



Subject card

Subject name and code	Electromagnetic Compatibility of Medical Equipment, PG_00068223						
Field of study	Biomedical Engineering, Biomedical Engineering, Biomedical Engineering						
Date of commencement of studies	October 2026	Academic year of realisation of subject			2028/2029		
Education level	first-cycle studies	Subject group			Optional subject group Subject group related to scientific research in the field of study		
Mode of study	Full-time studies	Mode of delivery			at the university		
Year of study	3	Language of instruction			Polish		
Semester of study	6	ECTS credits			2.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Department of Biomedical Engineering -> Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Adam Bujnowski					
	Teachers	dr inż. Adam Bujnowski					
Lesson types	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		3.0		17.0	50
Subject objectives	The aim of the course is to familiarize students with the basic issues related to electromagnetic compatibility. The sources of interference, coupling methods and typical types of interference will be discussed. The basic standards in the field of EMC and typical construction techniques that allow for the elimination of interference, coupling or their influence on the behavior of equipment will be indicated.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_K02] is ready to critically assess possessed knowledge and acknowledge the importance of knowledge in solving cognitive and practical problems	The student identifies the risk and analyzes the consequences of not meeting EMC standards.	[SK5] Assessment of ability to solve problems that arise in practice
	[K6_W10] knows and understands, to an advanced extent, the parameters, functions, and methods of analysis, design, and optimization of electronic circuits and systems, the definitions of error and measurement uncertainty, measurement methods, including time, frequency, and phase measurements, the properties of converters, and methods of digital signal processing, as well as the basic processes occurring in the life cycle of technical devices, objects, and systems, and methods of supporting processes and functions, specific to the field of study	The student knows the basic issues related to interference sources and coupling methods. The student knows the basic normative acts in the field of compatibility. The student knows the basic rules for designing equipment to ensure EM compatibility.	[SW3] Assessment of knowledge contained in written work and projects
	[K6_U08] while identifying and formulating specifications of engineering tasks related to the field of study and solving these tasks, can: n- apply analytical, simulation and experimental methods, n- notice their systemic and non-technical aspects, n- make a preliminary economic assessment of suggested solutions and engineering work n	The student analyzes and identifies compatibility problems. The student uses analytical tools to assess the risk of electromagnetic compatibility problems.	[SU3] Assessment of ability to use knowledge gained from the subject
Subject contents	<p>Course content – lecture</p> <p>Basic concepts - electromagnetic compatibility Legal conditions, standards and recommendations Propagation of electromagnetic waves Interference - types and methods of interference. Types of couplings in electronic equipment Testing of immunity to fast transient states Testing of immunity to electromagnetic discharges Testing of immunity to electrostatic discharges Testing of immunity to short pulses and electrical discharges Testing of immunity to network dips and sags Methods of testing emission in electronic equipment, anechoic chambers Apparatus used in testing electromagnetic compatibility Typical techniques for improving electromagnetic compatibility</p>		
Prerequisites and co-requisites	Circuit theory basics		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Test wiedzy	50.0%	50.0%
	Ocena realizacji zadania	50.0%	50.0%

Recommended reading	Basic literature	<p>Charoy, Kompatybilność elektromagnetyczna, Zakłócenia w urządzeniach elektronicznych T1 . Źródła, sprzężenia, skutki WNT 1999</p> <p>Charoy, Kompatybilność elektromagnetyczna, Zakłócenia w urządzeniach elektronicznych T2. uziemienia, masy, przewodowanie WNT 2000</p> <p>Charoy, Kompatybilność elektromagnetyczna, Zakłócenia w urządzeniach elektronicznych T3. Ekran, filtry, kable i przewody ekranowane, WNT 2000</p> <p>Charoy, Kompatybilność elektromagnetyczna, Zakłócenia w urządzeniach elektronicznych T4 Zasilanie,ochrona odgromowa, środki zaradcze. WNT 2000</p> <p>Hasse i inni Zakłócenia w aparaturze elektronicznej, Radioelektronik, 1995</p> <p>Seria norm PN-IEC 61000 dotyczących kompatybilności elektromagnetycznej (aktualny stan normalizacyjny dostępny na stronie internetowej: www.pkn.pl).</p> <p>Dyrektywy UE dotyczące Kompatybilności Elektromagnetycznej (89/336/EEC) dostępne na stronie internetowej: www.oznaczenie-ce.pl.</p>
	Supplementary literature	<p>Więckowski Tadeusz Wiesław: Badania kompatybilności elektromagnetycznej urządzeń elektrycznych i elektronicznych; Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2001.</p> <p>Więckowski Tadeusz Wiesław: Pomiar emisyjności urządzeń elektrycznych i elektronicznych; Wrocław: Politechnika Wroclawska, 1997</p>
	eResources addresses	
Example issues/ example questions/ tasks being completed	<p>Indicate techniques for improving EMC in PCB design</p> <p>Indicate techniques for preventing interference transfer</p> <p>Discuss selected sources of interference</p> <p>Design a circuit that eliminates overvoltages in the signal line</p> <p>Discuss the importance of galvanic separation and provide typical solutions</p> <p>Discuss basic shielding techniques</p>	
Practical activities within the subject	Not applicable	

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