GEORGIAN NATIONAL UNIVERSITY SEU

MASTER'S EDUCATIONAL PROGRAM

DATA SCIENCE

2023

General Information

Program title: Data Science

Higher education level: second level (Master's studies)

Qualification to be granted: Master of Computer Science

Detailed field: Software and Applications Development and Analysis

Study language: Georgian

Duration of studies: 2 years (**4** term)

Volume of the program: 120 ECTS

Program supervisor: Gulnara Janelidze, professor

Program co-supervisor: Romeo Galdava, invited lecturer

Program co-supervisor: Lia Kurtanidze, assistant professor
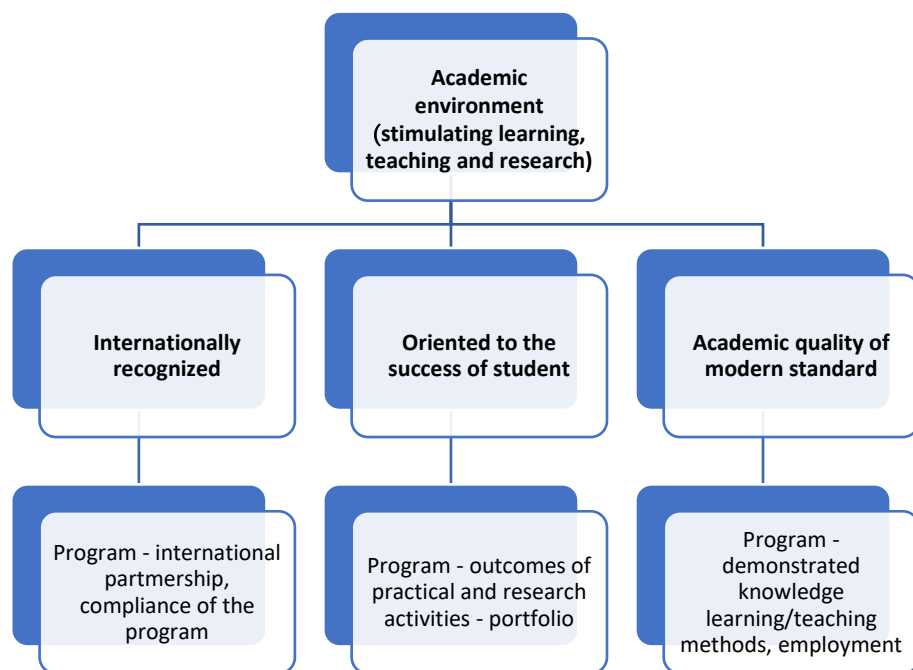
The mission of the Georgian National University SEU is:

To create internationally acknowledged academic environment with modern standards, which is oriented to student and his/her success and which stimulates learning, teaching and research, therefore, creates the opportunity of full realization of one's potential for everyone and prepares high-qualified competitive specialists for labor market.

Ensuring of education based on the values and principles of the European higher education area, using of innovative and flexible approaches in response to different needs or demands of students and society, contemplation of future trends and focus on improving the quality, also focusing on the enhancement of quality is a permanent goal of SEU.

The vision of the Georgian National University SEU is:

To be prestigious and value-based University, which rests upon the personal development and serves the society with high quality education and research.

Description of the program

Master's Program in Data Science is prepared according to the Procedures for the Development, Revision and Termination of the Educational Programs of the Georgian National University SEU. The program is developed in line with the modern challenges of the field and the demands of the local labor market, it is directed at elaborating the learning outcomes of the second level of higher education, which aims at providing deep and systematic knowledge in the given field and the participation of students in terms of various branches of the field. More thoroughly, the program is focused on such field competences as, knowledge of the basics of modern computer sciences and their use in practice, which is so necessary for organizations in order to manage information correctly.

The content, volume and complexity of the Master's Program in Data Science corresponds with the second level of higher education. The content of the program includes the prerequisites for admission to the program and learning outcomes. The structure of the program is consistent and logical. The content and the structure ensures the accomplishment of the study outcomes of the program. The qualification to be granted – Master of Data Science corresponds with the content and learning outcomes of the program.

The language of the study components determined under the program is Georgian, some elective courses are offered in foreign language as well, namely, these courses are, e-government and Agile development. The basic study materials are in Georgian, some auxiliary materials are provided in the form of foreign sources as well (in English).

Master's Program in Data Science is structured according to the following principle: core and elective subjects. It is mandatory for the students to write Master's thesis.

Program Goals

The goals of the Master's Program in Data Science are:

- **To familiarize** students with the methods of processing and studying of the Big Data with different structures and types.
- **Develop in students** the skills of obtaining, analyzing of data from all possible sources, including, the information flows existing in real time and making of decisions;
- **Deepen in students** the competence of solving the practical tasks given in the field of Data Science.;
- **Develop in students** the skills of finding of logical links within the information collected in the system and processing of business solutions based on it;
- Considering the most recent approaches in Data Science **develop in students** the skill of planning, creation, development and management of a project/task in the interdisciplinary environment;
- Based on the most recent methods **develop in students** the research skills.

Learning outcomes

Learning outcomes of the Master's Program in Data Science:

I. Describes the basic concepts, theories, methods, the most recent trends and technological solutions in the field of Computer and Data Science;

II. Determines the research, data transformation and standardization, machine learning methods and approaches in the field of Computer and Data Science, the technologies of storing and processing of Big Data;

III. Regulates the processes of creation/implementation of products in the field of Computer and Data Science, their ethical and legal aspects;

IV. Studies and develops new approaches in the field of Data Science, makes adequate and original decisions independently, plans and implements short-term and long-term objectives;

V. Uses computer and the most recent data science technologies, the theory of probability and mathematical statistical elements for the creation of new or significantly improved products, services, processes, business models;

VI. Based on the most recent research methods and technologies, creates and develops new products, both in the local and in interdisciplinary context;

VII. Submits the study outcomes in a laconic, understandable manner, considering the lingual norms, observing the principles of academic good faith and ethics;

VIII. Coordinates the working team by observing the norms of professional ethics, determines his/her own needs and the needs of the team members and acts coherently in a multidisciplinary environment;

IX. Decides the issues related to the collection, integration and processing of data independently and takes responsibility on those decisions;

X. Contributes to the development of computer and data science with his/her research and/or practical activities.

Map of Components

The correspondence of the program goals with the learning outcomes

Learning outcomes										
Program goals	I	II	III	IV	V	VI	VII	VIII	IX	X

No.	Description										
I	**To familiarize** students with the methods of processing and studying of the Big Data with different structures and types.	x	x						x		x
II	**Develop in students** the skills of obtaining, analyzing of data from all possible sources, including, the information flows existing in real time and making of decisions;				x			x	x		x
III	**Deepen in students** the competence of solving the practical tasks given in the field of Data Science.;	x	x		x	x	x			x	
IV	**Develop in students** the skills of finding of logical links within the information collected in the system and processing of business solutions based on it;				x		x	x	x	x	x
V	Considering the most recent approaches in Data Science **develop in students** the skill of planning, creation, development and management of a project/task in the interdisciplinary environment;						x	x	x	x	x
VI	Based on the most recent methods **develop in students** the research skills.			x	x		x	x	x	x	x

Correspondence of the course with the learning outcomes

Courses \ Learning Outcomes		I	II	III	IV	V	VI	VII	VIII	IX	X
1.	Intense Course in Statistics	2	2			3					
2.	Information Security	2	2						3		
3.	Modern Database Management Systems (Sql, NoSql)		2		2					3	

#	Subject										
4.	Research Methods			2				2			3
5.	Data Science for Business	2		2	2						
6.	Methods and Algorithms of Artificial Intelligence	3	3		3	3	3				
7.	Big Data Systems	2	3	3	3	3				3	
8.	Analytical Services in Databases	3		3	3						
9.	Analytics of Big Data			3			3	3	3	3	
10.	Cybercrime	2		3							
11.	Academic writing								3		3
12.	Practice			3	3	3	3	3	3	3	
13.	Master's Thesis	3	3	3	3	3	3	3	3	3	3

Program Prerequisites

The following are the prerequisites for the enrolment at the Master's Program of Data Science:

Enrolment based on the results of Unified Master's Exams

The persons having as least Bachelor's or equal academic degree, who obtain the right to continue studies based on the unified master's exams and the internal university exams and who undergo administrative registration within the terms determined by the university, shall have the right to continue studies on the program.

It is permitted to study without taking the Unified Master's Exams for:

a) Master's candidates, who have received the document certifying the academic degree of the relevant higher education abroad;

b) Foreign citizens (except for the students involved in the joint higher educational programs), who study/have studied and have obtained credits/qualification abroad at the Master's program of the higher educational institution recognized pursuant to the legislation of that country;

b[1]) Georgian citizens (except for the students participating in the joint higher educational programs and the students participating in exchange programs), who, for the term determined by the Ministry of education and Science of Georgia, live/have lived, study/have studied and have obtained credits/qualification in a foreign country at the Master's program of the higher educational institution recognized pursuant to the legislation of that country;

c) Master's candidates who have enrolled at the higher educational institution without Unified National Exams;

d) foreign citizens, who have obtained the right to continue studies at the higher educational institution of Georgia before the entry into force of the Law of Georgia On Higher Education and possess the document certifying higher education issued in Georgia and recognized bt the state.

e) higher educational institution shall be obliged to hold interview in order to determine the level of knowledge of the language of the program by the persons with the right to enrolment without the unified master's exams and ensure the availability of the video recording of the mentioned interview for the Ministry.

Enrolment by mobility

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

Those persons shall have the right to mobility, 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.

The enrolment at the master's educational program or the enrolment as a transfer student from the recognized higher educational institution of a foreign country shall be performed based on the order of the Minister of Education and Science of Georgia, based on the decision/consent of the Ministry of Education and Science of Georgia.

Organization of studies

The duration of the Master's Program in Data Science is 2 academic years (4 semesters) and implies the accumulation of 120 ECTS credits, which equals to 3000 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.

The allocation of credits between different study components is based on the actual assessment of the workload of the student with average academic achievements, which is necessary for the achievement of the learning outcomes and goals established for each component.

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 full workload of an academic year includes 60 (ECTS). During the academic (spring and autumn) semester the student must cover on average 30 credits. 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).

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 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.

The program is regarded as completed, when the student accumulates at least 120 ECTS, which implies the fulfilment of the basic, elective and free components of the field determined under the program.

Teaching and learning methods

The teaching and learning methods of each course included in the Master's Program in Data Science correspond with the second level of higher education, the content of the course, learning outcomes and ensure their achievement. The totality of the teaching and learning methods applied in various components of the program ensure the achievement of the results determined under the program and is directed at the development of the respective competence.

The studies may be conducted using various methods, such as independent processing/interpretation of printed, digital and other type of educational resources, performing of practical and laboratory work, preparation of the report of professional activities, performing of written assignments, independent preparation of research thesis/project etc. During the studies, the accent shall be made on the opportunity of the student to apply his/her knowledge, skills and values on a regular basis. This approach shall imply the active participation of the student in the learning process and application of his/her theoretical knowledge into practice within the framework of real or close to real situations and cases.

The measures applied to teaching and learning improve and correlate with each other. The academic and invited personnel implementing the study program can use various different methods. Within the framework of the educational program courses, the application of methods, especially, cooperative methods must be considered, which requires active use of the student's knowledge in practice.

The personnel implementing the component of the educational program applies modern teaching and learning methods. Based on their specifics, the educational courses are conducted using different formats and various teaching and learning methods. The teaching methods and activities planned within each course are directed to the interest of the students and to the development of necessary skills. The applied teaching and learning methods are flexible and consider the individual requirements and needs of the students.

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.

Master's thesis is the final phase of the Master's 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 Master'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.

Assessment components

Transparent criteria are applied upon the assessment of the student's knowledge, which ensure the awareness of students regarding the achieved outcomes, flaws and ways of improving them. The assessment criteria and components existing at the University correspond with the norms determined by the legislation of Georgia and they consist of multiple 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.

Internationalization of the program

- University of Economics and Human Sciences
- University of Rome Tor Vergata
- RTU Riga Business School
- Berkeley
- Instituto politecnico de Braganca/
- Klaipeda State University

Partner Objects for Practice

- ➤ 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

Scope of Employment

Master's Program in Data Science unifies technical and managerial components, therefore, the alumni have particularly broad opportunities for professional advancement. The gained theoretical and practical knowledge will enable the alumni to get employed in the organizations of various profiles. This might be public or private sector, on the following positions: Database Administrator, Computer Science Infrastructure Manager, Data Manager, Data Analyst etc. The potential employers on the labor market of Georgia are the partner organizations of the University and also the interested large or small business companies, banks, state structures, educational institutions, international companies, telecommunication companies etc.

Opportunity to Continue Studies

The alumni of the Master's Program in Data Science may continue his/her studies at the related doctoral programs in Georgia and abroad, except for the doctoral programs, whose necessary prerequisite is having the diploma in the same specialty.

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.

Funding of the program

Master's Program in Data Science is funded from the budget of the Program. The money allocated from the budget is directed to the constant renewal of the material and technical resources and literature determined under the program, arrangement of scientific conferences, salary

expenses of the academic/invited personnel and the issuing and printing of their works. The budget also includes the expenses of official visits of the academic/invited and administrative personnel, funding of students in exchange programs, international training and conferences.

Monitoring of the Program Quality

The monitoring and the periodical assessment of the Master's Program in Data Science shall be performed with the participation of academic/invited, administrative/assistant personnel, students, alumni, employers and other interested persons, through systematic collection, processing and analysis of information. Based on the assessment outcomes, when necessary, the program will be modified/developed.

The Quality Enhancement Department performs regular analysis and other activities intended for the quality enhancement, which consist of the following surveys:
- Assessment of the course and lecturer by the student (once per semester);
- Assessment of the educational program by the students (last year);
- Institutional assessment of the University by students (once in a year);
- Assessment of the practice component by the students (upon the completion of the practice);
- Assessment of the supervisor of the master's thesis by the student (upon the completion of the master's thesis);
- Survey of alumni (after six months from the completion of the program);
- Survey of employers (once in a year);
- Self-assessment of the course (once per semester by the lecturer)
- Self-assessment of the program (once in a year by the program supervisor)

Each survey is analyzed and the tendencies are determined across the University. Also, at the level of structural units, faculties and educational programs. The surveys and studies enable the conducting of the comparative analysis between the faculties and the educational programs. The comparative analysis is performed by the Quality Enhancement Department and the results are provided to all interested persons. The Quality Enhancement Department plans the organization of trainings with the personnel and students involved in the quality assurance processes in order to further reinforce the processes for their active participation in these processes.

Curriculum Annex N1

Human resources Annex N2