



## Teaching Guide

| Teaching Guide           |                                                                                                                                                                                                                                                                                                                                                          |        |                   |           |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------------------|-----------|
| Identifying Data         |                                                                                                                                                                                                                                                                                                                                                          |        |                   | 2021/22   |
| Subject (*)              | Structural Engineering                                                                                                                                                                                                                                                                                                                                   |        | Code              | 730497214 |
| Study programme          | Mestrado Universitario en Enxeñaría Industrial (plan 2018)                                                                                                                                                                                                                                                                                               |        |                   |           |
| Descriptors              |                                                                                                                                                                                                                                                                                                                                                          |        |                   |           |
| Cycle                    | Period                                                                                                                                                                                                                                                                                                                                                   | Year   | Type              | Credits   |
| Official Master's Degree | 2nd four-month period                                                                                                                                                                                                                                                                                                                                    | First  | Optional          | 4.5       |
| Language                 | SpanishGalician                                                                                                                                                                                                                                                                                                                                          |        |                   |           |
| Teaching method          | Face-to-face                                                                                                                                                                                                                                                                                                                                             |        |                   |           |
| Prerequisites            |                                                                                                                                                                                                                                                                                                                                                          |        |                   |           |
| Department               | Enxeñaría Naval e Industrial                                                                                                                                                                                                                                                                                                                             |        |                   |           |
| Coordinador              | Loureiro Montero, Alfonso                                                                                                                                                                                                                                                                                                                                | E-mail | a.loureiro@udc.es |           |
| Lecturers                | Loureiro Montero, Alfonso                                                                                                                                                                                                                                                                                                                                | E-mail | a.loureiro@udc.es |           |
| Web                      | http://https://sites.google.com/site/structuralanalysislab/                                                                                                                                                                                                                                                                                              |        |                   |           |
| General description      | Nesta materia perséguese adquirir as competencias específicas básicas necesarias para o deseño e análise de diferentes tipos de estruturas, baseadas en distintas técnicas de análise estrutural.                                                                                                                                                        |        |                   |           |
| Contingency plan         | 1. Modifications to the contents<br><br>2. Methodologies<br>*Teaching methodologies that are maintained<br><br>*Teaching methodologies that are modified<br><br>3. Mechanisms for personalized attention to students<br><br>4. Modifications in the evaluation<br><br>*Evaluation observations:<br><br>5. Modifications to the bibliography or webgraphy |        |                   |           |

## Study programme competences / results

| Code | Study programme competences / results                                                                                                                                                                                                                                               |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A19  | EI3 - Knowledge and skills for the calculation and design of structures.                                                                                                                                                                                                            |
| 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. |
| B6   | G1 - Have adequate knowledge of the scientific and technological aspects in Industrial Engineering.                                                                                                                                                                                 |
| B7   | G2 - Project, calculate and design products, processes, facilities and plants.                                                                                                                                                                                                      |
| 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.                     |
| B17  | G12 - Knowledge, understanding and ability to apply the necessary legislation in the exercise of the profession of Industrial Engineer.                                                                                                                                             |
| 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. |
| C5  | ABET (e) - An ability to identify, formulate, and solve engineering problems.                                                                                                                                                             |
| C6  | ABET (f) - An understanding of professional and ethical responsibility.                                                                                                                                                                   |
| C8  | ABET (h) - The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.                                                                                    |
| 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 / results |                                                                                      |
| Theoretical and practical knowledge applied in the structural analysis.               |  | AJ19                                  | BJ1 CJ1<br>BJ2 CJ2<br>BJ3 CJ3<br>BJ6 CJ5<br>BJ7 CJ6<br>BJ13 CJ8<br>BJ14 CJ11<br>BJ17 |
| Knowledge and skills for the calculation and design of steel structures and concrete. |  | AJ19                                  | BJ1 CJ1<br>BJ2 CJ2<br>BJ3 CJ3<br>BJ6 CJ5<br>BJ7 CJ6<br>BJ13 CJ8<br>BJ14 CJ11<br>BJ17 |

| Contents                                                                                |                                                                                                                                                                                                                                                                   |
|-----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Topic                                                                                   | Sub-topic                                                                                                                                                                                                                                                         |
| Chapter 0. The following topics develop the contents set up in the verification memory. | Matrix analysis. Basis of calculation. Analysis and design of structures. Concrete structures. steel structures. Soil mechanics. Design of foundations                                                                                                            |
| Chapter 1. Introduction to matrix structural analysis.                                  | Introduction. Structure idealization. System redundances and degrees of freedom. Method of flexibility. Direct stiffness method. Comparison between the two methods. Global and local coordinates. Transformations of spatial coordinates. Transformation matrix. |
| Chapter 2. Stiffness matrix of structural elements                                      | Introduction. Axial force member with plane movement. General axial force member. Beam bending member with plane movement. Beam torsional and bending member. General beam member. Problems.                                                                      |

| Planning                       |                                                            |                                      |                               |             |
|--------------------------------|------------------------------------------------------------|--------------------------------------|-------------------------------|-------------|
| Methodologies / tests          | Competencies / Results                                     | Teaching hours (in-person & virtual) | Student's personal work hours | Total hours |
| Guest lecture / keynote speech | A19 B1 B2 B3 B13<br>B14 B17 B7 B6 C1<br>C2 C3 C5 C6 C8 C11 | 6.5                                  | 15                            | 21.5        |
| Problem solving                | A19 B1 B2 B3 B13<br>B14 B17 B7 B6 C1<br>C2 C3 C5 C6 C8 C11 | 8.5                                  | 20                            | 28.5        |



|                                                                                                                                 |                                                            |     |    |      |
|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|-----|----|------|
| Supervised projects                                                                                                             | A19 B1 B2 B3 B13<br>B14 B17 B7 B6 C1<br>C2 C3 C5 C6 C8 C11 | 4.5 | 26 | 30.5 |
| ICT practicals                                                                                                                  | A19 B2 B3 B6 C1 C5<br>C11                                  | 6   | 10 | 16   |
| Mixed objective/subjective test                                                                                                 | A19 B1 B2 B3 B13<br>B14 B17 B7 B6 C1<br>C2 C3 C5 C6 C8 C11 | 4   | 10 | 14   |
| Personalized attention                                                                                                          |                                                            | 2   | 0  | 2    |
| (*)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  | Guest lecture / keynote speech Oral lecture supplemented with the use of audiovisual means, aiming transmit knowledge and facilitate the learning within the scope of structural analysis |
| Problem solving                 | Methodology that allows the realization of activities of practical character, with computer, such as modelization and structural analysis                                                 |
| Supervised projects             | Methodology designed to promote autonomous learning of students, solving a problem that involves the contents of the course and involves specific skills, under teacher supervision.      |
| ICT practicals                  | O alumno terá que resolver unha serie de casos prácticos de aplicación dos conceptos estudados mediante o uso de programas informáticos.                                                  |
| Mixed objective/subjective test | Proba escrita utilizada para a avaliación do aprendizaxe                                                                                                                                  |

| Personalized attention |                                                                                                                                                                               |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Methodologies          | Description                                                                                                                                                                   |
| Supervised projects    | Guidance and revision about specific problems posed at the development of the different activities proposed in the course. Revision and help when making supervised projects. |

| Assessment                      |                                                            |                                                                                                                                                                                                                                                |               |
|---------------------------------|------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| Methodologies                   | Competencies / Results                                     | Description                                                                                                                                                                                                                                    | Qualification |
| Mixed objective/subjective test | A19 B1 B2 B3 B13<br>B14 B17 B7 B6 C1<br>C2 C3 C5 C6 C8 C11 | Esta proba consiste nun exame onde o alumno resolverá os problemas plantexados polo profesor.<br><br>É preciso acadar unha nota igual ou superior a 3 puntos sobre 7 nesta proba mixta para poder sumar a nota obtida nos traballos tutelados. | 70            |
| Supervised projects             | A19 B1 B2 B3 B13<br>B14 B17 B7 B6 C1<br>C2 C3 C5 C6 C8 C11 | The work involves the contents theoretical and practical in the subject. It must be made individually, in practical session and at the homework hours. It will track the work performance in the practical sessions.                           | 30            |

| Assessment comments |
|---------------------|
|---------------------|



The

student, whose presence along the quarter is insufficient to perform the monitoring and the assessment of their work, by academic waiver or other causes, will also have to develop and submit it for their evaluation. Support and monitoring of such work shall be carried out in tutoring sessions. The assessment is done through the presentation of supervised work and/or the objective test. In this case, the evaluation process can include a session practical, individually or in group, in which the student addresses manually or with the computer the problems posed by the teacher.

For the

second chance you can present the supervised work and/or improve the already accomplished. Support and monitoring is done in tutorial sessions. The assessment is done through the presentation of supervised work pending and/or improved and/or the objective test. The process of evaluation may include, in addition to the above, a practice session individually or in group, in which the student addresses manually or with the computer the problems posed by the teacher.

## Sources of information

|                      |                                                                                                                                                                                                                         |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Basic</b>         | <ul style="list-style-type: none"> <li>- (). Apuntes de la asignatura.</li> <li>- (). Instrucción de Acero Estructural EAE. Ministerio de Fomento</li> <li>- (). Documento Básico SE-AE.</li> <li>- (). EC3.</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

Simulation of Mechanic and Structural Systems/730497224

### Other comments

To help achieve a sustained environment and meet the objective of the action number 5: "Teaching and healthy and sustainable environmental and social research" of the "Plan of action Green Campus Ferrol": documentary work that where delivered in this subject: should be requested in virtual format and/or support computer be made through Moodle, in digital format without having to print them if necessary do them on paper: - Plastics will not be utilized - will be double-side printing. - Will use recycled paper. - Prevent printing drafts. You should make a sustainable use of resources and the prevention of negative impacts on the natural environment

(\*)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.