



## IDENTIFYING DATA

### Materials science and technology

|                     |   |           |      |            |
|---------------------|---|-----------|------|------------|
| Subject             | Materials science and technology  |           |      |            |
| Code                | V12G380V01301   |           |      |            |
| Study programme     | Degree in Mechanical Engineering  |           |      |            |
| Descriptors         | ECTS Credits  | Choose    | Year | Quadmester |
|                     | 6   | Mandatory | 2nd  | 2nd        |
| Teaching language   | Spanish<br>Galician   |           |      |            |
| Department          |   |           |      |            |
| Coordinator         | Figueroa Martínez, Raúl<br>Abreu Fernández, Carmen María  |           |      |            |
| Lecturers           | Abreu Fernández, Carmen María<br>Álvarez Dacosta, Pedro<br>Cortes Redin, María Begoña<br>Feijó Vázquez, Iria<br>Figueroa Martínez, Raúl<br>Gutián Saco, María Beatriz<br>Iglesias Rodríguez, Fernando<br>Pena Uris, Gloria María<br>Riobó Coya, Cristina<br>Vázquez Castro, Alfonso |           |      |            |
| E-mail              | cabreu@uvigo.es<br>raulfm@uvigo.es  |           |      |            |
| Web                 | <a href="http://fatic.uvigo.es">http://fatic.uvigo.es</a>   |           |      |            |
| General description | The aim of this subject is to introduce the main concepts of materials technology as well as to study applications of the most common materials   |           |      |            |

## Competencies

|      |  |
|------|--|
| Code |  |
| B3   | CG3 Knowledge in basic and technological subjects that will enable students to learn new methods and theories, and provide them the versatility to adapt to new situations.  |
| B4   | CG4 Ability to solve problems with initiative, decision making, creativity, critical thinking and the ability to communicate and transmit knowledge and skills in the field of industrial engineering in Mechanical specialty. |
| B6   | CG6 Capacity for handling specifications, regulations and mandatory standards.   |
| C9   | CE9 Knowledge of the fundamentals of the science, technology and chemistry of materials. Understand the relationship between microstructure, the synthesis, processing and properties of materials.                            |
| D1   | CT1 Analysis and synthesis   |
| D5   | CT5 Information Management.  |
| D9   | CT9 Apply knowledge.   |
| D10  | CT10 Self learning and work.   |

## Learning outcomes

| Expected results from this subject  | Training and Learning Results |    |     |
|---|-------------------------------|----|-----|
| It comprises the fundamental concepts of link, structure and microstructure of the distinct types of materials                  | B3                            | C9 | D10 |
| It comprises the relation go in to microstructure of the material in his mechanical behaviour, electrical, thermal and magnetic | B3                            | C9 |     |
| It comprises the mechanical behaviour of the metallic materials, ceramic, plastics and compound                                 | B4<br>B6                      |    |     |
| It knows how they can modify the properties by means of mechanical processes and thermal treatments                             | B4                            | C9 | D9  |

|  |          |    |          |
|--|----------|----|----------|
| It knows the basic technicians of structural characterisation of the materials | B3<br>B6 | C9 |          |
| It purchases skills in the handle of the diagrams and charts                   |          |    | D1<br>D5 |
| It purchases skill in the realisation of essays                                | B6       | C9 | D10      |
| It analyses the results obtained and extracts conclusions of the same          |          |    | D1<br>D9 |
| It is able to apply norms of essays of materials                               | B6       |    | D1<br>D9 |

## Contents

| Topic  |  |
|--|--|
| Introduction                                   | Introduction to the Science and Technology of Material. Classification of the materials. Terminology. Orientations for the follow-up of the matter.  |
| Crystalline arrangement.                       | Crystalline and amorphous solids. Crystalline lattices, characteristics and imperfections. Allotropic transformations.   |
| Properties of materials. Laboratory practices. | Mechanical, chemical, thermal, electric and magnetic properties. Standards for materials analysis. Compressive and tensile deformation. Principles of fracture mechanisms. Toughness. Hardness. Main test methods. Fundamentals of thermal analysis. Fundamentals of non-destructive testing. Introduction to metallography. Binary isomorphous and eutectic systems. Microstructure in eutectic alloys. Analyses of practical situations. |
| Metallic materials.                            | Solidification. Constitution of alloys. Grain size. Main binary phase diagrams. Processing. Carbon steels: classification and applications. Cast iron alloys. Heat treatments: fundamentals and classification. Annealing, normalizing, quenching and tempering. Nonferrous alloys.  |
| Polymers and composites                        | General concepts. Classification. Properties. Types of polymers. Processing. Classification of composite materials. Polymer matrix composite materials. Processing of composite materials. Problems related to polymeric and composite materials.  |
| Ceramic materials                              | Structure and bonding in ceramic materials. Silicates structure. Glasses. Properties of ceramic materials. Processing of ceramic materials. Applications.  |

## Planning

|                                 | Class hours | Hours outside the classroom | Total hours |
|---------------------------------|-------------|-----------------------------|-------------|
| Introductory activities         | 1.5         | 0                           | 1.5         |
| Lecturing                       | 31          | 55.8                        | 86.8        |
| Laboratory practical            | 18          | 18                          | 36          |
| Autonomous problem solving      | 0           | 12                          | 12          |
| Objective questions exam        | 0.5         | 0.5                         | 1           |
| Problem and/or exercise solving | 1           | 0.95                        | 1.95        |
| Problem and/or exercise solving | 1.25        | 1.5                         | 2.75        |
| Essay                           | 0.5         | 7.5                         | 8           |

\*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

## Methodologies

|                            | Description  |
|----------------------------|--|
| Introductory activities    | Presentation of the subject. Introduction to materials science and technology.   |
| Lecturing                  | Exhibition by the lecturers of the main contents of the subject, theoretical bases and/or projects guidelines. Hands on science methodology. |
| Laboratory practical       | Practical application of the theoretical contents. Practical exercises in the materials laboratory.  |
| Autonomous problem solving | Formulation of a practical activity related to the subject. The student must be able to resolve them by himself.                             |

## Personalized assistance

| Methodologies                   | Description |
|---------------------------------|-------------|
| Lecturing                       |             |
| Laboratory practical            |             |
| Tests                           | Description |
| Problem and/or exercise solving |             |
| Essay                           |             |

| Assessment                      |   |               |                               |    |                 |
|---------------------------------|---|---------------|-------------------------------|----|-----------------|
|                                 | Description   | Qualification | Training and Learning Results |    |                 |
| Laboratory practical            | Attendance, participation and periodical assignments.   | 2             | B3<br>B6                      | C9 | D1<br>D9<br>D10 |
| Problem and/or exercise solving | In the final exam, short questions will be included. The final exam will be hold the day fixed by the school. | 40            | B3<br>B4<br>B6                | C9 | D1<br>D9<br>D10 |
| Problem and/or exercise solving | Exercises will be assessed along the course (25%). The final exam will include similar exercises (20%).       | 50            | B3<br>B4<br>B6                | C9 | D1<br>D9<br>D10 |
| Essay                           | The main guidelines to successfully develop short projects will be given.                                     | 8             | B3<br>B4<br>B6                | C9 | D1<br>D9<br>D10 |

### Other comments on the Evaluation

**Continuous assessment:** The continuous assessment activities will be carried out during the teaching period and correspond to 30% of the grade.

**Final Exam:** Will consist of a written test weighed 70% of the course grade, that will be taken on the official date set by the EEI direction.

### Requirements to pass the course:

- 1- To get a minimum mark of 40% in the final exam, that is: 2.8 / 7 points and
- 2- The sum of the continuous assessment mark and the written tests has to be get a minimum of 50%, that is, 5/10 points.

If these requirements are not met, the student will have been deemed to have failed the course, and final grade for the course will be that obtained in the written exam.

**Students that do not follow the continuous assessment activities**, after receiving authorization from the EEI direction, will be evaluated with a single final exam on the contents of all the course that will weight the 100% of the grade.

**July exam (2nd Edition):** In the July edition, the continuous assessment marks will be also considered (Valid only in course 2020-21). The characteristics of the exam will be the same as the first edition, and will be taken on the official date set by the EEI direction.

**Extraordinary Call:** The extraordinary call exam contents will cover the entire course, both lecture and labo items, weighing 100%, 10 points. A minimum mark of 5 (50%) will be required to pass the course.

Ethical commitment: Students are expected to carry out their work in accordance with an appropriate ethical behaviour. If the professor detects a behaviour that constitutes academic dishonesty (cheating, plagiarism, use of unauthorized electronic devices, for example) the student will be deemed not met the requirements to pass the subject, and student will be informed that the final grade of this course will be FAIL (0.0). The use of any electronic device will not be allowed during the evaluation tests, unless expressly authorized. Introducing an unauthorized electronic device into the exam room will be considered reason for not passing the course in the present academic year and the final grade will be: FAIL (0.0).

### Sources of information

#### Basic Bibliography

Callister, William, **Materials Science and Engineering: an introduction**, Wiley,  
 Askeland, Donald R, **The science and engineering of materials**, Cengage Learning,  
 Shackelford, James F, **Introduction to materials science for engineers**, Prentice-Hall,

#### Complementary Bibliography

Smith, William F, **Fundamentals of materials science and engineering**, McGraw-Hill,  
 AENOR, **Standard tests**,  
 Montes J.M., Cuevas F.G., Cintas J., **Ciencia e Ingeniería de Materiales**, Paraninfo,

### Recommendations

#### Subjects that continue the syllabus

Materials engineering/V12G380V01504

#### Subjects that are recommended to be taken simultaneously

### **Subjects that it is recommended to have taken before**

Computer science: Computing for engineering/V12G350V01203

Physics: Physics I/V12G380V01102

Physics: Physics II/V12G380V01202

Mathematics: Algebra and statistics/V12G380V01103

Mathematics: Calculus I/V12G380V01104

Chemistry: Chemistry/V12G380V01205

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### **Contingency plan**

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#### **Description**

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=== EXCEPTIONAL PLANNING ===

Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===

\* Teaching methodologies maintained

All the lecture-based sessions will be maintained, moving them totally or partially to an online version, through the Online Campus (Campus Remoto) of the UVigo.

\* Teaching methodologies modified

Laboratory sessions will be modified to adapt the group size to that set by the University or the EEI as safe. Sessions will be organized to ensure the safety distance. All the activities that can be performed in non face-to-face mode will be deployed on online platforms.

\* Non-face-to-face student attention (tutoring)

Non-face-to-face tutorial services will be held through the virtual offices on the Online Campus, although the attention of the students may be carried out also by other ways (email, videoconference, FAITIC forums, ...), always after previous agreement with the teacher.

\* Modifications (if applicable) of the contents of the course

According to the moment when the University decision of starting non-face-to face or mix teaching is made, some reduction of the lab contents will need to be done, following the defined organization. Students will be informed of the changes through FAITIC platform.

\* Additional bibliography to facilitate self-learning

If student access to academic libraries is limited, additional documentation will be provided.

\* Other modifications

=== ADAPTATION OF THE COURSE ASSESSMENT ===

\* Tests already carried out

The marks obtained in the continuous assessment tests already performed will maintain their weight in the final grade without changes, as defined in the teaching guide.

\* Pending tests that are maintained

- Those continuous assessment tests or exams that have not yet been done will also maintain their contribution in the final grade, as defined in the teaching guide. Exams will be held face-to-face if possible and will be adapted to take place fully online, if the applied contingency measures make it necessary.

\* Tests that are modified

- Final exam: The final exam weight (70% of the course grade) can be modified depending on the date when the non face-to-face teaching is established. It can be reduced to a minimum contribution of 40% of the course grade.

- Students will be informed through Fatic of the change in the reweighting of the final exam, as well as the new tests that will be proposed to increase the weight of the continuous assessment.

- The final exam will be held face-to-face if possible but, if not, it will be adapted to be performed online.

\* New tests

- In case of reducing the weight of the final exam mark in the course grade, new online tests and/or exercises will be proposed covering different items of the course syllabus and performed online using FAITIC platform. The sum of the marks

for the new tests and the final exam will contribute 70% to the course grade.

- Students will receive sufficient information in advance of the new tests and the grading procedure through FAITIC platform.