UNIVERSIDADE DA CORUÑA

Teaching Guide				
Identifying Data				2019/20
Subject (*)	Materials Science		Code	610G01035
Study programme	Grao en Química			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	1st four-month period	Fourth	Obligatory	6
Language	SpanishGalicianEnglish			
Teaching method	Face-to-face			
Prerequisites				
Department	Química			
Coordinador	Castro Garcia, Socorro	E-mail	socorro.castro.garcia@udc.es	
Lecturers	Castro Garcia, Socorro Sanchez Andujar, Manuel Señaris Rodriguez, Maria Antonia	E-mail	socorro.castro.garcia@udc.es m.andujar@udc.es m.senaris.rodriguez@udc.es	
Web				
General description	Materials Science is a compulsory subject of the 7th semester (4th year, 1st semester) of our Degree in Chemistry, that belongs to the module "Complementary Formation in Chemistry". This subject, of marked interdisciplinary character, is devoted to the study of the different types of materials (metals, ceramics, polymers, composites), their properties (mechanical, electrical, magnetic, optical) and their performance.			

Study programme competences / results	
Code	Study programme competences / results
A1	Ability to use chemistry terminology, nomenclature, conventions and units
A3	Knowledge of characteristics of the different states of matter and theories used to describe them
A6	Knowledge of chemical elements and their compounds, synthesis, structure, properties and reactivity
A12	Ability to relate macroscopic properties of matter to its microscopic structure
A17	Ability to work safely in a chemistry laboratory (handling of materials, disposal of waste)
A20	Ability to interpret data resulting from laboratory observation and measurement
A23	Critical standards of excellence in experimental technique and analysis
A24	Ability to explain chemical processes and phenomena clearly and simply
A25	Ability to recognise and analyse link between chemistry and other disciplines, and presence of chemical processes in everyday life
B2	Effective problem solving
B3	Application of logical, critical, creative thinking
B4	Working independently on own initiative
C4	Self-development as an open, educated, critical, engaged, democratic, socially responsible citizen, equipped to analyse reality, diagnose problems, and formulate and implement informed solutions for the common good
C6	Ability to assess critically the knowledge, technology and information available for problem solving

Learning outcomes			
Learning outcomes	Study programme competences / results		
To achieve a general vision of Materials Science and its interdisciplinary character . To achieve basic notions about different criteria for the classification of materials.	A25	B3	C4 C6
To know the different families of materials (metals, ceramics, polymers, composites) and the main methods of synthesis and processing To know their most outstanding properties and to be able to relate them to their composition, structure and microstructure.	A1 A3 A6 A12 A24		

To know the basics and applications of materials of interest for the electrical and electronic industries, and also of magnetic and optical materials.	A12 A24 A25		
To develop criteria for the selection of materials based on their applications.	A6 A25	B2 B3 B4	C4 C6
To get acquainted with techniques and working methodologies of common use in Materials Labs.	A17 A20 A23	B2 B4	
To be able to analyze and interpret data containing scientific and technical information about materials.	A1 A20 A23	B2 B3 B4	C4 C6

Contents	
Topic	**Sub-topic**
I. Introductory Section	? Introduction to Materials Science ? Criteria for classification of Materials ? Criteria for selection of Materials ? Mechanical tests and properties ? Structure, microstructure and phase diagrams
II. Families of Materials	? Metals and alloys (steels, cast irons and non-ferrous alloys) ? Ceramics (clay products, refractories, abrasives, cements, glasses, advanced ceramics) ? Polymers (thermoplastics, termosetting polymers, elastomers) ? Composites ?Synthesis and processing tecniques
III: Materials of technological interest	? Materials for the electrical and electronic industries: metals, semiconductors, superconductors, dielectrics, ferroelectrics, piezoelectrics, ionic conductors , etc. Devices. ? Magnetic materials: ferromagnetic, ferrimagnetic and antiferro-magnetic.Hard and soft magnetic materials. Main apllications (motors, magnetic storage, etc.) ? Introduction to optical materials and their applications
IV: New trends in Materials Science and examples of selection of materials	? Biomaterials, nanomaterials, etc. ? Examples of selection of materials
V: Materials Laboratoy	? Synnthesis and processing ? Characterization and study of materials properties

Planning				
Methodologies / tests	**Competencies / Results**	**Teaching hours (in-person & virtual)**	**Student?s personal work hours**	**Total hours**
Guest lecture / keynote speech	A1 A3 A6 A12 A16 A25 B3 C4	25	62.5	87.5
Problem solving	A1 A3 A6 A12 A16 A24 B2 B3	5	12.5	17.5
Seminar	A1 A3 A6 A12 B2 B3	2	6	8
Events academic / information	A1 A24 A25 B3 C4	1	2	3
Supervised projects	A1 A3 A6 A12 A16 A24 A25 B3 B4 C4 C6	2	5	7

Laboratory practice	A1 A16 A17 A20 A23 B2 B3 B4	9	9	18
Mixed objective/subjective test	A1 A3 A6 A12 A24 A25 C4 C6	3	4.5	7.5
Personalized attention		1.5	0	1.5
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	**Description**
Guest lecture / keynote speech	In these lectures the teacher will present the contents of the different themes, enphasizing their main aspects and paying special attention to fundamental and/or difficult concepts.
Problem solving	These classes will be devoted to the resolution of a series of problems and questions that will be given in advance to the student so that he/she can work on them before the corresponding session.
Seminar	Work in small groups devoted to the discussion of a topic, a case study etc. prepared in advanced by the students.
Events academic / information	Complementary activities consisting in a visit to centers/installations working in aspects related to this subject, attendance to scientific talks organized by the Faculty and other organisms during this semester, etc. These activities will be organized and announced during the course depending on the number of students, the invited speakers that will come tro the Faculty during this period, etc.
Supervised projects	Before starting the work in the Lab the students will have to carry out a study about aspects of interest for the topic of his/her experiment. This task will be guided and supervised by the teacher with whom the student will have at least one personal interview.
Laboratory practice	Supervised work that will be carried out in the Lab and that will be centered in the synthesis and processing of different types of materials, their characterization and study of their properties.
Mixed objective/subjective test	Final exam that will take place on the official dates approved by the "Junta de Facultad". It will evaluate the level of knowledge and competences acquired by the student ands his/her capability to integrate them as well as proof a global vision on the subject.

Personalized attention	
Methodologies	**Description**
Guest lecture / keynote speech Seminar Events academic / information Laboratory practice Problem solving Supervised projects Mixed objective/subjective test	Personalized attention will be given mainly through activities carried out in small groups, and also in individualized tutorials, fundamentally associated with the methodologies "problem solving", "supervised work" and "laboratory practices". For students with "academic dispensation": - the tutorials associated with "laboratory practices" will be the same as for the rest of the students; - the rest of the tutorials may be replaced by personalized tutorials that will not be evaluated. These students would pass a particular examination, in addition to the compulsory mixed test, which would leave no doubt about their level of knowledge, competences, skills and abilities, and which would score 20% of the overall grade. In order to benefit from this system, the student must notify the responsible teacher at the beginning of the course. Obviously, and apart from the tutorials proposed by the teacher, any student can carry out tutorials at their own request (face-to-face or virtual) within the 6 hours of weekly tutorial that the teacher makes available to the student. Whenever possible, the teacher will facilitate these tutorials outside these hours and/or at a distance.

Assessment

Methodologies	Competencies / Results	Description	Qualification
Guest lecture / keynote speech	A1 A3 A6 A12 A16 A25 B3 C4	Aspects that will be taken into account: extent of previous preparation, of follow-up and of active participation "Guest lecture", "Problem solving", "seminars" and "events" will be assessed together.	0
Seminar	A1 A3 A6 A12 B2 B3	Aspects that will be taken into account: the work done by the students, their answers, their level of knowledge and their active participation in debates with the other students . "Guest lecture", "Problem solving", "seminars" and "events" will be assessed together.	0
Events academic / information	A1 A24 A25 B3 C4	Aspects that will be taken into account: the conclusions that the students have extracted from these activities and that they should also refect in a written summary that they will have to present afterwards. "Guest lecture", "Problem solving", "seminars" and "events" will be assessed together.	0
Laboratory practice	A1 A16 A17 A20 A23 B2 B3 B4	The work done in the lab will be assessed from the point of view of: organization and security, knowledge of material and techniques, working skills, and specially degree of understanding and rationalization of observed facts on a scientific basis. The previous preparation of this work and the laboratory notebook will be also taken into account in this evaluation. Although the grade will be based on a continuous evaluation, in particular cases the teacher can also carry out an exam. "Laboratory practice" and "supervised projects" will be assessed together.	20
Problem solving	A1 A3 A6 A12 A16 A24 B2 B3	Aspects that will be taken into account: the response of the students and their active participation in presencial activities. Occasionally, and if requested by the teacher, the students should submit their answers to selected questions, that can also be evaluated. "Guest lecture", "Problem solving", "seminars" and "events" will be assessed together.	20
Supervised projects	A1 A3 A6 A12 A16 A24 A25 B3 B4 C4 C6	In the tutoring sessions associated to the activity "Trabajos tutelados" the teacher will not only guide the students but will also evaluate all aspects related to their preparation for the work in the Lab (in fact the student will not be allowed to start the work in the Lab until he/she have done a goodenough previous preparation), for the case studies , etc. "Laboratory practice" and "supervised projects" will be assessed together.	0
Mixed objective/subjective test	A1 A3 A6 A12 A24 A25 C4 C6	This final exam, that will take place at the end of the semester, can contain: questions to develop, short questions, a test and problems that will be similar to those solved during the Course.	60

Assessment comments

The final grade will result from the addition of the following partial contributions:
- Final exam ("Prueba mixta"): up to a maximun of 6 points.
-Activities carried out during the different sessions (seminars, exercises, tutoring sessions, scientif events, etc): up to a maximum of 2 points.
-Laboratory sessions: up to a maximum of 2 points.
A minimum of 5 points will be required to pass the Materials Science subject, with the restriction that a minimum of 2.7 (over a maximum of 6) will be necessary in the final exam ("prueba mixta"), as well as a minimum of 0.8 (over a maximum of 2) in the laboratory sessions. If these minima are not achieved the studentt will fail. When a sum of more than 5 points is obtained but the minimum required mark is not reached in one of the activities, the final grade will be "Failed: 4.5 points".
As the assessment of this subject is based on a continuous evaluation model, the progression of the student throughout the semester will be taken into consideration with a maximum of 1 point.
Also, and according to this evaluation model, if the student has participated in activities whose relativeweight is more than a 25% of the total grade, he/she will be assessed.
In this same context, and according to the rules contained in ?Probas de Avaliación e Actas de Cualificación de Grao e Mestrado?, the so-called ?second opportunity of July? is understood as a second opportunity to carry out a final exam ("prueba mixta"). Nevertheless, and in very special cases, the teacher could also include a second part concerning aspects of the Laboratory Sessions. This mark will be considered together with the others obtained during the course corresponding to the other activities (seminars, exercises, scientific events, etc.). The percentages of the different contributions will be the same as those of the former "first opportunity".
The highest grade "Matricula de Honor" will be mainly given to students that pass the subject in the "first opportunity". And it will only be given in the so-called "second opportunity" if there are still any available.
In the case of exceptional, objective and adequately justified circumstances (such as in the case of students with an academic exemption of attendance), the responsible teacher could totally or partially exempt the student from attending the continuous assessment process. In any case, this student will have to undergo a particular examination (in addition to the compulsory mixed test) that will leave no doubt about their level of knowledge, competences, abilities and skills, and that will score 20% of the overall grade.
The teaching-learning process, including assessment, refers to an academic year (this implies that each year starts a new process, including all assessment activities and procedures).

Sources of information	
Basic	W.D. CALLISTER, D.G. RETHWISCH (2011). MATERIALS SCIENCE AND ENGINEERING . Asia, John Wiley and Sons. A.G. SHACKELFORD (2009)INTRODUCTION TO MATERIALS SCIENCE FOR ENGINEERS. New York, Prentice Hall.W.D. CALLISTER, D.G. RETHWISCH (2011). MATERIALS SCIENCE AND ENGINEERING . Asia, John Wiley and Sons. A.G. SHACKELFORD (2009)INTRODUCTION TO MATERIALS SCIENCE FOR ENGINEERS. New York, Prentice Hall.
Complementary	A.R. WEST (1992). Solid State Chemistry and its Applications. Chichester, John Wiley and SonsA.R. WEST (1999). Solid State Chemistry. Chichester, John Wiley and SonsL.E. SMART, E.A. MOORE (1995). Química del Estado Sólido. Wilmington, Addison-Wesley IberoamericanaL.E. SMART, E.A. MOORE (2005). Solid State Chemistry. Boca Raton, Taylor and FrancisW.F. SMITH (1998). Fundamentos de la Ciencia e Ingeniería de Materiales . Madrid, McGraw-HillJ.C. ANDERSON (1990). Materials Science. Londres, Chapman and Hall

Recommendations
Subjects that it is recommended to have taken before
Inorganic Chemistry 1/610G01021 Inorganic Chemistry 2/610G01022 Inorganic Chemistry 3/610G01023 Inorganic Chemistry 4/610G01024
Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus
Other comments

(*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.