Subject (course) name: **Electrical Engineering - Circuit Theory 1**		
Programme: **Automation & Robotics** Specialty:		Subject code: **5K**
		Title graduate: **Engineer**
Type of course: **obligatory**	Course level: **First-cycle studies**	Year: **I** Semester: **II** Semester: **spring**
Form of classes: **Lectures, Classes, Labs, Seminar, Project**	Number of hours per week: **2L, 2C, 0, 0, 0**	Credit points: **6 ECTS**

GUIDE TO SUBJECT

SUBJECT OBJECTIVES

C1. General knowledge of properties and parameters of electrical circuit elements.

C2. General knowledge of fundamental laws in circuit theory.

C3. General ability of analyzing linear DC and AC circuits in steady-state and simple no-linear circuits.

SUBJECT REQUIREMENTS

1. General knowledge of physics related to electricity and magnetism.
2. General knowledge of calculus and complex numbers and ability of using them.
3. General ability to independently search in literature.

LERNING OUTCOMES

EK1 – The student formulates and applies the laws governing the flow of electric current.

EK2 – The student characterizes the basic phenomena occurring in linear DC and AC circuits in steady states.

EK3 – The student creates circuit models and their mathematical description.

EK4 – The student knows, selects and uses appropriate methods of analysis of linear DC and AC circuits in steady states.

EK5 – The student knows, selects and uses appropriate methods of analysis of simple non-linear DC circuits.

SUBJECT CONTENT

Form of classes - lectures

Topic	Hours
L1 – Introduction – basic ideas and fundamental quantities.	**2**
L2 – Basic elements of electric circuits.	**2**
L3 – Fundamental laws governing the flow of electric current.	**2**
L4 – Reductions and transformations of electric circuits.	**2**
L5 – Network analysis.	**2**
L6 – Network analysis – continued.	**2**
L7 – Active two-terminals.	**2**
L8 – DC circuits with current and voltage controlled sources.	**2**
L9 – DC circuits with capacitors.	**2**

L10 – DC circuits with non-linear elements.	**2**
L11 – Basic AC circuits.	**2**
L12 – AC circuit analysis with phasor diagrams.	**2**
L13 – Power in AC circuits.	**2**
L14 – AC circuit analysis with complex numbers.	**2**
L15 – AC network analysis.	**2**
Total	**30**

Form of classes

Topic	Hours
C1 – Charge, current, voltage, power.	**2**
C2 – Resistance and equivalent resistance.	**2**
C3 – Using Kirchhoff's laws.	**2**
C4 − Transformations of electrical circuits.	**2**
C5 – Network analysis.	**2**
C6 – Network analysis.	**2**
C7 – Active two-terminals.	**2**
C8 – DC circuits with current and voltage controlled sources.	**2**
C9 – DC circuits with capacitors.	**2**
C10 – DC circuits with non-linear elements.	**2**
C11 – Basic AC circuits.	**2**
C12 – AC circuit analysis with phasor diagrams.	**2**
C13 – Power in AC circuits.	**2**
C14 – AC circuit analysis with complex numbers.	**2**
C15 – AC network analysis.	**2**
Total	**30**

STUDY METHODS

1. Lectures with use of multimedia presentations.
2. Solving problems in classes.
3. Discussion during the course and individual consultations.

EDUCATIONAL TOOLS

1. Audiovisual equipment, lectures in electronic version.
2. Black board and chalk or white board and markers.

METHODS OF ASSESMENT (F – Forming, P – Summary)

F1. Assessment of comprehending material from previous classes – short test.
F2. Assessment of preparation to classes – oral answer.
P1. Lecture – written examination test of solving electric circuits (50%).
P2. Lecture – written examination test of the theory (50%).
P3. Classes – assessment of comprehending particular topics from classes (short tests – 100%).

STUDENT WORKLOAD

Form of activity		Averaged workload (hours)		
		[h]	∑ [h]	ECTS
Participation in class activities	lectures	30	65	3
	classes	30		
	consultations	5		
Preparation for tutorials (reading literature)		10	70	3
Preparation for short tests		15		
Preparation for classes		15		
Preparation for exam		30		
Total			**135**	**6**

BASIC READING

1. Nahvi M., Edminister J.A., Schaum's Outline of Electric Circuts, McGraw-Hill.
2. Syed A. Nasar, 3000 solved problems in electrical circuits, Schaum's Solved Problems Series, McGraw-

Hill, 1988.
3. Piątek Z., Electrical design. Part I – DC analysis, digital version accessible in The Main Library of Częstochowa University of Technology.
4. Piątek Z., Electrical design. Part II – AC analysis, digital version accessible in The Main Library of Częstochowa University of Technology.
5. Kuphaldt T., Lessons in electric circuits, volume 1 – DC, digital version freely accessible at http://www.ibiblio.org/kuphaldt/electricCircuits/
6. Kuphaldt T., Lessons in electric circuits, volume 2 – AC, digital version freely accessible at http://www.ibiblio.org/kuphaldt/electricCircuits/
7. Bolkowski S., Teoria obwodów elektrycznych. WNT, Warszawa 2009.
8. Bolkowski S., Brociek W., Rawa H., Teoria obwodów elektrycznych Zadania. WNT, Warszawa 2009.
9. Cichowska Z., Pasko M., Przykłady zadań z elektrotechniki cz.II., t. 1,2. Wyd. Pol. Śl., Gliwice 2000.
10. Lubelski K., Elektrotechnika teoretyczna. Część I, II, III. Wyd. Pol. CZ., Częstochowa 1994.

FURTHER READING

1. Charles Alexander, Matthew Sadiku, Fundamentals of electric circuits, McGraw-Hill, 2008.
2. David McMahon, Circuit analysis demystified, McGraw-Hill, 2007.
3. William H. Hayt, Jack Kemmerly, Steven M. Durbin, Engineering circuit analysis, McGraw-Hill, 2007.
4. Raymond A. DeCarlo, Pen-Min Lin, Linear circuit analysis, Prentice Hall, Englewood Cliffs, New Jersey 1995.
5. Osiowski J., Szabatin J.: Podstawy teorii obwodów. Tom I. WNT, Warszawa 2009.
6. Osiowski J., Szabatin J.: Podstawy teorii obwodów. Tom II. WNT, Warszawa 2005.
7. Pasko M., Piątek Z., Topór-Kamiński L.: Elektrotechnika ogólna. Część I. Wyd. Pol. Śl., Gliwice 2004.

Learning objectives	In relation to the learning outcomes specified for the field of study	Subject objectives	Study methods	Methods of assessment
EK1	KE1A_W06 KE1A_U07	C2	lectures, classes	F1, F2, P1, P2, P3
EK2	KE1A_W06	C1	lectures, classes	F2, P2
EK3	KE1A_W05 K1EA_U07	C1, C2	lectures, classes	F1, F2, P1
EK4	KE1A_W06 KE1A_U07 KE1A_U08 KE1A_U10	C3	lectures, classes	F1, F2, P1, P2, P3
EK5	KE1A_W06 KE1A_U07 KE1A_U08 KE1A_U10	C3	lectures, classes	F1, F2, P1, P2, P3

II. EVALUATION

Grade	Outcome
EK1	**The student formulates and applies the laws governing the flow of electric current.**
2 (F)	The student cannot formulate the fundamental laws governing the flow of electric current.
3 (E)	The student poorly formulates the fundamental laws governing the flow of electric current.
4 (C)	The student formulates the laws governing the flow of electric current.
5 (A)	The student formulates the laws governing the flow of electric current, can apply them and explain their origin.
EK2	**The student characterizes the basic phenomena occurring in linear DC and AC circuits in steady states.**
2 (F)	The student cannot explain any of phenomena or problems occurring in linear DC currents (e.g. electrical resistivity) or AC currents (e.g. power factor correction).
3 (E)	The student can enumerate some phenomena occurring in linear DC and AC circuits.
3,5 (D)	The student can hardly explain some phenomena occurring in linear DC and AC circuits.
4 (C)	The student can explain phenomena occurring in linear DC and AC circuits.
4,5 (B)	The student can explain some phenomena occurring in linear DC and AC circuits as well as indicate the interconnections between them.
5 (A)	The student can explain some phenomena occurring in linear DC and AC circuits as well as indicate the interconnections between them and analyze them.
EK3	**The student creates circuit models and their mathematical description.**

2 (F)	The student cannot create any models adequate to simple electric circuits, and cannot write equations for the model.
3 (E)	The student poorly can create models adequate to simple electric circuits.
3,5 (D)	The student can create models adequate to simple electric circuits.
4 (C)	The student can create models adequate to branched electric circuits.
4,5 (B)	The student can create models adequate to branched electric circuits, and write down the corresponding equations.
5 (A)	The student can create models adequate to branched electric circuits, and write down the corresponding equations.
EK4	**The student knows, selects and uses appropriate methods of analysis of linear DC and AC circuits in steady states.**
2 (F)	The student cannot use any of methods of linear network analysis.
3 (E)	The student can write down the equations adequate for a simple linear circuit and the network analysis method selected by himself.
3,5 (D)	The student can write down and solve the equations adequate for a simple linear circuit and the network analysis method selected by himself.
4 (C)	The student can write down and solve the equations adequate for a linear circuit and any of the network analysis method.
4,5 (B)	The student can select and apply any of the methods of linear network analysis, and write down appropriate equations.
5 (A)	The student can select and apply any of the methods of linear network analysis, write down appropriate equations and solve them.
EK5	**The student knows, selects and uses appropriate methods of analysis of simple non-linear DC circuits.**
2 (F)	The student cannot solve a simple non-linear DC circuit.
3 (E)	The student can write the appropriate equation(s) for a non-branched circuit with a single non-linear element.
3,5 (D)	The student can write the appropriate equation(s) for a non-branched circuit with a single non-linear element, and explain at least one method of solving the equations.
4 (C)	The student can solve a non-branched DC circuit with one non-linear element.
4,5 (B)	The student can solve a branched DC circuit with one non-linear element.
5 (A)	The student can solve a branched DC circuit with one non-linear element using different methods.

III. OTHER USEFUL INFORMATION

1. All information for students on the schedule are available on the notice board and on the website: https://we.pcz.pl/
2. Information on the consultation shall be provided to students during the first lecture and will be placed on the website https://we.pcz.pl/
3. Terms and conditions of credit courses will be provided to students during the first lecture