Syllabus
Course title
Advanced applications of fluid mechanics
Course code
46049
Scientific sector
ICAR/02 (08/A1)
Degree
PhD in Sustainable Energy and Technologies
Semester
2
Year
1
Academic year
2021/2022
Credits
3
Modular
NO

<table>
<thead>
<tr>
<th>Total lecturing hours</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total exercise hours</td>
<td>14</td>
</tr>
<tr>
<td>Attendance</td>
<td>Not compulsory</td>
</tr>
<tr>
<td>Prerequisites</td>
<td>Fundamentals of fluid mechanics</td>
</tr>
<tr>
<td>Course page</td>
<td>Reserve collection</td>
</tr>
</tbody>
</table>

Specific educational objectives
The students will have the opportunity to improve their knowledge on some specific topics that are generally not treated in depth in basic courses of fluid mechanics, such as turbulence and non-Newtonian fluids, with a special focus on energy engineering applications. A significant part of the course will be devoted to the explanation and utilization of advanced measuring methods used for fluid mechanics applications in laboratory. In this way the candidates will acquire the competences necessary in order to design and carry out experimental measures on fluids within their research activity.

Lecturer
Maurizio Righetti, Larcher Michele, Pisaturo Giuseppe Roberto
Scientific sector of the lecturer
ICAR/02 and ICAR/01 (08/A1)
Teaching language
English
Office hours
Whole week, on appointment
Teaching assistant (if any )

List of topics covered
The course will cover the following topics:
- Turbulence insights
- General features of granular flows
- Advanced measuring techniques in fluid mechanics:
  - Experimental methods, e.g. Particle Image Velocimetry (PIV), Particle Tracking Velocimetry (PTV), Laser Doppler Anemometry (LDA).
### Teaching format

| - Experimental instruments  |
| - Experimental applications  |

Lectures and tutorials in class; experiments in the laboratory.

### Learning outcomes

By the end of the course, students are supposed to be able to:

- **Knowledge and understanding:** explain the main principles relevant to the topics addressed in the course; develop an intuitive comprehension.
- **Applying knowledge and understanding:** give examples of real applications and practical problems to underline how the topics treated in the course are used within scientific and engineering activity.
- **Making judgements:** show the ability to make autonomous judgements in the choice and comparison of the suitable methods and tools for the solution of scientific and engineering problems involving the mechanics of fluids.
- **Communication skills:** communication skills to correctly and properly present the concepts acquired in the course and the analysis of experimental results.
- **Learning skills:** Ability to autonomously extend the knowledge acquired during the study course by reading and understanding scientific and technical documentation.

### Assessment

The assessment is based on a discussion on the topics covered within the course and on the presentation of the analysis of the results of the experimental activity.

### Assessment language

English

### Evaluation criteria and criteria for awarding marks

Students will be evaluated on the base of the oral discussion. Evaluation is based on a 30 points scale.

At the examination, knowledge and understanding of the topic (25%), the attitude at applying knowledge and understanding (20%) and at making judgments (20%), the communication skills (20%) and the learning skills (15%) will be assessed.

### Required readings

The topics will be sampled out of different books and scientific publications. Attending regularly the classes is highly recommended. Some material will be made available in the reserve collection.

### Supplementary readings

<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>R. Adrian, J. Westerweel, Particle image velocimetry, Cambridge University Press 2011;</td>
</tr>
</tbody>
</table>