COURSE DESCRIPTION CARD - SYLLABUS

Course name
Hybrid vehicles [S1Elmob1>PH]

Course

Field of study
Electromobility

Year/Semester
2/4

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 (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

KNOWLEDGE: the student has a basic knowledge of the design and construction of components and systems of hybrid drives SKILLS: the student is able to integrate the obtained information, interpret it, draw conclusions, formulate and justify opinions SOCIAL COMPETENCES: the student is aware of the importance and understands the non-technical aspects and effects of transport activities

Course objective

Providing basic information on the construction and construction of hybrid drives in passenger vehicles, trucks and buses, taking into account the latest solutions

Course-related learning outcomes

Knowledge:
He/she has basic knowledge of mechanics, including vehicle dynamics; knows and understands the basic principles of graphic representation of structures in engineering applications
He/she knows, to an advanced level, the construction, principle of operation and application of energy storage systems, especially in the power systems of hybrid and electric vehicles
Student has a general knowledge of the life cycle, design and operation of hybrid and electric vehicles,

as well as the infrastructure dedicated to their power and charging; knows and understands the principle of their operation.
He/shehas basic knowledge necessary to understand social, ethical, economic, ecological, legal and other non-technical determinants of engineering activity

Skills:
Can plan and carry out experiments, including measurements of basic measurable quantities characteristic of electromobility in typical and not fully predictable conditions; can present the obtained results in a numerical and graphic form, interpret them and draw appropriate conclusions
Can test and diagnose simple systems and devices related to the electromobility area and operate them in accordance with the requirements and technical documentation
Can, when formulating and solving tasks related to electromobility, notice their systemic and non-technical aspects, including environmental, economic and legal
Can, with the use of appropriately selected methods and tools, make a critical analysis and evaluation of the functioning of existing technical solutions in electric and hybrid vehicles as well as the infrastructure intended for their power supply and charging

Social competences:
Understands the importance of improving professional, personal and social competences; is aware that knowledge and skills in the field of electromobility are evolving rapidly

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Lecture: the knowledge acquired during the lecture is verified during the written exam during the exam session and the part test on the Moodle platform. The exam consists of open and closed questions, depending on the difficulty level. Points from the partial test are added to the points obtained in the exam. Passing threshold: 50% of the total number of points. Exam issues are sent to the head of the year by e-mail using the university e-mail system 2-3 weeks before the exam date and discussed during the last lecture.
Laboratory: the skills acquired during the laboratory exercises are verified on the basis of reports made by students during or after the exercises. Exercises take place in 2 cycles. Each cycle ends with a final test which checks the knowledge of students acquired during the exercises. During the laboratory classes, verbal preparation of students for the exercise is verified. Passing the laboratory classes requires the completion of all exercises, individual completion of the reports indicated by the teacher and passing tests.

Programme content

Possibilities of using hybrid drives in means of transport. Division and characteristics of hybrid drives (series, parallel and mixed systems). Elements and structure of the drive train, examples of hybrid drive structures in passenger cars, trucks and buses. Internal combustion and electric drive: connection methods and analysis of operating states. Examples of the construction of hybrid drives in various means of transport. Hybrid hydraulic drives, advantages, disadvantages, application possibilities. Hybrid drives with fuel cells. Emissivity of hybrid drives: their advantages and disadvantages. Development trends of hybrid drives.

Course topics

1. Possibilities of using hybrid drives in means of transport.
2. Division and characteristics of hybrid drives (series, parallel and mixed systems).
3. Elements and structure of the drive train, examples of hybrid drive structures in passenger cars, trucks and buses.
4. Internal combustion and electric drive: connection methods and analysis of operating states.
5. Examples of the construction of hybrid drives in various means of transport.
6. Hybrid hydraulic drives, advantages, disadvantages, application possibilities.
7. Hybrid drives with fuel cells.
8. Emissivity of hybrid drives: their advantages and disadvantages. Development trends of hybrid drives.

Teaching methods

1. Lecture: multimedia presentation (including: drawings, photos, animations, films) supplemented with examples given on the board, especially computational examples. Taking into account various aspects of the presented issues, including: economic, ecological, legal and social. Presenting a new topic preceded by a reminder of related content, known to students from other subjects.
2.Laboratory: performing laboratory exercises in teams (preparation of the stand, building measuring systems, carrying out experiments) with the help and supervision of the teacher.

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.
6. Szumanowski A.: Akumulacja energii w pojazdach, WKiŁ, Warszawa 1984.
Additional
1. Conference materials on hybrid drives
2. Combustion Engines quarterly

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