



| Teaching Guide           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |                                                                                                                            |           |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|----------------------------------------------------------------------------------------------------------------------------|-----------|
| Identifying Data         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        | 2020/21                                                                                                                    |           |
| Subject (*)              | Material Analysis and Characterization Lab                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |        | Code                                                                                                                       | 730497232 |
| Study programme          | Mestrado Universitario en Enxeñaría Industrial (plan 2018)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |        |                                                                                                                            |           |
| Descriptors              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |                                                                                                                            |           |
| Cycle                    | Period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Year   | Type                                                                                                                       | Credits   |
| Official Master's Degree | 2nd four-month period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Second | Optional                                                                                                                   | 3         |
| Language                 | SpanishGalician                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |                                                                                                                            |           |
| Teaching method          | Face-to-face                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |        |                                                                                                                            |           |
| Prerequisites            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |                                                                                                                            |           |
| Department               | Enxeñaría Naval e Industrial                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |        |                                                                                                                            |           |
| Coordinador              | Tobar Vidal, María José                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | E-mail | maria.jose.tobar@udc.es                                                                                                    |           |
| Lecturers                | Amado Paz, José Manuel<br>Artiaga Diaz, Ramon Pedro<br>Garcia Diez, Ana Isabel<br>López Beceiro, Jorge José<br>Tobar Vidal, María José                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | E-mail | jose.amado.paz@udc.es<br>ramon.artiaga@udc.es<br>ana.gdiez@udc.es<br>jorge.lopez.beceiro@udc.es<br>maria.jose.tobar@udc.es |           |
| Web                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |                                                                                                                            |           |
| General description      | Introduction to analysis tecniques and materials characterization. Mechanical, thermal and metallurgical evaluation. It has an eminently practical character and will be developed at EPS research laboratories related to analysis and processing of materials (CIM G000127, LAIL G000188, PROTERM G000660)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |        |                                                                                                                            |           |
| Contingency plan         | 1. Modifications to the contents<br>No changes.<br><br>2. Methodologies<br>*Teaching methodologies that are maintained<br>Supervised projects: Delivery of report or oral presentation corresponding to the activity proposed and/or developed in the laboratory<br><br>*Teaching methodologies that are modified<br>Laboratory practices: Attendance is replaced by bibliographic review with documentation provided (Moodle, Teams) by teachers<br><br>3. Mechanisms for personalized attention to students<br>Teams, Moodle, Email: Weekly attention at student request<br><br>4. Modifications in the evaluation<br>Laboratory Practices 40% Attendance at the scheduled sessions before the activation of the contingency plan<br>Supervised projects 60% Report or presentation of laboratory work or bibliographic review.<br><br>*Evaluation observations:<br><br>5. Modifications to the bibliography or webgraphy |        |                                                                                                                            |           |

| Study programme competences |                                                                                                                                                                           |
|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Code                        | Study programme competences                                                                                                                                               |
| B1                          | CB6 - Possess and understand knowledge that provides a basis or opportunity to be original in the development and / or application of ideas, often in a research context. |



|     |                                                                                                                                                                                                                                                                                     |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| B2  | CB7 - That students know how to apply the knowledge acquired and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study.                                                                   |
| B3  | CB8 - That students are able to integrate knowledge and face the complexity of making judgments based on information that, being incomplete or limited, includes reflections on the social and ethical responsibilities linked to the application of their knowledge and judgments. |
| B4  | CB9 - That the students know how to communicate their conclusions -and the knowledge and ultimate reasons that sustain them- to specialized and non-specialized audiences in a clear and unambiguous way.                                                                           |
| B5  | CB10 - That students have the learning skills that allow them to continue studying in a way that will be largely self-directed or autonomous.                                                                                                                                       |
| B6  | G1 - Have adequate knowledge of the scientific and technological aspects in Industrial Engineering.                                                                                                                                                                                 |
| B13 | G8 - Apply the knowledge acquired and solve problems in new or unfamiliar environments within broader and multidisciplinary contexts.                                                                                                                                               |
| B14 | G9 - Be able to integrate knowledge and face the complexity of making judgments based on information that, being incomplete or limited, includes reflections on social and ethical responsibilities linked to the application of their knowledge and judgments.                     |
| B15 | G10 - Knowing how to communicate the conclusions -and the knowledge and ultimate reasons that sustain them- to specialized and non-specialized publics in a clear and unambiguous way.                                                                                              |
| B16 | G11 - Possess the learning skills that allow to continue studying in a self-directed or autonomous way.                                                                                                                                                                             |
| C1  | ABET (a) - An ability to apply knowledge of mathematics, science, and engineering.                                                                                                                                                                                                  |
| C2  | ABET (b) - An ability to design and conduct experiments, as well as to analyze and interpret data.                                                                                                                                                                                  |
| C3  | ABET (c) - An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.                                           |
| C6  | ABET (f) - An understanding of professional and ethical responsibility.                                                                                                                                                                                                             |
| C7  | ABET (g) - An ability to communicate effectively.                                                                                                                                                                                                                                   |
| C8  | ABET (h) - The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.                                                                                                                              |
| C9  | ABET (i) - A recognition of the need for, and an ability to engage in life-long learning.                                                                                                                                                                                           |
| C11 | ABET (k) - An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.                                                                                                                                                               |

| Learning outcomes                                                                           |  |                             |      |
|---------------------------------------------------------------------------------------------|--|-----------------------------|------|
| Learning outcomes                                                                           |  | Study programme competences |      |
| Knowledge of main analysis techniques for materials characterization and their application. |  | BJ1                         | CJ1  |
|                                                                                             |  | BJ4                         | CJ3  |
|                                                                                             |  | BJ5                         | CJ7  |
|                                                                                             |  | BJ6                         | CJ9  |
|                                                                                             |  | BJ13                        | CJ11 |
|                                                                                             |  | BJ15                        |      |
|                                                                                             |  | BJ16                        |      |
| Adquisition of systematic and rigorous work capacity in the laboratory                      |  | BJ2                         | CJ2  |
|                                                                                             |  | BJ3                         | CJ3  |
|                                                                                             |  | BJ13                        | CJ6  |
|                                                                                             |  | BJ14                        | CJ9  |
| Capacity to manage standards and existing facilities                                        |  | BJ3                         | CJ3  |
|                                                                                             |  | BJ4                         | CJ6  |
|                                                                                             |  | BJ6                         | CJ7  |
|                                                                                             |  | BJ14                        | CJ8  |
|                                                                                             |  | BJ15                        | CJ11 |

| Contents |           |
|----------|-----------|
| Topic    | Sub-topic |



|                                                                                                                                   |                                      |
|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|
| The planned activities develop the contents established in the Memoria de Verificación, approached in an eminently practical way. | Sample preparation                   |
|                                                                                                                                   | Composition and structural analysis. |
|                                                                                                                                   | Thermal analysis                     |
|                                                                                                                                   | Mechanical properties.               |

| Planning                                                                                                                        |                                           |                      |                               |             |
|---------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|----------------------|-------------------------------|-------------|
| Methodologies / tests                                                                                                           | Competencies                              | Ordinary class hours | Student's personal work hours | Total hours |
| Guest lecture / keynote speech                                                                                                  | B1 B2 B13 B6 C1 C2 C11                    | 2                    | 4                             | 6           |
| Laboratory practice                                                                                                             | B1 B2 B3 B4 B15 B14 B6 C1 C2 C3 C6 C7 C11 | 16                   | 24                            | 40          |
| Supervised projects                                                                                                             | B3 B4 B5 B15 B14 B16 C1 C3 C6 C7 C8 C9    | 3                    | 21                            | 24          |
| Personalized attention                                                                                                          |                                           | 5                    | 0                             | 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 | Description of the equipment and procedures mostly used to characterize the composition and physical properties of materials                                                                                           |
| Laboratory practice            | Laboratory tasks in the facilities of the EPS research groups (CIM, LAIL and PROTERM). The activity may be related to ongoing research projects or result from an agreed proposal between the student and the teacher. |
| Supervised projects            | Delivering of a report with the analysis of the results obtained in the laboratory work                                                                                                                                |

| Personalized attention                     |                                                                                                                                                               |
|--------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Methodologies                              | Description                                                                                                                                                   |
| Supervised projects<br>Laboratory practice | The activity with the laboratory equipment and the work development will be carried out with the help and supervision of the personnel of the research teams. |

| Assessment          |                                           |                                                                                                                                                                                        |               |
|---------------------|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| Methodologies       | Competencies                              | Description                                                                                                                                                                            | Qualification |
| Supervised projects | B3 B4 B5 B15 B14 B16 C1 C3 C6 C7 C8 C9    | Qualification will take into account several aspects related to the structure a of the report, the description of the measurement method, the analysis of results and its conclusions. | 40            |
| Laboratory practice | B1 B2 B3 B4 B15 B14 B6 C1 C2 C3 C6 C7 C11 | Attendance to all appointed working sessions will be taken into account.                                                                                                               | 60            |

| Assessment comments                                                                                                                                                                                                                                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Partial-time students will be evaluated in the same terms as those of full-time students.<br>Evaluation criteria in second opportunity will be the same as in first opportunity. There is not academic exemption for class attendance in this subject |

| Sources of information |
|------------------------|
|------------------------|



|                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Basic</b>         | <ul style="list-style-type: none"><li>- R.E. Whan, Ed. (1986). ASM Handbook Volume 10: Materials Characterization. ASM International</li><li>- H. Kuhn and D. Medlin Ed. (2000). ASM Handbook Volume 8: Mechanical Testing and Evaluation. ASM International</li><li>- D. Cramer and Bernard S. Covino, Jr. Ed. (2003). ASM Handbook Volume 13A: Corrosion: Fundamentals, Testing, and Protection. ASM International</li><li>- J.D. Menczel, R.B. Prime, eds. (2009). Thermal analysis of polymers: fundamentals and applications. John Wiley, Hoboken, N.J</li><li>- R. Artiaga Díaz (2005). Thermal analysis, fundamentals and applications to material characterization: proceedings of the international seminar?: thermal analysis and rheology, Ferrol, Spain, 30 Juny-4 July 2003 <a href="http://searc. Universidade da Coruña">http://searc. Universidade da Coruña</a></li></ul> |
| <b>Complementary</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

## Recommendations

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

### Subjects that are recommended to be taken simultaneously

### Subjects that continue the syllabus

### Other comments

1. The delivery of the documentary works for this subject: 1.1. Will be requested in virtual format and / or computer support. 1.2. Will be done through Moodle, in digital format avoiding the need of printing. 1.3. If made on paper: -Do not use plastics. -Double sided printing will be made. -Recycled paper will be used. -The printing of drafts will be avoided. 2. Sustainable use of resources and prevention of harm to the natural environment must be observed.

(\*)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.