240061 - Fluid Mechanics

Coordinating unit: 240 - ETSEIB - Barcelona School of Industrial Engineering
Teaching unit: 729 - MF - Department of Fluid Mechanics
Academic year: 2017
Degree: BACHELOR'S DEGREE IN MATERIALS ENGINEERING (Syllabus 2010). (Teaching unit Compulsory) BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2010). (Teaching unit Compulsory) BACHELOR'S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Teaching unit Compulsory)
ECTS credits: 6
Teaching languages: Catalan, Spanish

Teaching staff
Coordinator: ESTEBAN JOU SANTACREU
Others: M.DEL CARMEN VALERO FERRANDO - ALEXANDRE PRESAS BATLLÓ - ENRIQUE TRILLAS GAY - FRANCESC XAVIER ESCALER PUIGORIOL - EDUARDO EGUSQUIZA ESTEVEZ - OSCAR DE LA TORRE RODRÍGUEZ

Degree competences to which the subject contributes

Specific:
1. Knowledge of basic principles of mechanical fluids and their application to solve engineering problems. Calculation of pipes, channels and systems of fluids.

Transversal:
2. SELF-DIRECTED LEARNING. Detecting gaps in one's knowledge and overcoming them through critical self-appraisal. Choosing the best path for broadening one's knowledge.

Teaching methodology
In the subject's sessions theory and problems are combined. Theoretical concepts are developed in classes and these are complemented with laboratory sessions.

Learning objectives of the subject
Provide students with basic knowledge and skills in the field of fluid dynamics. The student should be able to describe fluids at rest, in motion, and the effects of fluids on boundaries calculating the most significant magnitudes.

Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group: 50h</th>
<th>33.33%</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group: 0h</td>
<td>0.00%</td>
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<tr>
<td></td>
<td>Hours small group: 10h</td>
<td>6.67%</td>
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<td></td>
<td>Guided activities: 0h</td>
<td>0.00%</td>
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<tr>
<td></td>
<td>Self study: 90h</td>
<td>60.00%</td>
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# 240061 - Fluid Mechanics

## Content

| Theme 1.- Introduction and basics concepts. | Learning time: 14h  
Theory classes: 6h  
Laboratory classes: 3h  
Self study: 5h |
|------------------------------------------|------------------|
| Description:  

| Theme 2.- Basic Equations of Fluid Mechanics | Learning time: 37h  
Theory classes: 15h  
Laboratory classes: 1h  
Self study (distance learning): 21h |
|-------------------------------------------|------------------|
| Description:  
General considerations. Basic equations: Mass conservation (Continuity equation), Newton's second law (Momentum equation), Navier-Stokes equations and Energy equation (Bernoulli equation). Integral forms of the basic equations. Applications. |

| Theme 3.- Dimensional Analysis and Similitude | Learning time: 20h 30m  
Theory classes: 9h  
Self study: 11h 30m |
|---------------------------------------------|------------------|
| Description:  

| Theme 4.- External flow. Boundary layer and potential flow. | Learning time: 41h  
Laboratory classes: 2h  
Self study (distance learning): 24h  
Theory classes: 15h |
|------------------------------------------------------------|------------------|
| Description:  
Introduction to turbulent flow. Reynolds equations.  
Boundary layers: Basic concepts. Laminar boundary layer on a flat plate. Turbulent boundary layer on a flat plate. Lift and drag of airfoils.  
Potential flow: Elementary potential flows. Superposition of elementary potential flows |

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**History. Definition of fluid. Dimensions and units.**

**Thermodynamic fluid properties. Viscosity and other properties.**

**Techniques and basic laws of flow analysis.**

**Flow description: Streamline. Path line. and Streak line.**

**The fluid velocity field. Fluid acceleration. Vorticity and circulation.**

**Flow classification. Transport phenomena.**

**General considerations. Basic equations: Mass conservation (Continuity equation), Newton's second law (Momentum equation), Navier-Stokes equations and Energy equation (Bernoulli equation).**

**Integral forms of the basic equations. Applications.**

**Introduction. Buckingham Pi theorem. Similitude and model development. Correlation of experimental data.**

**Introduction to turbulent flow. Reynolds equations.**

**Boundary layers: Basic concepts. Laminar boundary layer on a flat plate. Turbulent boundary layer on a flat plate. Lift and drag of airfoils.**

**Potential flow: Elementary potential flows. Superposition of elementary potential flows.**
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**Qualification system**

The final qualification NF is:
\[
NF = 0.15 \text{A} + 0.1 \text{B} + 0.25 \text{C} + 0.5 \text{D}
\]
A: Mark of laboratory sessions.
B: Mark of continuous evaluation exercises
C: Mark of the partial exam.
D: Mark of the final exam.

Reassessment:
The test consists of a multiple-choice test of 20 questions with four answers. The right questions added 0.5 points, incorrect remaining 0.167. The mark of this test is directly subject mark and replace the previous note, if it is higher.

**Regulations for carrying out activities**

Final Exam. The test consists of a multiple-choice test of 30 questions with four answers. The right questions added 0.33 points, incorrect remaining 0.11.

Midterm Exam. The test consists of a multiple-choice test of 20 questions with four answers. The right questions added 0.5 points, incorrect remaining 0.167.

For the resolution of the test will not be allowed to consult books or notes. However, it will take the form of the department that will be posted on the digital campus. Forms that do not comply with the rules will be removed during the test.

Continuous assessment tests: During the course manuscripts collected weekly exercises. Who has delivered more than 90% of the exercises have a continuous assessment mark equal to the grade obtained in the final exam. If delivered less than 90% the proportion obtained the note. The ratings of continuous assessment is not validated.

Assessment practices: Attendance at each of the first four practices and delivering a brief preliminary report represents half a point made practical. The eight remaining points are the marks obtained in the individual defense of the practices carried out in practice 5. This practice five, students will prepare a presentation with the results obtained in previous practices and expose them. The professor made some questions to assess the knowledge of the practice.
# Bibliography

**Basic:**


**Complementary:**


**Others resources:**

- **Audiovisual material**
  - *Transparències de classe*

- **Col·lecció de problemes d'examen resolts**

- **Col·lecció de test d'examen resolts**

- **Guions de pràctiques**