POZNAN UNIVERSITY OF TECHNOLOGY

EUROPEAN CREDIT TRANSFER AND ACCUMULATION SYSTEM (ECTS)

COURSE DESCRIPTION CARD - SYLLABUS

Course name
Modeling of electromechanical transducers [S2MwT1>MPE]

Course

Field of study
Mathematics in Technology

Year/Semester
1/1

Area of study (specialization)
–

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
30

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

The student starting this subject should have basic knowledge of: electromagnetic field theory, electrical engineering, numerical methods, computer science, materials science and mechanics acquired during the first cycle studies. He should also have the ability to effectively self-study in a field related to the selected field of study and in the field of team work and verbal communication, as well as be aware of the need to broaden their competences and knowledge.

Course objective

The main goal is to get acquainted with modern mathematical models and methods of analysis of electromechanical transducers. Mastering modern methods and techniques of electromechanical design of special transducers. Acquiring the skills to use selected calculation packages.

Course-related learning outcomes

Knowledge:
1. Know the development trends and the most significant new achievements in the field of electrical engineering
2. Know the design of selected electromechanical and electromagnetic cyclic and acyclic energy

converters
3. The student has knowledge of the possibilities and limitations of the methods used in computer aided design in electrical engineering

Skills:
1. The student will be able to work individually and in a team, is able to assess the time consumption of a task; can manage a small team in a way that ensures the implementation of the task within the set deadline
2. The student will be able to develop detailed documentation of the results of the experiment, project or research task; can prepare a study discussing these results
3. The student will be able to assess the usefulness and possibility of using new technical and technological achievements in the design and manufacture of electrical systems and devices containing innovative solutions

Social competences:
1. The student is aware of the value of his work, is able to comply with the principles of teamwork, is able to prepare a report on the results of his own and team work

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Lecture:
- Written exam in the form of a test 8-12 questions (test and open), variously scored. Passing threshold: 50% of points. Final issues on the basis of which questions are prepared will be sent to students by e-mail using the university e-mail system.

Laboratory:
- checking and rewarding knowledge necessary to implement the problems posed in a given area of laboratory tasks,
- assessment of knowledge and skills related to the implementation of laboratory tasks, assessment of the report on the completed project.

Extra points for the activity in the classroom, and in particular for:
- effectiveness of applying the acquired knowledge while solving a given problem,
- ability to cooperate within a team that practically performs a specific task in a laboratory,
- care and aesthetics of prepared reports.

Programme content

Design methods and techniques for electromechanical special transducers.
The use of professional software for the design and modeling of electromechanical transducers.
Simulation and laboratory tests of selected electromechanical transducers.

Course topics

Lectures: Design methods and techniques for electromechanical special transducers. Magnetic circuit design with permanent magnets. Permanent magnets and their parameters. Magnetoelectric machines: factors influencing the selection of the magnetic circuit structure, structures of permanent magnet machines. Motors with electronic commutation: mathematical model, control. Sensors and actuators with intelligent materials: construction, operation and applications. Properties and application of magnetostrictive materials. Mathematical model and design of magnetostrictive transducers. Construction and properties of magnetic fluid, applications of magnetic fluids. Mathematical model and design of transducers with magnetorheological fluid. Construction and properties of shape memory alloys, applications of shape memory alloys. Mathematical model and design of actuators made of shape memory alloys. Methods for analyzing electromagnetic transducers. Professional software used in the design of electromechanical transducers.
Laboratory: The use of professional software for the design and modeling of electromechanical transducers. Simulation and laboratory tests of selected electromechanical transducers.

Teaching methods

1. Lecture: multimedia presentation supplemented with examples given on the board, lecture

conducted in an interactive way with the formulation of questions for a group of students.
2. Laboratory: multimedia presentation supplemented with examples given on the board, practical and demonstration exercises.

Bibliography

Basic
1. Glinka T., Maszyny elektryczne wzbudzane magnesami trwałymi, Wydawnictwo Politechniki Śląskiej, Gliwice 2002.
2. Gieras J., F. and Wing M.: Permanent Magnet Motors Technology: Design and Applications, Marcel Dekker Inc., New York 1996.
3. Furlani E.P., Permanent magnet and Electromechanical Devices, Academic Press, 2001.
4. Ławniczak A., Milecki A.: Ciecze elektro- i magnetoreologiczne oraz ich zastosowania w technice, WPP1999.
5. Engdahl G., Handbook of giant magnetostrictive materials. San Diego, USA, Academic Press, 2000.
6. Lagoudas D. C., Shape Memory Alloys: Modeling and Engineering Applications, Springer, 2008
Additional
1. Bishop R. H.,The Mechatronics Handbook, Austin, Texas, CRC Press 2002
2. Stachowiak D., Kurzawa M., Charchuta I., Oprogramowanie do projektowania aktuatorów liniowych wykonanych ze stopów z pamięcią kształtu, Academic Journals Poznan University of Technology, Numer: 91/2017 Str: 355-364, 2017

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	69	3,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	31	1,00