GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Electric Machines, PG_00038436		
Field of study	Electrical Engineering		
Date of commencement of studies	October 2022	Academic year of realisation of subject	2023/2024
Education level	first-cycle studies	Subject group	
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 inż. Grzegorz Kostro	
	Teachers	dr inż. Grzegorz Kostro 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	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	To provide students with: general principles of construction and physical performance of electrical machines; principles of construction, modeling and performance characteristics of power transformers; principles of construction, modeling and performance characteristics of dc machines; principles of construction, modeling and performance characteristics of synchronous machines; principles of construction, modeling and performance characteristics of induction machines; general principles of electrical machines design.

Learning outcomes

Course outcome	Subject outcome	Method of verification
K6_K05	Student knows and applies the rules working with electrical equipment	[SK4] Assessment of communication skills, including language correctness
K6_W06	Student explains the general principles of construction and physical performance of electrical machines, Student explains the construction, performance and modelling of transformers, Student draws and explains the performance characteristics of transformers, Student explains the construction, performance and modelling of dc machines, Student draws and explains the performance characteristics of dc machines, Student explains the construction, performance and modelling of synchronous machines, Student draws and explains the performance characteristics of dc synchronous, Student explains the construction, performance and modelling of induction machines, Student draws and explains the performance characteristics of dc induction, Student explains the general principles of electrical machines design.	[SW1] Assessment of factual knowledge
K6_U11	Student selects measuring devices to perform basic measurements in electrical systems. Makes measurements. Assesses the condition of the device based on measurements results.	[SU2] Assessment of ability to analyse information
K6_K01	The student reads technical literature and looks for information on the analyzed subjects.	[SK5] Assessment of ability to solve problems that arise in practice
K6_K02	student works in a group assuming different roles during classes.	[SK1] Assessment of group work skills

Subject contents

General buildings rules and performance physical fundamentals of electrical machines (EM). Transformers. Buildings, performance and cooling methods. Circuit model. Performance states. Voltage changing, power losses and efficiency. Connections systems. Parallel operating. Special transformers. DC machines. Buildings and performance. Generation of electromagnetic torque. Pattern electromechanical coupling. Armature reaction. Circuit model. Performance states. Power losses and efficiency. Performance characteristics. Speed control. Brushless dc motors with permanent magnets - application of electronic commutator. Synchronous machines. Buildings, performance and cooling methods. Rotating magnetic field excited by mechanical and electrical methods. Generation of electromagnetic torque. Armature reaction. Performance states. Turbogenerator and hydrogenerator. Circuit model. Performance characteristics. Single operating and operating in power system - synchronizing. Universal diagram. Synchronous motor. Reluctance motor. Speed control. Induction machines. Buildings and performance. Generation of electromagnetic torque. Circuit model. Performance states. Power losses and efficiency. Performance characteristics. Single phase motors. Piezoelectric machines. Constructions and performance. Performance characteristics. Speed control. Basics of electrical machines design. Calculation of machine dimensions and choice of winding on the example of an induction motor. Electric machines in industry environment - electric machines virtual laboratory.

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Practical exercise	60.0%	60.0%
Written exam	60.0%	40.0%

Recommended reading	Basic literature	1. Latek W.: Zarys maszyn elektrycznych. WNT, W-wa 1974. 2. Manitius Z.: Transformers. DC machines. Synchronous machines. Asynchronous machines (series of textbooks in Polish). Wyd. Pol. Gd., Gdańsk 1973 - 1978. 3. Matulewicz W.: Maszyny elektryczne. Podstawy (textbook in Polish). Wyd. PG, Gdańsk 2005. 4. Plamitzer A.: Maszyny elektryczne. WNT, W-wa 1976. 5. Roszczyk S.: Teoria maszyn elektrycznych. WNT, W-wa 1979. 6. Ronkowski M., Michna M., Kostro G., Kutt F.: Maszyny elektryczne wokół nas: zastosowanie, budowa, modelowanie, charakterystyki, projektowanie. Wyd. PG, Gdańsk, 2009/2011 (e-book, access at : POMORSKA BIBLIOTEKA CYFROWA) 7. Ronkowski M., Michna M., Kostro G.: Laboratory of electrical machines (in Polish). Wydz. EiA PG, Gdańsk 2012-2013. (set of instructions, access at internet).
	Supplementary literature	1. Fitzgerald A.E.: Electric Machinery. 6th edition. McGraw-Hill Book Comp., New York 2003. 2. Rafalski W., Ronkowski M.: Zadania z maszyn elektrycznych. Part. I i II (textbooks in Polish). Wyd. PG, Gdańsk 1994. 3. Staszewski P., Urbański W., Zagadnienia obliczeniowe w eksploatacji maszyn elektrycznych, Warszawa, Oficyna Wyd. PW, Warszawa 2009.
	eResources addresses	Adresy na platformie eNauczanie: MASZYNY ELEKTRYCZNE EL [2023/24] - Moodle ID: 32119 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=32119
Example issues/ example questions/ tasks being completed	• Explain the purpose of the no-load and short-circuit tests of transformer. • For a given data of no-load test measurements of a transformer calculate: no-load current (in A and %), core losses and equivalent circuit parameters (in ohms and %). • For a given data of short-circuit test measurements of a transformer calculate: short-circuit (in V and %), winding losses (in W and %); equivalent circuit parameters (in ohms and %); steady-sate short-circuit (in A and %) at rated supply voltage.	
Work placement	Not applicable	