Measurement Systems in Industry and Polish obligatory Cycle of study: Form of study (full-time,part-time) Form of study (full-time,part-time) No. of hours full-time No. of credits Lecture: 15 Classes: - Laboratory: 30 Project/seminars: - 3 Status of the course in the study program (Basic, major, other) (university-wide, from another field) (brak) ECTS distribution (number and %) Education areas and fields of science and art (brak) (brak) ECTS distribution (number and %) technical sciences Technical sciences 3 100% 3 100% Dr inž. Rafal M. Wojciechowski Prof. dr hab inž. Andrzej Demenko email: andrzej demenko@put.poznan.pl tel.48 061 665 213 96 Electrical Engineering U. Piotrowo 3a, 60-965 Poznari U. Piotrowo 3a, 60-965 Poznari Protrowo 3a, 60-965 Poznari Itel. 48 006 665 21 26 Electrical Engineering U. Piotrowo 3a, 60-965 Poznari U. Piotrowo 3a, 60-965 Poznari Terwisites in terms of knowledge of electrical engineering, electromagnetic field theory, electrical machines and numerical methods. 1 Knowledge <t< th=""><th></th><th>STUDY MODULE D</th><th>ESCRIPTION FORM</th><th></th></t<>		STUDY MODULE D	ESCRIPTION FORM		
Electrical Engineering (graenal academic, practical) (brak) 3 / 6 Elective path/speciality Measurement Systems in Industry and Cycle of study: Subject offende in: Polish Course (computatory, elective; Dollgatory Cycle of study: First-cycle studies Form of study (full-sime, part-sime) No. of credits No. of hours Lecture: 15 Classes: Laboratory: 30 Project/seminars: No. of credits Status of the course in the study program (Basic, major, other) (university-wide, from another field) ECTS distribution (number and %) Education areas and fields of acience and art ECTS distribution (number and %) Status of the course in the study program (Basic, major, other) (university-wide, from another field) ECTS distribution (number and %) technical sciences Project/seminars: No Status of the course in the study program, pl technical sciences Project/seminars; No No Terequisites in terms of Knowledge, skills and social competencies: Electrical Engineering u.t. Piotrowo 3a, 60-965 Poznań Electrical engineering u.t. Piotrowo 3a, 60-965 Poznań Electrical engineering u.t. Piotrowo 3a, 60-965 Poznań Elementary knowledge of electrical engineering, electromagnetic field theory, electrical machines and numerical methods. 2		namics			
Measurement Systems in Industry and Polish obligatory Cycle of study: Form of study (full-time,part-time) Form of study (full-time,part-time) Form of study (full-time,part-time) No. of nours Lecture: 15 Classes: - 3 Status of the course in the study program (Basic, major, other) (brak) (university-wide, from another field) No. of credits Education areas and fields of science and art (brak) (brak) ECTS distribution (number and %) Education areas and fields of sciences 3 100% 3 100% Responsible for subject / lecturer: Responsible for subject / lecturer: Prof. dr hab in2, Andrzej Demenko email: radit wojcleiechowski@put.poznan.pl tel. 48 061 665 23 96 Program Prof. dr hab in2, Andrzej Demenko email: radit radit diversity study and social competencies: 1 Knowledge Electrical engineering u Piotrowo 3a, 60-965 Poznań U. Piotrowo 3a, 60-965 Poznań 2 Skills The skill of effective self-education in a field related to the chosen major of studies, the skill to make a right diccisions to solve simple problems related to the electromagnetic field, the ability to use Windows OS. 3 Social competencies Studen is aware of the widening his competence, demonstrate a willingness to work i	-	ng	(general academic, practical)	
Cycle of study: First-cycle studies Form of study (full-time,part-time) No. of hours Lecture: 15 Classes: - 13 Status of the course in the study program (Basic, major, other) (university-wide, from another field) (brak) 3 Education areas and fields of science and art Editation (number and %) 3 100%<		t Systems in Industry and	-	Course (compulsory, elective)	
No. of brours No. of credits Lecture: 15 Classes: Laboratory: 30 Project/seminars: 3 Status of the course in the study program (Basic, major, other) (university-wide, from another field) (brak) Education areas and fields of sciences (university-wide, from another field) (brak) Education areas and fields of sciences 3 100% Technical sciences 3 100% Technical sciences 3 100% Chain and the status of the course in the study program (Basic, major, other) (brak) 8 Drinz, Rafat M. Wojciechowski Prof. dr hab in2. Andrzej Demenko amail: andrzej demenko @put.poznan.pl tei. 48 061 665 21 36 Electrical Engineering U. Piotrowo 3a, 60-965 Poznań U. Piotrowo 3a, 60-965 Poznań Elementary knowledge of electrical engineering, electromagnetic field theory, electrical machines and numerical methods. 2 Skills The skill of effectives self-education in a field related to the chosen major of studies, the skill to make a right decisions to solve simple problems related to the theory of studies, the skill to make a right decisions to solve simple problems related to the theory of studies, the akill to comply with the rules in force on the lecture and laboratory. 3 Student is aware of the widening his competen					
Lecture: 15 Classes: - Laboratory: 30 Project/seminars: - 3 Status of the course in the study program (Basic, major, other) (university-wide, from another field) (brak) Education areas and fields of science and at (brak) (brak) EGTS distribution (number and %) technical sciences 3 100% 3 100% Technical sciences 3 100% 3 100% Responsible for subject / lecturer: Prof. dr hab in2. Andrzej Demenko email: andrzej demenko@put.poznan.pl tel. 48 061 665 21 36 Electrical Engineering U. Piotrow 3a, 60-965 Poznań U. Piotrow 3a, 60-965 Poznań Electrical engineering U. Piotrow 3a, 60-965 Poznań Electrical engineering Electric	First-cy	cle studies	full-time		
Execution to course in the study program (Basic, major, other) (university-wide, from another field) Education areas and fields of science and art (brak) Education areas and fields of science and art (brak) technical sciences 3 100% Technical sciences 3 100% Responsible for subject / lecturer: Responsible for subject / lecturer: Dr in Z, Rafal M, Wojcieicchowski Bput, poznan, pl email: rafal, wojcieicchowski Bput, poznan, pl email: rafal, wojcieicchowski Bput, poznan, pl email: rafal, wojcieicchowski Bput, poznan, pl tel. 48 061 665 23 96 Electrical Engineering ul. Piotrowo 3a, 60-965 Poznań Ul. Piotrowo 3a, 60-965 Poznań 1 Knowledge Elementary knowledge of electrical engineering, electronagnetic field theory, electrical machines and numerical methods. 2 Skills The skill of effective self-education in a field related to the chosen major of studies, the skill to make a right decisions to solve simple problems related to the electromagnetic field, the ability to comply with the rules in force on the lecture and laboratory. 3 Social competencies Student is aware of the widening his competence, demonstrate a willingness to work in a team the ability to comply with the rules in force on the lecture and laboratory. Assumptions and objectives off the course: The student should obtain knowledge of the des	No. of hours			No. of credits	
(brak) (brak) Education areas and fields of science and art ECTS distribution (number and %) technical sciences 3 100% Technical sciences 3 100% Responsible for subject / lecturer: Responsible for subject / lecturer: Drinz, Rafal M, Wojciechowski Prof. dr hab in2, Andrzej Demenko emait: rafal, wojciechowski@put.poznan.pl tel. 48 061 665 23 9 I. Net Wojciechowski Prof. dr hab in2, Andrzej Demenko emait: rafal, wojciechowski@put.poznan.pl tel. 48 061 665 21 26 Electrical Engineering ul. Piotrowo 3a, 60-965 Poznań U. Piotrowo 3a, 60-965 Poznań Yerrequisites in terms of knowledge, skills and social competencies: I 1 Knowledge Elementary knowledge of electrical engineering, electromagnetic field theory, electrical machines and numerical methods. 2 Skills The skill of effective self-education in a field related to the chosen major of studies, the skill to make a right decisions to solve simple problems related to the theory of the electromagnetic field, the ability to use Windows OS. 3 Social competencies Studen ti sound objectives of the course: The student is hould obtain knowledge of the description and analysis of electromagnetic phenomena in electrical devices as well as knowledge of finite element method in electromagnetism. Study outcomes and reference to the educational results	Lecture: 15 Classe	s: - Laboratory: 30	Project/seminars:	- 3	
Education areas and fields of science and at ECTS distribution (number and %) technical sciences 3 100% Responsible for subject / lecturer: Responsible for subject / lecturer: Dr in2, Rafal M. Wojciechowski Prof. dr hab in2, Andrzej Demenko email: rafal-wojciechowski@put.poznan.pl email: andrzej.demenko@put.poznan.pl tel. 48 061 665 23 96 Electrical Engineering ul. Piotrowo 3a, 60-965 Poznań ul. Piotrowo 3a, 60-965 Poznań 7 Knowledge 1 Knowledge 2 Skills The skill of effective self-education in a field related to the chosen major of studies, the skill to make a right decisions to solve simple problems related to the thory of the electromagnetic field, the ability to use Windows OS. 3 Social competencies Student is aware of the widening his competence, demonstrate a willingness to work in a team the ability to comply with the rules in force on the lecture and laboratory. Assumptions and objectives of the course: 1 The student should obtain knowledge of numerical methods and software for the numerical calculation of electromagnetic framework. 3 Study outcomes and reference to the educational results for a field of study Knowledge: 1 1. The student has a basic knowledge of numerical methods and software for the				,	
technical sciences 3 100% Responsible for subject / lecturer: Responsible for subject / lecturer: Prof. dr hab inż. Andrzej Demenko email: rafal.wojciechowski Dr inż. Rafał M. Wojciechowski email: rafal.wojciechowski Prof. dr hab inż. Andrzej Demenko email: andrzej.demenko@put.poznan.pl tel. 48 061 665 23 96 Electrical Engineering ul. Piotrowo 3a, 60-965 Poznań Prof. dr hab inż. Andrzej Demenko email: andrzej.demenko@put.poznan.pl tel. 48 061 665 23 96 Prerequisites in terms of knowledge, skills and social competencies: 1 Knowledge 1 The skill of effective self-education in a field related to the chosen major of studies, the skill to make a right decisions to solve simple problems related to the theory of the electromagnetic field, the ability to use Windows OS. 3 Social competencies Student is aware of the widening his competence, demonstrate a willingness to work in a team the ability to comply with the rules in force on the lecture and laboratory. Assumptions and objectives of the course: Study outcomes and reference to the educational results for a field of study Knowledge 1 The student should obtain knowledge of numerical methods and software for the numerical calculation of electromagnetic field, the ability to complemence is results for a field of study Knowledge 1 The student has a basic knowledge of numerical methods and software for the numerical calculation of electromagnetic field (_transducers - [K_W02+++; K_W06++++]				ECTS distribution (number	
Technical sciences 3 100% Responsible for subject / lecturer: Responsible for subject / lecturer: Drin2. Rafal M. Wojciechowski Prof. dr hab inž. Andrzej Demenko email: rafal-wojcieiechowski@putpoznan.pl Prof. dr hab inž. Andrzej Demenko email: andrzej.demenko@putpoznan.pl Electrical Engineering Ul. 48 061 665 23 96 Electrical Engineering ul. Piotrowo 3a, 60-965 Poznań Ul. Piotrowo 3a, 60-965 Poznań Prerequisites in terms of knowledge, skills and social competencies: 1 Knowledge 2 Skills 3 Social competencies 3 Social competencies 3 Student is aware of the widening his competence, demonstrate a willingness to work in a team the ability to comply with the rules in force on the lecture and laboratory. Assumptions and objectives of the course: Nady outcomes and reference to the educational results for a field of study 1 The skullent has a basic knowledge of numerical methods and software for the numerical calculation of electromagnetic phenomena in electrical devices as well as knowledge of functional needed of study 1 The student should obtain knowledge of numerical methods and software for the numerical calculation of electromagnetic phenomena in electrical devices as well as knowledge of functinelectromagnetic phenomena in electrical devices as well as knowled	technical sciences				
Dr inż. Rafał M. Wojciechowski email: rafal.wojciechowski@put.poznan.pl tel. 48 061 665 23 96 Prof. dr hab inż. Andrzej Demenko email: andrzej.demenko@put.poznan.pl tel. 48 061 665 21 26 Electrical Engineering ul. Piotrowo 3a, 60-965 Poznań Electrical Engineering ul. Piotrowo 3a, 60-965 Poznań Prerequisites in terms of knowledge, skills and social competencies: 1 Knowledge 2 Skills 3 Social competencies: 3 Social competencies: 3 Social competencies: 3 Social competencies: 1 The skill of effective self-education in a field related to the chosen major of studies, the skill to make a right decisions to solve simple problems related to the theory of the electromagnetic field, the ability to use Windows OS. 3 Social competencies: Student is aware of the widening his competence, demonstrate a willingness to work in a team the ability to comply with the rules in force on the lecture and laboratory. Assumptions and objectives of the course: The student should obtain knowledge of the description and analysis of electromagnetic phenomena in electrical devices as well as knowledge of finite element method in electromynamics - [K_W02++; K_W06+++] 1. The student has a basic knowledge of numerical methods and software for the numerical calculation of electromagnetic transducers - [K_W02+++; K_W06+++; K_W12+] Skills: 1. The student will be able to use known methods and m		ences			
Dr inż. Rafał M. Wojciechowski email: rafal.wojciechowski@put.poznan.pl tel. 48 061 665 23 96 Prof. dr hab inż. Andrzej Demenko email: andrzej.demenko@put.poznan.pl tel. 48 061 665 21 26 Electrical Engineering ul. Piotrowo 3a, 60-965 Poznań Electrical Engineering ul. Piotrowo 3a, 60-965 Poznań Prerequisites in terms of knowledge, skills and social competencies: 1 Knowledge 2 Skills 3 Social competencies: 3 Social competencies: 3 Social competencies: 3 Social competencies: 1 The skill of effective self-education in a field related to the chosen major of studies, the skill to make a right decisions to solve simple problems related to the theory of the electromagnetic field, the ability to use Windows OS. 3 Social competencies: Student is aware of the widening his competence, demonstrate a willingness to work in a team the ability to comply with the rules in force on the lecture and laboratory. Assumptions and objectives of the course: The student should obtain knowledge of the description and analysis of electromagnetic phenomena in electrical devices as well as knowledge of finite element method in electromynamics - [K_W02++; K_W06+++] 1. The student has a basic knowledge of numerical methods and software for the numerical calculation of electromagnetic transducers - [K_W02+++; K_W06+++; K_W12+] Skills: 1. The student will be able to use known methods and m					
email: rafal.wojcielechowski@put.poznan.pl email: andrzej.demenko@put.poznan.pl tel. 48 061 665 23 96 tel. 48 061 665 21 26 Electrical Engineering ul. Piotrowo 3a, 60-965 Poznań ul. Piotrowo 3a, 60-965 Poznań ul. Piotrowo 3a, 60-965 Poznań 1 Knowledge Elementary knowledge of electrical engineering, electromagnetic field theory, electrical machines and numerical methods. 2 Skills The skill of effective self-education in a field related to the chosen major of studies, the skill to make a right decisions to solve simple problems related to the theory of the electromagnetic field, the ability to use Windows OS. 3 Social competencies Student is aware of the widening his competence, demonstrate a willingness to work in a team the ability to comply with the rules in force on the lecture and laboratory. Assumptions and objectives of the course: The student knowledge of technical electrodynamics - [K_W02++; K_W06+++] 1. The student has a basic knowledge of numerical methods and software for the numerical calculation of electromagnetic transducers : [K_W02+++; K_W06+++; K_W12+] Skills . 1. The student will be able to use known methods and models for field analysis and synthesis of simple systems with the electromagnetic field using professional software - [K_U08++] 2. The student will be able to use known methods and models for field analysis and synthesis of simple systems with the electromagnetic field using professional software - [K_U08++] <td>Responsible for subj</td> <td>ect / lecturer:</td> <td>Responsible for subje</td> <td>ct / lecturer:</td>	Responsible for subj	ect / lecturer:	Responsible for subje	ct / lecturer:	
tel. 48 061 665 23 96 tel. 48 061 665 21 26 Electrical Engineering Electrical Engineering ul. Piotrowo 3a, 60-965 Poznań ul. Piotrowo 3a, 60-965 Poznań Prerequisites in terms of knowledge, skills and social competencies: 1 Knowledge 2 Skills 3 Social competencies 3 Social competencies 5 Student is aware of the widening his competence, demonstrate a willingness to work in a team the ability to comply with the rules in force on the lecture and laboratory. Assumptions and objectives of the course: The student has a basic knowledge of technical electrodynamics - [K_W02++; K_W06+++] 2. The student has a basic knowledge of technical electrodynamics - [K_W02++; K_W06+++] 2. The student has a basic knowledge of technical electrodynamics - [K_W02++; K_W06+++] 2. The student will be able to use known methods and models for field analysis and synthesis of simple systems with the electromagnetic field - [K_U10++; K_U11+++] 2. The student will be able to use known methods and models for field analysis and synthesis of simple systems with the electromagnetic field using professional activare - [K_U08++] 3. The student will be able to use known methods and models for field analysis and synthesis of simple systems with the electromagnetic field using professional activare - [K_U08++] 3. The student will be able to use known methods and models for field analysis and synthesis of simp	-		,		
Electrical Engineering ul. Piotrowo 3a, 60-965 Poznań Electrical Engineering ul. Piotrowo 3a, 60-965 Poznań Prerequisites in terms of knowledge, skills and social competencies: 1 Knowledge 2 Skills 3 Social competencies 3 Social competencies 4 Knowledge of the description and numerical methods. 2 Skills The skill of effective self-education in a field related to the chosen major of studies, the skill to make a right decisions to solve simple problems related to the theory of the electromagnetic field, the ability to use Windows OS. 3 Social competencies Student is aware of the widening his competence, demonstrate a willingness to work in a team the ability to comply with the rules in force on the lecture and laboratory. Assumptions and objectives of the course: The student should obtain knowledge of the description and analysis of electromagnetic phenomena in electrical devices as well as knowledge of finite element method in electromagnetism. Study outcomes and reference to the educational results for a field of study Knowledge: 1. The student has a basic knowledge of numerical methods and software for the numerical calculation of electromagnetic transducers - [K_W02+++; K_W12+] Skills: 1. The student will be able to use known methods and models for field analysis and synthesis of simple systems with the electromagnetic field - [K_U10++; K_U11+++] <td></td> <td>ski@put.poznan.pl</td> <td></td> <td>put.poznan.pl</td>		ski@put.poznan.pl		put.poznan.pl	
ul. Piotrowo 3a, 60-955 Poznań ul. Piotrowo 3a, 60-955 Poznań Prerequisites in terms of knowledge, skills and social competencies: Imachines and numerical methods. 1 Knowledge Elementary knowledge of electrical engineering, electromagnetic field theory, electrical machines and numerical methods. 2 Skills The skill of effective self-education in a field related to the chosen major of studies, the skill to make ar ight decisions to solve simple problems related to the theory of the electromagnetic field, the ability to use Windows OS. 3 Social competencies Student is aware of the widening his competence, demonstrate a willingness to work in a team the ability to comply with the rules in force on the lecture and laboratory. Assumptions and objectives of the course: The student should obtain knowledge of the description and analysis of electromagnetic phenomena in electrical devices as well as knowledge of finite element method in electromagnetism. Study outcomes and reference to the educational results for a field of study Knowledge: 1. The student has a basic knowledge of numerical methods and software for the numerical calculation of electromagnetic field - [K_U10++; K_W12+] Skills 1. The student will be able to use known methods and models for field analysis and synthesis of simple systems with the electromagnetic field - [K_U10++; K_U11+++] 2. The student will be able to prepare a report on the numerical calculations of electromechanical transducers and systems with the electromag					
Prerequisites in terms of knowledge, skills and social competencies: 1 Knowledge Elementary knowledge of electrical engineering, electromagnetic field theory, electrical machines and numerical methods. 2 Skills The skill of effective self-education in a field related to the chosen major of studies, the skill to make a right decisions to solve simple problems related to the theory of the electromagnetic field, the ability to use Windows OS. 3 Social competencies Student is aware of the widening his competence, demonstrate a willingness to work in a team the ability to comply with the rules in force on the lecture and laboratory. Assumptions and objectives of the course: The student should obtain knowledge of the description and analysis of electromagnetic phenomena in electrical devices as well as knowledge of finite element method in electromagnetism. Study outcomes and reference to the educational results for a field of study Knowledge: 1. The student has a basic knowledge of numerical methods and software for the numerical calculation of electromagnetic transducers - [K_W02++; K_W06+++] 2. The student will be able to use known methods and models for field analysis and synthesis of simple systems with the electromagnetic field - [K_U10++; K_U11+++] 2. The student will be able to prepare a report on the numerical calculations of electromechanical transducers and systems with the electromagnetic field using professional software - [K_U08++] Social competencies: 1. The student is aware of the value of hi	0 0	οτροή	5 5	znań	
1 Knowledge machines and numerical methods. 2 Skills The skill of effective self-education in a field related to the chosen major of studies, the skill to make a right decisions to solve simple problems related to the theory of the electromagnetic field, the ability to use Windows OS. 3 Social competencies Student is aware of the widening his competence, demonstrate a willingness to work in a team the ability to comply with the rules in force on the lecture and laboratory. Assumptions and objectives of the course: The student should obtain knowledge of the description and analysis of electromagnetic phenomena in electrical devices as well as knowledge of finite element method in electromagnetism. Study outcomes and reference to the educational results for a field of study Knowledge: 1. The student has a basic knowledge of technical electrodynamics - [K_W02++; K_W06+++] 2. The student has a basic knowledge of numerical methods and software for the numerical calculation of electromagnetic transducers - [K_W02+++; K_W06+++; K_W12+] Skills: 1. The student will be able to use known methods and models for field analysis and synthesis of simple systems with the electromagnetic field using professional software - [K_U08++] S. The student will be able to prepare a report on the numerical calculations of electromechanical transducers and systems with the electromagnetic field using professional software - [K_U08++] Social competencies: 1. The student will be aware of the value of his work, respect the prin	· · · · · ·				
2 Skills The skill of effective self-education in a field related to the chosen major of studies, the skill to make a right decisions to solve simple problems related to the theory of the electromagnetic field, the ability to use Windows OS. 3 Social competencies Student is aware of the widening his competence, demonstrate a willingness to work in a team the ability to comply with the rules in force on the lecture and laboratory. Assumptions and objectives of the course: The student should obtain knowledge of the description and analysis of electromagnetic phenomena in electrical devices as well as knowledge of finite element method in electromagnetism. Study outcomes and reference to the educational results for a field of study Knowledge: 1. The student has a basic knowledge of technical electrodynamics - [K_W02++; K_W06+++] 2. The student has structured knowledge of numerical methods and software for the numerical calculation of electromagnetic transducers - [K_W02+++; K_W06+++; K_W12+] Skills: 1. The student will be able to use known methods and models for field analysis and synthesis of simple systems with the electromagnetic field - [K_U10++; K_U11+++] 2. The student will be able to prepare a report on the numerical calculations of electromechanical transducers and systems with the electromagnetic field using professional software - [K_U08++] Social competencies: 1. The student is aware of the value of his work, respect the principles of teamwork, takes responsibility for collaborative work - [K_K03++] <td>1 Knowledge</td> <td></td> <td></td> <td>tic field theory, electrical</td>	1 Knowledge			tic field theory, electrical	
2 Skills make a right decisions to solve simple problems related to the theory of the electromagnetic field, the ability to use Windows OS. 3 Social competencies Student is aware of the widening his competence, demonstrate a willingness to work in a team the ability to comply with the rules in force on the lecture and laboratory. Assumptions and objectives of the course: The student should obtain knowledge of the description and analysis of electromagnetic phenomena in electrical devices as well as knowledge of finite element method in electromagnetism. Study outcomes and reference to the educational results for a field of study Knowledge: 1. The student has a basic knowledge of technical electrodynamics - [K_W02++; K_W06+++] 2. The student has a basic knowledge of numerical methods and software for the numerical calculation of electromagnetic transducers - [K_W02+++; K_W06+++; K_W12+] Skills: 1. The student will be able to use known methods and models for field analysis and synthesis of simple systems with the electromagnetic field - [K_U10++; K_U11+++] 2. The student will be able to prepare a report on the numerical calculations of electromechanical transducers and systems with the electromagnetic field using professional software - [K_U08++] Social competencies: 1. The student is aware of the value of his work, respect the principles of teamwork, takes responsibility for collaborative work - [K_K03++]					
S competencies the ability to comply with the rules in force on the lecture and laboratory. Assumptions and objectives of the course: The student should obtain knowledge of the description and analysis of electromagnetic phenomena in electrical devices as well as knowledge of finite element method in electromagnetism. Study outcomes and reference to the educational results for a field of study Knowledge: 1. The student has a basic knowledge of technical electrodynamics - [K_W02++; K_W06+++] 2. The student has structured knowledge of numerical methods and software for the numerical calculation of electromagnetic transducers - [K_W02+++; K_W06+++; K_W12+] Skills: 1. The student will be able to use known methods and models for field analysis and synthesis of simple systems with the electromagnetic field - [K_U10++; K_U11+++] 2. The student will be able to prepare a report on the numerical calculations of electromechanical transducers and systems with the electromagnetic field using professional software - [K_U08++] Social competencies: 1. The student is aware of the value of his work, respect the principles of teamwork, takes responsibility for collaborative work - [K_K03++]	2 Skills	make a right decisions to solve s	simple problems related to the		
Assumptions and objectives of the course: The student should obtain knowledge of the description and analysis of electromagnetic phenomena in electrical devices as well as knowledge of finite element method in electromagnetism. Study outcomes and reference to the educational results for a field of study Knowledge: 1. The student has a basic knowledge of technical electrodynamics - [K_W02++; K_W06+++] 2. The student has structured knowledge of numerical methods and software for the numerical calculation of electromagnetic transducers - [K_W02+++; K_W06+++; K_W12+] Skills: 1. The student will be able to use known methods and models for field analysis and synthesis of simple systems with the electromagnetic field - [K_U10++; K_U11+++] 2. The student will be able to prepare a report on the numerical calculations of electromechanical transducers and systems with the electromagnetic field using professional software - [K_U08++] Social competencies: 1. The student is aware of the value of his work, respect the principles of teamwork, takes responsibility for collaborative work - [K_K03++]	5		Student is aware of the widening his competence, demonstrate a willingness to work in a team,		
well as knowledge of finite element method in electromagnetism. Study outcomes and reference to the educational results for a field of study Knowledge: 1. The student has a basic knowledge of technical electrodynamics - [K_W02++; K_W06+++] 2. The student has structured knowledge of numerical methods and software for the numerical calculation of electromagnetic transducers - [K_W02+++; K_W06+++; K_W12+] Skills: 1. The student will be able to use known methods and models for field analysis and synthesis of simple systems with the electromagnetic field - [K_U10++; K_U11+++] 2. The student will be able to prepare a report on the numerical calculations of electromechanical transducers and systems with the electromagnetic field using professional software - [K_U08++] Social competencies: 1. The student is aware of the value of his work, respect the principles of teamwork, takes responsibility for collaborative work - [K_K03++]	•	jectives of the course:			
Knowledge: 1. The student has a basic knowledge of technical electrodynamics - [K_W02++; K_W06+++] 2. The student has structured knowledge of numerical methods and software for the numerical calculation of electromagnetic transducers - [K_W02+++; K_W06+++; K_W12+] Skills: 1. The student will be able to use known methods and models for field analysis and synthesis of simple systems with the electromagnetic field - [K_U10++; K_U11+++] 2. The student will be able to prepare a report on the numerical calculations of electromechanical transducers and systems with the electromagnetic field using professional software - [K_U08++] Social competencies: 1. The student is aware of the value of his work, respect the principles of teamwork, takes responsibility for collaborative work - [K_K03++]				nomena in electrical devices as	
 The student has a basic knowledge of technical electrodynamics - [K_W02++; K_W06+++] The student has structured knowledge of numerical methods and software for the numerical calculation of electromagnetic transducers - [K_W02+++; K_W06+++; K_W12+] Skills: The student will be able to use known methods and models for field analysis and synthesis of simple systems with the electromagnetic field - [K_U10++; K_U11+++] The student will be able to prepare a report on the numerical calculations of electromechanical transducers and systems with the electromagnetic field using professional software - [K_U08++] Social competencies: The student is aware of the value of his work, respect the principles of teamwork, takes responsibility for collaborative work - [K_K03++] 	Study outco	omes and reference to the	educational results for	a field of study	
 2. The student has structured knowledge of numerical methods and software for the numerical calculation of electromagnetic transducers - [K_W02+++; K_W06+++; K_W12+] Skills: The student will be able to use known methods and models for field analysis and synthesis of simple systems with the electromagnetic field - [K_U10++; K_U11+++] The student will be able to prepare a report on the numerical calculations of electromechanical transducers and systems with the electromagnetic field using professional software - [K_U08++] Social competencies: The student is aware of the value of his work, respect the principles of teamwork, takes responsibility for collaborative work - [K_K03++] 	-				
transducers - [K_W02+++; K_W06+++; K_W12+] Skills: 1. The student will be able to use known methods and models for field analysis and synthesis of simple systems with the electromagnetic field - [K_U10++; K_U11+++] 2. The student will be able to prepare a report on the numerical calculations of electromechanical transducers and systems with the electromagnetic field using professional software - [K_U08++] Social competencies: 1. The student is aware of the value of his work, respect the principles of teamwork, takes responsibility for collaborative work - [K_K03++]					
 The student will be able to use known methods and models for field analysis and synthesis of simple systems with the electromagnetic field - [K_U10++; K_U11+++] The student will be able to prepare a report on the numerical calculations of electromechanical transducers and systems with the electromagnetic field using professional software - [K_U08++] Social competencies: The student is aware of the value of his work, respect the principles of teamwork, takes responsibility for collaborative work - [K_K03++] 	transducers - [K_W02+++; k		s and software for the numerica	al calculation of electromagnetic	
electromagnetic field - [K_U10++; K_U11+++] 2. The student will be able to prepare a report on the numerical calculations of electromechanical transducers and systems with the electromagnetic field using professional software - [K_U08++] Social competencies: 1. The student is aware of the value of his work, respect the principles of teamwork, takes responsibility for collaborative work - [K_K03++]	Skills:				
with the electromagnetic field using professional software - [K_U08++] Social competencies: 1. The student is aware of the value of his work, respect the principles of teamwork, takes responsibility for collaborative work - [K_K03++]			for field analysis and synthesis	s of simple systems with the	
1. The student is aware of the value of his work, respect the principles of teamwork, takes responsibility for collaborative work - [K_K03++]				nical transducers and systems	
work - [K_K03++]					
		ne value of his work, respect the pr	inciples of teamwork, takes res	sponsibility for collaborative	
		ntify the problem and choose the c	correct way to solve the subject	of electrodynamics - [K_K06++]	
Assessment methods of study outcomes		Assessment metho	ds of study outcomes		

Lecture:

-assessment of knowledge and skills by the completion of a written test (solving problem), -continuous evaluation for each course (rewarding activity and quality of the expression).

Laboratory:

- end test and favoring the knowledge necessary to complete tasks during laboratory,

- continuous evaluation for each course rewarding gain skills,
- assessment of skills related to the practical implementation of lecture knowledge to solve laboratory tasks,
- evaluation of the reports from performed exercise.

Extra points for the activity in the classroom, and in particular for:

-discussion and proposition of additional aspects of the subjects,

-effectiveness of the application of the knowledge gained during solving the given problem,

-ability to work within a team, which performs the task detailed at the laboratory,

-quality and diligence of the developed reports.

Course description

The field approach in the description of electromagnetic phenomena. Differential, integral and circuit forms of electromagnetic field equations. Boundary conditions. Two dimensional (2D) fields. Methods of electromagnetic field analysis, field and potential formulations. Integral and finite difference methods of 2D electro and magnetostatic field analysis. Finite element method. Network models of systems with magnetic and electric field. Inducted currents. Electromagnetic shields. Field method of electromagnetic torques and forces calculation. Electromagnetic levitation. Equations of 2D transient field. Numerical methods of solving diffusion equation. Implicit and explicit schemes, Crank-Nicholson method. Professional software for electromagnetic field analysis in electrical devices.

Basic bibliography:

1. Feynman L. S., Feynmana wykłady z fizyki. Elektrodynamika, fizyka ośrodków ciągłych, t. 2.2, PWN Warszawa 2012

2. Brzezowska J., Gajewski A., Wprowadzenie do elektrodynamiki klasycznej, WPK, Kraków, 2010

3. Demenko A., Obwodowe modele układów z polem elektromagnetycznym, WPP, Poznań, 2004

4. Bastos J., Sadowski J., Electromagnetic Modeling by Finite Element Methods, Marsel Dekker Inc., 2003

5. Nowak L., Modele polowe przetworników elektromechanicznych w stanach nieustalonych, WPP, Poznań, 1999

6. Bossavit A., Computational electromagnetism, variational formulations, complementarity, edge element method, Academic Press Limited, London, 1998

7. Demenko A., Symulacja dynamicznych stanów pracy maszyn elektrycznych w ujeciu polowym, WPP, Poznań, 1997

8. Turowski J., Elektrodynamika techniczna, Wyd.II, WNT, Warszawa, 1993

Additional bibliography:

1. Jian-Ming J., Theory and Computation of Electromagnetic Fields, John Wiley and Sons, 2010

2. Sikora J., Numeryczne metody rozwiązywania zagadnień brzegowych, WUPL., Lublin 2009

3. Dolezel I., Karban P., Solin P., Integral methods in low-frequency electromagnetics, Wiley and Son, New Jersey, 2009

4. Binns K., Lawrenson P., Trowbridge C., The analytical and numerical solution of electric and magnetic fields, John Wiley and Sons, 1992

Result of average student's workload

Activity	Time (working hours)
1. Lectures	15
2. Laboratories	30
3. Participate in the consultations on the lecture	3
4. Participate in the consultations on the laboratories	5
5. Preparation for laboratory	15
6. Homework preparation	20
Student's workload	

ludent's workload

Source of workload	hours	ECTS
Total workload	88	3
Contact hours	53	2
Practical activities	65	2