GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

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|---|---|---|---|---|---|---|---|
| Subject name and code | Design of Electric Systems, PG_00038368 | | | | | | |
| Field of study | Electrical Engineering | | | | | | |
| Date of commencement of studies | October 2022 | | Academic year of realisation of subject | 2022/2023 | | | |
| Education level | second-cycle studies | | Subject group | | | | |
| Mode of study | Part-time studies | | Mode of delivery | at the university | | | |
| Year of study | 1 | | Language of instruction | Polish | | | |
| Semester of study | 2 | | ECTS credits | 3.0 | | | |
| Learning profile | general academic profile | | Assessment form | assessment | | | |
| Conducting unit | Department of Power Electronics and Electrical Machines -> Faculty of Electrical and Control Engineering | | | | | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | dr inż. Grzegorz Kostro | | | | | |
| | Teachers | dr inż. Filip Kutt<br>dr hab. inż. Michał Michna | | | | | |
| Lesson types and methods of instruction | Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
| | Number of study hours | 10.0 | 10.0 | 10.0 | 0.0 | 0.0 | 30 |
| | E-learning hours included: 0.0 | | | | | | |
| | Address on the e-learning platform: https://enauczanie.pg.edu.pl/moodle/course/view.php?id=22422 | | | | | | |
| Learning activity and number of study hours | Learning activity | Participation in didactic classes included in study plan | | Participation in consultation hours | Self-study | SUM | |
| | Number of study hours | 30 | | 6.0 | 39.0 | 75 | |
| Subject objectives | The aim of the course is to introduce students with the methods of analysis, modeling and design of electromechanical drive systems | | | | | | |

## Learning outcomes

| Course outcome | Subject outcome | Method of verification |
|---|---|---|
| K7_W10 | Student knows the basic power electronics and drive systems. Student knows the methods of control and diagnostics of power electronic systems. | [SW1] Assessment of factual knowledge |
| K7_U07 | The student is able to analyze the operating states of an electromechanical system fed by a power converter | [SU2] Assessment of ability to analyse information |
| K7_K03 | The student is able to cooperate with others in order to implement the given task. | [SK3] Assessment of ability to organize work<br>[SK1] Assessment of group work skills |
| K7_W13 | Student is able to connect, configure and start the drive system fed from the power converter. | [SW1] Assessment of factual knowledge |
| K7_K02 | Student understands the non-technical effects of engineering activities on the environment | [SK5] Assessment of ability to solve problems that arise in practice |
| K7_U02 | Student knows how to prepare and present an oral presentation on a chosen technical topic | [SU4] Assessment of ability to use methods and tools<br>[SU5] Assessment of ability to present the results of task |
| K7_U06 | Student can make the analysis, develop the model and simulate the basic operating states of the electric system, can perform the design of electric system | [SU3] Assessment of ability to use knowledge gained from the subject<br>[SU4] Assessment of ability to use methods and tools |
| K7_W04 | Student knows how to perform the analysis of the electromechanical system in chosen operating states | [SW2] Assessment of knowledge contained in presentation<br>[SW3] Assessment of knowledge contained in written work and projects |

## Subject contents

**Lecture** Structures and components of modern electromechanical drive systems. Calculation of equivalent parameters and modelling of complex electromechanical drive systems. Thermal and Electromagnetic analysis of electromechanical transducers using analytical and numerical methods. Analysis of the motion equations and calculation of mechanical transient processes in complex electromechanical drive systems. Design principles of electromechanical drive systems. Selection rules of the required power and drive parameters of different types of electromechanical drive systems.

**Laboratory** Identification of mechanical and electromagnetic parameters of electromechanical drive system. Study of selected states of a electromechanical system with BLDC motor. Study of selected states of a electromechanical system with induction motor fed by power converter. Study of selected states of a electromechanical system with DC motor fed by DC converter.

**Exercises** Issues related to project management. Design calculations for the selected electromechanical drive system and the development of a numerical model with the use of CAD programs (thermal and electromagnetic calculations). Modelling of elements of the electromechanical system with the use of programs for calculations using the finite element method. Analysis of selected system operating states based on the results of simulation tests.

## Prerequisites and co-requisites

Knowledge in the range of electrical machines and analysis methods of electric and magnetic circuits. Extended knowledge in the field of power electronics. Knowledge in the range of design, programming and diagnostics of power converters.

## Assessment methods and criteria

| Subject passing criteria | Passing threshold | Percentage of the final grade |
|---|---|---|
| Project | 60.0% | 60.0% |
| Practical exercise | 60.0% | 40.0% |

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| Recommended reading | Basic literature | 1. Bisztyga K.: Sterowanie i regulacja silników elektrycznych. WNT, Warszawa, 1989.<br><br>2. Orłowska-Kowalska T.: Bezczujnikowe układy napędowe z silnikami indukcyjnymi.<br><br>3. Praca zbiorowa pod red. Z. Grunwalda: Napęd elektryczny, WNT, Warszawa,1987.<br><br>4. Kałuża E.: Zbiór zadań i ćwiczeń projektowych z trakcji elektrycznej. Skrypt Politechniki Śląskiej nr 1848, Gliwice, 1994.<br><br>5. Praca zbiorowa pod red. T. Orłowskiej-Kowalskiej: Napęd elektryczny. Ćwiczenia laboratoryjne. Oficyna Wydawnicza Politechniki. Wrocławskiej, Wrocław, 2002.<br><br>6. Tunia H., Kaźmierkowski M.P.: Automatyka napędu przekształtnikowego. PWN, Warszawa, 1989.<br><br>7. Kaczmarek T., Zawirski K.: Układy napędowe z silnikiem synchronicznym. Wydawnictwa Politechniki Poznańskiej, Poznań, 2001.<br><br>8. Jagiełło A.,S.: Systemy elektromechaniczne dla elektryków, Politechnika Karakowska, Kraków, 2008.<br><br>9. Leonard W., "Control of Electrical Drives", Springer-Verlag, Berlin, 1985.<br><br>10. Ronkowski M., Michna M., Kostro G., Kutt F.: Maszyny elektryczne wokół nas: zastosowanie, budowa, modelowanie, charakterystyki, projektowanie. (e-skrypt). Wyd. PG, Gdańsk 2011. |
| | Supplementary literature | 1. Michna M: Designing of brushless permanent magnet motor. Auxiliary materials.<br><br>2. Kostro G: Designing of squirrel cage induction motor. Auxiliary materials. |
| | eResources addresses | Adresy na platformie eNauczanie: |
| Example issues/ example questions/ tasks being completed | 1. Calculation of the operation point of a permanent magnet.<br><br>2. The choice of the motor to the drive system.<br><br>3. The choice of the gear box to the drive system.<br><br>4. Calculation of basic parameters of the gear box.<br><br>5. Design calculations of electric machines. | |
| Work placement | Not applicable | |