COURSE SPECIFICATION

Course code	full-time programme:	**M#2-S1-ME-311**
	part-time programme:	
Course title in Polish	**Napędy i sterowanie hydrauliczne i pneumatyczne**	
Course title in English	**Hydraulic and pneumatic drive and control systems**	
Valid from (academic year)	**2024/2025**	

GENERAL INFORMATION

Programme of study	**MECHANICAL ENGINEERING**
Level of qualification	**first-cycle**
Type of education	**academic**
Mode of study	**full-time programme**
Specialism	**all**
Department responsible	**Department of Mechatronics and Weapons Engineering**
Course leader	**Ryszard Dindorf**
Approved by	**dr hab. Jakub Takosoglu, prof. PŚk, Dean of the Faculty of Mechatronics and Mechanical Engineering**

COURSE OVERVIEW

Course type		**programme-specific**
Course status		**compulsory**
Language of instruction		**English**
Semester of delivery	full-time programme	**Semester III**
	part-time programme	
Pre-requisites		
Examination required (YES/NO)		**YES**
ECTS value		**4**

Mode of instruction		**lecture**	**class**	**laboratory**	**project**	**seminar**
No. of hours per semester	full-time programme	**15**	**15**	**15**		
	part-time programme					

LEARNING OUTCOMES

Category of outcome	**Outcome code**	**Course learning outcomes**	**Corresponding programme outcome code**

Knowledge	W01	Has structured, advanced knowledge in the field of hydraulic and pneumatic drives and controls, including detailed knowledge of classification, construction and operating principles, necessary to formulate and solve technical problems in the design of hydraulic and pneumatic drive systems.	MiBM1_W04
	W02	Has in-depth knowledge of the nomenclature, structure, and operating principles of various types of hydraulic and pneumatic components, determining the basic operating parameters of hydraulic and pneumatic drives, as well as technical solutions used in various areas of application of hydraulic and pneumatic drives.	MiBM1_W06
Skills	U01	Is able to use knowledge from the area of hydraulic and pneumatic drives and control to formulate and solve engineering tasks in various areas of machine construction, both at the design, construction and component selection stages. Is able to evaluate, critically analyze and synthesize the obtained results and express their opinions and comments	MiBM1_U01
	U02	Is able to select appropriate hydraulic and pneumatic drive components to ensure correct operation of the machine.	MiBM1_U14
Competence	K01	Is ready to critically evaluate the knowledge he possesses and the need to acquire new information both from the literature and from experts in the field of hydraulic and pneumatic drives.	MiBM1_K01
	K02	Is aware of the need to independently supplement and expand knowledge in the field of hydraulic and pneumatic drives, critically approaches the knowledge acquired. Understands the need and knows the possibilities of continuous improvement (2nd and 3rd degree studies, postgraduate studies, courses) aimed at improving professional, personal and social competences.	MiBM1_K03

COURSE CONTENT

Type of instruction lecture	Topics covered
lecture	Introduction to hydraulic and pneumatic drive and control, classification, construction and principle of operation. Symbols and graphic diagrams of hydraulic and pneumatic systems. Application of hydraulic and pneumatic drives. Theoretical foundations I - application of the principle of conservation of mass in fluid systems. Theoretical foundations II - application of conservation of energy in fluid systems. Theoretical foundations III - air as a working medium. Application programs for designing hydraulic and pneumatic systems.

class	Construction of hydraulic and pneumatic system diagrams. Application of the stream continuity equation and flow rate balance in the calculation of fluid drives. Application of the Bernoulli equation in the calculation of fluid drives. Calculations of hydraulic drives, hydrostatic transmissions, hydraulic accumulator. Calculations of pneumatic drives, compressed air flow in pneumatic valves, compressed air tanks. Application of application programs in the design of hydraulic drives. Application of application programs in the design of pneumatic drives.
laboratory	Construction of hydraulic control systems. Construction of pneumatic control systems. Throttle and volume control systems for hydraulic drives. Direct and indirect control systems for pneumatic drives. Application of hydraulic valves in controlling hydraulic drives. Application of pneumatic valves in controlling hydraulic drives. Safe control systems for hydraulic drives. Safe control systems for pneumatic drives.

ASSESSMENT METHODS

Outcome code	Methods of assessment *(Mark with an X where applicable)*					
	Oral examination	Written examination	Test	Project	Report	Other
W01	X	X				
W02	X	X				
U01			X			
U02			X			
K01					X	
K02					X	

ASSESSMENT TYPE AND CRITERIA

Mode of instruction	Assessment type	Assessment criteria
lecture	examination assessment	Successful completion of the final exam. At least 50% of points.
class	non-examination assessment	Successful completion of the final test. At least 50% of points.
laboratory	non-examination assessment	Successful completion of the course reports. The final grade is an arithmetic mean.

OVERALL STUDENT WORKLOAD

ECTS weighting												
No.	Activity type	Student workload										Unit
		full-time programme					part-time programme					
1.	Scheduled contact hours	L	C	Lb	P	S	L	C	Lb	P	S	h
		15	15	15								
2.	Other contact hours (office hours, examination)	4	2	2								h
3.	**Total number of contact hours**	**53**										h
4.	**Number of ECTS credits for contact hours**	**2,1**										ECTS

5.	**Number of independent study hours**	**47**		h
6.	**Number of ECTS credits for independent study hours**	**1,9**		ECTS
7.	**Number of practical hours**	**67**		h
8.	**Number of ECTS credits for practical hours**	**2,7**		ECTS
9.	**Total study time**	**100**		h
10.	**ECTS credits for the course** *1 ECTS credit = 25-30 hours of study time*	**4**		ECTS

READING LIST

1. Dindorf R. pod red.: Hydraulika i Pneumatyka. Podręcznik Akademicki. Wydawnictwo Politechniki Świętokrzyskiej, Kielce 2003.
2. Dindorf R.: Modelowanie i symulacja nieliniowych elementów i układów regulacji napędów płynowych. Monografia nr 44. Wydawnictwo Politechniki Świętokrzyskiej, Kielce 2004.
3. Dindorf R.: Napędy płynowe. Podstawy teoretyczne i metody obliczania napędów hydrostatycznych i pneumatycznych. Podręcznik akademicki. Wydawnictwo Politechniki Świętokrzyskiej, Kielce, 2009.
4. Dindorf R. Elastyczne aktuatory pneumatyczne. Monografia. Wydawnictwo Politechniki Świętokrzyskiej, Kielce 2013.
5. Dindorf R., Woś P.: Przetworniki i układu pomiarowe w systemach hydraulicznych i pneumatycznych. Monografie, Studia, Rozprawy M63. Wydawnictwo Politechniki Świętokrzyskie, Kielce 2014.
6. Dindorf R., Woś P.: Developments of hydraulic power systems. Monografie, Studia, Rozprawy M72. Wydawnictwo Politechniki Świętokrzyskie, Kielce 2016.
7. Dindorf R., Takosoglu J., Woś P.: Developments of pneumatic control systems. Monografie, Studia, Rozprawy M89. Wydawnictwo Politechniki Świętokrzyskie, Kielce 2017.
8. Dindorf R., Takosoglu J., Woś P.: Bezpieczeństwo układów hydraulicznych i pneumatycznych. Monografie, Studia, Rozprawy M97. Wydawnictwo Politechniki Świętokrzyskie, Kielce 2018.