COURSE DESCRIPTION CARD - SYLLABUS

Course name
Electromechanical energy convertion

Course

Field of study
Mathematics in Technology

Year/Semester
3/6

Area of study (specialization)

Profile of study
general academic

Level of study
First-cycle studies

Course offered in
polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
30	15	
Tutorials	Projects/seminars	

Number of credit points

3

Lecturers

Responsible for the course/lecturer:
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Responsible for the course/lecturer:

Prerequisites

Knowledge:
Knowledge of electrical and magnetic circuits, principles of mechanics and energy conversion, extended knowledge of insulating and conductive materials and basic information about soft and hard magnetic materials, knowledge of the structure and operating principles of selected electromechanical static and kinetic energy converters

Skills:
Knowledge of differential and integral calculus at general level, ability to effectively self-study in the field related to the chosen field of study

Social competencies:
The student is aware of the need to expand their competences, readiness to cooperate within a team

Course objective

Acquainting with the principles of operation and construction of selected converters of mechanical energy into electric and vice versa. Getting to know the methods of determining the integral parameters of electromagnetic systems and gaining the ability to analyze the operating states of electromagnetic actuators. Practical mastering of principles of formulating and solving equations of electromechanical systems. Strengthening the ability to select the components of propulsion systems operating in various work regimes.

Practical knowledge of the principles of operation and construction of selected converters of mechanical energy into electricity and vice versa. The use of previously known methods for determining the parameters of integral electromagnetic systems and acquiring the ability to analyze the operating states of electromagnetic actuators. Practical mastery of the principles of conducting a research experiment. Consolidation of information on the assessment of the performance of propulsion systems operating in different operating regimes

Course-related learning outcomes

Knowledge

1. Student has structured and theoretically founded knowledge in the field of technical sciences, including electrical engineering, electronics and automation [K_W04 (P6S_WG)]
2. Student has the ordered and theoretically founded knowledge related to the design, construction, operation principle and operation of devices, machines, systems, etc .; knows and understands the processes occurring in their life cycle [K_W08 (P6S_WG)]

Skills

1. Student is able to select appropriate sources of knowledge and obtain the necessary information from them and make a critical analysis and evaluation of solutions for complex and unusual engineering problems [K_U06 (P6S_UW)]
2. Student can use the knowledge and methods and tools to solve typical engineering tasks [K_U06 (P6S_UW)]
3. Student can design, build and test a simple device, object, system, etc. [K_U11 (P6S_UW)]

Social competences

1. Student is able to think and act in a creative and entrepreneurial way, taking into account the safety, ergonomics of work and its economic aspects, is aware of the need to initiate action for the public interest and responsibility for the effects of the team and its participants [K_K03 (P6S_KO)]
2. Student is aware of his social role as a graduate of a technical university, he is ready to communicate popular scientific content to the society and to identify and resolve basic problems [K-K05 (P6S_KR)]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:
Ongoing checking and rewarding of the knowledge necessary to implement the problems posed in a

given area of theoretical and practical tasks through:
- continuous assessment, in each experiment

- written exam

- rewarding the level of acquired knowledge and the ability to use known principles and methods,

- assessing research reports.
Getting additional points for activity during classes, especially for:
- offering discuss additional aspects of the issue;
- effectiveness of applying the acquired knowledge when solving a given problem;
- comments related to the improvement of teaching materials

Programme content

Nonlinear and non-stationary circuits. The energy concept of Sommerfeld: energy and co-energy. Electromagnetic and mechanical systems - analogies. Forces and moments of magnetic origin. The principle of virtual work. Dynamics of electromechanical systems - the Hamilton principle and Lagrange equations. Acyclic electromechanical transducers: basic structures, static characteristics, dynamic states. Rotary encoders. The principle of energy dissipation in electromagnetic converters - the problem of heating of electrical devices. Motor selection and conversion of rated power when supply conditions change. Operational properties of selected electromagnetic transducers.

Experimental determination of forces and torques of magnetic and electromagnetic origin. Determination of the stady-state output characteristics of acyclic and cyclic converters. Investigation of the heating process of electrical equipment into the results of internal losses: non-contact and touch methods. Study of the impact electromagnetic processes on environmental

Teaching methods

Lecture with multimedia presentation (including drawings, photos, animations, films) supplemented with examples given on the board, taking into account various aspects of the issues presented, including: economic, ecological, legal and social, presenting a new topic preceded by a reminder of related content known to students from other items; presentation of selected transducers in the laboratory.

Classes in the laboratory using previously prepared research stands, conversation with students during the implementation of the research.

Bibliography

Basic

1. Sidorowicz J.: Napęd elektryczny i jego sterowanie, , Oficyna Wydawnicza Politechniki Warszawskiej , Warszawa, 1994.
2. Wach P.: Dynamics and Control of Electrical Drivers, Springer Verlag, Berlin-Heidelberg, 2011.
3. Griffiths D.J. Podstawy elektrodynamiki, PWN Warszawa, 2001.

4. Turowski J.: Elektrodynamika techniczna, PWN Warszawa, 1993
5. Furlani E.P., Permanent magnet and Electromechanical Devices, Academic Press, 20015
6. Wprowadzenie do napędów elektrycznych, Skrypt Politechniki Krakowskiej, Kraków, 1998

Additional

1. Zawirski K., Sterowanie silnikiem synchronicznym o magnesach trwałych, Wydawnictwo Politechniki Poznańskiej, Poznań, 2005
2. Orłowska-Kowalska T., Bezczujnikowe układy napędowe z silnikami indukcyjnymiOficyna Wydawnicza Politechniki Wrocławskiej, Wrocław, 2003

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,0
Classes requiring direct contact with the teacher	50	2,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	25	1,0

[1] delete or add other activities as appropriate