COURSE DESCRIPTION CARD - SYLLABUS

Course name
Computer Aided Design [S1EiT1>KWP]

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
30

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

The student has basic knowledge of circuit theory and electrical metrology. He knows the basic symbols of electronic components. Has knowledge of basic electronic components and their characteristics. Demonstrates knowledge of basic electronic circuits. He knows the principles of operation and can design basic electronic systems. Can use catalog data of electronic components and systems. Uses the computer to perform the assumed tasks. Demonstrates the ability to obtain information (catalog data) on the Internet. Able to learn independently (textbooks, computer programs). He behaves actively during classes, asks questions, consciously uses contacts with the teacher (e.g. during consultations).

Course objective

Provide students with knowledge of the basics and tools of computer-aided design of electronic circuits (CAD), the role of CAD in various stages of designing electronic devices. Developing students" ability to create schematic diagrams using CAD tools (eg LTSPICE, MULTISIM and APLAC), conduct basic analyzes (constant current, frequency, time) and extended analyzes (temperature, parametric, FFT, noise, Worst Case, Monte Carlo). Acquainting with models of elements, problems of simulating analog, digital and analog-digital systems, optimization of parameters of the designed system.

Course-related learning outcomes

Knowledge:
He has a structured and extensive knowledge of the properties and characteristics of electronic components, the construction of models of electronic components, design and analysis of electronic circuits, and design of printed circuits. He knows the theoretical basics and principles of designing analog and digital circuits, construction of digital electronic components, analysis and design of electronic circuits, computer-aided design.

Skills:
Has the ability to analyze, design and simulate the operation of analog and digital systems, taking into account the given criteria, using appropriate engineering methods and tools, can use models, catalog cards and application notes for semiconductor electronic components, can analyze and design systems and systems using CAD tools . Can obtain information from literature, databases and other sources in Polish or English; is able to integrate the obtained information, interpret it, draw conclusions and justify opinions. Can communicate in Polish or English in a professional environment. He can further educate himself.

Social competences:
Has a sense of responsibility for the designed electronic and telecommunications systems and is aware of the potential dangers to other people or society if used inappropriately.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
The knowledge acquired during the lecture, supplemented with practical skills acquired during the laboratory classes, is verified by self-completion and completion of a term paper (simulation of the operation of a given electronic system). Individual topics for the final papers are published on 6/7 lectures. Students submit their semester work (paper report and simulation files - sent by e-mail using the university"s e-mail system), and receive a credit according to the date of the final session. The assessment includes the ability to use the knowledge obtained during the lectures, the correctness of the simulation, the correctness of the selection and the scope of analyzes to the nature of the system, the ability to modify the used models of elements. The scope of the tasks of the term paper (degree of difficulty and labor intensity) is graded (for a satisfactory, good and very good grade). Students have the right to choose the scope (minimum - satisfactory, maximum - very good). After issuing the grade, until it is approved in the e-proto system, students also have the option of individual consultations and verification of the grade (oral answer). Laboratory classes are credited on the basis of a report prepared by the student (in writing). The report is prepared after each laboratory unit (performing the given exercise). The semester grade from the laboratory is determined on the basis of the grades of all reports (arithmetic mean value). The correctness and scope of the simulation are assessed (obligatory tasks and additional tasks). Students have the option of individual consultations, verification of the grade (oral answer or additional tasks) and obtaining a higher grade.

Programme content

The course program covers the following topics:
• Element models used in CAD programs.
• Models of sources.
• Comparison of element models used in CAD programs.
• Basic and advanced analytics.
• Layout optimization.
• Comparison of analyzes in CAD programs.

Course topics

The lecture and laboratory program covers the following topics:
• Models of basic passive electronic components (resistor, capacitor, coil) used in simulation programs.
• Models of active elements (diode, zener diode, bipolar transistor, unipolar).
• Models of voltage and current sources (DC, AC, SIN, PULSE, EXP), controlled sources.
• Models and macromodels of operational amplifiers.
• Comparison of component models used in SPICE (LTSpice, Multisim) and APLAC.

• DC analysis.
• AC frequency analysis.
• Time and FFT analysis.
• Parametric analysis.
• Temperature analysis.
• Statistical analyzes (Worst Case, Monte Carlo).
• Noise analysis.
• Optimization.

Teaching methods

1. Lecture: traditional lecture; multimedia presentation, illustrated with examples of simulation programs.
2. Laboratory exercises: practical exercises on computer stands, performing simulation tasks given by the teacher, supported with examples of solutions (multimedia presentations of the teacher).

Bibliography

Basic
1. Dobrowolski A., Pod maską Spice"a. Metody i algorytmy analizy układów elektronicznych, BTC, 2004.
2. Michalak S., Symulacja układów elektronicznych w środowisku APLAC, Wydawnictwo PP, Poznań, 2005.
3. Baranowski K., Matuszczyk M., Welo A., Symulacja układów elektronicznych: PSpice pakiet DESIGN CENTER, MIKOM, Warszawa, 1996.

Additional
1. Porębski J. Korohoda P., SPICE program analizy nieliniowych układów elektronicznych, WNT, Warszawa, 1996.
2. Zachara Z., Wojtuszkiewicz K., PSpice: symulacje wzmacniaczy dyskretnych, MIKOM, Warszawa, 2001.
3. Sidor T., Komputerowa analiza elektronicznych układów pomiarowych, Kraków, Wydawnictwo AGH, 2006.
4. Walczak J., Pasko M., Komputerowa analiza obwodów elektrycznych z wykorzystaniem programu SPICE: zagadnienia podstawowe, Wydawnictwo Politechniki Śląskiej, Gliwice, 2002.

Breakdown of average student's workload

	Hours	ECTS
Total workload	90	3,00
Classes requiring direct contact with the teacher	55	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	35	1,00