

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, part-time**  
 Kind of subject: **obligatory**  
 Subject code: **ELR041270**  
 Group of courses: **NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):			11		
Number of hours of total student workload (CNPS):			81		
Form of crediting:			crediting with grade		
For group of courses mark (X) final course:					
Number of ECTS points:			3		
including number of ECTS points for practical (P) classes :			3		
including number of ECTS points for direct teacher-student contact (BK) classes:			2.10		

**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 EDUCATIONAL EFFECTS***relating to knowledge:**relating to skills:*

- PEK\_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  
 PEK\_U02 Student is able to evaluate the possibility of using dielectric materials in electrical engineering

*relating to social competences:*

- PEK\_K01 Student understands the need for self-education, including improving the skills of concentration 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	Piezo-active materials and polymer composites	3
Lab 6	Correction and supplementing class. Laboratory assessment.	2
Total hours:		<b>11</b>

### TEACHING TOOLS USED

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

### EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation <i>F – forming (during semester) P – concluding (at semester end)</i>	Educational effect number	Way of evaluating educational effect achievement
F1(L)	PEK_U01 PEK_U02	Written/oral test
F2(L)	PEK_U01 PEK_U02 PEK_K01	Crediting of reports from research
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., Elektrolity stałe, WNT, Warszawa 1995.
- [3] Hilczer B., Małecki J., Elektrety i piezopolimery, PWN, Warszawa 1992

### SUBJECT SUPERVISOR

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### MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT **ELR041270 - Electromagnetic materials** AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Electrical Engineering** AND SPECIALIZATION **Industrial Electrical Engineering**

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_U01	S2ETP_U06	C.1 C.2	Lab1 Lab2 Lab3 Lab4 Lab5 Lab6	N.1 N.2 N.3 N.4
PEK_U02	S2ETP_U06	C.1 C.2	Lab1 Lab2 Lab3 Lab4 Lab5 Lab6	N.1 N.2 N.3 N.4
PEK_K01	K2ETK_K01 K2ETK_K03	C.3	Lab1 Lab2 Lab3 Lab4 Lab5 Lab6	N.1 N.2 N.4