Óbuda University **Kandó Kálmán Faculty of Electrical Engineering**			**Department of Automation**	
Subject name and code: Digital Technics I. KAXDT1EBNF			**Kreditérték/Credits: 4**	
full time				
Electrical engineering course				
Responsible:	Dr. Semperger Sándor	Teaching staff:	Dr. Balázs Kovács, PhD associate professor	
Prerequisites:				
Contact hours per week:	Lecture: **2**	Class work: **0**	Laboratory: **0**	Tutorial:
Assesment:	**examination**			

Subject description

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.

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. Sequential circuits basics. Flip-flops, elementary sequential functional blocks, counters, registers.

Topics:	**week/hours:**
Fundamental concepts of digital technics and of logic networks. Specific characteristics of digital technics. Digital (binary) representation.	**1st week, 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.	**2nd week, 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.	**3rd week, 2**
Manipulation and transformation of logic functions. Graphic representation: Veitch diagrams and Karnaugh maps). The concept and methods of logic function minimization.	**4th week, 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.	**5th week, 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.	**6th week, 2**
Number systems, fundamentals. Binary numbers. Arithmetic operations in the binary number systems.	**7th week, 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.	**8th week, 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.	**9th week, 2**
Digital logic functional building blocks II. Multiplexers, demultiplexers, comparators, arithmetic elements, half-adder, full adder.	**10th week, 2**
Combinational logic design examples. 1-bit model arithmetic logic unit (ALU), 4-bit comparator, priority decoder, etc. Logic design using multiplexers.	**11th week, 2**
Realization of combinational circuits using memory elements. Programmable logic devices, PLDs	**12th week, 2**
Basics of sequential circuits. Flip-flops RS, JK, D, DG, and T types, properties, and operation.	**13th week, 2**
Simpe sequential functional blocks, registers, counters. End-of-term review.	**14th week, 2**

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 %.

Making good deficiencies:

According to the Rules and Regulations of the University

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 %.

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 technika példatár*, KKMF 1105, Budapest 1999.
Gál Tibor: Digitális rendszerek I, II, Műegyetemi Kiadó, Budapest, 2002, 2003
Benesóczky Zoltán: Digitális tervezés funkcionális elemekkel és mikroprocesszorokkal, Műegyetemi Kiadó Budapest, 2006.

Other materials (electronic course materials)

Balázs Kovács: Digital technics I (course materials for 1 st year English language course), available in the University E-learning (Moodle) system.