COURSE DESCRIPTION CARD - SYLLABUS

Course name
Circuits theory [S1Eltech1>TO2]

Course

Field of study
Electrical Engineering

Year/Semester
1/2

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
30

Other (e.g. online)
0

Tutorials
30

Projects/seminars
0

Number of credit points

8,00

Coordinators

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Lecturers

Prerequisites

Student starting this subject should have basic knowledge in mathematics, physics and the basics of electrical engineering, and also the ability to work in a laboratory group.

Course objective

Extending knowledge on the methods of analyzing 1- and 3-phase circuits of alternating and non-sinusoidal current. Recognition the classic method of transient analysis of RLC linear systems. Understanding how to calculate circuits with non-sinusoidal periodic waveforms. Learning the theory of two-ports and filters. Acquiring practical skills in calculating, connecting, testing and measuring branched DC and AC 1- and 3-phase circuits and simple analog electronics systems.

Course-related learning outcomes

Knowledge:
1. has knowledge of methods of analysis of three-phase systems
2. has knowledge of linear electric circuits with periodically distorted currents
3. has knowledge of the classic analysis of transient states in RLC linear systems
4. has knowledge of two-ports and frequency filters

Skills:
1. knows how to apply appropriate methods for the analysis of: symmetrical and asymmetrical three-phase circuits and transients in linear RLC circuits
2. knows how to build an electrical circuit in accordance with the schematic diagram and make measurements of fundamental electrical quantities
3. knows how to use the elementary substitute diagrams of devices given in the form of two-ports networks to analyze their operation

Social competences:
1. understands that knowledge of methods for analyzing the work of electrical circuits is necessary in the work of an engineer

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Lecture: assessment of knowledge and skills demonstrated on the written exam of a descriptive / problem (checking the ability to use acquired knowledge). Individual elements assessed according to the points system, 50% of the maximum number of points required to pass. Exam issues are sent to the foreman by e-mail using the university e-mail system 2-3 weeks before the exam date and discussed during the last lecture.
Skills acquired as part of the auditorium exercises are verified during two written tests - on the 7th and final exercises. Each colloquium consists of several tasks. Passing threshold: 50% of points.
Laboratory: checking knowledge before performing the exercise in the form of an entry test and evaluating reports. To pass the labratory it is necessary to pass all entry tests and obtain positive grades from reports prepared as part of teams.

Programme content

Symmetrical and asymmetrical three-phase systems, symmetrical components method, electrical circuits powered by distorted voltage,
two-port network and electrical filters, transient states in RL and RC circuits.

Course topics

Lecture:
Symmetrical and asymmetrical three-phase systems, power supply asymmetry - the method of symmetrical components. Linear 1- and 3-phase electric circuits with periodic distorted currents (application of Fourier series, effective values of voltages and currents, power theories, methods of analysis). The classic method of transient states analysis in RLC linear systems (differential integral equations of electric circuits, commutation laws, initial conditions, transient and fixed component, time constant, analysis of selected RC, RL and RLC systems). Passive two-ports circuits (clamp equations, reversibility and symmetry of two-ports circuit, T, Pi and Gamma connections, connection methods, wave parameters) and LC and RC electric frequency filters (construction, parameters, types, frequency characteristics, application).
Auditorium exercises:
Solving exemplary calculating tasks in the field of analysis of three-phase sinusoidal AC circuits, circuits with non-sinusoidal sources, transients, and determination of passive two-ports circuits parameters and the use of their models of electrical devices.
Laboratory:
Realized issues are related to:
- selected laws of electrical engineering in DC circuits
- real energy sources and matching the receiver to the source for maximum power
- Thevenin and Norton laws
- RLC elements and resonance in single-phase sinusoidal alternating current circuits
- circuits with resistive unilateral elements
- capacitance and capacitor loss measurements
- measurements of active and reactive power in one- and three-phase systems, improvement of the power factor

- equivalent two-ports network studies

Teaching methods

Lecture: multimedia presentation (including drawings, photos, animations, films) supplemented with examples given on the board, especially computational ones. Showing various aspects of the issues presented, including: economic, ecological, legal and social. Presenting a new topic preceded by a reminder of related content known to students in other subjects,
Auditorium exercises: solving sample tasks by the teacher with the active participation of students, independent solving of tasks by students. Examples of analysis of circuits encountered in industry. Analysis of problem-based tasks.
Laboratory: performing laboratory exercises in teams (preparing the position, building measuring systems, performing experiments) with the help and control of the teacher.

Bibliography

Basic
1. Bolkowski S.: Teoria obwodów elektrycznych, WNT, Warszawa 2013.
2. Chua L. O., Desoer C. A., Kuh E. S.: Linear and nonlinear circuits, McGraw-Hill Inc., New York 1987.
3. Rawa H., Bolkowski S., Brociek W.: Teoria obwodów elektrycznych. Zadania., PWN, Warszawa 2019.
4. Szabatin J., Śliwa E.: Zbiór zadań z teorii obwodów. Część 1, Wydawnictwo Politechniki Warszawskiej, Warszawa 2015.
5. Mikołajuk K., Trzaska Z.: Zbiór zadań z elektrotechniki teoretycznej, WNT, Warszawa 1976.
6. Frąckowiak J., Nawrowski R., Zielińska M.: Teoria obwodów. Laboratorium, Wydawnictwo Politechniki Poznańskiej, Poznań 2017.
Additional
1. Krakowski M.: Elektrotechnika teoretyczna, tom 1. Obwody liniowe i nieliniowe., PWN, Warszawa 1995.
2. Jastrzębska G., Nawrowski R.: Zbiór zadań z podstaw elektrotechniki, Wydawnictwo Politechniki Poznańskiej, Poznań 2000.
3. Dobrzycki A., Filipiak M., Komputerowo wspomagana analiza pracy układów czwórnikowych, Academic Journals Poznan University of Technology, nr 89, 2017, 155-162

Breakdown of average student's workload

	Hours	ECTS
Total workload	200	8,00
Classes requiring direct contact with the teacher	120	5,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	80	3,00