



COURSE DESCRIPTION CARD - SYLLABUS

Course name

Design of electrical machines for electromobility [S2Elmob1-SPE>PMEdE1]

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

15

Laboratory classes

0

Other

0

Tutorials

0

Projects/seminars

15

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

Possession of basic knowledge of electrical engineering and electromagnetism. Ability to analyze simple magnetic circuits. Knowledge of the basic parameters and properties of magnetic and electroinsulating materials and the effect of temperature on their change. Knowledge of basic methods of describing electromagnetic, mechanical and thermal phenomena, in particular, knowledge of basic analytical and numerical methods of solving differential equations describing phenomena in electromagnetic transducers.

Course objective

Acquisition of knowledge and skills of methods of synthesis of magnetic circuits of electromechanical converters taking into account the requirements for electric vehicle traction drives.

Course-related learning outcomes

Knowledge:

Has expanded and deepened knowledge of selected branches of mathematics necessary to describe

components, systems and systems used in electromobility

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

Has advanced and in-depth knowledge of the design, diagnosis and operation of propulsion systems of hybrid and electric vehicles including traction vehicles; knows the basic processes occurring in the life cycle of technical systems of hybrid and electric vehicles including traction vehicles

Skills:

Able to apply knowledge of the latest technical and technological developments in the design of non-standard devices and systems in the field of electromobility

Is able, when determining the functionality and design of electric vehicle systems and systems, to apply adequate analytical, simulation and experimental methods, assessing in advance their suitability and limitations, as well as adapting them to the specifics of the problem or the need to take into account unpredictable operating conditions

Is able, in the formulation and implementation of engineering projects, to integrate knowledge from various sources and related disciplines

Social competences:

Understands that in the field of technology, knowledge and skills are rapidly devaluing which requires their constant replenishment

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture:

passed on the basis of a test of knowledge during a written examination during the examination session and on the basis of student activity during the class. Credit for the lecture is certified by grades

Project:

- the credit of the project classes is based on the current control of progress, activity during the classes,
- realization of the final project performed in groups of several people,
- verification of the correctness of the completed project task in groups.

Programme content

Phenomena occurring in magnetic circuits of rotating electrical machines. Sizing of main dimensions.

Thermal phenomena in electrical machines. Dynamic interactions occurring in transient states.

Requirements and limitations arising from the application in traction drive systems used in electromobility.

Course topics

Lecture:

Phenomena occurring in magnetic circuits of rotating electric machines: radial and tangential forces occurring in the air gap of an AC machine, slot leakage flux, leakage flux around end connections, magnetostrictive forces. Sizing of the magnetic circuit of an electric machine for assumed values of current load and magnetic flux density. Types of windings of AC electrical machines. Thermal phenomena in electrical machines. Dynamic loads occurring in transients.

Project:

- Design of a transformer dedicated to operation in a converter system of a frequency converter.

Teaching methods

Lecture:

- lecture with multimedia presentation supplemented by examples given on the blackboard,
- lecture conducted in an interactive manner with formulation of questions to a group of students,
- taking into account the activity of students during the class in the final assessment.

Project:

- credit for project classes is given on the basis of current control of progress, activity in class,
- realization of the final project performed in groups of several people,
- verification of the correctness of the completed project task in groups.

Bibliography

Basic:

1. T. Glinka, "Maszyny elektryczne wzbudzone magnesami trwałymi", Wydawnictwo Naukowe PWM, 2018
2. M. Dąbrowski, "Projektowanie maszyn elektrycznych prądu przemiennego", Wydawnictwa Naukowo-Techniczne, Warszawa, 1994
3. Design of Rotating Electrical Machines, 2nd Edition, Juha Pyrhonen, Tapani Jokinen, Valeria Hrabovcova, ISBN: 978-1-118-58157-5, December 2013, 616 Pages.

Additional:

1. T. Glinka, "Ćwiczenia tablicowe z maszyn elektrycznych i transformatorów", Wydawnictwa Naukowe PWN SA, Warszawa, 2022
2. J. Gieras, M. Win, Permanent Magnet Motor Technology. Design and Applications. M. Dekker, Inc., New York, 2002
3. Electric Vehicle Machines and Drives: Design, Analysis and Application, K. T. Chau, ISBN: 978-1-118-75252-4, August 2015, Wiley-IEEE Press, 375 Pages.

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