

FACULTY OF ELECTRICAL  
ENGINEERING**SUBJECT CARD**

Name in Polish: **Silne pola EM w procesach technologicznych**  
 Name in English: **Strong electrical and magnetic fields in technology**  
 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: **ELR051212**  
 Group of courses: **NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	30		30		
Number of hours of total student workload (CNPS):	90		60		
Form of crediting:	examination		crediting with grade		
For group of courses mark (X) final course:					
Number of ECTS points:	3		2		
including number of ECTS points for practical (P) classes :			2		
including number of ECTS points for direct teacher-student contact (BK) classes:	2.10		1.40		

**PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES**

1. Student has a general knowledge of applied electrostatic
2. Student has general knowledge of high voltage technology

**SUBJECT OBJECTIVES**

- C1. Acquisition of basic knowledge in the area of interaction of strong electrical and magnetic fields with materials  
 C2. Acquisition of measuring ability in the range of strong electrical and magnetic fields, analysis and interpretation of measurement results  
 C3. Acquisition and consolidation of social skills including emotional intelligence skills involving the cooperation to effective problem solving. Responsibility, honesty and fairness in the procedure of academic community and society

**SUBJECT LEARNING OUTCOMES***relating to knowledge:*

- PEU\_W01 Student knows the concept of strong electric and magnetic fields, the basic relationships describing their interaction with matter  
 PEU\_W02 Student knows the modern application of strong electrical and magnetic fields in selected technological processes and equipment

*relating to skills:*

- PEU\_U01 Student is able to apply strong electric and magnetic fields in technological processes  
 PEU\_U02 Student is able to use the proper methods and instruments for electrostatic measurements

*relating to social competences:*

- PEU\_K01 Student is able to act and to think independently and creatively

PROGRAMME CONTENT		
Form of classes - lecture		Number of hours:
Lec 1	An introduction to the lecture, credits conditions, literatura. Cocept and definition of strong electrical and magnetic fields.	2
Lec 2	Generation of constant and pulse strong magnetic fields	2
Lec 3	An interaction of magnetic fields with matter and their application in technological processes	2
Lec 4	Interaction of strong pulse electric fields with living organisms (electroporation, etc.)	2
Lec 5	Electron guns	2
Lec 6	Ionic guns	2
Lec 7	Strong electric and magnetic fields in application to particles acceleration	2
Lec 8	Generation of high power (TW) electro-magnetic pulses	2
Lec 9	Technological processes and devices using strong DC electrical fields	2
Lec 10	High current pulses generation	2
Lec 11	High and ultra high voltage power supplies	2
Lec 12	Application of strong ac electric fields for plasma generation	2
Lec 13	Application of strong and non-uniform dc electric fields for plasma generation	2
Lec 14	Application of strong electric fields in measurements and monitoring of non-electrical quantities	2
Lec 15	Application of strong electric fields for polymers processing (surface activation, electrets, piezo-activation)	2
Total hours:		<b>30</b>

Form of classes - laboratory		Number of hours:
Lab 1	Introduction, organizational matters	3
Lab 2	Application of electron beam for metals melting	3
Lab 3	Preparation of thin polymer films using plasma polymerization	3
Lab 4	Application of magnetron sputtering to obtain layers of high-melting materials	3
Lab 5	Investigation of charge decay characteristics	3
Lab 6	The formation and measurements of electrets properties	3
Lab 7	Investigation of properties of the electroctatic strong electrical field sources	3
Lab 8	Electrification of solid state particles in strong electric fields	3
Lab 9	Gas flow velocity measurements using ionic marking	3
Lab 10	Crediting	3
Total hours:		<b>30</b>

TEACHING TOOLS USED
N1. Traditional lecture using a multimedia presentation N2. Laboratory exrecises N3. Consultations N4. Student's own work

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT		
Evaluation <i>F - forming (during semester) P - concluding (at semester end)</i>	Educational effect number	Way of evaluating educational effect achievement
F1(W)	PEU_W01 PEU_W02 PEU_K01	Exam
P(W)	P=F1	
F1(L)	PEU_U01 PEU_U02 PEU_K01	Written/oral test
F2(L)	PEU_U01 PEU_U02 PEU_K01	Evaluation of research reports
P(L)	P=0.5F1+0.5F2	

<b>PRIMARY AND SECONDARY LITERATURE</b>
---

<b>PRIMARY LITERATURE:</b>
----------------------------

- |   |
|---|
| <p>[1] Gajewski A., Procesy i technologie elektrostatyczne , PWN, Warszawa-Kraków, 2000.<br/>[2] Laboratory instructions.</p> |
|---|

<b>SECONDARY LITERATURE:</b>
------------------------------

- |   |
|---|
| <p>[1] Bajorski Z., Dołżycki S., Kurdziel R., Skopec A., Elektryczność i magnetyzm, Skrypt P.Wr. Wrocław 1983.<br/>[2] Lutyński J., Elektrostatyczne odpylanie gazów, WNT, Warszawa, 1965.<br/>[3] Miernik K., Działanie i budowa magnetronowych urządzeń rozpylających, Wydawnictwo i Zakład Poligrafii Instytutu Technologii Eksploatacji (ITE), Radom 1997.<br/>[4] Szymanowski W., Elektrofotografia, WNT, Warszawa 1965.<br/>[5] Michelson D., Electrostatic Atomization, Adam Hilger. IOP Publishing Ltd. N.Y. 1990.<br/>[6] Hayt W., Engineering Electromagnetics, McGraw-Hill Book Company, 1981. N.Y.<br/>[7] Moore A. D. ,(Ed.), Electrostatics and its application, J. Wiley &amp; Sons, New York, 1973.<br/>[8] Grill A., Cold Plasma in Materials Fabrication. From Fundamentals to Application, IEEE Press, N.Y. 1993.<br/>[9] Herlach F. (Ed.) Strong and Ultrastrong Magnetic Fields and Their Applications, Springer Verlag, Berlin, 1985.<br/>[10] Crowley J.M., Fundamentals of Applied Electrostatics, J.Wiley &amp; Sons, N.Y. 1986.</p> |
|---|

<b>SUBJECT SUPERVISOR</b>
---------------------------

Ryszard Kacprzyk, ryszard.kacprzyk@pwr.edu.pl
---