COURSE DESCRIPTION CARD - SYLLABUS

Course name
Methods of design and construction of electronic devices [S1EiT1>MPiTRUE]

Course

Field of study
Electronics and Telecommunications

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
15

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

A student has a basic knowledge in mathematics, physics, fundamentals of circuit theory and electronics. Is able to extract information from literature, databases and other sources. Is able to participate in collaborative projects.

Course objective

To acquaint students with the design and construction of electronic devices. Presentation of standards introducing the rules for the design and construction. Digest of the design principles to reduce electromagnetic interference in electronic devices.

Course-related learning outcomes

Knowledge:
1. A student has knowledge of the design and construction of electronic devices.
2. Knows the standards introducing the rules for the design and construction of PCBs.
3. Has knowledge of methods for reducing the level of electromagnetic interference in electronic devices.

Skills:
1. Student can obtain information from literature and other sources, can integrate obtained information, interpret it, draw conclusions and justify opinions.
2. Can prepare a well-documented assumptions for the project of a electronic device.
3. Can use catalogs to select appropriate electronic components taking into account the given criteria.
4. Can design a simple electronic device using appropriate engineering methods and tools.

Social competences:
1. A student is aware of the need for a professional approach to solved technical problems and taking responsibility for the proposed technical solutions.
2. Can work in a group in the laboratory and perform team tasks.
3. Can formulate opinions on the basic challenges faced by modern technology of electronic devices.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Lectures passing based on one written and/or oral test from content of the lectures. The written test contains 8 open questions. The oral test contains 4-6 questions. Passing threshold 50% of the sum of points for the test. The issues for the test (20) are sent to students by e-mail. Grading scale: <50% - 2.0 (ndst); 50% to 59% - 3.0 (dst); 60% to 69% - 3.5 (dst +); 70% to 79% - 4.0 (db); 80% to 89% - 4.5 (db +); 90% to 100% - 5.0 (bdb). The passing threshold may change depending on the results of the tests. Laboratory passing based on grades for reports, preparation for classes, behaviour and commitment during classes and tests. Grading scale: Sw>4,75 - 5,0 (bdb); 4,25=4,75 - 4,5 (db+); 3,75=4,25 - 4,0 (db); 3,25=3,75 - 3,5 (dst+); 2,75=3,25 - 3,0 (dst); Sw<=2,75 - 2,0 (ndst) where Sw – the weighted arithmetic mean of all partial grades.

Programme content

Lecture
Principles of electronic devices designing in industry, design and production cycle of an electronic device, technical and financial assumptions of the project, analysis of the safety, development of a block and schematic diagram, selection of the method of assembly of electronic components, determining the methods of testing device parameters, device documentation development, Electronic Design Automation and Mechanical Design Automation software, deductive, intuitive and speculative methods of creating technical assumptions for the project. Production stages of making a printed circuit board, rules for drawing a block diagram, schematic diagram, graphic symbols used in diagrams, international standard IEC 60617, Polish standard PN - EN 60617/2003, standard ANSI Y32 / IEEE 315, rules for the correct electronic component placement, coding system of package outlines for semiconductor device packages - standard IEC 60191-4, computer methods of PCBs design, metric and imperial basic raster, technologies of printed circuit boards , soldering technologies, testing of the printed circuit boards. Multilayers PCB production technology, light-sensitive materials, positive and negative photoresists, UV lithography, irradiation and etching, registration reference holes, electroless (chemical) copper deposition, plating (electrochemical metallization), applying soldermask, electroless gold over nickel deposition, THT and SMT elements assembly, automation of SMD assembly. Specification for base materials for rigid and multilayer printed boards – IPC-4101 standard, flexible based dielectrics for use in flexible printed wiring - PC-FC-231 standard, what is prepreg, laminate, resin matrix and fibers, forms and types of fibers, fiber angular orientation, adhesive coated dielectric films and flexible adhesive bonding films (IPC-FC-232), flexible metal-clad dielectrics (IPC-FC-241), metal foil for PCB (IPC-MF-150), printed board size standardization, probing test lands. Soldering methods, solder alloys, phase diagram for the tin-lead alloy, eutectic Sn-Pb alloy, dangers of using lead, standard lead-free solder alloys, solder paste composition, methods of applying solder paste, screen printing, reflow soldering process, wave soldering, optimization of process parameters in wave soldering, desoldering techniques for SMD components. Servicing of electronic devices.
Laboratory
Multilayers PCB production technology, light-sensitive materials, positive and negative photoresists, UV lithography, irradiation and etching, registration reference holes, electroless (chemical) copper deposition, plating (electrochemical metallization), applying soldermask, electroless gold over nickel deposition. Specification for base materials for rigid and multilayer printed boards, flexible based dielectrics for use in flexible PCB, t is prepreg and laminate, adhesive coated dielectric films and flexible

adhesive bonding films, flexible metal-clad dielectrics, materials for multi-layer boards, metal foil for PCB, printed board size standardization, probing test lands. Servicing of electronic devices. Steps to design a printed circuit boards, rules for drawing a block diagram, schematic diagrams, graphic symbols used in diagrams, rules for the correct electronic component placement, coding system of package outlines for semiconductor device packagess, Electronic Design Automation software, metric and imperial basic raster. Drawing a schematic diagram and selecting electronic components on the example of selected projects.

Teaching methods

Lecture: traditional multimedia presentation (examples also on the blackboard) and conversational lecture.
Lab: traditional multimedia presentation (examples also on the blackboard) and performance of tasks given by the teacher - practical exercises.

Bibliography

Basic
1. Kisiel R., Podstawy technologii dla elektroników, Poradnik praktyczny, Wydawnictwo BTC, 2005.
2. Kisiel R., Podstawy technologii montażu dla elektroników, Wydawnictwo BTC, 2012.
3. Horowitz P., Hill W., Sztuka elektroniki, cz. 1 i 2, WKiŁ, Warszawa 2009.
Additional
1. Rymarski Z., Materiałoznawstwo i konstrukcja urządzeń elektronicznych, Wydawnictwo Politechniki Śląskiej, Gliwice 2000.
2. Blackwell G. R., The electronic packaging handbook, CRC Press, 2017.
3. Thierauf S. C., High-speed circuit board signal integrity. Artech House, 2017.

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	31	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	44	1,00