



## Subject card

Subject name and code	Electromagnetic Interference in Printed Circuit Boards, PG_00057620						
Field of study	Electrical Engineering						
Date of commencement of studies	October 2022	Academic year of realisation of subject			2022/2023		
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	Acquiring the ability to solve basic problems of disturbances in printed circuits						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	K7_U03	Orderly Knowledge in the scope of EMC requirements at printed circuit design.			[SU3] Assessment of ability to use knowledge gained from the subject		
	K7_W01	Knowledge of the sources of knowledge specialized expanding scope of program content.			[SW1] Assessment of factual knowledge		
	K7_U02	Presentation skills engineering research results.			[SU5] Assessment of ability to present the results of task		
	K7_W02	Orderly Knowledge in the scope of EMC requirements at device design.			[SW3] Assessment of knowledge contained in written work and projects		

Subject contents	<p>PCB technology review</p> <p>EMI sources and propagation paths</p> <p>SI in analog, digital and mixed PCB circuit.</p> <p>PCB design rules:</p> <p>Components placements</p> <p>Layering</p> <p>Grounding</p> <p>Decoupling</p> <p>TL impedance matching</p> <p>Clock distribution</p> <p>EMI protection of IO interfaces</p> <p>RFI filtering</p> <p>Shielding</p> <p>Crosstalk</p> <p>Selected issues of PCB design</p> <p>PCB diagnostics and testing.</p>		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Midterm colloquium	50.0%	100.0%
Recommended reading	Basic literature	<p>Charoy A. Zakłócenia w urządzeniach elektronicznych. Warszawa: WNT, 2000.</p> <p>Ott H. W. Metody redukcji zakłóceń i szumów w układach elektronicznych. WNT 1979.</p> <p>Spiralski L., Kołodziejcki J., Konczakowska A., Hasse L. Zakłócenia w aparaturze elektronicznej. Radioelektronik Sp. z o.o. Warszawa 1995.</p> <p>Howard W. Johnson, Martin Graham: High-speed Signal Propagation: Advanced Black Magic. Prentice Hall Professional, 2003.</p>	
	Supplementary literature	Howard W. Johnson, Martin Graham: High-speed Signal Propagation: Advanced Black Magic. Prentice Hall Professional, 2003.	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	PCB project		

Work placement	Not applicable
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