# Computer-aided design - course description

## General information

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| Course name | Computer-aided design |
| Course ID | 11.9-WE-INFD-C-AD-Er |
| Faculty | Faculty of Computer Science, Electrical Engineering and Automatics |
| Field of study | Computer Science |
| Education profile | academic |
| Level of studies | Second-cycle Erasmus programme |
| Beginning semester | winter term 2021/2022 |

## Course information

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|---|---|
| Semester | 2 |
| ECTS credits to win | 5 |
| Course type | obligatory |
| Teaching language | english |
| Author of syllabus | • dr hab. inż. Janusz Kaczmarek, prof. UZ |

## Classes forms

| The class form | Hours per semester (full-time) | Hours per week (full-time) | Hours per semester (part-time) | Hours per week (part-time) | Form of assignment |
|---|---|---|---|---|---|
| Lecture | 15 | 1 | - | - | Credit with grade |
| Laboratory | 30 | 2 | - | - | Credit with grade |
| Project | 15 | 1 | - | - | Credit with grade |

## Aim of the course

Know-how and competences in the field of applying Electronic Design Automation software supporting the process of designing electronic circuits with emphasis on embedded microprocessor systems.

## Prerequisites

Principles of programming, Digital system design, Microcomputer circuits and systems

## Scope

Introduction to the computer-aided design of electronic circuits. Historical outline. Overview of Electronic Design Automation systems. Basic notions and definitions. Imperial and metric system of units.

Methodology of designing an electronic circuit using EDA system. Basic concepts on capturing a circuit as a schematic diagram: netlist, wires and buses. Component library structure: part, symbol, package and padstack. Creating schematic diagrams with hierarchical and multipage techniques. Printed Circuit Board designing using layout editor. Methods of placing components and routing traces. Designing one, two and multilayer PCB. Automatic routing of PCB traces with an autorouter tool. Design rule check in EDA systems.

Printed Circuit Board designing for EMC requirements. Basic knowledge of RF emissions and susceptibility of electronic circuits. PCB EMC techniques: circuit zoning, suppressing interfaces between circuit zones, ground system, power routing and decoupling, signal routing and line termination. Signal integrity and transmission lines on PCB.

Computer simulation of electronic circuits. SPICE simulation fundamentals. Types of simulation analysis: nonlinear dc, small signal ac, transient, sensitivity and distortion. Models of electronic devices. Schematic-level simulation of embedded microprocessor systems. Analysis of simulation results.

Computer simulation of thermal and electromagnetic properties of printed circuit boards.

Producing design documentation and CAM files in EDA systems.

## Teaching methods

Lecture: conventional lecture

Laboratory: laboratory exercises, group work

Project: project method, discussions and presentations

## Learning outcomes and methods of theirs verification

| Outcome description | Outcome symbols | Methods of verification | The class form |
|---|---|---|---|
| Can design and study microprocessor systems using EDA program | | • a project<br>• an evaluation test<br>• an ongoing monitoring during classes<br>• carrying out laboratory reports | • Lecture<br>• Laboratory<br>• Project |

| Outcome description | Outcome symbols | Methods of verification | The class form |
|---|---|---|---|
| Can design printed circuit boards with manual and automatic routing | | • a preparation of a project<br>• an evaluation test<br>• an ongoing monitoring during classes<br>• carrying out laboratory reports | • Lecture<br>• Laboratory<br>• Project |
| Knows design methodology of electronic devices with EDA type software. | | • an evaluation test<br>• an ongoing monitoring during classes<br>• carrying out laboratory reports | • Lecture<br>• Laboratory |
| Can create technical documentation of a designed device and generate the files needed to produce the printed circuit board. | | • a preparation of a project<br>• an ongoing monitoring during classes<br>• carrying out laboratory reports | • Laboratory<br>• Project |

## Assignment conditions

Lecture – the passing condition is to obtain a positive mark from the final test.

Laboratory – the passing condition is to obtain positive marks from all laboratory exercises to be planned during the semester.

Project - the project documentation and oral presentation.

Calculation of the final grade: lecture 30% + laboratory 40% + project 30%

## Recommended reading


1. Williams T.: The Circuit Designer's Companion, Newnes, 2005
2. Krzyżanowski R.: Układy mikroprocesorowe, Wydawnictwo Naukowe PWN, Warszawa, 2017 (in Polish).
3. Kundert K. S.: The Designer’s Guide to Spice and Spectre, Kluwer Academic Publishers, 2003
4. Archambeault B. R., Drewniak J.: PCB Design for Real-World EMI Control, Kluwer Academic Publishers, 2004
5. Mazidi M.A., Mazidi J.: The 8051 Microcontroller and Embedded Systems, Prentice Hall, 1999


## Further reading

## Notes

Modified by dr hab. inż. Janusz Kaczmarek, prof. UZ (last modification: 14-07-2021 13:08)