COURSE DESCRIPTION CARD - SYLLABUS

Course name
Electrical engineering II [S1Elmob1>ET2]

Course

Field of study
Electromobility

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
0

Tutorials
30

Projects/seminars
0

Number of credit points

7,00

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 symmetrical and ansymmetrical 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: 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. knows how to use given in basic form of two-ports substitute diagrams of devices 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:

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Lecture: the knowledge acquired during the lecture is verified during the written exam during the exam session and the part test on the Moodle platform. The exam consists of open questions, scored depending on the difficulty level. Points from the subtest (10% of the total number of points) are added to the points obtained in the exam. Passing threshold: 50% of the total number of points. Exam issues are sent to the head of the year by e-mail using the university e-mail system 2-3 weeks before the exam date and discussed during the last lecture.
Classes: skills acquired during the auditorium exercises are verified during a written test - two tests after the 7th and the last classes. Tests consist of tasks that are scored depending on the difficulty level. In addition, students gain access to mandatory homework on the Moodle platform. Solving them increases the number of points obtained from completing by a maximum of 10% of all points possible. Passing threshold: 50% of points.
Laboratory: the skills acquired in the laboratory exercises are verified on the basis of reports made by students at home after the exercises. Exercises are held in 4 cycles. Each cycle ends with a final test which checks the knowledge of students acquired during the exercises. During the laboratory classes, verbal preparation of students for the exercise is verified. Passing the laboratory classes requires the completion of all exercises, individual completion of reports indicated by the teacher and passing tests.

Grading scale for the lecture , laboratory and auditorium exercises in accordance with the document "Good practices for academic teachers" adopted by the Academic Senate of Poznań University of Technology: (<0;50%) - 2.0 unsatisfactory, <50%;60%) - 3.0 satisfactory <60%;70%) - 3.5 sufficient plus, <70%;80%) - 4.0 good, <80%;90%) - 4.5 good plus, <90%; 100%> - 5.0 very good.

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 (basic concepts, star and delta connections, phasor diagrams, powers and systems for active power measurements), power unbalance - symmetric components method (definition of symmetrical components, symmetrical components powers, symmetrical component filters). Linear electric circuits 1- and 3-phase with steady-state periodic distorted currents (application of the Fourier series, effective values of voltages and currents, power theories, analysis methods). Classic method of analyzing transients in linear RLC systems (differential-integral equations of electric circuits, commutation laws, initial conditions and values, transient and steady state components, time constant, analysis of selected RC, RL and RLC systems with excitations constant in time and harmonics). Passive crosses (clamping equations, reversibility and symmetry of a cross, T, "Pi" and "Gamma" crosses, connection methods, wave parameters). LC and RC frequency

electric filters (construction, parameters, types, frequency characteristics, application, differences).
Auditorium exercises:
Analysis of three-phase symmetrical and asymmetrical sinusoidal alternating current circuits, the use of the superposition method in the analysis of circuits with distorted signals, the classic method of transient analysis in RLC circuits, methods for determining the parameters of passive quadrants and the use of given quadruple models of electrical devices.
Laboratory:
Realized issues are related to:
- selected laws of electrical engineering in DC circuits
- real voltage and current 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 resistive unilateral elements
- measurements of capacitance and loss of capacitors
- symmetrical and asymmetrical three-phase systems as well as active and reactive power measurements in single- and three-phase systems, improvement of the power factor
- studies of equivalent two ports
-frequency analysis of LC and RC quads
- transient states

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	180	7,00
Classes requiring direct contact with the teacher	92	3,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	88	3,50