COURSE DESCRIPTION CARD - SYLLABUS

Course name
Exploitation and diagnostics of electric drive systems [S1Elmob1>EiDEUN1]

Course

Field of study
Electromobility

Year/Semester
3/6

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 (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

The student starting this course should have basic knowledge of the theory of electric circuits, computer science and numerical methods. The student starting this course should have basic knowledge in the field of construction, analysis and synthesis of electromechanical converters and measurement methods used in electrical engineering.

Course objective

Acquainting with the basic issues and concepts related to the technical diagnostics of electric drive systems and with selected operational problems requiring diagnostics. Acquisition of the basic skills necessary to determine the relationship between a symptom of damage and damage to the device Acquiring knowledge in the field of vibration measurements, processing of measurement signals in the diagnosis of electric drive systems and their interpretation in accordance with applicable standards. Acquiring the ability to use selected computational packages for modeling drive systems.

Course-related learning outcomes

Knowledge:
1. The student has knowledge of the methods of testing low and very low power electric drive systems.
2. The student has knowledge of the circuit models of the electric drive system including damage.
3. The student has knowledge of the measurement procedures of damaged electric drives.
4. The student has knowledge of the numerical analysis of diagnostic signals.
5. The student has knowledge of the challenges of modern civilization related to the mass use of electromobility; is aware of the latest development trends related to the field of study

Skills:
1. The student is able to carry out measurements and computer simulation of the operating states of the electric drive system including damage.
2. The student can write software for the analysis of diagnostic signals.
3. The student knows how to prepare a numerical circuit model of the drive system including damage
4. The student is able to independently plan and implement his own learning throughout his life in order to improve professional and social competences.

Social competences:
1. The student is aware that knowledge and skills in the field of electromobility are evolving rapidly.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: credit on the basis of a test consisting of general and test questions. Rating scale 51-60% points satisfactory, 61-70% points satisfactory+, 71-80% points good, 81-90% points good +, 91-100% points very good.
Laboratory: rewarding practical knowledge gained during previous laboratory exercises, checking practical programming skills in Java (final test), assessment of knowledge and skills related to the implementation of individual and group programming projects.
Obtaining additional points for activity during classes, especially for: the ability to cooperate as part of a team practically carrying out a detailed task in the laboratory, the use of elements and techniques that go beyond the material of the lecture and laboratory exercises, aesthetic diligence of completed projects.

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, examples (e.g. computational) given on the blackboard, discussion on problem issues.
Laboratory: performing laboratory exercises in teams under the supervision of the teacher.

Bibliography

Basic:
1. C. Cempel, Podstawy wibroakustycznej diagnostyki maszyn. WNT Warszawa 1982
2. W. Latek, Badanie maszyn elektrycznych w przemyśle. WMT Warszawa 1987
3. W. Paszek, Dynamika maszyn elektrycznych prądu przemiennego. HELION 1998
4. T. P. Zieliński, Cyfrowe przetwarzanie sygnałów. WKŁ Warszawa 2005
5. A. Biernat: Analiza sygnałów diagnostycznych maszyn elektrycznych, Politechnika Warszawska, 2015
6. J. Przybysz: Hydrogeneratory. Zagadnienia eksploatacyjne, Instytut Energetyki, Warszawa, 2014
7. Cz. T. Kowalski: Diagnostyka układów napędowych z silnikiem indukcyjnym z zastosowaniem metod sztucznej inteligencji, Wrocław, 2013

Additional:
1. C. Cempel, Wibroakustyka stosowana. PWN Warszawa-Poznań 1977
2. M. Krauss, E. Woschni, Systemy pomiarowo-informacyjne PWN Warszawa 1979

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