RTU Course "Digital Electronics and Computer Architecture"

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General data

Code	RAE261
Course title	Digital Electronics and Computer Architecture
Course status in the programme	Compulsory/Courses of Limited Choice
Responsible instructor	Andis Supe
Volume of the course: parts and credits points	1 part, 3.0 Credit Points, 4.5 ECTS credits
Language of instruction	LV, EN
Annotation	This course is intended for the study of the basic knowledge (key terms, operating principles, typical applications), related to digital signals and various components used in digital electronics devices and computers. The main topics of the course: types of electrical signals, binary numbers arithmetic's, logic algebra and its functions, logic function (LF) minimization methods, synthesis and analysis of combination-type schematics, the basic elements of sequential type digital schemes, the overall structure of computer architecture, the basic concepts of computers — algorithm, command, software, operand, address, operating system.
Goals and objectives of the course in terms of competences and skills	The aim of the study course is to learn basic knowledge related to digital signals, binary arithmetic's and logic algebra, and to understand in-depth the principles and key parameters of digital electronics devices and computers. The tasks of the study course: *To introduce the terminology related to the course; *To learn to work with the number systems used in computer systems and make conversions from one to another; *To provide knowledge about the basic axioms of logic algebra, its laws, compose logical equations, and perform minimization; *To develop skills about standard logical gates, and functional units - their functions and graphical symbols; *To explain the synthesized logical structures and analyze them in various logic gate bases; *To explain the basic definitions of computer hardware; *To acquaint with the overall structure of computer architecture; *To learn to recognize the structure and functionality of the key elements in computer architecture.
Structure and tasks of independent studies	Independent work is organized in the form of individual study of lecture materials, solving the tasks set by the lecturer, and preparing laboratory work reports.
Recommended literature	Obligātā literatūra / Obligatory literature: 1.A. Klūga. Ciparu elektronika un datoru arhitektūra. Rīga: RTU, 2006. 186 lpp. 2.Aldis Baums. Datoru arhitektūra un organizācija. 2010, Rīga. 236 lpp 3.J. Greivulis, I. Raņķis. Iekārtu vadības elektroniskie elementi un mezgli. Rīga: Avots. 288 lpp. 4.Laboratorijas darbu praktikums diskrētās un ciparu iekārtās. Rīgā: RTU, 1993. 44 lpp 5.Paul Horowitz, Winfield Hill ''The Art of Electronics 3rd edition'' Cambridge University Press, 2015, 1192 p. 6.Modern Digital Electronics. By R. P. Jain. McGraw-Hill, 2008. 636 p. 7.M. Predko. Digital Elektronics Guidebook. New-York: Mc Graw - Hill, 2002. 530 p. 8.Brian Holdsworth, CliveWoods. Digital Logic Design, fourth edition "Newnes" 2002. 519p. Papildliteratūra / Additional literature: 1. Linda Null, Julia Lobur: "The Essentials of Computer Organization And Architecture", (2nd Edition), Jones & Bartlett Pub, (February 2006), ISBN-10: 0763737690 2. Опадчий Н., Глудкин О., Гуров А. Аналоговая и цифровая электроника. Москва: Горячая Линия–Телеком, 1999. 768 с. 3. Угрюмов Е. Цифровая схемотехника. Санкт-Петербург: Cbhv, 2000. 518 с. 4. К.Хамахер, З. Вранешич, С. Заки. Организация ЭВМ, 5-е изд., «Питер», 2003, Москва, Ст-Петербург. 5. Mano Kime ''Logic and Computer Design Fundamentals 3rd Ed.'' 6. M. Rafiquzzaman ''Fundamentals of Digital Logic'' (2005) Kursa apguvē var izmantot arī interneta resursus / Internet resources can also be used to acquire the course: Digital Electronics Tutorial. Available: http://www.asic-world.com/digital/tutorial.html
Course prerequisites	General knowledge about electric circuits an logic (Boolean) algebra

Course contents

Content	Full- and part-time intramural studies		Part time extramural studies	
	Contact Hours	Indep. work	Contact Hours	Indep. work
Types of electric signals – analogue, discrete, quantized, digital	4	4	0	0
Binary number arithmetics, hexadecimal number system	4	4	0	0
Logic (Boolean) algebra and its functions	4	4	0	0
Shannon theorem, logic functions` canonical forms DNF and CNF	8	8	0	0

Logic functions minimization methods, Quine-McCluskey method, Karnaugh maps	6	6	0	0
Basic logic functions and logic gates	8	8	0	0
Synthesis and analysis of combination-type logic circuits, typical combinational logic circuits	12	12	0	0
Sequential type logic circuits, flip-flop gates, registers, and counters	8	8	0	0
General computer architecture, basic hardware concepts — algorithm, command, program, operand, address, operating system	6	6	0	0
Total:	60	60	0	0

Learning outcomes and assessment

Learning outcomes	Assessment methods
The student is able to transform numbers between different counting systems.	Tests, exam
The student knows how to minimize logical equations using different techniques.	Tests, exam
The student recognizes logical function canonical forms and knows how to convert from one to another.	Tests, exam
The student is able to synthesize logical circuits based on specific logic gates.	Laboratory work, test, exam
The student is able to analyze real logical structures.	Laboratory work, test, exam
The student has experimental testing skills to determine parameters and operating algorithms of logic components.	Laboratory work
The student understands the functionality of the main units of computers and the general principles of their construction.	Laboratory work, test, exam

Evaluation criteria of study results

Criterion	%
Tests.	40
Laboratory work.	10
Exam.	50
Total:	100

Study subject structure

Part	CP	Hours per Week			Tests		
		Lectures	Practical	Lab.	Test	Exam	Work
1.	3.0	2.0	0.0	1.0		*	