GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

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|---|---|---|---|
| Subject name and code | , PG_00053437 | | |
| Field of study | Electrical Engineering | | |
| Date of commencement of studies | October 2023 | Academic year of realisation of subject | 2026/2027 |
| Education level | first-cycle studies | Subject group | |
| Mode of study | Full-time studies | Mode of delivery | at the university |
| Year of study | 4 | Language of instruction | Polish |
| Semester of study | 7 | ECTS credits | 4.0 |
| Learning profile | general academic profile | Assessment form | assessment |
| Conducting unit | Faculty of Electrical and Control Engineering -> Faculties of Gdańsk University of Technology | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | prof. dr hab. inż. Jarosław Guziński | |
| | Teachers | | |

**Lesson types**

| Lesson type | Lecture | Tutorial | Laboratory | Project | 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 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**

The aim of the course is to acquire knowledge and skills in the field of electric electromobility. The aim of the course is to get knowledge and skills in the field of electromobility, in particular electric drives, electric motors, power-electronic converters and charging systems used in electric vehicles as well as issues related to self-driving cars.

**Learning outcomes**

| Course outcome | Subject outcome | Method of verification |
|---|---|---|
| K6_W10 | knows the basic principles of processing, use and rational use of electricity in electric vehicles | [SW1] Assessment of factual knowledge |
| K6_K01 | is aware of the need to acquire knowledge in the field of electric vehicles | [SK2] Assessment of progress of work |
| K6_U09 | is able to examine selected components of an electric vehicle's equipment in steady and transient states | [SU1] Assessment of task fulfilment |
| K6_U10 | can designe and select the drive system of an electric vehicle | [SU1] Assessment of task fulfilment |

**Subject contents**

Course content – lecture
Introductory news. Energy demand, battery capacity assessment, vehicle energy consumption meters, driving range estimation. Energy storage and converters for cooperation with energy sources: batteries, flywheel, fuel cells, supercapacitors. Automatic systems of converter drive of vehicles with electric motors. Vehicle drives with permanent magnet motors. Electric drives in hybrid vehicles: diesel-electric. Methods of controlling electric motors in vehicles. Sensorless control. Powerelectronic converters in electric vehicles. Battery charging systems. Superior vehicle control. Self-driving cars. Hydrogen technologies in electric vehicles. Design of an electric vehicle with battery supply.

Course content – laboratory
Simulation part: Steer-By-Wire (SBW) in cars, electric vehicle drive system with PMSM motor and FOC sensorless control method, two-wheeled vehicle control. Experimental part: torque and speed control of the induction motor for building speed-torque characteristics of the electric vehicle, control of the electric drive with an PMSM motor for electric vehicle

**Prerequisites and co-requisites**

Knowledge of the basics of electrical engineering and automation

**Assessment methods and criteria**

| Subject passing criteria | Passing threshold | Percentage of the final grade |
|---|---|---|
| Laboratory (tests, reports) | 60.0% | 50.0% |
| Colloquium at the lecture | 60.0% | 50.0% |

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|---|---|---|
| Recommended reading | Basic literature | 1. Chau K.T.: Electric Vehicle Machines and Drives: Design, Analysis and Application. Wiley - IEEE, 2015.<br>2. Dembowski A,.: Elektryczny napęd trakcyjny. WNT. Warszawa 2019.<br>3. Karwowski K. (red.): Energetyka transportu zelektryfikowanego. Wyd. PG, Gdańsk 2018.<br>4. Szumanowski A.: Hybrid Electric Vehicle Drives Design. Wyd. NRI. Warszawa-Radom 2006.<br>5. Choromański W., Grabarek I., Kozłowski M., Czerepicki A., Marczuk K.: Pojazdy autonomiczne i systemy transportu autonomicznego. PWN. Warszawa 2020. |
| | Supplementary literature | 1. Ali Emadi (Ed.): Advanced Electric Drive Vehicles. CRC Press, Taylor & Francis. 2015.<br>2. Ehsani, Y. Gao, S. Longo, K. Ebrahimi: Modern Electric, Hybrid Electric, and Fuel Cell Vehicles Fundamentals, Theory, and Design. M. CRC Press, 3rd Edition, 2018.<br>3. Merkisz. J., Pielecha I.: Alternatywne napędy pojazdów. Wyd. PP. Poznań 2006.<br>4. Dębicki M.: Teoria samochodu, teoria napędu. WNT. Warszawa 1969.<br>5. Gomółka J., Kowalczak F., Franke A.: Współczesne chemiczne źródła pradu. Wyd. MON. Warszawa 1977.<br>6. Węgrzyn B.: Samochody z napędem elektrycznym. WNT. Warszawa 1970. |
| | eResources addresses | |
| Example issues/ example questions/ tasks being completed | 1. Design an electric drive system to replace internal combustion engine in selected car.<br>2. Run and investigate drive system of EV with an induction motor.<br>3. Run and investigate drive system of EV with an PMSM motor. | |
| Practical activites within the subject | Not applicable | |

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