

。 GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

| Subject name and code | Electric drives, PG_00058351 | | | | | | | | |
|--|--|--|--|-------------------------------------|-----------|--|---------|-----|--|
| Field of study | Hydrogen Technologies and Electromobility | | | | | | | | |
| Date of commencement of studies | October 2024 | | Academic year of realisation of subject | | | 2025/2026 | | | |
| 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 | | | 3.0 | | | |
| | general academic profile | | Assessment form | | | assessment | | | |
| Conducting unit | Department of Contro | olled Flectric Dr | rives -> Eaculty of Electrical and Control Engineering | | | | | | |
| | Subject supervisor | ubiect supervisor | | | | | | | |
| of lecturer (lecturers) | Teachers | | | 12.00100.0.1 | den rert. | | | | |
| Lesson types and methods of instruction | Lesson type | Lecture | Tutorial | Laboratory | Projec | t | Seminar | SUM | |
| | Number of study hours | 15.0 | 0.0 | 15.0 | 0.0 | | 0.0 | 30 | |
| | E-learning hours included: 0.0 | | | | | | | | |
| Learning activity and number of study hours | Learning activity | Participation ir classes includ plan | n didactic led in study | Participation in consultation hours | | Self-study | | SUM | |
| | Number of study hours | 30 | | 6.0 | | 39.0 | | 75 | |
| Subject objectives | To get the basic knowleage on electrical machines, electrical engineering and control theory | | | | | | | | |
| Learning outcomes | Course outcome Subject outcome | | | | | Method of verification | | | |
| | [K6_W06] knows the construction and operation of transformers, electrical machines, low and high temperature electrolysers, electrical drive systems, their modeling and industrial applications | | 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] can build and analyze models of systems and systems in the field related to hydrogen devices and installations as well as control and automation systems | | Is able to select and configure an electrical drives for operation in electrrical power plants. | | | [SU1] Assessment of task fulfilment [SU5] Assessment of ability to present the results of task | | | |

| Subject contents | Lectures. 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 for drive systems: heating, power calculation, supply cables, and protection. Cooling of electric motors for drive systems: heating, power calculation, supply cables, and protection. Cooling of electric amachines. Selection and configuration of frequency converters. Industrial drive systems: drives for pumps, fans, centrifuges, compressors, cranes. Electric drives vehicles. | | | | | | |
|--|---|---|-------------------------------|--|--|--|--|
| Prerequisites and co-requisites | Basic knowleage on electrical machines, electrical engineering and control theory | | | | | | |
| Assessment methods | Subject passing criteria | Passing threshold | Percentage of the final grade | | | | |
| and criteria | Laboratory exercises | 60.0% | 50.0% | | | | |
| | Midterm colloquium | 60.0% | 50.0% | | | | |
| Recommended reading | Basic literature | Koczara W.: Wprowadzenie do napędu elektrycznego, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2012. Sieklucki G., Bisztyga B., Zdrojewski A., Orzechowski T., Sykulski R.: Modele i zasady sterowania napędami elektrycznymi. Wydawnictwa AGF, Kraków 2014. Zawirski K., Deskur J., Kaczmarek T.: Automatyka napędu elektrycznego, Wydawnictwo Politechniki Poznańskiej, Poznań 2012. Grunwald Z. (red): Napęd Elektryczny. Warszawa, WNT 1987. Szklarski L., Dziadecki A., Strycharz J., Jaracz K.: Automatyka napędu elektrycznego. Wyd. AGH, Kraków 1996. | | | | | |
| | Supplementary literature | Tunia H., Kaźmierkowski M. Automatyka napędu przekształtnikowego.PWN 1987. Orłowska-Kowalska T: Bezczujnikowe układy napędowe z silnikami indukcyjnymi. Wrocław, Oficyna Wydawnicza PW 2003. Krzemiński Z. Cyfrowe sterowanie maszynami asynchronicznymi.Gdańsk, Wyd. PG 2001. Guzinski J.: "Układy napędowe z silnikami indukcyjnymi i filtramiwyjściowymi falowników napięcia. Zagadnienia wybrane".Seria Monografie nr 115, Wydawnictwo Politechniki Gdańskiej, Gdańsk 2011. 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: | | | | | |
| Example issues/ example questions/ tasks being completed | Motion equation for electrical drive with constant inertia. Motor selection for cyclic variable load. Measurement of electrical machines mechanical speed. Properties of the rolling mill electric drives. Mechanical characteristics of the DC motor with permanent magnets and the possibility of forming it. Compare scalar control and vector control of induction motor. Field oriented control of induction motor - principle, vectors, DC motor analogy, control scheme. Principle of operation of an electronic commutator of BLDC motor. Electric drive with swithced relucance motor. How to select the electric motor for cyclic loading. Not applicable | | | | | | |

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