COURSE UNIT DESCRIPTION

Course unit title	Code
Computer Architecture	

Annotation
Computer components and elements, architectural design, their development. Digital logic, data coding and representation at the machine level. Processor, arithmetic, logic and control modules. Instructions and their cycles. Command formats. Interrupts. Memory systems, their hierarchy. Random access memory. Cache memory and architectural design, parameters. Virtual memory. External storage devices and their principles of operation. Input and output devices and their control. Communication and multimedia equipment. Parallel processes. Increasing productivity. Assembler commands, directives, operands and their addressing.

Lecturer(s)	Department, Faculty
Coordinating: Lect. Dr. Dainius Balbonas **Other: Lect.**	Šiauliai Academy

Study cycle	Type of the course unit
First cycle studies	Compulsory

Mode of delivery	Semester or period when it is delivered	Language of instruction
Face-to-face	1 semester	English

Requisites	
Prerequisites: No	**Co-requisites (if relevant): No**

Number of ECTS credits allocated	Student's workload (total)	Contact hours	Individual work
5	133	56	77

Purpose of the course unit: programme competences to be developed		
To know the architecture of modern computer equipment, computer classes, architectural, logical and physical design, memory hierarchy, CPU technologies and architecture, instructions and microarchitecture, modern computer equipment, input-output systems, single-crystal computer architecture, computer hardware peripheral structure. Be able to evaluate and optimally select the equipment of a modern computer business management system.		
Learning outcomes of the course unit	**Teaching and learning methods**	**Assessment methods**
Consistently explain the basic facts, concepts, theories, and mathematical methods related to computer operation, computer hardware and software, its features and practical applications, computer	Theoretical lecture, laboratory work, search of scientific literature.	Laboratory work defense, test (exam)

communication, and applied solutions related to important historical, current time, and potential developments in computer science and future trends.		
Apply knowledge of software systems in developing IT application that meet safety and other actual criteria to solve relevant professional problems.	Theoretical lecture, laboratory work.	Laboratory work defense, test (exam)
To describe the problems of professional activity in the field of study of program systems at different levels of abstraction.	Theoretical lecture, laboratory work.	Laboratory work defense, test (exam)
Using effective methods and various criteria to analyze the data, information and solutions necessary for solving the actual problem of professional activity of program systems	Theoretical lecture, laboratory work, remote consultation	Laboratory work defense, test (exam)
Methodologically prepare the specification, design, and other documentation required to create, install, develop, use, and administer an application systems product or service	Theoretical lecture, laboratory work.	Laboratory work defense, test (exam)

Course content: breakdown of the topics	**Contact hours**							**Individual work: time and assignments**	
	Lectures	Tutorials	Seminars	Workshops	Laboratory work	Internship/work placement	**Contact hours, total**	**Individual work**	**Assignments**
1. Architecture of modern computer equipment. Domain-specific architectures. Architectural, logical and physical design. Computer architecture, basic concepts, components, their functionality and relationships, buses. Computer classes: peripherals / mobile devices, laptop / desktop computer, server, server clusters, Internet of Things, embedded systems.	2				4		**6**	**6**	Analysis of scientific literature on computer architecture and networks
2. Memory chips NAND, 3D NAND, memory interfaces and protocols, memory hierarchy, SLC, MLC, TLC technologies, virtual memory, paging, segmentation, memory protection, virtualization and virtual machines. JEDEC memory modules: NVDIMM-N, NVDIMM-F, NVDIMM-P.	4				4		**8**	**10**	Preparation and defense of laboratory works

Internal, cache and external memory, their logical structure, characteristics, architecture. Disk arrays.									
3. Central processing unit, technologies, architecture, cores, ambiguity, process parallelism. Concept of instructions, architecture: CISC, RISC, VLIW, EPIC. Microarchitecture: interrupts, registers, operands, addressing, ALU, FPU, pipelines, threads, timers, AD converters. Single crystal computer architecture. BIOS. GPU architecture	4				4		**8**	**10**	Preparation and defense of laboratory works
4. Input-output (I / O) system architecture. Programmable Interrupt-Based (IRQ) and Direct Memory Access (DMA) I / O devices. Buses, their structure, functions. Peripherals, interfaces, communication, control, buffering.	4				4		**8**	**9**	Preparation and defense of laboratory works
5. Structure, functions, parameters, installation, testing, debugging and integration of computer peripherals into the business management system, communication solutions with other hardware.	2				4		**6**	**9**	Preparation and defense of laboratory works
6. Architecture, components, features, debugging and integration of smart, futuristic and non-standard computer hardware.	2				4		**6**	**9**	Preparation and defense of laboratory works
7. FORTH, FPGA machines. Servers, clusters and other computer equipment.	2				2		**4**	**6**	Preparation and defense of laboratory works
8. Assembler instructions, directives, operands, addressing.	4				6		**10**	**18**	Preparation and defense of laboratory works
Total	**24**				**32**		**56**	**77**	

Assessment strategy	Weight %	Deadline	Assessment criteria
Defense of laboratory works (G)	50%	Time during the semester	Evaluation of performed laboratory works and their defense (evaluations of each laboratory work and its defense are averaged and multiplied by 6.25% weighting factor, a total of 8 laboratory works)
Exam (E)	50%	Time during the session	A test consisting of closed and open questions

Author	Publishing year	Title	Issue of a periodical or volume of a publication; pages	Publishing ho00use or internet site

Required reading				
John L. Hennessy, David A. Patterson	2020	Computer Architecture: A Quantitative Approach.		Morgan Kaufmann publishers
Ata Elahi	2018	Computer Systems: Digital Design, Fundamentals of Computer Architecture and Assembly Language.		Springer International Publishing AG
Blanchet, G., & Dupouy, B.	2013	Computer architecture (electronic resource)		Iste ; Wiley.
Recommended reading				
		Various tutorials and YouTube channels		https://www.studytonight.com/computer-architecture/ https://www.learncomputerscienceonline.com/computer-organization-and-architecture/ https://tutorialsinhand.com/tutorials/computer-organization-and-architecture-coa-tutorial/computer-fundamentals/computer-organization-architecture-coa-tutorial.aspx https://www.youtube.com/hashtag/computerorganizationandarchitecture
		Hardware analysis and recognized international tests		http://www.tomshardware.com/ http://www.pcworld.com/ http://reviews.cnet.com http://www.xbitlabs.com/ https://www.anandtech.com/ https://www.pcmag.com/