

**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 №4 as of 02.04.2018)

**MEDICAL ENGINEERING**

**PROGRAM OF PROFESSIONAL EDUCATION**

**of the first (Bachelor) level of higher education**

<b>Specialty</b>	<b>163 Biomedical engineering</b>
<b>Knowledge branch</b>	<b>16 Chemical and bioengineering</b>
<b>Qualification</b>	<b>Bachelor of biomedical engineering</b>

Changes and amendment notices approved by  
Academic Council of Igor Sikorsky Kyiv Polytechnic  
Institute

163 Biomedical engineering  
(protocol № 1 as of « 03 » 06 2020)

Educational program with changes and applications  
enacted as of 2020/2021  
(order № 1/231 as of « 08 » 07 2020)

## FOREWORD

DEVELOPED by the working group:

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Head of the Department of Biomedical Engineering

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APPROVED:

The first version of the educational program were approved by the Methodological Council of Igor Sikorsky Kyiv Polytechnic Institute for specialty (protocol № 7 as of « 29 » 03 2018)

Changes and amendment notices to the educational program were approved by the Methodological Council of Igor Sikorsky Kyiv Polytechnic Institute for specialty 163 Biomedical engineering (protocol № 1 as of « 03 » 06 2020)

Head of Methodical Council Vitaliy MAKSYMENKO

**TAKEN INTO CONSIDERATION:**

The educational program was discussed and changed after receiving all the suggestions and remarks from employers and applicants for higher education Igor Sikorsky Kyiv Polytechnic Institute, approved by the Methodical Council 163 Biomedical Engineering and approved at a meeting of the Department of Biomedical Engineering.

**TAKEN INTO CONSIDERATION:**

**Marynsyi H.S.**, D.Sci., Senior researcher, Head of the Department of welding and related technologies in medicine and ecology E.O. Paton electric welding institute, National Academy of Sciences of Ukraine;

**Ozhihov D.V.**, Director of Limited Liability Company “UMT+”;

**Korovin S.I.**, M.D., D.Sci, Deputy director for research at the National Cancer Institute of Ukraine, Ministry of Health of Ukraine;

**Stychynskiy O.S.**, D. Sci., Senior researcher, head of the Department of electrophysiology and X-ray surgical treatment of cardiac arrhythmias Amosov National Institute of Cardiovascular Surgery of National Academy of Medical Science of Ukraine

The educational program followed the Standard of Higher Education in specialty 163 "Biomedical Engineering" for the first (bachelor's) level of higher education approved by order of the Ministry of Education and Science of Ukraine as of 19.11.2018 № 1264. According to the monitoring results for the program of professional education "Medical Engineering" for the first (bachelor's) level of higher education, the Methodological Council of Igor Sikorsky KPI for specialty 163 Biomedical engineering took into included suggestions and proposals from graduates, employers and other external stakeholders and approved changes and amendment notices by protocol № 1 as of 03.06.2020.

Project team considered:

1. Standard of higher education in the specialty 163 Biomedical Engineering for the first (bachelor's) level of higher education, which is 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>
2. Remarks and suggestions of reviewers on the standard of higher education in the specialty 163 Biomedical Engineering for the first (bachelor's) level of higher education, posted on the website of the Department of Biomedical Engineering: <http://bmi.fbmi.kpi.ua/standards-higher-education/>
3. Suggestions and remarks of stakeholders based on the results of public discussion:
  - scientific and pedagogical staff of the Department of Biomedical Engineering;
  - applicants for higher education enrolled in educational programs in the specialty 163 Biomedical Engineering
  - professional examination of employers and specialists in the field of 16 Chemical and bioengineering in the specialty 163 Biomedical engineering  
<http://bmi.fbmi.kpi.ua/department/educational-programs>

*Reviews of stakeholders are provided in the appendix*

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# 1. PROFILE OF THE EDUCATIONAL PROGRAM

## Specialty 163 Biomedical Engineering

<b>1 – General Information</b>	
Full title of the High Education Institution (HEI) and faculty name	National Technical University of Ukraine «Igor Sikorsky Kyiv Polytechnical Institute», Faculty of Biomedical Engineering
High Education level and Qualification title	Level – Bachelor’s Qualification – Bachelor in Biomedical Engineering
NRQ Level	Medical Engineering
Official title of the educational program	Bachelor’s Diploma, 240 credits, study term 3 years and 10 months
Diploma type and the volume of educational program	Ministry of Education and Science of Ukraine State Accreditation Commission Accreditation Certificate (НД, №1192633) on Specialty 163 Biomedical Engineering Expiration date of the Certificate – till 1 of July 2019 (the validity of the certificate was extended until 01.07.2022 by the Decision of the Accreditation Commission as of February 19, 2019, protocol № 134).
Prerequisites	Completed secondary education level
Study Languages	Ukrainian/English
Program validity term	Until the next Accreditation. The next accreditation is scheduled for 2022.
Internet address of the permanent location of the educational program	1. Department of Biomedical Engineering, Igor Sikorsky KPI <a href="http://bmi.fbmi.kpi.ua/department/educational-programs">http://bmi.fbmi.kpi.ua/department/educational-programs</a> 2. Education process at Igor Sikorsky KPI, section «Educational programs», <a href="https://osvita.kpi.ua/op">https://osvita.kpi.ua/op</a>
<b>2 – The Goal of the Educational Program</b>	
<p>Training of highly qualified, competitive, integrated into the global educational and scientific-technical fields specialists with a bachelor's degree in Chemical and Bioengineering, specialty 163 Biomedical Engineering, capable of commissioning, testing, engineering-operational, engineering-technical activity, engineering-design activity engineering and technology, which involves the implementation of intercultural interaction with representatives of the scientific and technical community in terms of:</p> <ul style="list-style-type: none"> <li>– scientific and technological progress in the field of Chemical and Bioengineering;</li> <li>– sustainable development of society and economic and environmental interests of society;</li> <li>– internationalization of education and integration of the international component into educational, scientific and technical activities of higher educational institutions;</li> <li>– labor market transformation through interaction with stakeholders;</li> <li>– comprehensive professional, intellectual, social and creative development of the individual in the educational and scientific environment;</li> <li>– combination of engineering and medical and biological knowledge for the means and methods of creating software and hardware biotechnical systems in biology and medicine.</li> </ul>	

<b>3 – Characteristics of the Educational Program</b>	
Subject area	<p>Knowledge branch – 16 Chemical and bioengineering. Specialty – 163 Biomedical engineering.</p> <p><b>Objects of study:</b> issues of development, production, testing, operation, service, repair and certification of medical equipment and biomedical products; processing of biomedical information; technical and informational support of medical technologies and systems.</p> <p><b>Theoretical content of the subject area:</b> clinical engineering, medical engineering, microelectromechanical biotechnical systems, medical radiology, medical biotechnology, biomechanics, medical robotics, biomedical informatics; receiving, processing, interpreting biological signals and images of biological objects.</p> <p><b>Methods, methodologies and technologies:</b> engineering-design methods, biotechnical and medical technologies, modeling, software in medical instrumentation and information technologies for data processing and analysis in biology and medicine.</p> <p><b>Instruments and equipment:</b> biological and medical equipment, biomedical and medical supplies, artificial organs, computer software and hardware.</p>
Direction of the Educational Program	Professional and educational
Main focus of the Educational Program	<p>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.</p> <p>Key words: biomedical engineering, biological and medical equipment, biomaterials for medical purposes, biomedical products, artificial organs and systems, diagnostic and therapeutic equipment.</p>
Program specifications	<p>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 part of the training is provided by the personnel under the influence of the scientific school of biomedical engineering named after M.M. Amosov, research and training laboratories, agreements on cooperation with leading clinical, medical and research institutions of the Ministry of Health and National Academy of Medical Sciences of Ukraine.</p> <p>The educational and 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.</p>

<b>4 – Suitability of Graduates for Employment and Further Education</b>	
Suitability for further employment	<p>Graduates are able to hold positions with the following qualification requirements for a bachelor's degree:</p> <ul style="list-style-type: none"> <li>- specialist in medical physics, technician for operation and repair of equipment, technician for preparation of technical documentation, technician for debugging and testing;</li> <li>- specialist in information technology (biology and medicine);</li> <li>- biomedical engineer, design engineer, process engineer, commissioning and testing engineer, operation and repair organization engineer, new equipment implementation engineer;</li> <li>- scientific and technical work in higher education institutions, health care institutions, research institutes of the technical and information sector;</li> <li>- scientific and technical work in departments and laboratories of specialized institutions and departments of universities (biology and medicine).</li> </ul>
Further education	The right to continue education at the second (Master's) level of higher education
<b>5 – Teaching and Grading</b>	
Teaching and studying	<p>The general style of learning is creatively oriented, aimed at solving practical problems and gaining in-depth knowledge.</p> <p>The educational process is carried out on the basis of a systematic, competency-based, personality-oriented and innovation-informative approach, technology of blended and distance learning.</p> <p>Use of a creative style of learning (active discussion in lectures), stimulating creativity in cognitive activity and initiative, learning on clinical bases.</p> <p>Teaching methods: communicative, problem-searching, research, explanatory-demonstration, partial-search, method of educational projects.</p> <p>Implementation: lecture courses, seminars and practical classes, computer workshops and laboratory work, course projects, consultations, independent training in library collections, use of Internet resources, application of information and communication technologies (e-learning, online lectures, distance learning courses ), bachelor's thesis.</p> <p>Education is carried out under the scientific guidance and consulting of leading specialists of the department. Write scientific papers and presentation at the university, all-Ukrainian and international scientific-practical conferences is planned.</p>
Grading	<p>Ongoing written and oral forms of knowledge control, including the form of tests. Ongoing certification of education follows students` individual plans (scheduled twice a year). Implementation of the results of scientific and technical tasks in the educational process of the department. Presentation and publication of the results of own research at scientific-practical conferences and in professional scientific publications.</p> <p>Certification requires public defense of the bachelor's thesis according to the approved procedure.</p>

<b>6 – Program Competencies</b>	
Integral competence	The ability to solve complex theoretical and practical problems in biomedical engineering or in a learning process that involves the application of certain theories and methods of chemical, biological and medical engineering, and is characterized by the complexity and uncertainty of learning conditions.
<b>General Competencies (GC)</b>	
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 official 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 analyze 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	Skills for safe activities.
GC 11	Ability to evaluate and ensure the quality of performed work.
GC 12	Ability to realize own 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, use different types of physical activity and leading a healthy lifestyle.
<b>Professional competencies (PC)</b>	
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 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.
<b>7 – Program Learning Outcomes (PLO)</b>	
PLO 1	Understanding of fundamental and applied, medical physical and bioengineering bases of technologies and equipment for investigation of processes in the human body.
PLO 2	Application of engineering methods to quantify the elements of devices and systems for medical purposes and selection of well-known and modern constructional materials.
PLO 3	Knowledge of design tools for devices and systems for medical and biological purposes.
PLO 4	Knowledge of methods to design digital and microprocessor systems for medical purposes.
PLO 5	Knowledge of research methods and techniques applied in the design of medical equipment.
PLO 6	Knowledge of methods of research, analysis and processing of experimental data.
PLO 7	Understanding of research and technical principles underlying the latest advances in biomedical engineering.
PLO 8	Knowledge of a foreign language at the level sufficient for general and professional communication.
PLO 9	Application of construction principles for automatic control of the systems and properties of their elements.
PLO 10	Knowledge of the basic physical and physico-chemical principles underlying the functioning of biological objects.
PLO 11	Knowledge of the basic operating conditions for diagnostic and therapeutic systems, medical complexes and equipment.
PLO 12	Operation and maintenance of medical equipment following the rules provided in technical documentation and regulations.
PLO 13	Use of methods and utilities for systematization and processing of experimental information.
PLO 14	Application of tools for experimental research (medical devices, biomaterials for medical purposes).
PLO 15	Use of technical systems with automated design considering features of their components.
PLO 16	Application of modern programming technologies and tools that support their use.
PLO 17	Knowledge of general information about the human body and its functions from the perspective of a systemic approach and their use in biomedical engineering.
PLO 18	Use of practical methods of organization for solving engineering, research and practical issues of different levels of complexity.
PLO 19	Knowledge of technical documentation for the commissioning, use and repair of medical equipment.
PLO 20	Use of signal theory and research methods for signals and images in biomedical engineering.
PLO 21	Knowledge of the basic methods and tools to quantify the functioning of physiological systems.
PLO 22	Use of methods of statistical analysis, modeling and simulation of processes and systems of physical and biological nature in biomedical engineering.
PLO 23	Knowledge of universal principles of structure of complex biological systems, including the human body.

PLO 24	Application of knowledge in the field 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 required to solve issues in biomedical engineering.
PLO 25	Formulation of logical conclusions and prof of assessment recommendations, operation and implementation of biotechnical, medical-technical and bioengineering utilities and methods.
PLO 26	Management of complex actions or projects that require engineering solutions under unpredictable conditions.
PLO 27	Application of normative provisions and regulating documents for technical certification, production certification.
PLO 28	Use of databases, mathematical methods and software for data analysis and computer modeling of biotechnical systems.
PLO 29	Professional communication in the field of healthcare, command of governmental and foreign languages (English or one of the other official EU languages) and understand their requirements for biomedical products and services.
PLO 30	Engineering support, service and maintenance of an operating laboratory, analytical equipment, medical diagnostic, therapeutic complexes and systems as well as the preparation of standard documentation for the types of work according to the technical regulations for medical devices.
PLO 31	Understanding of theoretical and practical approaches to the production and use of medical equipment.
PLO 32	Understanding of theoretical and practical approaches to the creation and application of artificial biological and biotechnical objects and medical materials.
PLO 33	Planning, organization and control of medical-technical and bioengineering systems and processes.
PLO 34	Quality control and operating conditions of medical equipment and materials for medical purposes, artificial organs and prostheses.
PLO 35	Ability to provide recommendations to select the equipment ensuing diagnosis and treatment.
PLO 36	Analysis of signals transmitted from organs to devices, receipt and processing of diagnostic information.
PLO 37	Ability to analyze the level of compliance with international standards in action as well as evaluate solutions and tasks for the development of automated control systems, considering modern hardware and software automation of medical equipment.
PLO 38	Ability to complete tasks for the development of automated control systems considering modern hardware and software automation of medical equipment.
PLO 39	Recommendations and technical support for appropriate medical equipment and biomaterials in medical institutions following the main stages of the technological process of diagnosis, prevention and treatment.
PLO 40	Use of computer-assisted design systems for development of technological and hardware schematics of medical devices and systems.
PLO 41	Application of knowledge in the field of chemistry and bioengineering for design and synthesis of artificial biotechnological and biological objects.
PLO 42	Development and implementation of modern diagnostic and therapeutic methods using computer sciences, biotechnology and nanotechnology.
PLO 43	Use of methods and tools for quantitative assessment of the functioning of physiological systems in practical engineering.
PLO 44	Application of modern methods for testing the experimental integrity and performance of biotechnical systems, analysis of their characteristics.

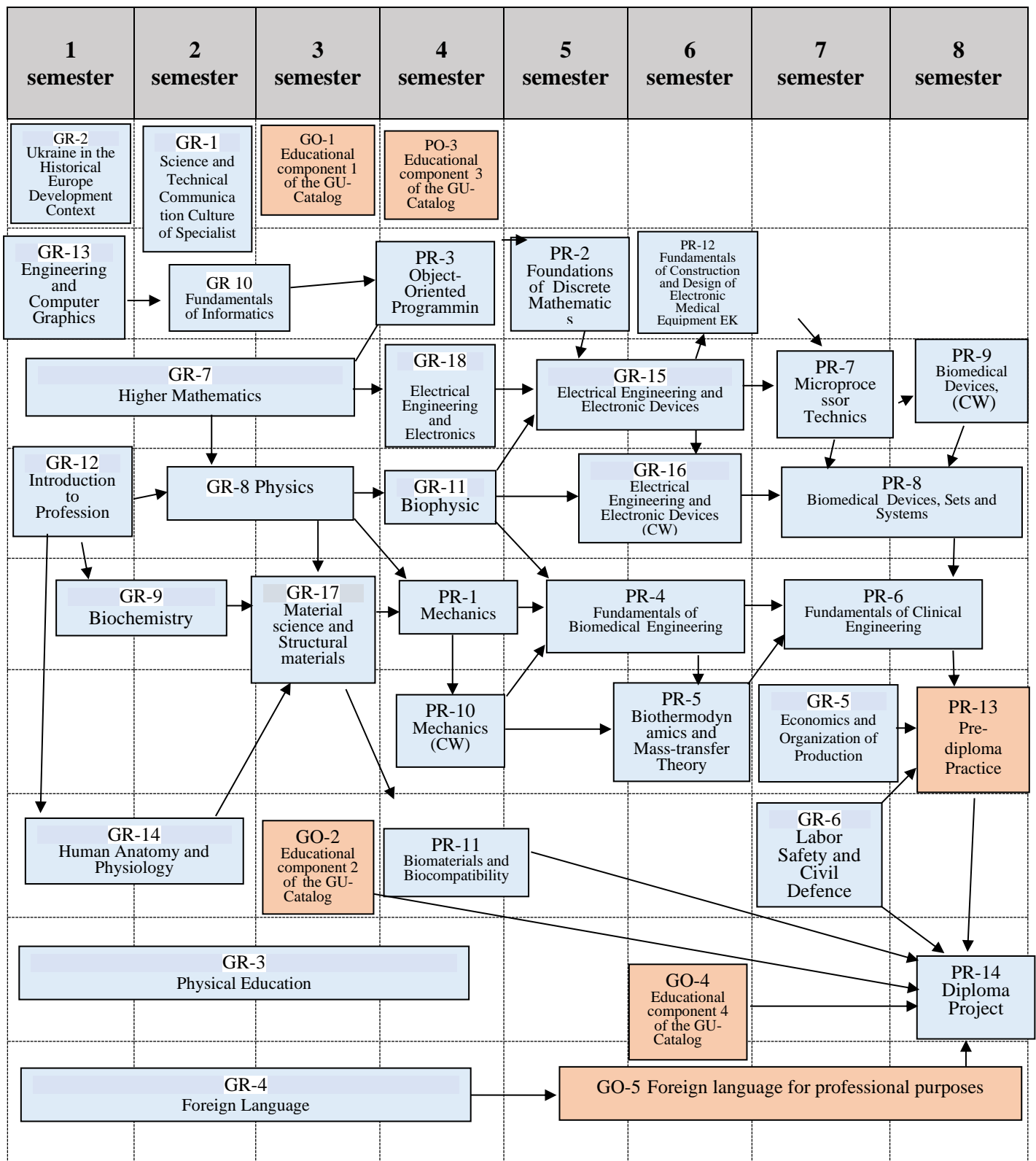
PLO 45	Improving the technical elements of medical devices and systems in professional activity.
<b>8 – Resource provisions for Program implementation</b>	
Human resource provisions	According to the personnel requirements to ensure the implementation of educational activities for the relevant level of HE, approved by the Resolution of the Cabinet of Ministers of Ukraine as of 30.12.2015 № 1187 (in action) in edition as of 23.05.2018 № 347.
Material and technical provisions	According to the technological requirements to ensure the implementation of educational activities for the relevant level of HE, approved by the Resolution of the Cabinet of Ministers of Ukraine as of 30.12.2015 № 1187 (in action) in edition as of 23.05.2018 № 347.
Informational and educational-methodological provisions	According to the technological requirements for educational and methodological and informational support of educational activities of the relevant level of HE, approved by the Resolution of the Cabinet of Ministers of Ukraine as of 30.12.2015, № 1187 (in action) in edition as of 23.05.2018 № 347. Use of the Scientific and Technical Library of Igor Sikorsky KPI.
<b>9 – Academic mobility</b>	
National grades mobility	Possibility of academic mobility based on the bilateral agreements between the National Technical University of Ukraine “Igor Sikorsky Kyiv Polytechnic Institute” and other institutions of higher education in Ukraine.
International grades mobility	Based on the bilateral agreements between the National Technical University of Ukraine “Igor Sikorsky Kyiv Polytechnic Institute” and foreign higher education institutions, Erasmus+ International Academic Mobility Programs with universities in EU and worldwide <a href="http://bmi.fbmi.kpi.ua/internationally/academic-mobility">http://bmi.fbmi.kpi.ua/internationally/academic-mobility</a>
Education for foreign students in HE programs	English language teaching.

## 2. LIST OF COMPONENTS OF THE EDUCATIONAL PROGRAM

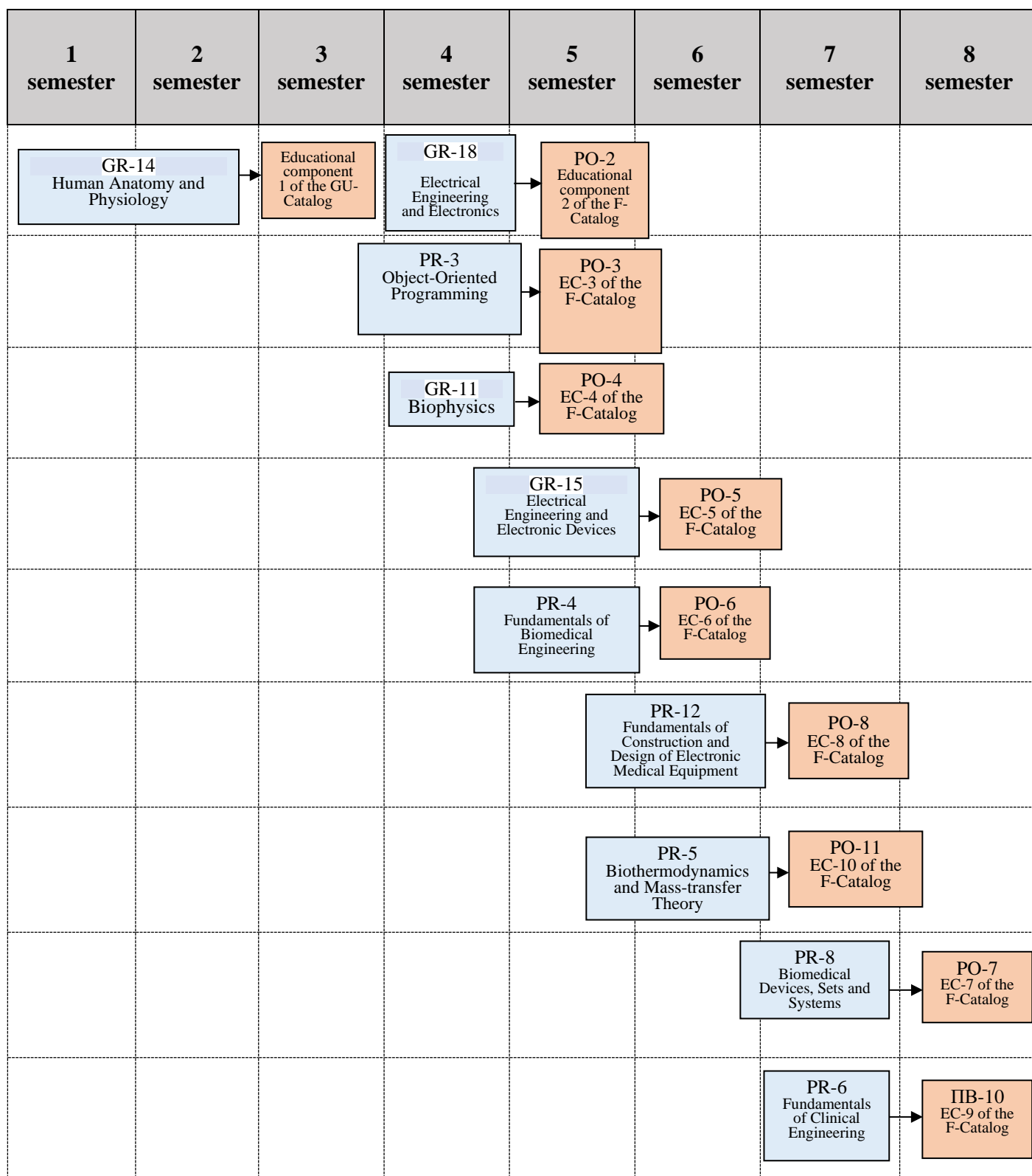
Course Code	Components of the educational program (courses, course projects / course theses, internships, qualifications)	Number of credits	Form of final assessment
1	2	3	4
<b>Required (normative) components of the EP</b>			
<b>1.1. General learning cycle (GR)</b>			
GR 1	Science and Technical Communication Culture of Specialist	2	test
GR 2	Ukraine in the Historical Europe Development Context	2	test
GR 3	Physical Education	5	test
GR 4	Foreign Language	6	test
GR 5	Economics and Organization of Production	4	test
GR 6	Labor Safety and Civil Defence	2	test
GR 7	Higher Mathematics	20,5	exam
GR 8	Physics	11	exam
GR 9	Biochemistry	7,5	test
GR 10	Fundamentals of Informatics	5,5	test
GR 11	Biophysics	4,5	test
GR 12	Introduction to Profession	5	test
GR 13	Engineering and Computer Graphics	4	exam
GR 14	Human Anatomy and Physiology	8,5	exam
GR 15	Electrical Engineering and Electronic Devices	10,5	exam
GR 16	Coursework in Electrical Engineering and Electronic Devices	1	test
GR 17	Material science and Structural materials	4,5	test
GR 18	Electrical Engineering and Electronics	5,5	exam
<b>1.2. Professional learning cycle (PR)</b>			
PR 1	Mechanics	5	exam
PR 2	Foundations of Discrete Mathematics	4	test
PR 3	Object-Oriented Programming	5	test
PR 4	Fundamentals of Biomedical Engineering	8,5	test
PR 5	Biothermodynamics and Mass-transfer Theory	4	test
PR 6	Fundamentals of Clinical Engineering	8	test
PR 7	Microprocessor Technics	5,5	exam
PR 8	Biomedical Devices, Sets and Systems	8	exam
PR 9	Coursework in Biomedical Devices, Sets and Systems	1	test
PR 10	Coursework in Mechanics	1	test
PR 11	Biomaterials and Biocompatibility	4	test
PR 12	Fundamentals of Construction and Design of Electronic Medical Equipment	4	exam
PR 13	Pre-diploma Practice	6	test
PR 14	Diploma Project	6	defence
<b>Optional components of the EP</b>			

1	2	3	4
<b>2.1. General learning cycle (Optional components from the university`s catalog) (GO)</b>			
GO 1	Educational component 1 of the GU-Catalog <i>(навчальні дисципліни з філософії)</i>	2	test
GO 2	Educational component 2 of the GU-Catalog <i>(навчальні дисципліни з психології)</i>	2	test
GO 3	Educational component 3 of the GU-Catalog <i>(навчальні дисципліни з екології)</i>	2	test
GO 4	Educational component 4 of the GU-Catalog <i>(навчальні дисципліни з права)</i>	2	test
GO 5	Foreign language for professional purposes	6	exam
<b>2.2. Professional learning cycle (Optional components from the faculty`s or department`s catalog) (PO)</b>			
PO 1	Educational component 1 of the F-Catalog	7,5	exam
PO 2	Educational component 2 of the F-Catalog	5	test
PO 3	Educational component 3 of the F-Catalog	5	test
PO 4	Educational component 4 of the F-Catalog	5	exam
PO 5	Educational component 5 of the F-Catalog	4	test
PO 6	Educational component 6 of the F-Catalog	4	test
PO 7	Educational component 7 of the F-Catalog	4,5	test
PO 8	Educational component 8 of the F-Catalog	4	test
PO 10	Educational component 9 of the F-Catalog	4	test
PO 11	Educational component 10 of the F-Catalog	4	test
Total amount of the <b>Required Components:</b>		<b>179</b>	
Total amount of the <b>Optional Components:</b>		<b>61</b>	
The scope of educational components <b>that ensure the acquisition of competency defined by the Standard of HE:</b>		<b>179</b>	
<b>TOTAL AMOUNT OF CREDITS IN EDUCATIONAL PROGRAM</b>		<b>240</b>	

### 3. STRUCTURAL-LOGICAL SCHEME OF THE EDUCATION PROGRAM (REQUIRED COMPONENTS)



## STRUCTURAL-LOGICAL SCHEME OF THE EDUCATION PROGRAM (OPTIONAL COMPONENTS)



– required components of the educational program;



– optional components of the educational program.

## **4. FORM OF GRADUATE PROFESSIONAL CERTIFICATION IN HIGHER EDUCATION**

Certification of applicants enrolled in higher education in the professional education program “Medical Engineering” specialty 163 Biomedical Engineering is carried out in the form of thesis defense and completes with standard document awarded a bachelor's degree with a qualification: Bachelor of Biomedical Engineering.

Qualification exam (for teaching in English) provides a written answer to complex engineering issues or practical problems in biomedical engineering with certain complexity based on theoretical knowledge and methods of chemical, biological and medical engineering.

The bachelor's thesis should demonstrate the graduate's ability to solve a complex specialized engineering issue or practical problem in biomedical engineering with certain complexity based on theoretical knowledge and methods of chemical, biological and medical engineering.

The final qualification work should not contain academic plagiarism, falsification or fabrication.

The applicant's qualification work should be posted on the website of the higher education institution (scientific institution), as well as on the national repository of the higher education institution in open access.

The qualification work of the applicant must meet all the requirements indicated by law.

Graduation certification is carried out openly and publicly.





## 6. MATRIX OF PROVISION OF THE PROGRAM RESULTS BY THE RELEVANT COMPONENTS OF THE EDUCATIONAL PROGRAM

	GR 1	GR 2	GR 3	GR 4	GR 5	GR 6	GR 7	GR 8	GR 9	GR 10	GR 11	GR 12	GR 13	GR 14	GR 15	GR 16	GR 17	GR 18	GO 1	GO 2	GO 3	GO 4	GO 5	PR 1	PR 2	PR 3	PR 4	PR 5	PR 6	PR 7	PR 8	PR 9	PR 10	PR 11	PR 12	PR 13	PR 14		
PLO 1						+	+	+	+	+	+			+			+							+	+	+	+	+	+	+	+				+	+			
PLO 2						+									+		+	+										+	+	+	+	+	+	+			+		
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PLO 8				+															+					+		+	+	+	+	+	+	+					+	+	
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	GR 1	GR 2	GR 3	GR 4	GR 5	GR 6	GR 7	GR 8	GR 9	GR 10	GR 11	GR 12	GR 13	GR 14	GR 15	GR 16	GR 17	GR 18	GO 1	GO 2	GO 3	GO 4	GO 5	PR 1	PR 2	PR 3	PR 4	PR 5	PR 6	PR 7	PR 8	PR 9	PR 10	PR 11	PR 12	PR 13	PR 14		
PLO 24							+	+	+	+	+	+	+	+	+	+	+	+						+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
PLO 25						+												+									+	+	+	+	+	+					+	+	
PLO 26				+	+													+									+	+	+	+	+	+					+	+	
PLO 27																													+									+	+
PLO 28										+																	+										+	+	
PLO 29			+						+	+	+	+		+				+					+				+	+	+	+	+	+			+		+	+	
PLO 30						+												+										+	+	+	+	+	+				+	+	
PLO 31															+	+		+						+				+	+	+	+	+	+		+		+	+	
PLO 32														+			+											+	+	+	+	+			+		+	+	
PLO 33																		+										+	+	+	+	+	+				+	+	
PLO 34						+																						+	+	+	+	+					+	+	
PLO 35																												+	+	+	+	+					+	+	
PLO 36										+																		+									+	+	
PLO 37																		+										+	+	+	+	+	+			+	+	+	
PLO 38										+							+	+											+	+	+	+	+				+	+	
PLO 39																			+									+	+	+	+	+	+			+	+	+	
PLO 40																	+	+										+	+	+	+	+				+	+	+	
PLO 41									+		+							+										+	+	+			+				+	+	
PLO 42										+	+							+										+	+	+	+	+					+	+	
PLO 43											+			+														+	+	+	+	+					+	+	
PLO 44																												+	+	+	+	+					+	+	
PLO 45																		+										+	+	+	+	+					+	+	