COURSE DESCRIPTION CARD - SYLLABUS

Course name

Low-emission powertrain systems

Course

Field of study

Construction and Exploitation of Means of Transport

Year/Semester

3/6

Area of study (specialization)

Internal Combustion Engines

Profile of study

general academic

Level of study

First-cycle studies

Course offered in

Form of study

full-time

Requirements

compulsory

Number of hours

Lecture

15

Laboratory classes

30

Other (e.g. online)

0

Tutorials

0

Projects/seminars

0

Number of credit points

2

Lecturers

Responsible for the course/lecturer:

Prof. DSc., DEng. Ireneusz Pielecha

email: ireneusz.pielecha@put.poznan.pl

tel. 61-224-4502

Faculty of Civil and Transport Engineering

Piotrowo 3 street, 60-965 Poznan

Responsible for the course/lecturer:

Prerequisites

KNOWLEDGE: the student has a basic knowledge of the design and construction of components and drive systems

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 of low-emission drive systems in passenger vehicles, trucks and buses, taking into account the latest solutions

Course-related learning outcomes

Knowledge

Has knowledge in the field of physics, including the basics of classical mechanics, optics, electricity and magnetism, solid state physics, quantum and nuclear physics, necessary to understand specialist lectures in the field of the theory of construction materials and materials science, theory of machines and mechanisms, theory of electric drives and mechatronic systems .

Has a basic knowledge of technical thermodynamics, i.e. the theory of thermodynamic changes, heat flow, thermal machines and heating, drying and cooling devices.

Has elementary knowledge of electric drives in machines, including three-phase current, AC and DC motors, frequency and voltage converters, power electronics.

Skills

The student is able to obtain information from literature, the Internet, databases and other sources. Can integrate the obtained information, interpret and draw conclusions from it, and create and justify opinions.

The student is able to use learned mathematical theories to create and analyze simple mathematical models of machines and their elements, and simple technical systems.

The student is able to develop a manual for operating and repairing a simple machine from a group of machines covered by a selected specialty.

The student is able to create a system diagram, select elements and perform basic calculations using ready-made computational packages of mechanical, hydrostatic, electric or hybrid machine drive system.

Social competences

He/she is ready to critically assess his knowledge and received content

Is ready to recognize the importance of knowledge in solving cognitive and practical problems and to consult experts in the event of difficulties in solving the problem on its own

It is ready to fulfill social obligations and to co-organize activities for the benefit of the social environment.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

For discussion, ongoing preparation and activity in class. Written credit. Mandatory individual reports from exercises and laboratories.

Programme content

Possibilities of using low-emission drives in means of transport. Classification and characteristics of drives (hybrid, electric, fuel cells and others). Elements and structure of the drive train, examples of low-emission drive structures in cars, trucks and buses. Fuel cell drive, drive with the design of internal combustion engines powered by low-emission fuels. Examples of low-emission drives design in various means of transport: advantages, disadvantages, application possibilities. Emissivity of low-emission drives: their advantages and disadvantages. Development tendencies of such drives.

The laboratory includes exercises with the use of fuel cells: PEM, methanol fueled, ethanol powered, salt water powered. Analysis of the operation of cells in a cogeneration system. Analysis of fuel cell drives with batteries.

Teaching methods

1. Lecture with multimedia presentation

2. Exercises - solving problems

3. Laboratory

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	60	2,0
Classes requiring direct contact with the teacher	45	1,5
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	15	0,5

[1] delete or add other activities as appropriate