საქართველოს ტექნიკური უნივერსიტეტი
GEORGIAN TECHNICAL UNIVERSITY

**Approved by**
Academic Board of GTU
2019. 28. 06
Order № 942

# Bachelor's Educational Program

## Program Title

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| ბიოსამედიცინო ინჟინერია |
| Biomedical Engineering |

## Faculty

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| ინფორმატიკის და მართვის სისტემების ფაკულტეტი |
| Faculty of Informatics and Control Systems |

## Program Supervisor

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| Professor Irine Gotsiridze |

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

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| Bachelor of Sciences in Biomedical Engineering<br>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

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| English |

## Admission Prerequisites to the Program

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| 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 Exams And Final/Additional Exams. Teaching period is during 15 weeks (I-XVI weeks). The Dates of Midsemester Exams and Final/Additional Exams 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 Exams(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 semester 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 Ccourses (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;
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 objective of Biomedical Engineering Bachelor's Bachelor's Program is to introduce a student's medical equipment and technologies, medical devices and systems, health information technologies; To develop skills for qualified technical services of medical technical systems, ability to perform medical equipment functional, technical condition and expertise. The aim of the program is to provide students with the knowledge of classification, restoration, storage and control of information obtained in health care. Graduates will function effectively in multidisciplinary team environments and communicate effectively to a variety of audiences, providing high quality of health care through using of modern medical techniques and technologies.Program graduates will build and expand upon their undergraduate foundations by engaging in learning opportunities throughout their careers.

## The Learning Outcome/Competencies (general and field-specific)

**Knowledge and understanding**

- Wide knowledge of the sphere of biomedical engineering, interpretation of theories and principles, in particular, theoretical and practical knowledge of biotechnical systems which is basis of the development of necessary abilities for the clinical engineers for the service of the medical devices;
- Knowledge of design and conduct experiments (including making measurements) on, as well as to analyse and interpret data from living systems;
- Understanding addressing the problems associated with the interaction between living and non-living materials and systems;
- Understanding and identify examples of the industrial and academic aspects of Bioengineering, including basic and applied research.;
- Understanding response ability of Clinical Engineer for providing high quality of Health Care.
- Understanding complex questions of the sphere of Biomedical Engineering;
- Understanding of professional and ethical responsibility;
- An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability;
- Knowledge of contemporary issues ;
- Knowledge of the methodology for solving analyzes and synthesis tasks in biomedical engineering

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**Applying knowledge**

- Applying knowledge of mathematics (including differential equations and statistics), science, and engineering to solve problems at the interface of engineering and biology;
- To take part in projection, elaboration, integration and introduction of biotechnical systems;
- Independent exploitation, service and installation of medical systems, among them the software if computer based medical systems;
- Design and conduct experiments, as well as to analyse and interpret biomedical data;
- An ability to make measurements and interpret data from living systems;
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice;
- Knowledge of using of computer and information technologies for solving practical tasks that are characteristic of medical instrumentation, medical information systems;
- Ability to participate in the design, manufacturing, service and operation of medical devices;

**Making judgments**

- An ability to collect and processing of new information;

- Data collection characterized for the sphere of biomedical engineering, their analysis and explanation, analysis of alienated data and/or situation as well with standard and some special methods and formation of argued conclusion on their basis;
- Argued judgment and explanation about of the technical condition and capacity of medical devices;
- Using relevant information and individual judgment to determine whether events or processes comply with laws, regulations, or standards;
- Judging the qualities of devices, services or people - assessing the value, importance, or quality of things or people.

**Communication skills**

- Conduct research, along with life scientists, chemists, and medical scientists, on the engineering aspects of the biological systems;
- Teach biomedical engineering or disseminate knowledge about the field through writing or consulting;
- Manage teams of engineers by creating schedules, tracking inventory, creating and using budgets, and overseeing contract obligations and deadlines;
- Conduct training or in-services to educate clinicians and other personnel on proper use of equipment.
- Write documents describing protocols, policies, standards for use, maintenance, and repair of medical equipment.
- Public presentation of own thoughts with the appropriate knowledge and logic and their clear argumentation as with experts so with non experts;
- Creative use of modern informational and communicational technologies;
- Kknowledge of media production, communication, and dissemination techniques and methods. This includes alternative ways to inform and entertain via written, oral, and visual media.
- An ability to function on multidisciplinary and diverse teams and provide leadership;

**Learning skills**

- To determine the learning directions with taking into account existed environment and priorities;
- Consequent and multilateral estimation of own learning process;
- To decide the necessity of future training;
- A recognition of the need for, and an ability to engage in life-long learning ;
- An ability of search, assimilation of the relevant information for the purpose of extension of area of knowledge and experience in the medicine sphere. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

**Values**

- The protection of professional values (accuracy, punctuality, objectivity, transparency, good organization and others);
- The protection of accepted norms of ethics;
- Participation in the process of values formation and aspirations to their sustainable implementation;
- Understanding of professional and ethical responsibility of the Biomedical Engineer. Observance of norms of ethics and moral responsibility and values in formation of this process.
- Conducting work in biomedical engineering spheres (medical diagnostic centers, clinics, medical equipment service providers) taking into consideration life and ecological safety and constant striving for their improvement

## 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 Ccapstone 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 positionindependently.

**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 i**mplies 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/extra 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: 56

## 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 | Don't have | 6 | | | | | | | |
| 2 | Physics A | Don't have | 5 | | | | | | | |
| 3 | Introduction to general and organic chemistry | Don't have | 5 | | | | | | | |
| 4 | Programming in Visual Studio | Don't have | 4 | | | | | | | |
| 5 | Introduction | Don't have | 5 | | | | | | | |

| № | Course | Admission Prerequisites | ECTS Credits | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | I Year | | II Year | | III Year | | IV Year | |
| | | | Semester | | | | | | | |
| | | | I | II | III | IV | V | VI | VII | VIII |
| | to Biomedical Engineering | | | | | | | | | |
| 6 | Electrophysiology | Don't have | 5 | | | | | | | |
| 7 | Engineering Mathematics 2 | Engineering Mathematics 1 | | 6 | | | | | | |
| 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#) | Don't have | | 5 | | | | | | |
| 12 | **Free components University Elective 1** | | | | | | | | | |
| 12.1 | Georgian History and Culture | Don't have | | 5 | | | | | | |
| 12.2 | Art Trough the age | Don't have | | | | | | | | |
| 13 | Engineering Mathematics 3 | Engineering Mathematics 2 | | | 6 | | | | | |
| 14 | Physics C | Physics B | | | 5 | | | | | |
| 15 | Electrical Circuits 1 | Physics B | | | 5 | | | | | |
| 16 | Biomedical Measurements | 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 | Engineering Mathematics 2 | | | | 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 | **Free Components University Elective 2** | | | | | 5 | | | | |
| 24.1 | Design and Society | Don't have | | | | | | | | |

| № | Course | Admission Prerequisites | ECTS Credits | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | I Year | | II Year | | III Year | | IV Year | |
| | | | Semester | | | | | | | |
| | | | I | II | III | IV | V | VI | VII | VIII |
| 24.2 | Principles of Contemporary Management | Don't have | | | | | | | | |
| 24.3 | Mimicry and Sustainability | Don't have | | | | | | | | |
| 25 | Basics of Medical Electronics | Biomedical Transducers | | | | | 6 | | | |
| 26 | Control Systems in Biology and Medicine | Linear Algebra | | | | | 5 | | | |
| 27 | Bioinformatics In Mat lab | Electrophysiology | | | | | 5 | | | |
| 28 | Materials for Medical Devices | Introduction to general and organic chemistry | | | | | 4 | | | |
| 29 | Elements of Mathematics for Business | Don't have | | | | | 5 | | | |
| 30 | Modeling in Electronic Workbench | Basics of Medical Electronics | | | | | 5 | | | |
| 31 | Health Care Management and Economics | Elements of Mathematics for Business | | | | | | 5 | | |
| 32 | Clinical Practice | Medical devices design, Biomedical Instrumentation | | | | | | 6 | | |
| 33 | Quality Control Of Medical Devices | Basics of Medical Electronics | | | | | | 5 | | |
| 34 | CAD Systems | Don't have | | | | | | 5 | | |
| 35 | Fundamentals of Business Communication | Don't have | | | | | | 4 | | |
| **36** | **Free Components University Elective 3** | | | | | | | 5 | | |
| 36.1 | Introduction to Ergonomics | Don't have | | | | | | | | |
| 36.2 | Job Analysis Methods | Don't have | | | | | | | | |
| 37 | Team Project | Clinical Practice | | | | | | | 6 | |
| 38 | **Professional Electives 1** | | | | | | | | 6 | |
| 38.1 | Microprocessor Medical Systems | Object-oriented Programming - 1(based on C#), Basics of Medical Electronics | | | | | | | | |
| 38.2 | Biomedical Signal and Image Processing | Linear Algebra | | | | | | | | |

| № | Course | Admission Prerequisites | ECTS Credits | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | I Year | | II Year | | III Year | | IV Year | |
| | | | Semester | | | | | | | |
| | | | I | II | III | IV | V | VI | VII | VIII |
| 39 | **Professional Electives 2** | | | | | | | | | |
| 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 | **Professional Electives 3** | | | | | | | | | |
| 40.1 | Mobile Health Systems | Lab View Programming Methods | | | | | | | 6 | |
| 40.2 | Telemedicine | Lab View Programming Methods | | | | | | | | |
| 41 | **Professional Electives 4** | | | | | | | | | |
| 41.1 | Hospital Administration And Management | Health Care Management and Economics | | | | | | | 6 | |
| 41.2 | Distance Medical Systems | Biomedical Transducers | | | | | | | | |
| 42 | **Professional Electives 5** | | | | | | | | | |
| 42.1 | Medical Informatics | Health Care Management and Economics | | | | | | | | 6 |
| 42.2 | Medical Sensors | Electrophysiology, Biophysics | | | | | | | | |
| 43 | **Professional Electives 6** | | | | | | | | | |
| 43.1 | Radiological Physics & Dosimetry | Physics C, Biophysics | | | | | | | | 6 |
| 43.2 | MRI Tomography | Physics C, Biophysics | | | | | | | | |
| 44 | **Professional Electives 7** | | | | | | | | | |
| 44.1 | Artificial Organs | Human Physiology, Materials for Medical Devices | | | | | | | | 6 |

| № | Course | Admission Prerequisites | ECTS Credits | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | I Year | | II Year | | III Year | | IV Year | |
| | | | Semester | | | | | | | |
| | | | I | II | III | IV | V | VI | VII | VIII |
| 44.2 | Mathematical Models in Biology and Medicine | Engineering Mathematics 3 | | | | | | | | |
| 45 | Capstone Design Project | Team Project | | | | | | | | 12 |
| **Per semester** | | | **30** | **30** | **30** | **30** | **30** | **30** | **30** | **30** |
| **Per year** | | | **60** | | **60** | | **60** | | **60** | |
| **Total** | | | **240** | | | | | | | |

## Learning Outcomes Map

| № | Subject | Knowledge and understanding | Applying knowledge | Making judgments | Communication skill | Learning skills | Values |
|---|---|---|---|---|---|---|---|
| 1 | Engineering Mathematics 1 | X | X | | | X | |
| 2 | Physics A | X | | X | | X | |
| 3 | General Chemistry | X | X | X | | X | |
| 4 | Programming in Visual Studio | X | X | X | | | |
| 5 | Introduction to Biomedical Engineering | X | X | | | | X |
| 6 | Electrophysiology | X | X | X | | X | |
| 7 | Engineering Mathematics 2 | X | X | | | X | |
| 8 | Physics B | X | | X | | X | |
| 9 | Biomechanics of Human Body | X | X | X | | | |
| 10 | Human Physiology | X | X | | | X | |
| 11 | Programing C++ | X | X | | | X | |
| 12 | University Elective 1 (Free components) | | | | | | |
| 12.1 | Georgian History and Culture | X | X | X | X | | |
| 12.2 | Art Trough the age | X | X | X | X | X | X |
| 13 | Engineering Mathematics 3 | X | X | | | X | |
| 14 | Physics C | X | | X | | X | |
| 15 | Electrical Circuits 1 | X | X | X | | X | |
| 16 | Biomedical Measurements | X | X | X | | | |
| 17 | Lab View Programming Methods | X | X | | | X | |
| 18 | Biomedical Instrumentation | X | X | X | | | |
| 19 | Linear Algebra | X | X | | | X | |
| 20 | Biophysics | X | X | X | | | |

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|---|---|---|---|---|---|---|---|
| 21 | Electrical Circuits 2 | X | X | X | | | |
| 22 | Medical device design | X | X | X | | | |
| 23 | Biomedical Transducers | X | X | X | | | |
| 24 | University Elective 2 (Free components) | | | | | | |
| 24.1 | Design and Society | X | X | X | X | X | X |
| 24.2 | Principles of Contemporary Management | X | X | X | | | X |
| 24.3 | Mimicry and Sustainability | X | X | X | | | |
| 25 | Basics of Medical Electronics | X | X | | X | | |
| 26 | Control Systems in Biology and Medicine | X | X | X | | | |
| 27 | Bioinformatics In Matlab | X | X | X | X | X | |
| 28 | Materials for Medical Devices | X | X | X | | X | |
| 29 | Elements of Mathematics for Business | X | X | | | X | |
| 30 | Modeling in Electronic Workbench | X | X | X | | | |
| 31 | Health Care Management and Economics | X | X | X | X | X | |
| 32 | Clinical Practice | X | X | X | X | | |
| 33 | Quality Control Of Medical Devices | X | X | | | X | |
| 34 | CAD Systems | X | X | | | X | |
| 35 | Fundamentas Business Correspondence | X | X | X | X | | |
| 36 | University Elective 3 (Free components) | | | | | | |
| 36.1 | Introduction to Ergonomics | X | X | | X | X | |
| 36.2 | Job Analysis Methods | X | X | | X | | X |
| 37 | Team Project | X | X | X | X | X | |
| 38 | Professional electives 1 | | | | | | |
| 38.1 | Microprocessor Medical Systems | X | X | X | | | |
| 38.2 | Biomedical Signal and Image Processing | X | X | X | X | | |
| 39 | Professional Electives 2 | | | | | | |
| 39.1 | Clinical Diagnostic Laboratory Devices | X | X | X | | | |
| 39.2 | Interfaces Of Medical Systems | X | X | X | | | |
| 40 | Professional electives 3 | | | | | | |
| 40.1 | Mobile Health Systems | X | X | | X | | X |
| 40.2 | Telemedicine | X | X | | X | | X |
| 41 | Professional electives 4 | | | | | | |
| 41.1 | Hospital Administration And Management | X | X | | X | | X |
| 41.2 | Distance Medical Systems | X | X | X | | | |
| 42 | Professional electives 5 | | | | | | |
| 42.1 | Medical Informatics | X | X | | X | | |
| 42.2 | Medical Sensors | X | X | X | | | |
| 43 | Professional electives 6 | | | | | | |
| 43.1 | Radiological Physics & Dosimetry | X | X | | X | | X |
| 43.2 | MRI Tomography | X | X | | X | | |

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| 44 | Professional electives 7 | | | | | | | |
| 44.1 | Artificial Organs | X | X | | X | | X |
| 44.2 | Mathematical Models in Biology and Medicine | X | X | X | | | |
| 45 | Capstone Design Project | X | X | X | X | X | X |

## Program Curriculum

| № | Subject code | Subject | ECTS Credit/Hours | Hours | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Lecture | Seminar (work in the group) | Practical Classes' | Laboratory | Practice | Course work/project | Mid-semester exaϖm | 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 | General 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 | BRS10208E1-LP | 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 | ICT10408G1-LP | Programming 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 1. | Electrical Circuits 1 | 5/125 | 15 | | | 30 | | | 1 | 2 | 77 |
| 16 | EET30408E1-LB | Biomedical Measurements | 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 2 | Medical device design | 5/125 | 15 | | 30 | | | | 1 | 2 | 77 |

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| 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 | Mimicry 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 | MAS30708E1-LP | Elements of Mathematics for Business | 5/125 | 15 | | 30 | | | | 1 | 2 | 77 |
| 30 | EET62608E1-PB | Modeling in Electronic 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-LR | 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 | Fundametals of Business Correspondence | 4/100 | | | 30 | | | | 1 | 2 | 67 |
| 36.1 | INERG09EA3-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 | ICT10608E1-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 | BRS10208E1-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 | EET04608E1-LP | Artificial Organs | 6/150 | 30 | | 30 | | | | 1 | 2 | 87 |
| 44.2 | EET38308E1-L | Mathematical Models in | 6/150 | 30 | | 30 | | | | 1 | 2 | 87 |

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| | | Biology and Medicine | | | | | | | | | | |
| 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

**Approved**

at the Session of the Faculty Council

05. 10. 2018

Chairman of the Faculty Council Zurab Tsveraidze

**Agreed with**

Quality Assurance Service of GTU Irma Inashvili