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| **Óbuda University**<br>Kandó Kálmán Faculty of Electrical Engineering | Microelectronics and Technology Institute |

**Tantárgy neve és kódja: Digital Technics I KEXDT1ABNE** **Kreditérték/Credits: 4**
**Subject name and code**

*nappali tagozat/full time 1st semester 2018/2019*

Szakok melyeken a tárgyat oktatják: Villamosmérnöki szak

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| Tantárgyfelelős oktató:<br>Responsible: | Dr. Balázs Kovács, CSC,<br>associate professor | Oktatók:<br>Teacing staff: | Dr. Bálint Pődör, CSc<br>honorary professor |

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| Előtanulmányi feltételek:<br>Prerequisites: | |

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| Heti óraszámok:<br>Contact hours per week: | Előadás: **2**<br>Lecture: | Tantermi gyak.: **0**<br>Class work: | Laborgyakorlat: **0**<br>Laboratory: | Konzultáció:<br>Tutorial: |
| Számonkérés módja (s,v,f):<br>Assesment: | **v**<br>**examination** | | | |

**A tananyag**

## Subject description

*Oktatási cél/Aims*:
This course will give an overview of the basic concepts and applications of digital technics, from Boolean algebra to microprocessors. The aim is to acquaint the future electrical engineers with the fundamentals of digital technics, with the digital circuits, and with their characteristics and applications. In the course of three-semester lectures, classroom-tutorials and laboratory exercises the future electrical engineer should acquire solid knowledge and sufficient proficiency in the functioning, operation, design and applications of digital systems.

*Tematika/Scope:*
Fundamentals of digital technics. Logic (Boolean) algebra, logic operations and functions. Combinational logic, analysis and synthesis and implementation of logic circuits. Binary arithmetics, algorithms and circuits. Code systems, code conversion. Combinational circuit functional building blocks, properties and applications.

| **Témakör:**<br>**Topics:** | **Óraszám:**<br>**Houts:** |
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| Fundamental concepts of digital technics and of logic networks. Specific characteristics of digital technics. Digital (binary) representation. | **2** |
| Introduction to and applications of logic algebra. Description of logic connection: textual, algebraic form, truth table, logic diagram. Boolean algebra: axioms and theorems. Fundamental logic operations. | **2** |
| Logic functions, fundamental concepts. Two-variable logic functions. Fully and incompletely specified logic functions. Canonic forms of logic functions. Disjunctive (sum-of-products, SOP), conjunctive (product-of-sum, POS) canonic forms, minterms and maxterms. | **2** |
| Manipulation and transformation of logic functions. Graphic representation: Veitch diagrams and Karnaugh maps). The concept and methods of logic function minimization. | **2** |
| Numerical/tabular minimization, Quine-McCluskey algorithm. Graphic minimization, Karnaugh map and applications. Minimization of incompletely specifies logic functions. Symmetric logic functions, XOR logic. Simple design/synthesis examples. | **2** |
| Effect of signal propagation delays on the operation of combinational logic networks. The concept and relevance of hazards in logic circuits. Static hazards (glitches) and their elimination. Functional hazards and their elimination. | **2** |
| Number systems, fundamentals. Binary numbers. Arithmetic operations in the binary number systems. | **2** |
| Codes and encoding, fundamental concepts. Numeric and alphanumeric codes. Pure binary codes (direct, 1s complement, 2s complement codes. Arithmetic operations in 1s and 2s complement codes. Tetrad codes, BCD codes. Arithmetic operations in tetrad and BCD codes. | **2** |
| Digital logic functional building blocks I. Encoders and decoders. Simple code changing combinational circuits. Binary/BCD and BCD/binary decoders. Gray code, binary/Gray, Gray/binary decoders. Encoding: error detection and correction, parity bit. | **2** |
| Digital logic functional building blocks II. Multiplexers, demultiplexers, comparators, arithmetic elements, half-adder, full adder. | **2** |
| Combinational logic design examples. 1-bit model arithmetic logic unit (ALU), 4-bit comparator, priority decoder, etc. Logic design using multiplexers. | **2** |

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| Realization of combinational circuits using memory elements. Programmable logic devices, PLDs | **2** |
| End-of-term review. | **2** |

**Félévközi követelmények** *(feladat, zh. dolgozat, esszé, prezentáció, stb.)*

**Assesment and avaluation**

The attendance of the lectures is compulsory. Students whose absence from lectures exceeds the limits stipulated in the Rules and Regulations of the University cannot be admitted to examination.
The coursework comprises several home assignments and a written mid-term test. Home assignments should be prepared according to the deadlines set. The condition for admission to examination, besides the above rules concerning lecture attendance, is the submission of all home assignments and at least a *pass* mark (2) in the test. The results of home assignments and of the test will be appropriately incorporated in the final grade. Weighing (app.): home assignments results 20 %, mid-term test result 20%, and exam paper 60 %.

**A pótlás módja**:

**Making good deficiencies:**

According to the Rules and Regulations of the University

**A félévközi jegy kialakításának módszere:**

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**A vizsga módja: írásbeli, szóbeli, teszt, stb.**

**Exams**

Written and oral examination at the end of the semester.
The threshold for pass mark (including the results of home assignments and mid-semester test) is 55 %.

**Irodalom**

**Suggested literature**

Any good recent English language textbook.

Arató Péter: *Logikai rendszerek tervezése*, Tankönyvkiadó, Budapest, 1990, Műegyetemi Kiadó 2004
Zsom Gyula: *Digitális technika I*, Műszaki Könyvkiadó, Budapest, 2000, (KVK 49-273/I). (Can be found on and downloaded from the internet.)
Rőmer Mária: *Digitális rendszerek áramkörei*, Műszaki Könyvkiadó, Budapest, 1989, (KVK 49-223).
Rőmer Mária: *Digitális technika példatár*, KKMF 1105, Budapest 1999.
Gál Tibor: Digitális rendszerek I, II, Műegyetemi Kiadó, Budapest, 2002, 2003.

**Egyéb segédletek**

**Other materials (electronic course materials)**

Bálint Pődör: Digital technics I (course materials for 1 st year 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*
Bálint Pődör: Digital technics (course materials for final year elective English language course), available from the web page of the Institute of Microelectronics and Technology, *mti.kvk.uni-obuda.hu*