



Bachelor's Educational Program

Program Title

ენერგეტიკა და ელექტროინჟინერია

Energy and Electrical Engineering

Faculty

ენერგეტიკის

Power Engineering

Program Head/Heads

Professor Tengiz MUSELIANI

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

Bachelor of Energy and Electrical Engineering

The qualification will be awarded by combining 212 credits of education courses and 28 credits of free components, in case of completion of 240 credits.

Language of Teaching

Georgian

Prerequisite for Admission to the Program

Only the holder of a state certificate confirming complete general education or a document equivalent to it, who is enrolled in accordance with the procedure established by the legislation of Georgia, has the right to study at the bachelor's level.

Program Description

Energy is a necessary prerequisite for social and economic well-being. Accordingly, the main task of the energy strategy is to provide the country's population and business sector with safe, clean and affordable energy. In this regard, the main challenge of the energy strategy is not only the alignment of the development of the energy system with the economic development of the country, but also the sustainable development of the sector taking into account the growth of energy consumption.

In order to solve the mentioned tasks, the undergraduate educational program "Energy and Electrical Engineering" at the Georgian Technical University serves to prepare qualified personnel for the free labor market, which prepares specialists with a bachelor's degree in energy and electrical engineering.

The program 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 of the program's education courses, teaching methods and the number of credits ensure the achievement of the goal of the bachelor's program.

Program structure

The program consists of 212 credits of courses corresponding to the main field of study, (including compulsory (169 credits), elective (43 credits) and free components (28 credits).

The program includes 5 elective concentrations. The amount of each concentration, including the thesis, is 30 credits. Production practice (5 credits) is provided within the program.

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 are 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/Forms/Forms.php](https://gtu.ge/Study-Dep/Forms/Forms.php)

Program Objective

- To provide the student with broad knowledge in modern technologies of production, transmission, distribution, consumption and transformation of thermal and electric energies into other energies, which includes general engineering education, design, installation, maintenance, testing and operation, economic and ecological aspects of thermal, hydro and electric power plants, power stations and substations, electric machines and devices, electrotechnical materials, energy-efficient technologies and the elements and nodes included in them;
- To develop engineering-practical skills to solve tasks and problems in industrial and commercial enterprises, as well as to carry out installation, maintenance, repair and fault diagnosis of electrical wiring and electrical devices in household conditions;
- To equip graduates with competencies compatible with the requirements of the labor market in the field of energy and create a basis for further education and professional development.

Learning Outcomes/Competences (general and professional)

Bachelor of Energy and Electrical Engineering:

1. Describes the types of energy sources and the conditions for their effective use. Classifies energy objects;
2. Explains the purpose and principles of operation of thermal, hydro and electric energy devices. Owns modern methods of calculating their work modes;

3. In accordance with the predetermined instructions, analyzes the electrical, thermal and hydrodynamic processes taking place in the power plants. Forms appropriate conclusions;
4. Uses appropriate physical-mathematical and engineering knowledge, computer technologies, modern methods and tools of practical engineering activities to solve the tasks of calculation and analysis of electrical devices, objects and systems;
5. Solves the basic practical tasks in accordance with the calculation of the operating modes of power plants and their characteristics;
6. In accordance with predetermined instructions, designs and/or installs, maintains, tests and operates the elements included in electric, thermal and hydropower installations;
7. Determines ways to reduce heating costs and/or energy balance of industrial facilities, energy consumption norms, taking into account electrical and thermal loads. Collects data for the energy passport of objects;
8. Together with a group of specialists, carries out the modernization of energy facilities and their separate devices; works effectively in a group in a complex, unpredictable work environment, taking into account social and ethical norms;
9. Prepares a written report/presentation about ways to solve existing problems, both for energy field specialists and non-specialists, using modern communication technologies;
10. Conducts development-oriented activities in the field of power engineering and electrical engineering in accordance with ecological and economic aspects, energy-efficient and energy-saving technologies, labor protection, electrical safety and technical operation norms. Plans his/her continuing professional development and identifies learning needs.

Concentration 1. Thermal energy

1. Based on broad knowledge of the field, describes the methods of heat energy generation and transformation, the processes taking place in heat energy installations, their construction schemes, working principles, modes and results of environmental impact. Establishes the main goals of energy audit, methods of thermal diagnostics and energy saving.
2. In accordance with the predetermined instructions, based on the collected data, calculates the characteristics of the thermal power plants and forms appropriate conclusions about the effectiveness of their work, taking into account the energy saving and environmental tasks. Participates in operation, repair, planned and emergency stop-start works of thermal energy installations and devices.
3. Complying with professional ethics, prepares a report on the energy-efficient operation of thermal power plants and presents it to both the professional and the interested public.

Concentration 2. Power plants, networks and systems

1. Describes the types of relay protection and their purpose in the electrical network. Characterizes the insulation systems of devices. Explains the main causes of transient processes in the electrical system, the essence of internal and external overvoltages and their negative impact. Establishes the basic principles and methods of electrical system design.
2. For small electrical systems, calculates electrical modes, values of short-circuit currents, selects basic parameters of drainage, switching and power equipment and analyzes the results in relation to energy efficiency. Performs modeling and simulation of atmospheric and switching overvoltages. Selects a relay protection device in simple networks. Participates in the installation and operation of equipment.
3. Prepares a written report on ways to solve technical challenges in the electric power industry. Creates and presents a presentation on normal and emergency modes of an electrical system.

Concentration 3. Hydropower

1. Based on extensive knowledge in the field of hydropower, describes the methods of using and transforming hydraulic energy, the principles of operation of hydropower installations and construction schemes. Owns the modern methods of determining the energy characteristics of various types of hydromachines and the main hydrological indicators of the river, methods of calculating the operating modes of hydromachines.
2. In accordance with the plan, calculates individual elements of different types of hydraulic machines. Participates in installation, repair and rehabilitation works, in the management of hydro units, in the process of passporting of hydropower facilities. Analyzes and develops draft conclusions about problems related to hydromachines, hydrological characteristics of the river, taking into account environmental requirements.
3. Qualifiedly presents information to the power engineering community or non-specialists about ways to solve local problems related to hydropower.

Concentration 4. Power supply and power consumption technologies

1. Describes the principles of operation of complexes of electrotechnological devices and automated electromechanical systems, electrical and electromechanical processes and modes of operation in their power elements, selects protection schemes and control systems for their power parts and individual elements.
2. Participates in the design of working and emergency modes of power supply voltage of different levels, electrical lighting networks, installation and selection of relay protection systems, repair and operation works of electrotechnological installations, complexes, cities and settlements. Selects switching equipment and tests for thermal and dynamic stability against expected short-circuit currents. Calculates the reactive power required by the electrical equipment from the network and sets the parameters of the compensating device.
3. In compliance with professional ethics, prepares a written report regarding the technologies of power supply and power consumption and properly presents it to the power engineering society or non-specialists.

Concentration 5. Electromechanics

1. Describes the features of constructions of electric machines and devices, the principles of operation, the physical process of energy conversion and the electromagnetic, electromechanical and thermal phenomena taking place in them in different modes of operation. Characterizes the modes of operation of electric machines and devices, rules of operation, types of tests and norms.
2. Calculates the structural and electrical parameters of the main nodes of electric energy conversion, different types of electric machines, energy losses in them. Participates in the design, installation, testing and operation of electrical machines and devices.
3. In accordance with professional ethics, prepares a written report on electromechanics, including the conversion of electrical and mechanical energies, and properly presents it to the power engineering community or non-specialists.

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 case of FX, an additional exam is prescribed, not less than 5 days after the announcement of the results. The mark obtained in the additional exam is not added to the mark obtained in the final assessment.

Detailed information is provided on the website of GTU:

Fields of employment

Graduates will be able to find work in: hydro and thermal power stations; in electrical systems; in power supply networks of cities, industries and villages; in distribution companies; in pumping stations of water supply systems of cities and regional centers and enterprises: in metropolitan and railways; in energy equipment diagnostics and certification centers; in agricultural products processing enterprises; in natural gas supply systems; in operational and service centers of thermal energy systems; in gas station compressor stations; in main pipeline systems of water, oil and petroleum products and their pumping stations; in energy equipment installation, repair, construction and manufacturing factories, firms and bureaus; in sectoral project 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 documents.

Number of attached syllabi: 113