COURSE SPECIFICATION

Course code	full-time programme:	**M#2-S2-ME-EM-114**
	part-time programme:	
Course title in Polish	**Budowa i badanie wybranych urządzeń mechatronicznych**	
Course title in English	**Design and Testing of Mechatronic Systems**	
Valid from (academic year)	**2024/2025**	

GENERAL INFORMATION

Programme of study	**MECHANICAL ENGINEERING**
Level of qualification	**second-cycle**
Type of education	**academic**
Mode of study	**full-time programme**
Specialism	**Machine Operation and Maintenance**
Department responsible	**Department of Mechatronics and Weapons Engineering**
Course leader	**dr hab. inż. Zbigniew Dziopa, prof. PŚk**
Approved by	**dr hab. Jakub Takosoglu, prof. PŚk, Dean of the Faculty of Mechatronics and Mechanical Engineering**

COURSE OVERVIEW

Course type		**specialism-related**
Course status		**compulsory**
Language of instruction		**English**
Semester of delivery	full-time programme	**Semester I**
	part-time programme	**Semester I**
Pre-requisites		
Examination required (YES/NO)		**NO**
ECTS value		**2**

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

LEARNING OUTCOMES

Category of outcome	Outcome code	Course learning outcomes	Corresponding programme outcome code
Knowledge	W01	Has in-depth knowledge of mechanics and mechanical engineering, at the stage of design, construction, prototyping of mechatronic devices and their functional structures.	MiBM2_W01
	W02	Has a structured and theoretically underpinned knowledge of modern information technologies and artificial intelligence to support the solution of various types of complex engineering tasks dealing with modelling, dynamics, vibration and control.	MiBM2_W03
	W03	Has advanced knowledge of automation and its applications in mechanics and mechanical engineering, e.g. has knowledge of the construction of robots with controllers and systems of sensors (sensors) and actuators (actuators).	MiBM2_W09
Skills	U01	Can apply knowledge to formulate and solve complex engineering tasks in optical coordinator research. Be able to evaluate, critically analyse and synthesise the results obtained and express opinions and comments.	MiBM2_U01
	U02	Be able to consciously select and use methods and tools, including advanced computer software, for research with advanced measuring apparatus.	MiBM2_U02
	U03	Can use analytical methods to solve complex engineering tasks in the field of construction and testing of selected mechatronic devices.	MiBM2_U11
Competence	K01	Is aware of the need to independently supplement and expand knowledge in the field of mechanics and machine construction Is ready to critically evaluate the knowledge they possess, the importance of knowledge in solving cognitive and practical problems and the need to acquire new information both from literature and from experts in the field of mechanics and machine construction. Understands the need and knows the possibilities of continuous improvement (third-cycle studies, postgraduate studies, courses) aimed at improving professional, personal and social competences.	MiBM2_K01

COURSE CONTENT

Mode of instruction	Topics covered

lecture	**Introduction.** A mechatronic system and the processes occurring in it. Basic types of mechatronic devices and their functional structure. Examples of mechatronic devices. **Construction, tasks, operating principle and analysis.** • Optical coordinator. • NI Lab-Store robot equipped with MyRIO controller and a system of sensors and actuators. • Remotely controlled flying object. • Fast digital camera used to record the process of shooting from an electric airsoft weapon. **Modeling, dynamics, vibration isolation and control.** • Gyroscope as an element of the coordinator. • Mobile land robot platforms. • Airsoft balls.

laboratory	**Optical coordinator research.**
	• Experimental research using selected modulators.
	• Theoretical analysis of the gyroscope movement with the control system.
	Research on the NI Lab-Store Robot and sensors placed on the platform
	• Experimental research on:
	  • Simultaneous and independent control of engines;
	  • Control of a manipulator with 2 degrees of freedom;
	  • Control of the camera's viewing direction using servomechanisms;
	  • Data collection and measurements using the following sensors:
	  • Ultrasonic distance meter, Infrared distance meter;
	  • Digital compass, Barometer, Accelerometer, Gyroscope.
	• Analysis of the dynamics and vibration isolation of a mobile land robot platform.
	Research using a fast digital camera
	• Experimental research on:
	  • Determination of the linear and angular velocity of a fired airsoft ball;
	  • Determination of the angular velocity of the propeller of a controlled flying object
	• Analysis of the flight of an airsoft ball.

ASSESSMENT METHODS

Outcome code	Methods of assessment					
	Oral examination	Written examination	Test	Project	Report	Other
W01			X			
W02			X			
W03			X			
U01					X	
U02					X	
U03					X	
K01						X

ASSESSMENT TYPE AND CRITERIA

Mode of instruction	Assessment type	Assessment criteria
lecture	non-examination assessment	Successful completion of the final colloquium. Obtaining at least 50% of points.
laboratory	non-examination assessment	Positive assessment of 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					
		L	C	Lb	P	S	L	C	Lb	P	S	
1.	Scheduled contact hours	**15**		**15**								h
2.	Other contact hours (office hours, examination)	**2**		**2**								h
3.	**Total number of contact hours**	**34**										h
4.	**Number of ECTS credits for contact hours**	**1,4**										ECTS
5.	**Number of independent study hours**	**16**										h
6.	**Number of ECTS credits for independent study hours**	**0,6**										ECTS
7.	**Number of practical hours**	**25**										h
8.	**Number of ECTS credits for practical hours**	**1,0**										ECTS
9.	**Total study time**	**50**										h
10.	**ECTS credits for the course** *1 ECTS credit = 25-30 hours of study time*	**2**										ECTS

READING LIST

1. Cegieła R., Zalewski A.: Matlab – numerical calculations and their application. WNakom, Poznań 1998
2. Chruściel M.: LabView in practice. BTC, Warsaw 2008
3. Engel Z., Kowal J.: Control of vibroacoustic processes. AGH Publishing House, Cracow 1995
4. Essick J.: Hands-On Introduction to LabView for Scientists and Engineers. Oxford University Press, 2009
5. Fortuna Z., Macukow B., Wąsowski J.: Numerical methods. Scientific and Technical Publishing House, Warsaw 1993
6. Inman D.J.: Vibration with Control. John Wiley & Sons, The Atrium, Southern Gate, Chichester, West Sussex PO19 8SQ, England 2006
7. Jarzębowska E.: Dynamics and Control of Mechanical Systems – Wheeled and Underwater Vehicles, Unmanned Aerial Objects, Satellites and Space Manipulators. PWN. Warsaw 2021
8. Kaczorek T., Dzieliński A., Dąbrowski W., Łopatka R.: Fundamentals of Control Theory. WNT, Warsaw 2006
9. Kaczorek T.: Control Theory. Volume 1 and 2. PWN. Warsaw 1981
10. Klempka R., Świątek B.: Programming, Numerical Algorithms and Modeling in MatLab. AGH, Cracow 2017
11. Kowal J.: Fundamentals of Automation. Volume 1 and 2. AGH, Cracow 2007
12. Kowal J.: Vibration Control. Gutenberg, Cracow 1996, ISBN 83-86310-06-5, p 180
13. Larsen R.W.: LabView for Engineers. Pearson Education, New Jersey, 2011
14. De Silva C.W.: Vibration Fundamentals and Practice. Taylor & Francis Group, Boca Raton, London, New York, 2007
15. Niederliński A.: Systems and Control. PWN, Warsaw 1983