

# SYLLABUS

Name: Circuit theory (AESAu-A>SI1CT24)

Name in Polish: Teoria układów

Name in English: Circuit theory

## Information on course:

Course offered by department: Faculty of Automatic Control, Electronics and Computer Science

Course for department: Silesian University of Technology

### Default type of course examination report:

ZAL

### Language:

English

### Short description:

Students are expected to understand circuit theory and be able to solve complex circuit system which is related to engineering problems by using basic concepts, basic theories and analytical methods of circuit.

### Description:

ECTS: 5

Total workload: 125 (65 contact hours / 60 student's own work hours)

Lecture: 30h

Exercise: 30h

Other (discussion of the report): 5h

Student's own work: preparation for classes, writing reports

#### Lecture

##### 1. Circuit models and circuit laws:

1.1. Actual circuit and circuit model. Current and voltage reference direction and power calculation.

1.2. Passive circuit components. Independent power supply and controlled source.

1.3. Kirchhoff's law.

##### 2. Analysis of resistance circuits:

2.1. Series, parallel and series parallel resistance. Calculation of bridge circuit and symmetrical resistance.

2.2. Resistance Y- connection and equivalent transformation.

2.3. Voltage source, current source series, parallel and equivalent transformation of power supply

2.4. Concepts and calculations of branch, node, mesh and circuit resistance circuit analysis methods

##### 3. Circuit theorem:

3.1. Superposition and substitution theorems.

3.2. Thévenin's and Norton theorems.

##### 4. Time domain analysis of dynamic circuits:

4.1. Establishment of dynamic circuit and its equations.

4.2. Determination of the initial conditions of the dynamic circuit.

4.3. The concept and calculation of zero-input and zero-state response for first-order circuits.

4.4. Full response concept of first-order circuit and "three elements" analysis method.

##### 5. Analysis of sinusoidal steady state circuit:

5.1. Sinusoidal quantity model and representation method, the basic concept of phasor method. Phasor expression of circuit law.

5.2. Concept of impedance and admittance and phasor model.

5.3. The concept of instantaneous power, complex power, active power, reactive power and power factor of sinusoidal steady-state circuit.

5.4. Phasor analysis method of sinusoidal steady state circuit. The concept of series resonance and parallel resonance of sinusoidal steady state circuit, parameter selection and their application.

5.5. The concept and representation of mutual inductance. Calculation methods for circuits containing coupled inductors.

5.6. Hollow transformer and ideal transformer.

##### 6. Three-phase circuit:

6.1. The concept of three-phase circuit, symmetrical three-phase circuit calculation.

6.2. The concept and simple calculation of asymmetric three-phase circuit.

6.3. Power of three-phase circuit.

### Bibliography:

1. K. Vasudevan, Basic Electronic Circuits Problems and Solutions, Springer, Berlin

2. Shradha N. Zanjat, Bhavana S. Karmore, Electronic Devices and Circuit Theory, LAP LAMBERT Academic Publishing

### Learning outcomes:

Students should obtain the following abilities through the theoretical teaching and experimental training of this course.

1. Knows how to express, describe and solve the circuit model in time domain by using the knowledge of mathematics, physics and circuit theory (K1A\_W1, K1A\_W8).

2. Knows how to apply basic principles of mathematics, physics and circuit theory to conduct modelling and simulation analysis of engineering problems, verify their correctness through experiments, and analyse as well as process experimental data (K1A\_W8).

3. Is able to identify, formulate and solve complex and uncommon engineering problems related to automation and electronic systems (K1A\_U1).

### Assessment methods and assessment criteria:

The condition for completing the course is passing all tests, submitting laboratory reports and passing the exam.

### Course credits in various terms:

<without a specific program>			
Type of credits	Number	First term	Last term
European Credit Transfer System (ECTS)	5	2024/2025-Z	