COURSE DESCRIPTION CARD - SYLLABUS

Course name
Electrical Engineering [S2Eltech1E>Eltech]

Course

Field of study
Electrical Engineering

Year/Semester
1/1

Area of study (specialization)
Electrical Systems in Industry and Vehicles

Profile of study
general academic

Level of study
second-cycle

Course offered in
english

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
15

Other (e.g. online)
0

Tutorials
30

Projects/seminars
0

Number of credit points

5,00

Coordinators

dr inż. Jarosław Jajczyk
jaroslaw.jajczyk@put.poznan.pl

Lecturers

Prerequisites

A student starting this course should have knowledge of mathematics, physics and theory of circuits at the level of the first degree, as well as the ability to measure electrical quantities and work in a team. They should also have the ability to obtain information from the indicated printed and electronic sources.

Course objective

Providing students with knowledge about: passive and active crosses (including electric filters), non- linear elements and circuits (including magnetic circuits), ferroresonance phenomena, signals and their flow theory, circuit diagrams, signal graphs and structural matrices. Understanding in-depth analytical methods for calculating electrical circuits.

Course-related learning outcomes

Knowledge:
1. Has knowledge of modeling methods and analytical and numerical methods for analyzing electrical circuits (with linear and non-linear elements, four-terminal).
2. Has knowledge of development trends in electrical engineering.
3. Has advanced knowledge about electric filters

4. Knows selected issues regarding electromagnetic interactions.

Skills:
1. Is able to apply knowledge of the in-depth theory of electrical circuits necessary to determine the parameters of electrical circuits such as: attenuation, displacement, wave impedance, static and dynamic resistance, transmittance.
2. Has the ability to obtain specialized information from literature and the Internet. He can work individually and in a team, independently and collectively solve tasks in the field of in-depth theory of electrical circuits.

Social competences:
1. Understands the importance of knowledge in solving cognitive and practical problems in the field of electrical engineering.
2. Is aware of the need for self-development in the field of electrical engineering.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Knowledge acquired as part of the lecture is verified on the written exam of in-depth theory on selected issues of electrical engineering. The exam consists of 5-7 questions. Passing threshold: 50% of points. The issues on the basis of which questions are prepared will be sent to students by e-mail using the university e-mail system.
Skills acquired as part of the tutorial classes are verified on the basis of the final test taking place during the last class and consisting of 3-5 tasks differently scored depending on the degree of their difficulty. It is possible to get extra points for activity during classes, and especially for: proposing to discuss additional aspects of the issue, the effectiveness of applying the acquired knowledge when solving a given problem, solving additional tasks. Additional points are a maximum of 10% of the final grade.

Programme content

Lecture: Creating, transforming and simplifying block diagrams. Mason graphs and graph reduction rules. Non-linear DC and AC circuits, methods of their analysis. Non-linear circuits with ferromagnetic elements (ferroresonance phenomenon). Analysis of transients in RLC circuits using the Laplace transform (operator models of electric circuit elements, rules for considering initial conditions, basic laws and theorems of circuit theory in operator form). Synthesis of passive couplers (basics of the synthesis task, physical feasibility of couplers, Cauer's method, Foster's method, canonical diagrams of LC, RL and RC systems). Fundamentals of the synthesis of non-linear circuits. Application of optimization methods to the synthesis of complex electrical systems. The method of state variables in the analysis of stationary and non-stationary electrical circuits (basics, creating the equation of state and output equation for example electrical circuits, methods of limiting the number of equations, methods of solving the equation of state - in the time domain and using the operator method).
Tutorials: Creating and simplifying block diagrams of signal flow in electrical circuits. Creating and simplifying signal graphs for electrical circuits. Solving by analytical and graphical methods DC and AC electric circuits with non-linear elements. Realization conditions of immittance in the class of passive couplers. Synthesis of passive twos using the Cauer method. Analysis of transients in electrical circuits using the operator method with the application of basic laws, theorems and methods of circuit theory analysis.
Laboratories: Execution of exercises in the following topics: non-linear elements, current ripple smoothing, frequency analysis of LC type crossovers, symmetrical and unsymmetrical 3-phase systems.

Teaching methods

Lecture: multimedia presentation (drawings, photos, animations) supplemented with examples given on the board, initiating discussion during the lecture.
Exercises: solving exemplary tasks on the board, discussions and comments on ways of solving tasks.
Laboratory: detailed review of reports by the laboratory leader and discussion of comments, demonstrations, team work.

Bibliography

Basic
1. Bolkowski S., Teoria obwodów elektrycznych, WNT, Warszawa 2015
2. Kurdziel R.: Podstawy elektrotechniki, WNT, Warszawa 1973.
3. Szabatin J., Śliwa E.: Zbiór zadań z teorii obwodów. Część 2, Wydawnictwo Politechniki Warszawskiej, Warszawa 2015.
4. Rawa H., Bolkowski S., Brociek W.: Teoria obwodów elektrycznych. Zadania., PWN, Warszawa 2019.
5. Frąckowiak J., Nawrowski R., Zielińska M.: Teoria obwodów. Laboratorium, Wydawnictwo Politechniki Poznańskiej, Poznań 2017.
6. Bartkowiak R. A., Electric circuit analysis, John Wiley & Sons, New York 1985.
7. Chua L. O., Desoer C. A., Kuh E. S.: Linear and nonlinear circuits, McGraw-Hill Inc., New York 1987.1. Bolkowski S., Teoria obwodów elektrycznych, WNT, Warszawa 2015
2. Kurdziel R.: Podstawy elektrotechniki, WNT, Warszawa 1973.
3. Szabatin J., Śliwa E.: Zbiór zadań z teorii obwodów. Część 2, Wydawnictwo Politechniki Warszawskiej, Warszawa 2015.
4. Rawa H., Bolkowski S., Brociek W.: Teoria obwodów elektrycznych. Zadania., PWN, Warszawa 2019.
5. Frąckowiak J., Nawrowski R., Zielińska M.: Teoria obwodów. Laboratorium, Wydawnictwo Politechniki Poznańskiej, Poznań 2017.
6. Bartkowiak R. A., Electric circuit analysis, John Wiley & Sons, New York 1985.
7. Chua L. O., Desoer C. A., Kuh E. S.: Linear and nonlinear circuits, McGraw-Hill Inc., New York 1987.

Additional
1. Krakowski M.: Elektrotechnika teoretyczna, PWN, Warszawa 1995.
2. Jastrzębska G., Nawrowski R.: Zbiór zadań z podstaw elektrotechniki, Wydawnictwo Politechniki Poznańskiej, Poznań 2000.
3. Czarnywojtek P., Kozłowski J., Machczyński W.: Teoria obwodów elektrycznych w zadaniach, Wydawnictwo Uczelni PWSZ w Kaliszu, Kalisz 2008
4. Mikołajuk K., Trzaska Z.: Zbiór zadań z elektrotechniki teoretycznej, WNT, Warszawa 1978.
5. Rutkowski J., Circuit theory, The Publishing House of the Silesian University of Technology, Gliwice 2006.

Breakdown of average student's workload

	Hours	ECTS
Total workload	130	5,00
Classes requiring direct contact with the teacher	77	3,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	53	2,00