SYLLABUS

Name: ***Introduction to electrical and electronic circuits (MakAu>SI2IEEC19)***
Name in Polish:
Name in English: ***Introduction to electrical and electronic circuits***

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:

EGZ

Language:

English

Course homepage:

https://platforma.polsl.pl/rau3/course/view.php?id=80215

Short description:

The course's main objective is to provide basic and advanced knowledge concerning alternating current (AC) and transmission line circuits description and analysis. During the course, the students should develop the skills concerning the analysis methods of circuits in time and frequency domains, know how to use simulation software to find the solution.

Description:

Lectures:
1. Time domain circuits. Transfer function-based transient analysis – examples.
2. AC steady-state analysis. Alternating current – RMS value, phasor notation. Complex numbers.
3. Phasor analysis. Kirchhoff's laws. Current-voltage relationship: resistor, inductor, capacitor. General two-terminal phasor circuit, phasor impedance.
4. AC steady-state analysis. Application of nodal analysis.
5. AC steady-state power. Measures of power. Instantaneous power. Average or real power. Apparent power. Reactive power. Complex power. Maximum power transfer theorem.
6. Frequency characteristics of the two-terminal subcircuit. Ideal elements – summary (Resistor. Inductor. Capacitor). Practical coil and practical capacitor characteristics, their impedances, and behaviors.
7. Simple electric filters RC, RL. Transfer function in the frequency domain. Amplitude and phase characteristics. Bode Plot (log-log characteristic).
8. Resonant circuits. Series-resonant circuit RLC. Parallel-resonant circuit RLC. Complex-resonant circuit. Resonant filters. Transfer function approach - frequency response. Bode (logarithmic) plot. Filters. Low-pass filter – LPF. High-pass filter – HPF. Band-pass filter – BPF. Band-stop filter – BSF.
9. Introduction to electronic circuits simulation software – AC domain examples.
10. Mutual inductance and transformers. Mutual inductance – basic transformer. Ideal transformer. Practical iron-core transformer. Step-up, step-down, and isolations transformers. Impedance converter.
11. Circuits with distributed parameters. Transient analysis in the transmission line.
12. AC analysis – standing waves. Matched load line. Arbitrary termination. Open-circuited line. Short-circuited line. A transmission line as a circuit element, input impedance.
13. Three-phase circuits. Wye-wye systems. Delta-delta and wye-delta systems. Combinational systems. Power in three-phase systems.
14. Introduction to electronic circuits simulation software – transmission line examples.
15. Electrical circuit summary lecture. Exam exemplary problems.

Classes:
1. Transients in the first-order circuits with zero and non-zero - material reminder.
2. AC domain circuits. Phasors. Phasor diagrams.
3. Power in AC domain circuits.
4. Frequency response of AC circuit. Resonant circuits and filters. Linear and logarithmic characteristics.
5. Transmission line. Time-domain analysis.
6. AC steady-state analysis of transmission line (standing wave).

Laboratory:
1. Introduction to laboratory and to work with the oscilloscope (optional).
2. Transient in first-order circuits with zero initial conditions switched on a DC source.
3. Transient in circuits with non-zero initial conditions
4. Transients in the 2nd order circuits - series and parallel RLC circuits (self-made)
5. Frequency analysis in RLC circuits – phasors, phasor diagram, RMS value.
6. Resonances and frequency responses.
7. Transmission lines.

The number of hours of classes with direct participation of academic teachers or other persons teaching courses and students. Contact hours:
Lecture: 30h
Classes: 15h
Laboratory: 15h

Student's own work:
Preparation for classes, weekly tests: 15h
Preparation for laboratory exercises, tests: 30h
Laboratory reports: 15h

Preparation for assessment: 15h
Computer tests on DLP: 15h

Preparation for the exam: 30h

Total workload: 180
Number of ECTS credits: 6
including
Number of ECTS credits covered by the study program to be earned as part of the course taught with the direct participation of academic

Bibliography:

- Rutkowski J., Circuit Theory, Wydawnictwo Politechniki Śląskiej, Gliwice 2006.
- Richard C. Dorf, James A. Svoboda, Introduction to electric circuits, john Wiley & Sons, Inc. (8th edition, 2009).
- Allan H. Robbins and Wilhelm C Miller, Circuit Analysis: Theory and Practice, Delmar Cengage Learning; 4 edition (July 19, 2006).
- http://platforma.polsl.pl/rau3

Learning outcomes:

Knowledge
The student knows and understands:

- elements of physics, electrical and electronics engineering, and electronics necessary to understand the production of digital technology and the technical principles of contemporary computers (K1A_W05),
- basics of electrical engineering, including electric circuit theory, signal processing theory, and methods of their processing (K1A_W06),
- issues in electronics, including optoelectronic components, analog and digital electronic systems, power systems, sensors, and basics of digital and microprocessor technology, to the extent necessary to solve simple engineering tasks (K1A_W07).

Skills
The student is able to:

- use known principles and methods of electricity (K1A_U12) by applying analytical, simulation, and experimental methods;

Social Competences
The student is ready to:
- recognize the importance of knowledge in solving cognitive and practical problems, and consult experts when facing difficulties in solving problems independently (K1A_K01)

Assessment methods and assessment criteria:

According to SUT regulations, lecture attendance is optional (although highly recommended), whereas laboratory experiments and classes are obligatory.
The condition for passing the course is obtaining positive results in the laboratory experiments, lecture tests, and final exam, where:
- Passing the laboratory requires completing and passing all exercises, which include:
- Passing the entrance tests (condition for admission to the exercises),
- Acceptance of all reports.
Caution! There are 5 obligatory laboratory exercises carried out in sections. Students must complete all exercises and prepare reports (one per section) containing processed information (plots, diagrams) and conclusions. If, for any reason, the labs are conducted remotely, all students must do the remote labs, but only one report per section is needed (both students must upload the same reports to the distance learning platform). Each report should be completed within a two-week period. Reports can be prepared in electronic form; in this case, a declaration of the student's original work is required. Teachers may verify the obtained results. The final laboratory grade is an average of all reports and all entrance tests (all must be passed).

Exam outcome: The exam, in the form of a test on the distance learning platform, can only be taken if the last lecture test was passed. The maximum score for exam no. 3 is reduced accordingly.
The final grade is calculated based on a weighted average of individual activities: 0.4 * Laboratory average + 0.6 * Exam outcome, rounded according to the university grading scale.

The syllabus is valid from the 2024/25 academic year, and its content cannot be changed during the semester.

Course credits in various terms:

<without a specific program>

Type of credits	Number	First term	Last term
European Credit Transfer System (ECTS)	6	2020/2021-L	