



## Subject card

Subject name and code	Electromagnetic Interference in Printed Circuit Boards, PG_00036795						
Field of study	Automation, Robotics and Control Systems						
Date of commencement of studies	February 2023		Academic year of realisation of subject		2023/2024		
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		Polish		
Semester of study	3		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						
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		8.0		12.0	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_U07		Ability to select simulation tools for the analysis of electromagnetic disturbances in printed circuits.		[SU4] Assessment of ability to use methods and tools		
	K7_U03		The ability to present the results of engineering research.		[SU5] Assessment of ability to present the results of task		
	K7_W06		knowledge of EMC requirements when designing printed circuits.		[SW1] Assessment of factual knowledge		
	K7_U04		Knowledge of sources of specialist knowledge extending the scope of the course content.		[SU3] Assessment of ability to use knowledge gained from the subject		
	K7_W11		Ability to select simulation tools for the analysis of electromagnetic disturbances in printed circuits.		[SW1] Assessment of factual knowledge		

Subject contents	PCB technology review		
	EMI sources and propagation paths		
	SI in analog, digital and mixed PCB circuit.		
	PCB design rules:		
	Components placements		
	Layering		
	Grounding		
	Decoupling		
	TL impedance matching		
	Clock distribution		
	EMI protection of IO interfaces		
	RFI filtering		
	Shielding		
	Crosstalk		
	Selected issues of PCB design		
	PCB diagnostics and testing.		
Prerequisites and co-requisites	No specific preconditions		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Midterm colloquium	50.0%	100.0%
Recommended reading	Basic literature	Charoy A. Zakłócenia w urządzeniach elektronicznych. Warszawa: WNT, 2000.  Ott H. W. Metody redukcji zakłóceń i szumów w układach elektronicznych. WNT 1979.  Spiralski L., Kołodziejski J., Konczakowska A., Hasse L. Zakłócenia w aparaturze elektronicznej. Radioelektronik Sp. z o.o. Warszawa 1995.  Howard W. Johnson, Martin Graham: High-speed Signal Propagation: Advanced Black Magic. Prentice Hall Professional, 2003.	
	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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