COURSE DESCRIPTION CARD - SYLLABUS

Course name
Computer analysis of electronic circuit [S1MiKC1>KAUE]

Course

Field of study
Microelectronics and digital communications

Year/Semester
3/5

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

A student knows the operation of basic electronic components and their characteristics, the basics of circuit theory and electrical metrology. He knows the basic symbols of electronic components and shows knowledge of basic electronic circuits. He knows the principles of operation and can design basic electronic systems. He can use the 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 makes use of contacts with the teacher (e.g. as part of consultations).

Course objective

Provide students with knowledge about the basics and tools of computer analysis of electronic circuits with the use of CAD programs, knowledge about the stages of designing and analyzing 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:
Student knows the theoretical basis and principles of designing analog and digital circuits, the operation of electronic circuits and the design and analysis of electronic circuits, computer aided design. He has a structured and broad knowledge of the properties and characteristics of electronic components, the construction of models of electronic components, design and analysis of electronic circuits.

Skills:
Can analyze and design layouts and systems using CAD tools. Can use models, catalog cards and application notes of electronic components. Has the ability to analyze, design and simulate the operation of analog and digital systems, taking into account given criteria, using appropriate engineering methods and 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. Is able to communicate in Polish or English in a professional environment. Is able to continue his/her own education.

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:

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 (PDF report and simulation files - sent using the university system), receive a grade (university grading scale is used) 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 (PDF file). The report is prepared after each laboratory unit (performing the given exercise). The semester grade (university grading scale is used) 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

CAD programs and basic analysis used in simulation programs. Basic analysis (DC current, AC frequency, time). Parametric, FFT and temperature analyzes. Statistical analyzes (Worst Case, Monte Carlo). Models of voltage and current sources (DC, AC, SIN, PULSE, EXP). Models of basic passive electronic components
(resistor, capacitor, coil) used in simulation programs. Models of active elements (diode, zener diode, bipolar transistor, unipolar). Models and macromodels of operational amplifiers. Comparison of element models used in CAD programs.

Course topics

Basics of computer-aided design and analysis of electronic systems, tools for computer analysis of electronic systems, the use of CAD programs, Creating schematic diagrams using CAD tools, element models and basic optimization of system parameters.

Teaching methods

1. Lecture: traditional lecture; multimedia presentation, illustrated with examples of simulation programs.The lectures are also illustrated with an overview and examples of new solutions in the field of CAD.
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). Students work on the latest available version of LTSPICE.

Bibliography

Basic:
1. Dobrowolski A., Projektowanie i analiza wzmacniaczy małosygnałowych, BTC, 2015
2. 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.

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

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	45	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	30	1,50