POZNAN UNIVERSITY OF TECHNOLOGY

EUROPEAN CREDIT TRANSFER AND ACCUMULATION SYSTEM (ECTS)

COURSE DESCRIPTION CARD - SYLLABUS

Course name
Electrical machines [N2Elenerg1>ME]

Course

Field of study	Year/Semester
Electrical Power Engineering	1/2
Area of study (specialization)	**Profile of study**
Smart Grids	general academic
Level of study	**Course offered in**
second-cycle	polish
Form of study	**Requirements**
part-time	compulsory

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
10	20	0
Tutorials	**Projects/seminars**	
0	0	

Number of credit points

3,00

Coordinators

dr hab. inż. Paweł Idziak
pawel.idziak@put.poznan.pl

Lecturers

dr hab. inż. Paweł Idziak
pawel.idziak@put.poznan.pl

dr inż. Łukasz Knypiński
lukasz.knypinski@put.poznan.pl

dr hab. inż. Wiesław Łyskawiński
wieslaw.lyskawinski@put.poznan.pl

Prerequisites

Knowledge of methods of analysis of electrical and magnetic circuits. Knowledge of electrical materials. Knowledge of mathematical analysis and description of physical phenomena by differential equations of the first and second degree. Knowledge of the construction and operating principles of transformers and electrical rotating machines. Knowledge of measurements of selected electrical and mechanical parameters specific to electromechanical and electromagnetic energy transducers. Awareness of the need to increase knowledge and skills. Ability to comply with the rules of during lecture and laboratory classes. Ability to communicate with the immediate environment during classes.

Course objective

The aim of the subject is: to acquire in-depth knowledge in the analysis of selected operating states of electromagnetic and electromechanical transducers commonly used in domestic and foreign electricity and transport systems; habit of constantly updating acquired skills and knowledge.

Course-related learning outcomes

Knowledge:
he/she has in-depth knowledge of mechanics, thermodynamics, fluid mechanics, solid physics, electrical and mechanical engineering laws and areas of practical use of elements of electromagnetic field theory and circuit theory in power engineering.
he/she has knowledge of the operation and use of equipment for the processing and conversion of electrical energy.

Skills:
he/she can plan and conduct a research experiment using modern diagnostic techniques, analyze the results and produce documentation from the studies carried out.
he/she can constructively undertake design work in the wider electricity industry.

Social competences:
he/she can work with others as part of teamwork to solve an engineering problem, as well as take on leadership functions in these teams. he/she has aware of the importance of electricity for the country and society and recognises its shared responsibility for its development in line with environmental requirements; is ready to act responsibly as a designer and diagnostician of power and measuring equipment.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Lecture: passing on the basis of a knowledge test during a written exam. The crediting of the lecture is attested by ratings.
Laboratory exercises: knowledge checking is carried out in three stages, through: (a) evaluation of the preparation for laboratory exercises; (b) an assessment of the activity and increase in knowledge and skills during laboratory exercises; (c) an assessment of the reports on the laboratory activities carried out. The laboratory"s credit is attested by ratings.

Programme content

Lecture: Magnetic circuits. The basics of electromagnetic energy processing. Three-phase transformers, parallel operation, selected transient states. Resistance to stroke short circuits - gradation of insulation. Synchronous machines - equations of synchronous generator states , magnetic and electrical phenomena during the short circuit of the generator, stroke short circuit current, the effect of the method of excitation on the shape of the output voltage curve of the generator with cylindrical rotor. The phenomenon of rocking the generator working on the network.
Asynchronous machines - of work of induction machine as generator with a cage rotor, operation on a dedicated network, two-sided generators, cooperation of an induction generator with the power grid. Synchronized asynchronous machines - construction, operating principle, operational characteristics. Permanent magnet machines, synchronous motor start-up, damping windings, selected transients. Stepper motors and positioning actuators. Thermal phenomena in electrical machines - heat dissipation systems, methods of measuring selected parameters characteristic of controlled heat transmission.
Laboratory exercises: Parallel work of transformers, determination of the system and group of connections of the three-phase transformer, operation of a three-phase transformer with asymetrical load, determination of characteristic parameters of the synchronous open-pole generator, synchronous machines excited by permanent magnets - motor and generator operation, synchronized induction machine operation, selected energy automation actuators - rotation transformers, selsins, work of induction generator on a network, autonomous generator operation of the induction machine, measurement of cooling air expenditure by calorimetric method, thermal phenomena in electrical machines, influence of the shape of the excitation current of the synchronous generator on the share of higher harmonics in output voltages.

Teaching methods

Lecture with multimedia presentation supplemented by examples on the board and examples for self-realization.
Laboratory: implementation of measurements and discussions on the results of obtained studies, detailed review of reports by the presenter.

Bibliography

Basic
1. J. Anuszczyk, Maszyny Elektryczne w Energetyce, WNT Warszawa, 2005.
2. W. Karwacki, Maszyny Elektryczne, Wyd. Pol. Wrocławskiej, Wrocław, 1994.
3. M. S. Sarma, Electric Machines, Steady-State Theory and Dynamic Performance, West Publishing Company, wyd. 2, 1996.
4. P. Staszewski, W. Urbański, Zagadnienia obliczeniowe w eksploatacji maszyn elektrycznych. Oficyna Wydawnicza Pollitechniki Warszawskiej, Warszawa 2009.
5. W. Przyborowski, G. Kamiński, Maszyny Elektryczne, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2014.
6. J. Gieras, Electrical Machines, Fundamentals of Electromechanical Energy Conversion, Taylor&FrancisInc, 2016.
7. G. Kamiński, W. Przyborowski, A. Biernat, J. Szczypior, Badania laboratoryjne maszyn elektrycznych, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2018.
Additional
1. W. Latek, Teoria Maszyn Elektrycznych, wyd. II, WNT Warszawa, 1987.
2. Praca zbiorowa, Poradnik Inżyniera Elektryka, Tom 2, wyd.3, WNT Warszawa 2009.

Breakdown of average student's workload

	Hours	ECTS
Total workload	80	3,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	50	2,00