

FACULTY OF ELECTRICAL
ENGINEERING**SUBJECT CARD**

Name in Polish: **Kompatybilność elektromagnetyczna**
 Name in English: **Electromagnetic Compatibility**
 Main field of study (if applicable): **Industrial Control Engineering**
 Specialization (if applicable): **Automation and Control in Electrical Power Systems**
 Level and form of studies: **2nd level, full-time**
 Kind of subject: **optional**
 Subject code: **APR011101**
 Group of courses: **NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	30		15		
Number of hours of total student workload (CNPS):	60		30		
Form of crediting:	examination		crediting with grade		
For group of courses mark (X) final course:					
Number of ECTS points:	2		1		
including number of ECTS points for practical (P) classes :			1		
including number of ECTS points for direct teacher-student contact (BK) classes:	1.40		0.70		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic knowledge of electrical engineering

SUBJECT OBJECTIVES

- C1. Gaining the knowledge base about electromagnetic interference
 C2. The acquisition of ability to measure the properties suppression and surge protection devices

SUBJECT LEARNING OUTCOMES*relating to knowledge:*

- PEU_W01 The student has knowledge about sources of interference in low-voltage installations
 PEU_W02 The student knows protection methods against interference in installations and low-voltage devices

relating to skills:

- PEU_U01 The student can designate the characteristics of dynamic and static overvoltage protection elements
 PEU_U02 The student can perform the measurements of noise levels in different drive systems

relating to social competences:

- PEU_K01 The student can think and act in a creative and enterprising manner

PROGRAMME CONTENT

Form of classes - lecture		Number of hours:
Lec 1	Introduction, basic problems and EMC requirements. External sources of the electromagnetic interference.	2
Lec 2	Lightning strikes	2
Lec 3	Elements and surge protection systems.	2
Lec 4	Lightning and overvoltage protection of the installations and devices in buildings.	2
Lec 5	Electrostatic discharge: the phenomenon, parameters, threats, remedies.	2
Lec 6	The issue of shielding the electromagnetic field.	2
Lec 7	Shielding efficiency, measuring methods and systems.	2
Lec 8	Polymer end textile shielding materials.	2
Lec 9	Nanocomposites shielding materials.	2
Lec 10	Magnetic field shielding. Absorbing materials.	2
Lec 11	Graphene and CNT based shielding materials. Aerospace shielding materials.	2
Lec 12	Power converters as a sources of the electromagnetic interference.	2
Lec 13	Filtering and compensation systems in converters drive systems.	2
Lec 14	The influence of the transformers and the connection groups on the propagation of harmonics generated by the inverter.	2
Lec 15	Issues of the harmonic filter selection in the systems powered by converter transformers	2
Total hours:		30

Form of classes - laboratory		Number of hours:
Lab 1	Preface, knowing with the rules of laboratory work, health and safety training	2
Lab 2	The study of static characteristics of surge protection elements.	2
Lab 3	The study of dynamic characteristics of surge protection elements.	2
Lab 4	Research of the surge arresters for medium voltage lines.	2
Lab 5	The survey conducted noise level in the propulsion system of controlled rectifiers of different types.	2
Lab 6	The survey conducted noise level in the propulsion system of frequency converters.	2
Lab 7	Studying the effects of passive filters and active on the level of generated conducted interference in adjustable frequency drives.	2
Lab 8	Credit lab	1
Total hours:		15

TEACHING TOOLS USED

- N1. Traditional lecture using multimedia presentation
- N2. Student's own work
- N3. Measurement Laboratory conducted in the traditional manner in student groups exercises
- N4. Reports of the laboratory exercises

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation <i>F – forming (during semester) P – concluding (at semester end)</i>	Educational effect number	Way of evaluating educational effect achievement
F1(W)	PEU_W01 PEU_W02 PEU_K01	Exam
P(W)	P=F1	
F1(L)	PEU_U01 PEU_U02 PEU_K01	Checking and evaluation of the preparation to laboratory exercises
F2(L)	PEU_U01 PEU_U02 PEU_K01	Evaluation of the reports from performed researches
P(L)	P = 0,5 F1 + 0,5 F2	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

- | |
|--|
| <p>[1] Charoy A., Zakłócenia w urządzeniach elektronicznych, t. 1-4, WNT, Warszawa 1999.</p> <p>[2] Sowa A., Kompleksowa ochrona odgromowa i przepięciowa, Biblioteka COSiW SEP, Warszawa, 2005.</p> <p>[3] Frąckowiak L., Energoelektronika, Cz. 2, Wyd. Politechniki Poznańskiej, Poznań, 2000</p> |
|--|

SECONDARY LITERATURE:

- | |
|--|
| <p>[1] Więckowski T., Badania kompatybilności elektromagnetycznej urządzeń elektrycznych i elektronicznych, Oficyna Wydawnicza PWr, Wrocław, 2001.</p> <p>[2] Praca zbiorowa pod red. D.J. Bena, Impulsowe narażenia elektromagnetyczne, Wyd. Politechniki Wrocławskiej, Wrocław, 1994.</p> <p>[3] Haase P., Overvoltage protection of low voltage systems, IEE, London, 2000.</p> <p>[4] Prasad Kodali V., Engineering Electromagnetic Compatibility, IEEE Press, New York, 1996.</p> |
|--|

SUBJECT SUPERVISOR

Maciej Jaroszewski, maciej.jaroszewski@pwr.edu.pl
