GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Design of Electric Systems, PG_00016898		
Field of study	Electrical Engineering		
Date of commencement of studies	February 2023	Academic year of realisation of subject	2023/2024
Education level	second-cycle studies	Subject group	
Mode of study	Full-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 dr hab. inż. Michał Michna dr inż. Łukasz Sienkiewicz dr inż. Roland Ryndzionek	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	15.0	15.0	0.0	0.0	45
	E-learning hours included: 0.0						

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	45	5.0	25.0	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_W04	Student knows how to perform the analysis of the electromechanical system in chosen operating states	[SW3] Assessment of knowledge contained in written work and projects [SW2] Assessment of knowledge contained in presentation
	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	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject
	K7_W04	Student knows how to perform the analysis of the electromechanical system in chosen operating states	[SW3] Assessment of knowledge contained in written work and projects [SW2] Assessment of knowledge contained in presentation
	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_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	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject
	K7_U02	Student knows how to prepare and present an oral presentation on a chosen technical topic	[SU5] Assessment of ability to present the results of task [SU4] Assessment of ability to use methods and tools
	K7_W13	Student is able to connect, configure and start the drive system fed from the power converter.	[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_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_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_K03	The student is able to cooperate with others in order to implement the given task.	[SK1] Assessment of group work skills [SK3] Assessment of ability to organize work
	K7_U02	Student knows how to prepare and present an oral presentation on a chosen technical topic	[SU5] Assessment of ability to present the results of task [SU4] Assessment of ability to use methods and tools
	K7_W13	Student is able to connect, configure and start the drive system fed from the power converter.	[SW1] Assessment of factual knowledge
Subject contents	**Lecture** Structures and components of modern electromechanical drive systems. Calculation of equivalent parameters and modeling 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. Modeling 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.		

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<tr><td>Assessment methods and criteria</td><td colspan="2"><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Project</td><td>60.0%</td><td>50.0%</td></tr>
<tr><td>Practical exercise</td><td>60.0%</td><td>30.0%</td></tr>
<tr><td>Midterm colloquium</td><td>60.0%</td><td>20.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>1. Bisztyga K.: Sterowanie i regulacja silników elektrycznych. WNT, Warszawa, 1989.
2. Orłowska-Kowalska T.: Bezczujnikowe układy napędowe z silnikami indukcyjnymi.
3. Praca zbiorowa pod red. Z. Grunwalda: Napęd elektryczny, WNT, Warszawa,1987.
4. Kałuża E.: Zbiór zadań i ćwiczeń projektowych z trakcji elektrycznej. Skrypt Politechniki Śląskiej nr 1848, Gliwice, 1994.
5. Praca zbiorowa pod red. T. Orłowskiej-Kowalskiej: Napęd elektryczny. Ćwiczenia laboratoryjne. Oficyna Wydawnicza Politechniki. Wrocławskiej, Wrocław, 2002.
6. Tunia H., Kaźmierkowski M.P.: Automatyka napędu przekształtnikowego. PWN, Warszawa, 1989.
7. Kaczmarek T., Zawirski K.: Układy napędowe z silnikiem synchronicznym. Wydawnictwa Politechniki Poznańskiej, Poznań, 2001.
8. Jagiełło A.,S.: Systemy elektromechaniczne dla elektryków, Politechnika Karakowska, Kraków, 2008.
9. Leonard W., "Control of Electrical Drives", Springer-Verlag, Berlin, 1985.
10. Ronkowski M., Michna M., Kostro G., Kutt F.: Maszyny elektryczne wokół nas: zastosowanie, budowa, modelowanie, charakterystyki, projektowanie. (e-skrypt). Wyd. PG, Gdańsk 2011.</td></tr>
<tr><td>Supplementary literature</td><td>1. ANSYS RMxprt: Electric Motor Design https://www.ansys.com/products/electronics/ansys-rmxprt
2. Glinka T.: Maszyny elektryczne wzbudzane magnesami trwałymi, Wydawnictwo Naukowe PWN, 2018
3. Lipo T.A. : Introduction to AC Machine Design, Wiley 2017
4. Gieras J.F., Piech Z.J.,Tomczuk B.: Linear Synchronous Motors: Transportation and Automation Systems, Second Edition, CRC Press 2017
5. Pyrhönen J., Jokinen T., Hrabovcová V.: Design of Rotating Electrical Machines, 2nd Edition, Wiley 2013
6. Gieras J.F: Advancements in Electric Machines. Springer-Verlag Gmbh 2008
7. Gieras J.F.: Mitchell Wing, Permanent Magnet Motor Technology, 2nd ed. Marcel Dekker, Inc, 2002
8. Hanselman D.: Brushless Permanent Magnet Motor Design, Magna Physics Pub, New York, 2006.
9. Dąbrowski M.: Projektowanie maszyn elektrycznych prądu przemiennego. Warszawa, Wydaw. Nauk. -Techn., 1994.
10. Own materials published on the website: https://enauczanie.pg.edu.pl/moodle/course/view.php?id=679</td></tr>
<tr><td>eResources addresses</td><td>Uzupełniające
Adresy na platformie eNauczanie:
PROJEKTOWANIE SYSTEMÓW ELEKTROMECHANICZNYCH [2023/24] - Moodle ID: 25061
https://enauczanie.pg.edu.pl/moodle/course/view.php?id=25061</td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="2">1. Calculation of the operation point of a permanent magnet.
2. The choice of the motor to the drive system.
3. The choice of the gear box to the drive system.
4. Calculation of basic parameters of the gear box.
5. Design calculations of electric machines.</td></tr>
<tr><td>Work placement</td><td colspan="2">Not applicable</td></tr>
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