COURSE DESCRIPTION CARD - SYLLABUS

Course name
Exploitation and diagnostics of drive systems

Course

Field of study
Electrical engineering
Area of study (specialization)
Drive Systems in Industry and Electromobility
Level of study
Second-cycle studies
Form of study
full-time
Year/Semester
2/3
Profile of study
general academic
Course offered in
English
Requirements
elective

Number of hours

Lecture
15
Laboratory classes
15
Other (e.g. online)
Tutorials
Projects/seminars

Number of credit points

2

Lecturers

Responsible for the course/lecturer:
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Prerequisites

The student starting this course should have a basic knowledge of the theory of electric circuits, computer science and numerical methods.

The student starting this course should have a 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 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 an extended and deepened knowledge of some areas of mathematics, including elements of discrete and applied mathematics, necessary for modeling and analyzing the operation of advanced electrical devices and systems, as well as description and analysis of the operation and synthesis of complex electrical systems.

2. The student has an organized and theoretically founded knowledge in the field of designing electrical devices and systems, taking into account their impact on the environment.

3. The student has a general knowledge of drive systems and their design, and a detailed knowledge of the application of the principles of identification and use of computer simulation software in this field.

4. The student has extended knowledge in the field of measurements of electrical quantities and selected non-electrical quantities; has in-depth knowledge of the preparation of the results of the experiment.

Skills

1. The student is able to work individually and in a team, is able to manage a team in a way that ensures the implementation of the task within the set deadline; can determine the directions of further learning and organize the process of self-education and other people.

2. The student is able to formulate and test hypotheses related to engineering problems and simple research problems, develop detailed documentation of the results of the experiment, design task, interpret the obtained results and draw conclusions.

3. The student is able to plan the process of testing complex electrical devices and systems.

Social competences

1. The student recognizes the importance of knowledge in solving cognitive and practical problems and understands that in technology, knowledge and skills quickly become obsolete, and therefore require constant replenishment.

2. The student is aware of the need to develop professional achievements and observe the rules of professional ethics, fulfill social obligations, inspire and organize activities for the social environment.

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 Python (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

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

8. J.-C. Trigeassou, Electrical Machines Diagnosis, Wiley-Iste, 2011

9. G. Vachtsevanos, F.L. Lewis, M. Roemer, A. Hess, B. Wu, Intelligent Fault Diagnosis And Prognosis For Engineering Systems, John Wiley & Sons, 2006

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	60	2,0
Classes requiring direct contact with the teacher	30	1,0
Student's own work (literature studies, preparation for laboratory classes, preparation for tests / examinations) [1]	30	1,0

[1] delete or add other activities as appropriate