Degree competences to which the subject contributes

Specific:

8378. Practical numerical modeling skills. Ability to acquire knowledge on advanced numerical modeling applied to different areas of engineering such as: civil or environmental engineering or mechanical and aerospace engineering or bioengineering or Nanotechnology and naval and marine engineering, etc.

8382. Experience in numerical simulations. Acquisition of fluency in modern numerical simulation tools and their application to multidisciplinary problems engineering and applied sciences.

8383. Interpretation of numerical models. Understanding the applicability and limitations of the various computational techniques.

8384. Experience in programming calculation methods. Ability to acquire training in the development and use of existing computational programs as well as pre and post-processors, knowledge of programming languages and standard calculation libraries.

Teaching methodology

The course consists of 1,2 hours per week of classroom activity (large size group) and 1,2 hours weekly with half the students (medium size group).

The 1,2 hours in the large size groups are devoted to theoretical lectures, in which the teacher presents the basic concepts and topics of the subject, shows examples and solves exercises.

The 1,2 hours in the medium size groups is devoted to solving practical problems with greater interaction with the students. The objective of these practical exercises is to consolidate the general and specific learning objectives.

The rest of weekly hours devoted to laboratory practice.

Support material in the form of a detailed teaching plan is provided using the virtual campus ATENEA: content, program of learning and assessment activities conducted and literature.

Learning objectives of the subject

This module presents an introduction to the first and last step of a numerical simulation in computational mechanics. That is, it presents the numerical techniques involved in the pre and post processing steps. On the one hand, the principal techniques that allow building a computational mesh from a CAD model are presented. On the other hand, numerical
techniques for the visualization of discrete fields defined on a computational grid are discussed. These techniques are introduced solving practical applications using Gid (an existing commercial package).

* The students will be able to understand and comprehend the basic steps for generating a mesh; advantages and disadvantages of the algorithms most commonly used, as well as knowing the basics of scientific visualization. * The students must be able to understand and identify the different causes of problems for a CAD representation, correct the characteristics of the graphic model and generate a mesh. * The students must equally be able to select the most adequate technique for the visualization in accordance with the variable type to be visualized. * The students must be able to implement and use computer programs, as well as meshing tools to solve solids and fluids problems.

* Geometry representation.
* Meshing algorithms overview.
* Structured mesh generation.
* Triangular and tetrahedral mesh generation.
* Quadrilateral and hexahedral mesh generation.
* Mesh quality improvement.
* Fundamentals of scientific visualization.
* Techniques for discrete field representation

### Study load

<table>
<thead>
<tr>
<th>Total learning time: 125h</th>
<th>Theory classes: 15h</th>
<th>12.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Practical classes: 15h</td>
<td>12.00%</td>
</tr>
<tr>
<td></td>
<td>Laboratory classes: 7h 30m</td>
<td>6.00%</td>
</tr>
<tr>
<td></td>
<td>Guided activities: 7h 30m</td>
<td>6.00%</td>
</tr>
<tr>
<td></td>
<td>Self study: 80h</td>
<td>64.00%</td>
</tr>
</tbody>
</table>

### Content

- Learning time: 90h
  - Theory classes: 15h
  - Practical classes: 15h
  - Laboratory classes: 7h 30m
  - Self study: 52h 30m

**Description:**
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- 
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**Specific objectives:**
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The mark of the course is obtained from the ratings of continuous assessment and their corresponding laboratories and/or classroom computers.

Continuous assessment consist in several activities, both individually and in group, of additive and training characteristics, carried out during the year (both in and out of the classroom).

The teachings of the laboratory grade is the average in such activities.

The evaluation tests consist of a part with questions about concepts associated with the learning objectives of the course with regard to knowledge or understanding, and a part with a set of application exercises.

Failure to perform a laboratory or continuous assessment activity in the scheduled period will result in a mark of zero in that activity.

Bibliography