

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: **ELR041209**
 Group of courses: **NO**

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

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. He has knowledge of electrical materials science
2. Student has a general knowledge of physics

SUBJECT OBJECTIVES

- C1. Understanding the physical nature of the phenomena describing the properties of solid materials which are important from the point of view of their applications in electrical engineering
 C2. Understanding the properties of selected groups of materials (conductive materials, including ionic, semiconductor materials, dielectric materials including non-linear materials, magnetic materials including non-linear materials) and their possible applications
 C3. Knowledge of developments in the field of materials engineering
 C4. Consolidation of traditional academic values

SUBJECT EDUCATIONAL EFFECTS*relating to knowledge:*

- PEK_W01 Student knows the physical nature of the phenomena determining the electromagnetic properties of materials
 PEK_W02 Student has an advanced knowledge in material science enabling proper selection of materials for the particular construction

*relating to skills:**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 - lecture		Number of hours:
Lec 1	Introduction (Lecture program, credits conditions, literature) , role of materials in technological development	2
Lec 2	Electrical conductivity, band model	2
Lec 3	Pure Metals	2
Lec 4	Alloys	2
Lec 5	Crystalline semiconductors	2
Lec 6	Non-crystalline and amorphous semiconductors	2
Lec 7	Conductive and semi-conductive polymeric materials	2
Lec 8	Materials with ionic conduction and solid electrolytes	2
Lec 9	Dielectric-dielectric composites	2
Lec 10	Dielectric-conductor composites	2
Lec 11	Dielectrics with relaxation polarization	2
Lec 12	Non-linear dielectrics	2
Lec 13	Magnetic materials	2
Lec 14	Special materials	2
Lec 15	Test	2
Total hours:		30

TEACHING TOOLS USED
N1. Traditional lecture using multimedia presentation N2. Short written tests 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(w)	PEK_W01 PEK_W02 PEK_K01	Short written tests
F2(w)	PEK_W01 PEK_W02 PEK_K01	Final test
P(w)	$P=0,4F1+0,6F2$	

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE: [1] Bogusz W., Krok F., Elektolity stałe, WNT, Warszawa 1995. [2] Chełkowski A., Fizyka dielektryków, PWN, Warszawa, 1993. [3] Szalimowa K.W., Fizyka półprzewodników, PWN, Warszawa, 1974. [4] Jacak L., Radosz A., Materia i materiały, Wyd. P. Wr., Wrocław 1996.
SECONDARY LITERATURE: [1] Hilczer B., Małecki J., Elektrety i piezopolimery, PWN, Warszawa 1992. [2] Kittel C., Wstęp do fizyki ciała stałego, PWN, Warszawa, 1976. [3] Hippel A., Fizyka dielektryków, PWN, Warszawa, 1963. [4] Kittel C., Introduction to Solid State Physics.J. Wiley & Sons Inc., N.Y. 1966. [5] Setter N., Piezoelectric Materials in Devices. EPFL, Lusanne, 2002 [6] Ferry D. K., Bird J. P., Electronic Materials and Devices, Academic Press, San Diego, 2001. [7] Zuo-Guang Ye, Handbook of advanced dielectric, piezoelectric and ferroelectric materials, Woodhead Publ. Ltd., Cambridge, England, 2008. [8] Sessler G. M., Electrets, Laplacian Press,m Morgan Hill, California, 1998. [9] Neelakanta P. S., Handbook of Electromagnetic Materials, CRC Press Inc. Boca Raton

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
ELR041209 - 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_W01	S2ETP_W03	C.1 C.2 C.3	Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11 Lec12 Lec13 Lec14	N.1 N.2 N.3 N.4
PEK_W02	S2ETP_W03	C.1 C.2 C.3	Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11 Lec12 Lec13 Lec14	N.1 N.2 N.3 N.4
PEK_K01	K2ETK_K01	C.4	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11 Lec12 Lec13 Lec14 Lec15	N.1 N.2 N.3 N.4