Digital system design

Summary
The goal is to familiarize the students with the hardware components of computing systems, and to teach the modern methods of analysis and synthesis of combinational and sequential systems, with the assistance of high-level languages such as VHDL.

Content
1. Analog versus digital, logic: the principles and the operators.
3. Sequential functions and their three representatives.
4. Coding, how do we interpret those bits.
5. Finite state machines.
6. Real gates and technology.
7. Programmable logic and their application.
8. Describing systems at a higher level by using a hardware description language (VHDL).

Keywords
Digital system design, logic gates, Boolean algebra, gates, flip-flops, latches, FPGA, CPLD, FSM, coding, VHDL

Learning Prerequisites
Required courses
None

Recommended courses
None

Learning Outcomes
By the end of the course, the student must be able to:
• Identify sequential and combinational logic functions
• Recognize logic functions, gates, latches, and flipflops
• Describe simple digital systems in VHDL
• Analyze digital systems either described in VHDL or implemented with gates
• Implement a digital system from a problem description
• Solve boolean equations and number system problems
• Design a complete digital system that runs on FPGA
• Detect differences between the theory and the practical application

Transversal skills
• Use a work methodology appropriate to the task.
• Continue to work through difficulties or initial failure to find optimal solutions.
• Use both general and domain specific IT resources and tools
• Access and evaluate appropriate sources of information.

Teaching methods
Course ex cathedra, exercises and practical laboratory projects

Expected student activities
The student must attend the course, prepare and solve the exercises, prepare and carry out the laboratory projects

Assessment methods
Midterm test (40%)
Final test (40%)
Midterm practical project (10%)
Final practical project (10%)

Supervision
Office hours No
Assistants Yes
Forum Yes

Resources
Bibliography
J. Wakerly, Digital design (4th edition), Prentice Hall, 2005
C. Maxfield, Bebop to the boolean boogie: An unconventional guide to electronics (3rd edition), Newnes, 2008

Notes/Handbook
All material is available on moodle including:
• Slides
• Theory booklet
• Exercises
• Old exams

Prerequisite for
Computer Architecture (CS-208)
Systems-on-Chip Architecture (CS-209)