GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Electromechanical Systems, PG_00038474		
Field of study	Electrical Engineering		
Date of commencement of studies	February 2027	Academic year of realisation of subject	2026/2027
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	1	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Power Electronics and Electrical Machines -> Faculty of Electrical and Control Engineering -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Andrzej Wilk	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	15.0	15.0	0.0	60

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	60	10.0	30.0	100

Subject objectives

The main objective of the subject is to develop mathematical models of electromechanical systems. Partial objectives include developing metamatic models of such transducers as: induction machine, synchronous machine, direct current machine, synchronous machine excited by permanent magnets.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W07] has an in-depth, theoretically grounded knowledge of electromechanical systems and their electromechanical systems and their design, electrotraction systems power supply and electrical energy storage devices	Designs electromechanical systems using electric machines	[SW3] Assessment of knowledge contained in written work and projects
[K7_U06] is able to analyse, model, simulate and design electrical systems	Models and analyzes electromechanical transducers	[SU1] Assessment of task fulfilment

Subject contents

Course content – lecture

Lecture: MMF of winding. Equivalent diagrams of windings of electromechanical converters. Equations of electromagnetic circuit: induced voltage of transformation, induced voltage of rotation, voltage drops on resistances. Electromagnetic torque and mechanical equation. Clarke and Park transformation. Model of induction machine in natural axes, alpha-beta and d-q. Model of synchronous machine in natural axes, alpha-beta and d-q. Model of PMSM machine in natural axes, alpha-beta and d-q. Model of DC machine.

Course content – laboratory

Lab: Study of steady and transient states of electric machines.

Course content – project

Project: Simulation of steady and transient states of electric machines

Prerequisites and co-requisites

General knowledge of the subjects of Electrical circuits, Electrodynamics and Electrical machines, ability to analyse electrical and magnetic circuits in steady and dynamic states, ability to analyse electrical machines in steady states.

<table>
<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>Practical exercise</td><td>60.0%</td><td>40.0%</td></tr>
<tr><td>Written exam</td><td>60.0%</td><td>60.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>1. Cichy M.: Modelling of energy systems (textbook in Polish). Wyd. PG, Gdańsk 2001. 2. Gieras J.: Advancements in electric machines. Springer Netherlands, 2008. 3. Kaczmarek T., Zawirski K.: Układy napędowe z silnikiem synchronicznym. Wyd. PP, Poznań 2000. 4. Lyshevski S. E., Nano- and micro-electromechanical systems: Fundamental of micro- and nano-engineering. CRC Press, 2000. 5. Meisel J.: Zasady elektromechanicznego przetwarzania energii. WNT, Warszawa 1970.</td></tr>
<tr><td>Supplementary literature</td><td>1. Karnopp D. C., Margolis D. L., Rosenberg R. C.: System dynamics, modeling and simulation of mechatronic systems. John Wiley Inc, 2000. 2. Lyshevski S. E.: Electromechanical systems, electric machines, and applied mechatronics. CRC Press, 2000. 3. Puchała A.: Electromechanical transducers (textbook in Polish). KOMEL, Katowice 2002. 4. Szymanowski A.: Fundamentals of hybrid vehicle drives. Instytut Technologii Eksploatacji, Warsaw-Radom 2000.</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="2">Draw and describe a general structure of electromechanical system.

Draw and describe the physical and dynamic circuit models, and dynamic characteristics of dc motor.

Calculate the circuit model parameters and time constant of dc motor using its manufacturing data sheet.</td></tr>
<tr><td>Practical activites within the subject</td><td colspan="2">Not applicable</td></tr>
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