საქართველოს ტექნიკური უნივერსიტეტი
GEORGIAN TECHNICAL UNIVERSITY

Bachelor's Educational Program

Program Title

Computer Science
კომპიუტერული მეცნიერება

Faculty

Faculty of Informatics and Control Systems
ინფორმატიკისა და მართვის სისტემების ფაკულტეტი

Program Supervisor/ Supervisors

Professor Kartlos Kachiashvili

Qualification to be Awarded, and the Number of Credits in the Program

"Bachelor of Computer Science" will be awarded in case of passing basic 210 credits of the program and free components (30 credits) for accumulation not less than 240 credits.

The Language of Teaching

English

Admission Prerequisites to the Program

The right of teaching on English bachelor educational program has an owner of the State certificate that confirms completion by him of the general education course or equalized to him person which will be enrolled by the rule stated by Georgian legislation. The applicant must submit the certificate confirming the knowledge of English on the level not less than B2 or international certificate of TOEFEL (The Test of English as a Foreign Language) of II certification level. The applicant is free to submit a certificate confirming his/her competence if he/she have completed general education course in English. At absence of the appropriate certificate or other analogous document, the applicant will have an interview in English. The temporary commission staffed by the experts from the staff of GTU will implement the interview.

Program Description

Content, training methods and number of the credits of learning courses of the program provides achievement of a goal and results.

The program follows the ECTS system, 1 credit equals to 25 hours, which includes the contact hours, as well as the hours of independent work. The distribution of hours is presented in the educational plan. The duration of the program is 4 years (8 semesters, 60 credits in a year) and it contains not less than 240 credits. For getting Bachelor's degree the student must master 240 credits. From here 210 credits are the credits of basic specialties and 30 credits are the credits of free teaching components. From 210 credits of basic specialty 198 credits are obligatory and 12 credits are selective from 30 credits volume of speciality obligatory selective teaching courses. From 210 credits 6 credits are selected out for teaching practice and 12 credits – for final project.

The annual learning process contains two semesters, with duration 21 weeks each of them. Student's assessments are realized by means of current activities, mid-semester exams and final/additional exams. The duration of the learning process is 15 weeks. The dates of mid-semester and final exams are regulated before beginning every semester by Rector's order about schedule of education. The student has a right to pass final exam when he/she collected established minimum positive assessments: in ongoing activities (15 points) and in mid-semester exam (7.5 point). Minimal positive assessment of the final/additional exam is 10 points. A semester contains 30 credits and, accordingly, a year contains 60 credits. Assessment of the student's knowledge is realized by maximum 100 points, from which 60 points are mid-semester assessments (ongoing activities and mid-semester exam) and 40 points – final exam. Assessment forms of mid-semester and final exams are described in the programs (syllabi) of educational courses.

Educational courses in the semesters are distributed as follows.

In I, II and III semesters of **the first, second and third educational years** a student learns six courses (in I and II semesters four of the courses contains 5 credits, one – 4 credits and one – 6 credits, in III semester all of six courses contains 5 credits) which in a semester gives 30 credits. The courses belong to mathematics, physics, English, information technologies, fundamentals of computer engineering and computer science. During IV and V semester a student learns five courses with 6 credits each, and in VI semester from five courses with 6 credits only four are obligatory and from two selective courses only one is obligatory and teaching practice with 6 credits.

In the first semester of the **fourth year** only two from five courses with six credits is obligatory for a student and from three selective courses only one is obligatory and final project with 12 credits. In the second semester of the **fourth year** from free components student choose courses so that the sum of selected courses was not less than 30 credits.

There were used many educational programs of data sciences of the bachelor level of well known in the world universities at development of the program. For example, see following sites:
1. Illinois Institute of Technology
    https://illinoistech.cambridgeeducationgroup.com/programs/undergraduate/bs-computer-science/
2. Harbour.Space - University for Technology and Design In Barselona
    https://www.bachelorstudies.com/Bachelor-of-Computer-Science/Spain/Harbour-Space/
3. Keele University, UK
    https://www.keele.ac.uk/study/undergraduate/undergraduatecourses/computerscience/
4. Iowa State University, USA
    http://catalog.iastate.edu/collegeofliberalartsandsciences/computerscience/
5. Chicago State University, USA
    https://www.csu.edu/macs/undercugc.htm
    San Diego State University
    SDSU_GeneralCatalog-full-cover-17-18.pdf ;   page-196 (Annex 11)

The program is also developed in accordance with the ABET accreditation standards and it corresponds to ABET accredited bachelor programs (<http://main.abet.org/aps/accreditedprogramsearch.aspx>) in computer science by structure and

organization:
1. Abilene Christian University) (USA)
   http://catalog.acu.edu/preview_program.php?catoid=2&poid=444
2. Illinois State University (USA) https://web.iit.edu/sites/web/files/departments/academic-affairs/undergraduate-academic-affairs/pdfs/2018-2019_UG_Bulletin_final.pdf (p. 183)
3. Michigan Technology University (USA) https://www.mtu.edu/cs/undergraduate/computer-science/

Program Objective

The aim of the program is to give to a Bachelor the knowledge about basic problems of the big data systems. It will be systematical, methodological, information-technological and information-analytical knowledge on the modern lvel that will allow bachelor successfully to realize the exploitation, the realization and the regulation of consumer service. He also will be able to participate in projection, integration and introduction of software of modern objects of computer science, among them the systems with data basis, data processing, special software and computer nets under guidance of the experts in these subjects.

The Learning Outcomes/Competence (general and professional)

- **Knowledge and understanding**
  - wide knowledge of the sphere of computer science and understanding the special questions;
  - understanding complex questions of computer science;
  - critical assessment, interpretation of the theories and principles.
- **Skills**
  - the use of methods that are characteristic of computer science and some special methods for solving problems arose; practical use of information technologies, modelling, algorithmization and basis of programing;
  - to take part in designing, manufacturing, integrating and utilizing information and big data systems; independent exploitation, service and debugging of software of computer systems and computer nets;
  - gathering, analysis and explanation of the data characterising the sphere of big data systems, analysing inaccurate data and/or situations by standard and some special methods and formation of grounded conclusions on their basis;
  - investigation of information processes and organizational management, software, technical, organizational support and information security;
  - public presentation of own thoughts with the appropriate knowledge and logic and their clear argumentation; preparation of a detailed written report concerning ideas, current problems and their solution ways, and transferring the information in English, creative use of modern information and communication technologies.
- **Responsibility and autonomy**
  - assessing the sequence of own learning process and multilateralism; determination of the learning directions, taking into account an existing environment and priorities;
  - participation in the formation of values and moral norms and striving to establish them.

Methods (teaching - learning) of Achieving Learning Outcomes

☒ Lecture ☒ Seminar (working in groups) ☒ Practical class ☒ Laboratory ☒ Practice
☒ Course work/project ☒ Consultation ☒ Independent work

Based on the specifics of a learning course, the appropriate activities listed below are employed, reflected in the relevant learning courses (syllabi):

Teaching and learning methods: in the process of teaching, on the basis of the specificity of learning course, the following teaching methods are used:

1. **Discussion/debate.** This is the most widely spread method of interactive teaching. A discussion process greatly increases the quality of students' involvement and their activity. A discussion may turn into an argument and this process is not merely confined to the questions posed by the teacher. It develops students' skills of reasoning and substantiating their own ideas.

2. **Cooperative learning** is a teaching strategy in the process of which each member of a group not only has to learn the subject himself, but also to help his fellow-student to learn it better. Each member of the group works at the problem until all of them master the issue.

3. **Collaborative work**: using this method implies dividing students into separate groups and giving each group its own task. The group members work at their issues individually and at the same time share their opinions with the rest of the group. According to the problem raised, it is possible to shift the functions among the group members in this process. This strategy ensures the students' maximum involvement in the learning process.

4. **Problem based learning** is based on the step-by-step solving of a given problem. It is realized by means of independent fixing of the facts in the teaching process and determining the ties among them.

5. **Case study** – the teacher discusses concrete cases together with the students and they study the issue thoroughly.

6. **Brain storming** – this method implies forming and presenting as many radically different ideas and opinions on a given topic as possible. This method sets conditions for developing a creative approach towards a problem. This method is effective in a large group of students and consists of the following stages:

- using a creative approach for defining a problem/issue;
- for a certain period of time listing (mainly on the blackboard) students' ideas on the problem without any criticism;
- determining the evaluation criteria for stating the correspondence of the idea to the aim of the research;
- evaluating the chosen ideas according to the previously determined criteria;
- selecting the ideas that most of all correspond to the given issue by applying the method of exclusion;
- revealing the best idea for solving the given problem

7. **Implication** implies presenting information with the help of visual aids. It is quite effective in reaching the required result. It is frequently advisable to present the material simultaneously through audio and visual means. The material can be presented both by a teacher and a student. This method helps us to make different steps of perceiving the teaching material more obvious, specify what steps the students are supposed to take independently; at the same time this strategy visually shows the essence of an issue/problem. Demonstration can be very simple.

8. **Induction** determines such a form of conveying any kind of knowledge when in the process of learning the train of thought is oriented from facts towards generalization, i.e. while presenting the material the process goes from concrete to general.

9. **Deduction** determines such a form of conveying any kind of knowledge which presents a logical process of discovering new knowledge on the basis of general knowledge, i.e. the process goes from general to concrete.

10. **Analysis** helps us to divide the whole teaching material into constituent parts. In this way the detailed interpretation of separate issues within the given complex problem is simplified.

11. **Synthesis** implies forming one issue from several separate ones. This method helps students to

develop the ability of seeing the problem as a whole.

12.**Verbal or oral transmitted** comprises a lecture, narration, conversation, etc. During the process the teacher conveys, explains the material verbally, and students perceive and learn it by comprehending and memorizing.

13.**The script** implies the following forms of activity: making extracts, records, notes, theses, abstract or essay and other.

14.**Explanation** is based on discussing a given issue. In the process of explaining the material the teacher brings concrete examples the detailed analysis of which is made in the framework of the given topic.

15.**Activity-oriented training** implies teachers' and students' active involvement in the teaching process, when practical interpretation of the theoretical material takes place.

16.**Project planning and presentation.** While designing a project a student applies the knowledge and skills he has acquired for solving a problem. Teaching by means of designing projects increases students' motivation and responsibility. Working on a project involves the stages of planning, research, practical activity and presenting the results according to the chosen issue. The project is considered to be completed if its results are presented clearly, convincingly, and correctly. It can be carried out individually, in pairs or in groups; also, within the framework of one or several subjects (integration of subjects); on completion the project is presented to a large audience.

Student Knowledge Assessment System

Grading system is based on a 100-point scale.

Positive grades:
- **(A)** - Excellent - grades between 91-100 points;
- **(B)** – Very good - grades between 81-90 points
- **(C)** - Good - grades between 71-80 points
- **(D)** - Satisfactory - grades between 61-70 points
- **(E)** - Pass - the rating of 51-60 points

Negative grades:
- **(FX)** - Did not pass - grades between 41-50 points, which means that the student is required to work more to pass and is given the right, after independent work, to take one additional exam;
- **(F)** – Failed - 40 points and less, which means that the work carried out by the student did not bring any results and he/she has to learn the subject from the beginning.

The criteria of the assessment of syllabuses are the conformity of the content of studying course with the aims of the course and with the results of teaching; perfect presentation of the results of study; the conformity between the aims of the course and the results of studying; the conformity between the results of studying and the methods of assessment.

Here is defined its own share for each assessment form and component in the final assessment, from the common assessment points (100 points). In particular, maximum point of mid-semester assessment is 60, and maximum point of final exam is – 40.

Assessment forms:
- ❖intermediate assessment;
- ❖final/additional exam.

The components of mid-semester assessment are:
- mid-semester exam;
- the assessment of current activity;
  - ➢ testing with open or closed questions;
  - ➢ fulfillment of practical/theoretical home-work;
  - ➢ thematic project;
  - ➢ course work/course project;
  - ➢ written or/and oral examination;
  - ➢ activity at the laboratory;
  - ➢ activity at the seminar;
  - ➢ participation in the discussions;
  - ➢ case.

The assessment method are:
- ❖ testing with closed questions;
- ❖ testing with open questions;
- ❖ written examination with questions;
- ❖ description/making of a laboratory work;
- ❖ examination with open text or questions;
- ❖ examination with closed text or questions;
- ❖ ability of fulfilling and defense of the project.

Sphere of Employment

Organizations and companies which create computer systems, built-in data bases, realize data search, their processing and analysis and make computer service of enterprises: engineering, economical and financial computations; design, integration and implementation of program, technical, technological, organizational support of information systems; design, integration and implementation of information safety systems. The spheres of employment are: energy, military, economy, communication, medicine, environment, agriculture, metallurgical and chemical industries, food, building and other industrial objects; also banking organizations, research institutes, planning and design offices.

Potential for Further Education

Master's Educational Programs

Human and Material Resources Required to Implement the Program

The program provides the appropriate human and material resources. For more information see the attached documents.

The Number of Syllabi Attached: 51

Courses in the Program

№		Admission Prerequisites	ECTS Credits			
			Year I	Year II	Year III	Year IV

	Course		I	II	III	IV	V	VI	VII	VIII
			Semester							
1	Engineering Mathematics 1.1	None	5							
2	General Physics 1	None	4							
3	Fundamentals of Computer Architecture and Organization	None	5							
4	Algorithmization Fundamentals and Programming Elements	None	6							
5	Introduction to Information Technologies	None	5							
6	Foreign Language (English) – B2 + 1	None	5							
7	Engineering Mathematics 2.1	Engineering Mathematics 1		5						
8	General Physics 2	General Physics 1		4						
9	Operating Systems Fundamentals	None		5						
10	Object-oriented Programming – 1 (based on C++/C#)	Algorithmization Fundamentals and Programming Elements		5						
11	Foreign Language (English) – B2+ 2	Foreign Language (English) – B2 + 1		5						
12	Fundamentals of Database Systems	Introduction to Information Technologies		6						
13	Engineering Mathematics 3.1	Engineering Mathematics 2			5					
14	Object-oriented Programming – 2 (based on Java)	Object-oriented Programming – 1 (based on C++/C#)			5					
15	Introduction to Computer Network	Introduction to Information Technologies, Fundamentals of Computer Architecture and Organization.			5					
16	Database Management System Oracle	Fundamentals of Database Systems			5					

17	Fundamentals of probability theory	Engineering Mathematics 2			5					
18	Optimization Methods	Engineering Mathematics 2			5					
19	Basics of Web Technologies	Introduction to Information Technologies				6				
20	Introduction to Information Security	Introduction to Computer Network				6				
21	Distributed Database Systems	Fundamentals of Database Systems, Database Management System Oracle				6				
22	Discrete Mathematics	No prerequisites				6				
23	Statistical Models and Simulation by SPSS	Fundamentals of probability theory, Engineering Mathematics 3.1, Optimization Methods				6				
24	Big Data Fundamentals	Statistical Models and Simulation by SPSS, Distributed Database Systems					6			
25	Introduction to Machine Learning	Statistical Models and Simulation by SPSS, Optimization Methods					6			
26	Data Warehousing Fundamentals	Database Management System Oracle, Distributed Database Systems, Introduction to Information Security					6			
27	Programig on Python	Algorithmization Fundamentals					6			

		and Programming Elements, Object-oriented Programming – 2 (based on Java)								
28	Fundamentals of Artificial Intelligence	Fundamentals of probability theory, Discrete Mathematics					6			
29	Data Mining and Knowledge Discovery for Big Data	Statistical Models and Simulation by SPSS, Introduction to Machine Learning						6		
30	Introduction to Grid Computing	Operating Systems Fundamentals, Basics of Web Technologies						6		
31	Cloud computing	Basics of Web Technologies, Distributed Database Systems						6		
32	Teaching practice	Fundamentals of Artificial Intelligence, Data Warehousing Fundamentals, Introduction to Machine Learning.						6		
	Selective 1									
33.1	Computer Network Organization	Introduction to Computer Network, General Physics 2								
33.2	Cognitive computing and Big Data Analytics	Fundamentals of Artificial Intelligence, Introduction to Machine Learning						6		
34	Big Data Storage and Processing	Basics of Web							6	

	System Hadoop	Technologies, Data Warehousing Fundamentals, Statistical Models and Simulation by SPSS, Programing on Python									
35	Introduction to Multi-method Modeling and Simulation	Statistical Models and Simulation by SPSS, Introduction to Grid Computing							6	
	Selective 2										
36.1	Geographic Information Systems (GIS) Fundamentals	DataBase Management System Oracle, Computer Network Organization, Statistical Models and Simulation by SPSS									
36.2	Knowledge Representation and Reasoning	Data Warehousing Fundamentals, Fundamentals of Artificial Intelligence, Introduction to Machine Learning							6	
36.3	Business Intelligence for Decision Making	DataBase Management System Oracle, Statistical Models and Simulation by SPSS									
37	Final Project in Cloud/or Grid computing and/or Big Data Processing	Cloud computing, Data Warehousing Fundamentals, Data Mining and Knowledge Discovery for Big Data, Introduction to							12	

№	Subject						
	Free components						
38	Bases of Policy	None					5
39	Cultural Studies	None					5
40	History and Culture of Georgia	None					5
41	Introduction to Ergonomics	None					5
42	Introduction to Philosophy	None					5
43	Job Analysis Methods	None					5
44	Philosophy and the History of Ideas	None					5
45	Principles of Contemporary Management	None					5
46	Principles of Economics	None					5
47	Sociology	None					5
	Per Semester		30	30	30	30	30 30 30 30
	Per Year		60	60	60	60	
	Total			240			

Program Curriculum

№	Subject code	Subject	ECTS Credit/Hours	Lecture	Seminar (work in the group)	Practical classes	Laboratory	Practice	Course work/project	Mid-semester exam	Final exam	Independent work
1	MAS30108E1-LP	Engineering Mathematics 1.1	5/125	30		30				1	2	62
2	PHS55708E1-LB	General Physics 1	4/100	15			15			1	2	67
3	ICT14508E2-LB	Fundamentals of Computer Architecture and Organization	5/125	15		30				1	2	77
4	ICT32808E2-LPB	Algorithmization Fundamentals and Programming Elements	6/150	15		15	30			1	2	87
5	ICT14608E2-LB	Introduction to Information Technologies	5/125	15			30			1	2	77
6	LEH14112E3-P	Foreign Language (English) – B2+1	5/125			45				1	1	78

No	Code	Name	Credits									
7	MAS30208E1-LP	Engineering Mathematics 2.1	5/125	30		30				1	2	62
8	PHS55808E1-LB	General Physics 2	4/100	15			15			1	2	67
9	ICT32908E2-LB	Operating Systems Fundamentals	5/125	15			30			1	2	77
10	ICT33008E2-LB	Object-oriented Programming – 1 (based on C++/C#)	5/125	15			30			1	2	77
11	LEH14212E3-P	Foreign Language (English) – B2+2	5/125		45					1	1	78
12	ICT25408E1-LP	Fundamentals of Database Systems	6/150	30	30					1	2	87
13	MAS30408E1-LP	Engineering Mathematics 3.1	5/125	30	30					1	2	62
14	ICT33108E2-LB	Object-oriented Programming – 2 (based on Java)	5/125	15			30			1	2	77
15	ICT25308E1-LB	Introduction to Computer Network	5/125	15			30			1	2	77
16	ICT25508E1-LB	Database Management System Oracle	5/125	15			30			1	2	77
17	MAS10308E2-LP	Fundamentals of probability theory	5/125	15	30					1	2	77
18	MAS10408E2-LS	Optimization Methods	5/125	15	30					1	2	77
19	ICT14708E2-LB	Basics of Web Technologies	6/150	30			30			1	2	87
20	ICT25708E1-LB	Introduction to Information Security	6/150	30			30			1	2	87
21	ICT25808E1-LB	Distributed Database Systems	6/150	30			30			1	2	87
22	MAS10508E2-LP	Discrete Mathematics	6/150	30	30					1	2	87
23	MAS24108E1-LB	Statistical Models and Simulation by SPSS	6/150	30			30			1	2	87
24	ICT25908E1-LB	Big Data Fundamentals	6/150	30			30			1	2	87
25	ICT25908E1-LB	Introduction to Machine Learning	6/150	30		15			15	1	2	87
26	ICT25908E1-LB	Data Warehousing Fundamentals	6/150	30	30					1	2	87
27	ICT33208E2-LB	Programig on Python	6/150	30			30			1	2	87
28	ICT15108E2-LP	Fundamentals of Artificial Intelligence	6/150	30	30					1	2	87
29	ICT26208E1-LP	Data Mining and Knowledge Discovery for Big Data	6/150	30	30					1	2	87
30	ICT26308E1-LP	Introduction to Grid Computing	6/150	30			15		15	1	2	87

#	Code	Name	Credit/Hours								
31	ICT26408E1-LP	Cloud computing	6/150	30		30			1	2	87
32	ICT26508E1-R	Teaching practice	6/150				60		1	2	87
33.1	ICT25608E1-LPB	Computer Network Organization	6/150	30		15	15		1	2	87
33.2	ICT26708E1-LS	Cognitive computing and Big Data Analytics	6/150	30		30			1	2	87
34	ICT26808E1-LB	Big Data Storage and Processing System Hadoop	6/150	30			30		1	2	87
35	MAS24208E1-LB	Introduction to Multi-method Modeling and Simulation	6/150	30			30		1	2	87
36.1	ICT26908E1-LB	Geographic Information Systems Fundamentals	6/150	30			30		1	2	87
36.2	ICT27008E1-LP	Knowledge Representation and Reasoning	6/150	30		30			1	2	87
36.3	ICT27108E1-LP	Business Intelligence for Decision Making	6/150	30		30			1	2	87
37	ICT27208E1-K	Final Project in Cloud computing and/or Big Data Processing	12/300					150	5	10	135
38	SOS24911E2-LSP	Bases of Policy	5/125	15	22	8			1	2	77
39	SOS44811E1-LS	Cultural Studies	5/125	15	30				2	2	76
40	HEL28812E1-LS	History and Culture of Georgia	5/125	15	30				1	1	78
41	ART11909E1-LS	Introduction to Ergonomics	5/125	15	30				1	1	78
42	HEL28712E1-LS	Introduction to Philosophy	5/125	15	30				2	2	76
43	BUA31308E2-LP	Job Analysis Methods	5/125	15		30			1	1	78
44	HEL30709E1-LS	Philosophy and the History of Ideas	5/125	30	15				1	1	78
45	BUA31408E2-LP	Principles of Contemporary Management	5/125	15		15			1	1	93
46	SOS10912E2-LS	Principles of Economics	5/125	15	30				1	1	78
47	HEL28912E1-LS	Sociology	5/125	15	30				1	1	78

Program Supervisor   Kartlos Kachiashvili

Faculty of Informatics and Management Systems
Head of Quality Assurance Service   Zurab Baiashvili

Dean of the Faculty   Zurab Tsveraidze

Agreed with
Quality Assurance Service of GTU   Irma Inashvili

Approved by
The Council of the Faculty of
Informatics and Control Systems 21.06.2019 (№4)
The Head of the Faculty Council   Zurab Tsveraidze

The Learning Outcomes [1]

Educational course	wide knowledge of the sphere of computer science and understanding the special questions	understanding complex questions of computer science	critical assessment, interpretation of the theories and principles	the use of methods that are characteristic of computer science and some special methods for solving problems arose; practical use of information technologies, modelling, algorithmization and basis of programing	to take part in designing, manufacturing, integrating and utilizing information and big data systems; independent exploitation, service and debugging of software of computer systems and computer nets	gathering, analysis and explanation of the data characterising the sphere of big data systems, analysing inaccurate data and/or situations by standard and some special methods and formation of grounded conclusions on their basis	investigation of information processes and organizational management, software, technical, organizational support and information security	public presentation of own thoughts with the appropriate knowledge and logic and their clear argumentation; preparation of a detailed written report concerning ideas, current problems and their solution ways, and transferring the information in English, creative use of modern information and communication technologies	assessing the sequence of own learning process and multilateralism; determination of the learning directions, taking into account an existing environment and priorities	participation in the formation of values and moral norms and striving to establish them
Engineering Mathematics 1					1	1		1	1	
General Physics 1					1		1	1	1	

[1] Indicate the appropriate numbers in the learning outcomes of the program: familiarization - 1; deepening - 2; Strengthening – 3.

										Project
Fundamentals of Computer Architecture and Organization	1		1		1		1		1	
Algorithmization Fundamentals and Programming Elements		1	1	1	1		1			
Introduction to Information Technologies	1				1	1	1		1	
Foreign Language (English) – B2 + 1								1	1	1
Engineering Mathematics 2	1			1		1			1	1
General Physics 2					1	1			1	
Operating Systems Fundamentals				1	1	1	1			
Object-oriented Programming – 1 (based on C++/C#)			1	1	1				1	
Foreign Language (English) – B2+ 2								2	1	
Fundamentals of Database Systems	1					1	1	1		
Engineering Mathematics 3.1				1		1		1	1	
Object-oriented Programming – 2 (based on Java)		2		2		2	2			
Introduction to Computer Network				1	1	1	1			
Database Management System Oracle	2				2	2			2	

[1] Indicate the appropriate numbers in the learning outcomes of the program: familiarization - 1; deepening - 2; Strengthening – 3.

										Project
Fundamentals of probability theory			1		1	1				
Optimization Methods		1		1		1				
Basics of Web Technologies				1	1	1	1		1	
Introduction to Information Security	1				1	1	1			1
Distributed Database Systems			2	2	2	2				1
Discrete Mathematics		1				1	1		1	
Statistical Models and Simulation by SPSS		2	2			2	2			
Big Data Fundamentals	2			2	2		2		2	
Introduction to Machine Learning		2		2	2		2			
Data Warehousing Fundamentals			2	2	2	2	2			
Programig on Python	2			2	2	2			2	
Fundamentals of Artificial Intelligence			2	2			2		2	
Data Mining and Knowledge Discovery for Big Data	3	3	3		3	3			3	
Introduction to Grid Computing	3			3				3	3	3
Cloud computing	3			3				3	3	3
Teaching practice	3	3	3	3	3	3	3	3	3	3

[1] Indicate the appropriate numbers in the learning outcomes of the program: familiarization - 1; deepening - 2; Strengthening – 3.

Computer Network Organization	3	3			3	3			3	3
Cognitive computing and Big Data Analytics	3	3				3	3		3	3
Big Data Storage and Processing System Hadoop	3	3		3		3	3		3	
Introduction to Multi-method Mode-ling and Simulati on	3	3	3	3					3	3
Geographic Information Systems (GIS) Fundamentals		3	3		3	3			3	
Knowledge Representation and Reasoning	3	3				3	3			3
Business Intelligence for Decision Making	3	3	3	3					3	3
Final Project in Cloud/or Grid computing and/or Big Data Processing	3	3	3	3	3	3	3	3	3	3
Bases of Policy	1								1	1
Cultural Studies									1	1
History and Culture of Georgia									1	1
Introduction to Ergonomics		1								1
Introduction to Philosophy									1	1

[1] Indicate the appropriate numbers in the learning outcomes of the program: familiarization - 1; deepening - 2; Strengthening – 3.

										Project
Job Analysis Methods	1						1	1		1
Philosophy and the History of Ideas									1	1
Principles of Contemporary Management	1		1	1						1
Principles of Economics	1						1	1		1
Sociology	1		1					1		1

[1] Indicate the appropriate numbers in the learning outcomes of the program: familiarization - 1; deepening - 2; Strengthening – 3.

Map of the program aims and learning outcomes [2]   Appendix 2

The program aims	wide knowledge of the sphere of computer science and understanding the special questions	understanding complex questions of computer science	critical assessment, interpretation of the theories and principles	the use of methods that are characteristic of computer science and some special methods for solving problems arose; practical use of information technologies, modelling, algorithmization and basis of programing	to take part in designing, manufacturing, integrating and utilizing information and big data systems; independent exploitation, service and debugging of software of computer systems and computer nets	gathering, analysis and explanation of the data characterising the sphere of big data systems, analysing inaccurate data and/or situations by standard and some special methods and formation of grounded conclusions on their basis	investigation of information processes and organizational management, software, technical, organizational support and information security	public presentation of own thoughts with the appropriate knowledge and logic and their clear argumentation; preparation of a detailed written report concerning ideas, current problems and their solution ways, and transferring the information in English, creative use of modern information and communication technologies	assessing the sequence of own learning process and multilateralism; determination of the learning directions, taking into account an existing environment and priorities	participation in the formation of values and moral norms and striving to establish them
To take part in projection, integration and introduction of	√	√	√	√		√	√	√	√	√

[2] Mark the learning outcomes of the program by symbol „√".

software of modern objects of computer science											
Systematical, methodological, information-technological and information-analytical knowledge on the modern level concerning the basic problems of big data systems	√	√	√		√	√	√		√		
The service of consumers of big data systems by exploitation, realization and regulation of existed means	√	√	√	√		√		√			√
To take part in providing of computer science objects, among them of the computer systems, with data basis, data processing, special software and computer nets	√	√	√	√	√		√	√	√		

[2] Mark the learning outcomes of the program by symbol „√".