STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Electrical machines**		Code **1010321341010320050**
Field of study **Electrical Engineering**	Profile of study (general academic, practical) **(brak)**	Year /Semester **2 / 4**
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: **15** Laboratory: **45** Project/seminars: **-**		No. of credits **6**
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 %) **6 100%** **6 100%**

Responsible for subject / lecturer:

Andrzej Demenko
email: Andrzej.Demenko@put.poznan.pl
tel. 616652126
Wydział Elektryczny
ul. Piotrowo 3A, 60-965 Poznań

Responsible for subject / lecturer:

Lech Nowak
email: Lech.Nowak@put.poznan.pl
tel. 616652380
Wydział Elektryczny
ul. Piotrowo 3A, 60-965 Poznań

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Knowledge of methods of electric and magnetic circuits analysis. Knowledge of methods of magnetic field and electromotive force generation. Acquirements of the construction and operation of transformers and induction machines. Cognizance within the framework of methodology.
2	**Skills**	Ability to analysis of simple electric and magnetic circuits and determination of equivalent ciruit parameters of the transformer and the induction motor. Ability to circuits connection and realization of measurements of electric and mechanical quantities.
3	**Social competencies**	Awareness of necessity of knowledge and acquirements extension. Ability to submission to rules standing during lectures and laboratory class. Ability to communicate with the teamwork during lectures and exercises.

Assumptions and objectives of the course:

Getting to know construction, principles of operation, characteristics, exploitation properties and basic methods of analysis of typical operation states of synchronous, commutator and special machines. Learning the fundamental methods of investigation and measurements of electrical machines.

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

Knowledge:

1. The student has knowledge of design, construction and principle of operation of electrical power engineering devices. - [K_W08++]

2. The student has both well-ordered and theory aided knowledge of construction and principle of operation of transformers, electrical machines and knowledge of technical systems exploitation - [K_W13+++]

Skills:

1. prepare and make short presentation on a subject of the problem connected with electrical engineering - [K_U08+]

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

3. plan and realize the simulation and measurements of basic characteristic quantities for electric systems; present the obtained results both in the numerical and graphical form; make interpretation and draw proper conclusions - [K_U02++]

Social competencies:

1. have awareness of importance and understand different aspects and results of electrical engineer activities - also influence on environment - and to be responsible for taking decisions - [K_K02++]

2. think and to be active by constructive way within electrical engineering - [K_K04++]

Assessment methods of study outcomes

Lectures and exercise classes

? evaluation of knowledge and skills presented in the written exam,

? frequent appraisal during exercise classes (the awarding student activity),

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,

? effectiveness and brilliance during exercise classes at problems solving,

? 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

Induction generator. Synchronous machines: construction and principle of operation, vector diagram, equivalent circuit, no-load and short-circuit of synchronous generator, steady-state characteristics, salient-pole machines, synchronous machine operation in power network, machines with permanent magnets, starting of synchronous motors, damping windings, selected transient states. Stepper motors. Direct-current commutator machines: construction and principle of operation, connection systems of windings, magnetic field in air-gap, armature reaction, commutation, compensating winding, generator characteristics, motor characteristics, control of motor speed, selected transient states. Alternating-current commutator motors. Brushless direct-current machines. Servo-motors. Investigations and measurements of electrical machines. Determination of parameters and characteristics of electrical machines on the ground of measurements.

Teaching methods - lectures with multimedia presentations that are supported by blackboard exercises and laboratory 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 Wydawnictwo Politechniki 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. participation in exercise classes	15
3. participation in laboratory classes	45
4. participate in consultations on the lectures	4
5. preparation to exams	30
6. preparation to laboratory classes	30
7. preparation of reports within laboratory classes	9
8. consultations related to exercise classes	5
9. consultations related to laboratory classes	5
10. realization of design problems	15
11. preparation to exercise classes	10

Student's workload

Source of workload	hours	ECTS
Total workload	198	6

Contact hours	104	4
Practical activities	99	4