



COURSE DESCRIPTION CARD - SYLLABUS

Course name

Fundamentals of electricity and electronics

Course

Field of study

Power Engineering

Area of study (specialization)

Level of study

First-cycle studies

Form of study

part-time

Year/Semester

1/2

Profile of study

general academic

Course offered in

polish

Requirements

compulsory

Number of hours

Lecture

20

Laboratory classes

20

Other (e.g. online)

Tutorials

10

Projects/seminars

Number of credit points

6

Lecturers

Responsible for the course/lecturer:

D.Sc. Łukasz Putz

Responsible for the course/lecturer:

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Institute of Electrical Engineering and
Electronics

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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. Has 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:

Lecture:

Assess the knowledge and skills demonstrated during the examination of a problematic, realized in the form of written. Passing threshold: 50% of points.

Tutorials:

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 eKursy 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

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.

Tutorials:

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:



The lecture with blackboard or multimedia presentation (including drawings, photos, animations, films) supplemented with examples given on the board, taking into account various aspects of the issues presented, including: economic, ecological, legal, social and practical examples known to students in everyday life. Presenting a new topic preceded by a reminder of the content of the previous lecture. Presenting material in connection with other objects. Additional materials posted on the eKursy platform.

Tutorials:

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. Additional materials posted on the eKursy platform.

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. Additional materials posted on the eKursy platform.

Bibliography

Basic

1. Bolkowski S.: Teoria obwodów elektrycznych, WNT, Warszawa 2017.
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.



Breakdown of average student's workload

| | Hours | ECTS |
|---|-------|------|
| Total workload | 160 | 6,0 |
| Classes requiring direct contact with the teacher | 60 | 2,0 |
| Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation of laboratory reports, preparation for the exam/tests) ¹ | 100 | 4,0 |

¹ delete or add other activities as appropriate