820013 - MF - Fluid Mechanics

Coordinating unit: 295 - EEBE - Barcelona East School of Engineering
Teaching unit: 729 - MF - Department of Fluid Mechanics
Academic year: 2019
Degree: BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN BIOMEDICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN ENERGY ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN MATERIALS ENGINEERING (Syllabus 2010). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN BIOMEDICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN ENERGY ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)

ECTS credits: 6
Teaching languages: Catalan, Spanish

Teaching staff
Coordinator: CARLOS RUIZ MOYA - ALFRED FONTANALS GARCIA
Others: ALBERT CARBÓ - JOAN GRAU - ALFRED FONTANALS - CARLOS RUIZ - ATTILA HUSAR - ALEJANDRO CARRILLO - JAVIER PRINCIPE

Requirements

Degree competences to which the subject contributes

Specific:
2. Understand the basic principles of fluid mechanics and its application to problems in the field of engineering. Calculate the parameters of ducts, channels and fluid systems.

Transversal:
1. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.

Teaching methodology
The subject will be developed using master classes to present the contents to the students. The students will have to do individual work for problem solving and test preparing, and also team work for lab experiences and complex problem solving.

Learning objectives of the subject
Giving the students the knowledge and basic skills on this subject in order to prepare him for professional tasks related to the contents of it, and at the same time encouraging the training and learning processes in the field of fluid mechanics.
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engineering.

**Study load**

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group: 45h</th>
<th>30.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group:</td>
<td>0h</td>
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<tr>
<td></td>
<td>Hours small group:</td>
<td>15h</td>
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<tr>
<td></td>
<td>Guided activities:</td>
<td>0h</td>
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<tr>
<td></td>
<td>Self study:</td>
<td>90h</td>
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**Description:**

**Specific objectives:**
Understanding the basic concepts of fluid mechanics. Identifying different kinds of problems in fluid mechanics. Applied knowledge of basic fluid properties and the influence of viscosity on friction in fluid flow.

### Learning time: 21h 30m
- Theory classes: 7h 30m
- Laboratory classes: 1h
- Self study: 13h

| Understanding the use of the material derivative for connecting the Eulerian and the Lagrangian approach, identifying different flow visualization techniques, understanding the use of Reynolds' transport theorem and knowing the differential, integral, experimental, and computational techniques used for flow analysis. |

## 2. Hydrostatics.

**Description:**

**Specific objectives:**
Achieving the capacity to determine the pressure distribution in a still fluid, to calculate hydrostatic forces over flat and curved submerged surfaces and to determine the pressure distribution in fluids in motion as rigid solids.

### Learning time: 18h 30m
- Theory classes: 6h 30m
- Laboratory classes: 1h
- Self study: 11h

| Description: |
| Understanding the use of the material derivative for connecting the Eulerian and the Lagrangian approach, identifying different flow visualization techniques, understanding the use of Reynolds' transport theorem and knowing the differential, integral, experimental, and computational techniques used for flow analysis. |

## 3. Basic concepts for flow analysis.

**Description:**

**Specific objectives:**
Understanding the use of the material derivative for connecting the Eulerian and the Lagrangian approach, identifying different flow visualization techniques, understanding the use of Reynolds' transport theorem and knowing the differential, integral, experimental and computational techniques used for flow analysis.

### Learning time: 10h 30m
- Theory classes: 3h 30m
- Laboratory classes: 1h
- Self study: 6h
<table>
<thead>
<tr>
<th>Section</th>
<th>Learning time</th>
<th>Description</th>
<th>Specific objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Basic integral equations in fluid mechanics (I).</td>
<td>40h 30m</td>
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<tr>
<td></td>
<td>Theory classes: 14h 30m</td>
<td>Continuity equation: massic and volumetric flow. Energy equation. Bernoulli equation. Scope and limitations. Velocity and flow rate meters.</td>
<td>Correctly applying the concepts of compressibility and steadiness in flow determination. Identifying and correctly estimating the different forms of mechanical energy together with the efficiency in their transformations. Correctly using Bernoulli's equation in solving basic hydraulic problems and in velocity and flow rate meters.</td>
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<td>Laboratory classes: 1h</td>
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<td></td>
<td>Self study : 25h</td>
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<tr>
<td>5. Basic integral equations in fluid mechanics (II).</td>
<td>25h</td>
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<tr>
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<td>Laboratory classes: 1h</td>
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<td></td>
<td>Self study : 15h</td>
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<td>6. Pipe flow</td>
<td>17h 30m</td>
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<td>Laboratory classes: 1h 30m</td>
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<td>Self study : 10h</td>
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7. Free surface flows

**Learning time:** 16h 30m
- Theory classes: 5h 30m
- Laboratory classes: 1h
- Self study: 10h

**Description:**

**Specific objectives:**
Solving slow problems in steady state open canals. Using pouring systems for flow control and measurement.

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**Qualification system**
Md-term exam (35%); Homework activities (10%); Final exam (35%); Lab Pràctices (15%); Generic skills (5%). In order to pass the course it is mandatory to attend to all lab practices and deliver the correspondent lab report.
There is a re-avaluaton test for this subject.
The student will be able to access the re-assessment test that meets the requierements set by the EEBE in its Assesment and Permanence Regulations.

**Regulations for carrying out activities**
The evaluation will be conducted through written test both for the mid-terms and final exam.
There will be 3 homework activities due during the term. These activities will be delivered online through the course intranet.
Practices will be graded based on a pre-test to be presented before the lab practice start, attendance (mandatory) and lab activity developed, together with the preparation and delivery of lab reports.

**Bibliography**

**Basic:**


**Complementary:**