



Subject card

Subject name and code	Fundamentals of Electrical Engineering and Electronics 1, PG_00042021						
Field of study	Power Engineering						
Date of commencement of studies	October 2026	Academic year of realisation of subject			2026/2027		
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 -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Jacek Horiszny					
	Teachers						
Lesson types	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_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		
	[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_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		

Subject contents	<p>Course content – lecture</p> <p>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.</p>		
	<p>Course content – exercises</p> <p>Coulomb's law, field intensity and potential, electric capacitance. Electric field in conducting medium: conductor resistance, grounding electrodes. Magnetic field: self-inductance and mutual inductance, electromagnetic induction. Linear DC circuits: Kirchhoff's laws, superposition principle, Thevenin's theorem. Nonlinear DC circuits: intersection method, iterative methods, linearization. Sinusoidal current circuits, phasor method, complex impedance, Kirchhoff's laws in complex form, phasor diagrams, Thevenin's theorem in complex form, solving three-phase circuits.</p>		
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
	Midterm colloquium	55.0%	30.0%
	Written exam	55.0%	70.0%
Recommended reading	Basic literature	Ceraolo M., Poli D.: Fundamentals of Electric Power Engineering: From Electromagnetics to Power Systems, Wiley-IEEE Press 2014	
		Alexander C., Sadiku M.: Fundamentals of Electric Circuits, McGraw-Hill	
	Supplementary literature	Hayt W., Kemmerly J., Phillips J., Durbin S.: Engineering Circuit Analysis, McGraw-Hill 2019	
	eResources addresses		

<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 axb 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>Practical activities within the subject</p>	<p>Not applicable</p>

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