Degree competences to which the subject contributes

Specific:
8233. Knowledge of and the ability to understand dynamic phenomena of the coastal ocean and atmosphere and respond to problems encountered in port and coastal areas, including the environmental impact of coastal interventions. The ability to analyse and plan maritime works.

Teaching methodology
The course consists of 3 hours per week of classroom activity

2.2 hours are devoted to theoretical lectures, in which the teacher presents the basic concepts and topics of the subject, shows examples and solves exercises.

0.8 hours 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.

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
Specialization subject in which knowledge on specific competences is intensified.

Knowledge and skills at specialization level that permit the development and application of techniques and methodologies at advanced level.
Contents of specialization at master level related to research or innovation in the field of engineering.

The objective of this course is to train students in the fields of dynamics, water quality and sediment transport in coastal areas, as well as in engineering and management activities in that area.

In particular, it is intended that students acquire an advanced knowledge of the agents and processes that act in the coastal zone (coastal dynamics, water quality and sediment transport). This training will focus mainly on training the student in the quantification of the processes which present the main methods, models and estimation techniques, emphasizing the range of application and validity.

### Study load

<table>
<thead>
<tr>
<th>Total learning time: 125h</th>
<th>Theory classes: 19h 30m</th>
<th>15.60%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Practical classes: 9h 45m</td>
<td>7.80%</td>
</tr>
<tr>
<td></td>
<td>Laboratory classes: 9h 45m</td>
<td>7.80%</td>
</tr>
<tr>
<td></td>
<td>Guided activities: 6h</td>
<td>4.80%</td>
</tr>
<tr>
<td></td>
<td>Self study: 80h</td>
<td>64.00%</td>
</tr>
</tbody>
</table>
## Content

<table>
<thead>
<tr>
<th>Introduction</th>
<th>Learning time: 7h 11m</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Image" /></td>
<td>Theory classes: 3h  Self study: 4h 11m</td>
</tr>
</tbody>
</table>

**Description:**
Presentation and course structure.  
The coastal area. Delimitation and components.  
Applications, resources, ecosystem functions and services. Processes, responses, pressures, impacts and issues in the coastal zone  

**Specific objectives:**
Approach of the course objectives and course development. Concepts of time and space scales to define processes, problems and solutions.  
Basic types of coastal problems.  
Sustainability.

<table>
<thead>
<tr>
<th>Hydrodynamic modeling in coastal environments</th>
<th>Learning time: 21h 36m</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image2.png" alt="Image" /></td>
<td>Theory classes: 6h  Practical classes: 3h  Self study: 12h 36m</td>
</tr>
</tbody>
</table>

**Description:**
Basics waves. Spectral wave models. Waves in coastal areas. Introduction to SWAN model  
Practical exercises with computer about the SWAN model  
Types of currents at sea. Observation and representation of oceanographic variables. Modeling ocean currents.  
Examples of Operational Oceanography.  

**Specific objectives:**
To familiarize students with the mathematical description of waves costaneras relevant from the perspective of civil engineering  
To familiarize students with the model of wave generation and propagation SWAN  
To familiarize students with the mathematical description and numerical ocean currents relevant from the perspective of civil engineering.
### Dispersion of pollutants in coastal areas and estuaries

**Description:**
- Molecular and turbulent diffusion.
- Dispersion in coastal and estuarine areas.
- Numerical models and field measurements.

- Statistics spills.
- Physical and chemical characteristics of oil.
- Environmental conditions.
- Processes and algorithms.
- Spills submarines.
- Dispersants.
- Models and applications.

Work experience with GNOME and ADIOS models from NOAA.

**Specific objectives:**
- Study of the physical and mathematical models related to the dispersion and transport of pollutants in the coastal zone.
- To familiarize the student with the problematic of oil spills at sea and the subsequent arrival of fuel stains on the coast, driven by currents, waves and wind.
- To familiarize students with oil spill models GNOME and ADIOS from NOAA.

### Evaluation

**Learning time:** 12h

- Laboratory classes: 5h
- Self study: 7h

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### Learning time:

- Theory classes: 3h
- Practical classes: 3h
- Self study: 8h 23m

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### Dispersion of pollutants in coastal areas and estuaries

<table>
<thead>
<tr>
<th>Description:</th>
<th>Learning time: 14h 23m</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 3h</td>
</tr>
<tr>
<td></td>
<td>Practical classes: 3h</td>
</tr>
<tr>
<td></td>
<td>Self study: 8h 23m</td>
</tr>
</tbody>
</table>

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### Specific objectives:

- Study of the physical and mathematical models related to the dispersion and transport of pollutants in the coastal zone.
- To familiarize the student with the problematic of oil spills at sea and the subsequent arrival of fuel stains on the coast, driven by currents, waves and wind.
- To familiarize students with oil spill models GNOME and ADIOS from NOAA.
### Sediment transport and coastal evolution

<table>
<thead>
<tr>
<th>Description:</th>
<th>Learning time: 14h 23m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initiation of motion.</td>
<td>Theory classes: 4h</td>
</tr>
<tr>
<td>Transport mechanism</td>
<td>Practical classes: 2h</td>
</tr>
<tr>
<td>Issues and actions typical in the coastal area based on an approach from the mechanics of transport</td>
<td>Self study : 8h 23m</td>
</tr>
<tr>
<td>Role of beach protection</td>
<td></td>
</tr>
<tr>
<td>Assessment of storm erosion.</td>
<td></td>
</tr>
<tr>
<td>Profile evolution models.</td>
<td></td>
</tr>
<tr>
<td>Proceedings before the impact of coastal storms</td>
<td></td>
</tr>
</tbody>
</table>

### Design and impact of coastal works and activities

<table>
<thead>
<tr>
<th>Description:</th>
<th>Learning time: 16h 48m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problems caused by gradients in the transport.</td>
<td>Theory classes: 4h</td>
</tr>
<tr>
<td>Affected functions.</td>
<td>Practical classes: 3h</td>
</tr>
<tr>
<td>Evaluation of gradient evolution.</td>
<td>Self study : 9h 48m</td>
</tr>
<tr>
<td>Models in plant evolution.</td>
<td></td>
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<tr>
<td>Coastal actions to gradient-induced problems in transport along the coast</td>
<td></td>
</tr>
<tr>
<td>Artificial beaches.</td>
<td></td>
</tr>
<tr>
<td>Systems breakwaters.</td>
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<tr>
<td>Sand extraction</td>
<td></td>
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</tbody>
</table>

### Planning and management of the coastal system

<table>
<thead>
<tr>
<th>Description:</th>
<th>Learning time: 7h 11m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrated Coastal Zone Management.</td>
<td>Theory classes: 3h</td>
</tr>
<tr>
<td>Coastal vulnerability to erosion and flooding.</td>
<td>Self study : 4h 11m</td>
</tr>
<tr>
<td>Coastal vulnerability to toxic dumping.</td>
<td></td>
</tr>
</tbody>
</table>
Qualification system

The mark of the course is obtained from the qualifications of the tutored course work (30%) and two specific evaluation tests (35% each one).

Course work is directed to develop a maritime engineering analysis to a real problem of the Spanish coast. Requires teamwork, preparation of a written report and a final presentation in front of the class.

Specific evaluation tests consist of a part with questions on concepts associated with the learning objectives of the course in terms of knowledge or understanding, and a set of application exercises.

Regulations for carrying out activities

Marks will range between 10 (maximum score) to 0 (minimum score).

The specific evaluation test will give approximate equal weight to the conceptual questions and to the application exercises. The tutored course work will be evaluated from the written report and the oral presentation. Different marks may be given to different members of the team, based on their respective contributions to the team work.
Bibliography

Basic:


Complementary:

DPTOP, Generalitat de Catalunya. Pla Director urbanístic del Sistema Costaner de Catalunya. 2006.