STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Electrical machines		**1010321331010320050**
Field of study: **Electrical Engineering**	Profile of study (general academic, practical): **(brak)**	Year /Semester: **2 / 3**
Elective path/specialty: **-**	Subject offered in: **Polish**	Course (compulsory, elective): **obligatory**
Cycle of study: **First-cycle studies**	Form of study (full-time,part-time): **full-time**	
No. of hours: Lecture: **30** Classes: **-** Laboratory: **-** Project/seminars: **-**		No. of credits: **3**
Status of the course in the study program (Basic, major, other): **(brak)**	(university-wide, from another field): **(brak)**	
Education areas and fields of science and art: **technical sciences** **Technical sciences**		ECTS distribution (number and %): **3 100%** **3 100%**

Responsible for subject / lecturer:

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Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Basic knowledge of electromagnetism and electrical circuits analysis.
2	**Skills**	Skill of analysis of simple electrical circuits of two degrees of freedom and solving systems of differential linear equations.
3	**Social competencies**	Awareness of necessity of knowledge and skills extension. Ability to submission to rules standing during lectures in big group. Skill of communication with the cooperating students and lecturers.

Assumptions and objectives of the course:

Learning of construction, principles of operation, characteristics, exploitation properties and basic methods of analysis of typical operation states of transformers and induction machines. Learning of basic methods of calculation of magnetic circuits in electromagnetic converters.

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

Knowledge:

1. have well-ordered knowledge related to electromagnetism and essentials of the theory of the electromagnetic field - [K_W06++]

2. have well-ordered and completed by theory knowledge of construction and principles of operation of transformers and electrical machines; have knowledge of exploitation of technical systems - [K_W13+++]

Skills:

1. design a simple electric system within various applications using proper methods, techniques and - [K_U03+]

2. use the known methods, mathematical models and computer simulations for analysis and estimation of elements and electric systems operation - [K_U10++]

Social competencies:

1. . have awareness of importance and understanding of different aspects and results of electrical engineer activities, taking into consideration influence on environment; awareness of responsibility for decisions - [K_K02++]

2. think and work by creative way within the electrical engineering - [K_K04++]

Assessment methods of study outcomes

Lecture accepted on the ground of written tests checking knowledge and studentclassroom activity (test is scored)

Course description

Magnetic circuits. Transformers ? no-load state, equivalent circuit, transformer operation at load, three-phase transformers, parallel operation, selected transient states. The elements of electromagnetic energy conversion. Electrical machines ? fundamental definitions: distributed windings, rotating magnetic fields, electromotive force induced by rotating magnetic fields, winding factors. Induction machines: construction and principle of operation, equivalent circuit, dependence of torque on rotational speed, machines with cage rotor, skin effect in bars, speed control. Starting and braking operation of induction machine. Single-phase induction motors.

Teaching methods - lectures with multimedia presentations that are supported by blackboard exercises.

Basic bibliography:

1. A. M. Plamitzer, Maszyny Elektryczne, wyd. VII, WNT Warszawa, 1982.

2. W. Karwacki, Maszyny Elektryczne, Wyd. Pol. Wrocławskiej, Wrocław, 1993.

3. M. S. Sarma, Electric Machines, Steady-State Theory and Dynamic Performance, West Publishing Company, wyd. 2, 1994 i wyd. następne

4. P. Staszewski, W. Urbański, Zagadnienia obliczeniowe w eksploatacji maszyn elektrycznych. Oficyna Wyd. Pol . Warszawskiej, Warszawa. 2011

5. W. Przyborowski, G. Kamiński, Maszyny Elektryczne, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa, 2014.

Additional bibliography:

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

2. Praca zbiorowa, Poradnik Inżyniera Elektryka, Tom 2, wyd 3, WNT Warszawa 2009.

Result of average student's workload

Activity	Time (working hours)
1. participation in lectures	30
2. consultations related to lectures	4
3. consultations related to project	6
4. realization of project problems	14
5. preparation to subject tests	15

Student's workload

Source of workload	hours	ECTS
Total workload	69	3
Contact hours	40	2
Practical activities	0	0