

STUDY MODULE DESCRIPTION FORM		
Name of the module/subject Introduction to electromagnetic compatibility		Code 1010321361010326005
Field of study Electrical Engineering	Profile of study (general academic, practical) general academic	Year /Semester 3 / 6
Elective path/specialty Electrical and Computer Systems in	Subject offered in: Polish	Course (compulsory, elective) obligatory
Cycle of study: First-cycle studies	Form of study (full-time, part-time) full-time	
No. of hours Lecture: - Classes: - Laboratory: - Project/seminars: 15		No. of credits 1
Status of the course in the study program (Basic, major, other) other		(university-wide, from another field) university-wide
Education areas and fields of science and art technical sciences Technical sciences		ECTS distribution (number and %) 1 100% 1 100%
Responsible for subject / lecturer: mgr inż. Dorota Typańska email: Dorota.Typanska@put.poznan.pl tel. 61 665 28 40 Faculty of Electrical Engineering ul. Piotrowo 3A 60-965 Poznań		
Prerequisites in terms of knowledge, skills and social competencies:		
1	Knowledge	Basic knowledge of physics, electrical engineering, electronics and circuit theory.
2	Skills	The ability to use computational methods in the field of electrical engineering, electronics and the electromagnetic field theory. The ability of electrical measurements, analyze the results and draw conclusions.
3	Social competencies	Caring for the continuous improvement of their own competence. Legible and clear presentation of prepared questions.
Assumptions and objectives of the course: Knowing some theoretical and practical problems related to electromagnetic compatibility of electrical equipment, systems and vehicles. The presentation in the form of a presentation prepared project-issues.		
Study outcomes and reference to the educational results for a field of study		
Knowledge: 1. Have a basic understanding of some phenomena and processes that occur during the conversion of energy from renewable sources in electricity and the devices implementing these changes in relation to the requirements of electromagnetic compatibility. - [K_W09+++] 2. Has a basic knowledge necessary to understand the social, economic, legal and other non-technical considerations engineering activities, familiar with the basic principles of ergonomics, safety and hazards that may exist in the electrical industry for electromagnetic compatibility requirements. - [K_W19+]		
Skills: 1. Able to plan and carry out the simulation and measurement of basic electrical characteristic; able to present the results in numerical and graphical form, to make their interpretations and draw conclusions. - [K_U02+] 2. Able to design simple electrical system designed for a variety of applications, using appropriate methods, techniques and tools, including EMC requirements. - [K_U03+] 3. Can use the known methods and mathematical models and computer simulations to analyze and evaluate the performance of electrical components and systems for electromagnetic compatibility requirements. - [K_U10+]		
Social competencies: 1. Understands the need and knows opportunities for learning throughout life (second-and third-degree and post-graduate) and raising professional competence, personal and social. - [K_K01+++]		

Assessment methods of study outcomes	
<p>Project:</p> <ul style="list-style-type: none"> - evaluation of project-prepared presentation topics from the contents, clarity and how it is presented, - rewarding gain skills they met the principles and methods - assess the knowledge and skills related to the implementation of the project-prepared questions, - rewarding activity, and participate in discussions related to the presented project-issue. 	
Course description	
<p>Knowing of theoretical and practical problems related to the electromagnetic compatibility. The impact of electromagnetic fields on biological objects. Electromagnetism in protecting jobs and the environment. Measurements of electromagnetic fields. Electromagnetic compatibility in the automotive industry. Current status of normative - legal in the electromagnetic compatibility of equipment and technical facilities. Methods for obtaining the CE certificate. Technical aspects of compatibility testing.</p> <p>2017 Update: Modeling work of selected electrical systems subjected to the influence of electromagnetic fields. Assessment of risks resulting from static electricity.</p> <p>Applied methods of education:</p> <p>Project: analysis / discussion of various methods (including non conventional) problem solving, analysis / discussion of various aspects of solving problems, including: economic, ecological, legal, social etc., detailed review of the project documentation by the project leader and commentary discussions, multimedia demonstration, case study, teamwork.</p>	
Basic bibliography:	
<ol style="list-style-type: none"> 1. Machczyński W.: Wprowadzenie do kompatybilności elektromagnetycznej, Wydawnictwo Politechniki Poznańskiej, Poznań 2010. 2. Charoy A.: Zakłócenia w urządzeniach elektronicznych. Zasady i porady instalacyjne. Kompatybilność elektromagnetyczna. Część 1-4, WNT, Warszawa 1999-2000. 3. Dyrektywa Parlamentu Europejskiego i Rady 2014/30/UE z dnia 26 lutego 2014 r. w sprawie harmonizacji ustawodawstw państw członkowskich odnoszących się do kompatybilności elektromagnetycznej 4. PN-EN 61000-4-2:2011 - wersja polska- Kompatybilność elektromagnetyczna (EMC) -- Część 4-2: Metody badań i pomiarów -- Badanie odporności na wyładowania elektrostatyczne 5. PN-EN 61000-4-4:2013-05 - wersja angielska - Kompatybilność elektromagnetyczna (EMC) -- Część 4-4: Metody badań i pomiarów -- Badanie odporności na serie szybkich elektrycznych stanów przejściowych 6. PN-EN 61000-4-6:2014-04 - wersja angielska - Kompatybilność elektromagnetyczna (EMC) -- Część 4-6: Metody badań i pomiarów -- Odporność na zaburzenia przewodzone, indukowane przez pola o częstotliwości radiowej 7. PN-EN 61000-4-5:2014-10 - wersja angielska - Kompatybilność elektromagnetyczna (EMC) -- Część 4-5: Metody badań i pomiarów -- Badanie odporności na udary 8. Machczyński W., Typańska D., Electromagnetic compatibility of smart installations, Poznan University of Technology Academic Journals, Tom 81, ISSN 1897-0737, 2015, str.95-100; 9. Szymenderski J., Typańska D., Immunity of fixed installation to electrostatic discharge, Poznan University of Technology Academic Journals, Tom 85, ISSN 1897-0737, 2016, str.106-116; 	
Additional bibliography:	
<ol style="list-style-type: none"> 1. Krawczyk A.: Praca zbiorowa: Elektromagnetyczne oddziaływania na obiekty biologiczne, Instytut Naukowo-Badawczy ZTUREK, Warszawa 2001. 2. Krawczyk A.: Praca zbiorowa: Bioelektromagnetyzm, Instytut Naukowo-Badawczy ZTUREK, Warszawa 2002. 3. Więckowski T. W.: Badanie odporności urządzeń elektronicznych na impulsowe narażenia elektromagnetyczne, Wydawnictwo Politechniki Wrocławskiej, Wrocław 1993. 4. Więckowski T. W.: Pomiary emisyjności urządzeń elektrycznych i elektronicznych, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 1997. 5. Alfa-Weka: Praktyczny poradnik. Certyfikat CE w zakresie kompatybilności elektromagnetycznej, Alfa-Weka, Warszawa 1998. 6. Garbarczyk Z., Kozłowski C., Nowicki M., Pachocki K.: Zagrożenia elektromagnetyczne. Bezpieczeństwo i ochrona człowieka w środowisku pracy. Część 11, Centralny Instytut Ochrony Pracy, Warszawa 1998. 7. Aniołczyk H.: Praca zbiorowa: Pola elektromagnetyczne. Źródła, oddziaływanie, ochrona, Instytut Medycyny Pracy im prof. J Nofera, Łódź 2000. 	
Result of average student's workload	
Activity	Time (working hours)

1. participation in project activities	15	
2. part in the consultation	5	
3. implementation of project tasks	10	
Student's workload		
Source of workload	hours	ECTS
Total workload	30	1
Contact hours	20	1
Practical activities	25	1