280645 - Fluid Mechanics

**Coordinating unit:** 280 - FNB - Barcelona School of Nautical Studies

**Teaching unit:** 742 - CEN - Department of Nautical Sciences and Engineering

**Academic year:** 2020

**Degree:** BACHELOR'S DEGREE IN MARINE TECHNOLOGIES (Syllabus 2010). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN MARINE TECHNOLOGIES/BACHELOR'S DEGREE IN NAVAL SYSTEMS AND TECHNOLOGY ENGINEERING (Syllabus 2016). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN NAVAL SYSTEMS AND TECHNOLOGY ENGINEERING (Syllabus 2010). (Teaching unit Compulsory)

**ECTS credits:** 6

**Teaching languages:** Catalan

**Teaching staff**

**Coordinator:** Anna Mujal i Colilles

**Opening hours**

**Timetable:**
- Tuesday 12:00-13:30
- Friday 12:00-13:30

**Prior skills**

- Algebra
- Calculus
- Physics

**Degree competences to which the subject contributes**

**Specific:**

1. Knowledge of the fundamental concepts of fluid mechanics and its application to the operation and use of naval systems.
2. Knowledge of the fundamental concepts of fluid mechanics and its application to the hulls of ships and artifacts, and machines, equipment and naval systems.

**Teaching methodology**

- Analysis of the state of the art of the subject
- To acquire, understand and synthesize knowledge
- Setting-up and resolution of problems
- To carry works out individually and in group
- To apply computer analysis techniques

**Learning objectives of the subject**

- To acquire knowledge about the theory and concepts of the fluid mechanics.
- To know and be able to apply the basis of the fluid mechanics to the analysis of machinery, equipment and naval systems.
- To use the computer analysis resources to solve problems in fluid mechanics.

This course will evaluate the following STCW competences:
5. Operate fuel, lubrication, ballast and other pumping systems and associated control systems (STWC A-III_1)
The corresponding Knowledge, understanding and proficiency points according to the STWC competences are:
5.1. Operational characteristics of pumps and piping systems, including control systems
5.3 Oil-water separators (or-similar equipment) requirements and operation

<table>
<thead>
<tr>
<th>Study load</th>
<th>Total learning time: 150h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours large group:</td>
<td>35h</td>
</tr>
<tr>
<td>Hours medium group:</td>
<td>15h</td>
</tr>
<tr>
<td>Hours small group:</td>
<td>0h</td>
</tr>
<tr>
<td>Guided activities:</td>
<td>10h</td>
</tr>
<tr>
<td>Self study:</td>
<td>90h</td>
</tr>
</tbody>
</table>

Total learning time: 150h

- Hours large group: 35h (23.33%)
- Hours medium group: 15h (10.00%)
- Hours small group: 0h (0.00%)
- Guided activities: 10h (6.67%)
- Self study: 90h (60.00%)
## Content

<table>
<thead>
<tr>
<th>Topic</th>
<th>Learning time</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Introduction to Fluid Mechanics</strong></td>
<td>20h</td>
<td><strong>Description:</strong> Concept of fluid. Properties of the velocity field. Thermo-dynamic properties of a fluid. Viscosity and other properties. Description of the flow. STWC A-III_1 KUP's are included: Oily-water separators (or-similar equipment) requirements and operation</td>
</tr>
<tr>
<td><strong>Hydrostatics</strong></td>
<td>26h</td>
<td><strong>Description:</strong> Concept of hydrostatics. Pressure distribution in hydrostatics. Hydrostatics forces. Floatability and stability. Pressure distribution in rigid body motion.</td>
</tr>
<tr>
<td><strong>Dimensional analysis and similarity</strong></td>
<td>22h</td>
<td><strong>Description:</strong> The principle of dimensional homogeneity. The Pi theorem. Nondimensionalization of the basic equations. Reynolds number.</td>
</tr>
</tbody>
</table>
## Viscous flow in ducts

**Description:** Flow in a circular pipe. Flow in non-circular ducts. Minor losses in pipe systems. Multiple-pipe systems.

<table>
<thead>
<tr>
<th>Learning time: 24h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 6h</td>
</tr>
<tr>
<td>Laboratory classes: 4h</td>
</tr>
<tr>
<td>Guided activities: 2h</td>
</tr>
<tr>
<td>Self study: 12h</td>
</tr>
</tbody>
</table>

## Free surface flows

**Description:** Wave theory. Wave properties. Boundary value problem.

<table>
<thead>
<tr>
<th>Learning time: 24h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 6h</td>
</tr>
<tr>
<td>Laboratory classes: 4h</td>
</tr>
<tr>
<td>Guided activities: 2h</td>
</tr>
<tr>
<td>Self study: 12h</td>
</tr>
</tbody>
</table>

## Planning of activities

### OpenFOAM work

**Hours:** 20h

- Laboratory classes: 20h

**Description:**
This work will be performed by three students throughout the course. The grades of the "continuous evaluation" will be the grade obtained in this work together with the mark obtained during the oral presentation.

**Support materials:**
OpenFOAM

**Specific objectives:**
- To learn fluid mechanics practical applications
- Work with other students
- Learn to present oral works

## Qualification system

NF = 0.35P1 + 0.25P2 + 0.4AC

NF := Final Grade
P1 := Parcial Exam 1
P2 := Parcial Exam 2
AC := Homework
Regulations for carrying out activities

Homework must be presented before the due date. Otherwise the grade of this task will be 0. The student not presenting to any of the activities of the course will be qualified as "not taken"

Bibliography

Basic:


Fox, Robert W; McDonald, Alan T. Introduction to fluid mechanics. 10. Willey, 2015. ISBN 9781118912652.

Complementary:

