COURSE DESCRIPTION CARD - SYLLABUS

Course name
Exploitation and diagnostics of electric drive systems [S1Elmob1>EiDEUN2]

Course

Field of study
Electromobility

Year/Semester
4/7

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

Knowledge - Basic knowledge of electronics, power electronics and microprocessor technology. Skills - The ability to effectively self-educate in a field related to the chosen field of study; the ability to make the right decisions when solving simple tasks and formulating problems in the field of power electronic drive systems. Competences - The student is aware of expanding his competences, demonstrates readiness to work in a team, the ability to comply with the rules applicable during lectures and laboratories.

Course objective

Getting to know the structure and principles of operation of selected drive structures of converter systems. Acquiring knowledge related to their proper operation and diagnostic methods.

Course-related learning outcomes

Knowledge:
1. The student should have knowledge of the construction and operation of basic drive converter

systems.
2. The student should have knowledge of the proper operation and maintenance of drive converter systems.
3. The student should have basic knowledge in the field of diagnostics of drive converter systems.

Skills:
1. The student will be able to use the knowledge in the field of construction and the principles of operation of basic power electronic converters used in drive systems.
2. The student will be able to diagnose the faults of the high-current part and the control part of power electronic transformers used in drive systems.
3. The student will be able to determine the conditions for the correct operation of drive converter systems.

Social competences:
1. The student understands the importance of knowledge in solving problems and improving professional, personal and social competences.
2. The student is aware that the knowledge and skills in the technique quickly become obsolete.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture:
- assessment of knowledge and skills demonstrated in the solved written test of a problem nature,
- continuous assessment, rewarding activity and substantive content of statements.

Laboratory:
- verification based on the reports made,
- continuous assessment, rewarding activity and substantive content of statements.

Programme content

Diagnostics and operation of power systems used in electric vehicles, control and measurement systems, traction substations, electronic and power electronic systems used in electric vehicle charging stations, diagnostic systems for on-board power electronic equipment for power in electric vehicles.

Course topics

Principles of proper and correct operation of drive systems. Environmental conditions and their influence on the operational parameters of drive systems. Wear of powertrain components. Classification of damage to electrical machines and devices. Methods of assessing the technical condition of electrical machines and devices. Diagnostic signals and their parameters. Selection of physical quantities as sources of diagnostic signals. Invasive and non-invasive measurements. Electrical measurements of selected physical quantities. Measurement converters used in diagnostics. Analog and digital processing of measured physical quantities. Systems for collecting, processing and analyzing measurement data. Computer hardware in diagnostic systems. Models of dynamic states of machines and electrical devices including damage. Monitoring of unbalance of rotating parts and bearing condition. Testing the insulation condition of electrical components. Measurements of electromagnetic disturbances emitted to the environment. Thermal imaging assessment of the condition of the device. Examples of solutions for diagnostics and monitoring systems for electrical machines and devices.

Teaching methods

Lecture: presentation of issues with the use of multimedia, illustrated with examples given on the board, discussion of the issues.
Laboratory: performing laboratory exercises in teams (preparation of the stand, building measuring systems, carrying out experiments) with the help and supervision of the teacher, testing simulation and experimental models - comparing the obtained results.

Bibliography

Basic:
1. Frąckowiak L., Power electronics. Th. 2, Publishing House of the Poznań University of Technology,

Poznań 2002.
2. Frąckowiak L., Januszewski S., Power electronics. Th. 1, Semiconductor devices and power electronics modules, Publishing House of the Poznań University of Technology, Poznań 2001.
3. Mikołajuk K., Fundamentals of power electronics analysis, Państwowe Wydawnictwo Naukowe, Warsaw 1998.
4. Mohan N., Undeland N., Robins W., Power Electronics, Jon Wiley; Sons Inc., New York 1999.
5. Tunia H., Smirnow A., Nowak M., Barlik R., Power electronic systems. Calculation, modeling, design, Scientific and Technical Publishing House, Warsaw 1982.
6. Strzelecki R., Supronowicz H., Power factor in AC power systems and methods of its improvement, Oficyna Wydawnicza Politechniki Warszawskiej, Warsaw 2000.
7. Kaźmierkowski M., Krishnan R., Blaabjerg H., Control in Power Electronics, Academic Press, Amsterdam 2002.
8. Szeląg A., Electric traction - the basics, Publishing House of the Warsaw University of Technology, Warsaw 2019.

Additional:
1. Technical documentation of drive power electronics systems
2. Technical documentation of processor systems dedicated to the control of power electronic systems.

Breakdown of average student's workload

	Hours	ECTS
Total workload	82	3,00
Classes requiring direct contact with the teacher	32	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	50	2,00