



## Subject card

Subject name and code	Electric Machines, PG_00038436						
Field of study	Hydrogen Technologies and Electromobility						
Date of commencement of studies	October 2022	Academic year of realisation of subject			2023/2024		
Education level	first-cycle studies	Subject group			Obligatory subject group in the field of study Subject group related to scientific research in the field of study		
Mode of study	Full-time studies	Mode of delivery			at the university		
Year of study	2	Language of instruction			Polish		
Semester of study	3	ECTS credits			5.0		
Learning profile	general academic profile	Assessment form			exam		
Conducting unit	Department of Power Electronics and Electrical Machines -> Faculty of Electrical and Control Engineering						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Michał Michna					
	Teachers	dr hab. inż. Michał Michna dr inż. Grzegorz Kostro dr inż. Filip Kutt					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	30.0	0.0	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	8.0		57.0	125	
Subject objectives	Get acquainted with construction, theory and application of electric machines and transformers.  Getting to know the basic structures and elements of electric drive systems.  Verification of the theory in the laboratory						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_K01] is aware of the need for continuous education and self-improvement in the field of the profession of an electrician and knows the possibilities of further education	Student understands the importance of constantly expanding their knowledge and skills regarding electrical machines and their applications. Student can use up-to-date technical documentation and publications for this purpose	[SK5] Assessment of ability to solve problems that arise in practice
	[K6_K02] can work in a group taking on different roles in it	Student organizes work in a team. Student chooses the appropriate methods of solving problem. Student exchanges information with the team members. Student uses technical language. Student knows how to estimate the time needed to complete task. Student is able to implement the work schedule.	[SK4] Assessment of communication skills, including language correctness [SK3] Assessment of ability to organize work [SK1] Assessment of group work skills
	[K6_K04] can react in abnormal and emergency situations, threats to health and life when using automation and robotics components and systems in hydrogen devices and installations	Student explains the basic principles of health and safety. Student applies the basic principles of health and safety. Student is able to react in emergency situations	[SK4] Assessment of communication skills, including language correctness [SK3] Assessment of ability to organize work
[K6_W06] knows the basics of the construction and operation of transformers, electrical machines, low and high temperature electrolysers, electrical drive systems, their modeling and industrial applications	Student explains the general principles of construction and physical basics of electric machines, Student explains the construction, operation and modeling of transformers, student draws and explains the basic characteristics of transformers, student explains the construction, operation and modeling of DC machines, student draws and explains the basic characteristics of DC machines, student explains the construction, operation and modeling of synchronous machines, student draws and explains the basic characteristics of synchronous machines, student explains the construction, operation and modeling of induction machines, student draws and explains the basic characteristics of induction machines, student explains the general principles of designing electrical machines	[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge	
Subject contents	<p><b>LECTURE:</b> Types and ways of producing magnetic fields.. Generation of electromagnetic torque and induced voltages. Electrical machines and material technology. Classification of electrical machines. Design, principle of operation and properties of single and three-phase transformers. Design, principle of operation and properties of dc and ac machines. General principles of regulating the speed of electric motors. Control properties of rotating generators. <b>LABORATORY</b> Transformer properties. Characteristics of asynchronous motor fed from converter and power system. Characteristics of shunt direct current motor and generator. Characteristics of synchronous generator and parallel works at power system. Electric machines in industry environment - electric machines virtual laboratory.</p>		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Practical exercise reports	60.0%	40.0%
	Writing, practical and oral exam	50.0%	60.0%

Recommended reading	Basic literature	<ol style="list-style-type: none"> <li>1. Ronkowski M., Michna M., Kostro G., Kutt F.: Maszyny elektryczne wokół nas: zastosowanie, budowa, modelowanie, charakterystyki, projektowanie. (e-skrypt) Wyd. PG, Gdańsk, 2009/2011.</li> <li>2. Matulewicz W.: Podstawy teorii maszyn elektrycznych, Wyd. PG, Gdańsk 2014</li> <li>3. Matulewicz W., Chomiakow M: Badania podstawowe maszyn elektrycznych. Wyd. PG, Gdańsk 2014</li> <li>4. Roszczyk S.: Teoria maszyn elektrycznych. WNT, W-wa 1979</li> <li>5. J. F. Gieras, Electrical Machines: Fundamentals of Electromechanical Energy Conversion, 1st Edition. Boca Raton: CRC Press, 2016</li> </ol>
	Supplementary literature	<ol style="list-style-type: none"> <li>1. Fitzgerald A.E, Kingsley Ch. (Jr.), Umans S. D.: Electric Machinery. New York: McGraw-Hill Book Comp. 2003. Gieras J. F.: Advancements In Electric Machines, Springer, 2008.</li> <li>2. Rafalski W., Ronkowski M.: Zadania z Maszyn Elektrycznych, cz. I, II. Wyd. 4/3 (skrypty) Wyd. PG, Gdańsk 1994.</li> <li>3. Plamitzer A.: Maszyny elektryczne. WNT, W-wa 1976.</li> <li>4. Manitius Z.: Transformatory. Maszyny prądu stałego. Maszyny Synchroniczne. Maszyny asynchroniczne. (seria skryptów). Wyd. PG, Gdańsk 1973 - 1978.</li> <li>5. Latek W.: Teoria Maszyn Elektrycznych. WNT, W-wa, 1982.</li> <li>6. Staszewski P., Urbański W.: Zagadnienia obliczeniowe w eksploatacji maszyn elektrycznych, Warszawa, Oficyna Wydawnicza Politechniki Warszawskiej 2009</li> </ol>
	eResources addresses	<p>Adresy na platformie eNauzanie:</p> <p>MASZYNY ELEKTRYCZNE [TWiE][2023/24] - Moodle ID: 32102  <a href="https://enauzanie.pg.edu.pl/moodle/course/view.php?id=32102">https://enauzanie.pg.edu.pl/moodle/course/view.php?id=32102</a></p>
Example issues/ example questions/ tasks being completed	<p>Explain how to control the speed of a DC motor,</p> <p>Describe the types of three-phase transformers construction.</p> <p>Explain the principles of generator synchronization with the grid.</p>	
Work placement	Not applicable	