FACULTY OF ELECTRICAL ENGINEERING

SUBJECT CARD

Name in Polish:	**Teoria obwodów 1B**
Name in English:	**Circuits theory 1B**
Main field of study (if applicable):	**Electrical Engineering**
Specialization (if applicable):	
Level and form of studies:	**1st level, part-time**
Kind of subject:	**obligatory**
Subject code:	**ELR051362**
Group of courses:	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	20	20			
Number of hours of total student workload (CNPS):	60	30			
Form of crediting:	examination	crediting with grade			
For group of courses mark (X) final course:					
Number of ECTS points:	2	1			
including number of ECTS points for practical (P) classes :		1			
including number of ECTS points for direct teacher-student contact (BK) classes:	1.40	0.70			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knows the basic laws of electrical engineering and electrical quantities.
2. Has knowledge of the foundations of the theory of electrical circuits. Has ordered knowledge of electrical circuits and components issues circuitry topology and has expertise in the analysis of linear-phase circuits.
3. Is able to apply the theoretical basis for the analysis of linear circuits in steady state with sinusoidal AC.
4. Can think and act in a creative and enterprising.

SUBJECT OBJECTIVES

C1. Is able to analyze circuit resonance. Is able to analyze the linear three-phase circuits. Is able to analyze unbalanced phase noise in circuits using the method of symmetrical components.

C2. Student awareness of the applicability of methods, techniques and tools used in electrical engineering to their use in engineering practice.

C3. The sophistication of the ability to apply computational techniques and measuring the steady-state phase in electric circuits and three-phase.

C4. The acquisition of practical knowledge and skills of connecting electrical circuits, measuring voltage and current, and power and energy.

SUBJECT LEARNING OUTCOMES

relating to knowledge:

PEU_W01 He has knowledge in the field the analysis and interpretation of the phenomenon of resonance of voltages and currents and the magnetic coupling.

PEU_W02 He has the knowledge concerning of the power and energy absorbed in the single and three-phase circuits and their methods of calculation.

relating to skills:

PEU_U01 Is able to apply the theoretical basis for the analysis of linear circuits in steady state with sinusoidal AC.

PEU_U02 Is able to measure currents and voltage drops and power in series and parallel RLC AC circuits.

relating to social competences:

PEU_K01 Can think and act in a creative and enterprising solution of the problem. Has a sense of responsibility for their own work and a willingness to comply with the principles of teamwork.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours:**
Lec 1	Familiar with the subject, requirements and method of assessment.	2
Lec 2	The resonance of voltages and currents. The resonance in the serial and parallel LCR circuit. Conditions of the resonance. The importance of resonances in electrical engineering. The resonance systems. Frequency characteristics of resonance circuits. Overvoltage. Overcurrent. Q-factor. Selectivity. Instantaneous energy. Compensation of the passive power. LCR filters.	2
Lec 3	Three-phase circuits. Basic notions. Multiphase sources of voltage. Three- and four-leads systems. Phase and inter-phase quantities. The operator of the rotation. Vector graphs. Three-phase circuits. Flow of currents in symmetrical and asymmetrical circuits.	2
Lec 4	The power in three-phase systems. The instantaneous power in three-phase systems. The power in three-phase circuits in the triangle or in the star connections. Measurement of the active and passive power of the symmetrical and asymmetrical systems (three and four leads). Compensation of the passive power in three-phase circuits. Meters of electric energy.	2
Lec 5	The method symmetrical components. The idea. Circuits of symmetrical components. The matrix of transformations. The measurement of impedances of symmetrical components.	2
Lec 6	The analysis of symmetrical disturbances. Longitudinal and transversal disturbances. The connection of symmetrical component circuits during longitudinal and transversal disturbances.	2
Lec 7	Filters. Filters of symmetrical components.	2
Lec 8	Four-terminal networks. Definition of four-terminal network. Classification of four-terminal networks. Conditions of symmetry and invertibility.	2
Lec 9	Equation of four-terminal networks (chain, admittance and impedance). Wave impedance of symmetrical four-terminal network. The coefficient of the transfer. Determining the constants of four - terminal network from diagram. Determination the parameters of four - terminal network on the basis of the measurements.	2
Lec 10	Ways of the connection of four – terminal networks. Distribution of potentials in the insulator chain.	2
	Total hours:	**20**

Form of classes - class		**Number of hours:**
Cl 1	Familiar with the subject, requirements and method of assessment. Particular tasks.	2
Cl 2	Determining the resonance conditions.	2
Cl 3	Calculation of overvoltage and overcurrent during the resonance condition.	2
Cl 4	Calculation of propagation of currents and voltages in the three-phase symmetrical.	2
Cl 5	Coloquium 1. Solurions and discussion of particular tasks.	2
Cl 6	Calculation of propagation of currents and voltages in the three-phase asymmetrical circuits. Indication wattmeters.	2
Cl 7	Calculation of single-and multi-phase short-circuits in electric power lines.	2
Cl 8	Calculation of the parameters of four - terminal networks on the basis of diagram.	2
Cl 9	Calculation of the parameters of four - terminal networks based on measurements of voltages and currents.	2
Cl 10	Coloquium 2. Solurions and discussion of particular tasks.	2
	Total hours:	**20**

TEACHING TOOLS USED
N1. Lecture using traditional techniques, audiovisual, multimedia presentations, transparencies.
N2. Exercises conducted in the traditional manner of exercises student groups.

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT		
Evaluation *F – forming (during semester)* *P – concluding (at semester end)*	**Educational effect number**	**Way of evaluating educational effect achievement**
F1(W)	PEU_W01 PEU_W02	examination
P(W)	P=F1	
F1(C)	PEU_U01 PEU_U02 PEU_K01	colloquium
P(C)	P=F1	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Osowski S., Siwek K., Śmiałek M., Teoria Obwodów, Oficyna Wydawnicza Politechniki Warszawskiej, 2006,
[2] Bolkowski S., Teoria Obwodów Elektrycznych, WNT 1995,
[3] R. Kurdziel – Podstawy Elektrotechniki – WNT 1972.
[4] E. Tarnawski, Matetmatyka dla elektryków, PWT – wydanie dowolne
[5] J. Osiowski, Zarys rachunku operatorowego. Teoria i zastosowania w Elektrotechnice, WNT wydanie dowolne
[6] W.Żakowski, W.Leksiński, Matematyka- cz. IV, Seria: Podręczniki Akademickie, WNT Warszawa.
[7] J. Długosz – Funkcje zespolone - teoria , przykłady, zadania – GiS, Wrocław 2001.S. Osowski,
[8] M. Uruski, W. Wolski – Teoria Obwodów t. I, II – skrypt PWr.
[9] Łobos T., Łukaniszyn M., Jaszczyk B., Teoria pola dla elektryków, Oficyna Wydawnicza PWr, 2004,
[10] Sikora R., Teoria pola elektromagnetycznego, WNT 1997,
[11] Rawa H., Podstawy Elektromagnetyzmu, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 1996,

SECONDARY LITERATURE:

[1] Mikołajuk K., Trzaska Z., Elektrotechnika Teoretyczna, PWN, 1984,
[2] Osiowski J., Szabatin J., Podstawy Teorii Obwodów, t. I, II, III, WNT 1992-1998
[3] A.Papoulis – Obwody i Układy - WKŁ 1988.
[4] Jackson J. D., Classical Electrodynamics – third edition, John Wiley & Sons, INC, 2001,
[5] Michalski W. Elektryczność i magnetyzm, Zbiór zagadnień i zadań, Oficyna Wydawnicza PWr, 2004.

SUBJECT SUPERVISOR

Paweł Kostyła, pawel.kostyla@pwr.edu.pl