

STUDY MODULE DESCRIPTION FORM		
Name of the module/subject Hybrid powertrains in transportation		Code 1010621261010622394
Field of study Transport	Profile of study (general academic, practical) (brak)	Year /Semester 3 / 6
Elective path/specialty Railway Transport	Subject offered in: Polish	Course (compulsory, elective) obligatory
Cycle of study: First-cycle studies	Form of study (full-time, part-time) full-time	
No. of hours Lecture: 1 Classes: 1 Laboratory: 1 Project/seminars: -		No. of credits 3
Status of the course in the study program (Basic, major, other) (brak)		(university-wide, from another field) (brak)
Education areas and fields of science and art technical sciences		ECTS distribution (number and %) 3 100%
Responsible for subject / lecturer: DSc. DEng. Ireneusz Pielecha email: ireneusz.pielecha@put.poznan.pl tel. 61 224 45 02 Faculty of Working Machines and Transport Piotrowo 3 Street, 60-965 Poznań		
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, credit classes on the basis of the work carried out, 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. Merksiz J., Pielecha I.: Alternatywne napędy pojazdów. Wydawnictwo Politechniki Poznańskiej, Poznań 2006.		
2. Merksiz J., Pielecha I.: Alternatywne paliwa i układy napędowe pojazdów. Wydawnictwo Politechniki Poznańskiej, Poznań 2004.		
3. Luft S.: Dwupaliwowy silnik o zapłonie samoczynnym z wtryskiem ciekłego LPG do kolektora dolotowego. Wydawnictwo Politechniki Radomskiej, Radom 2007.		
4. Czerwiński A.: Akumulatory, baterie, ogniwa. WKiŁ, Warszawa 2005.		
5. Pawelski Z.: Napęd hybrydowy dla autobusu miejskiego, Wydawnictwo Politechniki Łódzkiej, Łódź 1996.		
6. Szumanowski A.: Akumulacja energii w pojazdach, WKiŁ, Warszawa 1984.		
Additional bibliography:		
1. Proceedings of the hybrid powertrain		
2. ?Combustion Engines? Magazine		
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. Prepare for training auditorium	4	
5. Participation in exercises auditorium	15	
6. Capturing the content of training / report	4	
7. Preparation for laboratory	8	
8. Participation in laboratory exercises	15	
9. Capturing the content of training / report	8	
10. Preparing to pass	8	
Student's workload		
Source of workload	hours	ECTS
Total workload	86	3
Contact hours	49	2
Practical activities	37	1