



COURSE DESCRIPTION CARD - SYLLABUS

Course name

Design of electrical and electronic circuits [S1AiR2>PO7-PUEiE]

Course

Field of study

Automatic Control and Robotics

Year/Semester

3/6

Area of study (specialization)

–

Profile of study

general academic

Level of study

first-cycle

Course offered in

Polish

Form of study

full-time

Requirements

elective

Number of hours

Lecture

15

Laboratory classes

30

Other

0

Tutorials

0

Projects/seminars

0

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

The student starting the subject should have a good knowledge of electronics and electrical engineering. One should also be able to obtain information from specified sources and be willing to cooperate as part of a team.

Course objective

Familiarize students with the principles of electronic and electrical circuit design. Acquire the skills to use programs to support the process of designing and analysis of electronic and electrical circuits. Knowledge in reading and writing technical documentation.

Course-related learning outcomes

Knowledge:

Knowledge learning outcomes include advanced familiarity with the theory and methods of operation of basic electronic, analog and digital components and selected electronic circuits and systems [K1_W12]. In addition, the student acquires knowledge of techniques, technologies and principles of construction of simple automation and robotics systems. Student knows the principles of selection of actuators, computing units and measurement and control devices [K1_W20]. Thanks to the lecture content, which

is updated on a regular basis, the student also becomes familiar with the current status and the latest development trends in the area of automation and robotics [K1_W21].

Skills:

As part of the course, the student acquires the ability to use selected tools for rapid prototyping of automation and robotics systems [K1_U13]. In addition, he or she acquires the key skill of building, commissioning and testing simple electronic and electromechanical systems [K1_U15]. Implementation of practical projects of electrical and electronic systems teaches the selection of the type and parameters of measuring systems, control units or measuring and communication modules. As a result, the student is able to carry out this selection for a specific application and integrate them in the form of the resulting measurement and control system [K1_U22]. In addition, as part of the course, the student acquires the ability to design simple electrical and electronic circuits for various applications, taking into account material properties [K1_U25].

Social competences:

The course also develops social competencies, in particular, the readiness to critically evaluate the knowledge possessed and the understanding of the need and knowledge of the possibility of continuous training [K1_K1]. In addition, the content covered in the course of the lecture increases the awareness and understanding of the importance and non-technical aspects and consequences of engineering activities, including their impact on the environment and related responsibility [K1_K2]. The student participating in the course also acquires competencies related to the awareness of the need to approach technical issues in a professional manner and to be meticulously familiar with the documentation and environmental conditions in which equipment and its components may operate [K1_K5].

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: written exam (checking theoretical knowledge) on electronical and electrical circuits designing.

Design: Design review and assessment.

Programme content

The course program covers the following topics:

- symbols and general principles determining the design of correct technical documentation of a circuit or device
- ways of drawing electrical circuits and calculating their properties
- technology of manufacturing, assembly and testing of printed circuits
- getting acquainted with available tools supporting the design of electrical and electronic circuits

Course topics

Lecture.

- 1 Definitions, standards and standardization organizations. Historical and modern electronic circuit implementation techniques. Subject-specific units of measurement.
2. Printed circuit design, basic materials and manufacturing aspects. Properties of electronic components - typeseries, types of enclosures, application issues. Sources of knowledge and forms of documentation of electronic components.
3. Principles of creating schematic diagrams. Project organization and examples of EDA software and tools.
4. Printed circuit design techniques. Layout of printed circuit layers and control of technological limitations. Principles of component placement and printed circuit path routing. Actual design examples and DFM techniques.
5. Design of higher frequency circuits. Introduction to electromagnetic compatibility issues. Transmission lines and impedance matching in printed circuits. Techniques for reducing the impact of electromagnetic interference.
6. Preparation and adaptation of the design to the manufacturing process. Manufacturing of printed circuits - process and technologies. Materials and methods used in the soldering process. Types of procedures for testing and quality control of printed circuits.

Laboratory.

Successive execution of electronic circuit design:

- 1) Determination of design requirements and technological constraints. Agreeing on the function of the circuit and operating parameters.
- 2) Selection of electronic components for the task at hand. Familiarizing with component documentation and creating component libraries for EDA software.
- 3) Drawing schematic diagrams with the necessary calculations and simulation tasks.
- 4) Designing a printed circuit. Applying selected design techniques and performing technological calculations. Optimizing the design for manufacturing cost.
- 5) Development of manufacturing documentation. Generating CAM files, component list and assembly files. Pricing the production of the circuit.

Teaching methods

Lecture: multimedia presentation, illustrated with real-world examples of electronic and electrical circuits designing.

Laboratory: designing of electronic and electrical circuits. Teaching materials in the form of a series of instructional videos and ongoing consultation of the project with the instructor.

Bibliography

Basic

1. Cezary Zieliński, Podstawy projektowania układów cyfrowych, PWN 2012
2. Robert A. Pease, Projektowanie układów analogowych. Poradnik praktyczny, BTC 2005.
3. Harry Kybett, Earl Boysen, Elektronika dla każdego. Przewodnik, Helion.

Additional

1. Datasheets and application notes of selected electronic components.
2. David Cook, Budowa robotów dla początkujących. Wydanie II.

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	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)	30	1,00