

COURSE DESCRIPTION CARD

Faculty of Mechanical Engineering									
Field of study								Degree level and programme type	Bachelor's degree Master's degree
Specialization/ diploma path								Study profile	
Course name	Design of Hydraulic Power Systems							Course code	IS-FME-002012W
								Course type	Elective
Forms and number of hours of tuition	L	C	LC	P	SW	FW	S	Semester	Winter
	30	15						No. of ECTS credits	3
Entry requirements									
Course objectives	The course provides students with knowledge of the basic terms, principles and calculation methods for hydraulic power systems. Its purpose is to present a rational and well-balanced information about hydraulic systems and its components, their principles and features of work. Main types and construction of hydraulic pumps, motors, actuators, valves and ancillary hydraulic equipment are systematically considered. The course also explains principles of exploitation and service of hydraulic systems. Another goal of the course is to teach students skilfully reading and drawing hydraulic schemes and choosing the hydraulic equipment that suits best for exact propose. The emphasis of the course is on the achieving of skills to efficiently schematise, analyse and solve typical tasks of hydraulic power systems design.								
Course content	1. Introduction. Basics of hydraulics. Hydraulic fluids. Properties, requirements and specifics of application. 2. Principles of the hydraulic power systems action and its terminology. Hydraulic schemes and symbols. Advantages and disadvantages of hydraulic power systems. 3. Hydrostatic machines. Rotary piston hydrostatic machines. Classification, basics of calculation and application. 4. Rotary vane and gear hydrostatic machines. Classification, constructions and application. 5. Hydraulic cylinders. Types. Constructions. Basics of calculation and design. 6. Special hydraulic machines. Hydraulic rotary actuators. 7. Industrial and mobile hydraulic equipment. Check and pressure valves. Classification, construction and application. 8. Flow control valves. Types, construction and symbols. 9. Directional control valves. Classification, construction, types of control and features of connection into the hydraulic power systems. 10. Ancillary hydraulic equipment. Accumulators, filters, separators, manometers. Pipes, tubes and connections of hydraulic power systems. 11. Hydraulic transmissions. Open and closed hydraulic power systems. 12. Control of the hydraulic power systems outcome parameters. Proportional hydraulics. LS and LUDV control. Efficiency calculation of the hydraulic power systems. 13. Thermal design of hydraulic power systems. Choose of the tanks and coolers. 14. Hydraulic power systems design and calculation. Design of the								

	hydraulic schemes and choose of the suitable hydraulic equipment. 15. System management. Installation, exploitation and service of hydraulic power systems. Internal protection of hydraulic components and power units.	
Teaching methods	Regular lectures: blackboard lectures, presentations by teacher, discussions. Regular classes: blackboard classes, discussions. Work at home: home assignments, preparation for classes, preparation for exams.	
Assessment method	In-class test, home assignment reports, written exams	
Symbol of learning outcome	Learning outcomes	Reference to the learning outcomes for the field of study
LO1	Demonstrate knowledge of the hydraulics basics, terminology of the hydraulic power systems and symbols of the hydraulic equipment in the schemes	M1_W06, M1_W07
LO2	Demonstrate knowledge of construction, operation principles and design of rotary hydraulic machines parts	M1_W08, M1_W09
LO3	Demonstrate ability to provide design of hydraulic cylinder	M1_W09, M1_W20, M1_U14
LO4	Demonstrate knowledge of the hydraulic valves and ancillary equipment constructions, their operation principles and proper applications in the hydraulic power systems	M1_W07, M1_W08
LO5	Demonstrate adequate ability to apply proportional hydraulic equipment and other ways to control the hydraulic power systems outcome parameters	M1_W07, M1_W19
LO6	Demonstrate knowledge about hydraulic power systems design, choose of the suitable hydraulic equipment and their exploitation and service	M1_W10, M1_U03, M1_U21
Symbol of learning outcome	Methods of assessing the learning outcomes	Type of tuition during which the outcome is assessed
LO1	In-class test, written exam	L, C
LO2	In-class test, written exam	L, C
LO3	Home assignment report, in-class, test written exam	L, C
LO4	In-class test, written exam	L, C
LO5	In-class test, written exam	L, C
LO6	Home assignment report, in-class, test written exam	L, C
Student workload (in hours)		No. of hours
Calculation	Attendance of lectures	30
	Attendance of classes	15
	Work on home assignments	30
	Preparation for exams	15
	TOTAL:	90

Quantitative indicators		HOURS	No. of ECTS credits
Student workload – activities that require direct teacher participation		45	3
Student workload – practical activities		45	
Basic references	1. P. Chapple, Principles of hydraulic systems design, 2nd ed., Momentum Press, 2015. 2. R. Doddannavar, A. Barnard, J. Ganesh, Practical hydraulic systems operation and troubleshooting for engineers and technicians, Newnes, 2005 3. H. Exner, R. Freitag et al., The hydraulic trainer. volume 1: Basic principles and components of fluid technology, Mannesmann Rexroth GmbH, 1991 4. A. Parr, Hydraulics and pneumatics: A technician's and engineer's guide, Butterworth Heinemann, 2013		
Supplementary references	1. R. B. Walters, Hydraulic and electro-hydraulic control systems, Elsevier applied science London and New York, 1991 2. P. Drexler, H. Faatz, F. Feicht, Dr. Ing et. al., The hydraulic trainer. Volume 3: Planning and design of hydraulic power systems, Wiesmann Mannesmann Rexroth AG, 1988 3. R. Ewald, J. Hutter, D. Kretz et. al., The hydraulic trainer. Volume 2: Proportional and servo valve technology, Wiesmann Mannesmann Rexroth AG, 1989 4. R. Kordak, Hydrostatic drives with secondary control, 2nd ed., Mannesmann Rexroth GmbH, 1996		
Organisational unit conducting the course	Department of Mechanics and Applied Computer Science	Date of issuing the programme	
Author of the programme	Rafał Grądzki PhD	02.03.2020	

L – lecture, C – classes