



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	<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	No specific preconditions								
Assessment methods and criteria	<table border="1" data-bbox="448 1424 1490 1489"> <thead> <tr> <th data-bbox="448 1424 798 1456">Subject passing criteria</th> <th data-bbox="802 1424 1141 1456">Passing threshold</th> <th data-bbox="1145 1424 1490 1456">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="448 1462 798 1489">Midterm colloquium</td> <td data-bbox="802 1462 1141 1489">50.0%</td> <td data-bbox="1145 1462 1490 1489">100.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Midterm colloquium	50.0%	100.0%
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Midterm colloquium	50.0%	100.0%							
Recommended reading	<p>Basic literature</p> <p>Supplementary literature</p> <p>eResources addresses</p>	<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., Kołodziejki 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> <p>Howard W. Johnson, Martin Graham: High-speed Signal Propagation: Advanced Black Magic. Prentice Hall Professional, 2003.</p> <p>Adresy na platformie eNauczanie:</p>							
Example issues/ example questions/ tasks being completed	PCB project								

Work placement	Not applicable
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