

FACULTY OF ELECTRICAL
ENGINEERING**SUBJECT CARD**

Name in Polish: **Diagnostyka materiałów i układów izolacyjnych**
 Name in English: **Diagnostics of materials and insulation systems**
 Main field of study (if applicable): **Electrical Engineering**
 Specialization (if applicable):
 Level and form of studies: **1st level, full-time**
 Kind of subject: **optional**
 Subject code: **ELR051321**
 Group of courses: **NO**

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

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. He can correctly and efficiently apply knowledge of mathematics for qualitative and quantitative analysis of mathematical problems related to the field of corresponding engineering studies. He can correctly and efficiently apply the previously acquired principles and laws of physics to the qualitative and quantitative analysis of physical problems as engineering.
2. Knowledge of advanced mathematics on a level permitting to understand mathematical problems in engineering sciences. Knowledge of the principles and laws of physics and selected topics in solid state physics.

SUBJECT OBJECTIVES

- C1. Acquisition of theory- grounded knowledge about the properties of dielectric materials and insulation systems used in electrical engineering
 C2. Understanding the importance of dielectric materials and insulation systems in science and technology
 C3. Acquisition of skills related to research organization and dielectric materials diagnostics with carefully selected methods
 C4. Acquisition of competence of accountability, integrity and fairness at work in a group

SUBJECT LEARNING OUTCOMES*relating to knowledge:*

PEU_W01 Student has knowledge about the properties of dielectric materials and insulation systems. He/she understands the importance of dielectric materials and insulation systems in science and technology.

PEU_W02 Student is able to appropriately select dielectric materials for specific applications

relating to skills:

PEU_U01 Student can independently determine the parameters of selected dielectric materials and insulation systems

PEU_U02 Student can use acquired and well chosen methods for the diagnostics of dielectric 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, subject program, credit conditions.	2
Lec 2	Structure and properties of dielectrics	2
Lec 3	Electric polarization	2
Lec 4	Diagnostic methods for dielectrics	2
Lec 5	Diagnostic methods for insulation systems	2
Lec 6	Dielectric-dielectric composites	2
Lec 7	Dielectrics with special properties	2
Lec 8	Final test	1
Total hours:		15

Form of classes - laboratory		Number of hours:
Lab 1	Introduction: requirements and method of crediting. Presentation of the BHP rules of the lab. The division into groups.	3
Lab 2	Measurement of electrical capacity and dielectric loss coefficient with Q-meter	3
Lab 3	Electrical permittivity and dielectric loss analysis using the resonance curve width method	3
Lab 4	Electrical permittivity analysis of low-loss dielectrics in the X band (10 GHz)	3
Lab 5	Dielectrics testing by TSD	3
Lab 6	Ferroelectrics examination	3
Lab 7	Measurement of electric charge decay characteristics	3
Lab 8	Piezoeactive polymer materials	3
Lab 9	Digital bridge measurement of dielectric impedance	3
Lab 10	Correction and supplementing class. Crediting	3
Total hours:		30

TEACHING TOOLS USED
N1. Traditional lecture with the use of multimedia presentation
N2. Self study - self studies and preparation for final test
N3. Self study - preparation for laboratory class
N4. Making measurements using laboratory equipment
N5. Preparation of a laboratory report
N6. Tutorials

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	Final test
P(W)	P=F1	
F1(L)	PEU_U01 PEU_U02 PEU_K01	short test
F2(L)	PEU_U01 PEU_U02 PEU_K01	Preparation of a laboratory report
P(L)	P=0,5F1+0,5F2	

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE:
[1] Celiński Z., Materiałoznawstwo elektrotechniczne, Oficyna Wyd. Politechniki Warszawskiej, Warszawa, 2005
[2] Lisowski M., Badanie właściwości elektrycznych dielektryków, Wydawnictwo PWR, Wrocław 2010.
[3] Chełkowski A., Fizyka dielektryków, PWN, Warszawa, 1993.
SECONDARY LITERATURE:
[1] Chwaleba A., Poniński M., Siedlecki A., Metrologia Elektryczna WNT, Warszawa 2010
[2] Halliday D., Resnick R., Fizyka 2, PWN, Warszawa 1996
[3] Kolbiński K., Słowikowski J., Materiałoznawstwo elektrotechniczne, WNT, Warszawa 1988
[4] Motyl E., Space charge and polarization in solid dielectrics, Oficyna Wyd.. Politechniki Wrocławskiej, Wrocław 2007
[5] Kacprzyk R., Wybrane zagadnienia badań ładunku i jego zaniku w dielektrykach stałych, Oficyna Wyd.. Politechniki Wrocławskiej, Wrocław 2004

SUBJECT SUPERVISOR
Marcin Lewandowski, marcin.p.lewandowski@pwr.edu.pl