

FACULTY OF ELECTRICAL
ENGINEERING**SUBJECT CARD**

Name in Polish: **Podstawy inżynierii materiałowej**
 Name in English: **Fundamentals of Materials Engineering**
 Main field of study (if applicable): **Industrial Control Engineering**
 Specialization (if applicable):
 Level and form of studies: **1st level, full-time**
 Kind of subject: **obligatory**
 Subject code: **APR011201**
 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:	crediting with grade		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. Student has adequate knowledge from the range of physics and chemistry, relating to the structure and properties of matter from the range of the elementary and grammar school.
2. Student properly and effectively applies laws and rules of physics to the qualitative and quantitative analysis of physical phenomenon with engineering character.

SUBJECT OBJECTIVES

- C1. Understanding the phenomenon in physics and chemistry related with electrical, thermal and mechanical stresses
 C2. Recognition of properties, structure and production technology of materials used in electrotechnical constructions
 C3. Obtaining the knowledge about parameters characterizing the conducting, semi-conducting, dielectric and magnetic materials
 C4. Explication necessary knowledge to understand proprieties of electrotechnical materials
 C5. The practice of the skills of applying basic measuring techniques to the investigations of electrotechnical materials properties
 C6. Pointing the awareness of the responsibility for the own work

SUBJECT LEARNING OUTCOMES*relating to knowledge:*

- PEU_W01 Student has the knowledge electrotechnical materials, their structure, basic properties and uses in electrical engineering
 PEU_W02 Student has a general understanding of advanced (smart) materials, nanotechnology and development of materials science

relating to skills:

- PEU_U01 Student is able to apply the laws and rules of physics to analysis of the physical phenomenon and to plan and execute the measurements in safe way, and then to elaborate the results of the measurements
 PEU_U02 Student is able to measure properties of electrotechnical materials

relating to social competences:

- PEU_K01 Student has awareness of the responsibility for the own and team work and is ready to submit to work principles to obtain common aim

PROGRAMME CONTENT		
Form of classes - lecture		Number of hours:
Lec 1	Introduction, presentation of the program, requirements and form of crediting of the subject. Historical outline, division and general characteristics of the materials	2
Lec 2	Crystal and amorphous materials. The defects of crystal structures and their influence on the materials properties	2
Lec 3	Liquid crystals, properties and applications, directions of the development	2
Lec 4	Electrical conductivity of metals. Line materials. New superconducting materials	2
Lec 5	Contact materials. Resistive materials. Thermistors and varistors	2
Lec 6	Applications of thermoelectric phenomena: temperature measurements, cooling	2
Lec 7	Semiconducting materials and their applications	2
Lec 8	Test (lecture 1-7). The structure of dielectrics. Electrical conductivity, polarization, dielectric loss, electric strength.	2
Lec 9	Sensors - properties, applications	2
Lec 10	Structure of the polymers. Thermoplastic and thermosetting isolating materials. Properties modifying	2
Lec 11	Piezoelectric and pyroelectric polymer materials. Properties and applications	2
Lec 12	Conductive polymers, electromagnetic shields, smart windows, flexible displays, artificial muscles, batteries	2
Lec 13	Electro- and magnetorheological materials. Properties, applications	2
Lec 14	Materials in optoelectronics	2
Lec 15	The basis of magnetism. Characteristic properties of magnetic materials. Test lecture (8-14)	2
Total hours:		30

Form of classes - laboratory		Number of hours:
Lab 1	The topics of the three-hour laboratories: 1. Investigation of dielectrics resistivity. 2. Investigation of electric permittivity. 3. Investigation of dielectric loss factor. 4. Investigation of magnetic properties of electrical steels samples. 5. Investigation of thermoelectric phenomena. 6. Investigation of Hall effect. Each student must attend four from the three-hour exercises to choose from the above mentioned.	12
Lab 2	Correction and supplementing class. Laboratory assessment	3
Total hours:		15

TEACHING TOOLS USED
<p>N1. Traditional lecture using multimedia presentation</p> <p>N2. Student's own work</p> <p>N3. Consultation</p> <p>N4. Checking the student's knowledge in the form of short tests and questions</p> <p>N5. Measuring using laboratory equipment</p> <p>N6. Analysis of test results</p> <p>N7. Development of measurement results in a report</p>

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT		
Evaluation <i>F - forming (during semester)</i> <i>P - concluding (at semester end)</i>	Educational effect number	Way of evaluating educational effect achievement
F1(W)	PEU_W01 PEU_W02 PEU_K01	Written test (lecture 1-7)
F2(W)	PEU_W01 PEU_W02 PEU_K01	Written test (lecture 8-14)
P(W)	P=0,5F1+0,5F2	
F1(L)	PEU_U01 PEU_U02 PEU_K01	Checking and evaluation laboratory preparation
F2(L)	PEU_U01 PEU_U02 PEU_K01	Crediting of reports from research
P(L)	P=0,5F1+0,5F2	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

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| <p>[1] Podstawy inżynierii materiałowej. Laboratorium. Oficyna Wyd. Politechniki Wrocławskiej 2005.
[2] Celiński Z., Materiałoznawstwo elektrotechniczne, Oficyna Wyd. Politechniki Warszawskiej, Warszawa, 2005.
[3] Blicharski M., Wstęp do inżynierii materiałowej, Wyd. AGH, Kraków, 2003.</p> |
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SECONDARY LITERATURE:

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| <p>[1] Kolbiński K., Słowikowski J., Materiałoznawstwo elektrotechniczne, WNT, 1988.</p> |
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SUBJECT SUPERVISOR

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