### Syllabus

#### Course title
Advanced applications of fluid mechanics

#### Course code
46023

#### Scientific sector
ICAR/01

#### Degree
PhD in Sustainable Energy and Technologies

#### Semester
2

#### Year
1

#### Academic year
2016/2017

#### Credits
3

#### Modular
NO

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<tr>
<th>Total lecturing hours</th>
<th>30</th>
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<tr>
<td>Total lab hours</td>
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<td>Total exercise hours</td>
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#### Attendance

#### Prerequisites
Fundamentals of fluid mechanics

#### Course page
Reserve collection

#### 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, taught in collaboration with prof. Maurizio Righetti, will be devoted to the explanation and utilization of advanced measuring methods used for fluid mechanics applications in laboratory and on field. 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
Michele Larcher

#### Scientific sector of the lecturer
ICAR/01 (08/A1)

#### Teaching language
English

#### Office hours
Whole week, on appointment

#### Teaching assistant (if any)

#### Office hours

#### List of topics covered
The course will cover the following topics:
- Turbulence insights
- Non-Newtonian fluids
  - General features
  - Granular systems
  - Fluidized beds
- Granular segregation
- Applications to gasification, combustion, industrial production, drying, cooling
- Advanced measuring techniques in fluid mechanics
  - Experimental methods, e.g. Particle Image Velocimetry (PIV), Particle Tracking Velocimetry (PTV), Laser Doppler Anemometry (LDA), Ultrasonic Doppler Velocimetry (UDV)...
- Experimental instruments
- Experimental applications

**Teaching format**

Lectures and tutorials in class; experiments in the laboratory.

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**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.

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**Assessment**

The assessment is based on an oral examination on the topics covered within the flow 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.

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**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**

Y.A. Cengel & J.M. Cimbala, Fluid Mechanics -
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<tr>
<td>Between Fluid and Solid, Cambridge University Press, 2013</td>
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