



## Bachelor's Educational Program

### Program Title

ბიოსამედიცინო ინჟინერია

Biomedical Engineering

### Faculty

ინფორმატიკის და მართვის სისტემების ფაკულტეტი

Faculty of Informatics and Control Systems

### Program Supervisor/ Supervisors

Professor Irine Gotsiridze

### Qualification to be Awarded, and the Number of Credits in the Program

Bachelor of Sciences in Biomedical Engineering

Will be awarded in case of passing main speciality (220 credits) and free components (20 credits) of educational program, no less than 240 credits.

### The Language of Teaching

English

### Admission Prerequisites to the Program

An applicant has the right of teaching on foreign educational program when he has the permission in accordance with Georgian Legislation. The applicant must have the certificate confirming the knowledge of English on the level not less than B1 or must present international certificate TOEFEL (The Test of English as a Foreign Language) of II certification level. The applicant is free from the necessity of presenting a certificate confirming his/her competence at having completed course in the foreign language that is educational language of the program was English. At not having appropriate certificate or other analogous document, the applicant will have an interview in English. The interview will be implemented with the temporary commission which part the staff of GTU.

### Program Description

The program is drawn up with ECTS system, 1 credit is equal to 25 hours, implying both contact and

independent work hours. The distribution of credits is presented in the curriculum. The program duration is 4 years (8 semesters) and includes 240 credits (ECTS). Content, training methods and number of the credits of learning courses of the program provides achievement of a goal and results of educational program. To obtain Bachelor degree student must cover 240 credits.

To obtain the B.S. in Engineering, a student must obtain different course credits in: Mathematics and Basic Sciences, Engineering Basics and Speciality Obligatory Core and Elective Courses, also University Elective Humanities Courses.

The distribution of hours is presented in the educational plan

#### **The annual learning process:**

The annual learning process contains two semesters, with duration 21 weeks. Students assessment is made by Current Activity, Midsemester Exam And Final/Additional Exam Teaching period is during 15 weeks (I-XVI weeks). The Dates of Midsemester Exam and Final/Additional Exam are defined at the beginning of each semester by the Rector's order based on the learning process schedule. The right to pass the final exam has a student that collected no less than minimum points: Current Activity (15 points) and in Midsemester Exam (7.5 points). The minimum positive estimation of final/additional exams is 10 points. A semester contains 30 credits and, accordingly, a year contains 60 credits.

#### **Evaluating Student Performance**

Student Performance is evaluated a maximum of 100 points, 30 of which is current assessment during 15 weeks (homework, quizzes, presentation in the class, team or individual projects). Midsemester and final exams can be evaluated by tests, presentation in the class, team or individual projects. Forms of a Midsemester and final exam evaluation may vary for different subjects. Students' work and study success are evaluated according to the syllabus of each course, which is a combination of Midsemester and Final/additional exams.

The program consists from various objective oriented leaning courses, according to the semester.

During I semester students will cover learning courses: Mathematics, Physics, Information Technologies, Introduction Biomedical Engineering Courses – in total 30 credits.

During II-V semesters students will cover leaning courses: Mathematics, Physics, Basic Engineering and Core Engineering mandatory and elective courses, also university humanitarian elective courses (Free components). In total 30 credits for each semester.

During VI semester students will cover five obligatory and one humanitarian elective courses (Free components), Total 30 credits for semester.

During VII semester students will cover obligatory course of Team Project (6 credits) and professional elective Biomedical Engineering Courses (24 Credits). In total 30 credits for semester.

During VIII semester students will cover three professional elective courses (each 6 credits) and obligatory Capstone Project (12 credits). In total 30 credits for semester.

The bachelor's final / capstone project defense assessment includes a written report and presentation.

Program is prepare according ABET <http://www.abet.org> requirement and has analogs.

1. Illinois Technological University <https://engineering.iit.edu/bme>
2. Louisiana Technological University USA <http://coes.latech.edu/biomedical-engineering>
3. John Hopkins University USA <https://www.bme.jhu.edu/undergraduate/degree-requirements>
4. Michigan Technological University Michigan <http://www.mtu.edu/biomedical/department/what-is-Educational-Program-Website>;

BME Bachelor Educational Program Website:

<http://biomedeng.gtu.ge/programebi.html>

<https://bmegtu.wordpress.com>

In development and carrying out monitoring of the program is included “Committee of Support for Developing of BME Study”, which is founded at the “Biomedical and Clinical Society of Georgia”, Committee is comprised with 5 permanent members.

#### **Program Objective**

The program Objective is that after graduation from the B.S. in Biomedical Engineering program, graduates will

a) Successfully practice biomedical engineering to serve state and regional industries, hospitals, government agencies, or national and international industries. b) Work professionally in one or more of the following areas: biomedical electronics, medical instrumentation, medical imaging, biomedical signal processing, rehabilitation engineering, clinical engineering c) Achieve personal and professional success with awareness and commitment to their ethical and social responsibilities, both as individuals and in team environments. d) Maintain and improve their technical competence through lifelong learning, including entering and succeeding in an advanced degree program in a field such as engineering, science, business, or medicine. e) providing high quality of health care through using of modern medical techniques and technologies, will build and expand upon their undergraduate foundations by engaging in learning opportunities throughout their careers.

## The Learning Outcomes/Competencies (General and Professional)

### Knowledge and understanding

- an ability to identify, formulate and solve complex engineering problems by applying principles of engineering, science and mathematics;
- applying principles, of engineering, human physiology, chemistry, physics, biophysics, mathematics and statistics;
- analysing, modelling, designing and realizing bio/biomedical engineering devices, systems, components. or processes;
- making measurements on and interpreting data from living systems;

### Skills

- an ability to apply engineering, design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global. cultural, social, environmental and economic factors.
- an ability to function effectively on team whose members (biologists, chemists, medical doctors, healthcare providers) together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks and meet objectives;
- public presentation of own thoughts with the appropriate knowledge and logic and their clear argumentation as with experts so with non experts;

### Responsibility and Autonomy

- protection of professional values (accuracy, punctuality, objectivity, transparency, good organization, etc.); Trainings or services for the purpose of proper use of the physicians and healthcare personnel;
- an ability to recognize ethical and professional responsibilities in clinical engineering situations and make informed judgments, which must consider the impact of engineering, solutions in global, economic, environmental, and societal contexts.
- an ability to acquire and applying new knowledge as needed, using appropriate learning strategies.

## Methods (teaching - learning) of Achieving Learning Outcomes

Lecture  Seminar (working in groups)  Practical class  Laboratory  Practice  Course work/project  Consultation  Independent work

Based on the specifics of a learning course, the appropriate activities listed below are employed, reflected in the relevant learning courses (syllabi):

### Methods (teaching - learning)

**The lecture** is a creative process in which the lector and the student are participating simultaneously. The main goal of the lecture is to understand the idea of the provisions of the subject to be studied, which implies the creative and active perception of the presented material. In addition, attention should be paid to the basic provisions of the material, definitions, marks and assumptions. Critical analysis of key issues, facts and ideas are

needed. The lecture should provide scientific and logically consistent understanding of the basic provisions of the subject without overloading the details. Therefore, it must be logically completed. In addition, facts, examples, charts, drawings, experiments, and other visuals should serve to explain the idea of the lecture. The lecture should provide the correct analysis of the dialectical process of science and should be based on the possibility of students' free thinking in the concrete environment, mainly focused on understanding and comprehending of the major scientific problems. The material heard on the lecture is formulated as a whole system of knowledge with independent work of the student. The student should have the interest regarding the book and other sources of information and a desire to study the issues independently, which is a means of stimulating independent thinking, analysis and conclusions. Due to the main purpose of the lecture, the right to deliver it should be given only to experienced teachers, since their theoretical knowledge, practical experience and pedagogic skills are the guarantees of high level of lecture. While processing the methodological issues of the lecture, the teacher should pay attention to the sequence of the material transfer, the lecture style, the connection with the audience. The lecture should take place through active participation of students, using a wide range of methods and visuals. Theoretical material that is delivered during the lecture is well understood through seminars, laboratory and practical exercises

**The Seminar** purpose of the seminar (work in the group) is to allow students to master the topics they have heard on the lecture. Leading professor or the lector will indicate a student or group of students to find and process additional information, prepare the presentation, write essay and other. On the seminar hearing of reports and discussions are held, as well as conclusions are made. The teacher of the seminar coordinates the process of conducting these processes.

**Laboratory** work is more prominent and gives an opportunity to perceive the event or process. In the laboratory, the student studies how to conduct the experiment. During laboratory studies, the student must acquire to organize, regulate and work on the device. The skills obtained in experimental training labs allow to understand theoretical material delivered on the lectures. It implies the following types of actions: setting up the tests, showing video material, as well as the material of dynamic nature, and so forth.

**Practical work** - the purpose of practical work is the gradual study of theoretical material through solving specific tasks. This helps the student to master and use theoretical material independently. The head of practical training should focus on the methods of solving tasks, fulfilment of drawings, sketches, and schemes, as well as application of appropriate techniques in calculations, and so on.

**Practice** (learning and clinical practice) - helps the student to enhance and strengthen the obtained knowledge. It develops the ability to use knowledge in practice, using the methods that are used to study the subject to solve problems. It combines all the methods of learning that help the student to develop practical skills. In this case, on the basis of the acquired knowledge the student independently performs a certain action, such as pedagogical practice, field work, etc.

**Coursework/project** is a creative process. Every new building, machine, instrument, automatic device, etc. is created according to the project. The design process is a combination of theory and practice. In the course of the study, the student performs graphic assignments and course projects, which are actually the student's first independent work, which is carried out under the leadership of the pedagogue.

**Bachelor's Ccpstone Project** is the final stage of a separate cycle of teaching at higher education institution and its purpose is to systematize the obtained theoretical and practical knowledge and provide a reasonable solution for specific scientific, technical, economic or productive tasks. The work should reveal the level of research methods and experiments related to the issues and the student's readiness for independent work in the future professional activities. The work is led by an experienced teacher

**Consultations** with the help of the teacher, should help the student to learn to work independently, master the literature and work on other sources properly, as well as clear up the issues raised during independent work

#### **Appropriate activities of teaching and learning methods**

One particular issue cannot be studied in the teaching process only with one method and one activity. The

teacher has to use different methods and activities during the teaching process, and in most cases the activities are merged. The activities in the teaching process complement each other.

We offer you the most common activities and their definitions. The teacher will select the required activity from the specific goal and objective.

**Discussion/debates.** This is the most widely spread method of interactive teaching. A discussion process greatly increases the quality of students' involvement and their activity. A discussion may turn into an argument and this process is not merely confined to the questions posed by the teacher. It develops students' skills of reasoning and substantiating their own ideas.

**Cooperative teaching** is a teaching strategy in the process of which each member of a group not only has to learn the subject himself, but also to help his fellow-student to learn it better. Each member of the group works at the problem until all of them master the issue.

**Collaborative work;** using this method implies dividing students into separate groups and giving each group its own task. The group members work at their issues individually and at the same time share their opinions with the rest of the group. According to the problem raised, it is possible to shift the functions among the group members in this process. This strategy ensures the students' maximum involvement in the learning process.

**Problem based learning** is an activity which uses a specific problem as the initial stages of obtaining new knowledge and integration process.

**Case study** – the teacher discusses concrete cases together with the students and they study the issue thoroughly. E.g., in the sphere of engineering safety it can be a discussion of a concrete accident or catastrophe, or in political science it can be a study of a concrete problem conflict.

**Brain storming** – this method implies forming and presenting as many radically different ideas and opinions on a given topic as possible. This method sets conditions for developing a creative approach towards a problem. This method is effective in a large group of students and consists of the following stages:

- using a creative approach for defining a problem/issue;
- for a certain period of time listing (mainly on the blackboard) students' ideas on the problem without any criticism;
- determining the evaluation criteria for stating the correspondence of the idea to the aim of the research;
- evaluating the chosen ideas according to the previously determined criteria;
- selecting the ideas that most of all correspond to the given issue by applying the method of exclusion;
- revealing the best idea for solving the given problem

**Role and situational games** – games that are fulfilled according to predefined scenario allow students to look at the issue differently. It helps them to develop an alternative viewpoint. Like discussions, these games also formulate the student's ability to express and protect his/her position independently.

**Implication.** It is quite effective in terms of achieving the result. In many cases, it is better to provide the students with audio and visual materials simultaneously. The study material can be demonstrated by both the teacher and the student. This activity helps us to demonstrate different levels of learning material, to specify what students will have to do independently; at the same time, this strategy visually reflects the essence of the topic/ problem. Demonstration may be simple

**Deduction** is such a form of transmitting any knowledge, which based on general knowledge represents logical process of discovering new knowledge in other words, the process is going from general to concrete.

**Analysis** helps us to divide the study material into constituent parts. This will simplify the detailed coverage of individual issues within a difficult problem.

**The synthesis** implies the composition of one whole by grouping individual issues. This activity contributes to the development of the problem to be seen as a whole.

**Verbal or orally transmitted.** Narration, talking and so forth belong to this activity. In this process the teacher orally transmitted and explains study material and the students actively perceive and learn it through listening, remembering and thinking.

**The script** implies the following activities: making extracts, records, notes, theses, abstract or essay and other.

**Explanation** is based on the discussion on the issue. The teacher gives a concrete example from the material, which is discussed in detail within the given topic.

**Action-oriented training** requires active involvement of the teacher and student in the teaching process, where the practical interpretation of theoretical material is of special significance.

**Project planning and presentation.** When working on the project, the student uses the acquired knowledge and skills to solve the real problem. This increases students' motivation and responsibility. Working on the project includes planning, surveying, practical activity and the performance of the results in accordance with the selected issue. The project will be deemed implemented if its results are presented in a clear and convincing way. It can be performed individually, in couples or in groups; also within a subject or within a few subjects (integration of the subjects); after completion, the project can be presented to a big audience.

## Student Knowledge Assessment System

Grading system is based on a 100-point scale.

Positive grades:

- **(A)** - Excellent - the rating of 91-100 points;
- **(B)** – Very good - - the rating of 81-90 points
- **(C)** - Good - the rating of 71-80 points
- **(D)** - Satisfactory - the rating of 61-70 points
- **(E)** - Enough - the rating of 51-60 points

Negative grades:

- **(FX)** - Did not pass - 41-50 points of rating, which means that the student needs more work to pass and is given the right to take the exam once more with independent work;
- **(F)** – Failed - 40 points and less, which means that the work carried out by the student is not enough and he/she has to learn the subject from the beginning.

Each form and component of the evaluation from the general score of the assessment (100 points) has a definitive share in the final assessment. In particular, the maximum score of the intermediate score is 60, and the maximum score of the final exam – 40. In each form of assessment, the minimum competence limit is defined. Minimum positive score for final evaluation is 10, maximum score of Midsesmester exam 30. Minimum positive assessment is 7.5 points, maximum current score of 30, minimum positive - 15 points.

The forms of assessment:

- Intermediate Assessment
- Final/ Additional exams

Intermediate assessment components are:

- Current Activity
- Mid-Semester Exam

One Mid-semester exam is conducted during the semester. It is obligatory component of interim assessment. Assessment methods and criteria are detailed in the syllabus of courses,

## Sphere of Employment

The field of biomedical engineering is one of the fastest growing and demanded jobs in the world employment market

<https://money.usnews.com/careers/best-jobs/biomedical-engineer>

Biomedical engineers are employed in industry, in hospitals, in research facilities of educational and medical institutions, in teaching, and in government regulatory agencies. They often serve a coordinating or interfacing function, using their background in both the engineering and medical fields. In industry, they may create designs where an in depth understanding of living systems and of technology is essential. They may be involved in performance testing of new or proposed products. Government positions often involve product testing and safety, as well as establishing safety standards for devices. In the hospital, the biomedical engineer may provide advice on the selection and use of medical equipment, as well as supervising its performance testing and maintenance. They may also build customized devices for special health care or research needs. In research institutions, biomedical engineers supervise laboratories and equipment, and participate in or direct research activities in collaboration with other researchers with such backgrounds as medicine, physiology, and nursing. Some biomedical engineers are technical advisors for marketing departments of companies and some are in management positions.

In representative firms of vendors of medical devices, for carrying out of marketing and service. Also as Health Information Technology (HIT) specialists of information technologies for processing of medical information. Graduates can be employed at Scientific-Research Institutes and Centers of the Georgian Technical University (Eliashvili Institute of Control Systems, V. Chavchanidze Institute of Cybernetics, Center of Biotechnology).

### Potential for Further Education

Master's Educational Programs.

### Human and Material Resources Required to Implement the Program

The program provides the appropriate human and material resources. In the program implementation, there are involved professors from West Pomeranian University of Technology according the Co-Operation Agreement between the Georgian Technical University and West Pomeranian University of Technology. For more information see the attached syllabi and other attachment documentation

**The Number of Syllabi Attached: 55**

### Courses in the Program

№	Course	Admission Prerequisites	ECTS Credits									
			I Year		II Year		III Year		IV Year			
			Semester									
			I	II	III	IV	V	VI	VII	VIII		
1	Engineering Mathematics 1	N/A	6									
2	Physics A	N/A	5									
3	Introduction to general and organic chemistry	N/A	5									
4	Programming in Visual Studio	N/A	4									
5	Introduction to Biomedical Engineering	N/A	5									
6	Electrophysiology	N/A	5									
7	Engineering Mathematics 2	Engineering Mathematics 1		6								

№	Course	Admission Prerequisites	ECTS Credits								
			I Year		II Year		III Year		IV Year		
			Semester								
			I	II	III	IV	V	VI	VII	VIII	
8	Physics B	Physics A		5							
9	Biomechanics of Human Body	Electro physiology		4							
10	Human Physiology	Electrophysiology		5							
11	Object-oriented Programming - 1 (based on C#)	N/A		5							
12	<b>Free components University Elective 1</b>										
12.1	Georgian History and Culture	N/A		5							
12.2	Art Trough the age	N/A									
13	Engineering Mathematics 3	Engineering Mathematics 2			6						
14	Physics C	Physics B			5						
15	Electrical Circuits 1	Physics B			5						
16	Biomedical Measuring	Introduction to Biomedical Engineering			5						
17	Lab View Programming Methods	Object-oriented Programming - 1 (based on C#)			4						
18	Biomedical Instrumentation	Introduction to Biomedical Engineering			5						
19	Linear Algebra	N/A				6					
20	Biophysics	Physics A				5					
21	Electrical Circuits 2	Electrical Circuits 1				5					
22	Medical device design	Biomedical Instrumentation				5					
23	Biomedical Transducers	Biomedical Measurements				4					
24	<b>Free Components University Elective 2</b>					5					
24.1	Design and Society	N/A									
24.2	Principles of Contemporary	N/A									



Nº	Course	Admission Prerequisites	ECTS Credits							
			I Year		II Year		III Year		IV Year	
			Semester							
			I	II	III	IV	V	VI	VII	VIII
	Management									
24.3	Biomimicry and Sustainability	N/A								
25	Basics of Medical Electronics	Biomedical Transducers					6			
26	Control Systems in Biology and Medicine	Linear Algebra					5			
27	Bioinformatics In Matlab	Electrophysiology					5			
28	Materials for Medical Devices	Introduction to general and organic chemistry					4			
29	Fundamentals of probability theory	Engineering Mathematics 2					5			
30	Modeling in Electronics Workbench	Basics of Medical Electronics					5			
31	Health Care Management and Economics	Fundamentals of probability theory						5		
32	Clinical Practice	Medical devices design, Biomedical Instrumentation						6		
33	Quality Control Of Medical Devices	Basics of Medical Electronics						5		
34	CAD Systems	N/A						5		
35	Fundamentals of Business Communication	N/A						4		
<b>36</b>	<b>Free Components University Elective 3</b>									
36.1	Introduction to Ergonomics	N/A						5		
36.2	Job Analysis Methods	N/A								
37	Team Project	CAD systems, Clinical Practice							6	
38	<b>Professional Electives 1</b>									
38.1	Microprocessor Medical Systems	Object-oriented Programming - 1(based on C#), Basics of Medical Electronics							6	
38.2	Biomedical Signal and Image Processing	Linear Algebra								

Nº	Course	Admission Prerequisites	ECTS Credits								
			I Year		II Year		III Year		IV Year		
			Semester								
			I	II	III	IV	V	VI	VII	VIII	
39	<b>Professional Electives 2</b>										
39.1	Clinical Diagnostic Laboratory Devices	Clinical practice								6	
39.2	Interfaces Of Medical Systems	Object-oriented Programming - 1(based on C#), Basics of Medical Electronics									
40	<b>Professional Electives 3</b>										
40.1	Mobile Health Systems	Programming in Visual Studio Lab View Programming Methods,								6	
40.2	Telemedicine	Programming in Visual Studio Lab View Programming Methods,									
41	<b>Professional Electives 4</b>									6	
41.1	Hospital Administration And Management	Health Care Management and Economics,									
41.2	Distance Medical Systems	Biomedical Transducers									
42	<b>Professional Electives 5</b>										
42.1	Medical Informatics	Health Care Management and Economics, Bioinformatics In Matlab									6
42.2	Medical Sensors	Electrophysiology, Biophysics									
43	<b>Professional Electives 6</b>										
43.1	Radiological Physics and Dosimetry	Physics C, Biophysics									6

Nº	Course	Admission Prerequisites	ECTS Credits									
			I Year		II Year		III Year		IV Year			
			Semester									
			I	II	III	IV	V	VI	VII	VIII		
43.2	MRI Tomography	Physics C, Biophysics										
44	<b>Professional Electives 7</b>											
44.1	Artificial Organs and Biotechnical systems	Human Physiology, Materials for Medical Devices										6
44.2	Mathematical Models in Biology and Medicine	Engineering Mathematics 3										
45	Capstone Design Project	Team Project, Fundamentals of Business Communication										12
<b>Per semester</b>			<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>
<b>Per year</b>			<b>60</b>		<b>60</b>		<b>60</b>		<b>60</b>			
<b>Total</b>			<b>240</b>									

### Program Curriculum

Nº	Subject code	Subject	ECTS Credit/Hours	Hours								
				Lecture	Seminar (work in the group)	Practical Classes'	Laboratory	Practice	Course work/project	Mid-semester exam	Final exam	Independent work
1	MAS30108E1-LP	Engineering Mathematics 1	6/150	30		30				1	2	87
2	PHS50708E1-LB	Physics A	5/125	15			30			1	2	77
3	PHS17308E1-LS	Introduction to General and Organic Chemistry	5/125	15	30					1	2	77
4	ICT19208E1-B	Programming in Visual Studio	4/100				30			1	2	67
5	EET30308E1-LP	Introduction to Biomedical Engineering	5/125	15		30				1	2	77
6	BRS10408E1-LS	Electrophysiology	5/125	15	30					1	2	77
7	MAS30208E1-LP	Engineering Mathematics 2	6/150	30		30				1	2	87
8	PHS50808E1-LB	Physics B	5/125	15			30			1	2	77
9	BRS10108E1-LS	Biomechanics of Human Body	4/100	15	15					1	2	67
10	BRS10308E1-LB	Human Physiology	5/125	15			30			1	2	77
11	ICT19308E1-LP	Object-oriented Programming -1(based on C#)	5/125	15		30				1	2	77

12.1	HEL21508E1-LS	Georgian History and Culture	5/125	15	30					1	2	77
12.2	ART30809E1-LS	Art Trough the age	5/125	30	15					1	1	78
13	MAS30308E1-LP	Engineering Mathematics 3	6/150	30		30				1	2	87
14	PHS50908E1-LB	Physics C	5/125	15			30			1	2	77
15	EET38508E1-LB	Electrical Circuits 1	5/125	15			30			1	2	77
16	EET30408E1-LB	Biomedical Measuring	5/125	15			30			1	2	77
17	EET37908E1-PB 1.	Lab View Programming Methods	4/100			15	15			1	2	67
18	EET30208E1-LP	Biomedical Instrumentation	5/125	15		30				1	2	77
19	MAS30808E1-LP	Linear Algebra	6/150	30		30				1	2	87
20	BRS10208E1-LP	Biophysics	5/125	15		30				1	2	77
21	EET38608E1-LB 2.	Electrical Circuits 2	5/125	15			30			1	2	77
22	EET38008E1-LP	Medical device design	5/125	15		30				1	2	77
23	EET30108E1-LB	Biomedical Transducers	4/100	15			15			1	2	67
24.1	ART22309E1-LS	Design and Society	5/125	30	15					1	2	77
24.2	BUA31408E2-LP	Principles of Contemporary Management	5/125	30		15				1	1	78
24.3	EET32208E2-LP	Biomimicry and Sustainability	5/125	15		30				1	2	77
25	EET04308E1-LB	Basics of Medical Electronics	6/150	30			30			1	2	87
26	EET31208E1-LB	Control Systems in Biology and Medicine	5/125	15			30			1	2	77
27	ICT11308E1-LB	Bioinformatics In Matlab	5/125	15			30			1	2	77
28	EET31108E1-LS	Materials for Medical Devices	4/100	15	15					1	2	67
29	MAS10308E2-LP	Fundamentals of probability theory	5/125	15		30				1	2	77
30	EET62608E1-PB	Modeling in Electronics Workbench	5/125			15	30			1	2	77
31	EET38208E1-LS 8-	Health care management and Economics	5/125	15	30					1	2	77
32	EET30808E1-R	Clinical Practice	6/150					60		1	2	87
33	EET30508E1-LP	Quality Control Of Medical Devices	5/125	15		30				1	2	77
34	ICT19408E1-PB	CAD Systems	5/125			15	30			1	2	77
35	LEH16108E1-P	Fundamentals of Business Correspondence	4/100			30				1	2	67
36.1	ART11909E1-LS	Introduction to Ergonomics	5/125	15	30					1	1	87
36.2	BUA31308E2-LP	Job Analyzing Methods	5/125	15		30				1	2	77
37	EET31008E1-K	Team Project	6/150						60	1	2	87
38.1	EET39608E1-LP	Microprocessor Medical Systems	6/150	30		30				1	2	87

38.2	EET38408E1-LP	Biomedical Signal and Image Processing	6/150	30	30				1	2	87
39.1	EET30608E1-LP	Clinical Diagnostic Laboratory Devices	6/150	30	30				1	2	87
39.2	EET04508E1-LP	Interfaces Of Medical Systems	6/150	30	30				1	2	87
40.1	ICT10808E1-LP	Mobile Health Systems	6/150	30	30				1	2	87
40.2	ICT10908E1-LP	Telemedicine	6/150	15	45				1	2	87
41.1	BUA30308E1-LP	Hospital Administration And Management	6/150	15	45				1	2	87
41.2	ICT10608E1-LP	Distance Medical Systems	6/150	15	45				1	2	87
42.1	ICT10708E1-LP	Medical Informatics	6/150	30	30				1	2	87
42.2	EET04408E1-LP	Medical Sensors	6/150	30	30				1	2	87
43.1	PHS60108E1-LP	Radiological Physics & Dosimetry	6/150	30	30				1	2	87
43.2	EET30708E1-LP	MRI Tomography	6/150	30	30				1	2	87
44.1	EET32508E2-LS	Artificial Organs and Biotechnical systems	6/150	30	30				1	2	87
44.2	EET38308E1-LP	Mathematical Models in Biology and Medicine	6/150	30	30				1	2	87
45	EET30908E1-K	Capstone Design Project	12/300					120	2	2	176

Program Supervisor

Irine Gotsiridze

Informatics and Control Systems Faculty

Head of Quality Assurance Service

Zurab Baiashvili

Dean of the Faculty

Zurab Tsveraidze

**Agreed with**

Quality Assurance Service of GTU

Irma inashvili

**Approved**

at the Session of the Faculty Council

21. 06. 2019 Protocol #4

Chairman of the Faculty Council

Zurab Tsveraidze

Program Learning Outcomes<sup>1</sup>

Learning Courses	an ability to identify, formulate and solve complex engineering problems by applying principles of engineering, science and mathematics;	applying principles, of engineering, human physiology, chemistry, physics, biophysics, mathematics and statistics	analysing, modelling, designing and realizing bio/medical engineering devices, systems, components. or processes	making measurements on and interpreting data from	an ability to apply engineering, design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global. cultural, social, environmental	an ability to function effectively on team whose members (biologists, chemists, medical doctors, healthcare providers) together provide leadership, create a collaborative and inclusive environment,	public presentation of own thoughts with the appropriate knowledge and logic and their clear argumentation as with experts so with non experts	protection of professional values (accuracy, punctuality, objectivity, transparency, good organization, etc.); Trainings or services for the purpose of proper use of the physicians and	an ability to recognize ethical and professional responsibilities in clinical engineering situations and make informed judgments, which must consider the impact of engineering, solutions in global, economic, environmental, and societal contexts	an ability to acquire and applying new knowledge as needed, using appropriate learning strategies
Engineering Mathematics 1	1	1								2
Physics A	1	2			1					2
Introduction to general and organic chemistry	1	1				2				
Electrophysiology	1	2				2				
Engineering Mathematics 2	1	2								1
Physics B	1	2				2				
Biomechanics of Human Body	1	2							2	
Engineering Mathematics 3	1	2				2				
Human Physiology	2	2			2				2	
Engineering Mathematics 3	1			1		2				2

<sup>1</sup> Indicate the appropriate numbers in the learning outcomes of the program: familiarization - 1; deepening - 2; Strengthening – 3.

Introduction to Biomedical Engineering	2	2								2
Physics C		1			2		1			
Electrical Circuits 1	2		2	3					1	
Biomedical Measurements	2				2	3		1		
Biomedical Instrumentation	2	3		2						
Biophysics										
Electrical Circuits 2		2	2		2	3		1		
Medical Device Design	2		1	3		1				
Biomedical Transducers		2			1			1		
Basics of Medical Electronics		2	2		2	1		1		
Control Systems in Biology Medicine		2				2		1		
Materials For Medical Devices					2	3				1
Fundamentals of probability theory	1	2		2						
Clinical Practice										
Quality Control Of Medical Devices		2		3		3		3		
CAD Systems						3	2		2	
Team Project	3	2				3	2			
Microprocessor Medical Systems	1		2	2						
Biomedical Signal and Image Processing		2	3			1			2	
Clinical Diagnostic Laboratory Devices	3	2				3				
Interfaces Of Medical Systems	3	2								
Hospital Administration And Management						3	2	2	3	
Distance Medical Systems					2		2	3		

<sup>1</sup> Indicate the appropriate numbers in the learning outcomes of the program: familiarization - 1; deepening - 2; Strengthening – 3.

Medical Informatics				2		3	2	1		
Medical Sensors	3	2		3						
Radiological Physics & Dosimetry					2	3		2	3	2
MRI Tomography	3				2	3				
Artificial Organs and Biotechnical systems	2		3		2			1	3	2
Mathematical Models in Biology and Medicine	3			2						
Capstone Design Project	3	3	3	3	3	3	3	3	3	3

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<sup>1</sup> Indicate the appropriate numbers in the learning outcomes of the program: familiarization - 1; deepening - 2; Strengthening – 3.



Program Objectives and Learning Outcomes MAP 4

Program Objectives	an ability to identify, formulate and solve complex engineering problems by applying principles of engineering, science and mathematics.	applying principles, of engineering, human physiology, chemistry, physics, biophysics, mathematics and statistics	analysing, modelling, designing and realizing bio/ biomedical engineering devices, systems, components. or processes	making measurements on and interpreting data from living systems	an ability to apply engineering, design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global. cultural, and	an ability to function effectively on team whose members (biologists, chemists, medical doctors, healthcare providers) together provide leadership, create a collaborative and inclusive environment,	public presentation of own thoughts with the appropriate knowledge and logic and their clear argumentation as with experts so with non experts	protection of professional values (accuracy, punctuality, objectivity, transparency, good organization, etc.); Trainings or services for the purpose of proper use of the physicians	an ability to recognize ethical and professional responsibilities in clinical engineering situations and make informed judgments, which must consider the impact of engineering, solutions in global, economic, environmental, and societal	an ability to acquire and applying new knowledge as needed, using appropriate learning strategies
a) Successfully practice biomedical engineering to serve state and regional industries, hospitals, government agencies, or national and international industries	✓	✓	✓		✓	✓	✓	✓	✓	✓
b) Work professionally in one or more of the following areas: biomedical electronics, medical instrumentation, medical imaging, biomedical signal processing, rehabilitation engineering, clinical engineering	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
c) Achieve personal and professional success with awareness and commitment to their ethical and social responsibilities, both as	✓					✓	✓	✓	✓	

<sup>2</sup> Mark the learning outcomes of the program by symbol „✓“.

individuals and in team environments.										
d) Maintain and improve their technical competence through lifelong learning, including entering and succeeding in an advanced degree program in a field such as engineering, science, business, or medicine.		✓					✓	✓	✓	✓
e) providing high quality of health care through using of modern medical techniques and technologies, will build and expand upon their undergraduate foundations by engaging in learning opportunities throughout their careers.	✓		✓	✓	✓	✓	✓	✓	✓	✓

<sup>2</sup> Mark the learning outcomes of the program by symbol „✓“.