COURSE DESCRIPTION CARD - SYLLABUS

Course name
Fundamentals of electricity and electronics [N1Energ2>PEiE2]

Course

Field of study
Power 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
0

Tutorials
10

Projects/seminars
0

Number of credit points

6,00

Coordinators

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Lecturers

Prerequisites

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

Course objective

Understanding the theoretical issues related to: 3-phase alternating current circuits and 1 and 3-phase non-sinusoidal alternating currents, transient states in linear RLC circuits,four terminal elements and frequency filters of LC and RC type and simple electronic circuits. The acquisition of practical skills in connecting, testing and measurement of DC and AC circuits (including one-phase or three-phase systems, and simple analog electronics circuit).

Course-related learning outcomes

Knowledge:
1. has knowledge of the methods of analysis of three-phase unbalanced symmetrical 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. knowledgeable about four-terminal networks and frequency filters, LC and RC

5. has basic knowledge of the electronic elements and simple analog electronics circuit

Skills:
1. knows how to apply appropriate methods for the analysis of DC circuits and single and three phase linear AC circuits
2. knows how to build, in accordance with the schematic diagram, a simple single- and three-phase electrical system, alone or in a team, and perform measurements of basic electrical quantities also in a team
3. knows how to apply the appropriate mathematical description in the analysis of circuits with deformed periodic currents
4. knows how to compare and use simple analog and digital electronics circuit

Social competences:
1. understands the need to improve professional competence and the effects of engineer activities

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Knowledge of the lecture is verified during the written exam during in the exam session. The exam consists of open questions that have points depending on the level of difficulty. Passing threshold: 50% of points. Exam issues are sent to the group staroste 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 the written test - colloquium on the last exercises. The colloquium consists of tasks whose points depending on the level of difficulty. After each exercise, students receive mandatory tasks on the moodle platform. Their solution increases the number of points received by passing by a maximum of 10% of all points possible to obtain. Passing threshold: 50% of points.
Laboratory:
Skills acquired as part of the laboratory exercises are verified on the basis of individual reports made by students at home after the exercises. Exercises take place in four cycles. Each cycle ends with a final test checking the students' knowledge acquired during the classes

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, basic electronic components and circuits.

Course topics

The analysis of 3-phase AC circuits (including symmetrical and asymmetrical circuits, powers: active, reactive and apparent power, active power measurements), the analysis 1- and 3-phase circuits for deformed forcing signal (with the usage of Fourier series, the effective value of current and voltage, powers: active, reactive, apparen, distortion), four-terminal network and methods of crosses and methods of their analysis (schematic and basic relations, types of equations, reversibility and symmetry terminal network, the method of connecting two-port networks, the parameters, wave adjustment), LC and RC filters RC (the transmission loss, diagrams of filters, frequency characteristics, application), analysis of transient responses in linear RLC (integral-differential equations of electrical circuits, the initial conditions and overall conditions of the transient occurrence, the laws of switching, time constant, classical analysis of RC and RL circuits), basic components and electronics: diodes, transistors, integrated rectifying one- and two-half-, logic circuits, integrated circuits, theoretical aspects of electronic circuit assembly, controlled circuits.
Auditorium exercises:
Basic methods of analysis of DC circuits (equivalent resistance, transfiguration, Kirchhoff's law method, superposition principle). Application of the symbolic method for analysis of AC circuits, analysis of reactive power compensation issues. Calculating exercises in the field of using ring methods and nodal potentials for DC and AC circuits. Thevenin's method.
Laboratory:
Completed tasks are related to:
- testing of linear and non-linear 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
- power and energy measurements in one- and three-phase systems, reactive power compensation
- frequency analysis of the four-terminal networks LC
- transient states in RL, RC and RLC circuits
- testing of semiconductor diodes, rectifiers and filtering systems
- tests of logic circuits

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 the content of the previous lecture and related content known to students in other subjects.
Auditorium exercises: students solving sample tasks on the board with the help of the teacher, thematic sets of homework provided to students after classes on the moodle platform where students have the opportunity to enter their results of calculations and verify them with correct answers
Laboratory: exercise instructions contained in scripts and electronic files available on the website of the Department of Theoretical and Applied Electrical Engineering (http://zetis.iee.put.poznan.pl) in the appropriate tab, laboratory exercises performed at dedicated positions under the supervision 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. Nawrocki W.: Elektronika: układy elektroniczne, Wydawnictwo Politechniki Poznańskiej, Poznań 2010.
5. Frąckowiak J., Nawrowski R., Zielińska M.: Teoria obwodów. Laboratorium, Wydawnictwo Politechniki Poznańskiej, Poznań 2017.
6. Opydo W., Kulesza K., Twardosz G.: Urządzenia elektryczne i elektroniczne. Przewodnik do ćwiczeń laboratoryjnych, Wydawnictwo Politechniki Poznańskiej 2002.

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. Mikołajuk K., Trzaska Z.: Zbiór zadań z elektrotechniki teoretycznej, WNT, Warszawa 1976.
4. Strona Zakładu Elektrotechniki Teoretycznej i Stosowanej, http://zetis.iee.put.poznan.pl

Breakdown of average student's workload

	Hours	ECTS
Total workload	152	6,00
Classes requiring direct contact with the teacher	52	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	100	4,00