Degree competences to which the subject contributes

Transversal:

1. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 3. Communicating clearly and efficiently in oral and written presentations. Adapting to audiences and communication aims by using suitable strategies and means.

Learning objectives of the subject

The goal of this elective course is to introduce students to numerical calculus, providing them with a broad knowledge of numerical techniques that will be very useful throughout the degree and later development of their profession. In particular the course will qualify students to numerically solve partial differential equations with particular interest in the Finite Element Method.

The aim of the lectures is to present the subjects without a deep theoretical formalisms in order to be able to provide a simple and practical training.

Lectures are held in computer rooms, where theoretical explanations of the different numerical methods are combined.
with the implementation of the methods using MATLAB. Because of this, the first lectures of the course are devoted to provide a fast and easy introduction to the software MATLAB.

### Study load

<table>
<thead>
<tr>
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<th>Total learning time: 150h</th>
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<tbody>
<tr>
<td>Hours large group:</td>
<td>45h</td>
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<tr>
<td>Hours medium group:</td>
<td>0h</td>
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<tr>
<td>Hours small group:</td>
<td>15h</td>
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<tr>
<td>Guided activities:</td>
<td>0h</td>
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<tr>
<td>Self study:</td>
<td>90h</td>
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# Content

## Module 1: Introduction to Matlab
- **Learning time:** 10h
  - Theory classes: 4h
  - Self study: 6h

**Description:**
Introduction to the Matlab software. Overview of the basic features, basic operations, definition of variables, vectors and matrices; files *.m; debugger; control statements. Basics on programming.

## Module 2: Introduction to numerical methods
- **Learning time:** 10h
  - Theory classes: 4h
  - Self study: 6h

**Description:**
Brief introduction to the subject. Applications of numerical methods in engineering.

## Module 3: Numerical linear algebra - basic tools
- **Learning time:** 30h
  - Theory classes: 12h
  - Self study: 18h

**Description:**

## Module 4: Numerical calculus - review of basic tools
- **Learning time:** 30h
  - Theory classes: 12h
  - Self study: 18h

**Description:**

## Module 5: Introduction to partial differential equations (PDEs)
- **Learning time:** 30h
  - Theory classes: 12h
  - Self study: 18h

**Description:**
Module 6: Numerical solution of PDEs - Introduction to the Finite Element Method

<table>
<thead>
<tr>
<th>Learning time: 40h</th>
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<tr>
<td>Theory classes: 16h</td>
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<td>Self study: 24h</td>
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Description:
Introduction to the basic concepts. Formulation of the finite element method. Structure of finite element codes. Pre and post-process. Applications to engineering.

Qualification system
Exams: 40%
Assignments: 35%
Validation of the assignments: 20%
Generic Skills: 5%

Bibliography

Basic:

Complementary: