Freie Universität Bozen
Libera Università di Bolzano
Università Liedia de Bulsan

Syllabus
Course description

Course title	Fundamentals of Machinery and Oleodynamics
Course code	42151
Scientific sector	ING-IND/08
Degree	Bachelor in Industrial and Mechanical Engineering
Semester	1st
Year	III
Academic year	2019/20
Credits	8
Modular	No

Total lecturing hours	50
Total lab hours	0
Total exercise hours	30
Attendance	Not compulsory
Prerequisites	
Course page	https://www.unibz.it/en/faculties/sciencetechnology/bachelor-industrial-mechanical-engineering/course-offering/?academicYear=2018

Specific educational objectives	The Fundamentals of Machinery and Oleodynamics course is a core teaching in the context of the degree in Industrial and Mechanical Engineering and specifically it deals with the fluid machines that are used for the conversion (production and use) of energy. The course consists of 36 hours of frontal lectures and 24 hours of exercises. The lectures introduce the fundamental concepts and the working principles of the fluid machines both using compressible and non-compressible fluids. The main mechanical and energy conservation principles and equations will be described and applied to fluid machines. In particular, the following topics will be addressed: constructive aspects, behavior of fluids in the fluid machines components, thermo-fluid-dynamic laws, evaluation of the fluid machines' performance. The exercises consist in solving exercises and practical problems with the aim to give the students a deeper comprehension and understanding of the topics.

Lecturer	Dr. Massimiliano Renzi, K1.12, Massimiliano.renzi@unibz.it +39 0471 017816 Dott. Rossi Mosé, K1.06, +39 0471 017701, mose.rossi@unibz.it Dott. Caligiuri Carlo, K0.04, +39 0471 017708, Carlo.Caligiuri@unibz.it

Scientific sector of the lecturer	ING-IND/08
Teaching language	English
Office hours	
List of topics covered	The course will cover the following topics: 1. Introduction and reference of fluid dynamics: definition of fluid machines; conservation equations for real flows in fluid systems and their application to heat engines and turbomachineries, velocity triangles and Eulerian work; fluid transformations in turbomachinery vanes: behavior of compressible and supersonic flows in nozzles and diffusers; similarity laws for turbomachinery 2. Centrifugal, mixed flow and axial pumps: flow rate and head; efficiency; constructive aspects; cavitation; NPSH; coupling with the circuit 3. Hydraulic turbines: Pelton, Francis, Kaplan; constructive aspects; specific speed 4. Gas and vapour turbines: nozzles and diffusers; isentropic and polytropic efficiencies; turbine blades; impulse and reaction turbine; one-dimensional analysis of the flow; design process and calculation of stage performance 5. Alternative and rotary gas compressors: working principles and working cycle
Teaching format	The course consists of classroom lectures in which the topics are presented by the lecturer. There are also exercises that will give practical examples of the application of the theoretical topics. Course topics will be presented through presentations. Teaching material will be given to the students; additional material will be provided by the Professor.

Learning outcomes	**Intended Learning Outcomes (ILO)** <u>Knowledge and understanding</u> Through the application of the principles of thermo-fluid-dynamics to energy conversion systems, students should acquire: 1. To know and understand the fundamental mechanical components used in the fluid machines and their operative function 2. To know and understand the fluid-dynamics of the fluid machines, the design of the fluid-machines components and the introduction of the fluid machines within the industrial and civil plants and devices <u>Applying knowledge and understanding</u> 3. the ability to apply the fluid-dynamic laws to the design of thermal and hydraulic machines'

components
4. the ability to apply the studied fluid-machines to industrial and civil plants and devices

Making judgements
5. to be able to make autonomous judgements in the choice of the design solutions, of the suitable machines and of the plant solutions in relation to their applications

Communication skills
6. the ability to correctly and properly present the concepts acquired in the course both in written and oral form
7. the ability to use the proper technical terms to describe the design solutions of the fluid machines

Ability to learn
8. the ability to acquire lifelong learning skills in the field of fluid machines by applying the methods and the concepts acquired in the course

Assessment

Examination of the course is conducted via a written and an oral exam. The written exam assesses the ability of the student to apply the topics of the course in practical applications, the comprehension of the theoretical concepts and the ability to make judgments. The oral examination includes questions to assess the knowledge and understanding of the course topics and questions designed to assess the ability to transfer these skills to case studies of fluid machines.

Formative assessment

Form	Length /duration	ILOs assessed
In class exercises	12 X 60 minutes	2, 3, 4, 5

Summative assessment

Form	%	Length /duration	ILOs assessed
Written exam – exercises	50%	1 exercise (1.5 hours)	2, 3, 4, 5
Written exam – theory	50%	2 open-ended questions (1 hour)	1, 2, 6, 7
Oral (optional)	-	2 open-question	1, 2, 6, 7

Assessment language	English
Evaluation criteria and criteria for awarding marks	Students regularly enrolled at the 3nd year of the Bachelor in Industrial and Mechanical Engineering are eligible for the attendance of the lessons and the exam. Other exceptional cases have to be discussed with the Professor. **Written exam - exercise** The written exam assesses the ability of the student to apply the topics of the course in a practical dimensioning exercise and the ability to make judgments. The following criteria will be taken into account: - Correctness of the design choices - Correctness of the dimensioning procedure - Correctness of the numerical solution - Appropriate use of measurement units **Written exam – theory** (open-end question) The written exam on the theory assesses the knowledge and understanding of the course topics, the knowledge of the fluid-dynamic behavior of compressible and incompressible fluids in the components of the fluid machines, as well as the ability to transfer these skills to case studies and to make judgment. The following criteria will be taken into account: - Theoretical knowledge - Ability to provide examples/applications of the theoretical concepts - Communication skills and master of the technical language **Oral exam (optional)** The following criteria will be taken into account: - Theoretical knowledge - Ability to provide examples/applications of the theoretical concepts - Communication skills and master of the technical language The exam will be weighted as follows: written (50%), oral (50%). It will not be possible to pass the exam if the exercise or the questions will not have a sufficient mark singularly.

Required readings	• S. Sandrolini, G. Naldi, “Macchine, Vol. 1: Fluidodinamica e termodinamica delle turbomacchine”, Pitagora Editrice • S. Sandrolini, G. Naldi, “Macchine, Vol. 2: Le turbomacchine motrici e operatrici”, Pitagora Editrice

	• R. Della Volpe, Macchine, Editore Liguori, Napoli
Supplementary readings	• G. Minelli, “Macchine idrauliche”, Pitagora Editrice • R. Della Volpe, Esercizi di macchine, Editore Liguori, Napoli