საქართველოს ტექნიკური უნივერსიტეტი
GEORGIAN TECHNICAL UNIVERSITY

Approved by
Resolution № 1028 of the
Academic Council of GTU dated
December 16, 2013

Amended by
Resolution № 01-05-04/196 of the
Academic Council of GTU dated
December 8, 2022

Bachelor's Educational Program

Program Title

ბიოსამედიცინო ინჟინერია
Biomedical Engineering

Faculty

ინფორმატიკისა და მართვის სისტემების ფაკულტეტი
Informatics and Control Systems Faculty

Program Head/Heads

Professor Zviad GHURTSKAIA

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

Bachelor of Science in Biomedical Engineering

will be awarded by combining the 230 credits in the program and free components (10 credits) if at least 240 credits are completed.

Language of Teaching

Georgian

Prerequisite for Admission to the Program

Only the holder of a state certificate proving complete general education, or an equivalent person enrolled in accordance with the procedure established by Georgia law, shall have the right to study at the Bachelor's Educational Program.

Program Description

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, education methods and the number of credits ensure the achievement of the objective. For the purpose of obtaining a bachelor's degree, a student must master 240 credits, of which 230 credits belong to main specialty, which includes: compulsory and elective courses of mathematics, physics, biological sciences, information technology, general engineering and biomedical engineering, as well as elective courses of university general education, and 10 credits belong to free components. Two elective modules of the core specialization are offered in the program:
Elective module 1 – "Medical computer systems";
Elective module 2 - "Medical informatics".

The annual education process includes two semesters, the duration of which is 21 weeks. Student evaluation is done through ongoing activities, mid-semester exams and final/supplementary exams. Educational process is carried out for 15 weeks. Mid-semester and final exam dates are regulated every year. A student who has gained at least 21 points with intermediate evaluations has the right to pass the final exam. The minimum positive grade of the final/supplementary exam is 7.5 points. In a semester, a student has 30 credits to gain according to the curriculum and, accordingly, 60 credits in a year. The student's knowledge is assessed with a maximum of 100 points, 30 of which are evaluated during 15 academic weeks (homework, tests, presentation in class, participation in team or individual projects, etc.). Forms of mid-semester and final exam evaluations differ for various courses and are detailed in the course syllabus.
The education program includes different targeted education courses depending on the semesters.
I semester – Mathematics, Natural sciences, information technologies, general university courses - 30 credits in total.
In the II-V semesters, students will also study mathematics and natural sciences courses, compulsory and elective courses of general and basic engineering specialties, as well as general university elective courses. In the IV and V semesters, the program provides free components - 10 credits in total.
In the VI semester, students are required to take three compulsory core biomedical engineering courses (15 credits in total), and an elective course in biomedical engineering (5 credits). In the same semester, the compulsory component for students is the group project education course - 10 credits.
In the VII-VIII semester, students master the main specialty education courses according to the chosen modules. In both modules, in the VIII semester, 10 credits are allocated to the final project.
A necessary component of the education program is the performance of a group project (VI semester), which in turn is a prerequisite for the completion of the final project (VIII semester). The final project defense/examination includes a written report and a presentation.

The program is prepared in accordance with ABET accreditation standards and is equivalent to ABET http://www.abet.org accredited biomedical engineering undergraduate programs:

1. Illinois University of Technology (USA) https://engineering.iit.edu/bme
2. Louisiana Tech University (USA) http://coes.latech.edu/biomedical-engineering
3. Johns Hopkins University (USA) https://www.bme.jhu.edu/undergraduate/degree-requirements
4. Michigan Technological University http://www.mtu.edu/biomedical/department/what-is

Bachelor's educational program website:
http://biomedeng.gtu.ge/programebi.html
https://bmegtu.wordpress.com

Program Objective

Objective 1: To educate professionals who will engage in professional practice as biomedical engineers and/or biomedical scientists in professional settings involving human health and well-being;
Objective 2: To prepare staff oriented to professional career advancement;
Objective 3: To prepare graduates who will engage in professional development, or postgraduate education, to continue their development in biomedical engineering or other fields

Learning Outcomes/Competences (general and professional)

1. Possesses the ability to identify, formulate and solve complex engineering problems using the principles of engineering, science and mathematics;
2. Makes decisions using engineering design that meet specific needs in terms of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors;
3. Establishes effective communication skills with a wide range of audiences;
4. Adhering to ethical and professional responsibility, he/she makes informed judgments about engineering situations and decisions, taking into account the impact of engineering decisions on the global, economic, environmental and social context:
5. Effectively functions in a team whose members together provide leadership, create a collaborative inclusive environment, set goals, plan tasks and ways to solve them:
6. Develops and conducts relevant experiments, uses the ability to analyze and interpret data. To make engineering judgment conclusions:
7. Acquires new knowledge as needed and uses it to determine appropriate learning strategies.

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 teaching-learning methods are used, which are given in the relevant education course programs (syllabi):

1. Discussion/debates;
2. Cooperative teaching;
3. Collaborative work;
4. Problem-based learning (PBL);
5. Case study;
6. Brain storming;
7. Demonstration method;

8. Inductive method;
9. Deductive method;
10. Method of analysis;
11. Synthesis method;
12. Verbal or oral method;
13. Method of written work;
14. Explanatory method;
15. Action-oriented learning;
16. 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 held, 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 GTU website: Instruction for managing the educational process at the Georgian Technical University https://gtu.ge/Study-Dep/Forms/Forms.php

Fields of Employment

The biomedical engineering field is one of the fastest growing and in-demand new jobs in the world job market. https://money.usnews.com/careers/best-jobs/biomedical-engineer

With the knowledge acquired within the mentioned program, graduates can be employed in organizations and companies where medical equipment, devices and systems are used: in hospitals and clinical-diagnostic centers, in engineering-practical firms, in the field of installation, preventive and service services of medical equipment and systems ("Ivermedi ", "Global Med", "Advanced Medical Technologies and Service", "Tbilmedservice", "Geomed","Medservice" and others). Graduates will be able to participate in the implementation of projects in the public-corporate sector. They can also take a large part in the processes of equipping and rearming hospitals with medical equipment. In the Georgian representative offices of foreign companies producing medical equipment, both medical equipment service engineers and marketing services. Graduates can also be employed in the field of health information technology - in the direction of health data processing and communication systems, technology use and processing. According to the profile, the graduates can be employed in the institutes of the Georgian Technical University (A. Eliashvili Management Systems, V. Chavchanidze Cybernetics, Biotechnology Center).

Opportunities for continuing education

Master's degree educational programs

Human and material resources needed to implement the program

The program is provided with adequate human and material resources. For additional information, please find the attached documentation.

Number of attached syllabi: 73

Semester 6										
32	Management in medical systems	Human physiology						5		
33	Biomedical devices	Medical instrumentation systems						6		
34	Service of biomedical devices	Medical electronics						5		
35	Methods and means of information protection	Object-oriented programming 1						4		
36	Group project in biomedical engineering	Medical instrumentation systems, medical electronics						10		
Semester 7										
Module 1 Medical computer systems										
37	Mathematical modeling of biomedical systems	Engineering Mathematics-3							5	
Elective 4										
38.1	Medical systems interfaces	Basics of programming (based on C++ language)							5	
38.2	Robotic devices	Medical electronics								
39	Clinical diagnostic laboratory equipment	Biomedical devices							6	
40	Radiological equipment	Biophysics, medical electronics							7	
41	Quality management of medical technical products	Medical electronics							7	
Semester 8										
42	Microprocessor medical systems	Elements and nodes of medical devices								5
Elective 5										
43.1	Artificial organs	Biomedical devices, biomechanics								5
43.2	Materials for medical devices	Biomechanics								
44	Clinical practice	Biomedical devices, biomedical devices service								10
45	Graduation project	A group project in biomedical engineering								10

Semester 7										
Module 2 Medical Informatics										
46	Digital processing of biomedical signals	Biostatistics							5	
Elective 6										
47.1	Telemedicine and mobile healthcare systems.	Biomedical supplier							5	
47.2	Remote medical systems	Biomedical supplier								
48	Medical informatics	Biostatistics							5	
49	Biostatistics (course project)	Biostatistics							5	
50	Medical information systems	Biostatistics							5	
Elective 7										
51.1	Programming in the Visual Studio environment	Object oriented programming							5	
51.2	Bioinformatics in the MATLAB environment	Object oriented programming 1								
Semester 8										
52	Project management	N/A								5
53	Methods of medical-computer diagnostics	Biostatistics								5
54	Administration and Management of Hospitals (Practice)	Service of biomedical devices								10
55	Graduation project	Group project in biomedical engineering								10
Per semester			30	30	30	30	30	30	30	30
Per year			60		60		60		60	
Total			240							

Free components			
	Subject	Prerequisite for admission	ECTS credits
1	Creative thinking	N/A	5
2	Web technologies	N/A	5
3	Information logistics	N/A	5
4	Basics of developing business projects	N/A	5
5	Basics of management and marketing	N/A	5
6	Principles of economics	N/A	5

Curriculum of the program

№	Subject code	Subject	ECTS credits/hours	Hours								
				Lecture	Seminar (group work)	Practical	Laboratory	Practice	Course work/Project	Mid-semester exam	Final exam	Independent work
1	MAS30908G2-LP	Engineering Mathematics-1	6/150	30		30				1	2	87
2	PHS50408G1-LB	Physics 1	5/125	15			30			1	2	77
3	ICT10408G1-LP	Basics of programming (based on C++ language)	4/100	30			15			1	2	52
4	EET36108G1-LP	Introduction to Biomedical Engineering	5/125	30		30				1	2	62
5	BRS17908G1-LS	Biomechanics	5/125	15	30					1	2	77
6.1	LEH10212G1-P	English language 1	5/125			45				1	1	78
6.2	LEH11012G1-P	German language 1										
6.3	LEH10612G1-P	French language 1										
6.4	LEH11412G1-P	Russian language 1										
7	MAS31008G2-LP	Engineering mathematics 2	6/150	30		30				1	2	87
8	PHS50508G1-LB	Physics 2	5/125	15			30			1	2	77
9	EET36208G1-LP	Medical instrumentation systems	3/75	15		30				1	1	28
10	PHS10304G1-LB	General chemistry	5/125	15			30			1	1	78
11.1	LEH10312G1-P	English language 2	5/125			45				1	1	78
11.2	LEH11112G1-P	German language 2										
11.3	LEH10712G1-P	French language 2										
11.4	LEH11512G1-P	Russian language 2										
12.1	HEL30212G1-LS	Basics of philosophy	3/75	15	15					1	1	43
12.2	SOS40312G1-LS	Introduction to Sociology										
12.3	HEL20212G1-LS	History of Georgia										
12.4	LEH12012G1-LS	Modern technologies of linguistic communications										
12.5	LEH12112G1-LS	Elements of Academic Writing										
13	BRS11108G1 –LS	Biophysics	3/75	15	15					1	2	42
14	MAS31108G2-LP	Engineering Mathematics-3	6/150	30		30				1	2	87

15	PHS50608G1-LB	Physics 3	5/125	15			30			1	2	77
16	ICT30608G1-LB	Object-oriented programming 1	4/100	15			30			1	2	52
17	EET39408G1-LB	Electrical measurements	4/100	15			15			1	2	67
18	EET65108G1-LB	Electrical circuits 1	4/100	15			30			1	2	52
19	BRS10908G1-LS	Electrophysiology	6/150	15	30					1	2	87
20	BRS11008G1-LB	Human physiology	7/175	30			30			1	2	112
21	ICT15508G1-LP	Modeling in the Electronics Workbench environment	4/100	15		30				1	2	52
22		Free components 1										
23	EET65208G1-LP	Elements and nodes of medical devices	4/100	15			30			1	2	52
24	MAS14408G2-LP	Linear Algebra	6/150	30		30				1	2	87
25	ICT15608G1-PB	CAD systems	4/100			15	15			1	2	67
26	EET36408G1-LB	Biomedical measurements	5/125	15			30			1	2	77
27	EET39508G1-LB	Medical electronics	5/125	15			30			1	2	77
28	EET36608G1-LB	Biomedical supplier	5/125	15			30			1	2	77
29	EET39108G1-PB	Lab View programming methods	4/100			15	30			1	2	52
30	MAS22108G1-LP	Biostatistics	6/150	30		30				1	2	87
31		Free components[2]										
32	EET65308G1-LP	Management in medical systems	5/125	15			30			1	2	77
33	EET36708G1-LB	Biomedical devices	6/150	15			45			1	2	87
34	EET36808G1-P	Service of biomedical devices	5/125			45				1	2	77
35	EET62008G1-LP	Methods and means of information protection	4/ 100	15		30				1	2	52
36	EET36908G1-K	A group project in biomedical engineering	10/250						75	1	2	172
37	EET38708G1-LB	Mathematical modeling of biomedical systems	5/125	15			30			1	2	77
38.1	EET38808G1-LP	Medical systems interfaces	5/125	15		30				1	2	77
38.2	EET02708G1-LB	Robotic devices	5/125	15			30			1	2	77
39	EET35508G1-LP	Clinical diagnostic laboratory equipment	6/150	15		45				1	2	87

40	EET35608G1-LP	Radiological equipment	7/175	30		30				1	2	112
41	EET35708G1-LP	Quality management of medical technical products	7/175	30		30				1	2	112
42	EET35808G1-LP	Microprocessor medical systems	5/125	15		30				1	2	77
43.1	EET35908G1-LS	artificial organs	5/125	15	30					1	2	77
43.2	EET36308G1-LP	Materials for medical devices	5/125	15		30				1	2	77
44	EET36008G1-R	Clinical practice	10/250					75		1	2	172
45	EET38908G1-K	Graduation project	10/250						75	1	2	172
46	EET39008G1-LP	Digital processing of biomedical signals	5/125	15		30				1	2	77
47.1	EET50308G1-LP	Telemedicine and mobile healthcare systems.	5/125	15		30				1	2	77
47.2	EET50408G1-LP	Remote medical systems	5/125	15		30				1	2	77
48	ICT31608G1-LP	Medical informatics	5/125	15		30				1	2	77
49	MAS25108G1-K	Biostatistics (course project)	5/125						3/45	1	2	77
50	ICT20208G1-LP	Medical information systems	5/125	15		30				1	2	77
51.1	ICT31108G1-B	Programming in the Visual Studio environment	5/125				45			1	2	77
51.2	ICT31708G1-LB	Bioinformatics in the MATLAB environment	5/125	15			30			1	2	77
52	ICT11408G1-LB	project management	5/125	15			30			1	2	77
53	EET39208G1-LP	Medical - computer diagnostic methods	5/125	15		30				1	2	77
54	BUA47608G1-LR	Administration and management of hospitals - (practice)	10/250	15				60		1	2	172
55	EET38908G1-K	Graduation project	10/250						75	1	2	172

Free components

№	Subject code	Subject	ECTS credits/hours	Hours								
				Lecture	Seminar (group work)	Practical	Laboratory	Practice	Course work/Project	Mid-semester exam	Final exam	Independent work
1	PHS51008G1-LS	Creative thinking	5/125	15	30					1	2	77
2	ICT13308G1-LB	Web technologies	5/125	15			30			1	2	77
3	BUA30408G1-LP	Information logistics	5/125	15		30				1	2	77
4	BUA30508G1-LP	Basics of developing business projects	5/125	15		30				1	2	77
5	BUA30108G1-LP	Fundamentals of management and marketing	5/125	15		30				1	2	77
6	SOS10912G1-LS	Principles of economics	5/125	15	30					1	1	78

Program Head/Head — Zviad GHURTSKAIA

Head of Quality Assurance Service of the Faculty of Informatics and Control Systems — Tinatin KAISHAURI

Dean of the Faculty — Tamar LOMINADZE

Agreed

with the Quality Assurance Service of the GTU — Davit MAKHVILADZE

Approved

At the meeting of the Council of the Faculty of Informatics and Control Systems on 08.11.2013 Protocol No. 5

Amended

At the meeting of the Council of the Faculty of Informatics and Control Systems on 15.06.2020 Protocol No. 7

Chairperson of the Faculty Council — Tamar LOMINADZE

Amended

At the meeting of the Council of the Faculty of Informatics and Control Systems on 08.12.2022 Protocol No.20

Chairperson of the Faculty Council — Tamar LOMINADZE