Syllabus

Course Description

Course Title	Elements of experimental research and advanced applications of fluid mechanics
Course Code	46049
Course Title Additional	
Scientific-Disciplinary Sector	CEAR-01/B
Language	English
Degree Course	PhD Programme in Sustainable Energy and Technologies
Other Degree Courses (Loaned)	
Lecturers	Prof. Maurizio Righetti, Maurizio.Righetti@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/33740 Prof. Michele Larcher, Michele.Larcher@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/33885 dr. Giuseppe Roberto Pisaturo, GiuseppeRoberto.Pisaturo@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/38803
Teaching Assistant	
Semester	Second semester
Course Year/s	1
CP	3
Teaching Hours	18
Lab Hours	12
Individual Study Hours	75
Planned Office Hours	
Contents Summary	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.
Course Topics	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) - Experimental instruments - Experimental applications
Keywords	Fluid mechanics, experimental measurements
Recommended Prerequisites	Fundamentals of fluid mechanics
Propaedeutic Courses	
Teaching Format	Lectures and tutorials in class; experiments in the laboratory.
Mandatory Attendance	Not compulsory
Specific Educational Objectives and 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.
Specific Educational Objectives and Learning Outcomes (additional info.)	
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.
Evaluation Criteria	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	C. Bailly & G. Comte-Bellot, Turbulence, Springer, 2015 H. Tennekes & J.L. Lumley, A First Course in Turbulence. MIT Press, Cambridge 1972 J.O. Hinze, Turbulence, McGraw-Hill International Book Company, New York, 1975 Y.A. Çengel, & J.M. Cimbala, Fluid Mechanics – Fundamentals and Applications, 2006, McGraw-Hill Zhang, Zhengji. LDA Application Methods: Laser Doppler Anemometry for Fluid Dynamics. Berlin: Springer, 2010 Albrecht, H. -E., Damaschke, N., Borys, M., and Tropea, Cameron. Laser Doppler and Phase Doppler Measurement Techniques. Guildford : Berlin, 2010. R. Adrian, J. Westerweel, Particle image velocimetry, Cambridge University Press 2011;

	M. Raffel et al., Particle image velocimetry: a practical guide, Second edition, Springer 2007
Further Information	
Sustainable Development Goals (SDGs)	Quality education, Climate action, Responsible consumption and production, Affordable and clean energy