

# Syllabus

## *Descrizione corso*

<b>Titolo insegnamento</b>	Elements of experimental research and advanced applications of fluid mechanics
<b>Codice insegnamento</b>	46049
<b>Titolo aggiuntivo</b>	
<b>Settore Scientifico-Disciplinare</b>	CEAR-01/B
<b>Lingua</b>	Inglese
<b>Corso di Studio</b>	Corso di Dottorato di ricerca in Sustainable Energy and Technologies (Energie e Tecnologie sostenibili)
<b>Altri Corsi di Studio (mutuati)</b>	
<b>Docenti</b>	prof. Maurizio Righetti, Maurizio.Righetti@unibz.it <a href="https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/33740">https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/33740</a> prof. Michele Larcher, Michele.Larcher@unibz.it <a href="https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/33885">https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/33885</a> dr. Giuseppe Roberto Pisaturo, GiuseppeRoberto.Pisaturo@unibz.it <a href="https://www.unibz.it/en/faculties/engineering/academic-staff/person/38803">https://www.unibz.it/en/faculties/engineering/academic-staff/person/38803</a>
<b>Assistente</b>	
<b>Semestre</b>	Secondo semestre
<b>Anno/i di corso</b>	1
<b>CFU</b>	3
<b>Ore didattica frontale</b>	18
<b>Ore di laboratorio</b>	12
<b>Ore di studio individuale</b>	75
<b>Ore di ricevimento previste</b>	

<b>Sintesi contenuti</b>	<p>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.</p>
<b>Argomenti dell'insegnamento</b>	<p>The course will cover the following topics:</p> <ul style="list-style-type: none"> <li>• Turbulence insights</li> <li>• General features of granular flows</li> <li>• Advanced measuring techniques in fluid mechanics: <ul style="list-style-type: none"> <li>- Experimental methods, e.g. Particle Image Velocimetry (PIV), Particle Tracking Velocimetry (PTV), Laser Doppler Anemometry (LDA)</li> <li>- Experimental instruments</li> <li>- Experimental applications</li> </ul> </li> </ul>
<b>Parole chiave</b>	Fluid mechanics, experimental measurements
<b>Prerequisiti</b>	Fundamentals of fluid mechanics
<b>Insegnamenti propedeutici</b>	
<b>Modalità di insegnamento</b>	Lectures and tutorials in class; experiments in the laboratory.
<b>Obbligo di frequenza</b>	Not compulsory
<b>Obiettivi formativi specifici e risultati di apprendimento attesi</b>	<p>By the end of the course, students are supposed to be able to:</p> <ul style="list-style-type: none"> <li>- Knowledge and understanding: explain the main principles relevant to the topics addressed in the course; develop an intuitive comprehension.</li> <li>- 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.</li> <li>- 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.</li> </ul>

	<ul style="list-style-type: none"> <li>- Communication skills: communication skills to correctly and properly present the concepts acquired in the course and the analysis of experimental results.</li> <li>- Learning skills: Ability to autonomously extend the knowledge acquired during the study course by reading and understanding scientific and technical documentation.</li> </ul>
<b>Obiettivi formativi specifici e risultati di apprendimento attesi (ulteriori info.)</b>	
<b>Modalità di esame</b>	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.
<b>Criteri di valutazione</b>	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.
<b>Bibliografia obbligatoria</b>	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.
<b>Bibliografia facoltativa</b>	<p>C. Bailly &amp; G. Comte-Bellot, Turbulence, Springer, 2015</p> <p>H. Tennekes &amp; J.L. Lumley, A First Course in Turbulence. MIT Press, Cambridge 1972</p> <p>J.O. Hinze, Turbulence, McGraw-Hill International Book Company, New York, 1975</p> <p>Y.A. Çengel, &amp; J.M. Cimbala, Fluid Mechanics – Fundamentals and Applications, 2006, McGraw-Hill</p> <p>Zhang, Zhengji. LDA Application Methods: Laser Doppler Anemometry for Fluid Dynamics. Berlin: Springer, 2010</p> <p>Albrecht, H. -E., Damaschke, N., Borys, M., and Tropea, Cameron. Laser Doppler and Phase Doppler Measurement Techniques. Guildford : Berlin, 2010.</p> <p>R. Adrian, J. Westerweel, Particle image velocimetry, Cambridge</p>

	University Press 2011;  M. Raffel et al., Particle image velocimetry: a practical guide, Second edition, Springer 2007
<b>Altre informazioni</b>	
<b>Obiettivi di Sviluppo Sostenibile (SDGs)</b>	Istruzione di qualità, Lotta contro il cambiamento climatico, Utilizzo responsabile delle risorse, Energia rinnovabile e accessibile