Coordinated with the Quality Assurance Office

Minutes № 7, September 15, 2023 year

Vice-rector /Associate Professor Nino Jojua/

Reviewed at the School Board

Minutes №32, September 18, 2023 year

Dean of the School / Prof. Tea Todua/

Approved by the Governing Board

Minutes №18, September 25, 2023 year

Rector / Saffet Bayraktutan /

Master’s Educational Program

**Computer Science**

**(English)**

Tbilisi

2023

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

**School:** Computer Science and Architecture

**Head of Program:** Tea Todua, Professor, Candidate of Technical Sciences. Tel.: +995 593 165999. E-mail: ttodua@ibsu.edu.ge

**Education Cycle and Level of the qualification:**  Master’s (The second cycle of Higher Education) Level 7 of the NQF

**Type of the Educational Programme:** Academic

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

**Awarded Qualification:** Master of Computer Science /კომპიუტერული მეცნიერების მაგისტრი

**Code of Qualification:** 0613

**Language of Education:** English

**Credit Value of the Programme:** 120 ECTS

**Structure of the Programme:** The program includes learning and research components. Teaching component consists of 90 credits. From these 90 credits 69 credits are assigned to mandatory courses and 21 credits to elective courses. Research component (preparation and defense of a master’s thesis) includes 30 credits.

**Programme Admission Precondition**:Student enrolment is made according to the Georgian legislation - based on the results of the Unified National Master’s Exams (Admission to the educational program without passing Unified National exams may be allowed only in cases considered by the Georgian law).

A person can become a student of Master program if he/she has a bachelor or equivalent degree. In addition, the applicant should pass the University internal exam in specialty and English language (B2 level). The issues of the entrance exams and the evaluation system will be posted on the University website.

Those students who have graduated from English Language Educational Program within the last 3 years and their GPA is at least 75 (out of 100) or 3 (out of 4) will be exempt from the English language requirement, as well as if student is a citizen of a country, where first/second official language is English, or presented certificate of exam which correspondent to B2 level, is exempted from passing the language exam. For more information, see IBSU.R04 REGULATION for MASTER’S EDUCATION . Exams in English and specialty are distributed according to the following ratio: 40%-60% respectively

International students are enrolled on the program in accordance with the Georgian legislation without Unified National Exams. Program admission preconditions could be accessed on the following link <https://iro.ibsu.edu.ge/en/home>

**Purpose of the Programme**:Aims of the Master's Program in Computer Science are:

(1) To provide Master's students research-based learning, which will deepen their knowledge in theoretical and practical issues of computer science. In particular, the Master's program focuses on giving students a deep understanding of courses from three areas of computer science: theoretical computer science, systems design and security, artificial intelligence.

(2) To enhance Master's students' knowledge needed for industry. This means that the program will master students to formulate, analyse, solve, and realize with the industry specific tasks. Also, the program will deepen Master's students' skills required for the search and preparation of technical documentation, and the communication with field experts.

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

**Learning Outcome**:

| 1. The graduate has deep knowledge understanding of algorithms and model theory, implementation of programming languages and systems, data mining, protection and processing. Is able to critically understand them. 2. The graduate knows how to use computer science to solve practical and theoretical tasks. Is deeply familiar with the computer systems needed for the industry. Has a solid background of problem modeling and implementation. 3. The graduate is familiar with research methods and technical literature, knows how to search technical information, prepare a report, write a thesis, and make a presentation. 4. By applying the principles of fairness a graduate can do collaborative research, create and use software to solve a given task. Is able to adhere the norms of professional ethics, to maintain academic honesty and standards. 5. By applying technical knowledge and skills, the graduate can develop secure computer systems and network-based technologies in various fields, using information technology research and design methods. 6. For solving complex problems the graduate is able to develop a new approach, create mathematical models, and algorithmic representation, analysis and implementation. 7. The graduate can divide a complex problem into subproblems. For each subproblem is able to find a suitable programming paradigm and implement. 8. The graduate in compliance with the standards of academic ethics is able to find needed information and prepare a report / article / paper and a small project proposal. He/She has the ability to present the research results to both academic and professional communities. 9. The graduate solves issues related to computer science in a multidisciplinary environment, takes responsibility for these decisions, independently determines the professional development needs of himself/herself and team members. |
| --- |

**Program goals and learning outcomes map:**

| **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 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **(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** | **LO 4** | **LO 5** | **LO 6** | **LO 7** | **LO 8** | **LO 9** |
| Logic for Computer Science and Artificial Intelligence | **1** | **1, 2** | **1** | **1** |  | **2** | **1** | **1** |  |
| Principles of Programming Languages | **2** | **2, 3** |  | **2** |  | **1** | **3** |  |  |
| Computer Networks Design |  | **2** | **2** | **2** | **2, 3** | **1** | **1** | **2** | **1** |
| Models of Computation | **2** | **3** |  |  |  | **3** | **1** |  |  |
| Advanced Algorithms | **3** | **2** |  | **1** | **2** | **3** | **2** |  |  |
| Information Security | **2** |  |  |  | **3** | **2** |  | **2** |  |
| MSc Seminar I | **1** | **1** | **2** | **2** | **1** | **1** |  | **2** | **2** |
| Data Mining and Analysis | **3** | **1** | **1** | **1** | **2** |  |  |  |  |
| IoT Design |  | **2** | **2** | **2** | **3** | **2** | **2** | **2** | **2** |
| Human-Machine Interaction |  | **2** |  |  | **2** | **2** |  |  |  |
| MSc Seminar II | **2** | **1** | **3** | **3** | **1** | **2** | **1** | **3** | **3** |
| MSc Thesis | **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 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.

**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.

**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.

**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 points;

2) (B) Very good – 81-90 points;

3) (C) Good – 71-80 points;

4) (D) Satisfactory – 61-70 points;

5) (E) Acceptable – 51-60 points.

b) Two types of negative grades

1) (FX) Fail – 41-50 points, 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 points 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 60% of final evaluation grade.

A credit can be awarded only after the attainment of learning outcomes, envisaged by the course syllabus and following requirements:

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, minimal competence level and the assessment criteria of midterm and final evaluations can be determined in the specific course/research component syllabus.

**Evaluation of research component:**

The evaluation system of the research component (Master thesis) is similar to the above. In case of (FX) assessment, the student is allowed to submit the re-considered master's thesis during the following semester, and in case of receiving (F), loses the right to submit the same thesis. Also, specific components and criteria for the evaluation of the research component are given in the syllabus of the Master thesis.

Master Thesis is assessed by final evaluation which is the sum of a supervisor (IBSU\_R04F05.b.); a reviewer (IBSU\_R04F04.b.) and a public defense commission evaluation (IBSU\_R04F01.), 30/33/37 points respectively.

**Specificities of the Organization of the Teaching Process:** The volume of the program is 120 ECTS, which is equally distributed throughout four semesters, where 1 ECTS = 25 astronomical hours, including contact and student-independent working hours. In the final semester students work on the master thesis, to which 30 credits are assigned.

**Field of Employment:** The Master of Science 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, as a leading specialist, 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 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. Also via an electronic 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](https://www.elsevier.com/solutions/scopus)

<http://polpred.com/>

[www.journals.cambridge.org](http://www.journals.cambridge.org/)

<https://home.heinonline.org/>

[www.opendoar.org](http://www.opendoar.org/)

[www.roar.eprints.org](http://www.roar.eprints.org/)

[www.doaj.org](http://www.doaj.org/)

[www.beallslist.weebly.com](http://www.beallslist.weebly.com/)

[www.gutenberg.org](http://www.gutenberg.org/)

[www.memory.loc.gov](http://www.memory.loc.gov/)

[www.wdl.org](http://www.wdl.org/)

[www.obiblio.sourceforge.net](http://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. | Michał Małafiejski | Doctor of Computer Science | Affiliate Professor |
| 2. | Irakli Rodonaia | Candidate of Technical Sciences (Equivalent to PhD) | Affiliate Professor |
| 3. | Giorgi Ghlonti | Candidate of Technical Sciences (Equivalent to PhD) | Affiliate Professor |
| 4. | Tea Todua | Candidate of Technical Sciences (Equivalent to PhD) | Professor |
| 5. | Giorgi Mandaria | Candidate of Pedagogical Sciences (Equivalent of Doctor) | Affiliate Associate Professor |
| 6. | Vakhtang Rodonaia | PhD degree in Engineering of Informatics (Equivalent to PhD) | Affiliate Associate Professor |
| 7 | Davit Datuashvili | Doctor of Engineering in Informatics (Equivalent to PhD) | Affiliate Associate Professor |
| 8 | Anri Morchiladze | PhD degree in Informatics | Affiliate Associate Professor |
| 9. | Mikheil Rukhaia | Doctor of Technical Sciences | Associate Professor |
| 10. | Mariam Dedabrishvili | Doctor of Engineering in Informatics (Equivalent to PhD) | Affiliate Assistant Professor |
| 11. | Avtandil Bichnigauri | Doctor of Informatics | Assistant Professor |
| 12. | Khatuna Elbakidze | Candidate of physics and mathematics Sciences (Equivalent to PhD) | Invited Lecturer |
| 13. | Teimuraz Davitashvili | Doctor of physics and mathematics Sciences | Invited Lecturer |
| 14. | Giorgi Baghaturia | PhD degree in Mathematics | Invited Lecturer |
| 15. | Tornike Kadeishvili | Doctor of physics and mathematics Sciences | Invited Lecturer |
| 16. | Shalva Kvirkvelia | Doctor of Engineering in Telecommunications | Invited Lecturer |

**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.** | | **Contact hours** | | | | | **Independent work** | **Total number of hours** |
| **I Semester** | **II Semester** | **III Semester** | **IV Semester** | **Lecture/Consultation** | **Seminar / Group Work / Lab. Work / Practical work** | **Midterm exam** | **Final exam** | **Total number of contact hours** |
| 1 | Logic for Computer Science and Artificial Intelligence | Mandatory | **7** | **7** |  |  |  | 28 | 14 | 2 | 2 | 46 | 129 | 175 | 3 |
| 2 | Principles of Programming Languages | Mandatory | **7** | **7** |  |  |  | 30 | 12 | 2 | 2 | 46 | 129 | 175 | 3 |
| 3 | Computer Networks Design | Mandatory | **6** | **6** |  |  |  | 14 | 28 | 2 | 2 | 46 | 104 | 150 | 3 |
| 4 | Models of Computation | Mandatory | **8** |  | **8** |  |  | 30 | 12 | 2 | 2 | 46 | 154 | 200 | 3 |
| 5 | Advanced Algorithms | Mandatory | **8** |  | **8** |  |  | 29 | 13 | 2 | 2 | 46 | 154 | 200 | 3 |
| 6 | Information Security | Mandatory | **6** |  | **6** |  |  | 14 | 28 | 2 | 2 | 46 | 104 | 150 | 3 |
| 7 | Seminar I | Mandatory | **3** |  | **3** |  |  | - | 28 | 2 | 2 | 32 | 43 | 75 | 2 |
| 8 | Data Mining and Analysis | Mandatory | **8** |  |  | **8** |  | 30 | 12 | 2 | 2 | 46 | 154 | 200 | 3 |
| 9 | IoT Design | Mandatory | **7** |  |  | **7** |  | 14 | 28 | 2 | 2 | 46 | 129 | 175 | 3 |
| 10 | Human-Machine Interaction | Mandatory | 6 |  |  | 6 |  | 14 | 14 | 2 | 2 | 32 | 118 | 150 | 2 |
| 11 | Seminar II | Mandatory | **3** |  |  | **3** |  | - | 28 | 2 | 2 | 32 | 43 | 75 | 2 |
| 12 | MSc Thesis | Mandatory | **30** |  |  |  | **30** | - | 28 | 1 | 1 | 30 | 720 | 750 | - |
| 13 | Computer algebra | Elective | **5** | **5** |  |  |  | 16 | 12 | 2 | 2 | 32 | 93 | 125 | 2 |
| 14 | Approximation Theory | Elective | **5** | **5** |  |  |  | 14 | 14 | 2 | 2 | 32 | 93 | 125 | 2 |
| 15 | Numerical Analysis | Elective | **5** | **5** |  |  |  | 16 | 12 | 2 | 2 | 32 | 93 | 125 | 2 |
| 16 | Modelling and Simulation | Elective | **5** | **5** |  |  |  | 14 | 14 | 2 | 2 | 32 | 93 | 125 | 2 |
| 17 | Distributed Application Development | Elective | **5** | **5** |  |  |  | 18 | 10 | 2 | 2 | 32 | 93 | 125 | 2 |
| 18 | Artificial Intelligence Applications | Elective | **5** | **5** |  |  |  | 14 | 14 | 2 | 2 | 32 | 93 | 125 | 2 |
| 19 | Software Development System Analysis | Elective | **5** |  | **5** |  |  | 14 | 28 | 2 | 2 | 46 | 79 | 125 | 3 |
| 20 | Semantic Web Technologies | Elective | **5** |  | **5** |  |  | 16 | 12 | 2 | 2 | 32 | 93 | 125 | 2 |
| 21 | Knowledge Representation and Reasoning | Elective | **5** |  | **5** |  |  | 16 | 12 | 2 | 2 | 32 | 93 | 125 | 2 |
| 22 | Software Verification | Elective | **5** |  | **5** |  |  | 14 | 14 | 2 | 2 | 32 | 93 | 125 | 2 |
| 23 | Expert Systems | Elective | **5** |  | **5** |  |  | 10 | 18 | 2 | 2 | 32 | 93 | 125 | 2 |
| 24 | Bayesian and probabilistic programming | Elective | **5** |  | **5** |  |  | 17 | 11 | 2 | 2 | 32 | 93 | 125 | 2 |
| 25 | Digital Signal Processing | Elective | **5** |  | **5** |  |  | 14 | 14 | 2 | 2 | 32 | 93 | 125 | 2 |
| 26 | Graph Algorithms and Computational Geometry | Elective | **6** |  |  | **6** |  | 22 | 6 | 2 | 2 | 32 | 118 | 150 | 2 |
| 27 | Neural networks | Elective | **6** |  |  | **6** |  | 17 | 11 | 2 | 2 | 32 | 118 | 150 | 2 |
| 28 | Network Modelling | Elective | **6** |  |  | **6** |  | 22 | 6 | 2 | 2 | 32 | 118 | 150 | 2 |
| 29 | Operations Research | Elective | **6** |  |  | **6** |  | 22 | 6 | 2 | 2 | 32 | 118 | 150 | 2 |
| 30 | Deep Reinforcement Learning | Elective | **6** |  |  | **6** |  | 14 | 14 | 2 | 2 | 32 | 118 | 150 | 2 |
| 31 | Internship | Elective | **6** |  |  | **6** |  | - | 90 | - | 2 | 92 | 58 | 150 | - |
| **Total number** | |  | **120** | **30** | **30** | **30** | **30** |  |  |  |  |  |  |  |  |

**Table of Prerequisites**

| **#** | **Course title** | **ECTS** | **Prerequisite** | **Semester course** |
| --- | --- | --- | --- | --- |
| **4** | Models of Computation | **8** | Logic for Computer Science and Artificial Intelligence | **2** |
| **11** | MSc Seminar II | **3** | MSc Seminar I | **3** |
| **12** | MSc Thesis | 30 | Must be completed all Compulsory Courses | **4** |
| **21** | Knowledge Representation and Reasoning | **5** | Logic for Computer Science and Artificial Intelligence | **2** |
| **22** | Software Verification | **5** | Logic for Computer Science and Artificial Intelligence;  Principles of Programming Languages | **2** |
| **23** | Expert Systems | **5** | Logic for Computer Science and Artificial Intelligence | **2** |
| **26** | Graph Algorithms and Computational Geometry | **6** | Advanced Algorithms, Models of Computation | **3** |
| **28** | Network Modelling | **6** | Models of Computation | **3** |
| **31** | Internship | **6** | All mandatory courses given during first year. | **3** |

**Additional Table of Study Plan**

| **№** | **Course / Module / Internship / Research Component** | **Code** | **Semester** | **Prerequisites** | **Lecturer** |
| --- | --- | --- | --- | --- | --- |
| **1** | Logic for Computer Science and Artificial Intelligence | CS301 | 1 | N/A | Mikheil Rukhaia |
| **2** | Principles of Programming Languages | CS302 | 1 | N/A | Mikheil Rukhaia  Michał Małafiejski |
| **3** | Computer Networks Design | CS334 | 1 | N/A | Vakhtang Rodonaia  Avtandil Bichnigauri |
| **4** | Models of Computation | CS303 | 2 | Logic for Computer Science and Artificial Intelligence | Michal Małafiejski |
| **5** | Advanced Algorithms | CS304 | 2 | N/A | Giorgi Mandaria |
| **6** | Information Security | CS335 | 2 | N/A | Vakhtang Rodonaia  Avtandil Bichnigauri |
| **7** | MSc Seminar I | CS307 | 2 | N/A | All academic staff |
| **8** | Data Mining and Analysis | CS305 | 3 | N/A | Giorgi Ghlonti  Anri Morchiladze |
| **9** | IoT Design | CS336 | 3 | N/A | Tea Todua  Shalva Kvirkvelia |
| **10** | Human-Machine Interaction | CS327 | 3 | N/A | Tea Todua |
| **11** | MSc Seminar II | CS308 | 3 | MSc Seminar I | All academic staff |
| **12** | MSc Thesis | CS310 | 4 | Must be completed all Compulsory Courses | All academic staff |
| **13** | Computer algebra | CS311 | 1 | N/A | Michal Małafiejski  Tornike Kadeishvili |
| **14** | Approximation Theory | CS312 | 1 | N/A | Giorgi Baghaturia |
| **15** | Numerical Analysis | CS313 | 1 | N/A | Khatuna Elbakidze,  Teimuraz Davitashvili |
| **16** | Modelling and Simulation | CS314 | 1 | N/A | Khatuna Elbakidze |
| **17** | Distributed Application Development | CS315 | 1 | N/A | Irakli Rodonaia |
| **18** | Artificial Intelligence Applications | CS328 | 1 | N/A | Tea Todua  Shalva Kvirkvelia |
| **19** | Software Development System Analysis |  | 2 | N/A | Anri Morchiladze |
| **20** | Semantic Web Technologies | CS317 | 2 | N/A | Mikheil Rukhaia |
| **21** | Knowledge Representation and Reasoning | CS318 | 2 | Logic for Computer Science and Artificial Intelligence | Mikheil Rukhaia |
| **22** | Software Verification | CS319 | 2 | Logic for Computer Science and Artificial Intelligence  Principles of Programming Languages | Giorgi Ghlonti |
| **23** | Expert Systems | CS320 | 2 | Logic for Computer Science and Artificial Intelligence | Tea Todua |
| **24** | Bayesian and probabilistic programming | CS321 | 2 | N/A | Mariam Dedabrishvili |
| **25** | Digital Signal Processing | CS322 | 2 | N/A | Davit Datuashvili |
| **26** | Graph Algorithms and Computational Geometry | CS323 | 3 | Advanced Algorithms, Models of Computation | Michal Małafiejski |
| **27** | Neural networks | CS324 | 3 | N/A | Mariam Dedabrishvili |
| **28** | Network Modelling | CS325 | 3 | Models of Computation | Michal Małafiejski |
| **29** | Operations Research | CS326 | 3 | N/A | Michal Małafiejski |
| **30** | Deep Reinforcement Learning | CS316 | 3 | N/A | Davit Datuashvili |
| **31** | Internship | BUS1024 | 3 | All mandatory courses given during first year | Tea Todua |