280823 - Mooring Systems

Coordinating unit: 280 - FNB - Barcelona School of Nautical Studies
Teaching unit: 742 - CEN - Department of Nautical Sciences and Engineering
Academic year: 2019
Degree: MASTER'S DEGREE IN NAVAL AND OCEAN ENGINEERING (Syllabus 2017). (Teaching unit Optional)
ECTS credits: 5  Teaching languages: English

Teaching staff
Coordinator: RAFAEL PACHECO BLAZQUEZ
Others: Primer quadrimestre:
RAFAEL PACHECO BLAZQUEZ - 1

Opening hours
Timetable: Thursday from 11:00h to 13:00h; by appointment in all the cases.

Prior skills
Remember the basic concepts referred to the "Numerical Calculus for Naval Structures", studied in the MARINE TECNOLOGY GRADE/ SYSTEMS ENGINEERING AND NAVAL TECNOLOGY GRADE.

Requirements
Remember the basic concepts referred to the "Numerical Calculus for Naval Structures", studied in the MARINE TECNOLOGY GRADE/ SYSTEMS ENGINEERING AND NAVAL TECNOLOGY GRADE.

Degree competences to which the subject contributes

Basic:
CB6. Possess knowledge and understanding that provide a basis or opportunity to be original in the development and / or application of ideas, often in a research context.
CB10. Students must possess the learning skills that enable them to continue studying in a way that will be largely self-directed or autonomous.
CB9. That students can communicate their conclusions and the knowledge and Latest rationale underpinning to specialists and non-specialty clearly and unambiguously

Specific:
CEE2-8. (ENG) Capacidad de proyecto de distintos sistemas de fondeo de estructuras offshore.
280823 - Mooring Systems

**Teaching methodology**

In this subject three different docent methodologies are combined:

- Presential exposition sessions of the contents of the subject, in which the professor shall introduce the theoretical basis of the subject by means of examples that easy their understanding.
- Presential practical coursework sessions by means of explaining the development of such exercises, problems and algorithms in which the professor will guide the students in the application of theoretical concepts.
- Autonomous study and undertaking of exercise and activities in which the students will apply the knowledge developed during the presential sessions. Inclusion of brief MATLAB assignments, which will require the submission of a report.

**Learning objectives of the subject**

Understanding of the basic concepts related to mooring systems.

Capability to resolve mathematic problems applied to mooring systems.

Understanding the algorithms and numerical methods basis in order to solve this problems.

**Study load**

<table>
<thead>
<tr>
<th>Total learning time: 45h</th>
<th>Hours large group:</th>
<th>45h</th>
<th>100.00%</th>
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</thead>
</table>
# 280823 - Mooring Systems

## Content

<table>
<thead>
<tr>
<th><strong>Mooring System Concept.</strong></th>
<th><strong>Learning time:</strong> 7h 30m</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 3h</td>
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<tr>
<td></td>
<td>Self study: 4h 30m</td>
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</tbody>
</table>

**Description:**  
Introduction to the concept of Mooring, Mooring system, Applications for the mooring systems, Mooring types, Mooring elements, Anchorage and Materials.

<table>
<thead>
<tr>
<th><strong>Linear wave theory.</strong></th>
<th><strong>Learning time:</strong> 7h 30m</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 2h</td>
</tr>
<tr>
<td></td>
<td>Guided activities: 1h</td>
</tr>
<tr>
<td></td>
<td>Self study: 4h 30m</td>
</tr>
</tbody>
</table>

**Description:**  
Introduction to linear wave theory (Airy) in order to obtain some understanding on the type of loads an offshore structure has to endure. Non-assessed directed activities will be undertaken in class.  
**Specific objectives:**  
- Potential Flow.  
- Linear wave equation Airy.

<table>
<thead>
<tr>
<th><strong>Catenary</strong></th>
<th><strong>Learning time:</strong> 15h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 3h</td>
</tr>
<tr>
<td></td>
<td>Guided activities: 3h</td>
</tr>
<tr>
<td></td>
<td>Self study: 9h</td>
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**Description:**  
Introduction to catenary models, examples and outline of the assessed coursework.  
**Specific objectives:**  
- Parabola equation.  
- Catenary equation.  
- Boundary conditions.
### Finite Element Method

**Learning time:** 42h  
Theory classes: 9h  
Guided activities: 3h  
Self study: 30h

**Description:**  
Introduction to numerical methods by means of finite elements for trusses/bars. Description of the linear model, structure for a finite element code, introduction to the non-linear model and iterative methods using Newton-Raphson.  
Assessment of the FEM coursework.

**Related activities:**  
MATLAB code development.

**Specific objectives:**  
Variational formulation / weak form of the elasticity equation for linear geometric bars.  
Resolution of the arisen system from the elasticity equation for linear geometric bars. Direct method.  
Variational formulation / weak form of the elasticity equation for non-linear geometric bars.  
Resolution of the arisen system from the elasticity equation for non-linear geometric bars. Iterative method.

### Regulations

**Learning time:** 10h 30m  
Theory classes: 2h  
Guided activities: 1h  
Self study: 7h 30m

**Description:**  
Description of the applicable regulations.

### Dynamic Position

**Learning time:** 21h  
Theory classes: 3h  
Guided activities: 3h  
Self study: 15h

**Description:**  
Brief introduction to dynamic position. Utilization of SIMULINK.

**Related activities:**  
SIMULINK.
Qualification system

The final grade is the sum of the partial grades below:

\[ G_{\text{final}} = 0.2 \times P_e + 0.4 \times C_w + 0.4 \times F_e \]

On:
- \( G_{\text{final}} \): Final grade.
- \( P_e \): Partial exam grade.
- \( C_w \): Coursework grade.
- \( F_e \): Final exam grade.

Regulations for carrying out activities

Rules for the fulfilment of the course activities:

Coursework Assessment:
Individual undertaking and submission of the courseworks. A report shall be submitted within the deadline. Any coursework delivered out of the deadline shall be qualified with a penalty of 10% less per day out of the deadline, meaning that a submission over 10 days would be equivalent to a 0.

Exams:
Exams will be open book. A not have taken qualification will be awarded to the student who does not take all the exams.

Bibliography