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, part-time**
Kind of subject:	**obligatory**
Subject code:	**ELR051274**
Group of courses:	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	22		22		
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 electrostatics
2. Student has general knowledge of high voltage technology

SUBJECT OBJECTIVES

C1. Acquisition of basic knowledge in the area of interaction af strong electrical and magnetic fields with materials

C2. Aquisition 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 tudent is able to applied 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	Electron guns	2
Lec 5	Ionic guns	2
Lec 6	Technological processes and devices using strong DC electrical fields	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	Application of strong electric and electro-magnetic fields for non-thermal plasma generation	2
Lec 10	Application of strong electric fields in measurements and monitoring of non-electrical quantities	2
Lec 11	Application of strong electric fields for polymers processing (surface activation, electrets, piezo-activation)	2
	Total hours:	**22**

Form of classes - laboratory		**Number of hours:**
Lab 1	Introduction, organizational matters	1
Lab 2	The application of electron beam for metals melting	3
Lab 3	Preparation of polymer thin films using plasma polymerization	3
Lab 4	Application of magnetron sputtering process to obtain layers of highmelting materials	3
Lab 5	Investigation of charge decay characteristics	3
Lab 6	The formation and measurements of electret properties	3
Lab 7	Investigation of properties of chosen strong electrical field sources	3
Lab 8	Crediting	3
	Total hours:	**22**

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

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT		
Evaluation *F – forming (during semester)* *P – concluding (at semester end)*	**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	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Gajewski A., Procesy i technologie elektrostatyczne , PWN, Warszawa-Kraków, 2000.
[2] Laboratory instructions.

SECONDARY LITERATURE:

[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 Instytytu 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.

SUBJECT SUPERVISOR

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