COURSE DESCRIPTION CARD - SYLLABUS

Course name
Electric traction power systems [S1Elmob1>SZTE]

Course

Field of study
Electromobility

Year/Semester
3/6

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

dr inż. Michał Krystkowiak
michal.krystkowiak@put.poznan.pl

Lecturers

Prerequisites

Knowledge - Basic information in the field of electronics and power electronics Skills - The ability to effectively self-educate in a field related to the chosen field of study; the ability to make the right decisions when solving simple tasks and formulating problems in the field of broadly understood electric traction power supply systems. Competences - The student is aware of expanding his competences, demonstrates readiness to work in a team, the ability to comply with the rules applicable during lectures and laboratories.

Course objective

Getting to know the structure and principles of operation of classic and modern converter systems used in electric traction supply systems. Getting acquainted with the probematics of the influence of power electronic systems on the power grid and methods of improving the quality of electricity conversion. Getting to know the systems enabling the recovery and storage of electricity.

Course-related learning outcomes

Knowledge:
1. The student should have knowledge of the construction and principles of operation of classic and modern converter systems used in electric tracking power supply systems.

2. The student should have knowledge of the ways of limiting the adverse impact on the power supply network of power electronic systems.
3. The student should know the idea behind the operation of selected energy recovery and storage systems used in electric traction.

Skills:
1. The student will be able to use the knowledge in the field of construction and principles of operation of converter systems used in electric traction.
2. The student will be able to propose a solution to reduce the negative impact on the power supply network of power electronic traction systems.
3. The student will be able to analyze whether it is possible to recover and store electricity from a selected traction system.

Social competences:
1. The student understands the importance of knowledge in solving problems and improving professional, personal and social competences.
2. The student is aware that the knowledge and skills in the technique quickly become obsolete.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture:
- assessment of knowledge and skills demonstrated in the solved written test of a problem nature,
- continuous assessment, rewarding activity and substantive content of statements.

Laboratory:
- verification based on the reports made,
- continuous assessment, rewarding activity and substantive content of statements.

Programme content

Traction rectifiers. Impact on the power grid. Closed regulation systems. Theories of power. Methods of improving the quality of converted electricity. Methods for improving the efficiency of power electronic systems.

Course topics

Complex rectifier systems with series and parallel connection, control algorithms in complex rectifier systems with series connection (symmetrical and sequential control), power transistor rectifier systems with improved transformed energy ratios, power transistor rectifier systems with the possibility of reactive power and distortion compensation, power rectifier systems with a voltage modulator in a DC circuit, modern power rectifier systems with a current modulator in a DC circuit, active parallel compensation in traction power rectifier systems, local energy storage cooperating with dedicated power electronics systems (issues including energy recovery and storage), systems enabling energy return to the AC voltage grid while ensuring high quality factors of the converted electricity.

Teaching methods

Lecture: presentation of issues with the use of multimedia, illustrated with examples given on the board, discussion on problem issues, results of simulation models research.
Laboratory: performing laboratory exercises in teams (preparation of the stand, building measuring systems, carrying out experiments) with the help and supervision of the teacher, testing simulation and experimental models - comparing the obtained results.

Bibliography

Basic:
1. Frąckowiak L., Energoelektronika. Cz. 2, Wydawnictwo Politechniki Poznańskiej, Poznań 2002.
2. Frąckowiak L., Januszewski S., Energoelektronika. Cz. 1, Półprzewodnikowe przyrządy i moduły energoelektroniczne, Wydawnictwo Politechniki Poznańskiej, Poznań 2001.
3. Mikołajuk K., Podstawy analizy obwodów energoelektronicznych, Państwowe Wydawnictwo

Naukowe, Warszawa 1998.
4. Mohan N., Undeland N., Robins W., Power Electronics, Jon Wiley & Sons Inc., New York 1999.
5. Strzelecki R., Supronowicz H., Współczynnik mocy w systemach zasilania prądu przemiennego i metody jego poprawy, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2000.
6. Szeląg A., Trakcja elektryczna - podstawy, Oficyna Wydawnicza Politechniki Warszaswkiej, Warszawa 2019.

Additional:
1. Kaźmierkowski M., Krishnan R., Blaabjerg H., Control in Power Electronics, Academic Press, Amsterdam 2002.
2. Przybyszewski M., Elektryczne zespołu trakcyjne, WKŁ, 2018.

Breakdown of average student's workload

	Hours	ECTS
Total workload	55	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	25	1,00