



## Subject card

|   |  |  |  |                                     |  |            |     |
|---|--|--|--|-------------------------------------|--|------------|-----|
| Subject name and code                       | Electrotechnics and electronics, PG_00044580   |  |  |                                     |  |            |     |
| Field of study                              | Transport  |  |  |                                     |  |            |     |
| Date of commencement of studies             | October 2023   | Academic year of realisation of subject                  |  |                                     | 2024/2025  |            |     |
| Education level                             | first-cycle studies  | Subject group  |  |                                     | Obligatory subject group in the field of study     |            |     |
| Mode of study                               | Full-time studies  | Mode of delivery   |  |                                     | at the university                                  |            |     |
| Year of study                               | 2  | Language of instruction                                  |  |                                     | Polish   |            |     |
| Semester of study                           | 3  | ECTS credits   |  |                                     | 4.0  |            |     |
| Learning profile                            | general academic profile   | Assessment form  |  |                                     | exam   |            |     |
| Conducting unit                             | Department of Electrical Engineering of Transport -> Faculty of Electrical and Control Engineering   |  |  |                                     |  |            |     |
| Name and surname of lecturer (lecturers)    | Subject supervisor   |  |  |                                     |  |            |     |
|   | Teachers   |  |  |                                     |  |            |     |
| Lesson types and methods of instruction     | Lesson type  | Lecture  | Tutorial   | Laboratory                          | Project  | Seminar    | SUM |
|   | Number of study hours  | 45.0   | 15.0   | 15.0                                | 0.0  | 0.0        | 75  |
|   | 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  | 75   |  | 5.0                                 |  | 20.0       | 100 |
| Subject objectives                          | Students is able to solve simple DC circuits and AC circuits, both single phase and three phase. Student is able to interpret the parameters of electrical equipment. Characterized electrical devices. Student is able to perform simple measurements of voltage, current and power of DC/AC circuits. Interpret the results of the measurements. Distinguished between analog and digital electronic and telecommunications devices. |  |  |                                     |  |            |     |
| Learning outcomes                           | Course outcome   |  | Subject outcome  |                                     | Method of verification                             |            |     |
|   | [K6_U01] able to use technical documentation and literature, databases and other sources of transport related information; able to interpret information, make logical links and formulate opinions and conclusions based on the above   |  | Students can use the technical documentation of electrical engineering. Student is able to look for and interpret new developments in the technical literature.  |                                     | [SU2] Assessment of ability to analyse information |            |     |
|   | [K6_W03] has basic knowledge of hydromechanics, thermodynamics, machine design, materials science and electrical engineering required for understanding the principles of construction and operation of means of transport   |  | Student is able to use the terms related to electrified transport infrastructure and vehicles.   |                                     | [SW1] Assessment of factual knowledge              |            |     |
|   | [K6_W04] has basic knowledge of informatics, electronics, telecommunications, automation and control, information technologies, computer graphics, geodesy and satellite navigation which is useful for understanding how it can be applied in transport   |  | Student has a basic knowledge on electrical engineering. Student is able to characterize selected electrical equipment. Student is able to characterize electronic and telecommunications equipment. Student is able to plan and perform simple measurements of electrical quantities. |                                     | [SW1] Assessment of factual knowledge              |            |     |

| Subject contents   | LECTURE Classification of electric signals and elements of electric circuits. Direct current linear electric circuits. Ohm's, and Kirchoff's law. Electric power and energy. The methods of electric circuits solutions: similarity method, node method and Thevenin method. DC non-linear electric circuits. Linearized circuit in bias point. Alternating current (AC) linear electric circuits. Method of determining of voltage and current waveforms on the resistance, inductance and capacitance. Complex numbers method. Phasor diagrams. Power in AC circuit. Method of solution of AC circuits: similarity method, node method. Phenomena of resonance - the resonant frequency. Three-phase electric circuits. Compensation of reactive power and voltage in power electrical systems. Electric and magnetic field. Sources of electricity. Magnetic coupling circuits. Transformers. Basic concepts of rotating machines. DC and Induction machines. Motor speed control. Power electronics in modern electrical engineering. Power switching devices. Review of standard power electronic circuits – converters and inverters. Electric installations. Low-voltage distribution circuit diagrams. Electrical safety. Protection in low voltage installations. Elements of electronics. Constructions and characteristics of semiconductor devices. Diodes. Transistors. Optoelectronics elements. Active circuits with operational amplifier. Amplifiers. Generators. Power supplies. Introduction to logic circuits. Introduction to microprocessors. Representation of numbers. Selected applications of microprocessors. The transmission of signals, types of transmission channels. Protocols and networks. TUTORIALS DC circuits. Power in DC circuit, matching the source to the load. Kirchoff method. AC circuits. Representation of the waveforms using complex numbers. The concept of impedance, reactance, equivalent circuit method. The concept of power in AC circuits. Active power, reactive and apparent power, power factor of the system. Calculation of the current drawn from the mains supply mixed group of receivers. Symmetrical three-phase circuits, basic concepts: line and phase voltage, line and phase currents for the receivers connected in a star or a delta. The concept of three-phase power system. Simplified one-wire diagrams: SEE, transformer, receiver. Operational amplifier circuits. LABORATORY Resonant circuits. Transformer. Multi-pulse rectifiers. AC and DC electric drive. Operational amplifier circuits. Optoelectronics. Electrical installations and equipment. |                               |  |                          |  |                               |                                  |  |       |                      |                                  |       |                    |       |       |
|--|---|-------------------------------|--|--------------------------|--|-------------------------------|----------------------------------|--|-------|----------------------|----------------------------------|-------|--------------------|-------|-------|
| Prerequisites and co-requisites                          | Basic knowledge on mathematics and physics.   |                               |  |                          |  |                               |                                  |  |       |                      |                                  |       |                    |       |       |
| Assessment methods and criteria                          | <table border="1" data-bbox="448 719 1487 853"> <thead> <tr> <th data-bbox="448 719 794 752">Subject passing criteria</th> <th data-bbox="794 719 1141 752">Passing threshold</th> <th data-bbox="1141 719 1487 752">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="448 752 794 786">Report from laboratory exercises</td> <td data-bbox="794 752 1141 786">60.0%</td> <td data-bbox="1141 752 1487 786">20.0%</td> </tr> <tr> <td data-bbox="448 786 794 819">Exam</td> <td data-bbox="794 786 1141 819">60.0%</td> <td data-bbox="1141 786 1487 819">60.0%</td> </tr> <tr> <td data-bbox="448 819 794 853">Practical exercise</td> <td data-bbox="794 819 1141 853">60.0%</td> <td data-bbox="1141 819 1487 853">20.0%</td> </tr> </tbody> </table>  |                               |  | Subject passing criteria | Passing threshold  | Percentage of the final grade | Report from laboratory exercises | 60.0%  | 20.0% | Exam                 | 60.0%                            | 60.0% | Practical exercise | 60.0% | 20.0% |
| Subject passing criteria                                 | Passing threshold   | Percentage of the final grade |  |                          |  |                               |                                  |  |       |                      |                                  |       |                    |       |       |
| Report from laboratory exercises                         | 60.0%   | 20.0%                         |  |                          |  |                               |                                  |  |       |                      |                                  |       |                    |       |       |
| Exam   | 60.0%   | 60.0%                         |  |                          |  |                               |                                  |  |       |                      |                                  |       |                    |       |       |
| Practical exercise                                       | 60.0%   | 20.0%                         |  |                          |  |                               |                                  |  |       |                      |                                  |       |                    |       |       |
| Recommended reading                                      | <table border="1" data-bbox="448 860 1487 1205"> <tbody> <tr> <td data-bbox="448 860 794 1037">Basic literature</td> <td colspan="2" data-bbox="794 860 1487 1037">Bolkowski S.: Teoria obwodów elektrycznych. Warszawa: WNT, 2007. Bolkowski S., Brociek W., Rawa H.: Teoria obwodów elektrycznych. Zadania. Warszawa: WNT, 2007. Pr. zb. : Elektrotechnika i elektronika dla nieelektryków. Warszawa: WNT, 2007. Tietze U. Schenk Ch.: Układy półprzewodnikowe. Warszawa: WNT, 2009. Rusek M., Pasierbiński J.: Elementy i układy elektroniczne w pytaniach i odpowiedziach. Warszawa: WNT, 2006.</td> </tr> <tr> <td data-bbox="448 1037 794 1167">Supplementary literature</td> <td colspan="2" data-bbox="794 1037 1487 1167">Judek S., Karwowski K.: Elektrotechnika, elektronika i telekomunikacja. Zbiór zadań wraz z wybranymi rozwiązaniami. (internal publication). Judek S., Karwowski K., Karkosiński D., Mizan M.: Elektrotechnika, elektronika i telekomunikacja. Instrukcje do laboratorium (internal publication).</td> </tr> <tr> <td data-bbox="448 1167 794 1205">eResources addresses</td> <td colspan="2" data-bbox="794 1167 1487 1205">Adresy na platformie eNauczanie:</td> </tr> </tbody> </table>  |                               |  | Basic literature         | Bolkowski S.: Teoria obwodów elektrycznych. Warszawa: WNT, 2007. Bolkowski S., Brociek W., Rawa H.: Teoria obwodów elektrycznych. Zadania. Warszawa: WNT, 2007. Pr. zb. : Elektrotechnika i elektronika dla nieelektryków. Warszawa: WNT, 2007. Tietze U. Schenk Ch.: Układy półprzewodnikowe. Warszawa: WNT, 2009. Rusek M., Pasierbiński J.: Elementy i układy elektroniczne w pytaniach i odpowiedziach. Warszawa: WNT, 2006. |                               | Supplementary literature         | Judek S., Karwowski K.: Elektrotechnika, elektronika i telekomunikacja. Zbiór zadań wraz z wybranymi rozwiązaniami. (internal publication). Judek S., Karwowski K., Karkosiński D., Mizan M.: Elektrotechnika, elektronika i telekomunikacja. Instrukcje do laboratorium (internal publication). |       | eResources addresses | Adresy na platformie eNauczanie: |       |                    |       |       |
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| Example issues/ example questions/ tasks being completed | <ol data-bbox="448 1211 1487 1335" style="list-style-type: none"> <li>1. Draw simple examples of electrical circuits DC and AC, and discuss ways to determine their parameters.</li> <li>2. Discuss the construction of DC and AC motors and show the ways to adjust the angular velocity.</li> <li>3. Characterize the electrical supply installations.</li> <li>4. Characterize electronic and power electronics components.</li> <li>5. Discuss methods of serial communications of signals.</li> </ol>  |                               |  |                          |  |                               |                                  |  |       |                      |                                  |       |                    |       |       |
| Work placement   | Not applicable  |                               |  |                          |  |                               |                                  |  |       |                      |                                  |       |                    |       |       |