საქართველოს ეროვნული უნივერსიტეტი სეუ
GEORGIAN NATIONAL UNIVERSITY SEU

Georgian National University SEU

Bachelor's Educational Program

DATA SCIENCE AND ARTIFICIAL INTELLIGENCE

2023

GENERAL INORMATION

Program title: Data Science and Artificial Intelligence

Higher education level: first level (Bachelor)

Qualification to be granted: Bachelor of Computer Science 0613.1.2

Detailed field: Software and Applications Development and Analysis 0613

Study language: Georgian

Duration of studies: 4 academic years / 8 terms

Volume of the program: 120 ECTS

Program supervisor: Lia Kurtanidze, assistant professor

Program co-supervisor: Romeo Galdava, invited lecturer

Program development manager: Besik Tabatadze, invited lecturer

DESCRIPTION OF THE PROGRAM

The actuality of the Bachelor's Program in Data Science and Artificial Intelligence is caused by the increased demand from the modern organizations on such specialists, who will be able to answer the challenges related to modern technologies. The Data Science and Artificial Intelligence Program includes not only the field of programming, but also basics of mathematics as well. Except for the program skills, the alumni of this field necessarily need algorithmic thinking and solid base in mathematics. The curriculum of Data Science and Artificial Intelligence is prepared in such manner, that most of the core subjects serve to provide students with such base. The curriculum offers the students a rich list of practical subjects as elective courses, which will enable them to select courses based on their interest and according to the market demand.

The mission of the program

The mission of the program of Data Science and Artificial Intelligence is to prepare students in the mentioned field. The program ensures for students high quality educational process, modern learning courses and access to all necessary resources. Also, to provide students with necessary knowledge and skills, which are necessary for achieving success in the fast-developing and complex field of computer science.

PROGRAM GOALS

The goals of the Bachelor's Program in Data Science and Artificial Intelligence of the Georgian National University SEU are:

I. Provide the alumni with profound theoretical and practical knowledge of Computer Science;
II. Provide the alumni with the competence of solution of practical tasks given in the field of Data Science and Artificial Intelligence;
III. Provide the alumni with the skill of using of the methods and instruments of the field of Computer and Data Science;
IV. By means of the received education, provide the alumni with the skill to answer the challenges related to the modern technologies and become a competitive specialist, who will be able to get employed at private and public structures.

LEARNING OUTCOMES

The alumni of the Data Science and Artificial Intelligence Program of the Georgian National University SEU:

I. **Knows** basic concepts of Data Science and theoretical issues;
II. **Describes** the instruments and the theoretical issues necessary for the implementation of the projects of the field of Data Science and Artificial Intelligence;
III. **Discusses** the algorithms, respective models and software related to Computer and Data Science pursuant to the given task;
IV. **Analyzes** the tasks given in Computer and Data Sciences using respective disciplines;
V. **Applies** the instrument sof Data Science and Artificial Intelligence for the development of the computer technology-based solutions.
VI. **Obtains, processes, analyses and presents** information pursuant to the given requests;
VII. **Prepares** presentation, **can** communicate effectively in the process of professional activities;
VIII. Considering the principles of professional ethics, **plans** development-oriented activities, in the process of both – individual and teamwork.

MAP OF COMPONENTS

THE CORRESPONDENCE OF THE PROGRAM GOALS WITH THE LEARNING OUTCOMES

Learning Outcomes / Program goals		According to the numeration of the learning outcomes							
		I	II	III	IV	V	VI	VII	VIII
I.	Provide the alumni with profound theoretical and practical knowledge of Computer Science;	√	√	√					
II.	Provide the alumni with the competence of solution of practical tasks given in the field of Data Science and Artificial Intelligence;	√	√	√	√	√	√	√	√
III.	Provide the alumni with the skill of using of the methods and instruments of the field of Computer and Data Science;	√	√	√		√	√	√	
IV.	By means of the received education, provide the alumni with the skill to answer the challenges related to the modern technologies and become a competitive specialist, who will be able to get employed at private and public structures.	√	√					√	√

CORRESPONDENCE OF THE COURSE WITH THE LEARNING OUTCOMES

MAP OF CORRESPONDENCE OF THE COURSE PROGRAM WITH LEARNING OUTCOMES (1 - INTRODUCTION; 2 - DEEPENING; 3 - REINFORCEMENT)

Learning Outcomes	Learning Outcomes According to the Numeration

Courses		I	II	III	IV	V	VI	VII	VIII
1.	Mathematical Analysis 1	1		2					
2.	Computer Skills		1	1					
3.	Basics of Computer Organization and Architecture	1					1		1
4.	Discrete Mathematics	1	1	1					
5.	Basics of Programming based on Python	1		1		1	1		
6.	Mathematical Analysis 2	2	2	3					
7.	Linear Algebra	1	1	2		1	1		
8.	Object-oriented Programming based on Python	2	2	2	2				
9.	Basics of Operational Systems	1	1	1			2		
10.	Data Processing with Electronic Tables	2	2		2	2	2		
11.	Database Basics	1	1	2		2	2		
12.	Introduction to Computer Networks	2	2	2	2	2	2		
13.	Basics of Data Science and Big Data	2	2			1	21		
14.	Database Management System Oracle				2	2	3		
15.	Web Technologies (client's part)	3	3	3	3	3	3		
16.	Theory of Probability and Statistics				2	3	3		
17.	Basics of Artificial Intelligence				2	2	2		

18.	Data Structures	**2**	**2**	**2**	**2**				
19.	Data Obtaining and Clearing Technologies	**3**	**3**	**3**	**3**	**3**	**3**		
20.	Applied Statistics	**3**		**3**	**3**	**3**	**3**		
21.	Software Systems of Data Processing				**2**	**2**	**2**	**2**	**2**
22.	Algorithms		**2**		**2**	**3**	**2**	**2**	**2**
23.	Artificial Neuron Networks				**2**	**2**	**2**	**2**	**2**
24.	IT Projects Management	**2**		**3**	**3**	**3**			
25.	Cybersecurity	**2**							**2**
26.	Basic Database Libraries based on Python	**3**		**3**		**3**	**2**	**3**	
27.	Web Technologies (server part)	**2**		**2**	**2**	**2**			**2**
28.	Natural Language Processing (NLP)	**3**	**3**					**3**	
29.	Cloud Calculations	**3**	**2**		**3**	**3**	**3**	**3**	
30.	R-Programming	**3**			**3**	**3**	**3**		
31.	Machine Learning	**3**	**3**	**3**	**3**	**3**		**3**	
32.	Data Analytics and Visualization				**3**	**3**	**3**	**3**	**3**
33.	Data Repository					**3**	**3**	**3**	
34.	Deep Learning				**3**	**3**	**3**	**3**	
35.	Practice	**3**		**3**	**3**	**3**	**3**		**3**
36.	Bachelor's Thesis	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

ORGANIZATION OF STUDIES

The duration of the Bachelor's Program in Data Science and Artificial Intelligence is 4 academic years (8 semesters) and implies the accumulation of 240 ECTS credits, which equals to 6000 astronomic hours. Each credit (ECTS) equals to the learning activity of a student (student workload) of 25 hours and includes both – contact and independent hours. Upon the calculation of the credit the time determined for resit exam (preparation, passing, assessment), also, the time for consultations with the person implementing the component of the educational program is not included.

The academic year consists of two – Autumn and Spring semesters. During each semester the student must cover on average 30 (ECTS) (30 credits = 750 hrs.), and throughout the year – 60 (ECTS) (1500 hours). Considering the peculiarities of the higher educational program and/or the individual learning program of the student, it is admissible for the annual learning workload of the student to exceed 60 credits or be less than 60 credits. It is inadmissible for the annual learning workload of the student to exceed 75 (ECTS).

The semester is the period of time, which includes the totality of the study weeks, the period of holding of exam/resit exam and the assessment of the period of achieving of the learning outcomes by the student.

Study week is the period of time, during which the study workload of the student having average academic achievement is allocated and includes the totality of activities to be performed during both - the contact time and the independent time.

The program is regarded as completed, when the student accumulates at least 240 ECTS, which implies the fulfilment of the basic, elective and free components of the field determined under the program.

Through the e-learning process management system (emis.seu.edu.ge) the student obtains information regarding the planning and the progress of the learning process. Upon the enrolment the student receives the log in username and the password of the e-learning process management system. He/she can undergo academic registration without visiting the university and he/she has academic freedom to register on the desirable courses during the academic registration considering his/her educational program, to have advance information on the courses to be undergone in future, see the syllabuses of the courses and familiarize himself/herself with the assessment system of each course based on the specifics of the subject.

PREREQUISITES FOR THE ADMISSION TO THE PROGRAM

The prerequisites and procedures for the admission to the Bachelor's Program in Data Science and Artificial Intelligence correspond with the applicable legislation, are stipulated in the Procedure for Regulation of Learning Process, is posted on the website of the University and is available for all interested persons. **Enrolment conditions**

All persons having full general education, who possess the relevant document certified by the state (School Leaving Certificate) or the equivalent document and who obtain the right to study on the mentioned program based on the results of the Unified National Exams and undergo administrative registration at SEU shall have the right to study on the Bachelor's Program in Data Science and Artificial Intelligence.

Enrolment without passing Unified National Exams

According to the procedure established by the legislation of Georgia, it shall be admissible to study on the Bachelor's Program in Data Science and Artificial Intelligence without passing the Unified National Exams for:

a) Foreign citizens and persons without citizenship, who received full general or equivalent education in a foreign country;

b) Georgian citizens, who received full general or equivalent education abroad and studied abroad during the last 2 years of their full general education;

c) Foreign citizens (except for the students participating in the joint higher educational programs and in exchange educational programs), who study/have studied and obtained credits/qualification in a foreign country at a higher educational institution recognized pursuant to the legislation of that country;

d) Georgian citizens (except for the students participating in the joint higher educational programs and in exchange educational programs), who live/have lived, study/have studied and obtained credits/qualification in a foreign country at a higher educational institution recognized pursuant to the legislation of that country;

e) In order to determine the knowledge of the language of the program by the persons willing to obtain the right to study without passing the Unified National Exams, the University conducts an interview and ensures the availability of the video recording of the mentioned interview to the Ministry of Education, Science, Sports and Culture.

Enrolment by mobility

The students transferring from other higher educational institution / program by mobility shall be admitted to the Bachelor' Program in Data Science and Artificial Intelligence according to the Procedure determined under the Order N 10/ნ of 4 February 2010 of the Minister of Education and Science of Georgia.

Those persons shall have the right to mobility to the Bachelor's Program of Data Science and Artificial Intelligence, whose enrolment at the higher educational institution was performed according to the procedure determined by the legislation and who have the status of a student of the institution at the moment of registration on the electronic portal of information system of educational management.

Also, those persons shall have the right to mobility, whose status of a student has been suspended at the time of registration on the portal or the persons with terminated status, within 12 months from the termination of status.

TEACHING AND LEARNING METHODS

The totality of the teaching and learning methods applied to various components of the program ensure the achievement of the learning outcomes determined under the program. It is impossible to study any specific issue during the learning process using just one method. The lecturer has to apply different methods in the learning process, also, in frequent cases, there is a merger of methods. In the learning process the methods complement each other. The lecture selects the necessary method among them based on specific goal and objective.

Lecture - is a creative process where a lecturer and a student take part simultaneously. The main aim of the lecture is to understand the idea of the subject regulations to be learnt, which means a creative and active perception of presented material. In addition, an attention should be paid to the main provisions of transferable material, definitions, indications, assumptions. Critical analysis of the main issues, facts and ideas are necessary. A lecture should provide a scientific and logically consistent knowledge of main subject regulations to be learnt without excessive details overloading. Therefore, it must be logically completed.

Collaborative - teaching method involves dividing students into groups and giving them learning assignments. The members of the group work on the issue individually and at the same time share it with the other members of the group. Due to the set task, it is possible to redistribute functions among the members during the group work process. This strategy ensures maximum involvement of all students in the learning process.

Independent work- material heard in the lecture is formed as a whole system of knowledge by the independent work of the student. The student should be interested in the book and other sources of information and want to study the issues independently, which is a way to stimulate independent thinking, analysis and drawing conclusions.

Verbal, or oral, method includes lecture, narration, conversation, and etc. In this process, the lecturer conveys the teaching material through words, while the students actively perceive and master it by listening, remembering and understanding.

Method of working on a book reading, processing and analysis of the given extra materials.

Method of written work implies the following activities: making excerpts and notes, writing a paper etc.

Practical methods combine all the forms of teaching that develop the student's practical skills, here the student independently performs this or that activity on the basis of acquired knowledge, for example: professional practice, field work, etc.

Discussion / debate is one of the most common methods of interactive teaching. The discussion process drastically increases the quality and activity of student engagement. The discussion can turn into an argument. This process is not limited to questions asked by the lecturer. This method develops the student's ability to argue and justify his or her own opinion.

Problem-Based Learning (PBL) - a learning method that uses the problem in the early levels of the process of acquiring and integrating new knowledge.

Cooperative learning - is a teaching strategy in which each member of the group is required not only to study but also to help his or her teammate learn the course better. Each group member works on the problem until all of them have mastered the issue.

Case study -an active problem-situation analysis method, based on teaching by solving specific tasks - situations (so-called case solving). This method of teaching is based on the discussion of specific practical examples (cases). The case is a kind of tool that allows the application of the acquired theoretical

knowledge to solve practical tasks. By combining theory and practice, the method effectively develops the ability to make reasoned decisions in a limited amount of time. Students develop analytical thinking, teamwork, listening and understanding alternative thinking, the ability to make generalized decisions based on alternatives, plan actions, and predict their outcomes.

Brain storming- is a method student can use to generate ideas for solving the problem. In the process of brainstorming students must suspend any concerns about staying organized. The goal is to pour their thoughts without worrying about whether they make sense or how they fit together. It is effective method within the group and contains following levels:

- Creative definition of problem
- Taking notes of ideas without criticism
- Definition of estimation criterion
- Evaluation of ideas by preliminarily defined criterion
- Selection of best matching ideas by exclusion
- Manifestation of idea with the highest estimation for solving the problem

Demonstration method- involves visual representation of information. It is quite effective in terms of achieving results. In many cases, it is best to provide the material to students in both audio and visual form. Demonstration of the study material can be done by both the teacher and the student. This method helps us to visualize the different levels of perception of the learning material, to specify what students will have to do independently; At the same time, this strategy visually illustrates the essence of the issue / problem. Demonstrations may look simply, such as solving a mathematical problem, visualizing a step on its board, or taking on a complex look, such as conducting a multi-level science experiment.

Inductive Method- the process of reasoning in which the premises seek to supply strong evidence for the truth of the conclusion. The truth of the conclusion of an inductive argument is probable, based upon the evidence given.

Deductive Method- the process of reasoning from one or more statements (premises) to reach a logically certain conclusion. It works from the more general to the more specific.

Analysis- through this method, lecturers and students discuss specific cases together. Students thoroughly learn the previously unknown sides of the issue. The method of analysis enables us to break up the whole part of the study the material into constituent parts, which simplifies the understanding of the specific issues of the problem.

The synthesis method -involves composing one whole by grouping individual issues. This method helps to develop the problem as the ability to see the whole.

The explanatory method is based on reasoning around a given issue. In presenting the material, the lecturer gives a specific example, which is discussed in detail in the given topic.

Action-oriented teaching - requires the active involvement of the lecturer and the student in the teaching process, where the practical interpretation of the theoretical material becomes particularly important.

The heuristic method- is based on a step-by-step solution to a task posed to students. This process is accomplished by teaching the facts independently and seeing the connections between them.

Laboratory learning- is more visible method and allows you to perceive an event or process. In the lab, the student learns to conduct an experiment. During the laboratory study, the student should be able to control the devices, adjust them and determine the mode of operation. Habits developed in learning laboratories provide an understanding of the theoretical material heard in lectures.

The development and presentation of the project -is a combination of educational and cognitive tools, which allows to solve the problem in the conditions of the necessary presentation of the student's independent actions and the obtained results. Teaching in this way raises students' motivation and responsibility. Work on the project includes levels of planning, research, practical activity and presentation of results according to the chosen issue. The project will be considered feasible if its results are visible, convincing and concrete. It can be performed individually, in pairs or in groups; Also, within one subject or several subjects (integration of subjects). Upon completion, the project will be presented to a wide audience.

E-learning - This method includes three types of teaching:

- Attendance when the teaching process takes place within the contact hours of the lecturer and the students, and the teaching material is delivered through an electronic course.
- Hybrid (attendance / distance), the main part of the learning course is done remotely, and a small part is done within the contact hours.
- Completely distance learning involves conducting the learning process without the physical presence of the lecturer. The learning course is held electronically from beginning to end.

Bachelor's project is the final phase of the Bachelor level and it aims at the systematization of the gained theoretical and practical knowledge and the reasoned solution of certain scientific, technical, economic and professional objectives. The thesis must reveal the level of knowledge of the research methods and experiments related to the given issue and the readiness of the student to work independently in the conditions of the future professional

activities. Consultation – the contact time used by the student with the supervisor of the Bachelor's thesis, when the student obtains information regarding the issues of drafting the plan, searching for empirical materials, their preparation, making conclusions in terms of the contents of the thesis, technical design of the thesis, its preparation for presentation.

Professional practice is an important part of the learning process and represents the planned and purposeful activity of the student, reinforcement of the theoretical knowledge obtained in an academic environment and gaining of practical skills. The aim of the practice is to equip students with practical skills and prepare them for future independent professional activities. Three parties are in the implementation of practice: university, student and potential employer/receiver organization/object of practice, therefore, it is important for all three parties: linking of the academic education and theory with the real world; involvement in the work environment, formation of business relations; exercising in practice of the competencies developed in the learning process; development of new competencies; renewal of educational program pursuant to the requirements of the fast-changing market; increasing of the employment of the alumni; communication with motivated youth; promotion of the better prepared professional; participation in the improvement of the educational programs considering the market requirements.

ASSESSMENT SYSTEM

The system of assessment of the learning outcomes and competencies is based on the system recognized by the legislation and corresponds with the Standards of Assessment and Granting of Credits approved by the Order N3 of 5 January 2007 of the Minister of Education and Science of Georgia.

Student assessment system includes:

a) Five positive assessments:

(A) (A) excellent - 91 and more of the highest grade;
(B) very good - 81-90 of the highest grade;
(C) good - 71-80 of the highest grade;
(D) satisfactory - 61-70 of the highest grade;
(E) enough - 51-60 of the highest grade;

b) Two types of negative grades are considered

(FX) not passed - 41-50 of the highest grades. It means that a student needs more individual work to cover material, and is given one more possibility to pass the exam.
(F) failed - 40 and less of the highest grade. It means that work done by the student was not enough and the subject should be learnt again.

In case student gets FX evaluation, he/she can take additional exam in the same semester at least 5 days after declaration the results of the final exam.

Grade gained by the student on resit exam is not added to final grade. Grade gained by the student on resit exam is the final grade and is added to the program database.

Considering the resit exam grade if the sum of all grades gained by student is 0-50, student is automatically evaluated with F-0.

Prerequisite for the permission of the student on final exam is to pass minimum midterm grade (at least 11 points in midterm).

Competency level for final exam is-30%, no less than 12 points.

Prerequisite for granting of credit is to accumulate no less than 51 points out of 100 points and to pass the minimum competency level of midterm and final exams.

Allocation of assessment components:

Individual criteria for the assessment of separate components, based on the specifics of the subject, are stipulated in the syllabuses of the respective courses. Each form and component of assessment has its relative ratio in the total volume (10 points) of assessment: midterm assessment – 60 points and final assessment – 40 points. Each assessment form has its minimum margin of competence, which must be passed in order to have positive result in the mentioned assessment. Each assessment form includes assessment component/components, which include assessment method/methods, and the assessment method/methods are measured according to the assessment criteria. The assessment criteria are stipulated in the course syllabuses based on the specifics of the subject.

OPPORTUNITY TO CONTINUE STUDIES

According to the procedure established by law the alumni of the Bachelor's Program in Data Science and Artificial Intelligence is authorized to continue studies at higher educational institutions of Georgia or foreign countries on the master's program of any field, if the prerequisite for the admission to that program is not limited to the bachelor's academic degree of other specialty.

SCOPE OF EMPLOYMENT OF THE PROGRAM

The alumni of the Bachelor's Program in Data Science and Artificial Intelligence can get employed both in public and private structures. The alumni will be able to work as a software developer, data analyst, specialist of information technologies, network administrator etc. They will be able to get employed everywhere, where they will practice their major professional work.

PARTNER ECONOMIC AGENTS

- Georgian National University SEU Ltd (Department of Information Technologies)
- IT Academy Step Ltd
- INI.GE Ltd
- Hosti.ge Ltd
- Global IT Ltd
- Avianet Ltd
- Micro-finance organization Lendup Ltd
- allmarket.ge Ltd
- Izi Credit Ltd
- JSC Wissol Petroleum Georgia
- JSC Bank of Georgia
- JSC TBC Bank
- JSC Finca Bank Georgia

INTERNATIONAL PARTNERS

- University of Economics and Human Sciences
- University of Rome Tor Vergata
- RTU Riga Business School

- Berkeley
- Instituto politecnico de Braganca/
- Klaipeda State University

INTERNATIONALIZATION OF THE PROGRAM

The orientation of the Bachelor's Educational Program in Data Science and Artificial Intelligence on the correspondence with the international context of the field and on the provision of the Program alumni with the skills necessary for getting employed/continuation of studies abroad is revealed in the following:

- The teaching of English language is included in the mandatory component of the Program with the volume of 30 ECTS, no less than including specialized English, considering the prerequisites for the courses of language level. For the students with low language competency or those interested in the deepening of the specialized language it is admissible to take additional credits at the expense of the free elective credits in the language component, pursuant to the procedure for the language competency established by the University.
- Promotion of academic mobility of students within the Program.
- For III and IV year students of the Program, the opportunity of studying at the partner university is provided.

Upon the development of the Program the best practices of foreign universities were used, the Program was compared with the Bachelor's programs of several foreign universities, in particular:

- University of Economics and Human Sciences in Warsaw - https://vizja.pl/en/
- Polytechnic Institute of Braganca in Portugal - https://portal3.ipb.pt/

PROGRAM RESOURCES

MATERIAL RESOURCES

Master's Program in Data Science is implemented in the campus equipped with modern infrastructure, it is provided with library, material and technical resources, which ensure the achievement of the program goals and learning outcomes in material and quality terms. All rooms are equipped with the devices necessary for the implementation of learning process. Students are informed about the opportunity to use existing resources and about the rules of use.

Computer classes are available at the University for practical and laboratory works with relevant equipment. The computer capabilities and their number totally make it possible to implement the program perfectly in terms of software and hardware.

All necessary literature and other materials (including those existing on the electronic carriers) determined by the course syllabuses of the program are available in the library, which ensures the achievement of the learning outcomes of the educational program.

The University has executed an agreement with the NNLE Georgian Library Association on the service of international electronic library bases. The most recent scientific periodicals, international electronic library bases are available for students, that enables the, to familiarize themselves with the most recent scientific data of the respective field in order to achieve the learning outcomes of the program.

- Cambridge Journals Online
- e-Duke Journals Scholarly Collection
- Edward Elgar Publishing Journals and Development Studies e-books
- IMechE Journals
- Royal Society Journals Collection
- Openedition Journals
- Scopus
- Science Direct
- ELSEVIER

PRACTICAL RESOURCES

The program includes mandatory component practical studies, which is composed of two parts in VII and VIII semesters. The University has executed the Memoranda/Agreements of Cooperation with the objects determined for practice. Practice is an important part of the learning process and represents the planned and purposeful activities of a student, reinforcement of the theoretical knowledge gained in academic environment and acquiring of practical skills. The aim of practice is to equip students with practical skills and prepare them for future independent professional activities.

Apart from the mandatory practical component, the University cooperates with economic agents, which organize and provide partnership for the periodic announcement of internships, seasonal schools, masterclasses, trainings etc.

PROGRAM CURRICULUM

See **Annex N1**

HUMAN RESOURCES OF THE PROGRAM

See **Annex N2**

TARGET INDICATORS

See **Annex N3**