COURSE DESCRIPTION CARD - SYLLABUS

Course name
Selected methods of analysis of electrical circuits [S2Elenerg1>WMAOE]

Course

Field of study
Electrical Power Engineering

Year/Semester
1/1

Area of study (specialization)
Renewable Sources and Storage of Energy

Profile of study
general academic

Level of study
second-cycle

Course offered in
polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
0

Other (e.g. online)
0

Tutorials
15

Projects/seminars
15

Number of credit points

3,00

Coordinators

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Lecturers

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Prerequisites

The student starting this subject should have knowledge of mathematics, physics and electrical engineering at the first degree level. He should also have the ability to obtain information from the indicated printed and electronic sources.

Course objective

Expanding knowledge on the methods of analyzing sinusoidal alternating current circuits. Understanding the operator methods and state variables for the analysis of transients in linear RLC circuits. Understanding the methods of analyzing nonlinear electrical circuits and analyzing with the use of block diagrams and signal flow graphs.

Course-related learning outcomes

Knowledge:
1. has extended knowledge of the use of mathematical models and computer aided calculation systems for the analysis of electrical circuits.
2. has in-depth knowledge of electrical engineering laws and circuit theory in terms of operators.
3. has in-depth knowledge of physical phenomena in linear and nonlinear electric circuits in steady and unsteady states.

Skills:
1. knows how to apply knowledge from the field of circuit theory to analyze the work of electrical devices in steady and transient states.
2. can design electric circuits for given criteria and carry out their analysis and simulation using appropriate methods and tools.

Social competences:
1. understands the importance of knowledge in the field of electrical engineering for the country and society in the correct identification and solving of cognitive and practical problems.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
The knowledge acquired during the lecture is verified by passing an in-depth theory on the analysis of electrical circuits in the last class. Credits consist of test and open questions with different scores depending on the level of difficulty. Passing threshold: 50% of points. The issues on the basis of which the questions are developed will be sent to students via e-mail.
The skills acquired during the accounting tutorials are verified on the basis of the final test taking place during the last class and consisting of 3-4 marked tasks depending on the degree of their difficulty. It is possible to gain additional points for activity during classes, and especially for: proposing to discuss additional aspects of the issue, the effectiveness of applying the acquired knowledge while solving a given problem, solving additional tasks. Additional points are a maximum of 10% of the final grade.
The knowledge and skills acquired during the project classes are verified on the basis of the final project. The topics of the projects will be determined during the first class. The activity in the classroom in trying to solve the problems posed is rewarded. Additional points are a maximum of 10% of the final grade.

Programme content

Lecture: The operator method for the analysis of transients in linear electrical circuits. Basics of Laplace transform, inverse transform, models of inductance and capacitance, Ohm"s law and Kirchhoff"s laws in operator terms, Thevenin and Norton theorems in the operator method. State variable method in the analysis of electric circuits. Defining equations of state for electric circuits, solving equation of state and output equations (time form, operator method). Nonlinear circuits of direct and alternating current, approximation of nonlinear characteristics, the phenomenon of voltage and current ferroresonance. Crosses and active filters, examples of the use of operational amplifiers. Application of block diagrams and signal flow graphs for modeling and analysis of electrical circuits.
Tutorials: solving calculus problems in the field of the analysis of periodic electric circuits in transient states and in the case of non-linear elements. Modeling and analysis of circuits using block diagrams and signal flow graphs.
Project: Based on the knowledge gained during lectures and tutorials, students solve a given problem in the field of electrical circuits in the form of a project. They report on progress, further plans, and encountered problems. The tutor guides the students to solve the encountered problems. Methods and tools for computer aided design of electrical circuits are presented.

Teaching methods

Lecture: multimedia presentation (drawings, photos, animations) supplemented with examples given on the blackboard, initiating discussions during the lecture.
Tutorials: solving example tasks on the board, discussions and comments on how to solve the tasks.
Project: A multimedia presentation illustrated with examples displayed on the screen. Performing tasks given by the teacher - practical tutorials. Reporting the status of work.

Bibliography

Podstawowa
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. Mikołajuk K., Trzaska Z.: Zbiór zadań z elektrotechniki teoretycznej, WNT, Warszawa 1978.
5. Mahadevan K., Chitra C.: Electrical circuit analysis, PHI Learning Private Limited, Delhi 2018.
6. Jajczyk J., Dobrzycki A., Filipiak M., Kurz D.: Analysis of power and energy losses in power systems of electric bus battery charging stations, E3S Web of Conferences, 19, 01027 (2017).
Uzupełniająca
1. Krakowski M.: Elektrotechnika teoretyczna, PWN, Warszawa 1999.
2. Chua L. O., Desoer C. A., Kuh E. S.: Linear and nonlinear circuits, McGraw-Hill Inc., New York 1987.
3. Jastrzębska G., Nawrowski R.: Zbiór zadań z podstaw elektrotechniki, Wydawnictwo Politechniki Poznańskiej, Poznań 2000.
4. Bartkowiak R.: Electric circuit analysis, John Wiley & Sons, New York 1985.
5. Jajczyk J., Kamiński R.: Analiza sposobów zasilania odbiorcy pracującego w systemie autonomicznym za pomocą turbiny wiatrowej, Przegląd Naukowo-Metodyczny, Edukacja dla Bezpieczeństwa, 2016, nr 1, s. 1169-1179.

Breakdown of average student's workload

	Hours	ECTS
Total workload	80	3,00
Classes requiring direct contact with the teacher	45	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	35	1,00