Caucasus University

Bachelor's Program in
Energy and Electrical Engineering

Caucasus University
Caucasus School of Technology

Program Name in Georgian	
	Energy and Electrical Engineering
Program Name in Georgian	
	ენერგეტიკა და ელექტროინჟინერია
Degree level	
	Bachelor's
Type of the educational program	
	Academic
Instruction Language	
	Georgian
Expected Qualification	
In English:	Bachelor of Engineering in Energy and Electrical Engineering, 0713
In Georgian:	ინჟინერიის ბაკალავრი ენერგეტიკასა და ელექტროინჟინერიაში, 0713
Date of Program Approval	
	Order #01/01-43, 03.11.2023
Academic head of the Program	
	Porfessor Giorgi Arziani, PhD.
Program Volume in Credit Hours	

The Bachelor's Program in Energy and Electrical Engineering comprises 240 credits. 1 ECTS equals to 25 hours, which includes class hours and time spent on independent work (midterm and final examinations, as well as homework assignments).
Consequently, the standard official duration of the Bachelor's Degree Program is four years, but maximun six years. After expiration of the standard duration of the Bachelor's Degree Academic Program, the students having academic debts, with the view of completing the program, are allowed to continue education through additional semesters by retaining the student's status.

The program is envisages a narrow sphere and free components learning courses:

<u>Learning courses of narrow sphere (199 ECTS credits):</u>

- Mandatory learning courses -170 ECTS
- Optional learning courses - 29 ECTS

<u>Learning courses of free component (41 ECTS credits):</u>

- Mandatory learning courses of university - 20 ECTS
- Optional learning courses of university - 15 ECTS
- Free credits – 6 ECTS

Admission Requirements

- Any person having a secondary education is entitled to enroll in the Undergraduate Program in Energy and Electrical Engineering.
- The precondition for admission to the program is to pass the Unified National Examination. Any exceptions to the Law on Enrolment at Higher Education Institutions are allowed only in the cases prescribed by Law.
- At the national exams, it is mandatory to pass the mathematics or physics exam from the optional subjects.
- A person authorized to enroll in the program without passing the unified national exams passes an internal exam in mathematics or physics established by the university.
- Mobility to the program is allowed in accordance with the procedures set by the relevant law

Program Description

Program Objectives

The objectives of the Program in Energy and Electrical Engineering are to:

- Provide students with the opportunity to gain a wide breadth of knowledge of power and electrical engineering which, prepares the individual to continue their studies in Master's programs and/or occupational work in their respective field.
- Give the students education based on the fundamental theories and principles of mathematics, electrical, and power engineering, which will give them the opportunity to develop professionally and make their own contribution to the development of the field.
- Prepare a high-level, competitive specialist equipped with wide range of knowledge and practice-oriented transferrable skills which are necessary for the modern energy sector.

Learning Outcomes

Upon completion of the Bachelor's degree program in Energy and Electrical Engineering, the graduate will acquire the following competencies:

1. Describes the basic concepts of power and electrical engineering. Based on the theoritical knowledge in mathematics, physics, and engineering defines the theoritical aspects of the field.
2. Describes power grid and power system design and operational principles.
3. Selects optimal methods and uses them for complex engineering and power engineering problem solving.
4. Uses modern power system multi-domain modeling and simulation methods and instrumentations effectively.
5. Defines basic configurations for relay protection devices and develops basic operational logic for various types of relays.
6. Utilizes power plant and substation control and monitoring systems, also uses central SCADA/EMS basic functions and relevant operational algorithms.
7. Evaluates development-oriented learning process, constant professional learning and the importance of gathering new knowledge, performs oral and written communication effectively.
8. Evaluates and shares the values, ethical and moral responsibilities associated with power and electrical engineering.

Building a Career

The obtained degree will allow the graduate to be employed in various types of organizations, be it a government structure, a private business company, a non-governmental organization or others. After completing the program, the graduate will be able to find employment in the field of energy. in the areas of production, transmission and distribution of electric energy. Also, in local and international energy consulting companies and large enterprises.

Study Continuation Opportunities

The program graduates can continue their studies at any of Master's Degree programs in Georgia or abroad, in accordance with the regulation required by the law.

Student Evaluation and Grading System

The aim of the evaluation is to assess to what extent the learning outcomes prescribed by the syllabus are reached. The student's evaluation consists of multiple components and evaluates the course goals and learning outcomes by applying measurable criteria and appropriate rubrics. The student's evaluation is based on four major principles: objectivity, trustworthiness, validity and transparency.

The students are evaluated according to two sets of evaluation: summative and formative. The aim of the summative assessment is to accurately evaluate the student's performance. It monitors quality of learning and the level of the student's achievement in relation to the goals set by the course. The formative assessment is oriented on the student's development. It gives students appropriate feedback on their achievements.

The evaluation system includes 100 points and envisages:

a) Five types of positive grades:

a.a) (A) Excellent – 91-100 points of assessment;

a.b) (B) Very good – 81-90 points of maximal assessment;

a.c) (C) Good – 71-80 points of maximal assessment;

a.d) (D) Satisfactory – 61-70 points of maximal assessment;

a.e) (E) Sufficient – 51-60 points of maximal assessment;

b) two negative grades:
b.a) (FX) Did not pass – 41-50 points of maximal assessment, which means the student needs to work harder and is allowed to retake the exam one more time after working independently;
b.b) (F) Fail – 40 points or less of maximal assessment, which means the student's work is insufficient and he/she has to retake the course.
Students are awarded credits on the basis of the final evaluation comprising the scores of the interim and final exam assessments.
The attainment of student's learning outcomes considers the interim and final evaluations, for which relative proportions out of the total score (100 points) and a minimum competence level are allocated. Namely, out of 100 points, the interim results are allocated 70 points, while the final exam results are 30 points. In both of the components (interim and final) the minimum competency barrier to be reached is 51%. The interim evaluation includes assessment components, the total of which is 70 points. For each assessment component, the evaluation is based on the pre-determined learning goals, task-oriented clear criteria and the learning rubrics drawn on their basis.
In the interim results Freshmen student (except B2 level English groups) has to accumulate at least 51% of the 70 points to be allowed to take the final exam. The student's final examination is passed, if he/she gets at least 51% of the total 30 points,
For All the rest the student has to accumulate at least 59% of the 70 points to be allowed to take the final exam. The student's final examination is passed, if he/she gets at least 60% of the total 30 points.
In case the student fails to overcome the minimum competency barrier of the final exam, he/she is allowed to retake the final examination. The student shall retake the final examination within the period prescribed by the academic calendar no later than 5 days after announcement of the results of the final exam.
In case the student totally scores 0-50 points or fails to overcome the minimum competency barrier set for any form of the evaluation (Interim/Final exam), he/she shall be given a grade of "F-0".

Teaching and Learning Methods

Different teaching methods are employed during the teaching process depending on the topics covered. Those include:
Discussions/debates – one of the most common methods of interactive teaching. Quality of Students' involvement is higher; classes are more dynamic and students are more active. Any discussion can turn into a debate. The method allows professors to give questions and get answers and enables students to develop skills of discussion and debates and prepares them for justifying their opinions and points.
Team (Collaborative) work - the method implies dividing students into teams and assigning different tasks to them. Each team member works on the task individually and shares his/her ideas with the rest. Depending on the type of task, team members can change tasks and roles. The strategy ensures students' maximum involvement in the learning process.
Problem Based Learning (PBL) – a problem is given and analyzed in order to acquire knowledge.
Cooperative Learning – where the whole class is responsible not only for his/her own learning and understanding of the subject matter but also for aiding and assisting others in better understanding it. Each student works on a problem until he/she fully understands everything.
Heuristic method – is largely incremental. Students are to discover facts on their own and make links between them.
Case Studies – Professors and students discuss a particular case and fully comprehend an issue at hand. In Medicine it can be discussion of the medical record of a particular patient, in Political Science it can be analysis of a conflict between any two countries (e.g., Armenia-Azerbaijan), etc.
Brain storming – the method facilitates to generating as many ideas about a particular topic as possible. The method encourages creativity; it is particularly efficient with a large group of students and consists of a few stages:

- Creative approach to a problem/issue
- Listing the ideas generated, without any criticism, on the board.
- Identifying the ideas most closely linked with the problem/issue;
- Identifying criteria for finding which idea is more relevant to the issue/problem at hand;
- Evaluating selected ideas according to pre-selected criteria;
- Selecting the best idea – the one having the best evaluation or meeting most of the criteria;

Role play – students are assigned different roles, which allows them to look at a problem from different perspectives. Like debates, role play also helps students develop skills needed for giving their opinion and justifying their judgments.
Method of Demonstration – displaying visual materials. In majority of cases it is better to give students both audio and visual material simultaneously; the material can be given by both - professors and students; the method implies giving visual information on the whiteboard or carrying out a complex laboratory experiment.

Induction, Deduction, Analysis, Synthesis.
A deductive approach means that the teacher gives students a new concept, explains it and then has the students practice using the concept.
In contrast with the deductive method, inductive instruction makes use of student "noticing". Instead of explaining a given concept and following this explanation with examples, the teacher presents students with many examples showing how the concept is used. The intent is for students to "notice", by way of the examples, how the concept works and fits together.
With the method of analysis a problem is disintegrated into components. This method facilitates to comprehensive analysis of each of the constituent elements of a more complex problem.
Method of synthesis is opposite of the process of analysis. One whole is made by grouping its constituent elements, which allows students to look at a problem as one whole.
Explanatory method – discussing a particular issue, i.e., professor provides examples and discusses all sides and details.
Action-oriented teaching – requires active participation of both professor and students where major emphasis is put on practical interpretation of theoretical knowledge.
E-learning - The method combines three ways of instruction
Teaching methods complement each other during the teaching process. Course syllabus provides detailed information about teaching methods used.

Human Resourses

The Program is implemented by the Academic and Invited Personnel: 10 (9 affiliated) Professors, 3 (1 affiliated) Associate Professors, 1 affiliated Assistant-Professor, and 34 Invited Lecturers, who, according to their quialification are ready to help students in developing the competencies, difined by the program.

Program Curriculum

№	Course Code	Prerequisite	Course	Year								ECTS
				I		II		III		IV		
				Semester								
				I	II	III	IV	V	VI	VII	VIII	
Learning courses of narrow sphere												
Mandatory learning courses -170 ECTS												
1.	MATH 0003		Calculus I	x								5
2.	CTC 1141		Fundamentals of Programming I	x								5
3.	MATH 0004	MATH 0003	Calculus II		x							5
4.	MATH 1240		Discrete Mathematics		x							5
5.	PHYS 1240	MATH 0003	Principles of Physics		x							5
6.	CTC 1243	CTC 1141	Fundamentals of Programming II		x							5
7.	PES 1240		Primary Energy Sources		x							5
8.	MATH 0002	MATH 0004	Linear Algebra			x						5
9.	ELC 2141		Electronic Components and Sensors			x						5
10.	ELC 2140	PHYS 1240	Electronics			x						5
11.	HET 2140		Hydropower Machines			x						5
12.	HET 2141		Thermal Power Machines			x						5
13.	WST 2240		Wind and Solar Power Machines				x					5
14.	ETM 2241		Electric Materials				x					5
15.	ELC 2241	PHYS 1240	Electrical Circuits I				x					5
16.	ELM 2242		Electrical Machines				x					5
17.	PST 3240	MATH 0003	Probability and Statistics					x				6
18.	ELC 3141	ELEC 2241	Electrical Circuits II					x				6
19.	PPS 3140	ELEC 2241	Power Plant and Substation Machines and Electrical devices					x				6
20.	OHL 3141	ELEC 2241	Transmission Lines					x				6
21.	EPS 3142	ELEC 2241	Electrical Power Systems					x				6
22.	POE 3240	ELC 3141	Power Electronics						x			6
23.	SSR 3241	EPS 3142	Steady-state Electrical Regimes						x			6
24.	OVP 3242	PPS 3140	Overvoltage and Protection						x			6
25.	SMS 3243	EPS 3142	Electrical Systems Modeling and Simulation						x			6
26.	ERP 4140	ELEC 3141	Relay Protection in Electrical Systems							x		6

№	Course Code	Prerequisite	Course	Year								ECTS
				I		II		III		IV		
				Semester								
				I	II	III	IV	V	VI	VII	VIII	
27.	ERA 4141	ELEC 3141	Relay Automation in Electrical Systems							x		6
28.	EPQ 4142	ELEC 3141	Electrical Power Quality							x		6
29.	PSA 4143	EPS 3142	Power System Analysis							x		6
30.	BPR 4242		Bachelor's Thesis								x	12
Optional learning courses – 29 ECTS												
31.	CMS 2243	EPS 3142	Control and Monitoring Systems				x					5
32.	ELF 2244		Fundamentals of Energy Law									5
33.	ENE 3144	PES 1240	Energy Economics						x			6
34.	EEM 3145	PES 1240	Energy Markets						x			6
35.	PSC 3143	EPS 3142	Power Systems Cybersecurity						x			6
36.	REFM 3244		Financial Management of Renewable Energy						x			6
37.	PSD 3245	EPS 3142	Power System Dynamics						x			6
38.	EPM 3246	ELEC 3141	Electrical Power Metering						x			6
39.	SCSP 3246	EPS 3142	Short-circuits in Power Systems						x			6
40.	PRW 3240		Specialization Project						x			6
41.	HVDC 4144	POE 3240	HVDC Systems							x		6
42.	PPM 4145		Power Project Management							x		6
43.	FACT 4146	POE 3240	FACTS Systems							x		6
44.	EMA 4147		Energy Management							x		6
45.	EED 4148	PPS 3140	Electrical Equipment Diagnostics							x		6
46.	ESS 4149	EPS 3142	Energy Storage Systems							x		6
47.	ELE 4243		Energy Law Europeisation								x	6
48.	LAER 4244		Legal Approximation and Energy Reform								x	6
49.	PSP 4245	EPS 3142	Power System Planning								x	6
50.	ETP 4246	ELEC 3141	Electromagnetic Transient Processes								x	6
51.	EMP 4247	ELM 2242	Electromechanical Transient Processes								x	6
52.	PSD 4248	EPS 3142	Power Systam Dispacth Control								x	6
53.	DEM 4249	EPS 3142	Distributed Generation and Microgrids								x	6

№	Course Code	Prerequisite	Course	Year								ECTS
				I		II		III		IV		
				Semester								
				I	II	III	IV	V	VI	VII	VIII	
Mandatory learning courses of university – 20 ECTS												
54.	CIS 1140		Computer Skills and Office Applications	x								5
55.	ACWR 0007		Academic Writing	x								5
56.	ENGL 0007	ENGL 0006	General English B2.0	x								5
57.	ENGL 0008	ENGL 0007	General English B2		x							5
Optional learning courses of university – 15 ECTS												
58.	HIST 0001		Introduction to World History & Civilization	x								5
59.	POLS 0002		Political Science									5
60.	HIST 0003		History of Georgia									5
61.	SOCI 0004		Sociology									5
62.	PHIL 0005		Philosophy									5
63.	PSYC 0006		Psychology									5
64.	ENTP 0009		Entrepreneurship									5
65.	ENGL 0005		General English B1.0 [1]	x								5
66.	ENGL 0006	ENGL 0005	General English B1		x							5
67.	ENGL 0009	ENGL 0008	General English C1.0			x						5
68.	ENGL 0010	ENGL 0009	General English C1				x					5
Free Course – 6 ECTS												
69.			Free Course[2]					x				
			ECTS Credits Per Year	60		60		60		60		
			Courses Per Year	12		12		10		9		

[1] General English Language B1 Level is mandatory for those students who have competency lower, than the Level B2.

[2] Student can take courses in terms of "Free Course" from the other Bachelor's degree programs and/or form the Elective Specialization Courses in this program.