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## EDUCATIONAL PROGRAM

Coordinated with the Quality Assurance Office

Minutes № 11, September 19, 2022

Vice-rector /Assoc. Prof. Dr. Nino Jojua/

Reviewed at the Faculty Board

Minutes №42, "26" September", 2022year

Dean of the Faculty / Professor Tea Kbiltsetskhlashvili /

Approved by the Academic Board

Minutes №31, "26" "September", 2022 year

Rector / Saffet Bayraktutan /

# Bachelor's Educational Program

# **Computer Science**
## (Georgian)
## Tbilisi
## 2022 year

# EDUCATIONAL PROGRAM

**Name of the Educational Programme:** Computer Science / კომპიუტერული მეცნიერება

**Faculty:** Business and Technology

**Programme Coordinator(s):** Affiliated Prof. Dr. Irakli Rodonaia, Phone: +995 599 243982, Email: irakli.rodonaia@ibsu.edu.ge;

**Programme Co-Coordinator(s):** Dr. Nikoloz Abzianidze, Phone: +995 599 98 49 48, Email: nabzianidze@ibsu.edu.ge

**Education Cycle and Level of the qualification:** Bachelor's (The first cycle of Higher Education, Level 6 of the NQF)

**Type of the Educational Programme:** Academic , Major

**Detailed Field and Code (ISCED – F – 2013):** Information and Communication Technologies 06, Computer Sciences 0613

**Awarded Qualification:** Bachelor of Computer Science/კომპიუტერული მეცნიერების ბაკალავრი

**Code of Qualification:** 0613.1.2.

**Language of Education:** Georgian.

**Credit Value of the Programme:** 240 ECTS

**Structure of the Programme:** The University uses the European Credit Transfer System (ECTS): 1 credit = 25 astronomic hours, that includes both contact and student independent work hours. The program full volume is 240 credits, which includes:

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- Academic writing – 5 ECTS
- Obligatory Computer Science Courses – 142 ECTS
- Elective Computer Science Courses – 50 ECTS
- Free (including extra specialty) Courses – 43 ECTS

**Programme Admission Precondition**: According to the Georgian law, passing Unified National Exams is required to be admitted to the educational program. Passing Unified National Exams in English language and as a third subject – mathematics or Physics is required. The applicant must pass one of the following foreign languages: English, German, French, RussianStudent of a bachelor program can become anyone with secondary education.

Admission to the educational program without passing Unified National exams may be allowed only in cases considered by the Georgian law. admission Preconditions for the foreigners can be found on the following link: (https://iro.ibsu.edu.ge/en/home).

**Purpose of the Programme:** Aims of the Bachelor Program in Computer Science are:

(1) To provide graduates with solid theoretical and practical knowledge in fundamental and modern subfields of computer science, such as mathematical foundations of computer science, algorithms and data structures, computer systems and networks and their security, databases, software engineering, computer architecture, methods of artificial intelligence and machine learning, etc.;

(2) To enable graduates to respond to the challenges related to modern technology, prepare internationally competitive specialists who will be able to work in the private or public sector;

(3) To enable graduates to pursue studies at the next level of academic education in computer science, computer engineering, information sciences, artificial intelligence, and information technology.

**Learning Outcome:** After completing the Bachelor Program of Computer Science, the graduate will have the following competencies necessary for his / her specialization.

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| Learning Outcome | |
|---|---|
| | 1. Demonstrates extensive knowledge of theoretical and practical issues in computer science, including the development of important aspects, principles and thesis's in the field; |
| | 2. Highlights the interdisciplinary nature of computer science, its practical importance for the analysis and modeling of theoretical tasks; |
| | 3. Defines the basic principles of software engineering and the importance of applying these principles in the implementation of the life cycle of computer programs; |
| | 4. Formulates the problem algorithmically using different programming paradigms and implements it in different programming languages; |
| | 5. Describes the fundamental principles of operation of database management systems, various data models, languages of requirements and principles of data management systems administration; |
| | 6. Describes computer architecture, principles of computer operation, physical characteristics of a computer, operating systems and their components, computer devices and their connections to operating systems; |
| | 7. Highlights the role of artificial intelligence in modern technologies and various fields of science; Conducts experiments using machine learning methods; |
| | 8. Analyzes complex problems and selects optimal methods for their solution; Performs mathematical modeling of problems, algorithmic problem solving, as well as software development, testing and modification; |
| | 9. Uses computer systems to solve various field tasks, prepares technical documentation and delivers presentations to field specialists and non-specialists; Prepares a research or practical paper in accordance with the instructions of the supervisor in computer science; Recognizes the potential ethical and social consequences of creating and using technology |
| | 10. Evaluates his / her knowledge in the field of computer science, determines the needs of further study and implements with a high degree of independence; Carries out activities in compliance with the principles of professional ethics |

**Program goals and learning outcomes map:**

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| Program goals | learning outcome 1 | learning outcome 2 | learning outcome 3 | learning outcome 4 | learning outcome 5 | learning outcome 6 | learning outcome 7 | learning outcome 8 | learning outcome 9 | learning outcome 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | |
| 2 | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | |
| 3 | | | | | | | | | | ✔ |

**Learning Outcome Map:**

| Course / Module / Internship / Research Component | Criteria of Competencies | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Knowledge and Understanding | | | | | | | Skills | | Responsibility and autonomy |
| | LO 1 | LO2 | LO3 | LO4 | LO5 | LO6 | LO7 | LO 8 | LO 9 | LO 10 |
| Calculus 1 | 1 | 1 | | | | | | 1 | | |
| Linear Algebra | 1 | 2 | | | | | | 1 | | |
| Principles of Programing | 1 | 1 | 1 | 3 | 1 | 1 | | 2 | | |
| Aspects of Computer Science and Technology | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Physics | 1 | 1 | | | | | | 2 | | |

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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Calculus 2 | 1 | 2 | | | | | | 2 | |
| Databases | 1 | | | 1 | 3 | 1 | | 2 | |
| Object Oriented Programming | 1 | | 2 | 3 | 1 | 1 | | 2 | 1 |
| Computer Architecture | 1 | | 1 | 1 | | 3 | | | 1 |
| Algorithms and Data Structures 1 | 1 | 1 | 1 | 3 | 1 | | | 1 | |
| Software Development | 2 | 1 | 2 | 2 | 2 | 1 | | 1 | 1 |
| Discrete Mathematics | 2 | 3 | | 2 | | | | 2 | |
| Professional English | | | | | | | | | 2 |
| Operating Systems | 1 | | | | | 2 | | | 1 |
| Algorithms and Data Structures 2 | 2 | 2 | 1 | 3 | 1 | | | 2 | |
| Academic Writing | | | | | | | | | 2 |
| Theoretical Foundations of Computer Science | 2 | 3 | | 2 | | | | 2 | |
| Probability and Statistics | 1 | 2 | | | | | 2 | 2 | |
| Computer Networks | 2 | | | | | 3 | | 2 | |
| Software Engineering | 1 | 1 | 3 | 1 | 1 | 2 | | 1 | |
| Artificial Intelligence | 3 | 2 | | 2 | | | 3 | 2 | |
| Computer Systems Security | 1 | | | | | 3 | | 2 | |

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| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Machine Learning | 3 | 2 | | 2 | | | 3 | 2 | | |
| Programming Paradigms | 2 | 1 | | 2 | 1 | | | 2 | | |
| Internship | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 |
| Methods and instructions for preparing papers | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 |
| Bachelor's Thesis | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

**Methods of Attainment of Learning Outcomes**: Study components considered by the program are carried out using following teaching and learning methods:

**Lecture** – Lectures involve discussion of major theoretical material, concepts, terms, etc. through ensuring students' active involvement. It is basically oriented on thorough teaching scientific theories and approaches of study material. During lectures, subject related issues are deeply explained, students are actively involved in the discussions and clear perception and comprehension of topics using brain-storming and other interactive methods.

**Group work** – Group work develops the knowledge and skills of planning and fulfillment of specific tasks under cooperative environment. Group work includes discussion of case studies, quizzes, practical assignments, different examples, through which students obtain skills of problem resolution in teams that in turn ensures development of team working skills and the possession of competencies of considering and accepting others opinion.

**Practice / lab work** – In order to ensure deep understanding and perception of the issues, practice/lab work concentrates on accurate discussion of relevant examples, cases, video materials, exercises and the ways of their resolution, which ensures the formation of students' ability to use the obtained theoretical knowledge in practice and develop analytic and creative thinking.

**Seminar** – The aim of seminars is to create the context for students which enables them to get the details, and better understand and realize the issues and topics discussed during lectures. Seminar is the means of knowledge transfer, involves discussion and drawing conclusions, and

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it is coordinated by a lecturer with certain specific objectives. Seminars are conducted in accordance to specific aims and are in line with the material covered throughout lecturers.

**Individual work** – Through individual work students deepen and internalize the knowledge obtained throughout the lecturers. Individual work involves searching for the materials through course-books or other sources of information, realizing and learning the obtained information; it also involves completing home-tasks. All these activities deepen the interest in certain issues, the wish to study these issues individually, they help students develop the ability of thinking individually, analyze the obtained information and draw conclusions.

The learning and teaching methods are implemented using the following activities:

**Presentation (by lecturer)** – The method consists of narration and speaking through which the information is provided by a teacher to a learner. Through this process teacher transfers knowledge verbally, explains the material and students obtain this knowledge through listening, memorizing and comprehension. It is important to make sure that understanding occurs and information is perceived correctly. In case of necessity additional instruction should be provided. A teacher is giving specific examples and provides detailed explanation.

**Demonstration** - It demonstrates information visually. It's sufficiently effective when reaching the result because it takes into consideration the interests of different students. Learning material can be demonstrated by lecturer or student. This method helps different steps of learning process to be seen visually and concretize, what should student do independently. At the same time, this strategy visually demonstrates the main point of the subject/problem.

**Induction** – modern, one of the most effective student-oriented methods. Major objective of this method is to collect much data and by generalizing the observed perspectives discover general principles through which it is possible to discuss the facts, cases and events and explain them. Learning is oriented at relying on facts and developing rules through generalizing these facts, thus, moving from specific facts to general rules.

**Deduction** – a traditional method of teaching and learning which sees a teacher as a major source of information and students learn general theories through a teacher's supervision. Deductive method of learning determines that kind of any subject knowledge, which presents the process when depending on general knowledge we discover new knowledge, so the process goes from general to concrete.

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**Analysis** – In the modern world majority of disciplines have become complex; accordingly, courses in these fields require complex approaches. The method of analysis helps us to dismantle multi-disciplinary and inter-disciplinary courses into parts which allows dividing an issue under the study into separate aspects. This helps to discuss separate issues in details.

**Synthesis** - Method of synthesis means back-procedure, using some parts and making the whole with them. This method helps to see the whole problem.

**Case Study** – active problem-situation analysis method, which presupposes discussing real cases and discussing them which allows students to look at the issues from different perspectives, analyze possible solutions of the problem and choose and justify specific strategies, objectives and expected outcomes. A case presents a context and it is an instrument by itself which allows a student to use specific knowledge obtained through the course and put it into practice in the context which is close to real-life situation.

**Brain Storming** - collecting as many/various ideas about the topic/issue as possible. The method enhances development of creative approach towards the problem. It supports the development of creative approaches when students try to see an issue from different perspectives. This approach ensures that every person is involved in the learning process. It is efficient for a large group and is used in stages.

**Discussion / Debates** – one of the most broadly spread interactive methods; discussion raises the level of student involvement; while discussion different opinions are confronted and the discussion is not limited to the questions asked by a teacher. Overall aim is to synthesis different views. This method develops students' ability of reflection and argumentation.

**Simulation, Role Plays and Situational Games** – belong to game-type of methods which consist of simulation (role-play) games, didactic or educational games, situational games, game-like approaches and procedures. Games developed through pre-developed scenarios enable students to look at important issues from different perspectives. They help students to form alternative viewpoints. Like discussion, these games develop students' ability to express their own opinion independently and defend their attitudes in a dispute.

**Project** – This approach is a unity of perceptive methods, which makes it possible to solve a problem through students' independent work and presenting the achieved solutions. This approach raises students' motivation and responsibility; working on the project involves planning, research, practical activities and presenting the results; the projects are complete if the outcomes are presented in a convincible manner through exemplifying specific results; a project could be done individually, in peer or group work; upon completion, the project is presented to a broader audience.

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**Presentation (by student/students)** – Taking into consideration the development of technology presentation is one of the most interactive and effective ways of teaching. It is a combination of teaching and learning methods which allows a student to solve a problem through independent work and presenting the outcomes. This method raises students' motivation to work independently; it also develops specific skills – planning, researching, and presenting data in an effective manner; it develops skills to work in groups or individually.

**Teaching though Electronic Sources** – The method implies teaching through internet and the means of multimedia. It consists of all the components of teaching process that are realized through specific means of internet and multimedia.

**Task Solving** – Gradual mastering of theoretical material through solution of specific tasks that ensures development of skills of using theoretical knowledge independently. While solving the tasks the lecturer pays attention to the methods of task solution and to the relevant use of the various schemes or chart drawing techniques or to the techniques of task solution;

**Problem Solving** – The method of teaching that enables employment of newly obtained knowledge by students through study, analysis and solution of specific problem. While employing this method it is important to assess and analyze the results received through the solution of a specific problem. By using this method the skills and the ability of a student to use obtained knowledge in practice is developed.

**Group Work** – Teaching method through which students are divided into the groups and the assignments are given to each of the groups. Group members process the information individually and share their ideas to other group members at the same time. Group members may be assigned different functions depending on the objective defined by the task. This method ensures active involvement of each student in the process of teaching.

**Individual Work** – The method when a student individually performs the tasks and the assignments determined through the academic process.

**Working with a Course-Book** – Actively used method in a process of learning through which a student process given material by using given literature and other sources.

**Doing Homework** – Independent work when students do the home assignments determined through the academic process. Doing home assignments implies reading, processing and studying material determined through the study course as well as doing given assignments in written form or presenting them orally.

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**Student Knowledge Evaluation System**: The goal of evaluation is to determine student's education results qualitatively in relation to academic program goals and parameters.

Student may be assessed orally and/or in a written way. A student's knowledge and skills are assessed through 100 points grading system. It consists of

midterm and final evaluations, sum of which makes up 100 points.

Grading system allows:

a) Five types of positive grades

   1) (A) Excellent – 91 – 100 point;

   2) (B) Very good – 81-90 point;

   3) (C) Good – 71-80 point;

   4) (D) Satisfactory – 61-70 point;

   5) (E) Acceptable – 51-60 point.

b) Two types of negative grades

   1) (FX) Fail – 41-50 point, meaning that a student requires some more work before passing and is given a chance to sit an additional

    examination after independent work;

   2) (F) Fail – 40 point and less, meaning that the work of a student is not acceptable and he/she has to study the subject anew.

For the midterm and final evaluations minimal passing grade is set. The final evaluation minimal passing grade must not exceed 30% of final evaluation grade.

Midterm and final evaluation grade distribution, their minimal competence levels and assessment criteria are described in the corresponding syllabus. A credit can be awarded only after the attainment of learning outcomes, envisaged by the course syllabus and following requirements:

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a) Obtaining minimal competence levels set for midterm and final evaluations;

b) Obtaining minimum 51 points out of 100 points of final grade.

A student is allowed to take an additional (make-up) exam in case he/she scored 41-50 points of final 100 grade or minimum 51 points, but did not obtain minimal competence level set for final evaluation.

Considering its specification, the format and the assessment criteria of mid-term and final evaluations can be determined in the specific module/course syllabus.

**Specificities of the Organization of the Teaching Process:**

The 240 credits provided by the educational program are distributed over four academic years, for eight semesters. The number of credits in each semester can be more than 30 or less than 30, but the student's annual study load should not exceed 75 (ECTS) credits. The credit transfer is based on the European Credit Transfer System (ECTS): 1 credit = 25 hours, which covers both contact and student independent working hours. In the seventh semester students are obligated to do internship and seminar courses, which includes 7 and 4 credits respectively. One of the main aims of the seminar course is to prepare students to write the bachelors thesis. In the last semester, students are obliged to take Bachelor Thesis to which 10 credits are allocated.

In the scope of the program, students have the possibility to collect 43 credits (free credits) out of 240 credits by choosing within the university any minor program (30 credits program) or by taking courses from other programs of the university.


In case, a student does not prove B2 level of English proficiency, he/she is obligated to use free credits to reach English B2 level. A student is exempted from choosing English if he/she provides an English certificate of B2 level or successfully passes the English language B2 level exam at the IBSU language school. If a student starts learning English from A1 level, he/she must choose an intensive A1- A2 English language course.


**Field of Employment:** The undergraduate program in Computer Science will prepare internationally competitive specialists. The knowledge and skills acquired by the graduates will enable them to respond to modern technology related challenges. Graduates will be able to be employed both the private and public sectors, where they perform professional functions both independently and in teams. In particular, they will be able to work as a software developers, software engineers, data analysts, information technology specialists, network administrators, etc. Graduates

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can also continue their studies at the next level of academic education in the direction of computer science, computer engineering, information science, artificial intelligence and information technologies.

**Information Concerning Material Resources Necessary for the Implementation of the programme:**

Information Concerning Material Resources Necessary for the Implementation of the programme: International Black Sea University is fully equipped with all the necessary material resources aimed to fulfil the educational program successfully:

- Classrooms equipped with different educational facilities;
- Computer laboratories with full internet access;
- University library equipped with modern technologies, internet, and rich paper and electronic books;
- Corresponding resources to the course relevant topics available through the electronic database of the university (through Smart portal);
- Other material resources owned by the university.
- Compulsory literature indicated in syllabuses is available in the university's library. IBSU is a registered member of the following e-libraries. IBSU is officially involved in the ELSEVIER international scientific system. IBSU staff and students are able to have an access to the Elsevier databases such as Scopus; Science Direct; Scival Funding (Funding Institutional)

  https://www.ebsco.com/
  https://www.elsevier
  http://polpred.com/
  www.journals.cambridge.org
  https://home.heinonline.org/
  www.opendoar.org
  www.roar.eprints.org
  www.doaj.org
  www.beallslist.weebly.com
  www.gutenberg.org
  www.memory.loc.gov

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www.wdl.org
www.obiblio.sourceforge.net

- In addition, the university has all the means for extracurricular activities for students (sports, creativity, social activities);

**Information Concerning Human Resources Necessary for the Implementation of the programme:**

| № | Name, Last name | Academic degree | Position |
|---|---|---|---|
| 1. | Besik Dundua | Doctor of Computer Science | Affiliated Professor |
| 2. | Irakli Rodonaia | PhD (Doctor of Philosophy) in Technology, Candidate of Technical Sciences | Affiliated Professor |
| 3. | Giorgi  Ghlonti | Candidate of Technical Sciences (Equivalent to PhD) | Affiliated Associate Professor |
| 4. | Mikheil Rukhaia | Dr.Techn area of concentration Computer Science (Equivalent to PhD) | Associate Professor |
| 5. | Diana Mchedlishvili | Candidate of physics and mathematics Sciences (Equivalent to PhD) | Affiliated Associate Professor |
| 6. | Vakhtang Rodonaia | PhD degree in Engineering of Informatics (Equivalent to PhD) | Affiliated Associate Professor |
| 7. | Khatuna Chargazia | Candidate of physics and mathematics Sciences (Equivalent to PhD) | Affiliated Associate Professor |
| 8. | Giorgi  Mandaria | Candidate of Pedagogical Sciences (Equivalent of Doctor) | Affiliated Associate Professor |

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|---|---|---|---|
| 9. | Davit Datuashvili | Doctor of Engineering in Informatics (Equivalent to PhD) | Affiliated Assistant Professor |
| 10. | Artiom Merabiani | Doctor of Engineering in Informatics (Equivalent to PhD) | Affiliated Assistant Professor |
| 11. | Mariam Dedabrishvili | Doctor of Engineering in Informatics (Equivalent to PhD) | Affiliated Assistant Professor |
| 12. | Maia Chkotua | PhD Degree in Education | Affiliated Associate Professor |
| 13 | Tea Todua | Candidate of Technical Sciences (Equivalent to PhD) | Invited Lecturer |
| 14. | Mzia Kiknadze | Candidate of Technical Sciences (Equivalent to PhD) | Invited Lecturer |
| 15. | Gela Pataraia | Master of Engineering in Computer Sciences | Invited Lecturer |
| 16. | Anri Morchiladze | Master of Engineering in Computer Sciences | Invited Lecturer |
| 17. | Nino Demetrashvili | Doctor of philosophy in Biostatistics | Invited Lecturer |
| 18. | Gvantsa Grigolia | Master of Science in Engineering | Invited Lecturer |
| 19. | Davit Razmadze | PhD Degree in Engineering of Informatics | Invited Lecturer |

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## Study Plan

| # | Course / Module / Internship / Research Component | Status | Credit number | Distribution of credits per courses and semesters | | | | | | | | Distribution of hours | | | | | | | Number of contact hours per week |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | I s.y. | | II s.y. | | III s.y. | | IV s.y. | | Contact hours | | | | | | | |
| | | | | I Semester | II Semester | III Semester | IV Semester | V Semester | VI Semester | VII Semester | VIII Semester | Lecture / Consultation | Seminar / Group Work / Laboratory Work / Practical work | Midterm exam(s) | Final exam | Total number of contact hours | Independent work | Total number of hours | |
| 2 | Calculus 1 | Obligatory | 6 | 6 | | | | | | | | 15 | 28 | 2 | 2 | 47 | 103 | 150 | 3 |

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| 3 | Linear Algebra | Obligatory | 5 | 5 | | | | | | | | 31 | 12 | 2 | 2 | 47 | 78 | 125 | 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | Principles of Programing | Obligatory | 5 | 5 | | | | | | | | 28 | 15 | 2 | 2 | 47 | 78 | 125 | 3 |
| 5 | Aspects of Computer Science and Technology | Obligatory | 5 | 5 | | | | | | | | 30 | 13 | 2 | 2 | 47 | 78 | 125 | 3 |
| 6 | Physics | Obligatory | 5 | | 5 | | | | | | | 14 | 29 | 2 | 2 | 47 | 78 | 125 | 3 |
| 7 | Calculus 2 | Obligatory | 6 | | 6 | | | | | | | 15 | 28 | 2 | 2 | 47 | 103 | 150 | 3 |
| 8 | Databases | Obligatory | 5 | | 5 | | | | | | | 26 | 17 | 2 | 2 | 47 | 78 | 125 | 3 |
| 9 | Object Oriented Programming | Obligatory | 5 | | 5 | | | | | | | 28 | 15 | 2 | 2 | 47 | 78 | 125 | 3 |
| 10 | Computer Architecture | Obligatory | 5 | | | 5 | | | | | | 43 | – | 2 | 2 | 47 | 78 | 125 | 3 |
| 11 | Algorithms and Data Structures 1 | Obligatory | 6 | | | 6 | | | | | | 29 | 14 | 2 | 2 | 47 | 103 | 150 | 3 |
| 12 | Software Development | Obligatory | 5 | | | 5 | | | | | | 28 | 15 | 2 | 2 | 47 | 78 | 125 | 3 |
| 13 | Discrete Mathematics | Obligatory | 6 | | | | 6 | | | | | 29 | 14 | 2 | 2 | 47 | 103 | 150 | 3 |
| 14 | Professional English | Obligatory | 4 | | | | 4 | | | | | 31 | 12 | 2 | 2 | 47 | 53 | 100 | 3 |
| 15 | Operating Systems | Obligatory | 5 | | | | 5 | | | | | 14 | 29 | 2 | 2 | 47 | 78 | 125 | 3 |
| 16 | Algorithms and Data Structures 2 | Obligatory | 6 | | | | 6 | | | | | 28 | 15 | 2 | 2 | 47 | 103 | 150 | 3 |
| 17 | Academic Writing | Obligatory | 5 | | | | | 5 | | | | 15 | 28 | 2 | 2 | 47 | 78 | 125 | 3 |
| 18 | Theoretical Foundations of Computer Science | Obligatory | 6 | | | | | 6 | | | | 29 | 14 | 2 | 2 | 47 | 103 | 150 | 3 |

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| No | Subject | Type | Credit | S1 | S2 | S3 | S4 | S5 | S6 | S7 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19 | Probability and Statistics | Obligatory | 6 | | | | 6 | | | | 29 | 14 | 2 | 2 | 47 | 103 | 150 | 3 |
| 20 | Computer Networks | Obligatory | 4 | | | | 4 | | | | 31 | 12 | 2 | 2 | 47 | 53 | 100 | 3 |
| 21 | Software Engineering | Obligatory | 5 | | | | | 5 | | | 30 | 13 | 2 | 2 | 47 | 78 | 125 | 3 |
| 22 | Artificial Intelligence | Obligatory | 5 | | | | | 5 | | | 28 | 15 | 2 | 2 | 47 | 78 | 125 | 3 |
| 23 | Computer Systems Security | Obligatory | 5 | | | | | 5 | | | 28 | 15 | 2 | 2 | 47 | 78 | 125 | 3 |
| 24 | Machine Learning | Obligatory | 6 | | | | | | 6 | | 29 | 14 | 2 | 2 | 47 | 103 | 150 | 3 |
| 25 | Programming Paradigms | Obligatory | 5 | | | | | | 5 | | 29 | 14 | 2 | 2 | 47 | 78 | 125 | 3 |
| 26 | Internship | Obligatory | 7 | | | | | | 7 | | – | 139 | 2 | 2 | 143 | 32 | 175 | – |
| 27 | Methods and instructions for preparing papers | Obligatory | 4 | | | | | | 4 | | 14 | – | 1 | – | 15 | 85 | 100 | 1 |
| 28 | Bachelor's Thesis | Obligatory | 10 | | | | | | | 10 | – | 28 | 1 | 1 | 30 | 220 | 250 | – |
| 29 | Computer Skills | Elective | 4 | 4 | | | | | | | 28 | 15 | 2 | 2 | 47 | 53 | 100 | 3 |
| 30 | Web Programming I | Elective | 4 | 4 | | | | | | | 28 | 15 | 2 | 2 | 47 | 53 | 100 | 3 |
| 31 | Web Programming II | Elective | 4 | | 4 | | | | | | 28 | 15 | 2 | 2 | 47 | 53 | 100 | 3 |
| 32 | Information Technology Project Management | Elective | 4 | | 4 | | | | | | 14 | 29 | 2 | 2 | 47 | 53 | 100 | 3 |
| 33 | Geographic Information Systems | Elective | 4 | | 4 | | | | | | 15 | 28 | 2 | 2 | 47 | 53 | 100 | 3 |
| 34 | Front End Development using Angular | Elective | 4 | | | 4 | | | | | 28 | 15 | 2 | 2 | 47 | 53 | 100 | 3 |

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| # | Course | Type | Cr | | S1 | S2 | S3 | S4 | | | | | | | | | |
|---|--------|------|----|---|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 35 | 3D Graphics in Blender 1 | Elective | 4 | | 4 | | | | 28 | 15 | 2 | 2 | 47 | 53 | 100 | 3 |
| 36 | Administration of databases | Elective | 4 | | 4 | | | | 14 | 29 | 2 | 2 | 47 | 53 | 100 | 3 |
| 37 | Backend programming | Elective | 4 | | | 4 | | | 28 | 15 | 2 | 2 | 47 | 53 | 100 | 3 |
| 38 | Designing and building mobile applications | Elective | 4 | | | 4 | | | 28 | 15 | 2 | 2 | 47 | 53 | 100 | 3 |
| 39 | 3D Graphics in Blender 2 | Elective | 4 | | | 4 | | | 28 | 15 | 2 | 2 | 47 | 53 | 100 | 3 |
| 40 | Computer game programming | Elective | 4 | | | | 4 | | 28 | 15 | 2 | 2 | 47 | 53 | 100 | 3 |
| 41 | Web Applications Programming | Elective | 4 | | | | 4 | | 28 | 15 | 2 | 2 | 47 | 53 | 100 | 3 |
| 42 | Applied Cryptography | Elective | 4 | | | | 4 | | 14 | 30 | 1 | 2 | 47 | 53 | 100 | 3 |
| 43 | Differential equations | Elective | 5 | | | | 5 | | 15 | 28 | 2 | 2 | 47 | 78 | 125 | 3 |
| 44 | Virtualization technology | Elective | 5 | | | | | 5 | 28 | 15 | 2 | 2 | 47 | 78 | 125 | 3 |
| 45 | Statistical Methods in Bioinformatics | Elective | 5 | | | | | 5 | 28 | 15 | 2 | 2 | 47 | 78 | 125 | 3 |
| 46 | Programming on Python | Elective | 5 | | | | | 5 | 29 | 14 | 2 | 2 | 47 | 78 | 125 | 3 |
| 47 | Natural language processing | Elective | 5 | | | | | | 5 | 28 | 15 | 2 | 2 | 47 | 78 | 125 | 3 |
| 48 | Basics of Neural Networks | Elective | 5 | | | | | | 5 | 15 | 28 | 2 | 2 | 47 | 78 | 125 | 3 |
| 49 | Essentials of Ethical Hacking and Network Security | Elective | 5 | | | | | | 5 | 14 | 29 | 2 | 2 | 47 | 78 | 125 | 3 |

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| # | Subject | Type | Tot | S1 | S2 | S3 | S4 | S5 | S6 | S7 | S8 | | | | | | | | |
|---|---------|------|-----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 50 | Programming on Matlab | Elective | 5 | | | | | | | | 5 | 29 | 14 | 2 | 2 | 47 | 78 | 125 | 3 |
| 51 | Wireless Communication | Elective | 5 | | | | | | | | 5 | 28 | 15 | 2 | 2 | 47 | 78 | 125 | 3 |
| 52 | Cloud computing | Elective | 5 | | | | | | | | 5 | 32 | 11 | 2 | 2 | 47 | 78 | 125 | 3 |
| 53 | Arduino Programming | Elective | 5 | | | | | | | | 5 | 10 | 34 | 1 | 2 | 47 | 78 | 125 | 3 |
| 54 | Computer vision | Elective | 5 | | | | | | | | 5 | 29 | 14 | 2 | 2 | 47 | 78 | 125 | 3 |
| | Free Curses<br><br>Foreign Language<br><br>(English, Russian, German, French,<br>Spanish, Turkish) | Elective | 43<br><br><br><br>(15) | 5<br><br><br><br>5 | 5<br><br><br><br>5 | 6<br><br><br><br>5 | 5 | 4 | 5 | 3 | 10 | – | – – | – | – | – | – | 1075 | – |
| **Total number** | | | **240** | **30** | **30** | **30** | **30** | **30** | **30** | **30** | **30** | **919** | **768** | **73** | **73** | **1833** | **3092** | **6000** | **106** |

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# EDUCATIONAL PROGRAM

## Table of Requirements

| # | Course title | ECTS | Prerequisite | Semester course |
|---|---|---|---|---|
| 1 | Foreign Language | 15 | Previous level of language | 1,2,3 |
| 2 | Calculus 1 | 6 | N/A | 1 |
| 3 | Linear Algebra | 5 | N/A | 1 |
| 4 | Principles of Programing | 5 | N/A | 1 |
| 5 | Aspects of Computer Science and Technology | 5 | N/A | 1 |
| 29 | Computer Skills | 4 | N/A | 1 |
| 30 | Web Programming I | 4 | N/A | 1 |
| 6 | Physics | 5 | N/A | 2 |
| 7 | Calculus 2 | 6 | Calculus 1 | 2 |
| 8 | Databases | 5 | N/A | 2 |
| 9 | Object Oriented Programming | 5 | Principles if Programing | 2 |
| 31 | Web Programming I I | 4 | Web Programming I | 2 |
| 32 | Information Technology Project Management | 4 | Computer Skills | 2 |
| 33 | Geographic Information Systems | 4 | N/A | 2 |
| 10 | Computer Architecture | 5 | N/A | 3 |
| 11 | Algorithms and Data Structures 1 | 6 | Object Oriented Programming, | 3 |
| 12 | Software Development | 5 | Object Oriented Programming, | 3 |
| 34 | Front End Development using Angular | 4 | Web Programming I I | 3 |
| 35 | 3D Graphics in Blender 1 | 4 | N/A | 3 |
| 36 | Administration of databases | 4 | Databases | 3 |

# EDUCATIONAL PROGRAM

| | | | | |
|---|---|---|---|---|
| 13 | Discrete Mathematics | 6 | N/A | 4 |
| 14 | Professional English | 4 | English B2 | 4 |
| 15 | Operating Systems | 5 | Computer Architecture | 4 |
| 16 | Algorithms and Data Structures 2 | 6 | Algorithms and Data Structures 1 | 4 |
| 37 | Backend programming | 4 | Web Programming I I | 4 |
| 38 | Mobile App Development | 4 | Software Development, Professional English | 4 |
| 39 | 3D Graphics in Blender 2 | 4 | 3D Graphics in Blender 1 | 4 |
| 17 | Academic Writing | 5 | Professional English | 5 |
| 18 | Theoretical Foundations of Computer Science | 6 | Discrete Mathematics, Professional English | 5 |
| 19 | Probability and Statistics | 6 | Calculus 2, Calculus 1, Professional English | 5 |
| 20 | Computer Networks | 4 | Computer Architecture, Professional English | 5 |
| 40 | Game Development | 4 | Computer Graphics I I, Professional English | 5 |
| 41 | Web Applications Development | 4 | Software Development, Web Programming II, Professional English | 5 |
| 42 | Applied Cryptography | 4 | Calculus 2, Discrete Mathematics, Professional English | 5 |
| 43 | Differential equations | 5 | Calculus 2, Professional English | 6 |
| 21 | Software Engineering | 5 | Principles of Programing, Professional English | 6 |
| 22 | Artificial Intelligence | 5 | Theoretical Foundations of Computer Science, Professional English | 6 |
| 23 | Computer Systems Security | 5 | Computer Networks, Professional English | 6 |
| 44 | Virtualization technology | 5 | Computer Networks, Professional English | 6 |

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| 45 | Statistical Methods in Bioinformatics | 5 | Probability and Statistics, Professional English | 6 |
|----|----|----|----|----|
| 46 | Programming on Python | 5 | Principles of Programing, Professional English | 6 |
| 24 | Machine Learning | 6 | Probability and Statistics, Artificial Intelligence, Principles of Programing, Linear Algebra, Professional English | 7 |
| 25 | Programming Paradigms | 5 | Object Oriented Programming, Professional English | 7 |
| 26 | Internship | 7 | Must be completed all Compulsory Courses | 7 |
| 27 | Methods and instructions for preparing papers | 4 | Academic Writing, Professional English | 7 |
| 47 | Natural language processing | 5 | Artificial Intelligence, Professional English | 7 |
| | Introduction of Neural Networks | 5 | Artificial Intelligence, Principles of Programing, Professional English | 7 |
| 49 | Essentials of Ethical Hacking and Network Security | 5 | Computer Systems Security, Professional English | 7 |
| 28 | Bachelor's Thesis | 10 | Must be completed all Compulsory Courses | 8 |
| 50 | Programming on MATLAB | 5 | Probability and Statistics, Professional English | 8 |
| 51 | Wireless Communication | 5 | Computer Networks, Professional English | 8 |
| 52 | Cloud computing | 5 | Computer Systems Security, Professional English | 8 |
| 53 | Arduino Programming | 5 | Physics, Principles of Programing, Professional English | 8 |

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| 54 | Computer vision | 5 | Machine Learning, Programming on Python, Professional English | 8 |

**\* – List all those courses which are necessary for a student to pass in order to take a particular course/block/module**

## Additional Table of Study Plan

| № | Course / Module / Internship / Research Component | Code | Semester | Prerequisites | Lecturer |
|---|---|---|---|---|---|
| 2 | Calculus 1 | CS102 | 1 | N/A | Diana Mchedlishvili |
| 3 | Linear Algebra | CS110 | 1 | N/A | Diana Mchedlishvili |
| 4 | Principles of Programing | CS104 | 1 | N/A | Giorgi  Ghlonti |
| 5 | Aspects of Computer Science and Technology | CS105 | 1 | N/A | Giorgi  Ghlonti |
| 6 | Physics | CS106 | 2 | N/A | Khatuna Chargazia |
| 7 | Calculus 2 | CS107 | 2 | Calculus 1 | Diana Mchedlishvili |
| 8 | Databases | CS108 | 2 | N/A | Vakhtang Rodonaia |
| 9 | Object Oriented Programming | CS109 | 2 | Principles of Programing | Anri Morchiladze |
| 10 | Computer Architecture | CS103 | 3 | N/A | Irakli Rodonaia |
| 11 | Algorithms and Data Structures 1 | CS111 | 3 | Object Oriented Programming. Principles of Programing | Giorgi  Mandaria |
| 12 | Software Development | CS112 | 3 | Object Oriented Programming. | Anri Morchiladze |
| 13 | Discrete Mathematics | CS113 | 4 | N/A | Davit Datuashvili |

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| 14 | Professional English | CS114 | 4 | English B2 | Gela Pataraia |
|----|----|----|----|----|----|
| 15 | Operating Systems | CS115 | 4 | Computer Architecture | Mzia Kiknadze |
| 16 | Algorithms and Data Structures 2 | CS116 | 4 | Algorithms and Data Structures 1 | Giorgi  Mandaria |
| 17 | Academic Writing | BUS119 | 5 | Professional English | Maia Chkotua |
| 18 | Theoretical Foundations of Computer Science | CS118 | 5 | Discrete Mathematics, Professional English | Besik Dundua |
| 19 | Probability and Statistics | CS119 | 5 | Calculus 2, Professional English | Davit Datuashvili |
| 20 | Computer Networks | CS120 | 5 | Computer Architecture, Professional English | Vakhtang Rodonaia |
| 21 | Software Engineering | CS121 | 6 | Principles of Programing, Professional English | Giorgi  Ghlonti |
| 22 | Artificial Intelligence | CS122 | 6 | Theoretical Foundations of Computer Science, Professional English | Mikheil Rukhaia |
| 23 | Computer Systems Security | CS123 | 6 | Computer Networks, Professional English | Vakhtang Rodonaia |
| 24 | Machine Learning | CS124 | 7 | Probability and Statistics; Artificial Intelligence, Principles of Programing, Linear Algebra, Professional English | Davit Datuashvili |
| 25 | Programming Paradigms | CS125 | 7 | Object Oriented Programming, Professional English | Besik Dundua |
| 26 | Internship | CS126 | 7 | Must be completed all Compulsory Courses | Besik Dundua |
| 27 | Methods and instructions for preparing papers | CS127 | 7 | Academic Writing, Professional English | All academic staff |
| 28 | Bachelor's Thesis | CS128 | 8 | Must be completed all Compulsory Courses | All academic staff |
| 29 | Computer Skills | CS129 | 1 | N/A | Gela Pataraia |
| 30 | Web Programming I | CS130 | 1 | N/A | Mikheil Rukhaia |

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| 31 | Web Programming II | CS131 | 2 | Web Programming I | Mikheil Rukhaia |
|----|----|----|----|----|----|
| 32 | Information Technology Project Management | CS132 | 2 | Computer Skills | Tea Todua |
| 33 | Geographic Information Systems | CS133 | 2 | N/A | Giorgi Ghlonti |
| 34 | Front End Development using Angular | CS134 | 3 | Web Programming II | Anri Morchiladze |
| 35 | 3D Graphics in Blender 1 | CS135 | 3 | N/A | Gela Pataraia |
| 36 | Administration of databases | CS136 | 3 | Databases | Mikheil Rukhaia |
| 37 | Backend programming | CS137 | 4 | Web Programming II | Anri Morchiladze |
| 38 | Designing and building mobile applications | CS138 | 4 | Object Oriented Programming, Professional English | Artiom Merabiani |
| 39 | 3D Graphics in Blender 2 | CS139 | 4 | 3D Graphics in Blender 1 | Gela Pataraia |
| 40 | Computer game programming | CS140 | 5 | Computer Graphics II, Professional English | Artiom Merabiani |
| 41 | Web Applications Programming | CS141 | 5 | Web Programming II, Software Engineering, Professional English | Mikhail Rukhaia |
| 42 | Applied Cryptography | CS142 | 8 | Calculus 2, Discrete Mathematics, Professional English | Gvantsa Griogolia |
| 43 | Differential equations | CS143 | 6 | Calculus 2, Professional English | Diana Mchedlishvili |
| 44 | Virtualization technology | CS144 | 5 | Computer Networks, Professional English | Irakli Rodonaia |
| 45 | Statistical Methods in Bioinformatics | CS145 | 6 | Probability and Statistics; Professional English | Nino Demetrashvili |
| 46 | Programming on Python | CS147 | 6 | Principles of Programing, Professional English | David Razmadze |
| 47 | Natural language processing | CS146 | 7 | Artificial Intelligence, Professional English | Besik Dundua |
| 48 | Basics of Neural Networks | CS148 | 7 | Artificial Intelligence, Principles of Programing, Professional English | Tea Todua |

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| 49 | Essentials of Ethical Hacking and Network Security | CS149 | 7 | Computer Systems Security | David Razmadze |
|----|----|----|----|----|----|
| 50 | Programming on Matlab | CS150 | 8 | Probability and Statistics, Professional English | Khatuna Chargazia |
| 51 | Wireless Communication | CS151 | 8 | Computer Networks, Professional English | Vakhtang Rodonaia |
| 52 | Cloud computing | CS152 | 5 | Computer Systems Security, Professional English | Irakli Rodonaia |
| 53 | Arduino Programming | CS153 | 8 | Physics, Principles of Programing, Professional English | Tea Todua |
| 54 | Computer vision | CS154 | 7 | Machine Learning, Programming on Python, Professional English | Davit Datuashvili |