COURSE DESCRIPTION CARD - SYLLABUS

Course name
Fuel cells hybridization [S2Elmob1-PAiME>HOP]

Course

Field of study
Electromobility

Year/Semester
1/2

Area of study (specialization)
Alternative Fuels and Energy Storage

Profile of study
general academic

Level of study
second-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. Filip Szwajca
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Lecturers

Prerequisites

KNOWLEDGE: the student has a basic knowledge of the fuel cell design and operation. Also knows the basic elements of the hybrid propulsion systems. SKILLS: the student has the ability to integrate obtained information, interpret it, formulate conclusions, and justify opinions SOCIAL COMPETENCIES: the student has an awareness of the relevance and ability to understand the non-technical aspects and consequences of fuel cell hybridization in propulsion systems.

Course objective

Achieve knowledge of the fuel cell's operation as the main energy source in a hybrid powertrain. Assessing the system's energy balance along with evaluating the fuel cell's sensitivity to different types of load.

Course-related learning outcomes

Knowledge:
Has advanced knowledge of propulsion system design, diagnostics and operation of hybrid and electric vehicles including traction vehicles; knows the basic processes occurring in the life cycle of technical systems of hybrid and electric vehicles including traction vehicles
Has knowledge of trends, new developments in the field of electromobility and the dilemmas of modern

civilization especially in terms of the impact of changes in the ways of powering vehicles on the environment
Has extended and deepened knowledge in the field of modeling, analysis and synthesis of elements and systems characteristic of hybrid and electric vehicles including traction vehicles

Skills:
Is able to apply knowledge of the most recent technical and technological developments in the design of non-standard devices and systems in the area of electromobility
Can formulate and test hypotheses related to complex engineering problems and simple research problems in the area of electromobility, as well as interpret the obtained results and draw critical conclusions
Be able to plan and conduct experiments involving computer simulations and measurements of electrical and non-electrical quantities in electric and hybrid vehicle systems and their charging infrastructure
Be able to plan the process of testing devices and complex electronic and electrical systems of hybrid and electric vehicles including traction vehicles

Social competences:
Understands that in the field of technology, knowledge and skills are rapidly devaluing which requires their constant replenishment
Is aware of the importance of the latest scientific and technical achievements in solving research and practical problems, and is supported by expert opinions when necessary

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows: For discussion, ongoing preparation and activity in class. Written exam. Mandatory individual laboratory reports.

Programme content

Possibilities of using fuel cells in the propulsion systems of hybrid means of transport. Types and structure of fuel cells used in propulsion systems. Elements and structure of transmission, examples of construction of hybrid propulsion systems using fuel cells in cars, trucks and buses. Fuel cell hybrid propulsion: methods of combination and analysis of operating states. Fuel cell hybrid drives: advantages, disadvantages, applicability. Environmental impact of using fuel cells in propulsion systems. Development trends of fuel cell hybrid propulsion systems.

Course topics

none

Teaching methods

1. Lecture with multimedia presentation
2. Laboratories - use of research facilities

Bibliography

Basic:
1. Merkisz J., Pielecha I.: Układy mechaniczne pojazdów hybrydowych. Wydawnictwo Politechniki Poznańskiej, Poznań 2015.
2. Merkisz J., Pielecha I.: Układy elektryczne pojazdów hybrydowych. Wydawnictwo Politechniki Poznańskiej, Poznań 2015
3. Merkisz J., Pielecha I.: Alternatywne napędy pojazdów. Wydawnictwo Politechniki Poznańskiej, Poznań 2006.
4. Merkisz J., Pielecha I.: Alternatywne paliwa i układy napędowe pojazdów. Wydawnictwo Politechniki Poznańskiej, Poznań 2004.
5. Czerwiński A.: Akumulatory, baterie, ogniwa. WKiŁ, Warszawa 2005.
7. Szałek A.: Ogniwa paliwowe i hybrydowe układy napędowe w motoryzacji, PWE, Warszawa 2023.

Additional:
1. Conference materials on hybrid drives and fuel cells
2. Scientific journals: Combustion Engines, Maintenance and Reliability, Hydrogen

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