



## Subject card

Subject name and code	The EMC measurement methods, PG_00044108						
Field of study	Automation, Robotics and Control Systems						
Date of commencement of studies	February 2022	Academic year of realisation of subject			2022/2023		
Education level	second-cycle studies	Subject group					
Mode of study	Full-time studies	Mode of delivery			at the university		
Year of study	2	Language of instruction			English		
Semester of study	3	ECTS credits			2.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Department of Metrology and Information Systems -> Faculty of Electrical and Control Engineering						
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Beata Pałczyńska					
	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		5.0		15.0	50
Subject objectives	Introduce students with the methods and tools for EMC measurements						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	K7_W06	The student knows how to configure the measurement system to carry out EMC research in the field of emission and immunity tests.			[SW3] Assessment of knowledge contained in written work and projects		
	K7_U04	The student understands the issues presented in the EMC standards.			[SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject		
	K7_W11	The student knows the basics of software supporting the operation of measurement procedures regarding emission and immunity tests.			[SW3] Assessment of knowledge contained in written work and projects		
	K7_U03	The student can present selected issues related to the methodology of counteracting electromagnetic disturbances.			[SU2] Assessment of ability to analyse information [SU5] Assessment of ability to present the results of task		
	K7_U07	The student defines the basic types of EMC testing. Explains the measurement methods on basic at present obligatory norms and standards.			[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools		

Subject contents	<p>The overview of EMC standards. Types of EMC testing. The measurement environment: an OATS, an anechoic chamber, a TEM cell, a GTEM cell.</p> <p>The instrumentation for emission testing: EMI receivers, spectrum analyses, preselectors and filters, digital storage oscilloscopes.</p> <p>The instrumentation for immunity testing: signal sources, RF power amplifiers, signal modulators. Measurement devices for conducted EMI; measurements by direct connection; inductively coupled devices. Standard conducted emission measurement. Standard conducted immunity testing.</p> <p>Antennas for EMC measurement. Standard radiated emission measurement. Standard radiated immunity testing</p> <p>The EMC measurement uncertainty.</p> <p>The methodology of EMC measurements for small electrical and electronic equipment. The alternative EMC measurement method using the GTEM cell testing and measurement techniques.</p>											
Prerequisites and co-requisites	Basic knowledge on physics, mathematics, metrology and electronics. Knowledge on electrical metrology. Ability to use the standards and norms.											
Assessment methods and criteria	<table border="1" data-bbox="448 757 1497 869"> <thead> <tr> <th data-bbox="448 757 794 801">Subject passing criteria</th> <th data-bbox="794 757 1141 801">Passing threshold</th> <th data-bbox="1141 757 1497 801">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="448 801 794 835">Lecture - Final test</td> <td data-bbox="794 801 1141 835">60.0%</td> <td data-bbox="1141 801 1497 835">20.0%</td> </tr> <tr> <td data-bbox="448 835 794 869">Laboratory - completed exercises</td> <td data-bbox="794 835 1141 869">100.0%</td> <td data-bbox="1141 835 1497 869">80.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Lecture - Final test	60.0%	20.0%	Laboratory - completed exercises	100.0%	80.0%
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Recommended reading	Basic literature	<ol style="list-style-type: none"> <li>1. Clayton R. Paul, Introduction to Electromagnetic Compatibility, 2nd Edition, Wiley, 2009.</li> <li>2. Więckowski T. W., Badania kompatybilności elektromagnetycznej urządzeń elektrycznych i elektronicznych. Wydawnictwo Politechniki Wrocławskiej. Wrocław 2013</li> <li>3. Charoy A.: Kompatybilność elektromagnetyczna. Zakłócenia w urządzeniach elektronicznych. t.1-4. WNT, 1999.</li> </ol>										
	Supplementary literature	<ol style="list-style-type: none"> <li>1. Henry W. Ott, Electromagnetic Compatibility Engineering, Wiley, 2009.</li> <li>2. Hasse L., Kołodziejki J., Konczakowska A., Spiralski L., Zakłócenia w aparaturze elektronicznej, Radioelektronika Sp.z o.o., Warszawa,</li> </ol>										
	eResources addresses											
Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"> <li>1. The requirements of standard measuring of a conducted emission.</li> <li>2. The requirements of standard measuring of a radiated emission.</li> <li>3. The measurement requirements of conducted immunity testing.</li> <li>4. The measurement requirements of radiated immunity testing.</li> <li>5. The identification of uncertainty sources in EMC measurement.</li> </ol>											
Work placement	Not applicable											