

**МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
НАЦІОНАЛЬНИЙ ТЕХНІЧНИЙ УНІВЕРСИТЕТ УКРАЇНИ
«КИЇВСЬКИЙ ПОЛІТЕХНІЧНИЙ ІНСТИТУТ
імені Ігоря Сікорського»**

ЗАТВЕРДЖЕНО

Вченою радою КПІ ім. Ігоря Сікорського

(протокол № 3 від «15» 03 2021 р.)

Голова Вченої ради

_____ Михайло ІЛЬЧЕНКО



**МЕДИЧНА ІНЖЕНЕРІЯ
MEDICAL ENGINEERING**

**ОСВІТНЬО-ПРОФЕСІЙНА ПРОГРАМА
першого (бакалаврського) рівня вищої освіти**

за спеціальністю 163 Біомедична інженерія
галузі знань 16 Хімічна та біоінженерія
кваліфікація бакалавр з біомедичної інженерії

Введено в дію Наказом ректора

КПІ ім. Ігоря Сікорського

(наказ № 101/89/2021 від «19» 04 2021 р.)

Київ – 2021 р.

**MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
NATIONAL TECHNICAL UNIVERSITY OF UKRAINE
"IGOR SIKORSKY KYIV POLYTECHNIC INSTITUTE"**

APPROVED

Academic Council of Igor Sikorsky Kyiv
Polytechnic Institute

(protocol № ___ from "___" _____ 2021)

Chairman of the Academic Council

_____ Mykhailo ILCHENKO

P.S.

MEDICAL ENGINEERING

EDUCATIONAL PROFESSIONAL PROGRAM

first (bachelor's) level of higher education

in specialty 163 Biomedical Engineering

fields of knowledge 16 Chemical and bioengineering

qualification bachelor in biomedical engineering

Put into effect by the Rector's Order of

Igor Sikorsky Kyiv Polytechnic Institute

(order № HOH/89/2021 from « 19 » 04 2021)

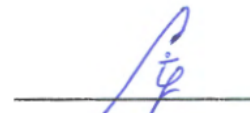
Kyiv - 2021

PREAMBLE

DEVELOPED by the project team:

Project team leader:

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Department of Biomedical Engineering



Project team members:

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Acting Head of the Department of Biomedical Engineering



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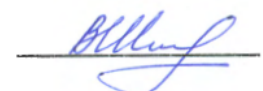


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Shlykov Vladyslav, Doctor of Technical Sciences, Associate
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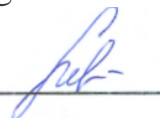


AGREED:

Scientific and methodical commission of Igor Sikorsky Kyiv Polytechnic Institute,
specialty 163 Biomedical Engineering

Chairman of the commission

(protocol № 2 from "19" 02 2021)



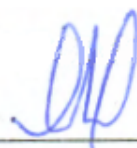
Vitaliy MAKSYMENKO

Methodical council of

Igor Sikorsky Kyiv Polytechnic Institute

Chairman of the Methodical Council

(protocol № 6 from "25" 02 2021)



Yuriy YAKYMENKO

TAKEN INTO ACCOUNT:

The review of the educational program was carried out to fulfill the order of the rector of Igor Sikorsky Kyiv Polytechnic Institute № HOH/35/2020 dated 30.11.2020 "On improving the educational programs of the first (bachelor's) level of higher education".

Project group TAKES INTO ACCOUNT:

1. Methodical recommendations of the higher education sector of the Scientific and Methodological Council of the Ministry of Education and Science of Ukraine (protocol №7 of February 6, 2020)

<https://mon.gov.ua/ua/osvita/visha-osvita/naukovo-metodichna-rada-ministerstva-osviti-i-nauki-ukrayini>

2. Standard of higher education in specialty 163 Biomedical engineering for the first (bachelor's) level of higher education, posted on the website of the Ministry of Education and Science of Ukraine

<https://mon.gov.ua/storage/app/media/vishcha-osvita/zatverdzeni%20standarty/12/21/163-biomedichna-inzheneriya-bakalavr.pdf>

and posted on the website of the Department of Biomedical Engineering of Igor Sikorsky Kyiv Polytechnic Institute

<http://bmi.fbmi.kpi.ua/wp-content/uploads/2020/09/163-biomedichna-inzheneriya-bakalavr.pdf>

3. Reviews of reviewers on Higher Education Standard in the specialty of 163 Biomedical Engineering for the first (bachelor's) level of higher education, posted on the website of the Department of Biomedical Engineering Igor Sikorsky Kyiv Polytechnic Institute

<http://bmi.fbmi.kpi.ua/standards-higher-education/>

4. Comments and suggestions of stakeholders based on the results of the public discussion:

- specialists of the educational and methodical department of Igor Sikorsky Kyiv Polytechnic Institute;
- scientific and pedagogical staff of the Department of Biomedical Engineering;
- applicants for higher education who study in educational programs in the specialty 163 Biomedical Engineering;
- employers and specialists in the field of 16 Chemical and Bioengineering , reviews of which on the educational- professional program of the first (bachelor's) level of higher education in the specialty 163 Biomedical Engineering is posted on the website of the Department of Biomedical Engineering

<http://bmi.fbmi.kpi.ua/department/educational-programs/>

AGREED:

Student Council of the Faculty of Biomedical Engineering of Igor Sikorsky Kyiv Polytechnic Institute (protocol № 1 from " 15 " 02 2021).

EP was discussed and changed after receiving all the wishes and suggestions from employers and applicants for higher education of Igor Sikorsky Kyiv Polytechnic Institute, approved by the Scientific and methodical commission 163 Biomedical Engineering and approved at a meeting of the Department of Biomedical Engineering (protocol № 2 from " 17 " 02 2021) .

Feedback reviews from stakeholders are attached.

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1. PROFILE OF THE EDUCATIONAL PROGRAM

in specialty 163 Biomedical Engineering

1 - General information	
Full name of HEI and institute / faculty	National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute", Faculty of Biomedical Engineering
Higher education degree and title of qualification in the original language	Degree – bachelor Qualification – Bachelor in Biomedical Engineering
The official name of the educational program	Medical engineering
Type of diploma and amount of educational program	Bachelor's degree. The amount of the educational component is 240 ECTS credits, the term of training is 3 years, 10 months. The professional component involves solving a scientific and practical problem in the form of qualifying work and its design in the form of a bachelor's diploma
Availability of accreditation	Ministry of Education and Science of Ukraine State Accreditation Commission. Certificate of accreditation in the specialty 163 Biomedical Engineering (HJ Series, №1192633). The certificate is valid until July 1, 2019 (the validity of the certificate was extended until July 1, 2022 by the Decision of the Accreditation Commission on February 19, 2019, protocol № 134).
Cycle / level of higher education	National Qualifications Framework of Ukraine - level 6; QF-EHEA (European Qualifications Framework for Higher Education Area) – first cycle; EQF-LLL (European Qualifications Framework for Lifelong Learning) – Level 6.
Prerequisites	Presence of complete general secondary education or appropriate degree (educational qualification level).
Language (s) of instruction	Ukrainian / English
Term of the educational program	Until the next accreditation. Re-accreditation is expected in 2022.
Internet address of the permanent placement of the educational program	1. Department of Biomedical Engineering of Igor Sikorsky Kyiv Polytechnic Institute http://bmi.fbmi.kpi.ua/department/educational-programs 2. The educational process in Igor Sikorsky Kyiv Polytechnic Institute https://osvita.kpi.ua/op
2 - The purpose of the educational program	
<p>The purpose of the educational program is to prepare qualified, capable competitiveness, integrated in the European and international scientific and educational space experts degree of Bachelor in the field of chemical and bioengineering specialty 163 Biomedical Engineering capable of independent commissioning, testing, engineering-operational, engineering-design, scientific and technical, scientific-organizational and practical activities in the field of biomedical engineering and technology, which involves intercultural interaction with representatives of the scientific and technical community in conditions:</p> <ul style="list-style-type: none"> – scientific and technological progress in the field of Chemical and Bioengineering; – sustainable development of society and economic and environmental interests of society; – internationalization of education and integration of the international component into educational, research activities of higher educational institutions; – labor market transformation through interaction with stakeholders; – comprehensive professional, intellectual, social and creative development of the individual in the educational and scientific environment; 	

– combination of engineering, medical and biological knowledge of the means and methods of creating software and hardware biotechnical systems in biology and medicine, which involves the application of theories and methods of chemical, biological and medical engineering.	
3 - Characteristics of the educational program	
Subject area (field of knowledge, specialty)	Field of knowledge - 16 Chemical and bioengineering. Specialty - 163 Biomedical Engineering .
	<p>Object of activity: development, production, testing, operation, service, repair and certification of medical equipment and products for medical and biological purposes, processing of biomedical information, technical and information support of medical technologies and systems.</p> <p>Theoretical content of the subject area: clinical engineering, medical equipment, microelectromechanical biotechnical systems, medical radiology, medical biotechnology, biomechanics, medical robotics, biomedical informatics; obtaining, processing, interpretation of biosignals and images of biological objects.</p> <p>Methods, techniques and technologies: engineering design methods, biotechnical and medical-technical technologies, modeling, software in medical instrument making and information technologies for data processing and analysis in biology and medicine.</p> <p>Tools and equipment: biological and medical equipment, biomedical products and biomaterials for medical purposes, artificial organs, computers.</p>
Orientation of the educational program	Educational professional
The main focus of the educational program and specialization	Obtaining special education in the specialty 163 Biomedical Engineering with the possibility of acquiring the necessary professional competencies for further professional activity in the field of 16 Chemical and Bioengineering. <i>Key words:</i> biomedical engineering, biological and medical equipment, biomaterials for medical purposes, biomedical products, artificial organs and systems, diagnostic and therapeutic equipment.
Features of the program	The bachelor's program is focused on solving scientific and technical problems in the field of biomedical engineering. The high level of educational and professional training is provided by the scientific school of biomedical engineering. M.M. Amosov, the presence of research and training laboratories, cooperation agreements with leading clinical, medical and research institutions of the Ministry of Health and the National Academy of Medical Sciences of Ukraine. The educational professional program was brought in line with the European educational programs within the framework of the international European program "TEMPUS: 543904-TEMPUS-1-2013-1-GR-TEMPUS-JPGR" in 2013-2016. Education of foreign applicants for higher education is carried out in English with the provision of learning Ukrainian as a foreign language.

4 - Suitability of graduates for employment and further study	
Suitability for employment	<p>Graduates are able to hold positions whose qualification requirements include a bachelor's degree:</p> <ul style="list-style-type: none"> - specialist in medical physics, technician for operation and repair of equipment, technician for the preparation of technical documentation, technician for debugging and testing; - specialist in information technology (biology and medicine) ; - biomedical engineer, design engineer, technological engineer, commissioning and testing engineer, operation and repair organization engineer, new equipment implementation engineer; - scientific and technical work in institutions of higher education, in health care institutions, in research institutes of the technical and information sector; - scientific and technical work in departments and laboratories of specialized institutions and university departments (biology and medicine).
Further study	The right to continue education at the second (master's) level of higher education
5 - Teaching and assessment	
Teaching and learning	<p>The general style of learning is creatively oriented, aimed at developing the skills of generating new ideas and gaining in-depth knowledge.</p> <p>The educational process is carried out on the basis of acmeological, axiological, systemic, competence, personality-oriented and innovation-informative approach, technology of blended and distance learning.</p> <p>A creative learning style is used, stimulating creativity in cognitive activity and initiative, learning through clinical practice.</p> <p>Teaching methods: communicative, problem-searching, research, explanatory-demonstration, partial-search, method of educational projects.</p> <p>Implemented: lecture courses, seminars and practical classes (active and interactive business games, presentations, discussions, projects), computer workshops and laboratory work, course projects and works, consultations, independent training in library funds, use of Internet resources, performance of qualifying diploma work of the bachelor. .</p> <p>Scientific guidance and consulting of leading specialists of the department is provided. It is planned to write scientific articles presented at university, all-Ukrainian and international scientific-practical conferences.</p>
Assessment	<p>Current written and oral forms of knowledge control, including in the form of tests. Current attestations of study are carried out according to the individual study plan of the student (2 times a year). Implementation of the results of scientific and technical tasks in the educational process of the department. Publication of the results of own research in professional scientific journals (at least one publication or abstract of a report in a professional publication).</p> <p>Certification is carried out on the basis of public defense of the bachelor's diploma according to the approved procedure.</p>

6 - Program competencies	
Integral competence	Ability to solve complex specialized tasks and practical problems in biomedical engineering or in the learning process, which involves the use of certain theories and methods of chemical, biological and medical engineering, and is characterized by complexity and uncertainty of conditions.
General Competences (GC)	
GC 1	Ability to apply knowledge in practical situations.
GC 2	Knowledge and understanding of the subject area and understanding of professional activity.
GC 3	Ability to communicate in the state language both orally and in writing.
GC 4	Skills in the use of information and communication technologies.
GC 5	Ability to conduct research at the appropriate level.
GC 6	Ability to search process and analyses information from various sources.
GC 7	Ability to generate new ideas (creativity).
GC 8	Ability to make informed decisions.
GC 9	Ability to communicate with representatives of other professional groups of different levels (with experts from other fields of knowledge / types of economic activity).
GC 10	Safe activities skills.
GC 11	Ability to evaluate and ensure the quality of work performed.
GC 12	Ability to exercise their rights and responsibilities as a member of society, to realize the values of civil (free democratic) society and the need for its sustainable development, the rule of law, human rights and freedoms and the citizen of Ukraine.
GC 13	Ability to preserve and increase moral, cultural, scientific values and achievements of society based on understanding the history and patterns of development of the subject area, its place in the general system of knowledge about nature and society and in the development of society, technology and technology, use different types of physical activity and leading a healthy lifestyle.
Professional competencies of the specialty (PC)	
PC 1	Ability to use engineering software packages for research, analysis, processing and presentation of results, as well as for automated design of medical devices and systems.
PC 2	Ability to provide engineering expertise in the process of planning, development, evaluation and specification of medical equipment.
PC 3	Ability to study and apply new methods and tools for analysis, modeling, design and optimization of medical devices and systems.
PC 4	Ability to provide technical and functional characteristics of systems and tools used in medicine and biology (in prevention, diagnosis, treatment and rehabilitation).
PC 5	Ability to apply physical, chemical, biological and mathematical methods in the analysis, modeling of the functioning of living organisms and biotechnical systems.
PC 6	Ability to effectively use tools and methods for analysis, design, calculation and testing in the development of biomedical products and services.
PC 7	Ability to plan, design, develop, install, operate, maintain, maintain, control and coordinate the repair of devices, equipment and systems for prevention, diagnosis, treatment and rehabilitation used in hospitals and research institutes.
PC 8	Ability to conduct research and observations on the interaction of biological, natural and artificial systems (prostheses, artificial organs, etc.).
PC 9	Ability to identify, formulate and solve engineering problems related to the interaction between living and non-living systems.
PC 10	Ability to apply the principles of construction of modern automated control systems for the production of medical devices, their technical, algorithmic, informational and software.

PC 11	Ability to understand the technical and functional characteristics of systems, methods and procedures used in prevention, diagnosis and therapy.
PC 12	Ability to develop, plan and apply mathematical methods in the analysis, modeling of the functioning of living organisms, systems and processes in biology and medicine.
PC 13	Ability to ensure and monitor compliance with safety and biomedical ethics when working with medical equipment.
PC 14	Ability to conduct experiments according to specified technical and medical methods, perform computer processing, analysis and synthesis of the results.
7- Program learning outcomes (PLO)	
PLO 1	Apply knowledge of the basics of mathematics, physics and biophysics, bioengineering, chemistry, engineering graphics, mechanics, resistance and strength of materials, properties of gases and liquids, electronics, computer science, obtaining and analyzing signals and images, automatic control, systems analysis and decision making methods needed to solve the problems of biomedical engineering.
PLO 2	Formulate logical conclusions and substantiated recommendations for the assessment, operation and implementation of biotechnical, medical-technical and bioengineering tools and methods.
PLO 3	Management of complex actions or projects, be responsible for making engineering decisions in unpredictable conditions, conduct technical, economic and safety assessment of projects.
PLO 4	Apply the provisions of regulatory and technical documents governing the procedure for product certification, production certification.
PLO 5	Be able to use databases, mathematical and software for data processing and computer modeling of biotechnical systems.
PLO 6	Be able to communicate with health professionals in the national and foreign languages (English or one of the other official EU languages) and understand their requirements for biomedical products and services, taking into account the philosophical, historical context and the concept of a healthy lifestyle.
PLO 7	Carry out engineering support, service and maintenance during the operation of laboratory and analytical equipment, medical diagnostic and therapeutic complexes and systems, as well as draw up standard documentation for the types of work in accordance with the Technical Regulations for medical devices.
PLO 8	Understand theoretical and practical approaches to the creation and management of medical equipment and medical equipment.
PLO 9	Understand theoretical and practical approaches to the creation and application of artificial biological and biotechnical objects and materials for medical purposes.
PLO 10	Be able to plan, organize, direct and control medical and technical and bioengineering systems and processes.
PLO 11	Carry out quality control and operating conditions of medical equipment and materials for medical purposes, artificial organs and prostheses.
PLO 12	Provide recommendations on the choice of equipment to ensure diagnosis and treatment.
PLO 13	Be able to analyses the signals transmitted from the organs to the devices, and to process diagnostic information (signals and images).
PLO 14	Be able to analyses the level of compliance with modern world standards, as well as evaluate solutions and tasks for the development of automated control systems, taking into account the capabilities of modern hardware and software automation of medical equipment.

PLO 15	Be able to select and recommend appropriate medical equipment and biomaterials to equip medical facilities and ensure the main stages of the technological process of diagnosis, prevention and treatment.
PLO 16	Be able to use automated design and engineering systems to develop a technological and hardware scheme of medical devices and systems, taking into account the peculiarities of their components.
PLO 17	Apply knowledge of chemistry and bioengineering to create, synthesize and apply artificial biotechnological and biological objects.
PLO 18	Understanding of fundamental-applied, medical-physical, physico-chemical laws of functioning of biological objects, and bioengineering bases of technologies and equipment for research of processes of a human body.
PLO 19	Possession of engineering methods of calculation of elements of devices and systems of medical appointment and a choice of classical and newest constructional materials, and also means of designing of devices, devices and systems of medico-biological appointment.
PLO 20	Knowledge of modern programming technologies and tools that support their use, methods of designing digital and microprocessor systems for medical purposes.
PLO 21	Knowledge of methods of object research, analysis and processing of experimental data.
PLO 22	Understanding of scientific and technical principles, methods and research methods that underlie the development, planning and design of the latest advances in biomedical engineering.
PLO 23	Operation and maintenance of diagnostic and therapeutic systems, medical complexes and systems in accordance with the rules established by technical documentation and regulations governing the commissioning, use and repair of medical equipment.
PLO 24	Use of methods and means of systematization and processing of experimental information, as well as methods of statistical processing, modeling and simulation of processes and systems of physical and biological nature in biomedical engineering.
PLO 25	Possession of tools for conducting experimental research using (medical devices, biomaterials for medical purposes, as well as for quantitative assessment of the functioning of physiological systems.
PLO 26	Knowledge of general information and principles of structure of complex biological systems, including the human body, about the human body and its functions from the standpoint of a systems approach and their use in biomedical engineering, as well as basic methods and tools used to quantify the functioning of physiological systems.
PLO 27	Development and implementation of modern diagnostic and therapeutic methods related to the use of biotechnology, computer and nanotechnology through the improvement of technical elements of medical devices and systems and medical devices in the process of professional activity.
PLO 28	Possession of modern methods of testing the experimental integrity and performance of biotechnical systems and determining their characteristics.
PLO 29	Be able to take into account historical, social, environmental, ethical, legal, economic aspects, requirements of labor protection, industrial sanitation and fire safety in the formation of technical solutions, taking into account the strengthening and preservation of personal and public health.
PLO 30	Communicate orally and in writing in Ukrainian and foreign languages in a professional environment, have professional terminology and professional discourse, adhere to the ethics of business communication; to compile documents, including in a foreign language (languages).

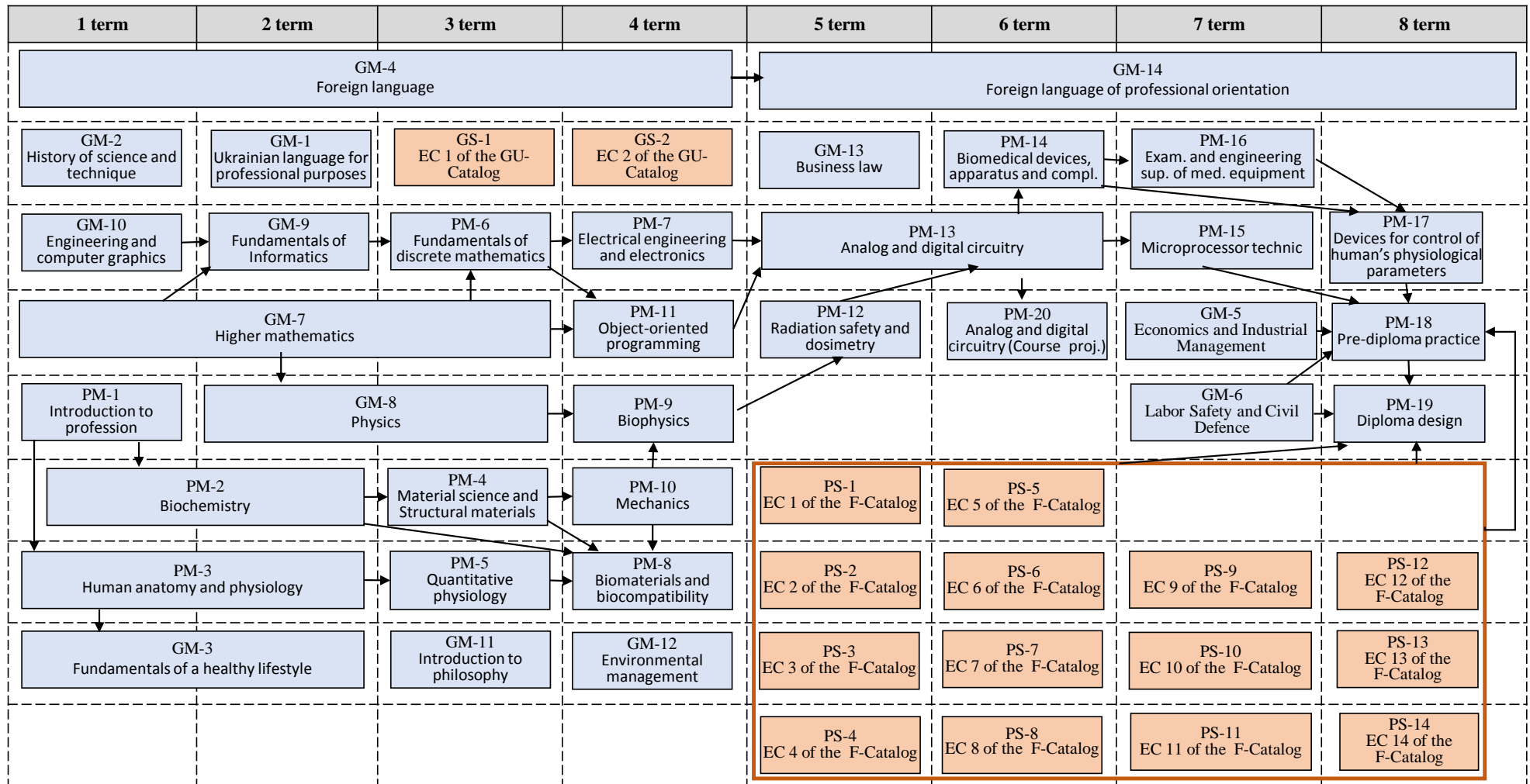
8 - Resource support for program implementation	
Staffing	In accordance with the personnel requirements for ensuring the implementation of educational activities for the relevant level of higher education, approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 (current) in the wording dated 23.05.2018 № 347.
Logistics	In accordance with the technological requirements for material and technical support of educational activities of the relevant level of higher education, approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 (effective) in the wording dated 23.05.2018 №347.
Information and educational methodical support	In accordance with the technological requirements for educational methodological and informational support of educational activities of the relevant level of HE, approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 (current) as amended on 23.05.2018 № 347. Use of Scientific and Technical Library of Igor Sikorsky Kyiv Polytechnic Institute. Use of the Scientific and Technical Library of Igor Sikorsky Kyiv Polytechnic Institute (2,537,394 paper copies, - 33,562 electronic resources (including 6,376 electronic manuals and textbooks for KPI teachers), and subscribed databases: Scopus and Web of Science, access to full texts of journals and e-books of international publishers Springer Nature) and the electronic library of the department (https://bmi.fbmi.kpi.ua/scientific-methodological-support).
9 - Academic mobility	
National credit mobility	Possibility of academic mobility on the basis of bilateral agreements between Igor Sikorsky Kyiv Polytechnic Institute and other institutions of higher education in Ukraine. National exchange program "Platskart".
International credit mobility	Based on bilateral agreements between the Igor Sikorsky Kyiv Polytechnic Institute and educational institutions of partner countries, agreements on international academic mobility (Erasmus + K1), concluded with leading universities in Europe and the World: http://bmi.fbmi.kpi.ua/internationally/academic-mobility
Training of foreign applicants for higher education	Teaching in English or Ukrainian in general training groups.

2. LIST OF COMPONENTS OF THE EDUCATIONAL PROGRAM

Code a/d	Components of the educational program (academic disciplines, course projects / course works, practices, qualification work)	Number of credits	Form of final control
1	2	3	4
Mandatory (regulatory) components of the EP			
1.1. General training cycle			
GM 1	Ukrainian language for professional purposes	2	test
GM 2	History of science and technique	2	test
GM 3	Fundamentals of a healthy lifestyle	3	test
GM 4	Foreign language	6	test
GM 5	Economics and Industrial Management	4	test
GM 6	Labor Safety and Civil Defence	4	test
GM 7	Higher mathematics	20.5	exam
GM 8	Physics	11	exam
GM 9	Fundamentals of Informatics	5.5	test
GM 10	Engineering and computer graphics	4	exam
GM 11	Introduction to philosophy	2	test
GM 12	Environmental management	2	test
GM 13	Business law	2	test
GM 14	Foreign language of professional orientation	6	exam
1.2. Cycle of professional training			
PM 1	Introduction to profession	4	test
PM 2	Biochemistry	8	test
PM 3	Human anatomy and physiology	8.5	exam
PM 4	Material science and Structural materials	4.5	test
PM 5	Quantitative physiology	4.5	test
PM 6	Fundamentals of discrete mathematics	4	test
PM 7	Electrical engineering and electronics	6	exam
PM 8	Biomaterials and biocompatibility	5	exam
PM 9	Biophysics	4.5	test
PM 10	Mechanics	4.5	test
PM 11	Object-oriented programming	4.5	test
PM 12	Radiation safety and dosimetry	5	exam
PM 13	Analog and digital circuitry	12	exam
PM 14	Biomedical devices, apparatus and complexes	4.5	exam
PM 15	Microprocessor technic	4,5	exam
PM 16	Examination and engineering support of medical equipment	4	exam
PM 17	Devices for control of human's physiological parameters	4.5	exam
PM 18	Pre-diploma practice	6	test
PM 19	Diploma design	6	defense
PM 20	Analog and digital circuitry (Course project)	1,5	test

1	2	3	4
Selective components of EP			
2.1. General training cycle (Selective educational components from the general university Catalog)			
GS 1	Educational component 1 of the GU-Catalog (disciplines of multidisciplinary orientation and institutional development)	2	test
GS 2	The educational component 2 of the GU-Catalog (discipline aimed at developing of personal potential)	2	test
2.2. Cycle of professional training (Selective educational components from interfaculty / faculty / departmental Catalogs) *			
PS 1	Educational component 1 of the F-Catalog	4	test
PS 2	Educational component 2 of the F-Catalog	4	test
PS 3	Educational component 3 of the F-Catalog	4	test
PS 4	Educational component 4 of the F-Catalog	4	test
PS 5	Educational component 5 of the F-Catalog	4	test
PS 6	Educational component 6 of the F-Catalog	4	test
PS 7	Educational component 7 of the F-Catalog	4	test
PS 8	Educational component 8 of the F-Catalog	4	test
PS 9	Educational component 9 of the F-Catalog	4	test
PS 10	Educational component 10 of the F-Catalog	4	test
PS 11	Educational component 11 of the F-Catalog	4	test
PS 12	Educational component 12 of the F-Catalog	4	test
PS 13	Educational component 13 of the F-Catalog	4	test
PS 14	Educational component 14 of the F-Catalog	4	test
The total amount of mandatory components :		180	
The total amount of selective components :		60	
The amount of educational components that support the acquisition of competencies defined by the SHE :		120	
TOTAL AMOUNT OF THE EDUCATIONAL PROGRAM		240	

3. STRUCTURAL AND LOGICAL SCHEME OF THE EDUCATIONAL PROGRAM (MANDATORY EDUCATIONAL COMPONENTS)



Required components of the educational program

Selective components of the educational program

4. FORM OF FINAL CERTIFICATION OF HIGHER EDUCATION APPLICANTS

Certification of applicants for higher education of the first (bachelor's) level of higher education under the educational-professional program "Medical Engineering" in the specialty 163 Biomedical Engineering is carried out in the form of public defense (demonstration) of qualification work.

Qualification work is checked for plagiarism and after the defense is placed in the repository of Scientific and technical library of the Igor Sikorsky Kyiv Polytechnic Institute for free access. Certification is carried out openly and publicly.

Certification ends with the issuance of a standard document on the award of a bachelor's degree with a bachelor's degree with a qualification: bachelor of biomedical engineering in the educational-professional program "Medical Engineering".

The qualifying work of the applicant must meet other requirements established by law.

5. CORRESPONDENCE MATRIX OF PROGRAM COMPETENCES TO COMPONENTS OF THE EDUCATIONAL PROGRAM

	GM 1	GM 2	GM 3	GM 4	GM 5	GM 6	GM 7	GM 8	GM 9	GM 10	GM 11	GM 12	GM 13	GM 14	PM 1	PM 2	PM 3	PM 4	PM 5	PM 6	PM 7	PM 8	PM 9	PM 10	PM 11	PM 12	PM 13	PM 14	PM 15	PM 16	PM 17	PM 18	PM 19	PM 20				
GC 1				+		+	+	+		+				+	+									+										+	+			
GC 2					+			+	+						+		+										+								+	+		
GC 3	+																																		+	+		
GC 4							+		+	+																+												
GC 5					+	+																														+	+	+
GC 6		+		+				+	+						+																					+	+	
GC 7					+		+		+																													
GC 8			+			+		+		+				+																								
GC 9	+			+	+										+																							
GC 10						+																																
GC 11						+			+																											+	+	
GC 12												+	+	+																								
GC 13		+	+									+	+																									
PC 1										+												+			+		+		+		+	+	+	+	+	+		
PC 2	+			+	+								+	+	+										+							+		+	+	+		
PC 3		+							+	+												+			+		+		+		+	+	+	+	+	+		
PC 4																							+	+					+		+		+	+	+	+		
PC 5							+	+								+		+	+	+	+		+	+	+										+	+		
PC 6				+		+				+				+	+			+				+						+		+		+	+	+	+	+		
PC 7					+																									+	+	+		+	+	+		
PC 8																+		+	+				+	+			+				+		+	+	+	+		
PC 9	+							+			+				+		+						+	+			+		+					+	+	+		
PC 10									+													+			+					+		+	+	+	+	+		
PC 11															+		+		+					+		+		+						+	+	+		
PC 12							+									+						+											+	+	+	+		
PC 13			+			+									+									+			+				+		+	+	+	+		
PC 14								+														+			+		+	+	+		+	+	+	+	+	+		

6. MATRIX FOR PROVIDING PROGRAM LEARNING OUTCOMES BY RELEVANT COMPONENTS OF THE EDUCATIONAL PROGRAM

	GM 1	GM 2	GM 3	GM 4	GM 5	GM 6	GM 7	GM 8	GM 9	GM 10	GM 11	GM 12	GM 13	GM 14	PM 1	PM 2	PM 3	PM 4	PM 5	PM 6	PM 7	PM 8	PM 9	PM 10	PM 11	PM 12	PM 13	PM 14	PM 15	PM 16	PM 17	PM 18	PM 19	PM 20			
PLO 1							+	+	+	+					+	+		+		+	+		+	+	+						+	+		+			
PLO 2										+																		+			+	+	+	+			
PLO 3					+	+				+		+	+																			+		+	+	+	
PLO 4					+	+																											+				
PLO 5							+		+																	+			+				+	+			
PLO 6	+	+	+	+							+			+																							
PLO 7																											+		+			+	+	+			
PLO 8																						+						+	+	+		+					
PLO 9																	+	+	+				+					+									
PLO 10															+																		+		+	+	+
PLO 11																		+					+						+		+	+	+	+			
PLO 12																												+			+	+					
PLO 13									+													+			+		+	+		+							
PLO 14													+		+			+					+		+	+	+	+	+	+	+	+	+	+	+		
PLO 15																		+					+					+				+					
PLO 16											+														+		+	+	+	+	+	+	+	+	+		
PLO 17															+	+		+					+						+			+					
PLO 18							+	+								+	+		+	+	+	+		+			+	+				+				+	
PLO 19																		+				+					+	+	+	+	+	+	+	+	+		
PLO 20									+																+			+		+							
PLO 21															+	+	+	+	+				+	+	+		+	+									
PLO 22															+									+	+												
PLO 23																													+		+	+	+				
PLO 24															+		+		+							+		+		+			+	+			
PLO 25															+			+	+				+	+									+				
PLO 26															+		+		+														+	+			
PLO 27																		+					+			+		+			+						
PLO 28																								+	+			+	+	+		+	+				
PLO 29		+	+		+	+				+		+	+																+	+	+						
PLO 30	+			+										+																							