Freie Universität Bozen
Libera Università di Bolzano
Università Liedia de Bulsan

Syllabus
Course description

Course title	FLUID MACHINES ENGINEERING
Course code	45527
Scientific sector	ING-IND/08 "Fluid Machinery"
Degree	Master Energy Engineering
Semester	2
Year	1
Academic year	2022/2023
Credits	9
Modular	No

Total lecturing hours	90
Total lab hours	
Total exercise hours	
Attendance	Recommended
Prerequisites	Fluid Machines, Thermodynamics, Mechanics
Course page	Course Offering / Free University of Bozen-Bolzano (unibz.it)

Specific educational objectives	To master the most important concepts about fluid machines dedicated to energy conversion systems and their integration in the energetic system, to give decision tools and criteria for design, cost analysis, efficiency analysis and selection with emphasis to community and small scale plants.

Lecturer	Dr. Giuseppe Soraperra
Scientific sector of the lecturer	ING/IND-08
Teaching language	English
Office hours	
Teaching assistant *(if any)*	-
Office hours	-
List of topics covered	The course will cover the following topics: 1. Introduction a. Essentials of fluid Machines and Energy systems i. Elements of fluid dynamics ii. Elements of Fluid Machinery

	iii. Elements of Energy systems b. Introduction to renewable energy 2. Fluid machines for renewable energy a. Solar Power i. Solar Resource ii. Solar photovoltaic iii. Concentrated and thermodynamic solar iv. Utility and community scale b. Hydro Power i. Hydro Resource ii. Mini-hydro iii. Reversible turbines, PATs and variable speed hydro-turbines iv. Utility and community scale v. Diagnostics and fault detection c. Wind Power i. Wind resource and Terrain ii. Horizontal and vertical axis wind turbines iii. Utility and community scale iv. Diagnostics and fault detection d. Waste Heat and Water i. Waste Heat ii. Waste Water e. Storages i. Types of storage ii. P2X iii. Hydrogen Applications iv. Utility and community scale f. Grid Management & Economics i. Smart Grids

	ii. Economic figures: LCA, ELCA, PBP, LCOE For each of the technologies presented in the course, the tools needed for the performance evaluation (power, work, efficiency, …) will be defined. For some of the proposed technologies, a techno-economic analysis will be carried out as well.
Teaching format	

Learning outcomes	During the course, the student will gain knowledge about: 1. Key energy production, storage, transmission and utilisation technologies, including their cost and sustainability aspects over their life cycle 2. How to evaluate the technical characteristics and resources of some of the major renewable power sources and the performance of energy systems and machines related. 3. Develop preliminary design and dimensioning for wind, solar, hydro and hydrogen systems and perform preliminary technology assessment for unconventional energy resources (e.g., Waste Heat)
Assessment	Written/Oral Exam and exercise report
Assessment language	English
Evaluation criteria and criteria for awarding marks	Oral exam performance and exercises reports assignments performance will be equally weighted for course final grade.

Required readings	Notes of the course
Supplementary readings	• Twidell, John, and Tony Weir. Renewable energy resources. Routledge, 2015. • Supplementary in-depth research material suggested throughout the course