## Syllabus
### Course description

<table>
<thead>
<tr>
<th>Course title</th>
<th>Experimental methods in Thermo-fluid Dynamics</th>
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<tbody>
<tr>
<td>Course code</td>
<td>45540</td>
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<tr>
<td>Scientific sector</td>
<td>ICAR/02</td>
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<tr>
<td>Degree</td>
<td>Master Energy Engineering</td>
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<tr>
<td>Semester</td>
<td>2</td>
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<tr>
<td>Year</td>
<td>2</td>
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<tr>
<td>Academic year</td>
<td>2018/19</td>
</tr>
<tr>
<td>Credits</td>
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</tr>
<tr>
<td>Modular</td>
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<tr>
<td>Total lecturing hours</td>
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<tr>
<td>Total lab hours</td>
<td></td>
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<tr>
<td>Total exercise hours</td>
<td>24</td>
</tr>
<tr>
<td>Attendance</td>
<td></td>
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<tr>
<td>Prerequisites</td>
<td>Basic knowledge of fluid mechanics</td>
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<tr>
<td>Course page</td>
<td>OLE</td>
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### Specific educational objectives
Experimental methods in Thermo-fluid Dynamics is an optional course within the master in Energy Engineering and is aimed to the students showing particular interest in fluid mechanics. Some specific topics addressed only marginally in the basic courses of hydraulics and fluid mechanics will be addressed, in order to provide the students with the fundamental knowledge about experimental techniques and methods for fluid dynamics, heat transfer, turbulent flows, physical modelling. Within the tutorials and the laboratory works the students will have the opportunity to develop experiments and apply state-of-the-art techniques (LDA, PIV, PTV) to practical applications relevant to energy engineering.

### Lecturer
Pisaturo Giuseppe Roberto  
Michele Larcher  
Medzid Muhasilovic  
Maurizio Righetti

### Scientific sector of the lecturer
ICAR/02 (08/A1)  
ICAR/01  
ICAR/02  
ICAR/02

### Teaching language
English

### Office hours
Whole week, on appointment

### Teaching assistant (if any)
Michele Larcher, Medzid Muhasilovic, Maurizio Righetti

### Office hours
Whole week, on appointment
### List of topics covered

The course will cover the following topics:
- introduction to turbulence and statistics (brief mention);
- the theory of similitude with practical applications to turbulent flows;
- Experimental methods for fluid flows: overview of the major experimental techniques in thermo-fluid dynamics;
- contactless methodologies for measurements in turbulent flows.

### Teaching format

Lectures and tutorials in the laboratory; homework of a fluid mechanics application.

### Learning outcomes

By the end of the course, students are supposed to be able to:
- **Knowledge and understanding:** show the experimental techniques to be applied to turbulent flows/heat transfer.
- **Applying knowledge and understanding:** give examples of real applications and practical problems to underline how the topics treated in the course are used within engineering activity.
- **Making judgements:** the ability to make autonomous judgements in the choice and comparison of the suitable tools for a proper design and development of a measurement campaign in thermo-fluid mechanics.
- **Communication skills:** communication skills to correctly and properly present the concepts acquired in the course and the results of the homework.
- **Learning skills:** Ability to autonomously extend the knowledge acquired during the study course by reading and understanding scientific and technical documentation.

### Assessment

The examination of the course is based on oral questions about the contents of the course and on the presentation and discussion of the experimental activities/reports. The oral examination includes questions to assess the knowledge and understanding of the course topics and the communication skills.

### Assessment language

English

### Evaluation criteria and criteria for awarding marks

Students will be evaluated on the base of an oral discussion (50%) and of the presentation and discussion of the homework (50%). At the oral part, knowledge and understanding of the topic (50%), the communication skills (25%) and the ability to summarize (25%) are assessed. At the presentation and discussion of the reports, applying knowledge and understanding (30%), making judgments (25%), the communication skills (25%) and the learning skills (20%) will be assessed.

### Required readings

The topics will be sampled out of different books and scientific papers. Attending regularly the classes and
laboratory activities is highly recommended. Some material will be made available in OLE.

M. Muste, Experimental Hydraulics: Methods, Instrumentation, Data Processing and Management, IAHR Monograph 2017  
J.C. Gibbings, Dimensional Analysis, Springer, 2011  
B. Zohuri, Dimensional Analysis and Self Similarity Methods for engineers and Scientists, Springer, 2015  
A. Adami, I modelli fisici nell'idraulica, CLEUP, 1994  