COURSE DESCRIPTION CARD - SYLLABUS

Course name
PO7: Electric bulk transport vehicles - Electric bulk transport

Course

Field of study
Electromobility

Year/Semester
3/6

Area of study (specialization)

Profile of study
general academic

Level of study
First-cycle studies

Course offered in
polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
30

Laboratory classes
15

Other (e.g. online)

Tutorials

Projects/seminars

Number of credit points

3

Lecturers

Responsible for the course/lecturer:
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tel. 61 665 2781

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Responsible for the course/lecturer:
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Prerequisites

The student has knowledge in the field of electrical engineering, electricity transmission, electrical machines, the basics of vehicle traffic theory, as well as the ability to work in a laboratory group.

Course objective

- defining and systematizing the terms: transport, bulk transport, public transport and presention of the legal principles of the operation of generally accessible means of transport,

- presentation of technical solutions for the construction and principles of operation of vehicles used to transport people and cargo, divided into local and unlimited-range vehicles,

- presentation of technical and environmental requirements for energy sources used to power vehicles, including requirements for energy storage in vehicles,

- presentation of drive systems and methods of controlling their operation depending on the current operating conditions.

- acquisition of basic skills in the calculation of parameters of power systems and energy storage used in public transport and the place of installation of these sources.

Course-related learning outcomes

Knowledge

Has an orderly and theoretically founded knowledge of the construction, principles of operation and operation of electric machines and drive systems used in electromobility; knows the principles and methods of diagnostics and the basics of reliability theory of technical systems appropriate for the field of study,

Knows and understands problems related to mass transport; is aware of the latest development trends related to the use of electricity in transport.

Skills

He is able to consciously use modern technical solutions in the field of bulk transport, taking into account environmental, economic and legal conditions.

He can compare various technical solutions, assess them in terms of selected utility criteria.

Social competences

He understands the need to formulate information and opinions on the positive and negative aspects of electromobility and is ready to act for the public interest.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture:

- assessment of knowledge and skills demonstrated during the written test.

Laboratory:

- knowledge test during laboratory exercises,

- assessment of student activity and assessment of the increase in knowledge, skills and social competences,

- evaluation of research reports.

Programme content

Lecture:

Definitions of terms: public, bulk and collective transport; legal conditions. Breakdown of generally available means of transport. Ways of powering electric vehicles. Traction network and its operation. Energy accumulators - design and operating parameters; charging stations for mobile electricity sources. Mobile fuel cells: structure, principle of operation, operation. Technical parameters and equipment of electric vehicles intended for collective transport of people and goods depending on the anticipated range of the vehicle. Rail vehicle drive units - structure, control systems, power supply. Methods of speed regulation of vehicles powered by DC and AC motors. Resistor and pulse start-up of a DC motor. Start-up limitations. Asynchronous machines in traction applications. Methods of speed and torque regulation. Traction characteristics of vehicles powered by AC motors. Influence of the traction network voltage on the traction and motion parameters of vehicles with an asynchronous motor. Drive systems in vertical transport (elevators) - construction, control methods and safety systems. Main drives and auxiliary drives (bow thruster, capstan) in water transport; power and control systems. Modern water-jet drives. Vehicles for urban, suburban, railway, super-fast traction. Optimization of vehicle traffic due to energy consumption. Energy management in vehicles. Regenerative braking efficiency. Innovative public transport concepts - high-speed rail (HSR), A-Train concept and Maglev system.

Laboratory:

Research on power systems as well as energy conversion and conversion structures in electric vehicles intended for the bulk transport of passengers and goods with an urban or national range.

Model testing (simulation test) of a traction drive with an asynchronous and synchronous motor with permanent magnets.

Study of the operational properties of models of traction motors of various designs, powered from various sources.

Selection of the power source (charger) to the energy needs of the mobile energy storage.

Lower and upper traction network. Cooperation of the pantograph with the overhead contact line.

Elevator drive test - modeling of the elevator control system.

Study of electromagnetic disturbances emitted to the environment by modern traction drive systems.

Teaching methods

Lecture with a multimedia presentation supplemented with examples on the blackboard, taking into account various aspects of the presented issues, including economic, ecological, legal and social.

Laboratory: discussions on the obtained research results, detailed review of reports by the lecturer, demonstrations.

Bibliography

Basic

Szeląg A.: Trakcja elektryczna-podstawy, OWPW, Warszawa 2019

Skarpetowski G.: Przetworniki i przekształtniki energii w napędach trakcyjnych. Część 1 Przetworniki. Wydawnictwo „PIT" Kraków 2016

Dębowski A.: Elektryczny napęd trakcyjny. Wydawnictwo WNT 2019

Energetyka transportu zbiorowego. Praca zbiorowa pod redakcją Krzysztofa Karwowskiego. Wydawnictwo Politechniki Gdańskiej Gdańsk 2018

Towpik K.: Infrastruktura transportu szynowego. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2017

Steimel A.: Electric Traction-Motive Power and Energy Supply. Oldenbourg Industrievelag München 2008

Additional

Krzysztof Karwowski i inni: Energetyka transportu zelektryfikowanego. Wydawnictwo Politechniki Gdańskiej. Gdańsk 2018

Kacprzak J., Kozierkiewicz M.: Układy napędowe i sterowania trolejbusów. Monografia 28, Politechnika Radomska Radom str. 225.

Madej J.: Teoria ruchu pojazdów szynowych. OWPW 2012.

Rawicki S.: Energooszczędne przejazdy tramwajów ze sterowanymi wektorowo silnikami indukcyjnymi w dynamicznym ruchu miejskim Wyd. Politechniki Poznańskiej, Poznań 2013

Szeląg A.: Wpływ napięcia w sieci trakcyjnej 3 kV DC na parametry energetyczno-trakcyjne zasilanych pojazdów. InstytutNaukowo-Wydawniczy SPATIUM, Radom 2013

Jarzębowicz L., Kulig E.: Analiza energochłonności pojazdu elektrycznego w oparciu o dane z pokładowego rejestratora parametrów. TTS,nr 12/2015.

Breakdown of average student's workload

	Hours	ECTS
Total workload	80	3,0
Classes requiring direct contact with the teacher	45	2,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation)[1]	35	1,0

[1] delete or add other activities as appropriate