



Subject card

Subject name and code	Electromagnetic Interference in Automation Systems, PG_00057619						
Field of study	Electrical Engineering						
Date of commencement of studies	October 2024	Academic year of realisation of subject			2024/2025		
Education level	second-cycle studies	Subject group					
Mode of study	Part-time studies	Mode of delivery			at the university		
Year of study	1	Language of instruction			Polish		
Semester of study	2	ECTS credits			2.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Department of Power Electronics and Electrical Machines -> Faculty of Electrical and Control Engineering						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Jarosław Łuszcz				
	Teachers		dr hab. inż. Jarosław Łuszcz				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	10.0	0.0	10.0	0.0	0.0	20
	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	20		5.0		25.0	50
Subject objectives	The aim of the course is to provide knowledge about causes of electromagnetic interference in automation systems and methods for its mitigation.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K7_W06] has in-depth knowledge of industrial electronics, microprocessor control systems, programmable logic systems and printed circuit design and prototyping computer-aided prototyping	applies systematized knowledge in the scope of the problems of diagnosing disturbances in automation systems			[SW1] Assessment of factual knowledge		
	[K7_U03] is able to obtain information from literature, databases and other sources, also in English, draw conclusions, formulate and fully justify opinions. substantiate opinions; is able to identify directions for further learning and implement the process of self-education	acquires knowledge from available sources in the field of electromagnetic interference			[SU4] Assessment of ability to use methods and tools		
	[K7_U02] is able to prepare and deliver a short oral presentation on a selected technical topic	prepares a presentation on a selected topic related to interference in automation systems			[SU5] Assessment of ability to present the results of task		
	[K7_W02] has an in-depth and structured knowledge of electrical measurements electrical measurements, the methods and equipment used for electrical measurements of non-electrical quantities, he/she knows the principles of testing operation tests of electrical equipment, has a structured knowledge of electricity quality issues	applies systematized knowledge in the field of electromagnetic disturbances			[SW1] Assessment of factual knowledge		

Subject contents	<p>LECTURE Sources and propagation of conducted and radiated electromagnetic disturbances. Electromagnetic emission and immunity of electrical devices. Typical causes of interference in control and automation systems. Selected methods of reducing electromagnetic interference in automation systems. Analysis of typical problems related to interference with electrical devices.</p> <p>LABORATORY Measurements of conducted and radiated electromagnetic interference levels. Testing the immunity of devices to electromagnetic interference. Presentation of the effectiveness of selected interference reduction methods. Presentation of examples of interference in analog and digital systems. Presentation of examples of mutual interference between electronic devices.</p>											
Prerequisites and co-requisites												
Assessment methods and criteria	<table border="1"> <thead> <tr> <th data-bbox="453 463 794 495">Subject passing criteria</th> <th data-bbox="799 463 1141 495">Passing threshold</th> <th data-bbox="1145 463 1492 495">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="453 501 794 533">Lab reports</td> <td data-bbox="799 501 1141 533">50.0%</td> <td data-bbox="1145 501 1492 533">50.0%</td> </tr> <tr> <td data-bbox="453 539 794 562">Colloquium from the lecture</td> <td data-bbox="799 539 1141 562">50.0%</td> <td data-bbox="1145 539 1492 562">50.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Lab reports	50.0%	50.0%	Colloquium from the lecture	50.0%	50.0%
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Lab reports	50.0%	50.0%										
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Recommended reading	<p>Basic literature</p>	<p>Charoy, Alain i in. Kompatybilność elektromagnetyczna: Zakłócenia w urządzeniach elektronicznych. Tom 1, 2, 3 i 4. Warszawa: Wydawnictwa Naukowo-Techniczne, 1999.</p> <p>Kempski, Adam Józef, Elektromagnetyczne zaburzenia przewodzone w układach napędów przekształtnikowych. Zielona Góra: Oficyna Wydawnicza Uniwersytetu Zielonogórskiego, 2005.</p> <p>L. Hasse, J. Kołodziejwski, Z. Karkowski, A. Konczakowska, L. Spiralski: Zakłócenia w aparaturze elektronicznej. Warszawa: "Radioelektronik ", 1995.</p> <p>Łuszcz, Jarosław. High Frequency Conducted Emission in AC Motor Drives Fed By Frequency Converters: Sources and Propagation Paths. John Wiley and Sons, Inc., Hoboken, N.J: 2018.</p>										
	<p>Supplementary literature</p>	<p>Smolenski, Robert. Conducted Electromagnetic Interference (EMI) in Smart Grids. 1st ed. 2012. London: Springer, 2012.</p> <p>Sroka, Jan, Compendium on Electromagnetic Compatibility. First edition. Warszawa, Oficyna Wydawnicza Politechniki Warszawskiej, 2021.</p> <p>Łuszcz, Jarosław, Motor Cable Influence on the Conducted EMI Emission of the Converter Fed AC Motor Drive. p. 77-95. (Book chapter 4) - Queensland University of Technology, Bentham Science Publisher, Australia 2011.</p> <p>Ott, Henry W. Electromagnetic Compatibility Engineering. Rev. ed. Hoboken, N.J: John Wiley & Sons, 2009.</p> <p>Zare Firuz Ed., Electromagnetic Interference Issues in Power Electronics and Power Systems. Editor. 1st ed. Sharjah, United Arab Emirates: Bentham Science Publishers, 2011.</p> <p>Sevgi, Levent. A Practical Guide to EMC Engineering / Levent Sevgi. Boston: Artech House, 2017.</p> <p>Keller, Reto B. Design for Electromagnetic Compatibility--In a Nutshell: Theory and Practice / by Reto B. Keller. 1st ed. 2023. Cham: Springer Nature, 2023.</p>										
Example issues/ example questions/ tasks being completed												
Work placement	Not applicable											

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