

FACULTY OF ELECTRICAL  
ENGINEERING**SUBJECT CARD**

Name in Polish: **Wybrane zagadnienia teorii obwodów**  
 Name in English: **Selected problems of circuit theory**  
 Main field of study (if applicable): **Electrical Engineering**  
 Specialization (if applicable): **Electrical Power Engineering**  
 Level and form of studies: **2nd level, full-time**  
 Kind of subject: **obligatory**  
 Subject code: **ELR041310**  
 Group of courses: **NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	30	15			
Number of hours of total student workload (CNPS):	90	30			
Form of crediting:	examination	crediting with grade			
For group of courses mark (X) final course:					
Number of ECTS points:	3	1			
including number of ECTS points for practical (P) classes :		1			
including number of ECTS points for direct teacher-student contact (BK) classes:	2.10	0.70			

**PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES**

1. The student knows the mathematical analysis and the linear algebra as well as some theory of complex functions upon the fundamental level
2. The student knows the electric - magnetic field theory and the circuit theory upon the fundamental level
3. The student is able to obtain some scientific information

**SUBJECT OBJECTIVES**

- C1. The purpose of this education is to be able to form the stability problem for the phase space  
 C2. The purpose of this education process is to be able to solve some selected nonlinear problems in electrical engineering  
 C3. The purpose of this education is to be able to form the stability problem for the number sequence field used to the digital system  
 C4. The purpose of this education is to be able to find some results of discrete problems for the circuit theory.  
 C5. The purpose of this education process is to be able to make use of the improper Fourier integral for the circuit synthesis - analysis problem  
 C6. The purpose of this education process is to be able to form and to solve some differential matrix equations for the circuit theory

**SUBJECT EDUCATIONAL EFFECTS***relating to knowledge:*

- PEK\_W01 The student has the knowledge in terms of the nonlinear circuit stability problem and of an analysis of nonlinear phenomenon  
 PEK\_W02 The student has the extensive theoretical and particular knowledge in terms of the discrete analysis for the circuit theory  
 PEK\_W03 The student knows the particular mathematical methods in terms of the circuit synthesis - analysis problem

*relating to skills:*

- PEK\_U01 The student is able to solve the stability problem for the nonlinear systems and he can analyse some phenomena in these systems  
 PEK\_U02 The student can realize some analysis - synthesis problem for the given circuit  
 PEK\_U03 The student can make use of the Zet and Fourier transformation

*relating to social competences:*

- PEK\_K01 The student is able to think in a creative way.

PROGRAMME CONTENT		
Form of classes - lecture		Number of hours:
Lec 1	The Liapunov stability	2
Lec 2	The first approximation method, the phase plane,	2
Lec 3	A chaotic system, the orbital stability, the small signal method,	2
Lec 4	The linearized equation problem, the voltage ferroresonance effect	2
Lec 5	The current ferroresonance effect, the nonlinear resistance circuit problem.	2
Lec 6	The periodicity operator, the continuous function filter theorem and the Zet transformation	2
Lec 7	The input - output distribution and the impulse (digital) system	2
Lec 8	The initial state - stability-stationary state problem for the impulse systems,	2
Lec 9	The Dirichlet - Cauchy conditions, the generalized form of the Zet transformation.	2
Lec 10	Some continuous Fourier analysis problems: the fundamental continuous spectrums	2
Lec 11	Some applications of the Cauchy theorem	2
Lec 12	A calculus of residuum in terms of the continuous spectrum theory	2
Lec 13	Indeterminacy principle, the Gibbs effect	2
Lec 14	Some state parameter vector problems : the own vector and a norm of a matrix, the matrix series and the matrix functions, the Sylvester relationship, the Cayley - Hamilton identity	2
Lec 15	the differential and integral operations for the matrix functions, the state parameter vector and the differential matrix equations	2
Total hours:		<b>30</b>

Form of classes - class		Number of hours:
Cl 1	The state parameter vector method	2
Cl 2	The unit - dimension stability problem	2
Cl 3	The block diagram method	2
Cl 4	The RLC circuit synthesis	2
Cl 5	The Foster method	2
Cl 6	The flow graph method	2
Cl 7	The Zet transformation, the Fourier transformation	2
Cl 8	Test	1
Total hours:		<b>15</b>

TEACHING TOOLS USED
N1. The problem lecture
N2. The traditional class form

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT		
Evaluation <i>F - forming (during semester)</i> <i>P - concluding (at semester end)</i>	Educational effect number	Way of evaluating educational effect achievement
F(W)	PEK_W01 PEK_W02 PEK_W03	Examination
P(W)	P=F1	
F1(C)	PEK_U01 PEK_U02 PEK_U03	Test
P(C)	P=F1	

PRIMARY AND SECONDARY LITERATURE
<b>PRIMARY LITERATURE:</b>
[1] Uruski M, Wolski M, Wybrane zagadnienia z teorii obwodów, PWr., Wrocław 1984
[2] Kudrewicz J, Nieliniowe obwody elektryczne, WNT, 1996
[3] Kurdziel R, Podstawy elektrotechniki, WNT, 1973
[4] Osiowski J, Zarys rachunku operacjowego, WNT, 1981
<b>SECONDARY LITERATURE:</b>
[1] Bolkowski S., Elektrotechnika teoretyczna, WNT, Warszawa, 1995
[2] Krakowski M., Elektrotechnika teoretyczna, PWN, Warszawa, 1980

**SUBJECT SUPERVISOR**

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**ELR041310 - Selected problems of circuit theory**  
 AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Electrical Engineering**  
 AND SPECIALIZATION **Electrical Power Engineering**

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K2ETK_W01	C.1 C.3 C.5 C.6	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11 Lec12 Lec13 Lec14 Lec15	N.1
PEK_W02	K2ETK_W01	C.2 C.4	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lec9	N.1
PEK_W03	K2ETK_W01	C.2 C.4 C.6	Lec1 Lec2 Lec3 Lec4 Lec5 Lec14 Lec15	N.1
PEK_U01	K2ETK_U01	C.1	CI1 CI2 CI3 CI4 CI5 CI6 CI7 CI8	N.1
PEK_U02	K2ETK_U01	C.1	CI1 CI2 CI3 CI4 CI5 CI6 CI7 CI8	N.1
PEK_U03	K2ETK_U01	C.1	CI1 CI2 CI3 CI4 CI5 CI6 CI7 CI8	N.1
PEK_K01	K2ETK_K01	C.5 C.6	CI1 CI2 CI3 CI4 CI5 CI6 CI7	N.2