National Technical University of Ukraine
"Igor Sikorsky Kyiv Polytechnic Institute"

Department
biomedical engineering

Practice

Working program of discipline (Syllabus)

Details of the discipline	
Level of higher education	***Second (master's)***
Branch of knowledge	*16 Chemical and bioengineering*
Specialty	*163 Biomedical Engineering*
Educational program	*Medical engineering*
Discipline status	*Mandatory discipline*
Form of study	*full-time / day / mixed / remote*
Year of preparation, semester	*2nd year, autumn semester*
The scope of discipline	*14 ECTS credit modules (420 hours)*
Semester control / control measures	*Test*
Timetable	*According to the schedule on the website http://rozklad.kpi.ua/*
Language of instruction	*Ukrainian/English*
Information about the course leader / teachers	*Prof. Orel V.E.,* *orel.valeriy@gmail.com*
Teacher profile	*http://bmi.fbmi.kpi.ua/department/staff-department/*
Course placement	*Platform "Sikorsky" - course "Practice"*

Curriculum of the discipline

1. Description of the discipline, its purpose, subject of study and learning outcomes

During practice, students gain new knowledge, skills and abilities, mainly when performing specific practical tasks, so the work of students in full-time positions (with or without pay) is the most appropriate in comparison with the practice by backups, in fact, bystanders..
Prior to the start of the practice, an agreement is signed between the department and the company where the students will take the practice.
Quite often during the practice students are involved by the administration to provide assistance to the practice base. The nature of such practice must strictly comply with the profile of training and the duration should not interfere with the implementation of educational tasks.
The practice begins with acquaintance of students with tasks, the form of carrying out, the schedule of a working day, rules of conducting diaries.
Students in practice must strictly adhere to the rules of protection and fire safety adopted on the basis of practice, with mandatory training (introductory and at each specific place of practice).
The purpose of the discipline: preparation of certification work for successful completion of training in the specialty.
Learning is carried out on the basis of a modern strategy of interaction between teacher and student in the electronic space in order for students to master the material and develop their practical skills. During training the following are applied:
- strategies of active and collective learning;
- personality-oriented development technologies based on active forms and teaching methods (team-based learning), think-pair-share , brainstorming method, case study method, business games, discussion, etc.);
- heuristic methods (methods of creating ideas, methods of solving creative problems, methods activation of creative thinking);

- method of problem-oriented learning.
For more effective communication in order to understand the structure of the discipline and assimilation of the material it is used the platforms: https://do.ipo.kpi.ua and https://classroom.google.com/ through which:
- simplifies the placement and exchange of educational material;
- provides feedback to students regarding learning objectives and the content of the discipline;
- students' learning tasks are evaluated;
- the account of performance by students of the plan of educational discipline, the schedule of performance
learning tasks and student assessment is performed.

***General competencies** (EP was put into effect by the Rector's Order NON / 89/2021 of 19.04.2021):*

GC 1 Ability to abstract thinking, analysis and synthesis.
GC 2 Ability to search, process and analyze information from various sources.
GC 3 Ability to identify, formulate and solve problems.
GC 4 Ability to work in a team.
GC 5 Ability to work in an international context. .

***Special (professional) competencies** (EP was put into effect by the Rector's Order NON / 89/2021 of 19.04.2021):*

PC 1	Ability to solve complex problems of biomedical engineering using the methods of mathematics, natural and engineering sciences.
PC 2	Ability to develop a working hypothesis, plan and set experiments to test the hypothesis and achieve the engineering goal using appropriate technologies, technical means and tools.
PC 3	Ability to analyze complex medical engineering and bioengineering problems and formalize them to find quantitative solutions using modern mathematical methods and information technology.
PC 4	Ability to create and improve tools, methods and technologies of biomedical engineering for research and development of bioengineering facilities and systems for medical and technical purposes.
PC 5	Ability to develop terms of reference for creation, as well as to model, evaluate, design and construct complex bioengineering and medical engineering systems and technologies.
PC 6	Ability to study biological and technical aspects of functioning and interaction of artificial biological and biotechnical systems.
PC 7	Ability to work in a multidisciplinary team.
PC 8	Ability to develop models and perform experiments aimed at solving problems related to human health, according to the specific needs of scientific research, to analyze, explain the results and evaluate the cost of research.
PC 9	Ability to create tools and methodologies of scientific activity, evaluation and implementation of the results of modern developments, solutions and achievements of engineering and exact sciences in medicine and biology.
PC 10	Ability to design and practical use of microcomputer and microprocessor systems in medical and diagnostic information and measuring equipment.
PC 11	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 12	Ability to perform research and observations on the interaction of biological, natural and artificial systems (prostheses, artificial organs, etc.), to plan biotechnical tests of artificial prostheses and systems.

Program learning outcomes *after study discipline " Practice"_is (EP enacted Decree Rector HOH / 89/2021 of 19/04/2021 p.):*

PLO 1	Understanding of fundamental-applied, medical-physical and bioengineering bases of technologies and equipment for research of physiological and pathological processes of the person .
PLO 2	Understanding the principles of action of modern diagnostic equipment and display systems of biomedical information, the basis of appropriate software .
PLO 3	Possession of modern methods of scientific research software, construction of adequate theoretical models and methods of their substantiation..
PLO 4	Application of calculation methods and selection of classical and new designs of biomaterials, elements of devices and systems of medical appointment .
PLO 5	Application of methods and tools for designing computer networks .
PLO 6	Possession of methods of designing digital microprocessor and biotechnical systems for medical purposes
PLO 7	Possession methods research, design and construction of objects of biomedical engineering, analysis and processing of experimental data .
PLO 8	Knowledge of general requirements for the conditions of engineering, technological and scientific projects .
PLO 9	Knowledge of the principles of development and modern problems of creating biocompatible materials in medical practice.
PLO 10	Knowledge in the most advanced fields of education and professional activity and at the junction of different fields
PLO 11	Understanding the latest achieving in Biomedical Engineering
PLO 12	Understanding of ethical, environmental and commercial constraints in engineering practice
PLO 13	Knowledge of a foreign language to an extent sufficient for general and professional communication
PLO 14	Possession of the basic provisions of the concept of sustainable development, the principles of building a secure existence of mankind, taking into account economic, social and environmental aspects.
PLO 15	Understanding of specialized conceptual principles acquired in the process of learning and/or professional activity at the level of the latest achievements, which are the basis for original thinking and innovation, in particular in the context of research work.
PLO 1 6	Knowledge of methods of design, construction, improvement and application of medical-technical and bioengineering products, devices and systems in compliance with technical requirements, as well as to support their operation.
PLO 17	Analysis and solution of complex medical-engineering and bioengineering problems with the use of mathematical methods and information technologies
PLO 18	Creation and improvement of means, methods and technologies of biomedical engineering for comprehensive research and development of bioengineering objects and systems of medical and technical purpose.
PLO 19	Development, planning, use and substantiation of innovative projects of bioengineering facilities and systems for medical-technical purposes, taking into account engineering, medical, legal, economic, environmental and social aspects, the implementation of their information and methodological support.
PLO 20	Evaluation of biological and technical aspects and consequences of interaction of engineering and bioengineering objects with biological systems, anticipation of their mutual influence, legal, deontological and moral and ethical consequences of use.
PLO 21	Solving in practice the tasks of biomedical engineering with awareness of their own ethical and social responsibility in personal activities and / or in a team.
PLO 22	Presentation of research and development results in the state and foreign languages in the form of applications for inventions, scientific publications, reports at scientific and technical events.
PLO 23	Providing methodological and practical assistance in the implementation of projects

and programs, plans and agreements.

PLO 24 Mastery of adaptation skills and action in situations related to work in the specialty, the ability to generate new ideas in the field of biomedical engineering.

PLO 25 Implementation of achievements of domestic and foreign science and technology, use of creative initiative, rationalization, invention and best practices that ensure the effective operation of the medical enterprise.

2. Prerequisites and postrequisites of the discipline (place in the structural and logical scheme of education according to the relevant educational program)

The discipline is interdisciplinary. It is the foundation for the preparation of certification work for the successful completion of training in the specialty.

Necessary skills

1. Successful implementation of an individual training plan.

3. The content of the discipline

The main sections and topics that will be considered in the process of studying the course:

According to the individual calendar plan for preparation and certification work and the work program.

4. Training materials and resources

Basic literature

1. *Стандарт вищої освіти зі спеціальності 163 Біомедична інженерія / Мін-ство освіти і науки України, НТУУ «КПІ». Київ, 2020. – 18 с. // http://bmi.fbmi.kpi.ua/wp-content/uploads/2020/09/163-biomedichnainzheneriya-bakalavr.pdf*
2. *Освітньо-професійні програми першого (бакалаврського) рівня вищої освіти: Медична інженерія та Регенеративна та біофармацевтична інженерія / Мін-ство освіти і науки України, НТУУ «КПІ». Київ, 2021. –19 с. // https://osvita.kpi.ua/163*
3. *ПОЛОЖЕННЯ ПРО ОРГАНІЗАЦІЮ ОСВІТНЬОГО ПРОЦЕСУ В КПІ ІМ. ІГОРЯ СІКОРСЬКОГО / Мін-ство освіти і науки України, НТУУ «КПІ». Київ, 2020. – 17с. // https://document.kpi.ua/files/2020_7-124.pdf*
4. *ПОЛОЖЕННЯ ПРО ПОРЯДОК ПРОВЕДЕННЯ ПРАКТИКИ ЗДОБУВАЧІВ ВИЩОЇ ОСВІТИ КПІ ІМ. ІГОРЯ СІКОРСЬКОГО / Мін-ство освіти і науки України, НТУУ «КПІ». Київ, 2020. – 16 с. https://document.kpi.ua/files/2020_7-172.pdf*

Supporting literature

5. *Палеха Ю. Основи науково-дослідної роботи / Ю. Палеха, Н. Леміш. – Київ: Ліра-К, 2013. – 336 с. – ISBN 978-966-2609-31-8*

Information resources

6. *Sikorsky Platform -* https://do.ipo.kpi.ua/course/view.php?id=3115
7. *Information Service of Igor Sikorsky Kyiv Polytechnic Institute - https://document.kpi.ua/*
8. *Faculty of Biomedical Engineering https://fbmi.kpi.ua*

The list of information resources lists the sources of their receipt.

Educational content

5. Methods of mastering the discipline (educational component)

№ i / o	Topic	Program learning outcomes	The main tasks	
			Control event	Term implementation

№ i / o	Topic	Program learning outcomes	The main tasks	
			Control event	Term implementation
1.	Arrival of the student for practice, registration and reception of passes.		Individual consultations	1st week
2.	Carrying out of training on safety and labor protection, etc.		Individual consultations	1st week
3.	Carrying out of individual organizational actions: - acquaintance with the scope of practice, knowledge, skills and abilities of the student for the period of practice; - with the content and technology of the practice; - with the peculiarities of finding, collecting and selecting the necessary scientific and practical sources and literature; - requirements for the report on the student's implementation of the practice program, individual task.	PLO 1- 25	Individual consultations	1st week
4.	Acquaintance with objects of practice	PLO 1- 25	Individual consultations	1st week
5.	Acquaintance with features of carrying out practice in: - diagnostic and in scientific and medical institutions, etc.; - public and private institutions and establishments	PLO 1-25	Individual consultations	1st week
6.	Carrying out of excursions on the enterprise, acquaintance with a place of work.		Individual consultations	1st week
7.	Development of the plan of the report, introduction (on a subject of work)		Individual consultations	4-6 days 1st week
8.	Acquaintance on the basis of practice with the list of literature: normative materials, descriptions, visual aids, etc.		Individual consultations	1st week 2nd week
9.	Execution of the program of practice and individual task (with weekly check of execution of the calendar plan).	PLO 1-25	Individual consultations	Throughout the practice
10.	Making a diary for the 1st week		Individual consultations	1st week
11.	Making a diary for the 2nd week		Individual consultations	2nd week
12.	Making a diary for the 3rd week		Individual consultations	3rd week
13.	Making a diary for the 4th week		Individual consultations	4th week
14.	Making a diary for the 5th week		Individual consultations	5th week
15.	Making a diary for the 6th week		Individual	6th week

№ i / o	Topic	Program learning outcomes	The main tasks	
			Control event	Term implementation
			consultations	
16.	Making a diary for the 7th week		Individual consultations	7th week
17.	Making a diary for the 8th week		Individual consultations	8th week
18.	Preparation of a report on practice	PLO 1- 25	Individual consultations	8th week
19.	Getting feedback on the practice from the head of the practice.		Individual consultations	8th week
20.	Preparation of a presentation on the defense of practice	PLO 1-25	Individual consultations	8th week
21.	Providing in e-form an annotation on practice in 3 languages in pdf - format on the website of the department		Individual consultations	8th week
22.	Providing a package of documents on practice responsible for practice at the department (report, diary, abstract, statement on the topic of DW / DP)		Individual consultations	8th week
23.	Defense of practice by a student at the commission appointed by the head of the department (subject or cycle commission)	PLO 1-25	Test	9th week

Responsibility for the organization, carrying out and control of student practice rests with the head of the graduating department of BMI. The direct management of the practice of each student is entrusted to the teacher (thesis supervisor) and the head of the practice from the department, who are appointed and approved at the meeting of the department by the head of the department. Assignment of thesis supervisors (projects) to the student and the approximate topic of the task for practice is approved at the meeting of the department in August of this year. By September 1 of the current year, the thesis supervisor must approve an individual task and a calendar plan for the individual task of the student (s) assigned to him / her .

The person in charge of practice from the department monitors weekly, with the help of thesis supervisors, the implementation of individual calendar plans by students and reports it to the head of the department.

At least once a month (at a meeting of the department) supervisors of the thesis and the person in charge of practice from the department report on the implementation of students in practice of their individual tasks.

In case of non-fulfillment by the student of the timely approved calendar plan (without a valid reason) at the meeting of the department a decision may be made not to admit the student to the defense of the practice and his further expulsion from the university.

Distance learning platform:
For more effective communication in order to understand the structure of the discipline "Practice" and master the material it is used e-mail, telegram channel, distance learning platform "Sikorsky" based on KPI-Telecom Moodle system and service for online meetings Zoom, through which:
- increases the efficiency of communication with students, provides convenient feedback;
- simplifies the placement, access and exchange of educational material;
- students' learning tasks are evaluated;

- student activity is analyzed.

6. Independent student work

The following types of independent work are planned: on the topic of attestation work, preparation and execution of the report and accompanying documents, preparation for the test. A total of 420 hours are planned for independent work.
One of the main types of semester control while mastering the discipline "Practice" is the fulfillment of report. The report is performed in accordance with the requirements, within the period specified by the teacher.
It aims to master the ability to identify current issues; additional, in-depth study and practical awareness of certain sections of the curriculum; development of skills of independent work with scientific literature.
The main purpose of the report is to solve a practical problem using theoretical material and practical skills acquired during training in the bachelor's program in biomedical engineering.
The student can write a report only on a topic agreed with the teacher.

Approximate topics of home control work:

1. According to the theme of certification work.

Detailed requirements for the implementation and execution of the report and accompanying documentation are given in the methodological recommendations for the discipline.
The title page of the report should have the following content: the name of the university; name of the faculty; name of department; name of specialty, name of educational-professional program, registration number, name of academic discipline; topic of the report; surname and name of the student, course, number of the academic group, year.
The title page is followed by a detailed plan (content) of the report, which should highlight the introduction, sections of the main content, conclusion, list of sources used. The table of contents on the right indicates the page numbers at the beginning of each question. Each section begins on a new page.
The total volume of the report, depending on the chosen theme can vary from 18 to 20 page. The scope of the report is determined by the student's ability to briefly and comprehensively disclose the topic: the relevance of the topic under consideration, current trends and problems, analyze the best foreign and Ukrainian technologies, draw conclusions and justify their own suggestions and recommendations.
The report is accompanied by an annotation in two languages - Ukrainian and English, indicating keywords.
Mandatory requirement: clear reference to sources of information. All figures, facts, opinions of scientists, quotations, formulas should have a reference in the form of [2, p.54] (the first digit means the source number in the list of references at the end of the work, and the second digit - the page number in this source). It is desirable to use tables, diagrams, graphs, charts, etc. The list of used sources (not less than 10 sources) is made out according to operating rules. If the information is taken from the Internet, it is necessary, as for the usual literature, to specify the author, the title of the article, and then provide the address of the site on the Internet.
The report is evaluated by the following criteria: logical plan; completeness and depth of topic disclosure; reliability of the received data; reflection of practical materials and results of calculations; availability of illustrations (tables, figures, diagrams, screenshots of web pages, etc.); the number of sources used and the clarity of references to them; design; substantiation of the student's own opinion on this issue in the form of a conclusion.
Deadline for submission of inspection report: 8th week of study.
The report is checked for plagiarism with the help of public resources and must meet the requirements of academic integrity. In case of academic dishonesty, the work is canceled and not checked.

Policy and control

7. Policy of discipline (educational component)

Attending classes

Attendance at lectures and practical classes is not provided. However, students are encouraged to attend one-on-one counseling. The grading system is focused on obtaining points for student activity, as well as performing tasks that are able to develop practical skills and abilities.
Missed and consultations are not worked out.

Control measures missed

Missed control events are not worked out.
A report submitted for verification that has not been plagiarized is not evaluated.

Violation of deadlines and incentive points

Encouragement points		*Penalty points**	
Criterion	*Weight score*	*Criterion*	*Weight score*
performing tasks to improve didactic materials in the discipline	*+ 1 point*	*Violation of control events term (for each control event)*	*-1 point for each week*
participation in scientific and scientific-innovative activities (with the provision of relevant documents)	*+10 points*	*Late execution and submission of the report*	*From -2 points to -10 points (depending on the delivery date)*

** if the control event was missed for a good reason (illness, which is confirmed by a certificate of the established sample) - penalty points are not accrued.*

Academic integrity

The policy and principles of academic integrity are defined in Section 3 of the Code of Honor of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute". Details: https://kpi.ua/code.

Norms of ethical behavior

Norms of ethical behavior of students and employees are defined in Section 2 of the Code of Honor of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute". Details: https://kpi.ua/code .

Procedure for appealing the results of control measures

Students have the opportunity to raise any issue related to the control procedure and expect it to be addressed according to predefined procedures.

The student has the right to appeal the results of the control measure according to the approved Provision on appeals in the "Igor Sikorsky Kyiv Polytechnic Institute" (approved by order №НОН / 128/2021 from 20.05.2021) - https://osvita.kpi.ua/index.php/node/ 182

Inclusive education

Academic discipline " Practice " can be taught to most students with special educational needs except students with severe visual impairments that prevent you perform the task using personal computers, laptops and / or other technical means.

Distance Learning

Distance learning takes place through the Sikorsky Distance Learning Platform.
Distance learning through additional online courses on certain topics is not allowed.
The list of courses is offered by the teacher after the students have expressed a desire (because the bank of available courses is updated almost every month).
Execution of control measures can be carried out during independent work of students in a remote mode (with a possibility of consultation with the teacher through e-mail, social networks).

Learning a foreign language

Teaching in English is carried out only for foreign students.

At the request of students, it is allowed to study the material with the help of English-language online courses on topics that correspond to the topics of specific classes.

8. Types of control and rating system for assessing learning outcomes (RSA)

Evaluation system (current control):

№ i / o	Control measure	%	weight score	Number	Total
1.	Assessment of the timeliness and completeness of the accompanying documents;	10	10	1	10
2.	Evaluation of a written report;	30	30	1	30
3.	Defense of report	60	60	1	60
	Total				100

The assessment is carried out in accordance with the PROVISIONS ON THE PROCEDURE FOR PERFORMING THE PRACTICE OF HIGHER EDUCATION.

***Calendar control** (CC) - not provided.*

Semester certification of students

Mandatory condition for admission to the exam		Criterion
1	Availability of accompanying documents	RD ≥ 0 points
2	The presence of a positive assessment for the report	More than 18 points

The results are announced to each student separately in the presence on a control event or in a remote form (by e-mail, in the system "Sikorsky"). Also recorded in the "Electronic Campus " system.

Optional conditions for admission to the test: no

Table of translation of rating points to grades on the university scale:

Scores	Score for university scale
100-95	Perfectly
94-85	Very good
84-75	Good
74-65	Satisfactorily
64-60	Enough
Less than 60	Unsatisfactorily
Admission conditions are not met	Not allowed

The test is carried out in accordance with the PROVISIONS ON THE PROCEDURE FOR PERFORMING THE PRACTICE OF HIGHER EDUCATION.

9. Additional information on the discipline (educational component)

Detailed requirements for the implementation and execution of the report and accompanying documentation are given in the methodological recommendations for the discipline.

Work program of the discipline (syllabus):

Compilled by: *senior lecturer at Department of Biomedical Engineering Ovcharenko Ganna Romanivna*

Approved by the *Department of Biomedical Engineering (protocol № 13 from 25.06.2021)*

Approved by the *Methodical Commission of the Faculty of Biomedical Engineering (protocol № 11 from 25.06.2021)*