საქართველოს ტექნიკური უნივერსიტეტი
GEORGIAN TECHNICAL UNIVERSITY

Approved by
Resolution № 01-05-04/179 of the
Academic Council of GTU
Dated July 22, 2019

Amended by
Resolution № 01-05-04/14 of the
Academic Council of GTU
dated February 14, 2023

Bachelor's Educational Program

Program Title

ელექტრული და ელექტრონული ინჟინერია
Electrical and Electronic Engineering

Faculty

ენერგეტიკის
Power Engineering

Program Head/Heads

Professor Simon NEMSADZE

Qualification to be Awarded and the Extent of the Program in terms of Credits

Bachelor of Science in Electrical and Electronic Engineering The bachelor's qualification is awarded by combining at least 234 credits of education courses and at least 6 credits of free components corresponding to the main field of study.

Language of Teaching

Georgian

Prerequisite for Admission to the Program

The right to study at the undergraduate educational program "Electrical and Electronic Engineering" is only available to the holder of a state certificate confirming complete general education or a person equivalent to it, who is enrolled in accordance with the procedure established by the legislation of Georgia. An additional prerequisite for admission to the program is knowledge of the English language

at the B1 level, or the applicant must have an internationally recognized certificate confirming the knowledge of the English language at least at the B1 level.

Program Description

Electrical and electronic engineering is an integrated field of engineering. The program deals with the technological aspects of electricity, especially the analysis and application of circuits, electrical and electronic devices. It also covers the concept of electricity production, distribution and management. The mentioned engineering field focuses on the research and analysis of the above concept of electricity, which can be achieved by a thorough study of the exact and natural sciences presented in the program in a rather large volume.

Electrical and electronic engineering is offered in various field courses, it combines broad knowledge in the core disciplines of the field of activity such as microprocessor control systems, microcontrollers, electrical energy conversion (electric machines), power electronics, dynamics of power system, analysis of power system, modeling, technical diagnostics of electrical and electronic devices. It should be noted that these courses cover a wide variety of topics, from semiconductors, analog electronics and power system, to transmission lines, digital electronics, DC and AC electrical machines, and control systems. All of the above adds more relevance to the undergraduate educational program.

The idea of implementing an undergraduate Georgian-language educational program "Electrical and Electronic Engineering" at the Faculty of Power Engineering was laid at the end of 2017, which was preceded by a 3-year mutual cooperation with San Diego State University-Georgia, supported by an international project implemented by the "Millennium Challenge Fund - Georgia" (MCA-Georgia) Within the framework of the second compact.

Based on the Memorandum of Cooperation between Georgian Technical University and San Diego State University-Georgia, since 2015 English language program "Electrical Engineering" has been implemented jointly. Experts from the Accreditation Board for Engineering and Technology (ABET) of the United States of America visited the Faculty of Power Engineering for periodical consultations. From their side, familiarization/consultation of documents, appendices, self-assessment report prepared according to ABET standards, monitoring of laboratories, periodical training of academic staff at San Diego State University is underway.

It is also worth noting that a modern laboratory of electrical engineering and electronics was organized with the financial assistance of San Diego State University in the Department of Electrical Engineering and Electronics, which will allow us to conduct various types of laboratory work for the subjects within the scope of this program, namely: Circuit Analysis 1, Circuit Analysis 2, Electrical and Electronic Measurement, Electrical Energy Conversion (Electric Machines), Technical Diagnostics of Electrical and Electronic Devices.

During the program modification process, similar ABET accredited undergraduate programs at the following US universities were studied and analyzed:

1. San Diego State University,
https://www.sandiego.edu/engineering/programs/electrical-engineering/
2. Boston University,
https://www.bu.edu/academics/eng/programs/electrical-engineering/bs/

And similar programs in the following universities:

3. Norfolk State University, USA, https://www.nsu.edu/
4. Kaslik University of the Holy Spirit, Lebanon, www.usek.edu.lb
5. Bilkent University, Turkey, https://catalog.bilkent.edu.tr/dep/d12.html
6. Anna University, India, https://www.annauniv.edu

Program Structure

The undergraduate educational program "Electrical and Electronic Engineering" presents all the important directions of this field (theoretical, technical, practical, applied), with the main emphasis on practical and applied components, which will contribute to the high competitiveness of the graduates of the program in the local and international labor market.

The undergraduate educational program "Electrical and Electronic Engineering" is compiled by the European Credit Transfer and Accumulation System (ECTS). At the Georgian Technical University 1 credit is equal to 25 hours, which includes both contact and independent work hours. The distribution of credits according to subjects is presented in the curriculum. The program lasts 4 years (8 semesters. 60 credits per year) and includes a total of 240 credits. The content, teaching methods and number of credits of the program's courses ensure that the program's objectives and relevant learning outcomes are achieved at a level appropriate to the National Qualifications Framework Bachelor's level descriptor.

Courses of content relevant to the main field of study include: a) compulsory courses of exact and natural sciences - with a total volume of 59 credits and a specific share of 24.6% in the program; b) engineering and computer sciences relevant education courses - 135 credits, including 5 education courses (25 credits) in the form of compulsory elective courses in Georgian and English languages and with a 56.2% share in the program; c) supporting (accompanying) education courses of the main field of study - 40 credits and with a specific share of 16.7% in the program. Free components in the program include 6 credits (2.5%).

The program includes an introduction to a bachelor's thesis (5 credits) with an integrated industrial practice component (15 hours) and a bachelor's thesis (10 credits).

The program offers students compulsory elective study components (25 credits) in Georgian and English languages, corresponding to the main field of study:

- Circuit Analysis 2, IV semester - 5 credits;
- Electrical Energy Conversion (Electrical Machines), V semester - 5 credits;
- Power System Modeling and Simulation, VI semester - 5 credits;
- Power System Protective Relaying, VII semester - 5 credits;
- Power System Planning, VII semester - 5 credits;

After accumulating 240 credits provided by the program, the student is awarded the qualification provided by the bachelor's program - "Bachelor of Science in Electrical and Electronic Engineering".

Organization of the educational process, assessment of student achievements, educational and financial agreements with students, accumulation of credits by the student and other necessary information is provided in the "Instructions for managing the educational process at the Georgian Technical University", which is posted on the website of GTU: https://gtu.ge/ Study-Dep.

Program Objective

The objective of the undergraduate educational program is to:

- To prepare students for a successful career in the electrical and electronic industry in accordance with the requirements of the labor market and to encourage them to complete their higher education; provide a broad knowledge of the natural sciences and mathematics necessary to formulate, solve and analyze electrical and electronic problems;
- To equip the student with a broad knowledge of the theoretical foundations of the field of electrical and electronic engineering, which includes a critical understanding of theories and principles; to develop the skills of identifying complex engineering problems, finding ways to solve them, ensuring efficient operation of electrical equipment using engineering principles:

in the areas of electrical circuit analysis, electromagnetic field theory, power system, microprocessor control systems, electrical energy conversion (electric machines), electrical and electronic device diagnostics, electronics fundamentals and power electronics, engineering project management and their application in power system.

- To ensure the increase of students' awareness in order to protect professional ethics in continuous learning and activities, to create the necessary basis for programming computer platforms and software in electrical and electronic engineering, as well as to provide knowledge of the principles and methods of information security (cyber security) protection, in the relevant field of technology.

Learning Outcomes/Competences (general and professional)

1. On the basis of extensive knowledge obtained in exact and natural sciences, explains the theoretical aspects of the processes in electrical and electronic engineering systems, namely: uses differential equations, integrals, vectors, matrix theory, probability theory and Laplace and Fourier transforms to identify and solve engineering problems;
2. Describes the principles of operation of electrical and electronic devices and systems, three-phase circuits, transformers, alternating current and direct current machines, synchronous generators and motors, controllers, microprocessors, power SCADA systems, and possesses the theoretical bases of calculating the electrical processes taking place in them;
3. Connects the basic principles of operation, programming, modeling and calculation of electrical networks, hardware and nodes;
4. Selects and uses a computer platform and software for engineering tasks, namely: with the applied software packages LabVIEW, MULTISIM, Matlab, analyzes the operation of electrotechnical devices, calculates their parameters and compliance with standards, evaluates the suitability/correctness of devices with the help of computer programs and technical diagnostics;
5. Calculates the inductance and capacitance of simple and complex, non-linear electric and magnetic circuits, as well as the basic parameters of simple electronic circuits, steady and transient modes of direct and alternating current electronic devices; uses the obtained results in computer modeling and processing of electrical and electronic systems;
6. Effectively and creatively uses modern modeling and simulation software of electrical networks and systems: (Digsilent power factory, EMTP/RV, PSS/E) for design, diagnosis, planning and multidomain analysis;
7. Collects data in order to identify clearly defined problems specific to the field of electrical and electronic engineering and to determine ways to solve them, and based on their analysis makes appropriate conclusions to improve the technical condition of electrical equipment, networks and systems, performance, regulation of working parameters and technical characteristics of the system;
8. Creates the general design of engineering electrical and electronic devices and systems in accordance with predetermined guidelines and ensures their proper functioning, works effectively in a group, in a complex, unpredictable work environment, taking into account social and ethical norms;
9. Consistently and multifacetedly evaluates and plans development-oriented own learning process; independently decides the need to continue studying in the master's degree and tries to acquire new knowledge gained in the field;
10. When performing professional activities, is responsible for environmental and labor protection issues, rules and norms of industrial safety and fire protection, principles and

methods of information security (cyber security) protection.

Methods of Achieving Learning Outcomes (teaching-learning)

☒ Lecture ☒ Seminar (group work) ☒ Practical ☒ Laboratory ☒ Practice
☒ Course work/Project ☒ Consultation ☒ Independent work

In the learning process, depending on the specifics of a particular study course program, the following activities of the teaching-learning methods are used, which are outlined in the relevant study course programs (syllabi):
Discussion/debate, Cooperative learning, Collaborative work, Problem-based learning (PBL), Case study, Brain storming, Demonstration method, Inductive method, Deductive method, Method of analysis, Synthesis method, Verbal or oral method, Writing work method, Explanatory method, Activity-based learning, Project development and presentation.

Student's Knowledge Assessment System

The student's knowledge is assessed on a 100-point scale.
Positive grades are:

- (A)-Excellent - 91-100 points;
- (B)-Very Good – 81-90 points;
- (C)-Good – 71-80 points;
- (D)-Satisfactory – 61-70 points;
- (E)-Sufficient – 51-60 points.

Negative grades are:

- (FX) - Failed to pass – 41-50 points, which means that the student needs more work to pass and is allowed to take an additional exam once with independent work;
- (F) - Failed - 40 points or less, which means that the work done by the student is insufficient and he/she will have to study the subject again.

In the component of the educational program, in case of FX, an additional exam is prescribed, not less than 5 days after the announcement of the results.

The number of points obtained in the final assessment is not added to the grade received by the student in the additional exam.

The grade obtained on the additional exam is the final grade and is reflected in the final grade of the educational program component.

In case of receiving 0-50 points in the final evaluation of the educational component, or if the student fails to overcome the minimum competence limit in the final/additional exam, the student will be assigned a grade of F-0.

Assessment of the level of achievement of student learning outcomes in each component of the program includes mid-term and final assessment. The mid-term assessment in turn includes the ongoing activity and the mid-semester exam.

Each assessment form and component has a specific share in the final assessment from the total assessment score (100 points). In particular, the maximum score of the midterm assessment is 60, and the maximum score of the final exam is 40. Each form of assessment has a minimum competence limit,

which is reflected in the program (syllabi) of each education course.

The right to pass the final exam is granted to a student who has accumulated at least a minimum positive grade in the component(s) of the intermediate evaluations in accordance with the program of the education course, and has completed and submitted on time the minimum amount of work defined by the program in the form of documentary material.

Detailed information on the organization of the educational process and evaluation of student achievements is provided at the following electronic address: "Instructions for managing the educational process at the Georgian Technical University " https://gtu.ge/StudyDep/Forms/Forms.php

Fields of employment

Power system; installation and distribution companies; innovative and engineering development companies, diagnostic centers for electrotechnical equipment, natural gas supply systems, service centers; electrotechnical equipment installation, repair, construction and manufacturing factories, firms and bureaus, sectoral design organizations.

Opportunities for continuing education

Master's degree educational programs

Human and material resources needed to implement the program

The program is provided with appropriate human and material resources. Additional information is provided in the attached syllabus.

Number of attached syllabi: 57