Course description

1 General information

Course name	**HYDRAULIC AND PNEUMATIC DRIVE AND CONTROL**
Course code	
Level of study (B.Sc, M.Sc., Ph.D.)	BSc
ECTS	5
Course manager	Dr inż. Janusz Pobędza Laboratorium Badań Technoklimatycznych i Maszyn Roboczych / Laboratory of Techno-Climatic Research and Heavy Duty Machines
Course length	One (1) semester
Coordinator for international programs	erasmus@mech.pk.edu.pl

2 Prerequisites

- Physics , Fluid Mechanics, Basic Automatics

2 Program

Type	Lectures	Classes	Labs	Computer labs	Project	Seminar
Hours	30		15	15		

3 Contents

Lectures		
No.		Hours
1.	Fluid power system – hydrostatic, hydrokinetic and pneumatic. Working fluids: mineral oils, synthetic oils, biodegradable and water, air.	2
2.	Theoretical and technical parameters of fluid power systems. Symbols and schema building rules of the fluid power system.	2
3.	The construction, principle of operation and characteristics of the hydraulic pumps, motors and linear actuators.	4
4.	Basic types and characteristics of control valves for; pressure, flow and direction control.	4
5.	Other hydraulic system components, as: filters, tanks, coolers, pipes and hoses, connectors, seals, measurement and controls.	2
6.	The hydrostatic drive and control system of typical machines.	2
7.	Throttle and volume control of the actuator velocity.	2
8.	Hydrostatic transmissions, definition, control characteristics.	2
9.	Pneumatic systems	2
10.	Pneumatic control valves	2
11.	Electro-Pneumatic system	2
12.	Fundamentals of fluid power system design.	2
13.	Hydrokinetic clutches and torque converters – operations characteristics	2

Labs		
No.		Hours
1.	Introduction to the laboratory + laboratory stands safety instructions	1
2.	Design schema, assembling of pneumatic circuits and testing its operation	2
3.	Positive displacement pump characteristic testing.	2
4.	Pressure relief and/or flow control valve characteristics investigation.	2
5.	Pneumatic cylinder testing.	2
6.	Velocity control system by use of throttle valve	2
7.	Electro pneumatic control system assembling and testing	2
8.	Mobile machines hydrostatic steering system testing.	2

Computer labs		
No.		Hours
1.	Introduction to simulation of hydraulic elements and systems (beginnings of working with Matlab Simulink or Simulation X software)	2
2.	Control of flow direction (directional control valves, system with cylinders and motors)	2
3.	Control of flow speed (throttle valves, flow control valves, check valves)	2
4.	Efficiency of hydraulic system (different ways to simulate hydraulic, mechanical and volumetric losses in hydraulic elements and systems)	2
5.	Construction diagrams of mechanical and pneumatic control systems. (implementation of systems on mechanical and pneumatic valves, including logic including methods of drawing and reading diagrams).	2
6.	Construction of electro-pneumatic diagrams control systems (implementation of control system on manipulators or actuators with mounted position sensors using a PLC controller including the use of various execution electro-valves).	2
7.	Simulation and analysis of selected hydraulic and pneumatic control systems	3

3 Learning Outcomes (skills and knowledge):

- 1. Theoretical basis of fluid power systems principle of operation
- 2. Construction and characteristics of pump, motors and cylinders
- 3. Construction and characteristics of pneumatic and electro- pneumatic control valves
- 5. Principles of hydraulic system design
- 6. Principles of pneumatic systems synthesis

4 Assessment policy (examination):

- Test from lecture
- Laboratory exercise reports
- Short laboratory related knowledge test

5 Literature

1. J. S. Stecki and A. Garbacik, Hydraulic Control Systems – System Design and Analysis, Fluid Power Net Publications, 2000;
2. J. Watton, Modeling, monitoring and diagnostic techniques for fluid power systems, Springer-Verl. 2007;
3. J. S. Cundiff, Fluid power circuits and controls: fundamentals and applications A.K., CRC Press, Boca Raton; cop. 2002.