COURSE DESCRIPTION CARD - SYLLABUS

Course name
Motors and electrical devices [N1Mech2>SiUE]

Course

Field of study
Mechatronics

Year/Semester
3/5

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
16

Laboratory classes
8

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

Lecturers

Prerequisites

The student should have knowledge of electromagnetism and knowledge of methods of analysis of electrical circuits, the ability to analyze simple electrical circuits with two degrees of freedom and solve systems of first-order differential equations. They should also be aware of the need to expand their knowledge and be able to comply with the rules applicable during lecture classes in a large group and the ability to communicate with the immediate environment and lecturers

Course objective

Getting to know the structure, principles of operation, characteristics, operational properties and basic methods of analysis of typical operating states of transformers, induction motors, synchronous motors, commutator motors and special motors. Getting to know the methods of speed control and braking of electric motors, the basic structures of drive systems and methods of selecting a motor for a working machine. Mastering the basic methods of testing and measuring electrical machines.

Course-related learning outcomes

Knowledge:
Knowledge of: construction, principle of operation, equivalent scheme, methods of analysis and functional characteristics of transformers, induction motors, synchronous motors and DC motors, special motors, including AC commutator motors, stepper and brushless DC motors. Basic knowledge of

start-up, braking operation, methods of rotational speed control, operation of electric motors and the structures of modern electric drive systems, selection of the motor for the working machine and selection of electrical protections

Skills:
Identifying and calculating parameters of equivalent schemes, explaining the principle of operation and determining the basic characteristics of transformers, induction motors, synchronous motors, stepper motors and commutator machines. Measurements of basic characteristics of electric machines and practical application of methods of motor speed control. Ability to select an electric motor for a working machine and to select electrical protections.

Social competences:
Understands the need for lifelong learning; can inspire and organize the learning process of others. They are aware of the importance and understanding of the non-technical aspects and effects of engineering activities, including their impact on the environment and the related responsibility for the decisions made.
Can interact and work in a group, taking on different roles in it.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture. Assessment of knowledge and skills on a written exam of a combined test and problem-based nature. Grading scale 51-60% points - dst, 61-70% points dst+, 71-80% points - db, 81-90% points - db+, 91-100% points - very good.
Laboratory. Testing and rewarding the knowledge necessary to carry out subsequent laboratory exercises, continuous assessment, during each class, of the student's activity and the growth of his knowledge and skills, as well as social competences related to teamwork, skills related to the implementation of a specific laboratory exercise. Evaluation of the report on the exercise. Additional points for activity during classes.

Programme content

Magnetic circuits. Transformers, electric motors. Mechanical characteristics and methods of controlling the rotational speed of electric motors. Braking operation of machines. Structures of modern electric drive systems. Rules for the selection of the motor, converter system and electrical protection system components

Course topics

Lecture: Magnetic circuits. Electric motors - basic concepts: distributed windings, rotating magnetic field, electromotive force excited by a rotating magnetic field. Induction motors: design and principle of operation, replacement scheme, mechanical characteristics, speed control, braking methods. Synchronous motors: design and principle of operation, replacement scheme, speed control. Magnetoelectric and reluctance synchronous motors. DC and AC commutator machines: design and principle of operation, mechanical characteristics, speed control, braking methods. Brushless DC motors and stepper motors. Powertrains with electric motors. Principles for the selection of a drive motor and a power electronic converter for an electric drive. Rules for the selection of electrical protections.
Laboratory: Introductory classes including discussion of the activities that the student will have to perform during the class. Presentation of the content of individual classes and requirements for passing the laboratory. Division of students into groups. Discussion of the health and safety rules in force in the laboratory. Laboratory exercises on the determination of transformer equivalent diagram parameters, characteristics and operating parameters of induction motors, synchronous magnetoelectric motors, stepper motors and DC motors, including research on the methods of control and regulation of rotational speed.

Teaching methods

Teaching methods used: a) lecture with multimedia presentation (including: drawings, photos, animations) supplemented with examples given on the board, b) lecture conducted in an interactive way with formulating questions to students, c) taking into account students' activity during classes when giving the final grade, d) posing problems and initiating discussions during laboratory exercises.

Bibliography

Basic:
1. Plamitzer A. M.: Maszyny Elektryczne, wyd. VII, WNT Warszawa, 1982.
2. Karwacki W.: Maszyny Elektryczne, wyd. Pol. Wrocławskiej, Wrocław, 1993.
3. M. S. Sarma, Electric Machines, Steady-State Theory and Dynamic Performance, West Publishing Company, wyd. 2, 1996.
4. P. Staszewski, W. Urbański, Zagadnienia obliczeniowe w eksploatacji maszyn elektrycznych. Oficyna Wydawnicza Pollitechniki Warszawskiej, Warszawa 2009.
5. W. Przyborowski, G. Kamiński, Maszyny Elektryczne, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2014
4. Kaczmarek T.: Napęd elektryczny robotów, Wyd.2, Wydawnictwo Politechniki Poznańskiej, 1998

Additional:
1. Latek W.: Teoria Maszyn Elektrycznych, wyd. II, WNT Warszawa, 1987.
2. Praca zbiorowa: Poradnik Inżyniera Elektryka, Tom 2, WNT Warszawa 2007.

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	26	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	49	2,00