Foundations of digital and microprocessor engineering - opis przedmiotu

Informacje ogólne

Nazwa przedmiotu	Foundations of digital and microprocessor engineering
Kod przedmiotu	06.5-WE-AutP-FDNE-Er
Wydział	Wydział Informatyki, Elektrotechniki i Automatyki
Kierunek	Automatyka i robotyka
Profil	ogólnoakademicki
Rodzaj studiów	Program Erasmus pierwszego stopnia
Semestr rozpoczęcia	semestr zimowy 2022/2023

Informacje o przedmiocie

Semestr	3
Liczba punktów ECTS do zdobycia	5
Typ przedmiotu	obowiązkowy
Język nauczania	angielski
Sylabus opracował	• dr hab. inż. Krzysztof Sozański, prof. UZ

Formy zajęć

Forma zajęć	Liczba godzin w semestrze (stacjonarne)	Liczba godzin w tygodniu (stacjonarne)	Liczba godzin w semestrze (niestacjonarne)	Liczba godzin w tygodniu (niestacjonarne)	Forma zaliczenia
Wykład	30	2	-	-	Zaliczenie na ocenę
Laboratorium	30	2	-	-	Zaliczenie na ocenę

Cel przedmiotu

Basic knowledge of: designing basic sequential and combinational circuits; calculating the representation of integers and real numbers as well as performing basic arithmetic operations on the representations; writing basic programs on the assembler level with the application of conditional statements, loops, operations on integers and real numbers, tables; designing and programming microprocessor systems and circuits.

Digital functional elements in MSI technique. Counters, registers, shift registers. Rules for designing synchronous and asynchronous counters. Designing combinational logic circuits with the application of : multiplexers, decoders, NAND gates. Data formats used in fixed point and floating point processors. Fixed point and floating point arithmetic. Arithmetic systems. Summation, subtraction and comparation of binary numbers. Medium-scale integration (MSI) circuits. Memory: ROM, RAM, EEPROM, FLASH. PLD, CPLD and FPGA systems. Designing digital systems with the application of PLD and CPLD systems. Microprocessors. Definitions, basic concepts and classification of microprocessors. Functional elements of microcomputer and their cooperation. Microprocessor architectures, the role of their functional elements, instruction cycle. Programming techniques, instruction set of microprocessors. Data exchange in microprocessor system. Organization and synchronization of data exchange among microprocessor system elements. Memory and I/O addressing modes. Data exchange between microprocessor system and external environment. Methods and conditions of servicing the elements of microprocessor system external environment. Data exchange among microprocessor systems. Methods for data exchange: with and without confirmation, synchronous and asynchronous, series and parallel. Advantages and drawbacks of particular methods, range of applications. Single chip-microcomputers. Characteristics of resources, application rules. Means supporting software and launch of microprocessor systems. History, trends and comparison of digital signal processors. Basic features of digital signal processors. Differences between a digital signal processor, microcontroller and microprocessor. Signal processor architectures: hardware multiplier, Harvard architecture, multibus architecture, stream conversion, delayed jumps, parallel instructions, long accumulator, shifting system, circular buffer. Memory addressing modes: direct, indirect, immediate, circular, bit reversion. Direct access systems to DMA. Multiprocessor systems.

Wymagania wstępne

Principles of Discrete Systems, Electronics Principles, Computer System Architecture.

Zakres tematyczny

Fundamentals of digital technology. Basic switching gates – technical specifications. Classes of integrated circuits. Integration scale. Numerical systems and codes. Boolean algebra. Logic function. Full function systems. Methods of logic function representation. Representation methods of logic function. Combinational logic circuits. Analysis and synthesis of combinational logic circuits. Minimization of logic function. Hazard in combinational logic circuits. Basic synchronous and asynchronous flip-flops. Sequential systems (Mealy and Moore machines). Analysis and synthesis of synchronous and asynchronous circuits. Characteristics of synchronous circuits and comparison with asynchronous circuits.

Metody kształcenia

Lecture, laboratory exercises.

Efekty uczenia się i metody weryfikacji osiągania efektów uczenia się

Opis efektu	Symbole efektów	Metody weryfikacji	Forma zajęć
Can program in a low and high level language, carry out the analysis of a processor and is able to identify the operating status of a processor		• bieżąca kontrola na zajęciach	• Laboratorium
Knows processor construction and memory types, can analyze command lists		• kolokwium	• Wykład
Can analyze and design simple digital systems realized with the application of discrete systems or programmable systems		• bieżąca kontrola na zajęciach • kolokwium	• Wykład • Laboratorium
Is aware of the dynamic development of microprocessors, microcontrollers and signal processors.		• bieżąca kontrola na zajęciach • kolokwium	• Wykład • Laboratorium
Knows fundamentals of object programming and can design software, with the application of object paradigms.		• bieżąca kontrola na zajęciach	• Laboratorium

Warunki zaliczenia

Lecture – the main condition to get a pass are sufficient marks in written or oral tests conducted at least once per semester.

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

Calculation of the final grade: lecture 60% + laboratory 40%

Literatura podstawowa

1. Martin K., Digital Integrated Circuit Design (Oxford Series in Electrical and Computer Engineering), Oxford University Press, 1999.

2. Brown S., Vranesic Z., Fundamentals of Digital Logic with VHDL Design, Mc Graw Hill, 2009.

3. Holdsworth B., Woods C., Digital Logic Design, Newnes, 2002.

4. Stallings W., Computer Organization and Architecture, Prentice Hall Inc., 2017.

5. Baer J., Microprocessor Architecture: From Simple Pipelines to Chip Multiprocessors, Cambridge University Press, 2009.

6. McFarland G., Microprocessor Design (Professional Engineering), McGraw-Hill Professional, 2006.

7. Chassaing R., Reay D., Digital signal processing and applications with the C6713 and C6416 DSK, A John Wiley & Sons, Inc., 2008.

Literatura uzupełniająca

1. Chassaing R., Digital Signal Processing with C and the TMS320C30, John Wiley & Sons, 1992.

2. 4. K. Sozanski, Digital Signal Processing in Power Electronics Control Circuits, second edition, Springer, 2017.

Uwagi

Zmodyfikowane przez dr hab. inż. Wojciech Paszke, prof. UZ (ostatnia modyfikacja: 11-04-2022 09:05)