Freie Universität Bozen
Libera Università di Bolzano
Università Liedia de Bulsan

Syllabus
Course description

Course title	HYDROPOWER AND WIND POWER SYSTEMS
Course code	45532
Scientific sector	
Degree	Master Energy Engineering
Semester	1
Year	2
Academic year	2020/2021
Credits	12
Modular	yes

Total lecturing hours	76
Total lab hours	
Total exercise hours	39
Attendance	
Prerequisites	EFM-HPP
Course page	

Specific educational objectives	

Module 1	**HYDROPOWER SYSTEMS**
Lecturer	Prof. Maurizio Righetti; Dr. Giuseppe Maurizio Pisaturo
Scientific sector of the lecturer	ICAR02
Teaching language	English
Office hours	
Teaching assistant *(if any)*	
Office hours	
List of topics covered	1. Description of Run-of-the-river Hydro Power plants, also through the detailed analysis of different plants already built 2. Optimal plant site assessment and hydrological analyses 3. Hydraulic design of Weir, intake, minimum vital flow outlet 4. Hydraulic design of headrace silting basin, forebay 5. Penstock and water hammer, water turbine house analysis and design Note for HPS: in total: 20 hours labs-exercises, 40 hours frontal lessons
Teaching format	*Frontal lessons, laboratory and exercises*

Module 2	**WIND POWER SYSTEMS**
Lecturer	Prof. Battisti Lorenzo
Scientific sector of the lecturer	ING/IND-08
Teaching language	English

Office hours	On appointment
Teaching assistant *(if any)*	
Office hours	
List of topics covered	1. Description of wind power plants, history, classification, uses, technology; 2. Wind turbine design, steps and tools; (key elements of the design, definition of the activities and organization of time, budget management, technical norms); 3. The fluid dynamic and geometric design of the rotor; 4. The power control; 5. The mechanical design and testing of the machine; 6. Elements of analysis of wind resources and site assessment; 7. Small wind turbines; 8. Wind farms design; 9. Economic and financial analysis;
Teaching format	Frontal lessons (40h), laboratory and exercises (20h)

Learning outcomes	**Knowledge and understanding:** The Hydro Power module provides the knowledge for run-of-the-river (RoR) hydro power plant analysis and design. The frontal lessons and laboratory exercises will give the necessary in-depth analysis of hydraulic design of each component of a RoR Hydro Power Plant (and assistance to design during laboratory hours). Wind energy course provides the basic knowledge for wind energy systems analysis and design. Main technical, and economical aspects for the proper selection and design will be faced and discussed. In particular small wind turbines application area and large wind farm design will be developed through two dedicated projects. **Applying Knowledge and understanding:** during one or two visits to large and/or mini hydro power plants (scheduled during the course), the elements which compose the hydroelectric system will be analyzed and understood, through practical examples. The wind power course makes use of lectures, with introduction and discussion of the general aspects of wind turbine design, project assignment, work in laboratory with commercial codes and group meetings to review the progress of the projects assigned. **Making judgments:** student will be able to analyze and evaluate the potential performances of a HPP. Students will acquire ability to analyze technical and economic feasibility of small wind project and large wind farm projects. **Communication skills:** (HS) For each visit a technical report has to be written by the student and discussed during oral exam. **Learning skills**

	Student will learn (second part of the "Hydropower systems" module) to develop in detail the hydraulic design of each compartment constituting a mini hydro power plant, including: weir, intakes, settling basin, head race, surge tank/forebay, penstock. The course will transfer knowledge and methods for the design of small wind turbines and wind farms. The draft design of a wind farm will be developed. Two visits will be organized
Assessment	Oral exams and exercises/report
Assessment language	English
Evaluation criteria and criteria for awarding marks	The exam of wind power module consists on oral presentation and discussion of the projects and deliverables of the individual working groups, with the identification and evaluation of the contributions of individual participants.

Required readings	Hydraulic structures (Novak) Hydraulic design of stilling basins (Peterka) Dam hydraulics (Vischer & Hager)
Supplementary readings	• L.Battisti. GLI IMPIANTI MOTORI EOLICI Ed. Lorenzo Battisti Editore. 2012 • L. Battisti Esercizi sulle turbine eoliche (edizione in corso) • T. Burton, D. Sharpe, N. Jenkins, E. Bossanyi, WIND ENERGY HANDBOOK ed. Wiley 2001 • J.F. Manwell, J.G. McGowan, A.L. Rogers, WIND ENERGY EXPLAINED ed. Wiley 2002 • R.Harrison, E. Hau, H. Snel, LARGE WIND TURBINES, ed John Wiley & Sons, 2000 • M.O. Hansen, AERODYNAMICS OF WIND TURBINES, Ed. James & James, 2003 R. Pallabazzer, SISTEMI EOLICI, Ed. Rubettino 2002