820527 - FQ - Physical Chemistry

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

Teaching unit: 713 - EQ - Department of Chemical Engineering

Academic year: 2017

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

ECTS credits: 6 Teaching languages: Catalan, Spanish

Teaching staff

Coordinator: Zanuy Gomara, David

Others: David Zanuy Gómara
Nuria Borras Cristofol
Joan Torras Costa

Opening hours

Timetable: .

Prior skills

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Requirements

Having Passed Chemistry and Termodynamics classes.

Degree competences to which the subject contributes

Specific:

1. Understand the basics of physical chemistry.

4. Solve mathematical problems that may arise in engineering. Apply knowledge of linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and partial differential equations; numerical methods; numerical algorithms; statistics and optimisation.
5. Summarise information and undertake self-directed learning activities.

6. Understand the basics of organic chemistry.

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

Transversal:

2. EFFECTIVE USE OF INFORMATION RESOURCES - Level 3. Planning and using the information necessary for an academic assignment (a final thesis, for example) based on a critical appraisal of the information resources used.
3. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

Teaching methodology

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Learning objectives of the subject

To expand the knowledge of basic thermodynamics to real cases of material equilibrium, which determines both transport phenomena and chemical equilibrium. To understand the actual behavior of gases. To study mixtures of substances in different phases. In real solutions, to define chemical activity - concentration relationships. To establish equilibrium criteria in mixtures and chemical reactions. To determine the energy exchange in chemical reactions. To study electrolyte solutions and properties whose presence affects. To study electrochemical processes, galvanic cells and corrosion processes. Study of kinetics of adsorption in surfaces and the kinetics of chemical reactions.

Study load

Total learning time: 150h	Hours large group:	60h	40.00%
	Hours medium group:	0h	0.00%
	Hours small group:	0h	0.00%
	Guided activities:	0h	0.00%
	Self study:	90h	60.00%

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Content

Chapter 0. Mass Equilibrium

Learning time: 12h
Theory classes: 4h
Self study : 8h

Description:
Gibbs equations, equilibrium condition. Chemical Potential, condition of material equilibrium: phase equilibrium, chemical equilibrium

Chapter 1. Chemical potentials and equilibrium constant.

Learning time: 27h 30m
Theory classes: 11h
Self study : 16h 30m

Description:
Potencial químico de un gas ideal puro. Potencial químico en una mezcla de gases ideales. Equilibrio químico en una reacción entre gases ideales. Constante de equilibrio. Tipo de constante (Kp, Kc, etc).

Chapter 2. Mixtures and solutions

Learning time: 30h
Theory classes: 12h
Self study : 18h

Description:
Phases and degrees of freedom. The rule of the phases. Systems Multi component: Dissolutions in liquid-vapor equilibrium. Collaborative properties. Phase diagram of a two component system. Ideal vs. ideals solutions. Real solutions. Phase equilibrium in single component systems.

Chapter 3. Non ideal Solutions

Learning time: 12h
Theory classes: 4h
Self study : 8h

Description:
Non-ideal dissolutions and chemical activity. Collaborative properties. Cryoscopic and ebulliscopic constant. Osmotic pressure. Phase diagram of a system of two or more components.

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Chapter 4. Termochemistry

Learning time: 15h
Theory classes: 6h
Self study : 9h

Description:
Thermochemistry: study of the heat transfer that accompanies chemical reactions in systems formed by a chemical reactor and its contents. Calorimetric measurements to determine the heat absorbed or produced in a reaction; Calculation of thermodynamic magnitudes of these processes and study of endothermic and exothermic reactions.

chapter 5. Electrolitic solutions

Learning time: 15h
Theory classes: 6h
Self study : 9h

Description:
Electrolytic solutions. Study of the behavior of electrolytes dissolved in ionizing solvents; Laws of Kholrausch. Properties of electrolyte solutions, conductivity measurement, conductivity, molar conductivity, equivalent conductivity and molar conductivity at infinite dilution. Concept of ionic strength and Debye-Hückel equation. Applications of electrolytic solutions: measure of concentration, solubility, neutralization, the equilibrium constant of an acid and the degree of dissociation.

Chapter 6. Galvanic Cells

Learning time: 25h
Theory classes: 10h
Self study : 15h

Description:
Concept of electrochemical potential. Equilibrium condition in electrochemical systems. Potential difference in systems with more than one phase. Concept of galvanic cell. Concept of electrodes. Type of electrodes. Standard reduction potential. Nerst equation and f.e.m. Type of commercial electrochemical batteries and accumulators.

Chapter 7. Corrosion

Learning time: 15h
Theory classes: 6h
Self study : 9h

Description:
Concept. Types of cathodic reactions. Velocity of Corrosion Penetration. Polarization. Polarization by activation and concetration. Overvoltage and exchange current density. Corrosion rate and corrosion potential. Passivity. Type of corrosion: classification. Protection against corrosion: cathodic protection concept. Sacrifice anode.

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Chapter 8. Kinetics	Learning time: 15h Theory classes: 6h Self study : 9h

Description:
Concept of adsorption. Adsorption isotherms. Introduction to kinetics of reactions, measurement of velocities, kinetic equations and determination of kinetic constants. Order of reaction. Catalysis and importance of this type of reactions in the industry; Types of catalysts. Order of reaction in biological systems, Michaelis-Menten mechanism.

Qualification system

Exams 85% (Mid term (EP) and final (EF))
assignments and papers 15% (NE)

Regulations for carrying out activities

There will be two exams, one mid term and one final.

Bibliography

Basic:

Levine, Ira N. Fisicoquímica. 5ª ed. Madrid: McGraw-Hill, 2004. ISBN 8448140052.

Atkins, P. W. Química física. 6a ed. Barcelona: Omega, cop. 1999. ISBN 8428211817.

Ball, David W. Fisicoquímica. México: Thomson, cop. 2004. ISBN 9706863281.

Complementary:

Enric Brillas [et al.]. Conceptes de termodinàmica química i cinètica. Barcelona: Publicacions i Edicions Universitat de Barcelona, 2004. ISBN 8447528421.

Chang, Raymond. Fisicoquímica para las ciencias químicas y biológicas. 3ª ed. México: McGraw-Hill, 2008. ISBN 9789701066522.