COURSE DESCRIPTION CARD - SYLLABUS

Course name
Magnetic and electro-insulating materials [S2Elmob1>MMiE]

Course

Field of study
Electromobility

Year/Semester
1/1

Area of study (specialization)
–

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
0

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

dr hab. inż. Dorota Stachowiak prof. PP
dorota.stachowiak@put.poznan.pl

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

Lecturers

Prerequisites

A student starting this subject should have basic knowledge of: electromagnetic field theory, electrotechnics and electrodynamics, knowledge of energy converter design. He/she should also have the ability for effective self-education in the field related to the chosen field of study and be aware of the need to broaden his/her competences and knowledge.

Course objective

The fundamental aim is to learn about magnetic and electro-insulating materials and their applications.

Course-related learning outcomes

Knowledge:
Has an in-depth knowledge of magnetic and electro-insulating materials and of coupled phenomena in systems with electric, magnetic, thermal and mechanical fields

Skills:
Be able to acquire information (in Polish and English) from a variety of sources, interpret, critically evaluate, analyse and synthesise it, draw conclusions and formulate and justify opinions
Is able to integrate knowledge from various sources and related disciplines when formulating and implementing engineering projects

Social competences:
Understands that, in the technical field, knowledge and skills rapidly devolve, requiring constant updating

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture:
-assessment of knowledge and skills by the completion of a written test,
-continuous evaluation for each course (rewarding activity and quality of the expression).
Extra points for the activity in the classroom, and in particular for:
-discussion and proposition of additional aspects of the subjects,
- comments related to the improvement of teaching materials,
- quality and diligence of the developed reports.

Programme content

Insulating materials. Conductive materials: conductors and "semiconductors".
Magnetic materials: soft magnetic and hard magnetic materials. Special materials: piezoelectric, magnetostrictive, shape memory and others.

Course topics

Insulating materials: role of insulating materials in the electrical industry; mechanical and electrical properties of insulating materials, absorption coefficient; types of materials: varnishes and impregnants, adhesives and binders. Admixture materials to increase thermal conductivity.
Conductive materials: conductors and "semiconductors"; mechanical and electrical properties of conductive materials.
Magnetic materials; division of soft magnetic and hard magnetic materials, magnetic and electrical properties of ferro- , ferri-, para- and di-magnetic materials.
Effect of mechanical treatment on properties of magnetic materials. Effects of magnetic and electric fields on the properties of magnetic circuits.
Methods of testing the performance properties of circuits made of soft and hard magnetic materials.
Special materials: piezoelectric, magnetostrictive, shape memory and others.

Teaching methods

Lecture with multimedia presentation supplemented with examples given on the board. Interactive lecture with questions to students. Student activity is taken into account during the course of the assessment process.
Lecture conducted on-line with using synchronous access methods.

Bibliography

Basic:
Anuszczyk Jan Wojciech, Pluta Wojciech Antoni, Ferromagnetyki miękkie w polach obrotowych. Badania i właściwości. WNT-Wydawnictwa Naukowo-Techniczne Sp.z o.o. 2009
Wac-Włodarczyk A., Materiały magnetyczne. Modelowanie i zastosowania. Politechnika Lubelska, Lublin 2012.
Florkowska B., Furgał J., Szczerbiński M., Włodek R., Zydroń P., Materiały Elektrotechniczne, Podstawy teoretyczne i zastosowania, Wyd. AGH, Kraków 2010
Marcin Leonowicz, Jerzy J. Wysłocki, Współczesne magnesy. Technologie, mechanizmy koercji, zastosowania. WNT -Wydawnictwa Naukowo-Techniczne Sp.z o.o. 2019.
Andrzej Szewczyk, Andrzej Wiśniewski, Roman Puźniak, Henryk Szymczak, Magnetyzm i Nadprzewodnictwo, Wydawnictwo Naukowe PWN, Warszawa 2012.

Jiles D., Magnetism and magnetic materials, Capman&Hall, 1998.
Kazimierczuk M., High-frequency magnetic components, John Wiley and Sons, 2009.
Fiorillo F., Measurement and characterization of magnetic materials, Elsevier, 2004.

Additional:
Celiński Z., Materiałoznawstwo elektrotechniczne, Wydawnictwo Politechniki Warszawskiej,1998
Stachowiak Dorota, Demenko Andrzej, Finite Element and Experimental Analysis of an Axisymmetric Electromechanical Converter with a Magnetostrictive Rod, Energies, vol. 13, no. 5, p. 1230, https://doi.org/10.3390/en13051230, 2020.
Stachowiak D., The influence of magnetic bias and prestress on magnetostriction characteristics of a giant magnetostrictive actuator, Przegląd Elektrotechniczny, R. 89 Nr 4/2013, pp. 233-236.
Kurzawa Milena, Stachowiak Dorota, Investigation on thermo-mechanical behavior in shape memory alloy actuator. Archives of Electrical Engineering, vol. 66, no. 4, pp. 751-760, DOI: https://doi.org/10.1515/aee-2017-0057, 2017.
Stachowiak Dorota, Idziak Paweł, Badanie właściwości magnetycznych materiałów magnetostrykcyjnych i stali konstrukcyjnych, Poznan University of Technology Academic Journals. Electrical Engineering, Issue 85, s. 95-106, 2016.
Fausto Fiorillo, Measurements of Magnetic Materials, Metrologia 47, 2010, pp. 114-142.
Tumański S., Modern magnetic materials - the review, Przegląd Elektrotechniczny, 4/2010, pp. 1-15.
Sievert J.: Badania właściwości magnetycznych blach elektrotechnicznych. Przegląd Elektrotechniczny 5/2005.

Breakdown of average student's workload

	Hours	ECTS
Total workload	55	2,00
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)	25	1,00