# Assessment and subject description

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| **Óbuda University**<br>Kandó Kálmán Faculty of Electrical Engineering | | | Institute of Microelectronics and Technology | | |
| Subject name and code**: Digital Technics KMEDT11AND** **Credits: 2**<br>**Full-time, Autumn Semester 2019/2020** | | | | | |
| Course: | | | | | |
| Responsible: | Dr. Balázs Kovács, CSc, associate professor | Teaching staff: | Dr. Bálint Pődör, CSc (honorary) full professor | | |
| Prerequisites: | **Digiális technika I, II** | | | | |
| Contact hours per week: | Lecture: **2** | Class discussion: **0** | Lab hours: **0** | Tutorial: **0** | |
| Assessment and evaluation: | **end-of-term grade** | | | | |

**Subject description**

*Aims*:

This course will give an overview of the basic concepts and applications of digital technics, from Boolean algebra to microprocessors. The material covered roughly corresponds to that contained in the introductory three-semester course of the Hungarian language B.Sc. programme. However in many respects it will go into deeper depths. The lectures will focus more on the general concepts of the subject and less on the practical details. In this respect it is presupposed that the students have already acquired a certain level of hands-on experience in digital electronics.

Basic concepts of digital technics. Combinational logic design. Synchronous sequential circuit analysis and synthesis. Arithmetic circuits, adders and multipliers. MOS, CMOS and VLSI digital circuits. Microprocessor basics.

*Topics to be covered:*

| Topics | Week | Lessons |
|---|---|---|
| General introduction. Combinational circuits basic concepts. Review of Boole algebra and of logic functions. | 1 | **2** |
| Numerical minimization, Quine-McCluskey algorithm, example. XOR logic. Karnaugh map and applications. | 2 | **2** |
| Hazards, their elimination. Digital logic building blocks: encoders, decoders, multiplexers, demultiplexers, comparators, etc. | 3 | **2** |
| Programmable logic PLDs. FGPA basics, architecture, examples. | 4 | **2** |
| Combinational logic design: case studies. Model ALU design. Arithmetic circuits, ripple carrier adder, look-ahead logic, multipliers. | 5 | **2** |
| Sequential circuits, basic concepts. Flip-flops.<br>Analysis and synthesis of sequential circuits. Simple examples. | 6 | **2** |
| Analysis and synthesis of sequential circuits. Case studies: Coin operated vending machine control, 4-bit parity indicator, Gray-code counter. | 7 | **2** |
| Sequential circuits applications examples. Registers, counters, etc. Sequential arithmetic circuits. | 8 | **2** |
| Digital logic circuits I. Basic principles (logic families, inverter). MOS circuits. CMOS logic, inverter, properties, characteristics, layout. Simple gates, adder, pass transistor logic. | 9 | **2** |
| Digital logic circuits II. Logic circuit generation and families. Bipolar and TTL. High speed and advanced logic components. Schottky technology, advanced CMOS. BiCMOS circuits. | 10 | **2** |
| Digital logic circuits III. ECL circuits. General comparison and evaluation of different logic circuits and technologies. Trends in VLSI and logic circuits development. Carbon based electronics. | 11 | **2** |
| Semiconductor memories. Advanced memory concepts and technologies | 12 | **2** |
| Microprocessors, review of basic concepts and properties. | 13 | **2** |
| End-of-term test. | 14 | **2** |

**Assessment and evaluation**

Requirements of the signature:

The attendance of lectures is strongly recommended.

Home assignments should be prepared according to the deadlines set.

Type of exam:

Final grade is based on the results of two home assignments and of an end-of-term test.

Evaluation of the exam:

1 st home assignment: combinational and sequential logic problem solving (30 % in the final grade).

2 nd home assignment: sequential logic design or essay on a specific subject (25 % in the final grade).

End-of-term test paper (45 % in the final grade).

Pass level: 55 %

**Suggested material**

Any good recent English language textbook.

Arató Péter: *Logikai rendszerek tervezése*, Tankönyvkiadó, Budapest, 1990, Műegyetemi Kiadó 2004

Gál Tibor: *Digitális rendszerek I., II*. Műegyetemi Kiadó, 2003, 51429, 514291

Benesóczky Zoltán: *Digitális tervezés funkcionális elemekkel és mikroprocesszorokkal*, Műegyetemi Kiadó, 2002, 55033

Mojzes Imre (szerk.) *Mikroelektronika és elektronikai technológia*, Műszaki Könyvkiadó, Budapest, 1995

Bálint Pődör: *Digital technics* (course materials for final year elective English language course), available in the University E-learning (Moodle) system. An earlier version is also available from the web page of the Institute of Microelectronics and Technology, *mti.kvk.uni-obuda.hu*

Comment: