Syllabus

Course Description

Course Title	Fundamentals of hydraulics and pneumatics
Course Code	42187
Course Title Additional	
Scientific-Disciplinary Sector	IIND-06/A
Language	English
Degree Course	Bachelor in Industrial and Mechanical Engineering
Other Degree Courses (Loaned)	
Lecturers	Dott. Carlo Maria Rozzi De Hieronymis, CarloMaria.RozziDeHieronymis@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/40195 Ing. Paolo Cusano, Paolo.Cusano@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/49085
Teaching Assistant	
Semester	First semester
Course Year/s	3
CP	6
Teaching Hours	36
Lab Hours	24
Individual Study Hours	90
Planned Office Hours	18
Contents Summary	List of topics The course covers the following topics: 1. General principles. Hydraulic energy transmission. Head and fluid loss. Hydraulic fluid classification. Graphic symbols and standardisation. 2. Hydraulic open and closed circuits. Pumps and motors with pistons, vane, gears. Hydraulic jacks. Geometrical displacement. Formulas for performances computation. Pressure regulation

	valves. Pressure reduction valves. Sequential valves; 3. Flow regulation valves. Flow limitation valves. Flow dividers. Oper-centre valves. Direction regulation valves. Non-reversal valves. Rotary and case distributors. Feeding groups. Utilizing groups. Parallel, in series and mixed circuits. Circuits for sequences. 4. Load sensing systems. Circuits and valves. Fitting elements for circuits. Compressors. Compressor and tank choice. Pneumatic jacks and hammers. Pressure, flow, direction regulation valves. Analytical and graphic computation examples.
Course Topics	The course will start with a review of basic laws for the hydraulic, for instance: Bernoulli's law, Archimede's law and Physic definition of the pressure, flow and its units of measure as well. Then the main laws, that describe most of hydraulic systems, will be explained and demostrated: law of the restrictor, continuity law, Poiselle's law, ecc. Will be explained how to apply these laws when the flow is turbolent and laminar. The ISO 1219-1 that show how to schematize an hydraulic system will be explained in detail with real example of hydraulic circuit. The most important hydraulic components and volumentric machines used in an hydraulic circuits will be examinated in details. It will be shown the internal architecture and it will be explained the working principle and the equations that describe the machine. Some real parts will be diassembled during the lesson in order to explain the function of the most impoant items. It will be explained how to use the hydraulic components in order to build an hydraulic system for a real application. It will be shown, during the exercise hours, real hydraulic systems used on the machines and how to correct calculate the dimensioning of the components.
Keywords	Hydraulic laws, Volumetric machines, Hydraulic systems, Hydraulic components, Fluid power
Recommended Prerequisites	
Propaedeutic Courses	
Teaching Format	The course consists of classroom lectures in which the topics are presented by the lecturer. There are also practical lessons 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; required additional material will be provided by the Professor.
Mandatory Attendance	Strongly recommended.
Specific Educational Objectives and Learning Outcomes	The course is the scientific sector of fluid machines and it consists of 36 hours of frontal lectures and 24 hours of exercises. The lectures introduce the fundamental concepts and the working principles of the main hydraulic and pneumatic components. The specific educational objectives consist in showing the specific function of each component and valve, to give the correct interpretation of Iso schemes of hydraulic or pneumatic circuits and to help in choosing components suited to their required use. The exercises are intended to present practical problems with the aim to give the students the adequate knowledge to project real working circuits. Knowledge and understanding: Through the application of the principles of thermo-fluid-dynamics to fluid machines, students should be able: 1. to acquire advanced knowledge on the main hydraulic and pneumatic systems 2. to recognize components and their specific function and application. Applying knowledge and understanding: 3. to interpret the operation and the potential of a hydraulic or pneumatic circuit 4. to acquire the know-how to determine the convenience of using a component or an entire plant in relation to end uses. Professional capabilities will be obtained through the ability to model and design hydraulic or pneumatic circuits. Making judgments: 5. 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. correctly and properly present the concepts acquired in the course both in written and oral form 7. to use the proper technical terms to describe the design

	solutions of the fluid machines Learning skills 8. to acquire lifelong learning skills through the possession of the tools for the acquisition of technical information on hydraulics and pneumatics and to update knowledge.
Specific Educational Objectives and Learning Outcomes (additional info.)	
Assessment	During the last part of the course some projects will be proposed. The students will develop in group or individually one of the proposed projects in order to discuss it during the oral examination. This project will be considered as written parts of the exam - Oral examination and / or deepening of the written test Themes - Formative assessment: 50% written exam (discussion about the project): 40 minutes; ILOs assessed: 1, 2, 3, 4, 8; - Summative assessment: 50% oral exam: 40 minutes; ILOs assessed: 2, 6, 7, 8.
Evaluation Criteria	Students regularly enrolled at the 2rd 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. Oral exam 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 Written exam – exercise (project) 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 independent judgments. The following criteria will be taken into account: - Correctness of the design choices: the student is asked to identify

	the proper machine for a specific application, select the main design criteria and identify the proper procedure to design the machine - Correctness of the dimensioning procedure: the student is asked to define the calculations to design in details the machine ducts, the machine blades and its performance - Correctness of the numerical solution: the student is asked to run calculations on the machine design and performance, and to be able to judge the correctness of the numerical results - Appropriate use of measurement units In order to get a positive final mark, the student must demonstrate that there are no gaps in the basic knowledge presented in the course. The maximum evaluation is achieved by demonstrating in-depth knowledge of course content. The written and the oral exam have the same weight in the final mark calculation.
Required Readings	• L'OLEOIDRAULICA nell'ambito industriale e mobile (ASSOFLUID) • Slides and documentation shared on teams
Supplementary Readings	• Passi nell'oleodinamica: vol1; vol2. (Nervegna, Rundò) • MANUALE DELL'OLEDINAMICA (Speich, Bucciarelli)
Further Information	
Sustainable Development Goals (SDGs)	Quality education, Decent work and economic growth, Affordable and clean energy