

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

APPROVED

**by the University Academic Council
Igor Sikorsky Kyiv Polytechnic Institute
(2021, March 15, protocol No. 3)
Head of Academic Council
Mykhaylo ILCHENKO**

“Regenerative and biopharmaceutical engineering”

EDUCATIONAL & PROFESSIONAL PROGRAM

The second (master’s) level of higher education

**Specialty: 163 Biomedical Engineering
Field of knowledge: 16 Chemical & Bioengineering
Qualification: Master of Biomedical Engineering**

Becomes effective by the Decree of Rector
of Igor Sikorsky Kyiv Polytechnic Institute
as of date 2021, April 19, No. HOH/89/2021

PREAMBLE

DESIGNED by the project group:

Head of the project group:

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Nataliia Schotkina, postgraduate student, Translational Medical Bioengineering Department.

Approved by

The Student’s Council of Faculty of Biomedical Engineering (protocol from 15 February 2021)

The Scientific and Methodical Board of Igor Sikorsky Kyiv Polytechnic Institute in specialty 163 Biomedical Engineering (protocol No 3 from February 22, 2021)

Head of the Scientific and Methodical Board of Speciality *Vitaliy MAKSYMENKO*

The Methodological Council of Igor Sikorsky Kyiv Polytechnic Institute (2021, February 25, protocol No. 6)

Head of the Methodological Council *Yurii YAKYMENKO*

PROFESSIONAL ASSESSMENT

Executed by the following stakeholders:

- Serhii HULYY, Ph.D. (Engineering), General Director, LLC “Nutrimed”, Kyiv;
- *Nadiia GORCHAKOVA*, D.Sc. (Medicine), Full Prof., Department of Pharmacology Bogomolets National Medical University, the member of Scientific and Expert Board of State Expert Centre;
- *Olena KLYUCHKO*, Ph.D. (Biology), Associate Professor, Associate Professor of Electronics, Robotics and Monitoring Technology and Internet of Things, National Aviation University, Kyiv.

The program has been updated considering stakeholders’ recommendations as well lecturers’ and students’ suggestions.

The project team have revised a credit balance and function of credits, ability of students to mastering educational components of the program as well as recommendations made by National Agency for Higher Education Quality Assurance.

The purpose and peculiarities of the program were specified more precisely according to the competences and program outcomes. The purpose corresponds with the concept of development of Igor Sikorsky KPI.

The list of educational components has been revised and strengthened with the additional course that forms competences within fields of information technologies and building of biotechnical systems components. The matrixes of correspondence between competences and program learning outcomes have been revised and rearranged.

The list of optional components has been diversified and updated.

The program has been discussed and approved concerning all the recommendations and suggestions on the meeting of Translational Medical Bioengineering Department (protocol No. 9 dated February 16, 2021).

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1. DESCRIPTION OF THE EDUCATIONAL PROGRAM in specialty 163 “Biomedical Engineering”

1 – General information	
Full title of higher educational institution and institution/faculty	National Technical University of Ukraine “Igor Sikorsky Kyiv Polytechnic Institute”; Faculty of Biomedical Engineering
The degree of higher education and the title of the qualification (in Ukrainian)	Master degree Qualification – Master in Biomedical Engineering
Level in the national qualifications framework	National Qualification Framework of Ukraine – 7 level; QF-EHEA (European Higher Education Area Qualification Framework) – 2nd cycle; EQF-LLL (European Qualification Framework for Lifelong Learning) – 7 level
The official title of the educational program	Regenerative and biopharmaceutical engineering
Type of diploma and scope of the educational program	Master’s Diploma, unitary, 90 ECTS credits, duration – 1 year 4 months
Accreditation	Accreditation Certificate pursuant to the official decision of Ministry of Education and Science of Ukraine, 18 January 2018. Serial number УД № 11001142, expiration date 1 July 2022; speciality – 163 “Biomedical engineering”.
Admission requirements	Bachelor’s degree
Teaching languages	Ukrainian/English
The duration of the educational program	Until the next accreditation
Internet address of the permanent placement of the educational program	https://osvita.kpi.ua/ http://bi.fbmi.kpi.ua/uk/educational-program-ua/
2 – The purpose of the educational program	
On the basis of the concept of sustainable development, internationalization and globalization of education, cutting-edge innovative scientific activity, human development the purpose is to train competitive experts who are able to organize and develop research, project, engineering, productive and technological activity within the field of regenerative and biopharmaceutical engineering.	
3 – Characteristics of the educational program	
Subject area (Field of study, speciality)	Field of study– 16 Chemical and Bioengineering, speciality – 163 Biomedical engineering. <i>Objects:</i> engineering methodology and means for solving problems in biology and medicine; design, development, production, testing, operation, service and maintenance, certification of medical equipment, biomaterials, bioengineering systems and processes, products biomedical function;

	<p>processing of biomedical data; engineering support of medical technological products and systems; development of general health, quality of life and life expectancy.</p> <p><i>Objectives:</i> formation of professional competencies necessary for experts who are able to solve complex problems either in the field of biomedical engineering or in the course of education that to include research and innovative activity under undefined conditions.</p> <p><i>Theoretical content:</i> fundamentals and applied skills in analysis, simulation, design, development, production, testing, operation, service and maintenance, certification of medical equipment, biomaterials, bioengineering systems and processes, products biomedical function; processing of biomedical data; engineering support of medical technological products and systems.</p> <p><i>Methodology:</i> engineering methods, biotechnologies and technologies within medical engineering, simulation, software and information technologies for data processing in biology, medicine and medical instrumentation engineering.</p> <p><i>Apparatuses and equipment:</i> apparatuses and equipment for biotechnology and medicine, biomedical products, biomaterials for medicine, artificial organs, computers, computer-assisted design systems.</p>
Orientation of the educational program	Educational & Professional Program
The main focus and specialization of the program	<p>Processes and equipment in the field of regenerative and biopharmaceutical engineering.</p> <p><i>Keywords:</i> regenerative engineering; cellular, tissue and genetic engineering; biopharmaceutical engineering, biomedical technologies, biomedical informatics, biocompatibility, artificial organs.</p>
Peculiarities of the program	<p>In the context of Subject area the program has a strong bias towards advanced study of methodology and means of biopharmaceutical engineering as well as <i>each stage of a life circle</i> of medical and other products derived from this engineering in health protection system. Students are focused on solving professional problems applying <i>cutting-edge engineering experience</i> on the basis of the concept of sustainable development.</p>
4 – Eligibility of graduates for employment and further training	
Eligibility for employment	Graduates are allowed to take a wide range of positions in industrial, research, health protection, educational etc. institutions; such range includes but not limited to biomedical engineer, design engineer, research engineer, technologist, expert in certification, expert in quality control, research scientist, lecturer.
Further training	Access to the third (PhD's) cycle of higher education.
5 – Teaching and assessment	
Teaching	Lectures, practicals and seminars, computer workshops and lab work; course projects and works; blended learning, practice and field trips; preparation and submission of the master's thesis.
Assessment	Rating system of assessment, oral and written examinations, testing.

6 – Competences	
Integral competence	Ability to solve complex problems either in the field of biomedical engineering or in the course of education that includes scientific and innovative activity under undefined conditions.
Generic Competencies (GC)	
GC 1*	Ability for abstract thinking, analysis and synthesis.
GC 2*	Ability to search for, process and analyse information from a variety of sources.
GC 3*	Ability to identify, pose and resolve various problems (<i>scientific, technical, managerial etc.</i>) concerning in particular the concept of sustainable development.
GC 4*	Ability to work in a team, <i>plan and manage work produced and team work.</i>
GC 5*	Ability to work in an international context.
GC 6	<i>Ability to support individual intellectual and cultural development as well as to form an educational trajectory.</i>
GC 7	<i>Ability to communicate in a foreign language for effective resolving of professional problems.</i>
Professional Competencies (PC)	
PC 1*	Ability to resolve complex problems in biomedical engineering employing methods of mathematics, natural sciences and engineering.
PC 2*	Ability to develop a working hypothesis; plan and perform an experiment to confirm the hypothesis and engineering goal by means of technology, engineering and devices.
PC 3*	Ability to analyse complex biomedical engineering problems and formalize them so that to resolve them by means of modern mathematical methods and information technologies.
PC 4*	Ability to invent and develop means, methods and technologies of biomedical engineering for research and design of biomedical products and systems.
PC 5*	Ability to draw up technical specifications of biomedical engineering systems and technologies as well as simulate, evaluate, develop and design them.
PC 6*	Ability to study biological and technical aspects of functioning and interaction of artificial biological and biotechnical systems.
PC 7*	Ability to participate effectively in multidisciplinary teams.
PC 8	<i>Capacity to plan and organize biomedical and biopharmaceutical production.</i>
PC 9	<i>Ability to employ innovative approaches to development of biomedical technologies on the basis of methods within biomelecular, celuller and tissue engineering.</i>
7 – Program Learning Outcomes	
PLO 1	<i>Recognize national and international copyright law, basic principles and concepts of intellectual property law; regcognize methods of defence copyright in the course of professional activity.</i>
PLO 2	<i>Recognize basic methodology for cultivation eukaryote cells as well as technologies of their application for scientific research, biomedical and biopharmaceutical engineering, biology and medicine.</i>
PLO 3*	Plan, design, develop and organize production of various biomedical products (including products of biological and bioengineering origin) within health protection system fulfilling modern technological requirements; provide engineering support in the course of operation.
PLO 4*	Analyse and resolve complex problems in biomedical engineering employing methods of mathematics and information technologies.

* Competences and Program Learning Outcomes according to National Standards for Higher Education; other Competences and Program Learning Outcomes are printed in italics.

PLO 5*	Invent and develop means, methods and technologies of biomedical engineering for comprehensive research and design of biotechnical, bioengineering and biopharmaceutical products and systems of medical engineering function.
PLO 6*	Plan, design and execute innovative projects of bioengineering objects and medical engineering systems concerning engineering, medical, legal, economic, environmental and social aspects; provide their informational and methodological support.
PLO 7*	Evaluate biological and technical aspects and impacts of interaction of technical and bioengineering objects with biological systems; anticipate their interference, legal, ontological and ethical effects.
PLO 8*	Resolve problems of biomedical engineering in the course of either independent or collaborative professional activity (including as a part of international team) with awareness of their own ethical and social responsibility.
PLO 9	<i>Plan, design and execute biomedical projects provided by institutions in various fields (scientific, health protection, production etc.) that specialize in production and storage of medical products (including their renovation and modernization) in health protection system in accordance with local and international standards and requirements.</i>
PLO 10	<i>Develop modern biomedical technologies and products employing methods of biomolecular, cellular and tissue engineering.</i>
PLO 11	<i>Formulate objectives of scientific-research and scientific-technical activity within the field of biomedical engineering concerning modern tendencies in scientific, technical and social development. Apply international experience in innovative management to the field of biomedical engineering.</i>
PLO 12*	Present the results of scientific work in the Ukrainian and English language in the form of completed scientific and research developments (invention application, scientific publications, reports etc.).
PLO 13	<i>Recognize modern issues and tendencies in development in the field of inventing biologically compatible materials in medical practice.</i>
PLO 14	<i>Recognize the fundamentals of concepts of sustainable development, principles behind safe living for humanity concerning economic, environmental and social aspects.</i>
8 – Resource provision of the program’s implementation	
Staffing	In accordance with the staff requirements for ensuring the educational activities’ implementation at the relevant level of HE, approved by Decree of the Cabinet of Ministers of Ukraine No. 1187 dated December 30, 2015, (prevailing) updated by Decree No. 347, May 23, 2018.
Material-and-technical supplying	In accordance with the technological requirements for material-and-technical supplying of educational activities’ implementation at the relevant level of HE, approved by Decree of the Cabinet of Ministers of Ukraine No. 1187 dated December 30, 2015, (prevailing) updated by Decree No. 347, May 23, 2018.
Informational and methodological supplying	In accordance with the technological requirements for informational and methodological supplying of educational activities’ implementation at the relevant level of HE, approved by Decree of the Cabinet of Ministers of Ukraine No. 1187 dated December 30, 2015, (prevailing) updated by Decree No. 347, May 23, 2018. Use of The Scientific and Technical Library of Igor Sikorsky KPI. Use of literature provided by lecturers of the German Academic Exchange Service.
9 – Academic Mobility	
National Credit Mobility	Participation in credit mobility and double diploma projects.

International Credit Mobility	Participation in credit mobility and double diploma projects (Erasmus + K1).
Training of foreign applicants acquiring higher education	Foreign language teaching.

2. LIST OF COMPONENTS OF THE EDUCATIONAL PROGRAM

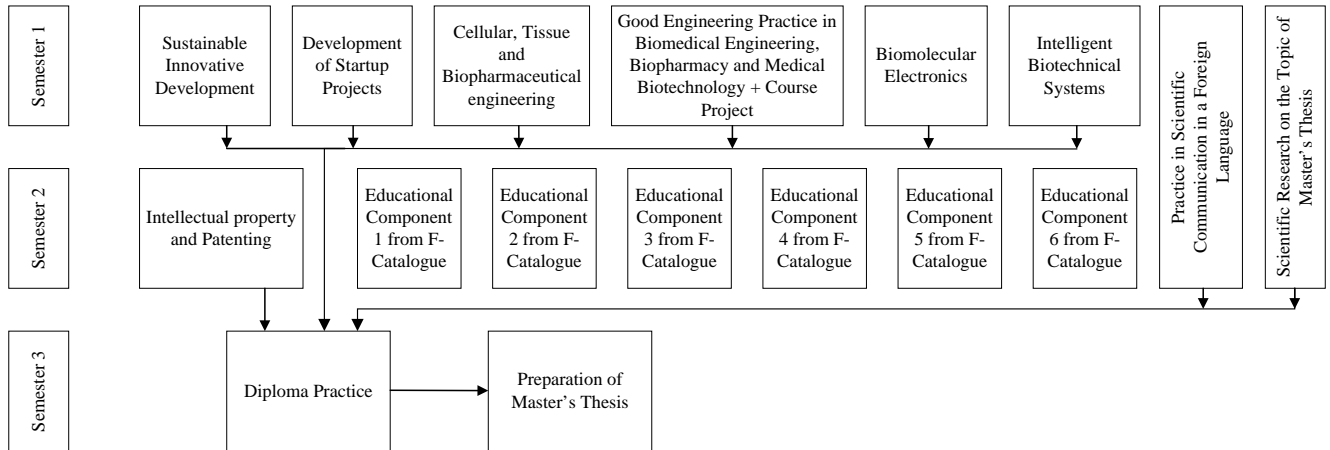
E/D code	Components of the educational program (disciplines, course projects (works), practices, qualification work)	Number of credits	Final assessment form
1	2	3	4
1. Compulsory Educational Components			
1.1. General Training Cycle			
GC 1	Intellectual property and Patenting	3	credit
GC 2	Sustainable Innovative Development	2	credit
GC 3	Practice in Scientific Communication in a Foreign Language	3	credit
GC 4	Development of Startup Projects	3	credit
1.2. Professional Training Cycle			
PC 1	Cellular, Tissue and Biopharmaceutical engineering	5	exam
PC 2	Good Engineering Practice in Biomedical Engineering, Biopharmacy and Medical Biotechnology	5	credit
PC 3	Course Project in Good Engineering Practice in Biomedical Engineering, Biopharmacy and Medical Biotechnology	1,5	credit
PC 4	Biomolecular Electronics	4	credit
PC 5	Intelligent Biotechnical Systems	6	exam
PC 6	Scientific Research on the Topic of Master's Thesis	4	credit
PC 7	Diploma Practice	14	credit
PC 8	Preparation of Master's Thesis	12	defence
2. Optional educational components			
OC 1	Educational Component 1 from F-Catalogue	4	credit
OC 2	Educational Component 2 from F-Catalogue	4	credit
OC 3	Educational Component 3 from F-Catalogue	4	credit
OC 4	Educational Component 4 from F-Catalogue	5	exam
OC 5	Educational Component 5 from F-Catalogue	5	exam
OC 6	Educational Component 6 from F-Catalogue (with course project)	5,5	exam, credit
Total scope of the compulsory components:		62,5 (69,5%)	
Total scope of the optional components:		27,5 (30,5%)	
Total scope of educational components to ensure competences according to National Standards for Higher Education:		62,5 (69,5%)	
TOTAL SCOPE OF THE EDUCATIONAL PROGRAM		90	

GC – General Compulsory

PC – Professional Compulsory

OC – Optional Component

3. STRUCTURAL-AND-LOGICAL SCHEME OF THE EDUCATIONAL PROGRAM



4. THE FORM OF GRADUATION CERTIFICATION FOR THE RECIPIENTS OF HIGHER EDUCATION

Graduation certification of a recipient of a Master's scientific degree in the field of Biomedical Engineering under the academic and scientific programme "Regenerative and biopharmaceutical engineering" is conducted in the form of a qualifying paper (Master's thesis) public defence. The qualifying paper has to be checked for plagiarism; after the defence it is stored in the repository of the University Scientific and Technical Library to be accessed freely. The certification is conducted openly and publicly. The graduation certification is finalised with the issue of a document of a standard form on conferring a Master's scientific degree and qualification "Master in Philology" under the academic and scientific programme "Regenerative and biopharmaceutical engineering".

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

	GC1	GC2	GC3	GC4	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8
GC 1	+	+		+	+	+	+	+	+	+	+	+
GC 2	+	+	+		+	+	+	+	+	+	+	+
GC 3	+	+	+	+	+	+	+	+	+	+	+	+
GC 4			+	+			+			+	+	+
GC 5	+	+	+	+		+	+	+	+	+	+	+
GC 6	+	+	+	+						+	+	+
GC 7	+		+				+			+	+	+
PC 1	+	+			+	+	+	+	+	+	+	+
PC 2										+	+	+
PC 3						+	+		+	+	+	+
PC 4					+	+	+	+	+	+	+	+
PC 5	+	+				+	+		+	+	+	+
PC 6	+				+				+	+	+	+
PC 7				+						+	+	+
PC 8	+			+		+	+			+	+	+
PC 9	+				+			+		+	+	+

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

	GC 1	GC 2	GC 3	GC 4	PC 1	PC 2	PC 3	PC 4	PC 5	PC 6	PC 7	PC 8
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		+								+	+	+