RUSSIAN MINISTRY OF SCIENCE AND EDUCATION

FEDERAL STATE BUDGETARY EDUCATIONAL INSTITUTION

OF HIGHER EDUCATION

«BASHKIR STATE UNIVERSITY»

НАИМЕНОВАНИЕ ФИЛИАЛА
НАИМЕНОВАНИЕ ФАКУЛЬТЕТА (ИНСТИТУТА)

Approved: at the department meeting
Protocol № 5 from January 26, 2021
Head of the department

_____/Yulmukhametov R.S.

Coordinated with:
EMC chairman of the faculty/institute

_____/ Efimov A.M.

WORKING PROGRAM OF DISCIPLINE (MODULE)

Discipline Computer architecture

Obligatory part

(name of the part enclosing the discipline (obligatory, formed by participants of the educational activity, facultative))

bachelor (undergraduate) program

Course of training (speciality)

01.03.02 Applied mathematics and informatics

(code and name of the course of training (speciality))

Subdivision of the course of training (profile)

Mathematical modeling and computational mathematics

Qualification (level of training)

bachelor

(name of the level of training)

Designer (compiler): associate professor of the PEI department, PhD	_____/Valeev N.F.

For enrollment of: 2021

Ufa 2021

Designer: associate professor, PhD Valeev Nurmukhamet Fuatovich.

The working program of the discipline is approved at the meeting of the department of Programming and Economic Informatics,
protocol № 5/1 from January , « 26 » 2021.

Head of the department _____ / Yulmukhametov R. S.

The addenda and updates introduced into the working program of the discipline are approved at the meeting of the department of Programming and Economic Informatics,
protocol № 11 from June , « 15 » 2021.

Head of the department _____ / Yulmukhametov R. S.

List of documents and materials

1. List of expected results of education in the discipline correlated with the indicators of achievement of competencies established in the educational program.
2. Goal and role of the discipline in the structure of educational program.
3. Content of the working program (duration of the discipline, sorts and forms of classes, educational and methodical support for the individual work of students).
4. Fund of grading materials in the discipline:
   4.1. The list of competencies and indicators of obtaining competencies with expected education results in the discipline associated with them. Description of the criteria and scales for evaluating the results of educating in the discipline.
   4.2. Typical grading tasks or other materials required for grading the education results in discipline correlated with the indicators of obtaining the competencies which are set in the educational program. Methodical materials determining the grading procedures for education results in the discipline.
5. Educational, methodical and informational support of the discipline:
   5.1. List of references to primary and complementary educational literature necessary for acquiring the discipline.
   5.2. List of the Internet resources and software necessary for acquiring the discipline, including professional data bases and reference systems.
6. Hardware equipment, materials and rooms necessary for implementing the educational process in the discipline.

1. List of intended education results of the discipline, correlated with the indicators of acquisition of competencies established in the educational program.

The following learning outcomes should be achieved at the end of the discipline:

Category (group) of competencies (if there is a GPC)	Competence being formed (with code)	Code and name of the indicator of acquiring the competency	Education results associated with the discipline
Information and communication technologies for professional activities	GPC-4. Is able to solve problems of professional activity using existing information and communication technologies and taking into account the basic requirements of information security	*GPC-4.1. Knows the directions of development of computers with traditional (non-traditional) architecture; development trends of functions and architectures of problem-oriented software systems and complexes in professional activity.*	*Knowledge of:* *- fundamentals of architecture and functioning of computer systems, networks and telecommunications;* *-physical foundations of the elemental base of computer technology and means of information transmission;* *-principles of construction and functioning of microarchitecture and computer architecture.*
		GPC-4.2. Able to program for computers with various modern architecture.	*Ability to program in assembly language processors with different architectures.*
		GPC-4.3. Has practical experience in choosing the architecture and integration of modern computers, systems, complexes and systems administration networks.	*Skills:* *- skills in building a computer system architecture model;* *- skills in selecting the configuration of a personal computer;* *- skills for evaluating computing systems for solving professional problems;*

2. Goal and role of the discipline in the structure of educational program.

The discipline «Computer architecture» refers to the part formed by the participants in educational relations.

The discipline is studied in the 2nd year in the 3rd semester.

The purpose of studying the discipline «Computer architecture» is to form, first of all, the fundamental knowledge of students in microarchitecture and computer architecture, the culture of architectural thinking and skills in working in assembly language. The discipline contains information about the methodology for studying complex hierarchically arranged systems, about the basics of digital electronic circuits of computers, the principles of their construction from the level of gates to the simplest MIPS and x86 processors. The theoretical material is accompanied by laboratory works performed on Logisim. Simulation models of almost all main processor units, including the simplest processor models, are designed and built at laboratory work. A mandatory requirement for building the simplest processor models is the ability to program the simplest programs in the processor assembly language. Each laboratory work is issued in the form of a report and submitted to the professor. The content of the discipline is included in the required minimum of professional knowledge of graduates in the relevant specialties and areas, and is also a necessary basis for mastering a number of disciplines of specialization, completing term papers, bachelor's, diploma and master's theses.

3. Content of the working program (duration of the discipline, sorts and forms of classes, educational and methodical support for the individual work of students).

The content of the work programme can be found in Appendix No. 1.

4. Fund of grading materials in the discipline.

4.1. The list of competencies and indicators of obtaining competencies with expected education results in the discipline associated with them. Description of the criteria and scales for evaluating the results of educating in the discipline.

Code and wording of the GPC-5 competence: *Able to use knowledge of the directions of development of computers with traditional (non-traditional) architecture; modern system software; operating systems, operating and network shells, service programs; trends in the development of functions and architectures of problem-oriented software systems and complexes in professional activities.*

Code and name of the indicator of acquiring the competency	**Education results associated with the discipline**	Criteria for evaluating learning outcomes.			
		2 ("Not Satisfactory")	3 ("Satisfactory")	4 ("Good")	5 ("Excellent")
GPC-4.1. Knows the directions of development of computers with traditional (non-traditional)	Knowledge of: - fundamentals of architecture and functioning of computer systems,	Lack of knowledge or fragmented understanding about - fundamentals of architecture and	Incomplete understanding about - fundamentals of architecture and functioning of	Formed, but containing separate gaps, understanding about - fundamentals	Formed systematic understanding about - fundamentals of architecture and

architecture; development trends of functions and architectures of problem-oriented software systems and complexes in professional activity. . .	networks and telecommunications; -physical foundations of the elemental base of computer technology and means of information transmission; -principles of construction and functioning of microarchitecture and computer architecture.	functioning of computer systems, networks and telecommunications; -physical foundations of the elemental base of computer technology and means of information transmission; -principles of construction and functioning of microarchitecture and computer architecture.	computer systems, networks and telecommunications; -physical foundations of the elemental base of computer technology and means of information transmission; -principles of construction and functioning of microarchitecture and computer architecture.	of architecture and functioning of computer systems, networks and telecommunications; -physical foundations of the elemental base of computer technology and means of information transmission; -principles of construction and functioning of microarchitecture and computer architecture.	functioning of computer systems, networks and telecommunications; -physical foundations of the elemental base of computer technology and means of information transmission; -principles of construction and functioning of microarchitecture and computer architecture.
GPC-4.2. Able to program for computers with various modern administration architectures	Ability to program in assembly language processors with different architectures.	Lack of programming skills for simple programs in assembly language for a simple processor.	Demonstrates the ability to program simple programs in processor assembly language.	Demonstrates the ability to program simple programs using the features of the processor architecture in assembly language.	Demonstrates the ability to program programs using the features of the processor architecture in assembly language.
GPC-4.3. Has practical experience in choosing the architecture and integration of modern computers, systems, complexes and systems administration networks.	Skills: - skills in building a computer system architecture model; - skills in selecting the configuration of a personal computer; - skills for evaluating computing systems for solving professional problems;	Doesn't have any of the following skills: - skills in building a computer system architecture model; - skills in selecting the configuration of a personal computer; - skills for evaluating computing systems for solving professional problems;	Partially owns at least two of the following skills: - skills in building a computer system architecture model; - skills in selecting the configuration of a personal computer; - skills for evaluating computing systems for solving professional problems;	Possesses at least two of the following skills: - skills in building a computer system architecture model; - skills in selecting the configuration of a personal computer; - skills for evaluating computing systems for solving professional problems;	Demonstrates solid skills: - skills in building a computer system architecture model; - skills in selecting the configuration of a personal computer; - skills for evaluating computing systems for solving professional problems;

4.2.Typical grading tasks or other materials required for grading the education results in discipline correlated with the indicators of obtaining the competencies which are set in the educational program. Methodical materials determining the grading procedures for education results in the discipline.

Code and name of the indicator of acquiring the competency	Education results associated with the discipline	Grading tasks
GPC-4.1. Knows the directions of development of computers with traditional (non-traditional) architecture; development trends of functions and architectures of problem-oriented software systems and complexes in professional activity. . .	Knowledge of: - fundamentals of architecture and functioning of computer systems, networks and telecommunications; -physical foundations of the elemental base of computer technology and means of information transmission; -principles of construction and functioning of microarchitecture and computer architecture.	Laboratory works, CGW, exam
GPC-4.2. Able to program for computers with various modern architecture.	Ability to program in assembly language processors with different architectures.	Laboratory works, CGW, exam
GPC-4.3. Has practical experience in choosing the architecture and integration of modern computers, systems, complexes and systems administration networks.	Skills: - skills in building a computer system architecture model; - skills in selecting the configuration of a personal computer; - skills for evaluating computing systems for solving professional problems;	Laboratory works, CGW, exam

The evaluation criteria for the *module-rating system* are the points that are set by the professor for the types of activities (assessment tools) based on the results of studying the modules (sections of the discipline) listed in the rating plan of the discipline *(for the exam:* current control - maximum 40 points; midterm control - maximum 30 points, incentive points - maximum 10; *for credit:* current control - maximum 50 points; midterm control - maximum 50 points, incentive points - maximum 10).

Evaluation scales:

(*for exam:*

from 45 to 59 points - "satisfactory";

from 60 to 79 points - "good";

from 80 points - "excellent".

for credit:

credited - from 60 to 110 rating points (including 10 incentive points),

not credited - from 0 to 59 rating points).

4.3 Rating plan for the discipline

«Computer architecture»

Course of training (speciality) 01.03.02 Applied mathematics and informatics

Year 2, semester1.

Professor: *Valeev N.F., PhD*

Department: *Programming and economic informatics*

Forms of education activities of students	Points for a particular task.	Number of tasks in a module.	Pointes	
			Minimum	Maximum
Модуль 1				
Current grading				
1. Report on laboratory work №1			0	10
2. Report on laboratory work №2			0	10
3. Report on laboratory work №3			0	10
4. Report on laboratory work №4			0	10
5 Report on laboratory work №5			0	10
6. Report on laboratory work №6			0	10
Midterm grading Oral examination on SGW			0	10
Attending/missing classes (scores for missing classes are subtracted)				
1. Attending lectures.			0	-18
2. Attending laboratory classes.			0	-12
Final control			0	30
1. Exam	10	3	0	30
TOTAL				**100**

Examination tickets

Exam ticket structure: 2 questions and 1 task.
Sample questions for the exam:

1. The concept of architecture J. Von Neumann.
2. Hierarchical description of computers. Basic computer levels and description languages. Functional description of the computer.
3. Command cycle of the processor.
4. Processor command system. Command formats.
5. System of operations of the processor.
6. The main types of valves, their design and principles of operation, truth tables.
7. Boolean algebra and equivalence (methods for constructing logical circuits for a given function, PCNF, PDNF, etc.).
8. Multiplexers, decoders, decoders
9. Comparators, logic matrices, shift schemes.
10. Adders
11. ALU, multi-bit ALU
12. Clock generators, principles of synchronization of processor nodes based on such signals
13. SR latches. Device and principles of functioning.
14. D - latches, triggers.
15. Registers. Register types. Counters.
16. The simplest memory chip (for example, 3x4).
17. Chips of processors.
18. General information about buses.
19. Synchronous buses.
20. Asynchronous buses.
21. Bus arbitration.
22. Multiplexing and the simplest bus models.
23. Finite automata. Machine guns Milli, Moore.
24. Examples of the simplest universal programmable automata. Machine programming.
25. The main nodes of the processor.
26. Simplified diagram of the processor data path.
27. Processor data path, basic principles of operation.
28. Control machine. Interaction of the data path of the processor and the control automaton.
29. The concept of processor architecture. MIPS architecture
30. The concept of microarchitecture. MIPS microarchitecture
31. Microarchitecture and architecture of x86 processors.

Topics of tasks in the exam (all tasks from the topics of laboratory work and SGW):

The task on the topic "Drawing up a scheme according to the truth table."
Task on the topic "Drawing a diagram for a logical function."
Task on the topic "Compiling a truth table according to the scheme."
Task on the topic "Diagramming of the simplest automata."
Task on the topic "Programming machines."
Task on the topic "Programming in MIPS assembler".

The transfer of the score from 100-point to four-point is carried out as follows:
- excellent - from 80 to 110 points (including 10 incentive points);
- good - from 60 to 79 points;
- satisfactory - from 45 to 59 points;
- unsatisfactory - less than 45 points.

Evaluation criteria (in points):
- **25-30 points** are given to the student if the student gave complete, detailed answers to all theoretical questions of the ticket, demonstrated knowledge of functionality, terminology, basic elements. The student answered all additional questions without difficulty and solved the problem.
- **17-24 points** are given to a student if the student has revealed mainly theoretical questions, but there are inaccuracies in the definition of basic concepts. When answering additional questions, small inaccuracies were made, the problem was solved with the help of a professor.
- **10-16 points** are given to a student if, when answering theoretical questions, the student made several significant errors in the interpretation of basic concepts. The logic and completeness of the answer suffer from noticeable flaws. Gaps in knowledge of the basic methods are noticeable. On the whole, the theoretical questions are presented sufficiently, but with material omissions. There are fundamental errors in the logic of constructing the answer to the question. When solving the problem, the student had significant difficulties.
- **1-10 points** are given to a student if the answer to theoretical questions indicates a misunderstanding and an extremely incomplete knowledge of the basic concepts and methods. The student could not answer any additional question and did not solve the problem.

Tasks for CGW.

Calculation-graphic work.

Low-level programming of the MISP architecture processor

The purpose of the CGW "Low-level programming of the MISP architecture processor" is to consolidate the theoretical material on the architecture and microarchitecture of the MISP. To perform the CGW, each student is given a Logisim-model of the MISP processor, a complete description of the model, commands, registers, etc. The student needs to write simple programs in MISP assembler, translate the program into machine language, load it into memory, and trace and describe the change in the architectural state of the processor at each clock cycle.

Task number 1. Summation of two or more numbers.

Task number 2. Multiplication of two numbers.

* Task number 3. Give an example and implement a program with branching. - add. exercise.

CGW is rated:

- set off, if the deadlines for submitting the report are not violated; there are no significant comments on the content and design of the work itself; the student gives complete answers to the questions asked.

-failed if (without good reason) the report on the GR was not submitted by the required deadline; less than 2 tasks were completed; the material of the RGR topic is not mastered.

Laboratory works

Laboratory work №1. “Learning the educational tool for designing and simulating digital logic circuits Logisim. Construction of the simplest combinational circuits.

Task number 1. According to the given truth table, construct CNF and DNF.
Task number 2. Using the simplest gates, construct combinational logic circuits for the obtained CNF and DNF.

Task No. 3. Simplify CNF and DNF using the rules of Boolean algebra (Zhegalkin polynomial) and build combinational logic circuits.

Task number 4. Simplify the resulting circuits using the built-in Logisim analyzer.

Task number 5. Build multiplexer, decoder, decoder circuits.

Task number 6. With the help of a multiplexer, implement a given logical function (truth table).

Description of the assessment methodology:

Evaluation criteria (in points):

For the report on laboratory work No. 1
- 10 points are given to the student: if the deadlines for submitting the report are not violated; there are no significant comments on the design and content of the work itself; the student gives complete answers to the questions asked.
Points are reduced (annulled) for late submission of the report; for comments on the design and content of the work itself; for unlearned concepts on the material of laboratory work.

Laboratory work 2. «Arithmetic-logic and other operating devices.»

1) Develop a single-bit multifunctional ALU circuit in Logisim, explain the principles of ALU operation.
2) Develop a multifunctional shift circuit in Logisim (8-bit)
3) Develop in Logisim a 4-bit ALU circuit combined at the output with a shift circuit.
4) Develop a 4-bit comparator circuit.
5) Develop a circuit for multiplying 2 4-digit numbers.

Description of the assessment methodology:

Evaluation criteria (in points):

For the report on laboratory work No. 2

- 10 points are given to the student: if the deadlines for submitting the report are not violated; there are no significant comments on the design and content of the work itself; the student gives complete answers to the questions asked.

Points are reduced (annulled) for late submission of the report; for comments on the design and content of the work itself; for unlearned concepts on the material of laboratory work.

Laboratory work №3. "Sequential Logic Circuits: Memory Elements, Memory Matrix Models".

Task 1. Implement an asynchronous RS flip-flop in Logisim using logic gates. Make sure that its behavior matches the behavior of the RS flip-flop from the built-in Logisim library. Values on input pins can be changed with the Press tool.
Task 2. Repeat task 1 for RS flip-flop with enabling input.
Task 3. Repeat task 1 for a D-flip-flop with an enabling input.
Task 4. Repeat task 1 for the synchronous D- flip-flop.
Task 5. Design an asynchronous 8-bit register with an enable input based on the D flip-flop from Task 3.
Task 6. Design a synchronous 8-bit register based on the D flip-flop from Task 4.
Task 7. Design a 4-bit counter based on the D-flip-flop from task 4 and a combination device of our own design, which has 4 inputs and 4 outputs. This combinational device outputs a 4-bit value one more than the 4-bit value at its inputs, and when the maximum value is applied, it outputs zero.
Task 7*. Design a synchronous 8-bit clock counter.
Task 8. Design a 3x4, 4x3 memory chip model.
Task 9*. Design a memory chip model with dual addressing (by rows and columns)

Tasks 7*,9* - additional**.**

Description of the assessment methodology:

Evaluation criteria (in points):

For the report on laboratory work No. 3

- 10 points are given to the student: if the deadlines for submitting the report are not violated; there are no significant comments on the design and content of the work itself; the student gives complete answers to the questions asked.

Points are reduced (annulled) for late submission of the report; for comments on the design and content of the work itself; for unlearned concepts on the material of laboratory work.

Laboratory work №4. "The simplest bus models."

Task 1. Design a circuit for transferring a sequence of 8-bit words over a single wire (plus a wire for transmitting clock pulses) from register to register.
Task 2. Design a circuit for transferring a sequence of 8-bit words over a single wire (plus a wire for transmitting clock pulses, address lines) from one memory matrix at a given address to another memory matrix (placed at a given address).
Task 3. Describe in general terms the types and principles of operation of buses for data transmission (text volume no more than an A4 sheet).

Description of the assessment methodology:

Evaluation criteria (in points):
For the report on laboratory work No. 4
- 10 points are given to the student: if the deadlines for submitting the report are not violated; there are no significant comments on the design and content of the work itself; the student gives complete answers to the questions asked.

Points are reduced (annulled) for late submission of the report; for comments on the design and content of the work itself; for unlearned concepts on the material of laboratory work. For the absence of task 3, 5 points are removed.

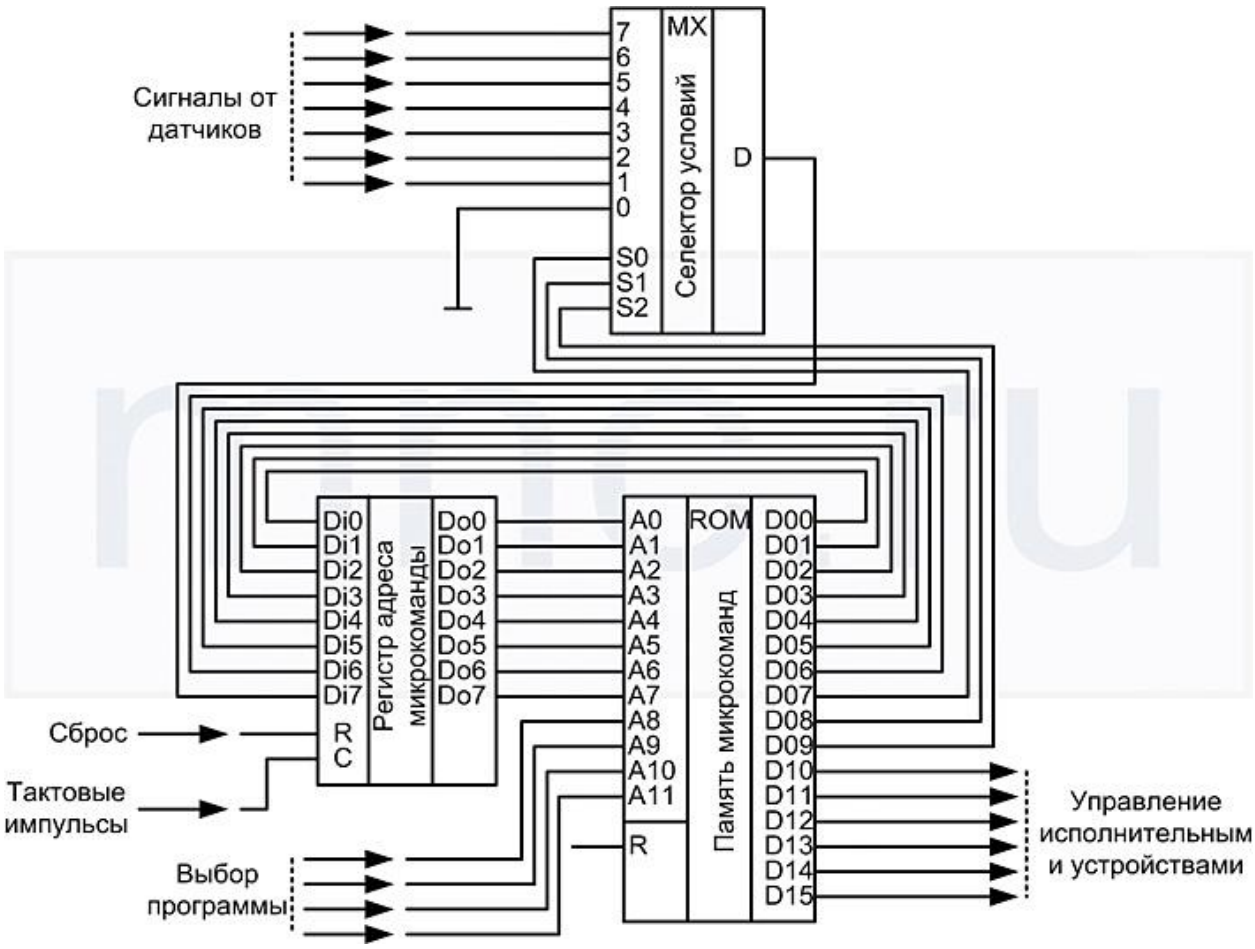
Laboratory work №5. "The Simplest Milli and Moore Automata".
Task number 1. According to the given graph of states (4 states) and transitions, build a truth table that determines the logic of the next state. Write the Boolean equation for the next state in perfect disjunctive normal form. Based on the data obtained, build a Moore automaton.
Task number 2. According to the given graph of states (3 states) and transitions, construct a truth table that determines the logic of the next state. Write the Boolean equation for the next state in perfect disjunctive normal form. Based on the data obtained, build a Mealy and Moore automaton.
Task number 3. Carry out a comparative analysis of Mealy and Moore automata (can be done orally).

Description of the assessment methodology:

Evaluation criteria (in points):
For the report on laboratory work No. 5
- 10 points are given to the student: if the deadlines for submitting the report are not violated; there are no significant comments on the design and content of the work itself; the student gives complete answers to the questions asked.

Points are reduced (annulled) for late submission of the report; for comments on the design and content of the work itself; for unlearned concepts on the material of laboratory work. For the absence of task 3, 3 points are removed.

Laboratory work №6. "Programming the states and outputs of the automaton".
Task number 1. Analyze the scheme of operation of the machine. Decipher the command format of the machine.



Task №2 A Christmas tree garland is connected to each control output.
Program the order in which the lights will light up.
Example.

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Адрес в памяти	управление внешними устройствами						выбор условия			адрес следующей команды						
0000000000000000	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
0000000000000001	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0
0000000000000010	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1
0000000000000011	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0
0000000000000100	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1
0000000000000101	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Description of the assessment methodology:

Evaluation criteria (in points):
For the report on laboratory work No. 6

- 10 points are given to the student: if the deadlines for submitting the report are not violated; there are no significant comments on the design and content of the work itself; the student gives complete answers to the questions asked.

Points are reduced (annulled) for late submission of the report; for comments on the design and content of the work itself; for unlearned concepts on the material of laboratory work.

5.1. List of references to primary and complementary educational literature necessary for acquiring the discipline.

Main literature:

1. Structured computer organization / Andrew S. Tanenbaum, Todd Austin. — 6th ed.: Pearson, 2013, -773 pp.
2. Догадин, Н. Б. Архитектура компьютера [электронный ресурс] : учеб. пособие / Н. Б. Догадин .— 2-е изд .— М. : БИНОМ. Лаборатория знаний, 2012 .— 272 с .— (Педагогическое образование) .— Электрон. версия печатной публикации .— Доступ к тексту электронного издания возможен через электронно-библиотечную систему "Университетская библиотека online" .— ISBN 978-5-9963-0920-7 . <URL:http://www.biblioclub.ru/index.php?page=book&id=222842>.
3. Пятибратов, А. П. Вычислительные системы, сети и телекоммуникации [электронный ресурс] : учебник / А. П. Пятибратов, Л. П. Гудыно, А. А. Кириченко .— 4-е изд., перераб. и доп .— М. : Финансы и статистика, 2013 .— 736 с .— Электрон. версия печатной публикации .— Доступ к тексту электронного издания возможен через электронно-библиотечную систему "Университетская библиотека online" .— ISBN 978-5-279-03285-3 .— <URL:http://www.biblioclub.ru/index.php?page=book&id=220195>.

Additional literature:

4. Digital Design and Computer Architecture David Money Harris and Sarah L. Harris. https://www.mips.com/downloads/digital-design-and-computer-architecture-russian-edition-second-edition/ (Free access)
5. Архитектура ЭВМ и операционные среды : учебник / В. Г. Баула, А. Н. Томилин, Д. Ю. Волканов .— 22-е изд., стер. — М. : Академия, 2012 .— 336 с. : ил. — (Высшее профессиональное образование) .— Библиогр.: с. 334 – 17 экз.
6. Архитектура ЭВМ и систем : учеб. пособие для бакалавров / О. П. Новожилов .— Москва : Юрайт, 2013 .— 527 с. : ил .— (Бакалавр. Базовый курс) .— Библиогр.: с. 518 .— Предм. указ. : с. 519 -9 экз

6. Hardware equipment, materials and rooms necessary for implementing the educational process in the discipline.

Name of special* rooms and rooms for independent work	Equipment of special rooms and rooms for independent work	List of licensed software. Details of the supporting document
1. ***classroom for conducting lecture-type classes:*** auditorium No. 501 (Physical and Mathematical Corps - educational), auditorium No. 531 (Physical and Mathematical Corps - educational) **2.** ***classroom for conducting seminar-type classes:*** room No. 522 (Physical and Mathematical Corps - educational) ***3. classroom for group and individual consultations:*** classroom No. 501 (Physical and Mathematical Corps - educational), classroom No. 531 (Physical and Mathematical Corps - educational), classroom No. 522 (Physical and Mathematical Corps - educational) ***4. classroom for current control and intermediate certification:*** classroom No. 501 (Physical and Mathematical Corps - educational), classroom No. 531 (Physical and Mathematical Corps - educational), classroom No. 522 (Physical and Mathematical Corps - educational) ***5. classrooms for independent work:*** classroom No. 426 (Physical and Mathematical Corps - educational), reading room No. 2 (Physical and Mathematical Corps - educational) **6.** ***room for storage and preventive maintenance of educational equipment:*** classroom № 522 (Physical and Mathematical Corps - educational)	**Classroom No. 501** Educational furniture, wall chalk board, personal computer and system unit /Corei5-4460(3.2)/CIGABAYTEGV-N710D3-1GL/4Gb, presenter LogitechWirelessPresenterR400 (210134000003592), projector SonyVPL-DX270, hand screen ViewScreenLotus 244x183 WLO-4304 **Classroom №531** Educational furniture, wall chalk board, multimedia projector Sony VPL-EX120, XGA, 2600 ANSI, 3,2 кг, projector ceiling mount (2101068302), classroom board ДА32. **Classroom №522** Educational furniture, blackboard, personal computer LenovoThinkCentre A70z IntelPentium E 5800, 320 Gb, 19" – 13 pcs., air conditioner LessarLS/LU-H24KB2. **Classroom №426** Educational furniture, blackboard, personal computers LenovoThinkCentreA70zIntelPentiumE 5800, 320 Gb, 19" – 13 pcs., cupboard TLKTWP-065442-G-GY **Читальный зал №2** Educational furniture, educational and visual aids, fire safety stand, stationary monoblocks - 8 pcs, printer - 1 pc., scanner - 1 pc.	1. Windows 8 Russian. Windows Professional 8 Russian Upgrade. Contract No. 104 dated June 17, 2013. Perpetual licenses. 2. Microsoft Office Standard 2013 Russian. Agreement No. 114 dated November 12, 2014. Perpetual licenses. 3. Logisim (GNU GPL license, free software).

Appendix № 1

FEDERAL STATE BUDGETARY EDUCATIONAL INSTITUTION
OF HIGHER EDUCATION
«BASHKIR STATE UNIVERSITY»

CONTENT OF THE WORKING PROGRAM

discipline "Computer Architecture" for the 3rd semester
full-time
form of education

Activity	Duration
Total duration of the discipline (CUD / hours)	4/144
Academic hours for the work with instructor:	73.7
lectures	18
seminars	
laboratory	54
other (consultation in group or individually and other forms of learning activities assuming collaboration of learners with instructor)	1.7
Academic hours for individual work of students	35.5
Academic hours for preparing to exam/credit test/differentiated credit test (Grading)	34.8

Forms of grading:
exam 3rd semester
CGW, 3rd semester

Appendix № 2	**Topic and content**	Total	LC	PR/SEM	LR	CR	Core and additional literature recommended to students (numbers from the list)	Assignments for students' independent work	Form of ongoing monitoring of progress (colloquia, tests, computer-based tests) tests, etc.)
1	2	3	4	5	6	7	8	9	10
	1st semester	107.5	18		54	35.5			
1	History and main stages in the development of computer technology. Logisim program		1		6	4	1-3	Chapter1, Tasks 1-14	Abstract work, oral survey
2	Hierarchical description of computers. The concept of computer architecture. Von Neumann architecture, basic concepts. Processor instruction cycle, instruction, basic instruction types, instruction format, addressing types, systems and operation types.		2		6	4	1-3	Chapter 2 Tasks 1-14 Laboratory work 5	Laboratory work report, oral survey
3	Digital logic level. Gates and Boolean Algebra. Combination circuits: multiplexers, decoders, comparators, adders, programmable logic matrices. Arithmetic-logical devices.		4		6	4.5	1-3	Chapter 3 Tasks 1-24 Laboratory work 1.2	laboratory work report, CGW
4	Sequential schemes.		2		6	4.5	1-3, 4-5	Chapter 3	Laboratory work

	Latches. Synchronous SR Latches. Synchronous D-Latches. Synchronous and asynchronous circuits. Registers, counters. clock generators. Flip-flops.							Tasks 19-24 Laboratory work 3	report, oral survey
5	Organization of memory. Models of computer memory chips. Random Access Memory, ROM.		2		6	4	1-3, 4-5	Chapter 3, Tasks 19-24 Laboratory work 4	Laboratory work report, oral survey
6	General principles of the bus device. Synchronous and asynchronous bus models.		1		6	2.5	1-3, 4-5	Chapter 3, Tasks 25-29 Laboratory work 5	Laboratory work report, oral survey
7	Finite automata. Finite state machine design: diagrams and tables of transitions and outputs with binary coding. Moore and Mealy machines.		2		6	6	1-3, 4-5	Chapter 4, Laboratory work 6	Laboratory work report, oral survey
8	The concept of the architecture and microarchitecture of the processor. Architectural state and command system. MIPS microarchitectures on the example of a single-cycle processor. Processor command system, instructions like R, I, J, machine codes. Scheme of the data path, control		3		12	6	1-3, 4-5	CGW	Report on CGW, oral survey

	device. The process of executing instructions like R, I, J. MIPS assembly language.								
9	**Total hours:**	107.5	18		54	35.5			

List of documents and materials

1. The list of competencies and indicators of obtaining competencies with expected education results in the discipline associated with them. Description of the criteria and scales for evaluating the results of educating in the discipline.

2. Control tasks or other materials necessary for evaluating learning outcomes in the discipline. Methodological materials that determine the procedures for evaluating learning outcomes in the discipline.