RTU Course "Digital Devices and Systems"

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General data

Code	RAE362
Course title	Digital Devices and Systems
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 to acquire knowledge of design and operating principles of electronic equipment used in digital signal processing, typically applied in electronics and telecommunications sectors. The main topics of the course: pulse shaped signals and their interaction with linear electrical circuits, digital signal switches, parameters and electrical structures of different logic gates, amplitude limiters, pulse shaped signals generators, comparators, digital-to-analogue and analogue-to-digital converters, timers, and computer memory structure and organisation, internal and external interface, system set modules and architectures.
Goals and objectives of the course in terms of competences and skills	The aim of the study course is to learn the basis of digital signals processing and to understand the operating principles and characteristics of various semiconductor element electrical circuits. The tasks of the study course: * to introduce the terminology related to the course; * to introduce linear electrical circuits and their impact on different types of input signals; * to provide knowledge about the basic operating principles of electronic switches based on bipolar junction transistors; * to learn to recognize electrical structures of different logic gates families, their advantages and disadvantages; * to explain the generating principles of different types of pulse shaped signals; * to understand the operating principles and applications of signal limiters, timers, comparators and optoelectronic devices; * to develop skills on different typical solutions and applications of analogue-to-digital and digital-to-analogue converters; * to explain the operating principles of computer memory devices; * to learn to experimentally test parameters and operation algorithms for discrete and digital devices.
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. Paul Horowitz, Winfield Hill ''The Art of Electronics 3rd edition'' Cambridge University Press, 2015, 1192 p. 2. Anil K. Maini ''Digital Electronics: Principles, Devices and Applications'', John Wiley & Sons, 2007, 727p. 3. Rabaey, J. M., Chandraksan, A., and Nikolic, B. Digital Integrated Circuits: A Design Perspective. 2nd ed. Upper Saddle River, NJ: Pearson Education, Inc., 2003. 363 p. 4. M. Predko. Digital Elektronics Guidebook. New-York: Mc Graw-Hill, 2002. 530 p. 5. Laboratorijas darbu praktikums impulsu iekārtās. Rīgā: RPI, 1980. 107 lpp. 6. Laboratorijas darbu praktikums diskrētās un ciparu iekārtās. Rīgā: RTU, 1993. 44 lpp. 7. J. Greivulis, I. Raņķis. Iekārtu vadības elektroniskie elementi un mezgli. Rīga: Avots, 1997. 288 lpp. Papildliteratūra / Additional literature: 1. D. C. Green. Digital Electronics. Edinburg: Longman, 1999. 398 p. 2. Mano Kime ''Logic and Computer Design Fundamentals 4th edition'' 3. Опадчий Н., Глудкин О., Гуров А. Аналоговая и цифровая электроника. Москва: Горячая Линия–Телеком, 1999. 768 с. 4. Угрюмов Е. Цифровая схемотехника. Санкт-Петербург: Cbhv, 2000. 518 с. 5. К.Хамахер, З. Вранешич, С. Заки. Организация ЭВМ, 5-е изд., «Питер», 2003, Москва, Ст-Петербург. 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: 1. ADC and DAC Glossary. Available: http://www.maxim-ic.com/app-notes/index.mvp/id/641
Course prerequisites	Electric circuits, Digital electronics, Logic (Boolean) algebra and its functions

Course contents

Content	Full- and part-time intramural studies		Part time extramural studies	
	Contact Hours	Indep. work	Contact Hours	Indep. work
Pulse shaped signals and their interaction with linear electrical circuits	4	4	0	0
Tranzistor operating in electronic switch mode	4	4	0	0

Logic gate families (DL, RTL, DTL, TTL, I2L, CMOS) electrical circuits and parameters	4	4	0	0
Signal amplitude limiters	4	4	0	0
Pulse shaped signal generators	4	4	0	0
Analog comparators	6	6	0	0
Digital-to-analogue and analogue-to-digital converters (DAC and ADC)	8	8	0	0
Timers.	6	6	0	0
Optoelectronics	4	4	0	0
Computer memory devices SRAM, DRAM, ROM, PROM, EPROM, EEPROM, Flash EPROM	8	8	0	0
Computer internal and outer interface	8	8	0	0
Total:	60	60	0	0

Learning outcomes and assessment

Learning outcomes	Assessment methods
The student knows different types and characteristics of pulse shaped signals.	Tests, exam.
The student knows how to analyze the effects of linear circuits on pulse-shaped signals.	Tests, exam.
The student understands and knows how to analyze electronic switches and signal limiters circuits, their operating principles, and applications.	Laboratory work, test, exam.
The student is capable to describe the general characteristics and operating principles of basic logic gates from the most popular families like DL, RTL, DTL, TTL, I2L, ECL, CMOS.	Tests, exam.
The student is able to describe the design and operating principles of rectangular and sawtooth-shaped pulse generator circuits.	Laboratory work, test, exam.
The student understands analog signal comparators and timers' electrical structures and operating principles.	Tests, exam.
The student recognizes different DAC and ADC circuits, operating principles, and the most significant parameters.	Laboratory work, test, exam.
The student understands differences among computer memory devices like SRAM, DRAM, ROM, PROM, EPROM, EEPROM, Flash EPROM, and the general principles of their construction.	Tests, exam.

Evaluation criteria of study results

Criterion	%
Tests	30
Laboratory work	20
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		*	