

Syllabus

Course description

Course title	FLUID MACHINES ENGINEERING
Course code	45527
Scientific sector	Fluid Machinery and energy systems
Degree	Master Energy Engineering
Semester	1
Year	1
Academic year	2017/2018
Credits	9
Modular	No

Total lecturing hours	70
Total lab hours	10
Total exercise hours	10
Attendance	YES
Prerequisites	Fluid Machines, Thermodynamics, Mechanics
Course page	http://www.unibz.it/en/sciencetechnology/.....

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	Lorenzo Battisti
Scientific sector of the lecturer	ING/IND-08
Teaching language	English
Office hours	Monday 15.00-18.00 Office THIRD FLOOR N.356
Teaching assistant (if any)	-
Office hours	-
List of topics covered	<p>The course will cover the following topics:</p> <ol style="list-style-type: none"> 1. Operations of fluid-machinery in energetic systems <ol style="list-style-type: none"> 1. Classification, size, stand alone, grid connected plants 2. Conventional process fluid (fossil fuel propelled plants) <ol style="list-style-type: none"> 2.1 Utility scale (external combustion plants, internal combustion plants); <ol style="list-style-type: none"> 2.1.1 Technologies, efficiency, emissions;

	<p>2.1.2 Design and selection ; 2.2 Community scale (steam, gas); 2.2.1 Technologies, efficiency, emissions; 2.2.2 Design and selection principle;</p> <p>3 Renewable process fluid (water, air, sun propelled plants) 3.1 Utility scale (hydropower, wind parks, solar towers, marine) 3.1.1 Technologies, efficiency, design principles 3.2 Community scale (micro-pico hydropower, small wind turbines, solar towers, marine) 3.2.1 Technologies, efficiency, design principles, selection criteria 3.3 Innovative generation systems 3.3.1 Variable speed (hydro turbines and wind turbines) 3.3.2 Reversible pumps (pumps as turbines) 3.3.3 Use of waste water (i.e. Irrigation hydropower and other release) 3.3.4 Hydrogen fuelled plants</p> <p>4 Technical operation of plants 4.1 Load and load matching 4.2 Plant availability, definition and examples; 4.2 Plant maintenance, methods; 4.3 Optimum plant management, optimum load allocation;</p> <p>5 Cost of energy 5.1 Determination of the cost of energy; 5.2 Economic analysis of plants, methods, ;</p>
Teaching format	
Learning outcomes	<p>The course aims at discussing the main power systems generation, either fossil and renewable fluids fuelled. The emphasis is put on the difference between utility and community scale, while main attention is drawn on design and selection criteria of the latter, since their application potential at territory scale. Innovative systems and technologies are presented and discussed, as community scale wind turbines, variable speed hydro turbines, reversible pumps (PAT), use of waste waters. Plants are detailed and discussed from the point of view of efficiency.</p>

	<p>Large part of the course is devoted to economic analysis of the plants through most used methodology, business plants organization to assess the economic viability.</p> <p>The course uses frontal classes and seminars held from visiting professors. Exercises on design and laboratory works are organized during the course. Two visits at generation plants are scheduled</p> <ol style="list-style-type: none"> 1. Wind park (to be yearly decided); 2. Small hydro plant and hydro factory (Trentino manufacturer); <p>By the end of the course, students should be able to:</p> <ol style="list-style-type: none"> 1. Have basic knowledge of work, power, efficiency of energetic systems; 2. Select and evaluate performances of hydropower plants; 3. Select and evaluate performances of wind turbines and wind parks; 4. Select and evaluate performances of turbogas, steam and MCI power plants; 5. Select and evaluate performances of energy accumulation systems; 6. set up valuable business plants and determine cost of energy for various plants.
Assessment	Oral exam and exercises 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	<ul style="list-style-type: none"> • L. Battisti, Gli impianti motori eolici, Ed. LB 2012 Trento • W.W Pulkrabek Engineering Fundamentals of the Internal Combustion Engine, Prentice Hall 1988 • R. Fox, Introduction to Fluid Mechanics, John Wiley and Sons 2004 • Klaus-Dieter E. Pawlik, Solutions Manual for Guide to Energy Management, The Fairmont Press, • S. L. Dixon, Fluid Mechanics, Thermodynamics of Turbomachinery, Pergamon Press 1988 • Layman, Layman's Handbook On How To Develop A Small Hydro Site. • A handbook prepared under contract for the Commission of the European Communities,

	Directorate-General for Energy by European Small Hydropower Association (ESHA) 1998 <ul style="list-style-type: none"> • Philip P. Walsh, Paul Fletcher, Gas Turbine Performance 2004 by Blackwell Science Ltd • R.K. TURTON Principles of Turbomachinery, Chapman e Hall 1995
Supplementary readings	Notes of the course