820425 - EFM - Fluid Engineering

Coordinating unit: 295 - EEBE - Barcelona East School of Engineering
Teaching unit: 729 - MF - Department of Fluid Mechanics
Academic year: 2017
Degree: BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
ECTS credits: 6
Teaching languages: Catalan, Spanish

Teaching staff

Coordinator: Ricardo Torres Cámara
Fontanals Garcia, Alfred

Others: Ricardo Torres Cámara
Alfred Fontanals
Alfredo Guardo-Zabaleta

Requirements

Fluid Mechanics (FM)
Thermodynamics and Heat Transfer (THT)

Degree competences to which the subject contributes

Specific:
CEMEC-24. Understand and apply the fundamentals of fluid mechanics systems and machines.

Transversal:
1. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.

Learning objectives of the subject

Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group: 45h</th>
<th>30.00%</th>
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<tbody>
<tr>
<td></td>
<td>Hours medium group: 0h</td>
<td>0.00%</td>
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<tr>
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<td>Hours small group: 15h</td>
<td>10.00%</td>
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<td>Guided activities: 0h</td>
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<td>Self study: 90h</td>
<td>60.00%</td>
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### Content

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Description</th>
<th>Specific Objectives</th>
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<tbody>
<tr>
<td><strong>(ENG) Chapter 1: Fonamental Equacions in differential form</strong></td>
<td>Kinematics of a fluid particle. Navier-Stokes equations: continuity, momentum and energy. Exact and approximate solutions of the Navier-Stokes equations. Euler equation. Bernoulli equation.</td>
<td>An understanding of the deduction of the equations of mass, momentum and energy in differential form including how to calculate the pressure field for a known velocity field and to obtain approximate and analytical solutions for simple flow fields.</td>
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<tr>
<td><strong>(ENG) Chapter 2: Dimensional and similarity. Modeling.</strong></td>
<td>The need for dimensional analysis. Dimensional homogeneity. The PI theorem. Nondimensionalization of the basic equations. Relevant dimensionless parameters in mass transport, momentum and energy and their physical meaning. Similarity: geometric, kinematic and dynamic similarities. Partial and incomplete similarities.</td>
<td>A knowledge of the scope of dimensional analysis in the study of fluid flow and its limitations. To identify characteristics scales correctly and to distinguish between different types of similarity. An ability to determine dimensionless groups and to know the physical meaning of the most important in the flow of fluids and fluid machinery. An ability to obtain partial similarity from simplifications.</td>
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### (ENG) Chapter 4: Fluid systems

**Learning time:** 2h  
**Theory classes:** 2h

**Description:**  

**Specific objectives:**  
An ability to solve multiple-pipe systems and to determine fluid systems characteristics. An understanding of essential problems in stationary fluid systems. Combinations in series / parallel of pumps and fluid systems. An ability to matching pumps to system characteristics. An ability to avoid abnormal operating conditions like cavitation as well as to assess the effects of a water hammer.

### (ENG) Tema 5: Turbomàquines i màquines volumètriques

**Learning time:** 3h  
**Theory classes:** 3h

**Description:**  

**Specific objectives:**  
A knowledge of the classification of fluid machinery. An understanding of the dynamics in the impeller of the turbomachinery and its influence on the energy transfer. A knowledge of the different types of turbomàquines, of the essential functional elements and their areas of operation. An ability to use the similarity rules to re-design new turbomachinery. An understanding of the performance parameters of positive-displacement machines. A knowledge of the mechanical designs of PDM, of the selection criteria an of the use as power transmission systems.
(ENG) Tema 6: Principles of numeric and computational analysis in fluid systems engineering

**Description:**

**Specific objectives:**
Valorar les aportacions dels métodes numèrics a l'estudi del flux de fluids en enginyeria. Conèixer les etapes fonamentals de les simulacions i les eines i arquitectures disponibles. Conèixer les diferents tècniques de discretització. Valorar la importància de la xarxa de discretització. Aplicar correctament les condicions de contorn i iniciales. Adquirir criteri per tal de valorar adequadament els resultats de les simulacions i inferir correctament a partir d'ells.

**Chapter 7. Compressible flow**

**Description:**

**Qualification system**

To pass the course will have completed and passed the practice. There will test reassessment.
- Continuous assessment: 35%
- Final assessment: 35%
- Exercises/problems: 10%
- Laboratory: 15%
- General competence: 5%
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Bibliography

Basic:


Others resources:

Hyperlink

How wings work Smoke streamlines around an airfoil

https://www.google.es/url?sa=t&rct=j&q=&e=UTF-8&source=video&cd=1&cad=rja&uact=8&ved=0ahUKEwi8pLys4uDNaHvFLC4Khd18BkAkQtwIHDA&url=https%3A%2F%2Fwww.youtube.com%2Fwatch%3Fv%3D6UlsArvbTeo&usg=AFQjCNHWUA5oQhKGStRYYgepZrIMZJO5w&bvm=bv.126130881,d.ZGg

Aerodynamic Stall - Wing Profile

https://youtu.be/Ti5zUD08w5s

Mercedes-Benz E-Class Coupe Aerodynamics

https://youtu.be/jd71qpfufEg

New BMW Aerodynamic Test Center Model, Wind Tunnel, Aerolab

https://youtu.be/eszhVxEx_9-8

The Aerodynamics of Flight

https://youtu.be/5l7fEei3Al

Audiovisual material

Nom recurs

Resource