrium. Reversible reactions. Equilibrium Constants. Homogeneous and Heterogeneous Equilibria. Free Energy and Chemical Equilibrium. Factors that affect Chemical Equilibrium. Le Châtelier's Principle. Variation of K with temperature.	1,66	6,5
	16	Topic 05. Worked examples and Exercises in class		X	NO	Problems and exercises on equilibrium constants, concentrations of reactants and products in systems at equilibrium. Factors affecting chemical equilibrium.	1,66	
9	17	Topic 06. Acid-Base and Solubility equilibrium	X		NO	Basic Concepts. Acid-base theories. The Acid-Base Properties of Water. The Self-Ionization of Water. pH Scale. The ionization constant. Strength of Acids and Bases. Relationship between the ionization constants of acids and their conjugate bases. Polyprotic Acids Acid-Base Properties of Salts. Hydrolysis. The Common-Ion Effect in Acid-Base Equilibria. Buffer solutions. Solubility. Solubility Equilibria. The Common Ion Effect.	1,66	6,5
	18	Topic 6. Worked examples and exercises in class. (**) LABORATORY SESSION 2. P2. Acid-base titration.			1.0.E02	Exercises on Chemical equilibrium in Acid-Base solutions. Salt Hydrolysis. Solubility Equilibrium.	1,66	

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10	19	Topic 7. Electrochemistry	X		NO	Concept of Oxidation and Reduction. Cell Types. Redox Reactions Potentials. Spontaneity of Redox Reactions. The effect of Concentration on the Potential. Faraday's law. Examples of Galvanic and Electrolytic Processes. Redox processes in aqueous solutions. Corrosion Cells. Cathodic Protection and Passivation	1,66	6,5
	20	Topic 7. Worked examples and exercises in class (**) LABORATORY SESSION 3. P3. Electrochemical potentials			1.0.E02	Worked examples and exercises on electrochemistry	1,66	
11	21	Topic 8. Chemical Kinetics. Examples.	X		NO	Rate of reaction. Rate laws and reaction order. Arrhenius' Law. Reaction mechanisms. Heterogeneous reactions. Homogeneous and heterogeneous catalysis. Chemical reactors. Heterogeneous reactors.	1,66	6,5
	22	Assessment Exercise 2 (*) LABORATORY SESSION 4. P4. Chemical Kinetics			1.0.E02	Worked examples and exercises on Topic 8.	1,66	
12	23	Topic 9. Organic Chemistry (I)	X		NO	Introduction to Organic Chemistry. Nomenclature. Hydrocarbons. Aliphatic Hydrocarbons. Aromatic Hydrocarbons. Physical Properties of Organic Compounds. Isomerism. Organic Reactions.	1,66	6,5
	24	Topic 8. Exercises on Chemical Kinetics. 9. Exercises on Organic Chemistry		X	NO	Worked examples and exercises on general properties of Organic Compounds and reactions.	1,66	

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13	25	Topic 9. Industrial Organic Chemistry. Fossil Fuels. Exercises.	X		NO	Fossil Fuels. Crude oil, Natural Gas and Coal. Energetic Exploitation of Fossil Fuels. Industrial Exploitation of Fossil Fuels. Petrochemical Industry and Carbochemistry Alternative Fuels. Exercises on combustion.	1,66	6,5
	26	Topic 10. Introduction to Chemical Engineering.		X	NO	Basic Principles and Concepts in Chemical Engineering. Classification of basic operations. Macroscopic balances Mass Balances. Basic operations. Mass transfer operations. Heat transfer operations. Heat and mass transfer operations. Momentum transfer operations.	1,66	
14	27	Topic 10. Introduction to Chemical Engineering. Exercises.	X		NO	Exercises on Chemical Engineering. Mass balances.	1,66	6,5
	28	Topic 10. Introduction to Chemical Engineering		X	NO	Further questions on Chemical Engineering. Projects on Chemical Engineering.	1,66	
	29	Additional session	X		NO	Review Session	1,66	3,25
Subtotal 1							48	94
Total 1 (Hours of class plus student homework)							142	

15		Tutorials, handing in, etc		X	NO	(**) Tutoring session on Topic 6 (Acid-Base and solubility Equilibria) and Topic 7 (Electrochemistry)	3,6	-
16		Assessment		X	NO	(*) Assessment Exercise 1;	4	10
17						(*) Assessment Exercise 2;		
18						(*) Assessment Exercise 3. Final Exam		

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