GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Electric Machines, PG_00055895		
Field of study	Power Engineering, Power Engineering, Power Engineering		
Date of commencement of studies	October 2021	Academic year of realisation of subject	2022/2023
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	4	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. Ireneusz Mosoń dr inż. Grzegorz Kostro dr hab. inż. Michał Michna dr inż. Filip Kutt dr inż. Roland Ryndzionek dr inż. Łukasz Sienkiewicz	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	30.0	0.0	0.0	75
	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	75	5.0	45.0	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_W05] has structured knowledge in the field of electrical engineering and electronics, necessary to understand the basics of operation and selection of electrical machines, electricity transmission systems and power electronic devices	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.	[SW1] Assessment of factual knowledge
[K6_W03] knows the basics of automation and automatic regulation, knows the principles of the selection of electrical devices, drive systems and their control	Student explains principles of DC and AC motors speed and torque control.	[SW1] Assessment of factual knowledge
[K6_U03] has the preparation necessary to work in an industrial environment, applies the principles of occupational health and safety, can perform diagnostics of the regulation system of a simple energy facility	Student selects measuring devices to perform basic measurements in electrical systems. Makes measurements. Assesses the condition of the device based on measurements results	[SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information

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.

Prerequisites and co-requisites

General knowledge of the subject of Electrical fundamentals, ability to analyse electrical and magnetic circuits.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Practical exercise	60.0%	50.0%
Midterm colloquium	60.0%	40.0%
Oral exam	60.0%	10.0%

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.: Eletrical machines. Fundamentals (textbook in Polish). Wyd. PG, Gdansk 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.: Electrical machines around us (E-textbook in Polish). Wydz. EiA PG, Gdańsk 2009-2010 (access at internet). 7. Ronkowski M., Michna M., Kostro G.: Laboratory of electrical machines (in Polish). Wydz. EiA PG, Gdańsk 2009-2010. (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.: Solving problems of electrical machines. Part. I i II (textbooks in Polish). Wyd. PG, Gdańsk 1994. 3. Staszewski P., Urbański W.: Solving problems of electrical machines in exploitations (textbook in Polish), Oficyna Wyd. PW, W-wa 2009.

	eResources addresses	
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	