COURSE DESCRIPTION CARD - SYLLABUS

Course name
Applied electrical engineering and electronics [S1FT2>EiES]

Course

Field of study
Technical Physics

Year/Semester
2/3

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
15

Other
0

Tutorials
0

Projects/seminars
15

Number of credit points

4,00

Coordinators

dr inż. Jan Szymenderski
jan.szymenderski@put.poznan.pl

Lecturers

Prerequisites

Basic knowledge of physics and mathematics (general level). Skills: Ability to use analytical methods to formulate and solve tasks related to determining physical quantities and possesses the ability for effective self-education in the chosen field of study. Social competences: Ability to work responsibly on an assigned task, independently and in a team.

Course objective

1. To provide students specializing in Technical Physics with knowledge of electrotechnology and electronics. Introduce students to the construction, operating principles, and application possibilities of electrical and electronic devices (lecture). 2. To familiarize students with the operation of specialized measuring equipment, conducting research, and methods of analyzing the obtained measurement results (laboratory). 3. To develop skills in designing with the selection of elements for optimal solutions, analyzing computer simulation results, preparing research reports, and public presentation and discussion of results (project). 4. To cultivate teamwork skills (laboratory, project).

Course-related learning outcomes

Knowledge:

As a result of the conducted classes, the student will:
1. Know the mathematical apparatus necessary to describe basic laws of electrotechnology and solve tasks in applied electrotechnology and electronics.
2. Have basic knowledge in electrotechnology and electronics that allows understanding the operating principles of measuring devices and research equipment.
3. Have basic knowledge in metrology, knows, and understands methods of measuring physical quantities and analyzing measurement results.

Skills:
As a result of the conducted classes, the student will have the following skills:
1. Can obtain information from literature, databases, and other sources, analyze and interpret it, draw conclusions, including in laboratory research, and justify opinions.
2. Can work both independently and in a team.
3. Can identify a technical problem and then propose a scheme for its analysis and/or solution.
4. Proficient in using selected computer programs supporting design decisions; can design selected elements and simple constructions: mechanical and electronic.

Social competences:
As a result of the conducted classes, the student will acquire the following social competences:
1. Aware and understands the importance of non-technical aspects and consequences of engineering activities, including their impact on the environment and associated responsibility for decisions made.
2. Can appropriately define priorities for carrying out a task defined by themselves or others; aware of the importance of behaving professionally; aware of the responsibility for tasks performed collaboratively in teamwork.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The learning outcomes listed above are verified as follows:
- Lecture: Written or oral examination. Additionally, continuous assessment rewarding activity and quality of perception during classes: 50.1%-70.0% (grade 3), 70.1%-90.0% (grade 4), from 90.1% (grade 5)
- Laboratory assessment: Continuous assessment at each session, rewarding skill development in using known principles and methods, assessment of knowledge and skills related to the execution of an exercise task, assessment of reports from conducted exercises: 50.1%-70.0% (grade 3), 70.1%-90.0% (grade 4), from 90.1% (grade 5)
- Project assessment: Assessment of knowledge and skills related to the execution of a project task, assessment of responses to questions on the use of simulation methods, ability to analyze results, and draw conclusions: 50.1%-70.0% (grade 3), 70.1%-90.0% (grade 4), from 90.1% (grade 5)

Programme content

Lecture:
Basic concepts in the field of electrical engineering, fundamentals of electrostatics, circuit elements, laws of electric circuits, matching the receiver to the source for maximum power, basics of magnetism and electromagnetism, types of materials based on electrical and magnetic interactions, generation of sinusoidally varying voltage, physical quantities and electrical parameters in AC circuits, methods of analysis of DC and AC circuits (outline of methods: Kirchhoff's laws, superposition, mesh currents, nodal potentials), circuit theorems (Thevenin's, Norton's, Tellegen's, reciprocity and compensation theorems), power and energy in AC circuits, RLC elements (phasor diagrams), voltage and current resonance, reactive power compensation, measurements of power and energy in electrical circuits. Creation and properties of three-phase systems. Analysis of systems under distorted excitation (application of Fourier series, root mean square value of current and voltage, powers: active, reactive, apparent, distortions, higher harmonics). Basic electronic components: diodes, transistors, thyristors, Hall effect sensors, thermistors, varistors, optoelectronic elements. Selected electronic circuits: rectifiers and filters, amplifiers, oscillators, power supplies, etc. Instruments and measurement methods in electrical engineering. Measurements of selected non-electrical quantities by electrical methods (sensors and their applications in industry and vehicles). Electromagnetic interactions between devices - electromagnetic compatibility (outline of the problem). Transformers and rotating machines - construction, operating principles, design solutions, functional properties.

Laboratory:
Analysis of DC circuits containing linear and nonlinear elements. Investigation of rectifiers and filtering circuits. Measurements of power and energy in single-phase systems. AC circuits with RLC elements. Examination of the electrical properties of light sources. Selected laws of electrical engineering in DC circuits.
Project:
Presentation of practical applications of software for designing and simulating electrical and electronic circuits. Discussion of the LTSpice simulation environment, demonstration of project creation, and conducting simple simulations. Introduction to KiCad software for designing printed circuit boards along with a presentation of project implementation methods. Independent creation by students of simulations and projects for elementary electrical and electronic circuits.

Course topics

none

Teaching methods

Lecture:
Lecture with presentation on the board or multimedia (including: drawings, photos, animations, videos). Consideration of various aspects of the presented topics, including: economic, ecological, legal, social, and practical examples known to students from everyday life. Introduction of a new topic preceded by a review of content from the previous lecture. Presenting parts of the material in relation to other subjects.
Laboratory:
Practical exercises, conducting experiments, discussions, teamwork.
Project:
Work consisting of individual project tasks, discussions, and presentations.

Bibliography

Basic:
1. Bolkowski S.: Teoria obwodów elektrycznych, WNT, Warszawa 2017, (dowolne wydanie).
2. Kurdziel R.: Podstawy elektrotechniki, WNT, Warszawa 1973.
3. Krakowski M., Elektrotechnika teoretyczna, tom 1 - Teoria obwodów (tom 2 - Pole elektromagnetyczne), PWN, Warszawa 1999, (dowolne wydanie).
4. Nawrocki W.: Elektronika: układy elektroniczne, Wydawnictwo Politechniki Poznańskiej, Poznań 2010.
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Additional:
1. Chua L. O., Desoer C. A., Kuh E. S.: Linear and nonlinear circuits, McGraw-Hill Inc., New York 1987.
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3. Charoy A., Zakłócenia w urządzeniach elektronicznych. Zasady i porady instalacyjne, cz. 1-4, z serii: Kompatybilność elektromagnetyczna, WNT, Warszawa 1999-2000.
3. Opydo W., Elektrotechnika i elektronika dla studentów studiów zaocznych wydziałów nieelektrycznych politechnik, skrypt Politechniki Poznańskiej nr1757.
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6. Bednarek K., Elektromagnetyczne oddziaływania i bilans energetyczny w sieci zasilającej w budynku banku, Przeglad Elektrotechniczny, 90 (2014), nr 12, 188-191.
7. Putz Ł., Bednarek K., Nawrowski R., Disturbances Generated by Lighting Systems with LED Lamps and the Reduction in Their Impacts, Applied Sciences, Vol. 9, issue 22, 2019, p. 1-18, DOI: 10.3390/app9224894.
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9. Bednarek K., Bugała A., Budzińska N., Wielogórski M., Stanowiska do badań i prezentacji

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Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	62	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	38	1,50