



## Subject card

Subject name and code	, PG_00056130						
Field of study	Mechatronics						
Date of commencement of studies	October 2023	Academic year of realisation of subject			2025/2026		
Education level	first-cycle studies	Subject group					
Mode of study	Full-time studies	Mode of delivery			at the university		
Year of study	3	Language of instruction			Polish		
Semester of study	6	ECTS credits			2.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Department of Microwave and Antenna Engineering -> Faculty of Electronics, Telecommunications and Informatics						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Łukasz Kulas				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	0.0	0.0	30
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	Number of study hours	30		0.0		0.0	30
Subject objectives	The aim of this course is introduction to the most important topics in wireless data transfer, including radio signals propagation effects in different environments and information about the most popular wireless systems used in unmanned applications together with their functional blocks, parameters and configurations important for high-quality data transfer. Additionally, practical installation and maintenance aspects of wireless systems will be covered during the course.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K6_W11] has knowledge about the life cycle of mechatronic systems and objects				[SW1] Assessment of factual knowledge		
	[K6_W10] has knowledge about development trends in the field of engineering and technology sciences and scientific disciplines: Mechanical Engineering, Automation, Electronics, Electrical Engineering and Space Technologies, adequate for Mechatronics course				[SW1] Assessment of factual knowledge		
	[K6_U05] is able to use properly chosen tools to compare design solutions of elements and mechatronics systems according to given application and economic criteria (e.g. power demand, speed, costs)				[SU1] Assessment of task fulfilment		
	[K6_W08] knows and understands design and production processes of elements and simple mechatronic devices				[SW1] Assessment of factual knowledge		
[K6_U06] is able to identify and formulate specification of simple, practical engineering tasks, distinctive for mechatronics				[SU1] Assessment of task fulfilment			

Subject contents	<p>LECTURE:</p> <ol style="list-style-type: none"> <li>1. Introduction to wireless data transmission</li> <li>2. Introduction to high frequency radio signals propagation</li> <li>3. Radio signals propagation - propagation effects</li> <li>4. Radio signals propagation - different operational environments</li> <li>5. The most popular wireless systems used in unmanned applications - introduction and examples</li> <li>6. The most popular wireless systems used in unmanned applications - key parameters and application areas</li> <li>7. Wireless data transmission system functional blocks</li> <li>8. Antennas - basic electrical and radio parameters</li> <li>9. Antennas - basic concepts and configurations</li> <li>10. Wireless data transmission system - design principles</li> <li>11. Wireless data transmission system - installation and configuration</li> <li>12. Wireless data transmission system - verification and testing methods</li> <li>13. Cybersecurity in wireless data transmission systems</li> <li>14. New development trends - wireless systems of the future</li> <li>15. Case study - summary of course topics</li> </ol> <p>LABORATORY:</p> <ol style="list-style-type: none"> <li>1. Deployment and analysis of simple low frequency wireless data transmission system</li> <li>2. Deployment and analysis of simple high frequency wireless data transmission system</li> <li>3. Configuration and installation methods methods of advanced wireless data transmission system</li> <li>4. Deployment and analysis of advanced wireless data transmission system</li> <li>5. Case study - performance verification of an unmanned unit wireless system, reliability and resistance to cyberattacks assessment in close to operational conditions</li> </ol>											
Prerequisites and co-requisites	Basic electronics knowledge.											
Assessment methods and criteria	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;">Subject passing criteria</th> <th style="width: 25%;">Passing threshold</th> <th style="width: 25%;">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td></td> <td style="text-align: center;">50.0%</td> <td style="text-align: center;">50.0%</td> </tr> <tr> <td></td> <td style="text-align: center;">50.0%</td> <td style="text-align: center;">50.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade		50.0%	50.0%		50.0%	50.0%
Subject passing criteria	Passing threshold	Percentage of the final grade										
	50.0%	50.0%										
	50.0%	50.0%										
Recommended reading	Basic literature	<p>Simon R. Saunders, "Antennas and Propagation for Wireless Communication Systems", Wiley, 2007</p> <p>David Tse, "Fundamentals of Wireless Communication", Cambridge University Press 2005</p> <p>K. Daniel Wong, "Fundamentals of Wireless Communication Engineering Technologies", Wiley, 2012</p>										
	Supplementary literature	<p>Andrea Goldsmith, "Wireless Communications", Cambridge University Press 2005</p> <p>Charles J. Brooks, "Cybersecurity Essentials", Wiley, 2018</p> <p>Walid Saad, "Wireless Communications and Networking for Unmanned Aerial Vehicles", Cambridge University Press, 2020</p>										
	eResources addresses	Adresy na platformie eNauczanie:										
Example issues/ example questions/ tasks being completed												
Work placement	Not applicable											