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220059 - Materials Chemistry

Coordinating unit: 205 - ESEIAAT - Terrassa School of Industrial, Aerospace and Audiovisual Engineering

Teaching unit: 713 - EQ - Department of Chemical Engineering

Academic year: 2019

Degree: BACHELOR'S DEGREE IN AEROSPACE VEHICLE ENGINEERING (Syllabus 2010). (Teaching unit Optional)
BACHELOR'S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Teaching unit Optional)
BACHELOR'S DEGREE IN AEROSPACE TECHNOLOGY ENGINEERING (Syllabus 2010). (Teaching unit Optional)
BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional)

ECTS credits: 3 Teaching languages: English

Teaching staff

Coordinator: José María Dagá Monmany

Others: José María Dagá Monmany
José María Gibert Vives

Requirements

It is useful to carry a laptop or similar to most classes curs.En the lectures, there will be special emphasis on library resources, and we must protect them and consult them. The library resources are essential for research work.

Teaching methodology

The course is divided into parts:
Theory classes
Self-study for doing exercises and activities.
In the theory classes, teachers will introduce the theoretical basis of the concepts, methods and results and illustrate them with examples appropriate to facilitate their understanding.
In the practical classes (in the classroom), teachers guide students in applying theoretical concepts to solve problems, always using critical reasoning. We propose that students solve exercises in and outside the classroom, to promote contact and use the basic tools needed to solve problems.
Students, independently, need to work on the materials provided by teachers and the outcomes of the sessions of exercises/problems, in order to fix and assimilate the concepts.
The teachers provide the curriculum and monitoring of activities (by ATENEA).

Learning objectives of the subject

The main objective is to develop contents of materials and solid state chemistry knowledge not discussed before in extent in the previous chemistry courses. So we will elaborate structural, reactivity, synthetic and analytical questions, covering also property and application concerns.

We will pay special attention to frontier research and development of new products in materials chemistry. Materials products with market definitive implementation could also be studied, taking into account possible alternatives. This objective will be specially achieved by a directed research work, developed individually by the student, or in a two team.

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Study load

Total learning time: 75h	Hours large group:	30h	40.00%
	Self study:	45h	60.00%

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Content

- Solid state chemistry (inorganic examples)

Learning time: 37h

Theory classes: 12h
Self study : 25h

Description:
Inorganic polymers, fibres, inorganic solids, semiconductors, superconductors, ceramics, glasses, pigments, coatings, hydrogen storage systems, thin films by chemical vapour deposition (CVD), imaging agents for magnetic resonance, catalysts, surface science and connections with chemical process technology.

Related activities:
These inorganic examples will be developed explaining first the fundamental theory, afterwards discussing case studies in seminars, then solving numerical problems in practical classes, and finally pointing at bibliogrraphic sources for further information (for research work).

- Organic polymers

Learning time: 13h

Theory classes: 6h
Self study : 7h

Description:
Specialty and high performance polymers, liquid crystalline polymers, elastomers, synthetic and natural fibres.

Related activities:
These examples of organic polymers will be develop explaining first the fundamental theory, afterwards discussing case studies in seminars, then solving numerical problems, and finally pointing at bibliographic sources for further information (for research work).

- Biomaterials and biomedical polymers

Learning time: 12h 30m

Theory classes: 6h
Self study : 6h 30m

Description:
Biocomposites, biomimetics, natural and modified fibres (natural and artificial nanomaterials; biomaterials from renewable resources; biomineralization).

Related activities:
These examples of biomaterials and biomedical polymers will be develop explaining first the fundamental theory, afterwards discussing case studies in seminars, then solving numerical problems, and finally pointing at bibliographic sources for further information (for research work).

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- Heterogeneous catalysis and physical techniques in materials chemistry characterization	Learning time: 12h 30m Theory classes: 6h Self study : 6h 30m

Description:
Physical techniques to characterise materials. Case studies covering the following techniques:

X-ray diffraction (XRD)

Scanning Electron Microscopy (SEM)

Raman and infrared spectroscopy

Nuclear Magnetic Resonance

Colorimetry

Related activities:
These examples of heterogenous catalysts and physical techniques will be develop explaining first the fundamental theory, afterwards discussing case studies in seminars, then solving numerical problems, and finally pointing at bibliographic sources for further information (for research work).

Qualification system

The final grade depends on the following assessment criteria:

F = 0.25 AEP + 0.5 AEF + 0.25 RWP
F: final evaluation
AEP: evaluation exam partial
AEF: evaluation exam final
RW: Research Work Project)

Any student who cannot attend any of the written tests or that wants to improve the obtained grade, will have the opportunity by taking an additional global witten exam that will take place the dated fixed in the calendar of final exams. The grade obtained in this test will range between 0 and 10, and will replace that of the previous tests only in case it is higher.

Regulations for carrying out activities

Because the contents of the partial exam are included in the final exam, passing the final exam implies having passed also the partial exam. In any case, the best average of the exams will remain.

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Bibliography

Basic:

Mitchell, Brian S. An introduction to materials engineering and science for chemical and materials engineers [on line]. New York: John Wiley & Sons, 2004 [Consultation: 21/05/2014]. Available on: <http://site.ebrary.com/lib/upcatalunya/docDetail.action?docID=10304984&p00=9780471436232>. ISBN 9780471436232.

Atkins, Peter [et al.]. Shriver & Atkins inorganic chemistry. 5th ed. Oxford: Oxford University Press, 2009. ISBN 9780199236176.

Hornyak, G.L. [et al.]. Introduction to nanoscience & nanotechnology. Boca Raton: CRC Press, 2009. ISBN 9781420047790.

Housecroft, Catherine E.; Sharpe, Alan G. Inorganic chemistry. 4th ed. Harlow, Eng: Pearson, 2012. ISBN 9780273742753.

Others resources:

Course notes available in Atena platform.