FACULTY OF ELECTRICAL ENGINEERING

SUBJECT CARD

Name in Polish:	**Materiały elektromagnetyczne**
Name in English:	**Electromagnetic materials**
Main field of study (if applicable):	**Electrical Engineering**
Specialization (if applicable):	**Industrial Electrical Engineering**
Level and form of studies:	**2nd level, full-time**
Kind of subject:	**obligatory**
Subject code:	**ELR051210**
Group of courses:	**NO**

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

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Student has knowledge on fundamentals of materials engineering
2. Student has a general knowledge of electromagnetic materials

SUBJECT OBJECTIVES

C1. The acquisition of skills in advanced research methods of electrical properties (conductivity, temperature and non-linear properties, polarization), electrical properties of piezoelectric materials

C2. The acquisition of qualitative understanding, interpretation and quantitative analysis - based on the laws of physics related to properties of selected materials, semiconductive and non-linear dielectric materials, piezo-active materials

C3. Consolidation of traditional academic values

SUBJECT LEARNING OUTCOMES

relating to knowledge:

relating to skills:

PEU_U01 Student is able to perform measurements of dielectric loss factor and permittivity, piezoelectric coefficient, current-voltage characteristics, temperature coefficient resistance of solid dielectric materials.

PEU_U02 Student is able to evaluate the possibility of using dielectric materials in electrical engineering

relating to social competences:

PEU_K01 Student understands the need for self-education, including improving the skills ofconcentration and focus on important things, and develop the ability to independently apply their knowledge and skills

PROGRAMME CONTENT

	Form of classes - laboratory	Number of hours:
Lab 1	Thin-layer varistors	3
Lab 2	Posistors – smart heaters	3
Lab 3	Linear dielectric composite	3
Lab 4	Piezo-active materials and polymer composites	3
Lab 5	Correction and supplementing class. Laboratory assessment	3
	Total hours:	**15**

TEACHING TOOLS USED
N1. Measurements using laboratory equipment N2. Report N3. Consultation N4. Student's own work

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT		
Evaluation *F – forming (during semester)* *P – concluding (at semester end)*	**Educational effect number**	**Way of evaluating educational effect achievement**
F1(L)	PEU_U01 PEU_U02	Short tests, oral response
F2(L)	PEU_U01 PEU_U02 PEU_K01	Short tests, oral response
P(L)	P=0,5F1+0,5F2	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Instrukcje do ćwiczeń.
[2] Treść wykładu „Materiały Elektromagnetyczne”.

SECONDARY LITERATURE:

[1] Lisowski M. ,Badanie właściwości elektrycznych dielektryków, Wydawnictwo PWr, Wrocław 2010.
[2] Bogusz W., Krok F., Elektolity stałe, WNT, Warszawa 1995.
[3] Hilczer B., Małecki J., Elektrety i piezopolimery, PWN, Warszawa 1992.

SUBJECT SUPERVISOR

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