

Faculty of Mechanical Engineering / MECHATRONICS / HYDRAULICS AND ELECTROHYDRAULICS

Course:	HYDRAULICS AND ELECTROHYDRAULICS			
Course ID	Course status	Semester	ECTS credits	Lessons (Lessons+Exercises+Laboratory)
12462	Optional	3	6	2+1+2
Programs	MECHATRONICS			
Prerequisites	None.			
Aims	Defining basic hydraulic terms and units, identifying hydraulic graphic symbols, hydraulic/electro-hydraulic components, describing the function of hydraulic/electro-hydraulic components, installing hydraulic systems, circuits and devices for hydraulic power.			
Learning outcomes	After passing the exam in this subject, students will be able to: Define basic hydraulic terms and units, identify hydraulic graphic symbols, hydraulic/electro-hydraulic components, describe the function of hydraulic/electro-hydraulic components, install hydraulic systems, circuits and devices for hydraulic power, calculate sizes for hydraulic power components, design, analyze and troubleshoot hydraulic circuits and perform maintenance on hydraulic systems.			
Lecturer / Teaching assistant	Prof. dr Milanko Damjanović			
Methodology	lectures, exercises, laboratory exercises.			
Plan and program of work				
Preparing week	Preparation and registration of the semester			
I week lectures	Introduction to hydraulics. Pascals law and related problems, continuity equations, introduction to unit conversion.			
I week exercises	Introduction to hydraulics. Pascals law and related problems, continuity equations, introduction to unit conversion.			
II week lectures	Structure of the hydraulic control system. A source of hydraulic power.			
II week exercises	Structure of the hydraulic control system. A source of hydraulic power.			
III week lectures	Pumps. Theory of pumps, classification of pumps.			
III week exercises	Pumps. Theory of pumps, classification of pumps.			
IV week lectures	Gear pumps, vane pumps, piston pumps, pump characteristics, pump selection.			
IV week exercises	Gear pumps, vane pumps, piston pumps, pump characteristics, pump selection.			
V week lectures	Hydraulic actuators and motors: linear hydraulic actuators (cylinders), hydraulic cylinder filling mechanism.			
V week exercises	Hydraulic actuators and motors: linear hydraulic actuators (cylinders), hydraulic cylinder filling mechanism.			
VI week lectures	Hydraulic rotary actuators, gear motors, vane motors, piston motors. Theoretical torque of the hydraulic motor, power and flow ratio, characteristics of the hydraulic motor.			
VI week exercises	Hydraulic rotary actuators, gear motors, vane motors, piston motors. Theoretical torque of the hydraulic motor, power and flow ratio, characteristics of the hydraulic motor.			
VII week lectures	Coupling components in hydraulic systems: control manifolds, symbols, design features. Pressure control valve, direct control and pilot control types, flow control valves.			
VII week exercises	Coupling components in hydraulic systems: control manifolds, symbols, design features. Pressure control valve, direct control and pilot control types, flow control valves.			
VIII week lectures	Colloquium I.			
VIII week exercises	Colloquium I.			
IX week lectures	Design of hydraulic circuits and analysis: control of single-acting and double-acting hydraulic cylinders, regenerative circuit, pump discharge circuit, hydraulic systems with double pumps.			
IX week exercises	Design of hydraulic circuits and analysis: control of single-acting and double-acting hydraulic cylinders, regenerative circuit, pump discharge circuit, hydraulic systems with double pumps.			
X week lectures	Application of valve balancing, sequential hydraulic cylinder circuit, locked cylinder with pilot control valve, cylinder synchronization circuit.			

X week exercises	Application of valve balancing, sequential hydraulic cylinder circuit, locked cylinder with pilot control valve, cylinder synchronization circuit.					
XI week lectures	Speed regulation of hydraulic cylinders, speed regulation of hydraulic motors, accumulators and accumulator circuits.					
XI week exercises	Speed regulation of hydraulic cylinders, speed regulation of hydraulic motors, accumulators and accumulator circuits.					
XII week lectures	Electrohydraulics. Hydraulic system flow. Electrohydraulic control chains. Hydraulic control distributors. Practical examples.					
XII week exercises	Electrohydraulics. Hydraulic system flow. Electrohydraulic control chains. Hydraulic control distributors. Practical examples.					
XIII week lectures	Maintenance of hydraulic systems: hydraulic oil, desired properties, general types of fluids, sealing devices, tank system, filters and strainers.					
XIII week exercises	Maintenance of hydraulic systems: hydraulic oil, desired properties, general types of fluids, sealing devices, tank system, filters and strainers.					
XIV week lectures	Problems caused by gas in hydraulic fluid, wear of moving parts due to solid particle contamination, temperature management, troubleshooting.					
XIV week exercises	Problems caused by gas in hydraulic fluid, wear of moving parts due to solid particle contamination, temperature management, troubleshooting.					
XV week lectures	Colloquium II.					
XV week exercises	Colloquium II.					
Student workload						
Per week			Per semester			
6 credits x 40/30=8 hours and 0 minuts 2 sat(a) theoretical classes 2 sat(a) practical classes 1 excercises 3 hour(s) i 0 minuts of independent work, including consultations			Classes and final exam: 8 hour(s) i 0 minuts x 16 =128 hour(s) i 0 minuts Necessary preparation before the beginning of the semester (administration, registration, certification): 8 hour(s) i 0 minuts x 2 =16 hour(s) i 0 minuts Total workload for the subject: 6 x 30=180 hour(s) Additional work for exam preparation in the preparing exam period, including taking the remedial exam from 0 to 30 hours (remaining time from the first two items to the total load for the item) 36 hour(s) i 0 minuts Workload structure: 128 hour(s) i 0 minuts (cources), 16 hour(s) i 0 minuts (preparation), 36 hour(s) i 0 minuts (additional work)			
Student obligations						
Consultations						
Literature			1. R.B. Walters, "Hydraulic and Electro-Hydraulic Control Systems", Springer, 1991, ISBN 1851665560. 2. L. Hamill, "Understanding Hydraulics"; Palgrave Macmillan, 2Rev Ed edition, 2001, ISBN-10: 0333779061			
Examination methods			2 colloquiums: 10 points each (20 points in total), - Laboratory tasks: 20 points in total, - Exam: 60 points.			
Special remarks						
Comment						
Grade:	F	E	D	C	B	A
Number of points	less than 50 points	greater than or equal to 50 points and less than 60 points	greater than or equal to 60 points and less than 70 points	greater than or equal to 70 points and less than 80 points	greater than or equal to 80 points and less than 90 points	greater than or equal to 90 points