

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: **ELR041212**
 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 EDUCATIONAL EFFECTS*relating to knowledge:*

- PEK_W01 Student knows the concept of strong electric and magnetic fields, the basic relationships describing their interaction with matter
 PEK_W02 Student knows the modern application of strong electrical and magnetic fields in selected technological processes and equipment

relating to skills:

- PEK_U01 Student is able to apply strong electric and magnetic fields in technological processes
 PEK_U02 Student is able to use the proper methods and instruments for electrostatic measurements

relating to social competences:

- PEK_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:		30

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:		30

TEACHING TOOLS USED
N1. Traditional lecture using a multimedia presentation N2. Laboratory exrecises N3. Consultations 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	Exam
P(W)	P=F1	
F1(L)	PEK_U01 PEK_U02 PEK_K01	Written/oral test
F2(L)	PEK_U01 PEK_U02 PEK_K01	Evaluation of research reports
P(L)	P=0.5F1+0.5F2	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

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

SECONDARY LITERATURE:

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

SUBJECT SUPERVISOR

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

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
ELR041212 - Strong electrical and magnetic fields in technology
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_W08	C.1	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11 Lec12 Lec13 Lec14 Lec15	N.1 N.3 N.4
PEK_W02	S2ETP_W08	C.1	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11 Lec12 Lec13 Lec14 Lec15	N.1 N.2 N.3 N.4
PEK_U01	S2ETP_U05	C.2 C.3	Lab2 Lab3 Lab4 Lab5 Lab6 Lab7 Lab8 Lab9	N.1 N.2 N.3 N.4
PEK_U02	S2ETP_U05	C.2 C.3	Lab2 Lab3 Lab4 Lab5 Lab6 Lab7 Lab8 Lab9	N.1 N.2 N.3 N.4
PEK_K01	K2ETK_K06	C.3	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11 Lec12 Lec13 Lec14 Lec15 Lab1 Lab2 Lab3 Lab4 Lab5 Lab6 Lab7 Lab8 Lab9 Lab10	N.1 N.2 N.3 N.4