240629 - Computational Fluid Dynamics

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 INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Teaching unit Optional)
BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2010). (Teaching unit Optional)
BACHELOR'S DEGREE IN MATERIALS ENGINEERING (Syllabus 2010). (Teaching unit Optional)
ECTS credits: 4,5
Teaching languages: English

Teaching staff
Coordinator: FRANCESC XAVIER ESCALER PUIGORIOL
Others: FRANCESC XAVIER ESCALER PUIGORIOL

Prior skills
Fundamentals of Fluid Mechanics

Degree competences to which the subject contributes

Transversal:
1. EFFICIENT ORAL AND WRITTEN COMMUNICATION. Communicating verbally and in writing about learning outcomes, thought-building and decision-making. Taking part in debates about issues related to the own field of specialization.

Teaching methodology

This subject will be given in the computer room where the teacher will combine explanations with practice. The explanation lectures will serve to explain the topic contents and to comment with the students. The practice lecture will be guided sessions where the students will use actively the CFD tools available at the computer room in order to solve different problems. The simulation results obtained in small groups or individually will be discussed jointly among all the students.

Learning objectives of the subject

The objective of the subject is to introduce to the non-initiated student the CFD philosophy and applications. It is intended that the student learns to apply the adequate procedure to perform a numerical simulation of a flow with commercial software. Through the discussion of practical cases, the student will be able to evaluate the validity of the obtained results based on his knowledge of Fluid Mechanics and on experimental results. In particular, the student has to:
- Understand the fundamental equations of Fluid Mechanics.
- Be familiar with the vocabulary of this discipline.
- Know the stages needed to simulate a standard flow problem.
- Learn how to use commercial software to simulate numerically the flow around a body or inside a duct.
- Be able to solve several practical cases and to evaluate their validity.
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<table>
<thead>
<tr>
<th>Study load</th>
<th>Total learning time: 112h 30m</th>
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<tbody>
<tr>
<td></td>
<td>Hours large group: 0h 0.00%</td>
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<tr>
<td></td>
<td>Hours medium group: 45h 40.00%</td>
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<tr>
<td></td>
<td>Hours small group: 0h 0.00%</td>
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<td>Guided activities: 0h 0.00%</td>
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<tr>
<td></td>
<td>Self study: 67h 30m 60.00%</td>
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## Content

### INTRODUCTION TO CFD

- **Learning time:** 15h
  - Theory classes: 3h
  - Practical classes: 3h
  - Self study: 9h

### APPLICATION OF CFD. CASE STUDIES

- **Learning time:** 37h 30m
  - Theory classes: 7h 30m
  - Practical classes: 7h 30m
  - Self study: 22h 30m

### TURBULENCE MODELS. BOUNDARY LAYER

- **Learning time:** 30h
  - Theory classes: 3h
  - Practical classes: 9h
  - Self study: 18h

### TRANSIENT SIMULATIONS. VON KÁRMÁN VORTEX SHEDDING

- **Learning time:** 30h
  - Theory classes: 3h
  - Practical classes: 9h
  - Self study: 18h
### Planning of activities

<table>
<thead>
<tr>
<th>Activity</th>
<th>Hours</th>
<th>Self study:</th>
<th>Practical classes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>REPORTS OF TEST CASES</td>
<td>15h</td>
<td>15h</td>
<td></td>
</tr>
<tr>
<td>FLAT PLATE BOUNDARY LAYER SIMULATION</td>
<td>15h</td>
<td>15h</td>
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<tr>
<td>VON KÁRMÁN VORTEX SHEDDING SIMULATION</td>
<td>15h</td>
<td>15h</td>
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<tr>
<td>ATTENDANCE AND PARTICIPATION AT THE CLASSROOM</td>
<td>22h 30m</td>
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### Qualification system

Final mark = 0.25*final exam mark + 0.25*tutorial reports mark + 0.25*team work mark +0.25*classroom involvement mark

### Regulations for carrying out activities

To pass, it is compulsory to obtain a result above zero in at least three of the four partial marks.
Bibliography

Basic:


Complementary:


Others resources: