Diagnosis of digital systems - course description

General information

Course name	Diagnosis of digital systems
Course ID	06.0-WE-INFP-DiagSystTes-Er
Faculty	Faculty of Computer Science, Electrical Engineering and Automatics
Field of study	Computer Science
Education profile	academic
Level of studies	First-cycle Erasmus programme
Beginning semester	winter term 2021/2022

Course information

Semester	6
ECTS credits to win	5
Course type	optional
Teaching language	english
Author of syllabus	• dr inż. Michał Doligalski

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

- Familiarize students with the tools and techniques to verify the operation of digital systems
- Shaping the understanding of the need to ensure the highest quality of digital systems
- Shaping skills to design and verification of digital systems, in particular, the use and measurement tools for the in-circuit verification stage

Prerequisites

Digital circuits, digital systems modeling language

Scope

Construction and operation of diagnostic tools: Introduction to the construction, principles of operation and measurement digital diagnostic apparatus including digital oscilloscopes, logic analyzers, arbitrary generators. The use of an oscilloscope and arbitrary waveform generator for generating digital waveforms and analog waveforms recorded on the basis of using an oscilloscope. Interfaces measuring apparatus (RS -232, RS -485, GPIB, USB). The study of selected parameters of digital circuits: Using the digital oscilloscope to measure the time parameters of digital circuits (TTL, CMOS, FPGA) including propagation delay, rise time, fall time, hold time. Electrical parameters including current, voltage. Margin and immunity to interference. The boundary conditions of work of digital circuits. Diagnosis of hardware-software digital systems: Verification of signals at the outputs of digital circuits using a digital oscilloscope. The logic analyzer in the analysis of digital systems. Algorithms based on a trigger or changes in the signal values. Use of simulation results verifies the prototype stage. Diagnostic software: Use specialized software in the process of diagnosis of digital systems (FPGAView, Chipscope Pro). JTAG interface in the analysis of digital systems. Use FPGAView software and digital oscilloscope and/or logic analyzer. Embedding test modules inside embedded systems (Chipscope Pro). Diagnosis of DSP systems: Use the signal generator and oscilloscope in the study of digital systems implementing DSP algorithms.

Teaching methods

- Lecture: Lecture problem, lecture conventional
- laboratory: group work, laboratory exercises
- project: teamwork, project method

Learning outcomes and methods of theirs verification

Outcome description	Outcome symbols	Methods of verification	The class form
Can characterize and select verification techniques for FPGA embedded micro informatics systems functioning. Can recognize serial Bus protocols and point at typical applications for them		• a pass - oral, descriptive, test and other	• Lecture
Can use digital diagnostic equipment (digital oscilloscope, logical states analyzer) and embedded logic analyzers and appropriately select tools for carrying out tests		• a project • an ongoing monitoring during classes	• Laboratory • Project
Is aware of the impact of particular stages of the design process on error occurrence in an IT projects and their elimination cost		• an ongoing monitoring during classes	• Lecture • Project

Outcome description	Outcome symbols	Methods of verification	The class form
Is able to creatively plan a measurement experiment and interpret its results. In the light of the results identify the malfunction area and suggest a method for its elimination		• an observation and evaluation of the student's practical skills	• Laboratory • Project
Understands the need and aim of informatics systems testing and verification		• a pass - oral, descriptive, test and other	• Lecture
Can name and explain measurement errors, estimate their impact on experiment outcome, apply measurement error compensation techniques in digital micro information systems		• a pass - oral, descriptive, test and other	• Lecture

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 - - project, report, oral presentation the passing condition is to obtain positive marks
- Calculation of the final grade: lecture 40% + laboratory 30% + project 30%

Recommended reading

1. Testing of Digital Systems, N. K. Jha (Author), S. Gupta (Author), Canbridge University Press, 2003
2. Digital Systems Testing and Testable Design, Miron Abramovici, Melvin A. Breuer, Arthur D. Friedman, Wiley-IEEE Press, 1994
3. Digital Systems Design with FPGAs and CPLDs, Ian Grout, 2008

Further reading

Notes

Modified by dr inż. Michał Doligalski (last modification: 08-09-2021 21:10)