GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Electric Drive, PG_00038403		
Field of study	Electrical 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	Part-time studies	Mode of delivery	at the university
Year of study	2	Language of instruction	Polish
Semester of study	4	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Controlled Electric Drives -> Faculty of Electrical and Control Engineering		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Jarosław Guziński	
	Teachers	prof. dr hab. inż. Jarosław Guziński dr inż. Mirosław Włas dr inż. Marcin Drzewiecki dr inż. Filip Wilczyński	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	20.0	0.0	10.0	0.0	0.0	30

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	30	5.0	65.0	100

Subject objectives: Get basic knowedge and skill on electrical drives

Learning outcomes

Course outcome	Subject outcome	Method of verification
K6_W06	Student defines work regimes of electrical machines, distinguishes kinds of load, defines machine loads, explains equations of machine dynamics, principles of motion control, determines machine models, defines structures of drive systems with AC and DC machines, explains principles of energy recovery, explains basic principles of vector control.	[SW1] Assessment of factual knowledge
K6_U07	Is able to select and configure an electrical drives for operation in electrrical power plants.	[SU1] Assessment of task fulfilment

Subject contents	**Lactures.** Theory of electromechanical energy conversion. The general form of the equations of motion drive. Converting the torque to the motor shaft. Mechanical characteristics of electric motors and load machines. Drives with DC machines: output characteristics; power converters - choppers, rectifiers, control system, dual-area of drive operation, the sellection and tunning of the controllers. Classification of power converters for AC electric motors AC: frequency converters. Drives with induction motors: characteristics, start-up, speed control and braking; mechanical characteristics in case of inverter voltage and current type supply. Phenomena related to power a converter motors, dV / dt, bearing currents, motor filters. Induction motor control methods: control V / f = const. (scalar), field-oriented (vector) control to direct torque control (DTC), non-linear control (multiscalar). Sensorless control of induction motors. Drives with double fed induction machines: constant torqe cascade, hydroelectric power generators and wind turbines. Synchronous motor drives: properties, accelerating, braking, speed control. Drive systems with motors permanent magnet synchronous (PMSM). Drive systems of brushless DC motors (BLDCM). The properties and control of switched reluctance motor drives. The properties and control of switched reluctance motor drives.stepper motors. Transient analysis: start-up, change of speed and load. Concurrency of electric motors. Speed and shaft position sensors. mechanical coupling and gearboxes, motoreducers. Types of electric motors. Selection of electric motors for drive systems: heating, power calculation, supply cables, and protection. Cooling of electrical machines. Selection and configuration of frequency converters. Industrial drive systems: drives for pumps, fans, centrifuges, compressors, cranes. Electric drives vehicles. Fundamentals of computer simulation of electric drives. **Laboratory.** DC drive with controlled rectifier. Scalar U/f control of induction motor. Electric drive with voltage inverter and induction motor - field oriented control (FOC). Programming of LS-iC5 frequency converter for operation in vehicle drive. Nonlinear (multiscalar) control od induction motor.
Prerequisites and co-requisites	Basic knowleage on electrical machines, power electronics and control theory.
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
Midterm colloquium	60.0%	50.0%
Laboratory exercises	60.0%	50.0%

Recommended reading	Basic literature	1. Koczara W.: Wprowadzenie do napędu elektrycznego, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2012. 2. Zawirski K., Deskur J., Kaczmarek T.: Automatyka napędu elektrycznego, Wydawnictwo Politechniki Poznańskiej, Poznań 2012. 3. Grunwald Z. (red): Napęd Elektryczny. Warszawa, WNT 1987. 4. Szklarski L., Dziadecki A., Strycharz J., Jaracz K.: Automatyka napędu elektrycznego. Wyd. AGH, Kraków 1996.
	Supplementary literature	1. Tunia H., Kaźmierkowski M. Automatyka napędu przekształtnikowego.PWN 1987. 2. Orłowska-Kowalska T: Bezczujnikowe układy napędowe z silnikami indukcyjnymi. Wrocław, Oficyna Wydawnicza PW 2003. 3. Krzemiński Z. Cyfrowe sterowanie maszynami asynchronicznymi. Gdańsk, Wyd. PG 2001. http://www.ely.pg.gda.pl/kane/Monografia.pdf 4. Guzinski J.: "Układy napędowe z silnikami indukcyjnymi i filtrami wyjściowymi falowników napięcia. Zagadnienia wybrane". Seria Monografie nr 115, Wydawnictwo Politechniki Gdańskiej, Gdańsk 2011. 5. Abu-Rub H., Iqbal A., Guzinski J.: "High Performance Control of AC Drives with Matlab / Simulink Models". A John Wiley & Sons (2012).
	eResources addresses	Adresy na platformie eNauczanie: NAPĘD ELEKTRYCZNY [ET][Niestacjonarne][2022/23] - Moodle ID: 28507 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=28507
Example issues/ example questions/ tasks being completed	1. Motion equation for electrical drive with constant inertia. 2. Motor selection for cyclic variable load. 3. Measurement of electrical machines mechanical speed.	
Work placement	Not applicable	