DESCRIPTION OF THE COURSES

- Course code: ARR1302
- Course title: ELECTRIC CIRCUITS 1
- Language of the lecturer: Polish

Course form	***Lecture***	***Classes***	***Laboratory***	***Project***	***Seminar***
*Number of hours/week**	*2*	*2*			
*Number of hours/semester**	*30*	*30*			
Form of the course completion	*Exam*	*Colloquium*			
ECTS credits	*3*	*3*			
Total Student's Workload	*90*	*90*			

- Level of the course (basic/advanced): basic
- Prerequisites: Algebra, Mathematical Analysis I & II, Fundamentals of Electrical Engineering.
- Name, first name and degree of the lecturer/supervisor: Tadeusz Łobos, Prof., D.Sc., Ph. D.
- Names, first names and degrees of the team's members:
  1. Przemysław Janik Ph. D.
  2. Paweł Kostyła Ph. D.
  3. Zbigniew Leonowicz Ph. D.
  4. Jerzy Piotrowicz Ph. D.
  5. Piotr Ruczewski Ph. D.
  6. Tomasz Sikorski Ph. D.
  7. Zbigniew Wacławek Ph. D.
- Year:..I..... Semester:.....2.....
- Type of the course (obligatory/optional): obligatory
- Aims of the course (effects of the course):

Ability of calculation of the stationary state in LCR circuits: Kirchhoff's equations, principle of superposition, method of loop currents, the method of node potentials, the Thevenin's theorem. Understanding of resonance circuits. Calculation skills of circuits with magnetic couplings. Determination of the parameters of four - terminal networks for the basic structures. Skills of three-phase circuits solving.

- Form of the teaching (traditional/e-learning): traditional
- Course description:

Linear electric circuit with sinusoidal sources. The symbolic method. Laws of the theory of circuits in the symbolic circuit analysis. Vector graphs. The complex power. Resonance. Circuits with magnetic couplings. Four-terminal networks. Three-phase arrangements. The method of symmetrical components

Lecture:

Particular lectures contents	*Number of hours*

1. Stationary state in electric circuits with sinusoidal sources. Waveforms of currents and voltages on LCR elements. Relationships between the waveforms of currents and voltages in serial and parallel branches of elements LR, CR, LCR. The effective value. The average value.	2
2. Symbolic method of solving SLS circuits with sinusoidal sources. Functions and complex values of currents and voltages. Kirchhoff's theorems for complex values. Current and voltage relationships for elements LCR in the symbolic notation. Complex impedance and admittance.	2
3. Stationary state in branches LR, CR and LCR calculated with the help of the symbolic method. Vector graphs. The triangle of voltages and currents. Active and passive components. The basic statements of the theory of circuits in symbolic method: the equivalence of real sources, Thevenin's theorem (principle of superposition)	2
4. The method of loop currents and node potentials, statement about turning on additional voltage and current sources, statement about compensation. The principle of reciprocity.	2
5. The waveforms of the instantaneous power in the circuit with sinusoidal sources. The notion of the complex power, active, passive and apparent power. The triangle of the power. The coefficient of the power. The improvement of the coefficient of the power - compensation of the passive power.	2
6. The phenomenon of the resonance in electric circuits. The resonance of voltages and currents. Frequency profiles of resonance circuits.	2
7. Circuits with the magnetic coupling. The serial and parallel connection of coupled elements. Replacing the circuit with the coupling with the circuit without the coupling. The power in coupled circuits.	2
8. Equation of four - terminal networks. Properties of four – terminal networks: invertibility, symmetry. Ways of the connection of four – terminal networks. Working parameters: entry impedances, current and voltage amplifier, the amplifier of the power.	2
9. Determination the parameters of four - terminal network on the basis of the measurements of open state and the condition of the short-circuit.	2
10. Characteristic parameters of four -terminal networks. Characteristic impedance (wave impedance), the coefficient of transfer.	2
11. Three-phase symmetrical and asymmetrical circuits. Static and rotating receivers. Distribution of currents and voltages in three-phase circuits - star or triangle connected.	2
12. Power and power measurements in three-phase circuits - method of two wattmeters (Aron's method).	2
13. Decomposition of three sinusoidal waveforms into symmetrical components: forward-, backward-, zero-components. Ohm's Law for symmetrical components. Utilization of the symmetrical method to the component e calculation of fault conditions in power system circuits.. Decomposition of impedance into symmetrical components.	2
14.. The separation of symmetrical components. Equivalent circuits for symmetrical components. Filters of symmetrical components.	2
15. Written test.	2

- Classes – the contents:

Calculation of the stationary state in LCR circuits: Kirchhoff's equations, principle of superposition , method of loop currents, the method of node potentials., the Thevenin's theorem. The investigation of resonance circuits. Solving circuits with magnetical couplings. Determination of the parameters of four - terminal networks for the basic structures of the type T, p, the X. Solving of three-phase circuits.

Seminars – the contents:

- Laboratory – the contents:
- Project – the contents:
- Basic literature:
  1. S. Osowski, K. Siwek, M. Śmiałek – Teoria Obwodów, Oficyna Wydawnicza Politechniki Warszawskiej, 2006.
  2. S. Bolkowski - Teoria Obwodów Elektrycznych -WNT 1995 ;
  3. Opracowania wewnętrzne Zakładu Elektrotechniki Teoretycznej
  4. Athanasios Papoulis -Circuits and Systems: A Modern Approach by Athanasios Papoulis, 1980, 1998.
  5. Raymond A. DeCarlo and Pen-Min Lin - Linear Circuit Analysis: Time Domain, Phasor, and Laplace Transform Approaches, 2003
- Additional literature:
  1. M. Uruski, W. Wolski - Teoria Obwodów t. I, II - skrypt P.Wr.
  2. K. Mikołajuk, Z. Trzaska - Elektrotechnika Teoretyczna - PWN 1984
  3. J. Osiowski, J. Szabatin - Podstawy Teorii Obwodów t. I, II - WNT 1992 - 1995
  4. Papoulis - Obwody i Układy - WKŁ 1988
  5. Leonard S. Bobrow - Fundamentals of Electrical Engineering (Oxford Series in Electrical and Computer Engineering), 1996
  6. William D. Stanley, John R. Hackworth, and Richard L. Jones - Fundamentals of Electrical Engineering and Technology, 2006

- Conditions of the course acceptance/credition: Lecture- passed exam, classes – written test completition.

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