COURSE DESCRIPTION CARD - SYLLABUS

Course name
Nonpropulsion subsystems of electric vehicles [S2Elmob1-PAiME>UPSE]

Course

Field of study
Electromobility

Year/Semester
2/3

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
0

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

1,00

Coordinators

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Lecturers

Prerequisites

Understanding the basic concepts of construction and the fundamental principles of operation of the most important vehicle components.

Course objective

Familiarizing students with technical solutions specific to electric and hybrid vehicles in areas directly related to the propulsion system.

Course-related learning outcomes

Knowledge:
1. Has knowledge of development trends, new achievements in the field of electromobility, and the dilemmas of modern civilization, particularly regarding their impact on the natural environment.
2. Possesses expanded and in-depth knowledge in the field of systems characteristic of hybrid and electric vehicles.

Skills:
1. Can utilize knowledge of the latest technical and technological advancements in designing innovative

devices and systems in the field of electromobility.
2. Can acquire information (in Polish and English) from various sources, interpret, critically assess, analyze, and synthesize it, as well as draw conclusions and formulate and justify opinions.
3. Can employ modern information and communication tools, advanced programming techniques, and machine learning methods for data collection, processing, and analysis.
4. Can formulate and test hypotheses related to complex engineering problems and simple research issues in the field of electromobility, interpret the obtained results, and draw critical conclusions.

Social competences:
1.Understands that knowledge and skills in the field of technology quickly devalue, requiring continuous updating.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Credit on the basis of a written colloquium at the last lecture class.The written test consists of answering closed questions and several open questions requiring a synthetic, multi-sentence answer. The test will be passed after obtaining at least 50% of the points. Answers are scored from 0 to 1 point for each question, 0.5 of the grade is determined by randomly controlled lecture attendance.

Programme content

1. New architecture of electric vehicles - impact on body and chassis construction.
2. Mechanical aspects of constructing traction battery packs (crash resistance, cooling, sealing, vibration resistance, fire hazard).
3. Cooling systems for batteries and motors in electric vehicles.
4. Brake systems in electric and hybrid vehicles (regenerative braking, brake-by-wire control, Electronic Stability Program - ESP for electric and hybrid vehicles - HEV).
5. Steering systems for electric and hybrid vehicles.
6. Heating, ventilation, and air conditioning systems (HVAC) for electric and hybrid vehicles.
7. Driver assistance systems (ESP-HEV, trip planning systems, and others)

Teaching methods

Multimedia Presentation

Bibliography

Basic:
1. Shashank Arora, Alireza Tashakori Abkenar, Shantha Gamini Jayasinghe, Kari Tammi , Heavy-duty Electric Vehicles From Concept to Reality, Butterworth- Heinemann, 2021
2. Ronald Jurgen: Electric and Hybrid-Electric Vehicles: Braking Systems and NVH Considerations, SAE 2011
3. Hu Donghai, Design and Control of Hybrid Brake-By-Wire System for Autonomous Vehicle, Springer
4. Andrew J. Day, David Bryant: Braking of Road Vehicles. 2nd Edition - March 21, 2022

Additional:
1.Qinghong Peng and Qungui Du Progress in Heat Pump Air Conditioning Systems for Electric Vehicles-A Review Reprinted from: Energies 2016
2. Fuad Un-Noor, Sanjeevikumar Padmanaban, Lucian Mihet-Popa, Mohammad Nurunnabi Mollah and Eklas Hossain A Comprehensive Study of Key Electric Vehicle (EV) Components, Technologies, Challenges, Impacts, and Future Direction of Development Reprinted from: Energies 2017

Breakdown of average student's workload

	Hours	ECTS
Total workload	28	1,00
Classes requiring direct contact with the teacher	15	0,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	13	0,50