COURSE DESCRIPTION CARD - SYLLABUS

Course name
Electronical and electrical circuits designing [S1AiR1E>PUEiE]

Course

Field of study
Automatic Control and Robotics

Year/Semester
3/5

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
English

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
0

Other
0

Tutorials
0

Projects/seminars
15

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

The student starting the subject should have a basic 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:
Knows and understands typical engineering technologies, principles and techniques of construction of simple automation and robotics systems; knows and understands the principles of selection of executive

systems, computational units and measurement and control elements and devices [K1_W20 (P6S_WG)].
Is familiar with the current status and latest development trends of the field of automation and robotics [K1_W21 (P6S_WG)].
Knows and understands the basic processes in the life cycle of devices and selected safety systems used in automation and robotics [K1_W22 (P6S_WG)].
Skills:
Can prepare documentation concerning the realisation of an engineering task in Polish and foreign language [K1_U4 (P6S_UW)].
Is able to build, commission and test a simple electronic and electromechanical system [K1_U15 (P6S_UW)].
Is able to select the type and parameters of the measurement system, control unit and peripheral and communication modules for the selected application and integrate them in the form of the resulting measurement and control system [K1_U22 (P6S_UW)].
Is able to evaluate the suitability of routine methods and tools for designing automation and robotics systems, and select and apply the appropriate method and tools [K1_U24 (P6S_UW)].
Social competences:
Is aware of the importance and understands the non-technical aspects and consequences of engineering activities, including their impact on the environment and the related responsibility for decisions; is ready to care for the achievements and traditions of the profession [K1_K2 (P6S_KR)].
The graduate is aware of the need for a professional approach to technical issues, meticulous familiarization with the documentation and environmental conditions in which the equipment and its components can operate. The graduate is ready to observe the rules of professional ethics and to demand it from others, to respect the diversity of opinions and cultures [K1_K5 (P6S_KR)].

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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	60	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	30	1,00