



## Subject card

|   |  |  |  |                                     |  |            |     |
|---|--|--|--|-------------------------------------|--|------------|-----|
| Subject name and code                       | Electrical and Alternative Drive Systems in Vehicles, PG_00055521  |  |  |                                     |  |            |     |
| Field of study                              | Mechanical Engineering   |  |  |                                     |  |            |     |
| Date of commencement of studies             | October 2025   |  | Academic year of realisation of subject  |                                     | 2027/2028  |            |     |
| Education level                             | first-cycle studies  |  | Subject group  |                                     | Optional subject group<br>Subject group related to scientific research in the field of study |            |     |
| Mode of study                               | Full-time studies  |  | Mode of delivery   |                                     | at the university  |            |     |
| Year of study                               | 3  |  | Language of instruction  |                                     | Polish   |            |     |
| Semester of study                           | 6  |  | ECTS credits   |                                     | 5.0  |            |     |
| Learning profile                            | general academic profile   |  | Assessment form  |                                     | assessment   |            |     |
| Conducting unit                             | Institute Of Energy -> Faculty Of Mechanical Engineering And Ship Technology -> Wydziały Politechniki Gdańskiej  |  |  |                                     |  |            |     |
| Name and surname of lecturer (lecturers)    | Subject supervisor   |  | dr hab. inż. Jacek Kropiwnicki   |                                     |  |            |     |
|   | Teachers   |  |  |                                     |  |            |     |
| Lesson types and methods of instruction     | Lesson type  | Lecture  | Tutorial   | Laboratory                          | Project  | Seminar    | SUM |
|   | Number of study hours  | 30.0   | 0.0  | 15.0                                | 15.0   | 0.0        | 60  |
|   | E-learning hours included: 0.0   |  |  |                                     |  |            |     |
| Learning activity and number of study hours | Learning activity  | Participation in didactic classes included in study plan |  | Participation in consultation hours |  | Self-study | SUM |
|   | Number of study hours  | 60   |  | 5.0                                 |  | 60.0       | 125 |
| Subject objectives                          | Presentation of the modern achievements and tendencies in the area of electric and alternative vehicle propulsion systems, classification, as well as an indication of the possible application nowadays and in the future, with particular emphasis on Polish conditions.                                       |  |  |                                     |  |            |     |
| Learning outcomes                           | Course outcome   |  | Subject outcome  |                                     | Method of verification   |            |     |
|   | [K6_W11] possesses knowledge on design, technology and manufacturing of machine parts, metrology, and quality control; knows and understands methods of measuring and calculating values describing the operation of mechanical systems, knows calculating methods applied to analyse the results of experiments |  | Understands the specificity of drive systems, understands the consequences of the selected solutions in terms of achieved energetics parameters of the system. |                                     | [SW1] Assessment of factual knowledge  |            |     |
|   | [K6_W08] possesses knowledge including the methodology of designing machine parts, mechanical devices, selection of construction materials, manufacturing and operation, with the lifetime cycle   |  | Can analyse and evaluate the methods of functioning of the electric and alternative drive systems.   |                                     | [SW1] Assessment of factual knowledge  |            |     |
|   | [K6_U05] is able to plant an experiment within the range of measuring the basic operating parameters of mechanical devices using a specialized equipment, interpret the results and reach the correct conclusions  |  | Can use modern tools and knowledge in designing, operating and components selecting of vehicle drive systems.  |                                     | [SU1] Assessment of task fulfilment  |            |     |
|   | [K6_U07] is able to design a typical construction of a mechanical device, component or a testing station using appropriate methods and tools, adhering to the set usage criteria   |  | Student designs alternative drive system, projects components, makes thermal and efficiency calculations.  |                                     | [SU1] Assessment of task fulfilment  |            |     |

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| Subject contents   | <p><b>Lecture:</b> General information on the configuration of the propulsion systems, characteristics of the electric, hydrogen-powered, hybrid and alternative propulsion systems, vehicle energy demand for propulsion, cold and heat generation, own consumption, regenerative braking, environmental impact, test and real operation conditions, vehicle range calculations, alternative fuels, charging stations, battery replacement and refuelling, diagnostics and autonomous driving systems.</p> <p><b>Project:</b> Calculation of the vehicle's energy demand for propulsion, cooling and heat generation, own consumption, vehicle range calculations, range extender system calculations, route optimization, optimization of the hybrid drive system control strategy.</p> <p><b>Laboratory:</b> identification of real urban driving conditions, energy consumption in real operating conditions, determination of the total efficiency of the electric drive system, determination of the total efficiency of the hybrid drive system, identification of the operating modes of the hybrid system, fuel cell characteristics.</p> |   |                               |
| Prerequisites and co-requisites                                |  |   |                               |
| Assessment methods and criteria                                | Subject passing criteria   | Passing threshold   | Percentage of the final grade |
|  | Project  | 50.0%   | 30.0%                         |
|  | Laboratory reports   | 90.0%   | 10.0%                         |
|  | Test (lecture)   | 50.0%   | 60.0%                         |
| Recommended reading  | Basic literature   | Merkisz J.: UKŁADY MECHANICZNE POJAZDÓW HYBRYDOWYCH. Wydawnictwo Politechniki Poznańskiej.            |                               |
|  |  | Kropiwnicki J. Modelowanie układów napędowych pojazdów z silnikami spalinowymi. AGNI.                 |                               |
|  |  | Ghosh T.K., Prelas M.A.: Energy Resources and Systems. Springer Dordrecht Heidelberg London New York. |                               |
|  | Supplementary literature   | <a href="http://www.combustion-engines.eu">http://www.combustion-engines.eu</a>                       |                               |
|  |  | <a href="http://www.ijat.net">http://www.ijat.net</a>   |                               |
|  | eResources addresses   | Adresy na platformie eNauczanie:  |                               |
| Example issues/<br>example questions/<br>tasks being completed | Characterize the basic types of hybrid systems, give their advantages and disadvantages.   |   |                               |
|  | Present the calculation diagram of the total vehicle energy consumption of the type "well to wheel", compare the energy efficiency of the classic and electric drive system.   |   |                               |
|  | Calculate how much the range of an electric vehicle will change if its average speed increases by 30%.   |   |                               |
| Work placement   | Not applicable   |   |                               |

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