Last update: 06-05-2019

230485 - ADMAT - Advanced Materials

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering
Teaching unit: 713 - EQ - Department of Chemical Engineering
Academic year: 2019
Degree: BACHELOR'S DEGREE IN ENGINEERING PHYSICS (Syllabus 2011). (Teaching unit Optional)
ECTS credits: 6 Teaching languages: Catalan, English

Teaching staff

Coordinator: CARLOS ENRIQUE ALEMAN LLANSO

Others: JORGE PUIGGALI BELLALTA

Opening hours

Timetable: By appointment

Degree competences to which the subject contributes

Specific:

FQES2. Knowledge of the interactions at different matter scales. Ability to analyze functional capabilities of physical systems at various scales.

FQES3. Knowledge of structural and functional applications of materials. Knowledge of the physical systems of low dimensionality. Ability to identify systems and/or materials suitable for different engineering applications.

Generical:

3. ABILITY TO IDENTIFY, FORMULATE, AND SOLVE PHYSICAL ENGINEERING PROBLEMS. Planning and solving physical engineering problems with initiative, making decisions and with creativity. Developing methods of analysis and problem solving in a systematic and creative way.

Transversal:

1. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.

2. 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.

4. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 3. Communicating clearly and efficiently in oral and written presentations. Adapting to audiences and communication aims by using suitable strategies and means.

Teaching methodology

Classes are divided into three categories: lectures, laboratory practical classes and discussion classes, in which the work done by the students is analyzed and discussed.

Learning objectives of the subject

Learn the basics about advanced materials with high performance technology and biotechnology. Acquire the theoretical foundations for understanding and design hybrid systems based on the combination of materials of different chemical nature. Learning to thinking about structure- properties relationships. Learn the patterns of reasoning that are applied at the level of research on advanced materials.

Last update: 06-05-2019

230485 - ADMAT - Advanced Materials

Study load

Total learning time: 150h	Hours large group:	65h	43.33%
	Self study:	85h	56.67%

Last update: 06-05-2019

230485 - ADMAT - Advanced Materials

Content

1. Advanced ceramics

Learning time: 8h

Theory classes: 6h 30m
Guided activities: 1h 30m

Description:
Advanced inorganic materials: concepts and applications. Functionalization of inorganic surfaces. Functionalized surfaces applied to Biotechnology, Biomedicine and Environmental Engineering. Porous ceramics: porous glasses. Nanostructured ceramics and their applications in Nanotechnology.

2. Biominerals

Learning time: 7h 30m

Theory classes: 7h 30m

Description:
Mineralization of biomolecules. Templating of minerals using biomolecules. Adsorption of biomolecules on inorganic surfaces. Encapsulation of biomolecules in inorganic minerals. Biomedical and biotechnological applications of biominerals: Transfection and tissue engineering.

3. Advanced polymers and biopolymers

Learning time: 9h 30m

Theory classes: 7h 30m
Laboratory classes: 2h

Description:
Biodegradable polymers. Shape memory effects in polymers. Biomedical applications of biodegradable polymers. Hydrogels. Nanoparticles and nanocapsules. Controlled drug delivery using advanced polymers.

4. Nanofibers

Learning time: 9h 30m

Theory classes: 7h 30m
Laboratory classes: 2h

Description:
Materials for the fabrication of nanofibers. Preparation of nanofibers. Functionalization of nanofibers. Applications of nanofibers.

Last update: 06-05-2019

230485 - ADMAT - Advanced Materials

5. Ultra-thin membranes

Learning time: 9h 30m

Theory classes: 7h 30m
Laboratory classes: 2h

Description:
Materials for the fabrication of ultra-thin membranes. Preparation of ultra-thin membranes. Giant free-standing nanomembranes. Functionalization of ultra-thin membranes. Applications of ultra-thin membranes in Electronics and Biomedicine.

6. Self-Assembled Materials

Learning time: 9h 30m

Theory classes: 8h
Guided activities: 1h 30m

Description:
Formation of new materials by self-assembly. Energetics and conditions for the self-assembly process. Self-assembled nanostructures. Applications of self-assembled materials: hydrogels and drug delivery systems.

7. Dendrimers and dendronized polymers

Learning time: 6h 30m

Theory classes: 6h 30m

Description:
Dendrimers and dendrons: Concepts and preparation. Synthesis and design of dendronized polymers. Functionalization of dendrimers and dendronized polymers. Molecular objects. Applications of dendrimers and dendronized polymers in Electronics and Biomedicine.

8. Advanced metals

Learning time: 6h

Theory classes: 4h
Laboratory classes: 2h

Description:
Fabrication, processing and applications of advanced alloys. Porous metals. Functionalization of metallic surfaces and advanced treatments for corrosion protection. Fabrication of metallic nanoparticles and their applications. Biometallic materials.Fabrication, processing and applications of advanced alloys. Porous metals. Functionalization of metallic surfaces and advanced treatments for corrosion protection. Fabrication of metallic nanoparticles and their applications. Biometallic materials.

Last update: 06-05-2019

230485 - ADMAT - Advanced Materials

Qualification system

NC= 0.15NL + 0.15NT + 0.20ND + 0.50NE
Where NC is the course mark, NL is the laboratory mark, NT is the mark of the work done during the course, ND is the mark from the discussion classes and NE is the final exam mark.

Regulations for carrying out activities

Laboratory: it is mandatory to attend 80% of practices corresponding and deliver questionnaires within established classes.
Jobs: NT is the average of the ratings associated with different work during the course.
Discussion: ND depends on the quality of the discussion provoked by each student in the different works, both in terms of questions and answers.
Final examination: it consists of several theoretical and practical questions related with the topics explained along the course.

Bibliography

Basic:

Halary, J.L.; Lauprêtre, F.; Monnerie, L. Polymer materials: macroscopic properties and molecular interpretations [on line]. Hoboken, NJ: John Willey & Sons, 2011 [Consultation: 26/09/2014]. Available on: <http://site.ebrary.com/lib/upcatalunya/docDetail.action?docID=10441472>. ISBN 9780470922019.

Pethrick, R.A. Polymer structure characterization: from nano to macro organization in small molecules and polymers. 2a ed. Royal Society of Chemistry Publishing, 2014. ISBN 978-1-84973-433-2.

Migliaresi, C.; Motta, A. Scaffolds for tissue engineering: biological design, materials, and fabrication [on line]. Boca Raton, FL: CRC Press, 2014 [Consultation: 26/09/2014]. Available on: <http://site.ebrary.com/lib/upcatalunya/docDetail.action?docID=10882793>. ISBN 9789814463218.

Others resources:

Audiovisual material

Nom recurs

Suitable bibliographic resources will be provided for each lesson through the ATENEA electronic system.