



საქართველოს ტექნიკური უნივერსიტეტი
GEORGIAN TECHNICAL UNIVERSITY

Approved by Academic Council of GTU on
“ ___ ” “ ” 2013
by Decree №

Bachelor's Degree Program

Program Title

Biomedical Engineering

Faculty

Informatics and Control Systems

Program Supervisor

Full Professor Irina Gotsiridze

Awarded Qualification

Bachelor of Biomedical Engineering

Will be awarded in the case of passing not less than 240 credits of an educational program.

Language

English

Program Objective

The program educational objectives of biomedical engineering program is to integrate engineering and life science principles into a comprehensive curriculum, that prepares students for entry into the master program, biomedical industry, or professional school. Primary research areas are biomedical imaging, biomedical implants and devices, cardiac electrophysiology, multiscale computational modeling, tissue engineering and regenerative medicine. Program provide graduates with a rigorous, broad-based education in engineering coupled with applied biology that will prepare bachelors for the many diverse career opportunities of biomedical engineering. Provide an empowering professional degree for students who intend to become practicing engineers .

Program prerequisites

Applicant is admitted in compliance with the Georgian Legislation

Learning Outcome/Competencies

– **Knowledge and understanding:** Deep knowledge of the field of Biomedical Engineering, critical understanding of theories and principles, understanding of field's complex issues; Develop a through understanding of advanced principles in Biomedical Engineering. Awareness of current and leading-edge topics in Biomedical Engineering. To understand the biological bases of the assessments routinely performed by Biomedical Engineers;

– **Applying Knowledge:** Using of the specific for the field of Biomedical Engineering problem-solving methods; Development of research or practical projects in the accordance; Develop critical review skills, in the area of Bio-Medical Engineering. To develop the ability to critically evaluate current advances in issues and controversies in the area of Biomedical Engineering. An ability to apply knowledge of mathematics, science, and engineering to biomedical engineering problems. An ability to design and conduct experiments, as well as to analyze and interpret data . An ability to design a system, component, or process to meet desired needs. An ability to identify, formulate, and solve engineering problems . An ability to make measurements on and interpret data from living systems, addressing the problems associated with the interaction between living and non-living materials and systems. A knowledge of biology and physiology . Clear public presentation of opinions in accordance with corresponding knowledge and logic for professional and general audience. An ability to use the techniques, skills, and modern engineering and computing tools necessary for engineering practice . An ability to function on multi-disciplinary teams . The capability to apply advanced mathematics (including differential equations and statistics), science, and engineering to solve the problems at the interface of engineering and biology. A recognition of the need for, and an ability to engage in life-long learning . A knowledge of contemporary issues

- **Making judgments:** The broad education necessary to understand the impact of engineering solutions in a global and societal context , also analysis of abstract data and/or situations analysis by the mean of standard and some distinctive methods and form of the reasoned conclusions on their basis;

– **Communication skills:** An ability to communicate effectively orally and in writing . preparing of detailed written reporting concerning Ideas, existing problems and their solutions; information pass orally to professionals and non professionals in foreign languages; Creative use of modern engineering, information and communication technologies; Skill to communicate in native and foreign languages;

– **Learning skills:** multilateral and consistent assessment of own learning process; determining of necessity of further studying; determining of directions of own learning with the goals of enrichment of professional knowledge and experience.

– **Values:** Participation in the process of values formation and aspirations to their sustainable implementation; Defense of professional values (accuracy, punctuality, objectivity, transparency, organization, etc.); An understanding of professional and ethical responsibility

Forms and Methods of achieving of the learning outcomes

Lecture Seminar (working in the group) Practical classes Laboratory classes Practice
 Course Work/Project Independent Work

Forms and Methods of achieving the learning outcomes are included to the Educational Program and can be find via the following link: <http://www.gtu.ge/quality/pdf/sc.pdf>

Student's Knowledge Assessment

Assessment is based on a 100 point grading scale.

Positive assessment is:

- (A) - excellent - 91% and more of the maximum grade;
- (B) - very good - 81-90% of the maximum grade;
- (C) - good - 71-80% of the maximum grade;
- (D) - satisfactory - 61-70% of the maximum grade;
- (E) - enough - 51-60% of the maximum grade;

Negative assessment is:

- (FX) - not passed - 41-50% of the maximum grades. It means that a student needs more individual work, and is given one more possibility to pass the exam;
- (F) - failed - 40% and less of the maximum grade. It means that work performed by a student was not enough and the subject should be learnt from the beginning;

For assessment methods, criteria and scales please refer to the following link:

<http://www.gtu.ge/quality/axali/shefasebisforma.pdf>.

For assessment Research Components please refer to the following link:

http://www.gtu.ge/study/scavleba/samag_Sefas.pdf

Spheres of Employment

Organizations and companies which perform: improve equipment, such as heart valves and artificial limbs as well as contribute to develop various medical devices such as heart pacemakers. They may research with scientists, chemists, and physicians in hospitals and universities. They also help maintain and monitor complex medical systems while working in hospitals.

Enormous job opportunities in varied spheres like medical equipments manufacturing, orthopedic and rehabilitation engineering, in public and in corporate sectors are available for the biomedical engineers. They can also be absorbed in hospitals to provide valuable advice on the status of medical equipments. Biomedical engineers can also employ themselves in research activities by working harmoniously with doctors in the field of computational mechanics, physiology, medicine and invent cutting - edge technology.

Possibilities for further continues education

Master educational programs.

Required human and material resources

The program provides the appropriate human and material resources. For more information see the attached syllabi.

The number of attached syllabi: 56

| № | Course Code | Course | Prerequisite | ECTS CREDITS | | | |
|----|-------------|--|--------------|--------------|----|---------|----|
| | | | | 1 year | | II year | |
| | | | | Semester | | | |
| | | | | I | II | III | IV |
| 1 | MAT01E8 | Mathematics 1 | Don't have | 5 | | | |
| 2 | PHY01E8 | Physics 1 | Don't have | 4 | | | |
| 3 | ECGRPE8 | Engineering Computer Graphics | Don't have | 3 | | | |
| 4 | IIT01E8 | Introduction in Information Technologies | Don't have | 5 | | | |
| 5 | FUCAOE8 | Fundamentals of Computer Architecture and Organization | Don't have | 4 | | | |
| 6 | BIMCHE8 | Biomechanics | Don't have | 4 | | | |
| 7 | IBMDEE8 | Introduction in Biomedical Engineering | Don't have | 5 | | | |
| 8 | MAT02E8 | Mathematics 2 | Don't have | | 5 | | |
| 9 | PHY02E8 | Physics 2 | Don't have | | 4 | | |
| 10 | BBINSE8 | Basis of Bioinstrumentation | Don't have | | 5 | | |
| 11 | PAS02E8 | Personal Application Systems | Don't have | | 4 | | |
| 12 | MMEDRE8 | Methods Of Medical Researches | Don't have | | 4 | | |
| 13 | DSTAPE8 | Data Structures and Programming | Don't have | | 4 | | |

| Nº | Course Code | Course | Prerequisite | ECTS CREDITS | | | |
|----|-------------|--|--------------|--------------|---|---------|---|
| | | | | 1 year | | II year | |
| | | | | Semester | | | |
| I | II | III | IV | | | | |
| 14 | BPHYSE8 | Biophysics | Don't have | | 4 | | |
| 15 | DIMATE8 | Discrete Mathematics | Don't have | | | 5 | |
| 16 | PHY03E8 | Physics 3 | Don't have | | | 5 | |
| 17 | ELMSRE8 | Electrical Measurements | Don't have | | | 5 | |
| 18 | FMEDLE8 | Fundamentals of Medical Electronics | Don't have | | | 5 | |
| 19 | OOP01E8 | Object-Oriented Programming | Don't have | | | 5 | |
| 20 | ELPHSE8 | Electrophysiology | Don't have | | | 5 | |
| 21 | HPSHLE8 | Human Physiology | Don't have | | | | 5 |
| 22 | MELWSE8 | Modeling in Electronic Workbench Space | Don't have | | | | 6 |
| 23 | BMTRLE8 | Biomaterials | Don't have | | | | 5 |
| 24 | ENMDTE8 | Elements and Nodes of Medical Technics | Don't have | | | | 6 |
| 25 | BUSCOE8 | Business Correspondence | Don't have | | | | 3 |
| 26 | CABMEE8 | CAD Systems | Don't have | | | | 5 |

MODULE 1 Medical Technics and Technologies

| Nº | CODES | DISCIPLINE | Prerequisite | ECTS Credits |
|------|---------|---|--------------|--------------|
| 1.1 | LVPRME8 | Lab View Programming Methods | Don't have | 4 |
| 1.2 | SSFPME8 | Software Systems for Project Management | Don't have | 4 |
| 1.3 | BMDMSE8 | Biomedical Measuring | Don't have | 4 |
| 1.4 | MEDELE8 | Medical Electronics | Don't have | 4 |
| 1.5 | BMDTRE8 | Biomedical Transducers | Don't have | 4 |
| 1.6 | BBMSPE8 | Basis Of Biomedical Signal Processing | Don't have | 4 |
| 1.7 | BDPBSE8 | Basis Of Digital Processing of Biomedical Signals | Don't have | 4 |
| 1.8 | CTSYSE8 | Control Systems in Medicine | Don't have | 4 |
| 1.9 | BMDEQE8 | Biomedical Equipments | Don't have | 5 |
| 1.10 | BMDESE8 | Biomedical Equipment Service | Don't have | 4 |
| 1.11 | BIOSTE8 | Biostatistics | Don't have | 4 |
| 1.12 | MDEXPE8 | Medical Expert Systems | Don't have | 5 |
| 1.13 | BMNTPE8 | Team Project in Biomedical Engineering | Don't have | 4 |
| 1.14 | BINFME8 | Bioinformatics in MATLAB | Don't have | 3 |
| 1.15 | PRGVSE8 | Programming in Visual Studio | Don't have | 3 |
| | Total | | | 60 credits |

Module II Medical Compute Systems

| Nº | CODES | DISCIPLINE | Prerequisite | ECTS CREDITS |
|------|---------|---|------------------|--------------|
| 2.1 | MDSYSE8 | Medical Diagnostic Systems | Don't have | 5 |
| 2.2 | MPMSSE8 | Microprocessor Medical Systems | Don't have | 4 |
| 2.3 | BMIMPE8 | Basis of Medical Image Processing | Don't have | 4 |
| 2.4 | BCENGE8 | Basis of Clinical Engineering | Don't have | 4 |
| 2.5 | MMBMSE8 | Mathematical modeling of Biomedical Systems | Don't have | 4 |
| 2.6 | BMINFE8 | Basis of Medical Informatics | Don't have | 4 |
| 2.7 | MBHLTE8 | Mobile Health | Don't have | 4 |
| 2.8 | INFMSE8 | Interfaces of Medical Systems | Don't have | 4 |
| 2.9 | ARORGE8 | Artificial Organs | Don't have | 3 |
| 2.10 | CDLDVE8 | Clinical Diagnostic Laboratory Devices | Don't have | 5 |
| 2.11 | RADDVE8 | Radiological Devices | Don't have | 4 |
| 2.12 | HCMNGE8 | Health Care Management | Don't have | 4 |
| 2.13 | TLMEDE8 | Telemedicine | Don't have | 3 |
| 2.14 | QMNGME8 | Quality Management of Medical Technology Products | Don't have | 4 |
| 2.15 | CLNPRE8 | Clinical Practice | Don't have | 4 |
| | | | Total 60 credits | |

Map of study results

| Nº | Course code | Course | General and technical competencies | | | | | |
|----|-------------|--|------------------------------------|--------------------|------------------|----------------------|-----------------|--------|
| | | | Knowledge and understanding | Applying knowledge | Making judgments | Communication skills | Learning skills | Values |
| 1 | MAT01E8 | Mathematics 1 | x | x | | | x | |
| 2 | PHY01E8 | Physics 1 | x | x | | | x | |
| 3 | ECGRPE8 | Engineering Computer Graphics | x | x | | | | |
| 4 | IIT01E8 | Introduction in Information Technologies | x | x | | x | x | |
| 5 | FUCAOE8 | Fundamentals of Computer Architecture and Organization | x | x | | | x | |
| 6 | BIMCHE8 | Biomechanics | x | x | x | | | |
| 7 | IBMDEE8 | Introduction in Biomedical Engineering | x | x | x | | | |
| 8 | MAT02E8 | Mathematics 2 | x | x | | | x | |
| 9 | PHY02E8 | Physics 2 | | x | x | | x | |
| 10 | BBINSE8 | Basics of Bioinstrumentation | x | x | x | | | |

| № | Course code | Course | General and technical competencies | | | | | |
|----|-------------|---|------------------------------------|--------------------|------------------|----------------------|-----------------|--------|
| | | | Knowledge and understanding | Applying knowledge | Making judgments | Communication skills | Learning skills | Values |
| 11 | PAS02E8 | Personal Application Systems | | x | | x | x | |
| 12 | MMEDRE8 | Methods Of Medical Research | x | x | x | | | |
| 13 | DSTAPE8 | Data Structures and Programming | | x | x | | x | |
| 14 | BPHYSE8 | Biophysics | x | x | x | | | |
| 15 | DIMATE8 | Discrete Mathematics | | x | x | | x | |
| 16 | PHY03E8 | Physics 3 | x | x | | | x | |
| 17 | ELMSRE8 | Electrical Measurements | x | x | | | | |
| 18 | FMEDLE8 | Fundamentals of Medical Electronics | x | x | | | | |
| 19 | OOP01E8 | Object-Oriented Programming | | x | | | | x |
| 20 | ELPHSE8 | Electrophysiology | x | x | | | | |
| 21 | HPSHLE8 | Human Physiology | x | x | | | x | |
| 22 | MELWSE8 | Modeling in Electronic Workbench Space | x | x | | | | |
| 23 | BMTRLE8 | Biomaterials | x | x | x | | | |
| 24 | ENMDTE8 | Elements and Nodes of Medical Technics | x | x | | | | |
| 25 | BUSCOE8 | Business Correspondence | | x | | x | | x |
| 26 | CABMEE8 | CAD Systems | x | x | | | | |
| 27 | LVPRME8 | Lab View Programming Methods | x | x | | | x | |
| 28 | SSFPME8 | Software Systems for Project Management | x | x | | | x | |
| 29 | BMDMSE8 | Biomedical Measurements | x | x | | | | |
| 30 | MEDELE8 | Medical Electronics | x | x | | | | |
| 31 | BMDTRE8 | Biomedical Transducers | x | x | | | | |
| 32 | BBMSPE8 | Basis Of Biomedical Signal Processing | x | x | | | | |
| 33 | BDPBSE8 | Basis Of Digital Processing of Biomedical Signals | x | x | | | | |
| 34 | CTSYSE8 | Control Systems In Medicine | x | x | | | | |
| 35 | BMDEQE8 | Biomedical Equipments | x | x | x | | | |
| 36 | MDEXPE8 | Biomedical Equipment Service | x | x | | | | |
| 37 | BIOSTE8 | Biostatistics | x | x | | | | |
| 38 | MDEXPE8 | Medical Expert Systems | x | x | | | | |
| 39 | BMNTPE8 | Team Project in Biomedical Engineering | | x | | x | | |
| 40 | BINFME8 | Bioinformatics in MATLAB | x | x | | | | |
| 41 | PRGVSE8 | Programming in Visual Studio | x | x | | | | |
| 42 | MDSYSE8 | Medical Diagnostic Systems | x | x | | | | |
| 43 | MPMSSE8 | Microprocessor Medical Systems | x | x | | | | |
| 44 | BMIMPE8 | Basis of Medical Image Processing | x | x | x | | | |
| 45 | BCENGE8 | Basis of Clinical Engineering | x | x | | x | | |
| 46 | MMBMSE8 | Mathematical modeling of biomedical systems | x | x | | | | |

| № | Course code | Course | General and technical competencies | | | | | |
|----|-------------|--|------------------------------------|--------------------|------------------|----------------------|-----------------|--------|
| | | | Knowledge and understanding | Applying knowledge | Making judgments | Communication skills | Learning skills | Values |
| 47 | BMINFE8 | Basis of Medical Informatics | x | | x | x | | |
| 48 | MBHLTE8 | Mobile Health | x | x | | | | |
| 49 | INFMSE8 | Interfaces of Medical Systems | x | x | | | | |
| 50 | ARORGE8 | Artificial Organs | x | x | | | | |
| 51 | CDLDVE8 | Clinical Diagnostic Laboratory Devices | x | x | | | | |
| 52 | RADDVE8 | Radiological Devices | x | x | | | | |
| 53 | HCMNGE8 | Health Care Management | x | | x | | | |
| 54 | TLMEDE8 | Telemedicine | x | x | | | | |
| 55 | QMNGME8 | Quality Management of Medical Devices | x | x | | | | |
| 56 | CLNPRE8 | Clinical Practice | | x | | x | | |

Program Curriculum

| № | Course code | Course | Hours | | | | | | | |
|----|-------------|--|-------------------|---------|----------------------|----------------|-----------------|----------|---------------------|------------------|
| | | | ECTS Credit\ Hour | Lecture | Seminar (group work) | Practical Work | Laboratory Work | Practice | Course Work/Project | Independent Work |
| 1 | MAT01E8 | Mathematics 1 | 5/135 | 30 | | 30 | | | | 75 |
| 2 | PHY01E8 | Physics 1 | 4/108 | 15 | | | 30 | | | 63 |
| 3 | ECGRPE8 | Engineering Computer Graphics | 3/81 | | | 15 | 30 | | | 51 |
| 4 | IIT01E8 | Introduction in Information Technologies | 5/135 | 15 | | 15 | 30 | | | 75 |
| 5 | FUCAOE8 | Fundamentals of Computer Architecture and Organization | 4/108 | 30 | | 15 | | | | 63 |
| 6 | BIMCHE8 | Biomechanics | 4/108 | 15 | | 30 | | | | 63 |
| 7 | IBMDEE8 | Introduction in Biomedical Engineering | 5/135 | 30 | | 30 | | | | 75 |
| 8 | MAT02E8 | Mathematics 2 | 5/135 | 30 | | 30 | | | | 75 |
| 9 | PHY02E8 | Physics 2 | 4/108 | 15 | | | 30 | | | 63 |
| 10 | BBINSE8 | Basis of Bioinstrumentation | 5/135 | 30 | | 30 | | | | 75 |
| 11 | PAS02E8 | Personal Application Systems | 4/108 | 15 | | 30 | | | | 63 |
| 12 | MMEDRE8 | Methods Of Medical Research | 4/108 | 15 | | | 30 | | | 63 |
| 13 | DSTAPE8 | Data Structures and Programming | 4/108 | 15 | | 30 | | | | 63 |

| № | Course code | Course | Hours | | | | | | | |
|----|-------------|---|-------------------|---------|----------------------|----------------|-----------------|----------|---------------------|------------------|
| | | | ECTS Credit\ Hour | Lecture | Seminar (group work) | Practical Work | Laboratory Work | Practice | Course Work/Project | Independent Work |
| 14 | BPHYSE8 | Biophysics | 4/108 | 30 | | 15 | | | | 63 |
| 15 | DIMATE8 | Discrete Mathematics | 5/135 | 30 | | 30 | | | | 75 |
| 16 | PHY03E8 | Physics 3 | 5/135 | 30 | | | 30 | | | 75 |
| 17 | ELMSRE8 | Electrical Measurements | 5/135 | 30 | | | 30 | | | 75 |
| 18 | FMEDLE8 | Fundamentals of Medical Electronics | 5/135 | 30 | | 30 | | | | 75 |
| 19 | OOP01E8 | Object-Oriented Programming | 5/135 | 15 | | 15 | 30 | | | 75 |
| 20 | ELPHSE8 | Electrophysiology | 5/135 | 30 | 30 | | | | | 75 |
| 21 | HPSHLE8 | Human Physiology | 5/135 | 30 | | | 30 | | | 75 |
| 22 | MELWSE8 | Modeling in Electronic Workbench Space | 6/162 | | | 30 | 45 | | | 87 |
| 23 | BMTRLE8 | Biomaterials | 5/135 | 30 | 30 | | | | | 75 |
| 24 | ENMDTE8 | Elements and Nodes of Medical Technics | 6/162 | 30 | | 45 | | | | 87 |
| 25 | BUSCOE8 | Business Correspondence | 3/81 | | | 30 | | | | 51 |
| 26 | CABMEE8 | CAD Systems | 5/135 | | | 30 | 30 | | | 75 |
| 27 | LVPRME8 | Lab View Programming Methods | 4/108 | | 15 | 30 | | | | 63 |
| 28 | SSFPME8 | Software Systems for Project Management | 4/108 | | 15 | 30 | | | | 63 |
| 29 | BMDMSE8 | Biomedical Measurements | 4/108 | 15 | | | 30 | | | 63 |
| 30 | MEDELE8 | Medical Electronics | 4/108 | 15 | | 30 | | | | 63 |
| 31 | BMDTRE8 | Biomedical Transducers | 4/108 | 15 | | 30 | | | | 63 |
| 32 | BBMSPE8 | Basis Of Biomedical Signal Processing | 4/108 | 30 | | 15 | | | | 63 |
| 33 | BDPBSE8 | Basis Of Digital Processing of Biomedical Signals | 4/108 | 30 | | 15 | | | | 63 |
| 34 | CTSYSE8 | Control Systems In Medicine | 4/108 | 30 | | 15 | | | | 63 |
| 35 | BMDEQE8 | Biomedical Equipments | 5/135 | 30 | | 30 | | | | 75 |
| 36 | BMDESE8 | Biomedical Equipment Service | 4/108 | | | 45 | | | | 63 |
| 37 | BIOSTS8 | Biostatistics | 4/108 | 15 | | | | | 30 | 63 |
| 38 | MDEXPE8 | Medical Expert Systems | 5/135 | 30 | 30 | | | | | 75 |
| 39 | BMNTPE8 | Team Project in Biomedical Engineering | 4/108 | | | | | | 45 | 63 |
| 40 | BINFME8 | Bioinformatics in MATLAB | 3/81 | | | 30 | | | | 51 |
| 41 | PRGVSE8 | Programming in Visual Studio | 3/81 | | | | 30 | | | 51 |
| 42 | MDSYSE8 | Medical Diagnostic Systems | 5/135 | 30 | | 30 | | | | 75 |
| 43 | MPMSSE8 | Microprocessor Medical Systems | 4/108 | 30 | | 30 | | | | 63 |
| 44 | BMIMPE8 | Basis of Medical Image Processing | 4/108 | 15 | | | | | 30 | 63 |
| 45 | BCENGE8 | Basis of Clinical Engineering | 4/108 | 15 | | | | 30 | | 63 |
| 46 | MMBMSE8 | Mathematical modeling of Biomedical systems | 4/108 | 30 | | 15 | | | | 63 |

| Nº | Course code | Course | Hours | ECTS Credit\ Hour | Lecture | Seminar (group work) | Practical Work | Laboratory Work | Practice | Course Work/Project | Independent Work |
|----|-------------|---|-------|-------------------|---------|----------------------|----------------|-----------------|----------|---------------------|------------------|
| 47 | BMINFE8 | Basis of Medical Informatics | | 4/108 | 30 | | 15 | | | | 63 |
| 48 | MBHLTE8 | Mobile Health | | 4/108 | 30 | 15 | | | | | 63 |
| 49 | INFMSE8 | Interfaces of Medical Systems | | 4/108 | 30 | | 15 | | | | 63 |
| 50 | ARORGE8 | Artificial Organs | | 3/81 | 45 | | | | | | 51 |
| 51 | CDLDVE8 | Clinical Diagnostic Laboratory Devices | | 5/165 | 30 | | 30 | | | | 75 |
| 52 | RADDVE8 | Radiological Devices | | 4/108 | 30 | | 15 | | | | 63 |
| 53 | HCMNGE8 | Health Care Management | | 4/108 | 15 | 30 | | | | | 63 |
| 54 | TLMEDE8 | Telemedicine | | 3/1/81 | 30 | | | | | | 51 |
| 55 | QMNGME8 | Quality Management of Medical Technology Products | | 4/108 | 15 | | 30 | | | | 63 |
| 56 | CLNPRE8 | Clinical Practice | | 4/108 | | | | | 45 | | 63 |

Educational Program Supervisor

Irina Gotsiridze

The Head of Quality Assurance Service at the
Faculty of Informatics and Control Systems

Zurab Baiashvili

Accepted at

The Council of the Faculty
Informatics and Control Systems

03.04. 2013

Protocol № 1

The Head of the Faculty Council

Zurab Tsveraidze

Agreed with

Quality Assurance Service of GTU

Giorgi Dzidziguri