

STUDY MODULE DESCRIPTION FORM		
Name of the module/subject Alternative Drive Sources		Code 1010622211010620563
Field of study Transport	Profile of study (general academic, practical) (brak)	Year /Semester 1 / 1
Elective path/specialty Ecology of Transport	Subject offered in: Polish	Course (compulsory, elective) obligatory
Cycle of study: Second-cycle studies	Form of study (full-time, part-time) full-time	
No. of hours Lecture: 1 Classes: 1 Laboratory: - Project/seminars: -		No. of credits 2
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 %) 2 100%
Responsible for subject / lecturer: DSc. DEng. Ireneusz Pielecha email: ireneusz.pielecha@put.poznan.pl tel. 61 224 45 02 Faculty of 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 alternative drive sources
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: Transfer of basic knowledge about the use of alternative sources of propulsion with the latest solutions		
Study outcomes and reference to the educational results for a field of study		
Knowledge:		
1. Student has a broader and deeper knowledge of the use of alternative drive sources in transport vehicles suitable for formulating and solving complex engineering tasks - [-]		
2. Student has a theoretical underpinnings detailed knowledge related to the use of alternative sources of propulsion - [-]		
3. Student knows the basic methods, techniques and tools used in solving complex engineering tasks related to alternative propulsion - [-]		
Skills:		
1. The student knows how to use analytical and experimental methods to formulate and solve problems associated with the use of alternative power sources - [-]		
2. Students can obtain information from the literature to make their identification and draw conclusions specific to electric drive vehicles - [-]		
3. Student can design according to the specifications set alternative means of transport drive - [-]		
4. Student is able to analyze and evaluate the functioning of the existing technical solutions for alternative power sources - [-]		
Social competencies:		
1. The student understands the necessity of lifelong learning - raising professional and personal competences - [-]		
2. The student is able to think and act in a creative and enterprising - [-]		
3. The student is aware of their responsibility for collaborative tasks related to teamwork - [-]		

Assessment methods of study outcomes		
Discussion of illustrative materials using alternative sources of power vehicles. The written examination, completion exercises based on the work done		
Course description		
The possibility of using alternative power sources in transport. Types and characteristics of alternative fuels. The possibility of using alternative power sources in automobiles and other means of transport. Possibility of using hydrogen in vehicles: range of engine modifications, the consequences, the emissivity of the drive. Means of storage and distribution of hydrogen. Design of electrical vehicles. The use of electric propulsion: the methodology of selection of electric motors and batteries. The range of an electric vehicle. Batteries in vehicles: determination of parameters. Generations of LPG injection systems and the ability to adapt engines to power the fuel. The use of LNG in transport. Distribution and types of injection systems for natural gas. The elements and structure of the drive turbine: distribution and use of gas turbines. The emissivity drive a turbine		
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. Sher E. : Handbook of Air Pollution from Internal Combustion Engines. Pollutant Formation and Control. Academic Press. Boston 1998		
4. Luft S.: Dwupaliwowy silnik o zapłonie samoczynnym z wtryskiem ciekłego LPG do kolektora dolotowego. Wydawnictwo Politechniki Radomskiej, Radom 2007		
5. Czerwiński A.: Akumulatory, baterie, ogniwa. WKiŁ, Warszawa 2005		
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. Consulting	2	
3. Exam preparation	5	
4. Prepare for training auditorium	8	
5. Participation in exercises auditorium	15	
6. Capturing the content of training / report	8	
Student's workload		
Source of workload	hours	ECTS
Total workload	53	2
Contact hours	32	1
Practical activities	21	1