Universitat Autònoma de Barcelona

2020/2021

Introduction to Materials Science

Code: 103948
ECTS Credits: 5

Degree	Type	Year	Semester
2500097 Physics	OT	3	2

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

Contact

Name: Santiago Suriñach Cornet
Email: Santiago.Surinyach@uab.cat

Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Prerequisites

They do not exist

Objectives and Contextualisation

This cours is about bringing students closer to the world of materials science. The physical properties are related to the applications and a brief incursion into the technological materials.
It is aimed at students who want to study materials science related to students interested in solid state physics and, in general, to students who want to relate the physical properties that they study in their career with them applications

Competences

- Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
- Apply fundamental principles to the qualitative and quantitative study of various specific areas in physics
- Be familiar with the bases of certain advanced topics, including current developments on the parameters of physics that one could subsequently develop more fully
- Communicate complex information in an effective, clear and concise manner, either orally, in writing or through ICTs, and before both specialist and general publics
- Develop the capacity for analysis and synthesis that allows the acquisition of knowledge and skills in different fields of physics, and apply to these fields the skills inherent within the degree of physics, contributing innovative and competitive proposals.
- Make changes to methods and processes in the area of knowledge in order to provide innovative responses to society's needs and demands.
- Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
- Use critical reasoning, show analytical skills, correctly use technical language and develop logical arguments
- Use mathematics to describe the physical world, selecting appropriate tools, building appropriate models, interpreting and comparing results critically with experimentation and observation

- Work independently, have personal initiative and self-organisational skills in achieving results, in planning and in executing a project

Learning Outcomes

1. Communicate complex information in an effective, clear and concise manner, either orally, in writing or through ICTs, in front of both specialist and general publics.
2. Describe the relationship between the structure, properties, processing and applications of materials.
3. Describe the various types of existing materials and their differences.
4. Distinguish the fields of application for different types of microscope (optical, electronic, tunneling or atomic force).
5. Establish the foundation for the study of nanomaterials and their application in society.
6. Explain the explicit or implicit code of practice of one's own area of knowledge.
7. Identify situations in which a change or improvement is needed.
8. Identify the social, economic and environmental implications of academic and professional activities within ones own area of knowledge.
9. Relate the properties of materials with their application to engineering.
10. Use calculation in the parameterization of material properties.
11. Use critical reasoning, show analytical skills, correctly use technical language and develop logical arguments
12. Work independently, take initiative itself, be able to organize to achieve results and to plan and execute a project.

Content

1. Introduction: Importance of materials science and engineering. Brief historical introduction. Types of materials. Competence and interrelation between them.
2. Structure of metals, ceramics and polymers
3. Imperfections and mechanisms of diffusion in solids
4. Diagrams and phase transformations
5. Mechanical properties and mechanisms of deformation in solids
6. Thermal, electrical, magnetic and optical properties of solids
7. New materials

Methodology

Lectures
The Introduction to Material Science course is totally interdisciplinary, which makes it suitable for being taught using the new educational resources: slide projector, internet, etc. Thus, the lectures will consist of a set of presentations in PowerPoint on the concepts and fundamental subjects of the physics of materials. Students will have this content in sufficient time to prepare the classes and follow them properly.
Problems class
The student will have a list of problems that will be facilitated throughout the course. The classes of problems will be coordinated with the theoretical classes, so that the students will be able to consider themselves and, in some cases, to solve the problems themselves. The list of problems is a set of exercises that illustrate the theory's content
Non-classroom teaching
During the course the student can download all the theoretical material of the subject and the lists of problems through the Virtual Campus of the UAB. In addition, there will be included in the Virtual Campus connections to various Internet pages showing animations related to the world of materials.
Tutorials
Throughout the course, the individualized discussion between the students and the teacher will be encouraged. Communication with teachers will be done through the VIRTUAL CAMPUS (TUTORIES tool).
Thematic work
Students, divided into groups of between 4 and 5 members, will have to present oral and publicly a work to

choose from a list, suggested by the teachers, of topics related to the world of "new materials". The exposure time will be approximately 40 minutes per subject.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
problems solved in the class	14	0.56	3, 2, 9, 10
theoretical classes	27	1.08	3, 2, 4, 5, 9
Type: Supervised			
tutorials	2	0.08	5, 9
Type: Autonomous			
personal work	33	1.32	3, 2, 4, 5, 9, 10
problems solved	21	0.84	2, 9, 10
thematic work	20	0.8	3, 2, 5, 9

Assessment

* The minimum qualification to pass each of the midterm tests is 3.0. If the overall score obtained in the two midterm tests is less than 4.0 (over 10 points), the note will not be considered with the rest of the blocks (delivery of problems and thematic work). In this case, the student will have to take a resit exam that will count 75% of the total grade.

** To opt for the resit examination, it must have been presented, at least, to evaluation activities that represent 2/3 parts of the total.

The student will be considered submitted for evaluation if it is presented in more than 35% of the final mark of the evaluation.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
delivery of problems	35%	0	0	3, 2, 4, 7, 11, 9, 12, 10
midterm exam* (2 partial tests)	40%	4	0.16	3, 2, 4, 5, 9, 10
resit exam	75%	3	0.12	3, 2, 4, 9, 10
thematic work (oral presentation)	25%	1	0.04	1, 3, 2, 4, 5, 6, 8, 11, 9

Bibliography

Theory books and / or problems

- Class notes: Campus Virtual UAB.

- Ciència dels materials; M.Cruells et al.; Publicacions i edicions de la Universitat de Barcelona, 2007.
- Ciencia e Ingeniería de los materiales; D.R.Askeland, Ed. Paraninfo, Madrid, 2001.
- Ciencia e Ingeniería de los Materiales; W.D.Callister y D.G.Rethwisch, 2ªed Ed. Reverté 2016
- Fundamentals of materials science and engineering, an integrated approach; W.D.Callister 3ª ed. Ed. John Wiley, 2008.
- Introducción a la Ciencia de Materiales para Ingenieros; J.F.Shackelford, 6a ed., Prentice Hall, Madrid, 2005.
- Solid State Physics, An introduction; Hofmann, P. ; 2nd Edition, Wiley-VCH 2015