COURSE DESCRIPTION CARD - SYLLABUS

Course name
Circuits theory [N1Eltech1>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
part-time

Requirements
compulsory

Number of hours

Lecture
20

Laboratory classes
20

Other (e.g. online)
0

Tutorials
20

Projects/seminars
0

Number of credit points

8,00

Coordinators

dr inż. Arkadiusz Dobrzycki
arkadiusz.dobrzycki@put.poznan.pl

Lecturers

dr inż. Krzysztof Budnik
krzysztof.budnik@put.poznan.pl

dr inż. Arkadiusz Dobrzycki
arkadiusz.dobrzycki@put.poznan.pl

mgr inż. Robert Pietracho
robert.pietracho@put.poznan.pl

dr inż. Maria Zielińska-Nawrowska
maria.zielinska@put.poznan.pl

Prerequisites

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

Course objective

Extending knowledge about the methods of analyzing 1- and 3-phase circuits of alternating and non-sinusoidal current. Getting to know the classic method of transient analysis of RLC linear systems. Understanding how to calculate circuits with non-sinusoidal periodic waveforms. Learning the theory of four-terminal and filters. Acquiring practical skills in calculating, connecting, testing and measuring branched DC and AC 1- and 3-phase circuits as well as 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 deformed currents,
3. has knowledge of the classic analysis of transient states in RLC linear systems,
4. has knowledge of four-terminal and frequency filters.

Skills:
1. knows how to apply appropriate methods for the analysis of: asymmetrical three-phase circuits and transients in RLC circuits,
2. knows how to build an electrical system in accordance with the schematic diagram and make measurements of basic electrical quantities,
3. they know to use the basic substitute diagrams of devices given in the form of crosses to analyze the operation of these devices.

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:

Learning outcomes presented above are verified as follows:
Lecture: assessment of knowledge and skills demonstrated on the written exam of a descriptive / problem nature (checking the ability to use the acquired knowledge); individual elements assessed according to the points system, 50% of the maximum number of points required to pass.
Tutorials: skills acquired as part of the are verified during written test on final exercises, each task consists of scores depending on the level of difficulty; passing threshold: 50% of points.
Laboratory classes: input test before performing the exercise in the form of an admission ticket and evaluating reports; to get credit, it is necessary to pass all tests and obtain positive grades from reports.

Programme content

Lecture: symmetrical and asymmetrical three-phase systems, power supply asymmetry - the method of symmetrical components, linear 1- and 3-phase electric circuits with periodically deformed periodic currents (use of Fourier series, effective voltage and current values, 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 crosses (clamp equations, reversibility and symmetry of the crossover, T, Pi and Gamma crosses, connection methods, wave parameters) and LC and RC electric frequency filters (construction, parameters, types, frequency characteristics, application).
Tutorials: solving exemplary accounting tasks in the field of analysis of three-phase sinusoidal AC circuits, circuits with non-sinusoidal sources, transients, and determination of passive four-terminal parameters and the use of four-terminal models of electrical devices.
Laboratory classes: selected laws of electrical engineering in DC circuits, real energy sources and matching the receiver to the source for maximum power, Thevenin and Norton theorems, RLC elements and resonance in single-phase sinusoidal alternating current circuits, circuits with unilateral resistive elements, capacity measurements and capacitor losses, measurements of active and reactive power in one- and three-phase systems, improvement of the power factor, testing of equivalent crosses.

Teaching methods

Lecture: multimedia presentation (including drawings, photos, animations, films) supplemented with examples given on the board, especially computational ones. Taking into account 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.
Tutorials: solving examples of tasks by the teacher with the active participation of students, independent problem solving by students. Examples of analysis of circuits encountered in industry. Problem solving.

Laboratory classes: independent performance of laboratory exercises (preparation of the position, construction of measuring systems, performance of experiments) with the help and under the supervision of the lecturer.

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	210	8,00
Classes requiring direct contact with the teacher	95	4,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	115	4,00