COURSE DESCRIPTION CARD - SYLLABUS

Course name

Digital microsystems design

Course

Field of study	Year/Semester
Computing Science	2/4
Area of study (specialization)	Profile of study
-	general academic
Level of study	Course offered in
first-cycle studies	Polish
Form of study	Requirements
full-time	elective

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
16	16	
Tutorials	Projects/seminars	

Number of credit points

3

Lecturers

Responsible for the course/lecturer:
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Responsible for the course/lecturer:
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Prerequisites

Knowledge: Student starting this module should have a basic knowledge in the field of digital electronics, structured programming and scripting languages.

Skills: The student should be able to obtain information from the indicated sources, as well as understand the need to expand his competences and be ready to cooperate in a team.

Social Competences: The student should show such features as: honesty, responsibility, perseverance, cognitive curiosity, creativity, personal culture, respect for other people.

Course objective

1. To provide students with basic knowledge related to design aiding tools and their application in designing, testing and prototyping digital systems.

2. Developing students' ability to solve design problems in the construction of digital microsystems and information exchange in reprogrammable systems..

3. Shaping students' teamwork skills by working in subgroups on practical design issues.

Course-related learning outcomes

Knowledge

1. has extended and deepened knowledge of the description and analysis of combination and sequence devices, numerical simulation of systems in the discrete time domain,
2. has an ordered and theoretically founded knowledge of the principles of operation of the basic components of the computing system and the communication between these elements,
3. has a basic knowledge of designing digital devices using hardware description languages; has basic knowledge of testing and verification of prototypes of digital circuits and virtual components.

Skills

1. is able to acquire, combine, interpret and evaluate information from literature, databases and other information sources (in mother tongue and English); draw conclusions, and formulate opinions based on it,
2. is able to, when formulating and solving design tasks, use appropriately selected methods, including analytical, simulation or experimental methods,
3. is able to design and develop a testing environment for basic digital system,
4. is able to design (according to a provided specification which includes also non-technical aspects) a digital system using technologies learned during the course,
5. is able to work in a group, performing a role of programmable hardware designer.

Social competences

1. understands that knowledge and skills related to computer science quickly become obsolete,
2. knows how new development technologies and tools could be helpful to solve practical problems like developing a digital system.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Formative assessment:

a) lectures: based on the answers to the questions which test understanding of material presented on the lectures

b) laboratory classes: based on the assessment of the tasks done during classes and as a homework

Summative assessment:

a) verification of assumed learning objectives related to lectures within an online written test. The final grade is determined using the following scale: (90%, 100%] -> 5.0, (80%, 90%] -> 4.5, (70%, 80%] -> 4.0, (60%, 70%] -> 3.5, (50%, 60%] -> 3.0, (0%, 50%] -> 2.0.

b) verification of assumed learning objectives related to laboratories is based on:

- verification of the laboratory tasks,
- assessment of documentation created systematically along with the progress of design works; this

assessment also includes teamwork.
The final grade is determined using the following scale: (90%, 100%] -> 5.0, (80%, 90%] -> 4.5, (70%, 80%] -> 4.0, (60%, 70%] -> 3.5, (50%, 60%] -> 3.0, (0%, 50%]-> 2.0.

Getting extra points for activity during classes, especially for:
- proposing to discuss additional aspects of the issue,
- effectiveness of applying the acquired knowledge while solving a given problem,
- ability to work within a team that practically performs a specific task in a laboratory,

Programme content

The lecture program includes the following topics:
1. Construction of modern reconfigurable circuits, FPGA / CPLD / FPAA / FPOA / 3D-PLD / PSoC. The role of IP (Intellectual Property) components in the design of complex digital systems.
2. A synthesized subset of the VHDL language according to the IEEE 1076-2008 standard. Methods of designing digital circuits using hardware description languages. Principles of design and implementation of machines. Building a test environment, testbench with automatic verification. Code parameterization.
3. Methods of testing and verification of prototypes of digital devices with discussion of examples of hardware implementations. Common design errors and their impact on the operation and maintenance costs of devices.

Laboratory classes are conducted in the form of 2-hour lab exercises, preceded by a 2-hour instructional session at the beginning of the semester. Exercises are carried out by 2-person teams. The program of laboratory classes includes the following topics:
1. Designing digital devices using Mentor Graphics and Xilinx software. Analysis of the influence of the applied description style on the results of the synthesis. Constructing advanced testing environments (testbench).
2. Implementation of selected hardware drivers for peripheral devices used in modern digital systems (including SPI, I2C, UART, 1-Wire, sensors with a digital interface, LCD, PWM, Ethernet, Bluetooth).
3. Verification of prototypes of designed devices on platforms with Xilinx FPGAs. The use of peripheral modules with sensors of various physical quantities. Use of embedded analyzers for verification in the system.

Some of the above-mentioned program content is carried out as part of the student's own work

Teaching methods

1. Lecture with multimedia presentation (diagrams, formulas, definitions, etc.) supplemented by the content of the board.
2. Laboratory exercises: multimedia presentation, presentation illustrated with examples given on the board and performance of tasks given by the teacher - practical exercises.

Bibliography

Basic

1. Mark Zwoliński, Projektowanie układów cyfrowych z wykorzystaniem języka VHDL, WKŁ2007, ISBN: 9788320616354.

2. Kevin Skahill, Język VHDL - projektowanie programowalnych układów logicznych, WNT, Warszawa 2010, ISBN: 8320429749.

3. Michael Gook, Interfejsy sprzętowe komputerów PC, Helion, Gliwice 2005, ISBN: 8373616632.

Additional

1. Peter J. Ashenden, Digital Design (VHDL): An Embedded Systems Approach Using VHDL, Elsevier Science, August 2007, ISBN: 0123695287

2. Richard Munden, ASIC and FPGA Verification: A Guide to Component Modeling (Systems on Silicon), Elsevier Inc. 2005, ISBN: 0-12-510581-9.

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,0
Classes requiring direct contact with the teacher	35	1,4
Student's own work (literature studies, preparation for laboratory classes, preparation for test, techical reports preparation) [1]	40	1,6

[1] delete or add other activities as appropriate