



COURSE DESCRIPTION CARD - SYLLABUS

Course name

PO7: Electric bulk transport vehicles - Traction drive systems

Course

Field of study

Electromobility

Area of study (specialization)

Level of study

First-cycle studies

Form of study

full-time

Year/Semester

3/6

Profile of study

general academic

Course offered in

polish

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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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 concepts of: transport, traction, traction energy distribution networks and presenting the legal principles of the operation of such networks,

- presentation of technical and environmental requirements for drives used in vehicles, including requirements for energy storage in vehicles,



- presentation of design solutions for modern drive systems used in vehicles powered from the distribution network,

- presentation of drive systems and methods of controlling their operation

depending on the current operating conditions and methods of energy supply to the vehicle, and the type of energy used,

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

- acquisition of basic skills in the field of testing selected drives.

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: transport, traction. Breakdown of generally available means of transport. Classification of methods of powering vehicles powered by energy taken from the grid. Mobile sources of electricity, incl. fuel cells: construction, principles of operation, operation. Technical parameters and equipment of electric and pneumatic driven vehicles depending on the anticipated range of the vehicle. Drive units for rail vehicles - construction, control systems, power supply. Propulsion of vehicles powered from on-board sources - construction of modern high-performance asynchronous and synchronous traction motors. Methods of controlling the operating point of electric traction motors. Dynamic states in traction drive systems (starting, braking) - starting overcurrents. Traction characteristics. Influence of voltage on the running parameters of drives with motors: asynchronous and synchronous. Reluctance traction motors. Environmental exposure due to electromagnetic field emission by drives.

Pneumatic and hybrid powered transport platforms. Pneumatic drive control.

Drive systems in vertical transport (elevators) - structures, control methods and safety systems.

Electric propulsion systems in water transport - main drives and auxiliary drives (bow thruster, capstan). Power and control systems. Modern water-jet drives.

Optimization of vehicle traffic due to energy consumption. Energy management in vehicles. Effectiveness of regenerative braking in cooperation with energy storage.

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.

Testing the model pneumatic transport platform.

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., Kozierekiewicz 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