



## IDENTIFYING DATA

### Materials for the aerospace industry

|                     |  |          |      |            |
|---------------------|--|----------|------|------------|
| Subject             | Materials for the aerospace industry   |          |      |            |
| Code                | O07G410V01903  |          |      |            |
| Study programme     | Grado en Ingeniería Aeroespacial   |          |      |            |
| Descriptors         | ECTS Credits   | Choose   | Year | Quadmester |
|                     | 6  | Optional | 4th  | 2nd        |
| Teaching language   | #EnglishFriendly<br>Spanish<br>Galician  |          |      |            |
| Department          |  |          |      |            |
| Coordinator         | Álvarez González, David  |          |      |            |
| Lecturers           | Álvarez González, David  |          |      |            |
| E-mail              | davidag@uvigo.es   |          |      |            |
| Web                 | <a href="http://dept05.webs.uvigo.es/">http://dept05.webs.uvigo.es/</a>  |          |      |            |
| General description | The aim of this subject is to offer to the students knowledges and tools for the selection of materials in the aerospace field.<br>English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English. |          |      |            |

## Skills

|      |  |
|------|--|
| Code |  |
| A2   | That the students know how to apply their knowledge to their work or vocation in a professional way and that they possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study   |
| A3   | That the students have the capability to gather and interpret relevant data (usually within their area of study) to issue judgments that include a reflection on relevant social, scientific or ethical issues   |
| A5   | That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.   |
| B1   | Capability for design, development and management in the field of aeronautical engineering (in according with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, aerospace propulsion systems, aerospace materials , airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems. |
| C20  | Appropriate knowledge applied to engineering: mechanics of fracture of the continuous media and their dynamic behavior, fatigue of structural instability and aeroelasticity.  |
| D3   | Capability of oral and written communication in native language  |
| D4   | Capability of autonomous learning and information management   |
| D5   | Capability to solve problems and draw decisions  |
| D6   | Capability for interpersonal communication   |
| D8   | Capability for critical and self-critical reasoning  |
| D11  | Show motivation for quality with sensitivity towards subjects within the scope of the studies  |
| D13  | Sustainability and environmental commitment. Equitable, responsible and efficient use of resources   |

## Learning outcomes

|                                    |                               |    |     |     |
|------------------------------------|-------------------------------|----|-----|-----|
| Expected results from this subject | Training and Learning Results |    |     |     |
| New                                | A2                            | B1 | C20 | D3  |
|                                    | A3                            |    |     | D4  |
|                                    | A5                            |    |     | D5  |
|                                    |                               |    |     | D6  |
|                                    |                               |    |     | D8  |
|                                    |                               |    |     | D11 |
|                                    |                               |    |     | D13 |

|     |                |    |     |  |
|-----|----------------|----|-----|--|
| New | A2<br>A3<br>A5 | B1 | C20 | D3<br>D4<br>D5<br>D6<br>D8<br>D11<br>D13 |
| New | A2<br>A3<br>A5 | B1 | C20 | D3<br>D4<br>D5<br>D6<br>D8<br>D11<br>D13 |

## Contents

| Topic   |  |
|---|--|
| Subject 1. Selection of Materials                       | Criteria employed for the selection of materials in function of his application. Employment of Indexes of Material and Indexes of Performance. Ashby diagrams. Management of databases of material properties. |
| Subject 2. Aerospace Alloys.                            | Steels.<br>Light alloys.<br>Titanium and Superalloys<br><br>Manufacture and optimisation of material properties. Termo-mechanical Treatments. Mechanical and thermal properties of alloys.                     |
| Subject 3. Composite materials.                         | Classification: polymeric , metallic or ceramic matrix.<br>Mechanical and thermal properties of the materials.<br>Estimation of properties of compound materials.  |
| Subject 4. Behaviour and Failure of aerospace materials | Friction and wear. Enbrittlement. Fracture. Corrosion and degradation. Fatigue. Creep.   |
| Subject 5. Mechanical and adhesive joints.              | Analysis of failures. Diagnostic and inspection of failures.<br>Mechanical joints. Welding. Adhesive joints.   |
| Subject 6. Quality control and Testing.                 | Classification and properties.<br>Quality control of raw materials. Techniques of thermal analysis.<br>Mechanical testing. Non destructive testing (NDT).  |

## Planning

|                            | Class hours | Hours outside the classroom | Total hours |
|----------------------------|-------------|-----------------------------|-------------|
| Lecturing                  | 24          | 52.5                        | 76.5        |
| Laboratory practical       | 4           | 7                           | 11          |
| Autonomous problem solving | 4           | 7.5                         | 11.5        |
| Studies excursion          | 6           | 2                           | 8           |
| Practices through ICT      | 10          | 17                          | 27          |
| Mentored work              | 2           | 10                          | 12          |
| Objective questions exam   | 2           | 0                           | 2           |
| Presentation               | 0.5         | 1.5                         | 2           |

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

## Methodologies

|                            | Description   |
|----------------------------|---|
| Lecturing                  | Oral presentation of the contents of the course.  |
| Laboratory practical       | Activities for the practical application of the knowledges purchased.                             |
| Autonomous problem solving | Resolution of problems and exercises related with the matter.                                     |
| Studies excursion          | Visits in groups to companies of the aeronautical sector.   |
| Practices through ICT      | Practical exercises of selection of materials with software CES-EduPack.                          |
| Mentored work              | Oral presentation of mentored related with the employment of materials in the aerospace industry. |

## Personalized assistance

| Methodologies | Description |
|---------------|-------------|
|---------------|-------------|

|                            |  |
|----------------------------|--|
| Laboratory practical       | Time in which the professor helps to the student to resolve and make the activities proposed in the lab.   |
| Autonomous problem solving | Orientation that the teacher loans to the students for the correct resolution of the problems .  |
| Lecturing                  | Attention that the professor loans of individual way to the students to resolve the doubts and difficulties that they find on the understanding of the contents of the matter. |
| Practices through ICT      | Time devoted to the resolution of doubts, and to the practical application of the available computer tools for the selection of materials.                                     |
| Mentored work              | It will facilitate to the student orientation and documentation for the preparation of the mentored works.   |

### Assessment

|                          | Description  | Qualification | Training and Learning Results |    |     |                                    |
|--------------------------|--|---------------|-------------------------------|----|-----|------------------------------------|
| Laboratory practical     | Reports of the lab work that the student will have to deliver (individual or in groups).   | 10            | A2<br>A3<br>A5                | B1 | C20 | D4<br>D5<br>D6<br>D8<br>D11<br>D13 |
| Practices through ICT    | Reports of the lab work that the student will have to deliver (individual or in groups).   | 10            |                               |    |     |                                    |
| Objective questions exam | Individual written proof in which the student/to will have to answer to relative questions to the matter presented in the classroom. | 60            | A2<br>A3<br>A5                | B1 | C20 | D3<br>D4<br>D5<br>D8<br>D11<br>D13 |
| Presentation             | Oral presentation by groups of a subject proposed during the development of the matter.  | 20            | A2<br>A3<br>A5                | B1 | C20 | D3<br>D4<br>D5<br>D6<br>D8<br>D11  |

### Other comments on the Evaluation

The data corresponding to schedules, classrooms and exam dates can be consulted in an updated way on the centre's website:<http://aero.uvigo.es/gl/docencia/exames>

To pass the course in this call, it will be necessary to achieve at least 40% of the maximum mark in each of the evaluated tests. If said 40% is not reached in any test, the final grade will be limited by 4.9

The use of any type of electronic device during the evaluation tests is prohibited, unless expressly authorized. The fact of introducing any unauthorized device in the classroom during the evaluation test will be considered a reason for not passing the subject. In this case, the student will obtain a grade of 0 (failed).

Evaluation for non-assistants: the qualification course will be that of a final exam to evaluate all the competences assigned to the subject.

### Sources of information

#### Basic Bibliography

Donald R. Askeland, **Ciencia e ingeniería de los materiales**, 6ª, Cengage Learning, 2012

William F. Smith, **Fundamentos de la Ciencia e Ingeniería de los Materiales**, 4ª, McGraw-Hill, 2014

#### Complementary Bibliography

A. Brent, **Plastics. Materials and processing**, 3ª, Pearson Prentice Hall, 2006

J. Antonio Pero-Sanz, **Ciencia e ingeniería de materiales. Estructura, transformaciones, propiedades y selección**, 5ª, CIE-Dossat 200, 2000

Michael F. Ashby, **Materiales para ingeniería 1. Introducción a las propiedades, las aplicaciones y el diseño**, 1ª, Reverté, 2008

Michael F. Ashby, **Materiales para ingeniería 2. Introducción a la microestructura, el procesamiento y el diseño**, 1ª, Reverté, 2009

Prasad, N.E., **Aerospace materials and Materials technologies**, 1, Springer, 2017

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## **Recommendations**

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

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Materials science and technology/O07G410V01304

Resistance of materials and resilience/O07G410V01405

Aerospace manufacturing/O07G410V01501

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