STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Hybrid powertrains		**1010611261010622492**

Field of study	Profile of study (general academic, practical)	Year /Semester
Mechanical Engineering	**(brak)**	**3 / 6**
Elective path/specialty	Subject offered in:	Course (compulsory, elective)
Motor Vehicles	**Polish**	**obligatory**

Cycle of study:	Form of study (full-time,part-time)
First-cycle studies	**full-time**

No. of hours				No. of credits
Lecture: **1**	Classes: **1**	Laboratory: **1**	Project/seminars: **-**	**3**

Status of the course in the study program (Basic, major, other)	(university-wide, from another field)
(brak)	**(brak)**

Education areas and fields of science and art	ECTS distribution (number and %)
technical sciences	**3 100%**
Technical sciences	**3 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	student has a basic understanding of the design and construction of components and systems of hybrid drives
2	**Skills**	student is able to integrate the information, make their interpretation, draw conclusions, formulate and justify opinions
3	**Social competencies**	student is aware of the important means non-technical aspects and impacts of transport

Assumptions and objectives of the course:

Provide basic information about the construction and design of hybrid systems in passenger vehicles, trucks and buses with the latest solutions.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. The student has general knowledge about the structure of different types of hybrid vehicles useful for formulating and solving simple engineering tasks - [W01]
2. The student knows the basic methods, techniques and solution of the hybrid drive - [W02]
3. The student has a detailed knowledge of hybrid solutions and knowledge of the development trends of the drives - [W03]

Skills:

1. The student knows how to use analytical and experimental methods for formulating and solving problems related to the hybrid system in vehicles - [U01]
2. Student can obtain information from the literature, to make them identify and formulate specific proposals for hybrid - [U02]
3. Student Able to plan and carry out experiments on hybrids powertrain - [U03]
4. The student is able to analyze and evaluate the functioning of the existing hybrid technology - [U04]

Social competencies:

1. The student understands the necessity of lifelong learning - raising professional and personal competences - [K01]
2. The student is able to think and act in a creative and enterprising - [K02]
3. The student is aware of their responsibility for collaborative tasks related to teamwork - [K03]

Assessment methods of study outcomes

Talk with the use of visual materials related to the hybrid system in vehicles.

The written examination, evaluation of laboratory reports.

Course description

Possible applications in hybrid modes. Distribution and characterization of hybrid (integrated serial, parallel and mixed). Elements and structure of the transmission system, examples of hybrid structures in cars and trucks and buses. Combustion engine and electric: Ways to connect and analysis of operation. Examples of hybrid structures in a variety of modes of transport. Hybrid hydraulic drives - advantages, disadvantages, possibilities of use. Hybrid drives with fuel cells. Emission of hybrid drives. Developments in hybrid powertrains.

Basic bibliography:

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 bibliography:

1. Materiały konferencyjne dotyczące napędów hybrydowych
2. Kwartalnik ?Combustion Engines?

Result of average student's workload

Activity	Time (working hours)
1. Participation in the lecture	15
2. Exam preparation	5
3. Participation in the exam	2
4. Preparation for laboratory	8
5. Participation in laboratory exercises	15
6. Capturing the content of training / report	8
7. Preparing to pass	8
8. Participation in exercises	15
9. Preparation for exercises	5

Student's workload

Source of workload	hours	ECTS
Total workload	75	3
Contact hours	50	2
Practical activities	25	1