LECTURER

Coordinating lecturer:  
RICARDO TORRES CAMARA - ALFRED FONTANALS GARCIA

Others:
Primer quadrimestre:
ALFRED FONTANALS GARCIA - M11, M12, M13, M14, T11, T12, T13
MARCEL GARCIA COROMINAS - M13, M14
RAUL OLEGARIO NAVARRETE ROMERO - T13
REyna MERCEDES PEÑa AGUILAR - T11, T12
PEDRO RUFES MARTINEZ - M11, M12

Segon quadrimestre:
ALFRED FONTANALS GARCIA - M11, M12, M13, M14, T11, T12, T13, T14
MARCEL GARCIA COROMINAS - M15, M16
ALEJANDRO MARTINEZ ALEGRE - M13, M14, M15, M16
ROGER MAYNOU GIL - T11, T12
REyna MERCEDES PEÑa AGUILAR - T13, T14
RICARDO TORRES CAMARA - M11, M12, M13, M14, M15, M16

REQUIREMENTS

TERMODINÀMICA I TRANSFERÈNCIA DE CALOR - Prerequisit

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.

TEACHING METHODOLOGY

LEARNING OBJECTIVES OF THE SUBJECT
STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours small group</td>
<td>15,0</td>
<td>10.00</td>
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<tr>
<td>Hours large group</td>
<td>45,0</td>
<td>30.00</td>
</tr>
<tr>
<td>Self study</td>
<td>90,0</td>
<td>60.00</td>
</tr>
</tbody>
</table>

Total learning time: 150 h

CONTENTS

(ENG) Chapter 1: Fonamental Equacions in differential form

Description:
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.

Specific objectives:
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.

Full-or-part-time: 3h

Theory classes: 3h

(ENG) Chapter 2: Dimensional and similarity. Modeling.

Description:

Specific objectives:
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.

Full-or-part-time: 2h

Theory classes: 2h
(ENG) Chapter 3: Lift and drag. External flow

Description:

Specific objectives:
An understanding of the effects of friction and pressure on drag and lift. An ability to know how to determine the fluid forces on common geometries and to describe the flow patterns around cylinders and spheres. An understanding of the models of the boundary layer and how to calculate their properties. An exposure to the difficulties of the turbulence: essential aspects of the turbulent phenomena and classification of the turbulence models.

Full-or-part-time: 3h
Theory classes: 3h

(ENG) Chapter 4: Fluid systems

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.

Full-or-part-time: 2h
Theory classes: 2h

(ENG) Tema 5: Turbomàquines i màquines volumètriques

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.

Full-or-part-time: 3h
Theory classes: 3h
### (ENG) Tema 6: Principles of numeric and computational analysis in fluid systems engineering

**Description:**

**Specific objectives:**
Valorar les aportacions dels mètodes 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 inicials. Adquirir criteri per tal de valorar adequadament els resultats de les simulacions i inferir correctament a partir d'ells.

**Full-or-part-time:** 2h
Theory classes: 2h

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### Chapter 7. Compressible flow

**Description:**

**Full-or-part-time:** 2h
Theory classes: 2h

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### GRADING SYSTEM

To pass the course will have completed and passed the practice. There will test reassessment. he students will be able to access the re-assessment test that meets the requirements set by the EEBE in its Assessment and Permanence Regulations (https://eebe.upc.edu/ca/estudis/normatives-academicques/documents/eebe-normativa-avaluacio-i-permanencia-18-19-aprovat-je-2018-06-13.pdf)

- Continuous assessment: 35 %
- Final assessment: 35 %
- Exercises/problems: 10 %
- Laboratory: 15 %
- Generical competence: 5%

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### BIBLIOGRAPHY

**Basic:**
RESOURCES

Audiovisual material:
- Nom recurs. Resource

Hyperlink:
- How wings work Smoke streamlines around an airfoil. https://www.google.es/url?sa=t&source=video&cd=1&ved=0ahUKEwi8pLys4uDNAhVFLeKHdv8BKAQtwIIHDA&url=https%3A%2F%2Fwww.youtube.com%2Fwatch%3Fv%3D6UlsArvbTeo&usg=AFQjCNHWUA5oQhKGStRYYgepZr1MIZJOSw&bvm=bv.126130881,d.ZGg
- Aerodynamic Stall - Wing Profile. https://youtu.be/Ti5zUD08w5s