COURSE DESCRIPTION CARD

<table>
<tr><td colspan="10">Faculty of Mechanical Engineering</td></tr>
<tr><td>Field of study</td><td colspan="6">Mechatronics</td><td>Degree level and programme type</td><td>full-time studies
1st degree, Eng.</td></tr>
<tr><td>Specialization/ diploma path</td><td colspan="6">general</td><td>Study profile</td><td></td></tr>
<tr><td rowspan="2">Course name</td><td colspan="6" rowspan="2">Drive systems in mechatronics</td><td>Course code</td><td>IS-FME- 00249S</td></tr>
<tr><td>Course type</td><td>obligatory</td></tr>
<tr><td rowspan="2">Forms and number of hours of tuition</td><td>L</td><td>C</td><td>LC</td><td>P</td><td>SW</td><td>FW</td><td>S</td><td>Semester</td><td>summer</td></tr>
<tr><td>30 (E)</td><td></td><td>15</td><td>15</td><td></td><td></td><td></td><td>No. of ECTS credits</td><td>5</td></tr>
<tr><td>Entry requirements</td><td colspan="9">Fundamentals of electrical engineering and electronics, Signals of measurement and control</td></tr>
<tr><td>Course objectives</td><td colspan="9">Familiarizing students with the basic components and principle of operation and directions of the development of fluid and electric drive systems. To acquire basic practical skills in the analysis, design, and assembly of simple and complex pneumatic, hydraulic and electric drive and control systems.</td></tr>
<tr><td>Course content</td><td colspan="9">Lecture: Acquainting with the basic concepts of fluid (pneumatic and hydraulic) and electric drive systems. Classification of fluid and electric drives. Graphic symbols of hydraulic, pneumatic, electric and hybrid components. Principles of reading and elaborating diagrams of pneumatic, hydraulic and electric drive and control systems. Areas of application and properties of the transmission medium. Production, preparation and transmission of the transmission medium. Pneumatic components used in drive and control systems. Pneumatic linear – cylinders. Pneumatic rotary drives actuators. Classification, properties and applications of electric drives. Feedback control, shaping mechanical characteristics of an electric motor. Start-up, control of angular speed, braking of a DC motor, a single-phase and a three-phase AC motor. Inverter drives with a DC motor (block diagrams, principle of operation, properties and applications). Frequency control of rotational speed of selected AC motors. Digital-analog control systems of angular speed and position. Position control systems with stepper motors and servo drives. Selection of electric motors for working machines. Electric equipment and protection systems for electric drive systems.

Laboratory classes: Implementation and testing of electric drive and control systems. Testing of static and dynamic characteristics (properties) of selected drive systems. Testing of measurement systems of rotational speed and angular displacement. Designing simple pneumatic and electric control systems in FluidSim computer software.</td></tr>
<tr><td>Teaching methods</td><td colspan="9">Presentations, discussion, project examples, other documents given by the teacher.
Realization of the project, presentation of the project. Laboratory classes.</td></tr>
<tr><td>Assessment method</td><td colspan="9">Lecture – written exam. Laboratory classes: evaluation of reports, marks for activity.
Project: performance of the project, defense of project, presentation and discussion, marks for activity.</td></tr>
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Symbol of learning outcome	Learning outcomes	Reference to the learning outcomes for the field of study
LO1	Student knows the basic concepts of electric and fluid drives.	**MK1_W01 MK1_W03**
LO2	Student names and classifies the basic components of electric and fluid (pneumatic and hydraulic) drive and control systems.	**MK1_W03**
LO3	Student knows development trends of electric and fluid (pneumatic and hydraulic) drives.	**MK1_W05**
LO4	Student correctly reads and draws pneumatic, hydraulic and electric circuit diagrams of drive and control systems.	**MK1_W07 MK1_U03**
LO5	Student assemblies and tests basic pneumatic, hydraulic and electric circuit diagrams of drive and control systems.	**MK1_U03 MK1_U02 MK1_K03**
LO6	Student can prepare the correct schematic diagram of the designed pneumatic, hydraulic and electric circuit diagrams of drive and control systems.	**MK1_K03 MK1_U03**

Symbol of learning outcome	Methods of assessing the learning outcomes	Type of tuition during which the outcome is assessed
LO1	written exam	L
LO2	written exam	L
LO3	written exam	L
LO4	Written exam. Evaluation of reports, marks for activity. Performance of the project, defense of project, presentation and discussion, marks for activity.	L, LC, P
LO5	Evaluation of reports, marks for activity.	LC, P
LO6	Performance of the project, defense of project, presentation and discussion, marks for activity.	LC, P

Student workload (in hours)		No. of hours
Calculation	**lecture attendance**	30
	laboratory classes attendance	15
	project attendance	15
	preparation to pass lecture; participation in the exam	19
	preparation for laboratory classes	14
	preparation to pass laboratory classes	3
	preparation for projects	22
	implementation of project tasks and preparation of presentation	6
	preparation to pass project	7
	participation in consultations	4
	TOTAL:	135

Quantitative indicators	HOURS	No. of ECTS credits
Student workload – activities that require direct teacher participation	66	2.5

Student workload – practical activities		84	3
Basic references	1. Awrejcewicz J., Kaliński K.J., Szewczyk R., Kaliczyńska M.: Mechatronics: ideas, challenges, solutions and applications / eds. Cham: Springer, 2016. 2. Jablonski R., Brezina T.: Mechatronics. Recent Technological and Scientific Advances. Springer, 2014. 3. Edited by Clarence W. Mechatronic Systems Devices, Design, Control, Operation and Monitoring, on-line: https://www.academia.edu/36353669/Mechatronic_Systems_Devices_Design_Control_Operation_and_Monitoring 4. Pneumatic and hydraulic symbols: British and International Standards e.g. BS 2917, PN-IS0 1219-2 (2009), ISO 9461 (Hydraulics), CETOP, RP68P, ISO 5599 (Pneumatics)		
Supplementary references	Scientifics journals connected with pneumatic, hydraulic and electric drive and control systems.		
Organisational unit conducting the course	Department of Robotics and Mechatronics	**Date of issuing the programme**	
Author of the programme	Ph.D., Eng. Rafał Grądzki	2018-04-20	

L – lecture, C – classes, LC – laboratory classes, P – project, SW – specialization workshop, FW - field work, S – seminar