STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Electromagnetic energy conversion**		Code **1010312421010325645**
Field of study **Power Engineering**	Profile of study (general academic, practical) **general academic**	Year /Semester **1 / 2**
Elective path/specialty **-**	Subject offered in: **Polish**	Course (compulsory, elective) **obligatory**
Cycle of study: **Second-cycle studies**	Form of study (full-time,part-time) **full-time**	
No. of hours Lecture: **15** Classes: **-** Laboratory: **15** Project/seminars: **-**		No. of credits **2**
Status of the course in the study program (Basic, major, other) **other**	(university-wide, from another field) **university-wide**	
Education areas and fields of science and art **technical sciences** **Technical sciences**		ECTS distribution (number and %) **2 100%** **2 100%**

Responsible for subject / lecturer:

dr hab. inż. Paweł Idziak
email: pawel.idziak@put.poznan.pl
tel. 61 665 2781
Faculty of Electrical Engineering
ul. Piotrowo 3A 60-965 Poznań

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Knowledge of methods of analysis of chosen phenomena occurring in electromagnetic converters used in power engineering; knowledge of methods of generation of rotation and transformation electromotive force, various variants of transformer equivalent circuits; basic knowledge relating to the method of the symmetrical components; knowledge of construction of electromagnets, DC motors, induction and synchronous machines.
2	**Skills**	Skill of analysis of simple electric and magnetic circuits, determination of parameters of equivalent circuits of the transformer, the induction machine, the synchronous generator and skill of connection of electric circuits and realization of measurements of electrical and mechanical quantities.
3	**Social competencies**	Awareness of necessity of knowledge and skills extension. Ability to submission to rules standing during lectures and laboratory classes. Skill of communication with the cooperating students and realization of common tasks.

Assumptions and objectives of the course:

Learning of methods of analysis of chosen phenomena in electromagnetic converters used in power engineering and principles of operation, characteristics, exploitation properties of transformers, synchronous machines and chosen electromagnetic actuators.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. have knowledge of power electronics systems for quality improvement and efficient electric energy transmission; have basic knowledge of means of heat transfer, electrothermal changes occurring in electrical engineering and electric heating engineering; skill of methods of temperature measurement - [K_W08++ K_W12+]

Skills:

1. choose the calculation method, use and realize the programming proper to solving the well-defined problem taking into account the new achievements of techniques and technologies - [K_U08++]
2. have preparation necessary to work in industrial environment and know rules of work safety - [K_U12++]
3. determine directions of the subsequent learning and realize self-education process - [K_U11++]

Social competencies:

1. have competences: correctly identify and decide within problems connected with state power engineering safety - [K_K02++]

Assessment methods of study outcomes

Lectures:

? evaluation of knowledge and skills presented in the written test.

Laboratory classes:

? test and awarding knowledge during realization of laboratory classes on electrical machines,

? evaluation of student activity and appraisal both of increase of his knowledge, skills and social competences connected with activities in teamwork,

? evaluation of knowledge and skills related to the individual laboratory class, appraisal of the report.

Obtainment of the additional points in connection with activity, in particular:

? preparation of answers on questions and problems given by the lecturer,

? skill of co-operation in the teamwork in laboratory,

? annotations connected with improvement of didactic materials,

? care and aesthetics of reports and problems elaborations within own learning.

Course description

Models of electromagnetic converters. Laws of electromagnetic energy conversion. Transformations of circuit models of electromagnetic converters: phasic, commutator and Fortescue. Generator operation of induction machine. Modern synchronous generators of different type: construction and principle of operation, vector diagram, equivalent circuit, problems od analysis of short-circuit states of synchronous generator, operation of synchronous generator in power network. Transformer operation at asymmetrical supply or asymmetrical load. Electromagnetic actuators, electromagnets. Energy conversions in transient states of induction and synchronous machines.

Basic bibliography:

1. Maszyny Elektryczne w Energetyce, J. Anuszczyk, WNT, Warszawa 2005.

2. Teoria Maszyn Elektrycznych, W. Latek, wyd. II, WNT Warszawa 1987.

3. Maszyny Elektryczne w Elektroenergetyce, W. Matulewicz, PWN, Warszawa 2005.

4. Dynamika Maszyn Elektrycznych Prądu Przemiennego, W. Paszek, Helion, Gliwice 1998.

5. Electro-Mechanical Energy Conversion with Dynamics of Machines, R. Das Beegamudre, John Wiley & Sons, Inc, New York, 1988.

6. Electric Machines, Steady-State Theory and Dynamic Performance, M. S. Sarma, West Publishing Company, 1994.

Additional bibliography:

1. Praca zbiorowa, Poradnik Inżyniera Elektryka, Praca zbiorowa, Tom 1 i 2, WNT Warszawa 2013.

Result of average student's workload

Activity	Time (working hours)
1. participation in lectures	15
2. participation in laboratory classes	15
3. participation in consultations	8
4. preparation to laboratory classes and elaboration of reports	10
5. preparation to written test	8
6. participation in the test	1
7. preparation of reports	9

Student's workload

Source of workload	hours	ECTS
Total workload	66	2
Contact hours	38	1
Practical activities	34	1