



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Magnetic and electrical insulating materials [S2Elmob1-SPE>MMiE]

### Course

Field of study  
Electromobility

Year/Semester  
1/2

Area of study (specialization)  
Energy Processing Systems

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  
0

Laboratory classes  
15

Other (e.g. online)  
0

Tutorials  
0

Projects/seminars  
0

### Number of credit points

1,00

### Coordinators

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### Lecturers

### Prerequisites

The student has knowledge about the properties of magnetic, electric and insulating materials and has knowledge in the field of electrical and magnetic measurements, as well as the ability to work in a laboratory group.

### Course objective

- learning about selected methods of testing the performance characteristics of circuits made of soft and hard magnetic materials, - acquiring basic skills in the area of testing the magnetic and insulating properties of various materials.

### Course-related learning outcomes

Knowledge:

Has in-depth knowledge of magnetic and electrically insulating materials, as well as coupled phenomena in systems with electric, magnetic, thermal and mechanical fields.

Has knowledge of development trends, new achievements in electromobility and dilemmas of modern civilization, especially in terms of the influence of changes in vehicle power supply on the natural environment.

Skills:

Can obtain information (in Polish and English) from various sources, make their interpretation, critical evaluation, analysis and synthesis, as well as 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:

He understands that in the area of technology, knowledge and skills devolve quickly, which requires their continuous supplementation.

### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

- knowledge test during laboratory exercises,
- assessment of student activity and assessment of the increase in knowledge, skills and social competences,
- evaluation of research reports.

### Programme content

Investigation of the basic characteristics and properties of systems with magnetic and electrical insulating materials

### Course topics

- measurement of magnetic flux density, magnetic field strength (magnetic flux meter),
- determination of primary magnetization characteristics and peak characteristics,
- ballistic technique used to test solid materials,
- determination of the influence of forces acting on the magnetic circuits of electromagnetic transducers,
- thermomagnetic materials,
- ferromagnetic liquids,
- magnetostrictive effect (terfenol test).

### Teaching methods

Discussions on the obtained research results, detailed review of reports by the lecturer, demonstrations.

### Bibliography

Basic:

Anuszczyk J. W., Pluta W. A., Ferromagnetyki miękkie w polach obrotowych. Badania i właściwości. WNT-Wydawnictwa Naukowo-Techniczne Sp.z o.o. 2009.

Biełow K.P., Zjawiska w materiałach magnetycznych, PWN Warszawa, 1962.

Kuryłowicz J. : Badania materiałów magnetycznych. Warszawa, WNT 1962.

Leonowicz M., Wystocki J. J., Współczesne magnesy. Technologie, mechanizmy koercji, zastosowania. WNT -Wydawnictwa Naukowo-Techniczne Sp.z o.o. 2019.

Szewczyk A., Wiśniewski A., Puźniak R., Szymczak H., Magnetyzm i Nadprzewodnictwo, Wydawnictwo Naukowe PWN, Warszawa 2012.

Tumański S.: Technika pomiarowa, WNT, Warszawa 2007.

Kazimierczuk M., High-frequency magnetic components, John Wiley and Sons, 2009.

Additional:

Wac-Włodarczyk A., Materiały magnetyczne. Modelowanie i zastosowania. Politechnika Lubelska, Lublin 2012.

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.

Fiorillo F., 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.

Nałęcz M., Jaworski J.: Miernictwo magnetyczne. Warszawa, WNT 1968.

Jiles D., Magnetism and magnetic materials, Capman&Hall, 1998.

Fiorillo F., Measurement and characterization of magnetic materials, Elsevier, 2004.

### Breakdown of average student's workload

	Hours	ECTS
Total workload	28	1,00
Classes requiring direct contact with the teacher	15	0,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	13	0,50