FACULTY OF ELECTRICAL ENGINEERING

SUBJECT CARD

Name in Polish:	**Teoria pola elektromagnetycznego**
Name in English:	**Electromagnetic field theory**
Main field of study (if applicable):	**Electrical Engineering**
Specialization (if applicable):	
Level and form of studies:	**1st level, part-time**
Kind of subject:	**obligatory**
Subject code:	**ELR051366**
Group of courses:	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	20	20			
Number of hours of total student workload (CNPS):	120	60			
Form of crediting:	examination	crediting with grade			
For group of courses mark (X) final course:					
Number of ECTS points:	4	2			
including number of ECTS points for practical (P) classes :		2			
including number of ECTS points for direct teacher-student contact (BK) classes:	2.80	1.40			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. He knows the basic concepts of vector analysis (addition of vectors, scalar and vector products, differential operation of vector function, surface and linear integrals).
2. He should be able to properly and effectively use knowledge in of scope of vector analysis and differential calculus in study discipline.

SUBJECT OBJECTIVES

C1. To provide students with the knowledge necessary to understand the basic theory of the electromagnetic field.
C2. Manufacturing skills in engineering practice with known laws that recognize the theory of EM fields.

SUBJECT LEARNING OUTCOMES

relating to knowledge:

PEU_W01 He knows the basic rights and the theoretical basis for the theory of the electric field.
PEU_W02 He knows the basic rights and the theoretical basis for the theory of the magnetic field.

relating to skills:

PEU_U01 He knows how correctly use rights endearing known electric field theory to determine the physical parameters of an engineering (RLC parameters, electrical field distribution)
PEU_U02 He knows how correctly use rights endearing known magnetic field theory to determine the physical parameters of an engineering (RLC parameters, magnetic field distribution)

relating to social competences:

PEU_K01 He understands the need for continuous training and improving professional, personal and social competences

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours:**
Lec 1	Some electrostatic field problems : the scalar charge field and its abstractions, the Coulomb's law, the electric field intensity and its abstractions, streamlines and the electric flux.	2
Lec 2	The Gauss's law in the differential and integral form in a vacuum, a case of a space with any charge or without any charge, the work in the electric field, the voltage and the scalar potential as well as some conditions for the existence of the potential field, the equipotential surfaces, the electric dipole space and its abstractions.	2
Lec 3	The Gauss's law in a dipole space, the electric flux density, the Laplace and Poisson equations, boundary conditions for perfect dielectric materials, the metal.	2
Lec 4	The potential energy problem and a law of behavior of energy of the electric field, the capacitance, the capacitor systems, the linear form of a potential function of the electrode systems.	2
Lec 5	Some charge flow field problems : the current density vector field and the scalar current field as well as their abstractions, the point form of Ohm's law, the differential and integral form of the continuity equation, the first Kirchhoff's law, boundary conditions for the current flow field, the Joule – Lenz' law.	2
Lec 6	The generalized form of Ohm's law and the resistance problem, the second Kirchhoff's law, a Laplace equation problem and the internal Dirichlet – Neumann problem, the Fourier method for Laplace equation.	2
Lec 7	Some magnetic and electric – magnetic field problems : the magnetic flux density vector field and the scalar magnetic potential field as well as their abstractions, the Biot – Savart – Laplace 's law, the vector potential and the divergence problem for the magnetic field, the Ampere' s circuital law in a vacuum.	2
Lec 8	The Grassmann' s law, the magnetic dipole space and its abstractions, the Ampere' s circuital law in materials and the magnetic field intensity, the magnetic flux and the Faraday' s law.	2
Lec 9	The self – inductance and mutual inductance problem, the electric – magnetic energy and a law of behavior of energy of the magnetic field, boundary conditions for the magnetic field, the Maxwell hypothesis and the Maxwell equations as well as the Gauss and Stokes theorems.	2
Lec 10	The law of behavior of energy of the electric – magnetic field, the plane wave equation and the theorem for the existence of solutions as well as the Fourier method, the D' Alembert wave problem and its relations with the Fourier method, some magnetic circuit theory.	2
	Total hours:	**20**

Form of classes - class		**Number of hours:**
Cl 1	Some fundamental elements of the vector field and of the scalar field. Some calculating examples.	2
Cl 2	The curvilinear integral problem and the work in the electric field. Some calculating examples.	2
Cl 3	The vector field flux problem and the Gauss theorem. Some calculating examples.	2
Cl 4	The Coulomb integrals, the potential integrals, the charge distributions. Some calculating examples.	2
Cl 5	The streamlines and the equipotential surfaces, the Poisson equation and the Laplace equation as well as the Fourier method. Some calculating examples.	2
Cl 6	The capacitors and their capacitance. Some calculating examples.	2
Cl 7	The capacitor system problems. Some calculating examples.	2
Cl 8	Some differential equations for charge of the resistance – capacitor systems. The second Kirchhoff' s law for the resistance circuit systems. Some calculating examples.	2
Cl 9	The resistance problem. The Biot - Savart - Laplace' s law. The electrodynamics force. The magnetic circuit systems. Some calculating examples.	2
Cl 10	Final test	2
	Total hours:	**20**

TEACHING TOOLS USED
N1. Traditional lecture
N2. Student's own work
N3. Consultations
N4. Solving classes

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	Final written egzamination
P(W)	P = F1	
F1(C)	PEU_U01 PEU_U02 PEU_K01	final test
P(C)	P=F1	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Łobos T., Łukaniszyn M., Jaszczyk B., Teoria pola dla elektryków, Oficyna Wydawnicza PWr, 2004,
[2] Sikora R., Teoria pola elektromagnetycznego, WNT 1997,
[3] Rawa H., Podstawy Elektromagnetyzmu, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2011,

SECONDARY LITERATURE:

[1] Jackson J. D., Classical Electrodynamics – third edition, John Wiley & Sons, INC, 2001,
[2] Michalski W. Elektryczność i magnetyzm, Zbiór zagadnień i zadań, Oficyna Wydawnicza PWr, 2004

SUBJECT SUPERVISOR

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