



Subject card

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| Subject name and code | Fundamentals of Electrical Engineering and Electronics 1, PG_00042021 | | | | | | |
| Field of study | Power Engineering, Power Engineering | | | | | | |
| Date of commencement of studies | October 2023 | Academic year of realisation of subject | | | | 2023/2024 | |
| Education level | first-cycle studies | Subject group | | | | Obligatory subject group in the field of study 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 | 1 | Language of instruction | | | | English | |
| Semester of study | 2 | ECTS credits | | | | 3.0 | |
| Learning profile | general academic profile | Assessment form | | | | exam | |
| Conducting unit | Faculty of Electrical and Control Engineering | | | | | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | | dr hab. inż. Jacek Horiszny | | | | |
| | Teachers | | dr hab. inż. Jacek Horiszny | | | | |
| Lesson types and methods of instruction | Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
| | Number of study hours | 30.0 | 15.0 | 0.0 | 0.0 | 0.0 | 45 |
| | 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 | 45 | | 7.0 | | 23.0 | 75 |
| Subject objectives | Providing the definition of basic concepts in electrical engineering on the basis of the theory of electromagnetic field. Presentation of methods of calculating capacitance, inductance, resistance, induced voltage. Acquainting with the methods of analysis of electric circuits and the phenomena occurring in them. | | | | | | |
| Learning outcomes | Course outcome | | Subject outcome | | | Method of verification | |
| | [K6_W05] has structured knowledge in the field of electrical engineering and electronics, necessary to understand the basics of operation and selection of electrical machines, electricity transmission systems and power electronic devices | | defines potential, voltage, electric current, electric capacity, self and mutual inductance, resistance; calculates the capacity of flat and cylindrical capacitors, mutual inductance of circuits, resistance of conductors and earth electrodes, voltages induced by magnetic flux; solves simple linear DC circuits; solves simple linear 1-phase and 3-phase sinusoidal current circuits; explains the phenomenon of electrical resonance. | | | [SW3] Assessment of knowledge contained in written work and projects | |
| | [K6_W03] knows the basics of automation and automatic regulation, knows the principles of the selection of electrical devices, drive systems and their control | | calculates parameters of equivalent circuits for elements of the power system | | | [SW3] Assessment of knowledge contained in written work and projects | |
| | [K6_K02] is able to work in a group taking different roles in it, can think and act in an entrepreneurial way, is aware of responsibility for their own work and responsibility for teamwork | | recognizes the potential exposures and hazards occurring in electrical systems | | | [SK5] Assessment of ability to solve problems that arise in practice | |

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| Subject contents | Elements of the electromagnetic field theory: electrostatic field, Coulombs law, electric field intensity and electric potential, electric capacity. Electric field of DC currents: resistance of a conductor, earthing. Magnetic field: magnetic field intensity and magnetic induction, self and mutual inductance, electromagnetic induction. Linear DC circuits: electric circuit components, energy and power of electric current, Kirchhoffs laws, superposition, Thevenins theorem. Nonlinear DC circuits: linearity and nonlinearity of components and circuits. Method of characteristics intersection, iterative methods, linearization. AC circuits: ideal R, L, C components in the AC circuit, phasor solution, complex impedance, complex Kirchhoffs laws, phasor diagrams, active, reactive and complex power, complex Thevenin theorem, circuits with magnetic coupling, transformer. The characteristics of three-phase systems, the introduction to the methods of analysis of three-phase symmetrical and asymmetrical circuits. | | |
| Prerequisites and co-requisites | Basic knowledge of vector calculus, differential and integral calculus, basic knowledge of complex numbers; knowledge of physics at the high school level. | | |
| Assessment methods and criteria | Subject passing criteria | Passing threshold | Percentage of the final grade |
| | Written exam | 55.0% | 70.0% |
| | Midterm colloquium | 55.0% | 30.0% |
| Recommended reading | Basic literature | Bolkowski S.: Elektrotechnika teoretyczna. Tom 1. Teoria obwodów elektrycznych. WNT, Warszawa 2001 Krakowski M.: Elektrotechnika teoretyczna. Tom 1 i 2. PWN, Warszawa 1999 Matusiak R.: Elektrotechnika teoretyczna. Tom 2. Teoria pola elektromagnetycznego. WNT, Warszawa 1976 | |
| | Supplementary literature | Cholewicki T.: Elektrotechnika teoretyczna. Vol 1 i 2. WNT, Warszawa 1972 | |
| | eResources addresses | Adresy na platformie eNauczanie: Fundamentals of Electrical Engineering and Electronics 1 [2023/24] - Moodle ID: 36896 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=36896 | |

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| <p>Example issues/ example questions/ tasks being completed</p> | <ol style="list-style-type: none"> 1. Three electric charges Q_1, Q_2, Q_3 are given at the vertices of an equilateral triangle with a side length d. Calculate: a) the force acting on the charge Q_1 and b) the electric field at that point. 2. Calculate the resistance of the coil containing n turns wound on the rectangular carcass $a \times b$ with wire of diameter D. 3. The concentrated cylindrical winding of diameter D, containing n turns, is placed in the homogeneous magnetic field of induction $B(t) = B \sin(\omega t)$. The winding is lying in the plane angled to the direction of the field vector at angle α. Calculate the maximum value of the voltage induced in the coil. 4. Calculate currents in the given circuit. 5. Define the electric capacitance. 6. Calculate the capacitance of flat and cylindrical condenser. 7. Calculate the currents in DC circuit. 8. Calculate the currents in AC circuit. 9. Calculate the resonant frequency of the circuit. 10. Calculate current and power in given symmetrical three-phase circuit with star-connected load. 11. Calculate current and power in given symmetrical three-phase circuit with delta-connected load. 12. Calculate current and power in given three-phase four-wire circuit with asymmetrical star-connected load. 13. Calculate current and power in given three-phase three-wire circuit with asymmetrical star-connected load. 14. Calculate current and power in given three-phase three-wire circuit with asymmetrical delta-connected load. |
| <p>Work placement</p> | <p>Not applicable</p> |

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