

Course guide

300202 - QUI - Chemistry

Last modified: 01/06/2023

Unit in charge: Castelldefels School of Telecommunications and Aerospace Engineering
Teaching unit: 713 - EQ - Department of Chemical Engineering.

Degree: BACHELOR'S DEGREE IN AEROSPACE SYSTEMS ENGINEERING (Syllabus 2015). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: definit a l'infoweb de l'assignatura

Others: definit a l'infoweb de l'assignatura

PRIOR SKILLS

Basic knowledge of chemical language, the structure of atoms, the periodic properties of chemical elements and the structure of molecules.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

CE4. CE 4 AERO. Capacidad para comprender y aplicar los principios de conocimientos básicos de la química general, química orgánica e inorgánica y sus aplicaciones en la ingeniería. (CIN/308/2009, BOE 18.2.2009)

Generical:

CG9. EFFICIENT USE OF EQUIPMENT AND INSTRUMENTS - Level 1: Using instruments, equipment and software from the laboratories of general or basic use. Realising experiments and proposed practices and analyzing obtained results.

CG1. (ENG) CG1 - Capacidad para el diseño, desarrollo y gestión en el ámbito de la ingeniería aeronáutica que tengan por objeto, de acuerdo con los conocimientos adquiridos, los vehículos aeroespaciales, los sistemas de propulsión aeroespacial, los materiales aeroespaciales, las infraestructuras aeroportuarias, las infraestructuras de aeronavegación y cualquier sistema de gestión del espacio, del tráfico y del transporte aéreo.

CG2. (ENG) CG2 - Planificación, redacción, dirección y gestión de proyectos, cálculo y fabricación en el ámbito de la ingeniería aeronáutica que tengan por objeto, de acuerdo con los conocimientos adquiridos, los vehículos aeroespaciales, los sistemas de propulsión aeroespacial, los materiales aeroespaciales, las infraestructuras aeroportuarias, las infraestructuras de aeronavegación y cualquier sistema de gestión del espacio, del tráfico y del transporte aéreo.

Transversal:

CE2. SUSTAINABILITY AND SOCIAL COMMITMENT - Level 1. Analyzing the world's situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.

CT4. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.

04 COE N1. 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.

Basic:

CB1. (ENG) CB1 - Que los estudiantes hayan demostrado poseer y comprender conocimientos en un área de estudio que parte de la base de la

educación secundaria general, y se suele encontrar a un nivel que, si bien se apoya en libros de texto avanzados, incluye también algunos aspectos que implican conocimientos procedentes de la vanguardia de su campo de estudio

CB2. (ENG) CB2 - Que los estudiantes sepan aplicar sus conocimientos a su trabajo o vocación de una forma profesional y posean las competencias que suelen demostrarse por medio de la elaboración y defensa de argumentos y la resolución de problemas dentro de su área de estudio

CB3. (ENG) CB3 - Que los estudiantes tengan la capacidad de reunir e interpretar datos relevantes (normalmente dentro de su área de estudio)

para emitir juicios que incluyan una reflexión sobre temas relevantes de índole social, científica o ética

CB4. (ENG) CB4 - Que los estudiantes puedan transmitir información, ideas, problemas y soluciones a un público tanto especializado como no especializado

CB5. (ENG) CB5 - Que los estudiantes hayan desarrollado aquellas habilidades de aprendizaje necesarias para emprender estudios posteriores con un alto grado de autonomía

TEACHING METHODOLOGY

- Large group teaching sessions where the teachers present the theoretical contents of the subject. For the follow-up of these sessions, teaching material prepared by the teachers is used.

- Small group sessions led by teachers where the student actively participates in the application of theoretical knowledge by solving exercises and calculations related to the topics of interest of aerospace engineering studies. In these sessions a collection of problems selected by the teachers is used.

- Activities aimed at the practical learning of the subject of Chemistry (experiments in the chemistry laboratory). These activities are carried out in groups of two students.

- Guided autonomous learning through the performance and follow-up of tasks based on problem solving and the use of questionnaires and other learning materials.

LEARNING OBJECTIVES OF THE SUBJECT

Upon completion of the Chemistry course, the student must be able to:

- Understand the behavior of matter based on its chemical properties.

- To know the main characteristics and properties of the solid state of matter.

- Apply the processes of chemical transformation (thermochemistry, chemical kinetics and chemical equilibrium), especially combustion reactions.

- Understand corrosion processes and identify, based on chemical characteristics, potentially corrosive substances and materials.

- Understand the basic principles of organic chemistry. Know the properties and reactivity of combustible compounds.

- Solve exercises and make basic calculations about the gaseous state, chemical reactions of combustion, electrochemistry and corrosion of materials.

STUDY LOAD

Type	Hours	Percentage
Hours large group	26,0	17.33
Self study	84,0	56.00
Guided activities	14,0	9.33
Hours medium group	13,0	8.67
Hours small group	13,0	8.67

Total learning time: 150 h



CONTENTS

General principles of chemistry

Description:

- States of matter
- Behavior of ideal gases
- Atomic structure
- Periodic properties of chemical elements
- Chemical bond
- Molecular structure
- Properties of chemical compounds

Related activities:

- Theory classes C1
- Practical classes C2
- Laboratory practice L1
- Control AC1
- Evaluation activity E1

Related competencies :

01 UEQ N1. EFFICIENT USE OF EQUIPMENT AND INSTRUMENTS - Level 1: Using instruments, equipment and software from the laboratories of general or basic use. Realising experiments and proposed practices and analyzing obtained results.

. CE 4 AERO. Capacidad para comprender y aplicar los principios de conocimientos básicos de la química general, química orgánica e inorgánica y sus aplicaciones en la ingeniería. (CIN/308/2009, BOE 18.2.2009)

05 TEQ N1. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.

Full-or-part-time: 40h 48m

Theory classes: 6h

Laboratory classes: 6h

Self study : 28h 48m



Solid state

Description:

- Basic notions of crystallography
- Defects and imperfections
- Conductors, semiconductors and insulators
- Diffusion mechanisms
- Solid-state solutions and alloys

Related activities:

- Theory classes C1
- Practical classes C2
- Task P1
- Evaluation activity E1

Related competencies :

01 UEQ N1. EFFICIENT USE OF EQUIPMENT AND INSTRUMENTS - Level 1: Using instruments, equipment and software from the laboratories of general or basic use. Realising experiments and proposed practices and analyzing obtained results.

. CE 4 AERO. Capacidad para comprender y aplicar los principios de conocimientos básicos de la química general, química orgánica e inorgánica y sus aplicaciones en la ingeniería. (CIN/308/2009, BOE 18.2.2009)

05 TEQ N1. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.

Full-or-part-time: 22h 48m

Theory classes: 4h

Laboratory classes: 4h

Self study : 14h 48m

Chemical transformations of matter

Description:

- Thermochemistry
- Basic kinetics
- Chemical balance
- Stoichiometry of chemical reactions
- Combustion reactions

Related activities:

- Theory classes C1
- Practical classes C2
- Laboratory practice L1 and L2
- Control AC2
- E1 and E2 evaluation activities

Related competencies :

01 UEQ N1. EFFICIENT USE OF EQUIPMENT AND INSTRUMENTS - Level 1: Using instruments, equipment and software from the laboratories of general or basic use. Realising experiments and proposed practices and analyzing obtained results.

. CE 4 AERO. Capacidad para comprender y aplicar los principios de conocimientos básicos de la química general, química orgánica e inorgánica y sus aplicaciones en la ingeniería. (CIN/308/2009, BOE 18.2.2009)

02 SCS N1. SUSTAINABILITY AND SOCIAL COMMITMENT - Level 1. Analyzing the world's situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.

05 TEQ N1. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.

Full-or-part-time: 40h 48m

Theory classes: 6h

Laboratory classes: 6h

Self study : 28h 48m



Basic electrochemistry

Description:

- Reduction-oxidation reactions
- Galvanic cells
- Corrosion

Related activities:

- Theory classes C1
- Pratical classes C2
- Laboratory practice L2
- Task P2
- Evaluation activity E2

Related competencies :

01 UEQ N1. EFFICIENT USE OF EQUIPMENT AND INSTRUMENTS - Level 1: Using instruments, equipment and software from the laboratories of general or basic use. Realising experiments and proposed practices and analyzing obtained results.

. CE 4 AERO. Capacidad para comprender y aplicar los principios de conocimientos básicos de la química general, química orgánica e inorgánica y sus aplicaciones en la ingeniería. (CIN/308/2009, BOE 18.2.2009)

05 TEQ N1. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.

Full-or-part-time: 22h 48m

Theory classes: 4h

Laboratory classes: 4h

Self study : 14h 48m

Principles of Organic Chemistry

Description:

- The chemistry of carbon
- Functional groups
- Hydrocarbons
- Fuels. Types and characteristics

Related activities:

- Theory classes C1
- Classes of Problems C2
- Task P3
- Evaluation activity E2

Related competencies :

01 UEQ N1. EFFICIENT USE OF EQUIPMENT AND INSTRUMENTS - Level 1: Using instruments, equipment and software from the laboratories of general or basic use. Realising experiments and proposed practices and analyzing obtained results.

. CE 4 AERO. Capacidad para comprender y aplicar los principios de conocimientos básicos de la química general, química orgánica e inorgánica y sus aplicaciones en la ingeniería. (CIN/308/2009, BOE 18.2.2009)

02 SCS N1. SUSTAINABILITY AND SOCIAL COMMITMENT - Level 1. Analyzing the world's situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.

05 TEQ N1. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.

Full-or-part-time: 22h 48m

Theory classes: 4h

Laboratory classes: 4h

Self study : 14h 48m



ACTIVITIES

C1. Theory classes

Description:

In a classroom with a large group, the contents of the subject are explained following a model of participatory expository class. The subject has been organized in 5 chapters with the contents of the subject.

Specific objectives:

Acquire and consolidate the theoretical chemical knowledge necessary for the follow-up of the studies of Aerospace Engineering indicated in the general learning objectives of the subject.

Material:

Basic and complementary bibliography. Slides for the follow-up of the subject. Self-learning questionnaires.

Related competencies :

. CE 4 AERO. Capacidad para comprender y aplicar los principios de conocimientos básicos de la química general, química orgánica e inorgánica y sus aplicaciones en la ingeniería. (CIN/308/2009, BOE 18.2.2009)
02 SCS N1. SUSTAINABILITY AND SOCIAL COMMITMENT - Level 1. Analyzing the world's situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.

Full-or-part-time: 74h

Theory classes: 24h

Self study: 50h

C2. Practical sessions

Description:

In a small group classroom, students solve the problems in each chapter proposed by the teacher, and follow up on the students' work, helping and resolving any questions that may arise.

Specific objectives:

To solve problems related to the contents of Chemistry of the subject from the analysis of the statement, the application of a plan for its resolution that takes into account the necessary data and information, the performance of calculations using the relevant equations to arrive at the correct solution, its interpretation and the verification of the necessary significant units and figures.

Material:

Basic and complementary bibliography. Slides for the follow-up of the subject. Collection of problems.

Related competencies :

. CE 4 AERO. Capacidad para comprender y aplicar los principios de conocimientos básicos de la química general, química orgánica e inorgánica y sus aplicaciones en la ingeniería. (CIN/308/2009, BOE 18.2.2009)
02 SCS N1. SUSTAINABILITY AND SOCIAL COMMITMENT - Level 1. Analyzing the world's situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.

Full-or-part-time: 48h

Laboratory classes: 20h

Self study: 28h

L1. Laboratory Practices: Properties of Matter and Thermochemistry

Description:

Laboratory practices:

1. Dissolution and polarity
2. Oxidation states
3. Endothermic and exothermic reactions

Specific objectives:

Experimentally check some of the properties of matter.

Experimentally study the thermochemistry of the transformations of matter.

Material:

- Glass laboratory equipment (test tubes, test tubes, funnels, beakers)
- Other laboratory work equipment (tweezers, shelf, dropper, bunsen burner, washing bottle, ...)
- Various chemicals

Delivery:

Chemistry Laboratory Questionnaire 1

Related competencies :

01 UEQ N1. EFFICIENT USE OF EQUIPMENT AND INSTRUMENTS - Level 1: Using instruments, equipment and software from the laboratories of general or basic use. Realising experiments and proposed practices and analyzing obtained results.

. CE 4 AERO. Capacidad para comprender y aplicar los principios de conocimientos básicos de la química general, química orgánica e inorgánica y sus aplicaciones en la ingeniería. (CIN/308/2009, BOE 18.2.2009)

05 TEQ N1. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.

Full-or-part-time: 2h

Laboratory classes: 2h

Q. Problem solving tasks

Description:

The student will do problems for topics 2, 4 and 5. Problems will be solved individually through a Task at Athena.

Specific objectives:

To deepen in the resolution of problems and the accomplishment of calculations of Chemistry

Material:

Collection of slides of the subject, bibliography recommended in the subject.

Related competencies :

. CE 4 AERO. Capacidad para comprender y aplicar los principios de conocimientos básicos de la química general, química orgánica e inorgánica y sus aplicaciones en la ingeniería. (CIN/308/2009, BOE 18.2.2009)

02 SCS N1. SUSTAINABILITY AND SOCIAL COMMITMENT - Level 1. Analyzing the world's situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.

Full-or-part-time: 7h

Guided activities: 7h



L2. Laboratory Practices: Chemical Reactions

Description:

Laboratory practices:

1. Reaction rate
2. Chemical equilibrium
3. Electrolytic cells and galvanic cells

Specific objectives:

Experimentally study some processes and the characteristics of the chemical transformations of matter.

Material:

- Glass laboratory equipment (test tubes, test tubes, funnels, beakers)
- Other laboratory work equipment (tweezers, shelf, dropper, bunsen burner, washing bottle, ...)
- Various chemicals

Delivery:

Chemistry Laboratory Questionnaire 2

Full-or-part-time: 2h

Laboratory classes: 2h

AC1. Control 1: General Principles of Chemistry

Description:

Individual verification test carried out in class on General Principles of Chemistry

Specific objectives:

Follow-up of the learning of solving exercises of topic 1

Related competencies :

. CE 4 AERO. Capacidad para comprender y aplicar los principios de conocimientos básicos de la química general, química orgánica e inorgánica y sus aplicaciones en la ingeniería. (CIN/308/2009, BOE 18.2.2009)
02 SCS N1. SUSTAINABILITY AND SOCIAL COMMITMENT - Level 1. Analyzing the world's situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.

Full-or-part-time: 0h 30m

Laboratory classes: 0h 30m

AC2. Control 2: Chemical Transformations of Matter

Description:

Individual verification test carried out in class hours on Chemical Transformations of Matter

Specific objectives:

Follow-up of the learning to solve exercises in topic 3

Full-or-part-time: 0h 30m

Laboratory classes: 0h 30m



E1. Mid-Term Exam

Description:

It consists of an individual examination that is carried out in the period of partial evaluation established by the school, in a session of 1.5 hours of duration, and in which the content of the subject studied in the first part of the subject is evaluated (topics 1, 2 and 3). The examination raises questions about the theoretical concepts studied and the solution of problems and chemical calculations of these topics.

Specific objectives:

Check the level of individual overall achievement of the skills that are being acquired in the subject.

Material:

All the teaching material of topics 1, 2 and 3 of the subject.

Related competencies :

. CE 4 AERO. Capacidad para comprender y aplicar los principios de conocimientos básicos de la química general, química orgánica e inorgánica y sus aplicaciones en la ingeniería. (CIN/308/2009, BOE 18.2.2009)
02 SCS N1. SUSTAINABILITY AND SOCIAL COMMITMENT - Level 1. Analyzing the world's situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.

Full-or-part-time: 3h 30m

Theory classes: 1h 30m

Self study: 2h

E2. Final Term Exam

Description:

It consists of an individual exam that is carried out in the period of partial evaluation established by the school, in a session of 1.5 hours of duration, and in which the content of the subject studied in the second part is evaluated. of the subject (topics 3, 4 and 5). The exam raises questions about the theoretical concepts studied and the solution of problems and chemical calculations of these topics.

Specific objectives:

Check the level of individual overall achievement of the skills to be acquired in the subject.

Material:

The teaching material of topics 3, 4 and 5 of the subject.

Related competencies :

01 UEQ N1. EFFICIENT USE OF EQUIPMENT AND INSTRUMENTS - Level 1: Using instruments, equipment and software from the laboratories of general or basic use. Realising experiments and proposed practices and analyzing obtained results.

. CE 4 AERO. Capacidad para comprender y aplicar los principios de conocimientos básicos de la química general, química orgánica e inorgánica y sus aplicaciones en la ingeniería. (CIN/308/2009, BOE 18.2.2009)

02 SCS N1. SUSTAINABILITY AND SOCIAL COMMITMENT - Level 1. Analyzing the world's situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.

05 TEQ N1. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.

Full-or-part-time: 3h 30m

Theory classes: 1h 30m

Self study: 2h

GRADING SYSTEM

defined in the info web of the subject

BIBLIOGRAPHY

Basic:

- Chang, Raymond; Overby, Jason. Chemistry. 13e. New York: McGraw-Hill Education, 2019. ISBN 9781260085310.
- Atkins, P. W; Jones, Loretta. Principios de química : los caminos del descubrimiento. 5a ed. Buenos Aires: Médica Panamericana, cop. 2012. ISBN 9789500602822.

Complementary:

- Callister, William D. Introducción a la ciencia e ingeniería de los materiales (vol. 1) [on line]. Barcelona [etc.]: Reverté, 1995-1996 [Consultation : 26/07/2022]. Available on : <https://web-p-ebshost-com.recursos.biblioteca.upc.edu/ehost/ebookviewer/ebook?sid=65e01a14-691a-4a0e-9c4e-a1d04b1f0a97%40redis&vid=0&format=EB>. ISBN 842917253X.
- Callister, William D. Introducción a la ciencia e ingeniería de los materiales (vol. 2). Barcelona [etc.]: Reverté, 1995-1996. ISBN 8429172548.
- Allinger, Norman L. Química orgánica. 2ª ed. Barcelona [etc.]: Reverté, DL 1978. ISBN 8429170154.

RESOURCES

Hyperlink:

- Periodic Videos. <http://www.periodicvideos.com/>

Other resources:

In Atena of the subject there is a section with Resources for Learning Chemistry that contains several links to study of Chemistry