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

Department of Biomedical Engineering

Introductory Practice in Medical Engineering

Working program of Elective discipline (Course Syllabus)

Course Details	
Level of higher education	***First (bachelor's) level***
Field of study	*16 Chemical and Bioengineering*
Specialty	*163 Biomedical Engineering*
Educational program	*Medical Engineering*
Course status	*Required*
Mode of study	*Full-time (day)*
Year of study / semester	*3rd year, spring semester*
Course workload	*3 ECTS credit modules (90 hours)*
Forms of assessment	*Test*
Course schedule	*Individual work*
Language of instruction	*Ukrainian*
Course Instructor(s)	*Senior Lecturer Ovcharenko Hanna Romanivna, ovcharenko.ganna@lll.kpi.ua*
Instructor profile	*http://bmi.fbmi.kpi.ua/department/staff-department/* *http://intellect.bmi.fbmi.kpi.ua/profile/ogr*
Course Delivery Platform	*Sikorsky Platform - Course " Introductory Practice in Medical Engineering "*

Course Programme

1. Course Description, Aim, Subject Matter and Learning Outcomes

Introductory practice in medical engineering as part of the practical training of applicants for the first (bachelor's) level of higher education at the University is a mandatory component of the educational and professional program "Medical Engineering" for training specialists in specialty 163 "Biomedical Engineering" and is aimed at familiarizing students with real clinical problems in organizations and institutions whose work is related to medical engineering. Such immersion in the clinical environment is necessary for understanding the needs of medicine, the peculiarities of working in multidisciplinary teams, and inspiration for engineering solutions in the field of biomedical engineering.

The purpose of the introductory practice is: familiarization with the clinical environment, medical devices, and working in multidisciplinary teams.

The practice is carried out on the basis of a modern strategy of interaction between the manager/consultant and the applicant in electronic space with the aim of mastering special (professional) competencies , general competencies and obtaining program learning outcomes according to the OPP of the corresponding year of recruitment of applicants (https://osvita.kpi.ua).

To study the discipline, the following skills are required:

1. Successful implementation of the individual learning plan. Since discipline is integrative, requires all skills acquired over six academic semesters.

***Integral competence** (OP put into effect by the Rector's Order NOD/434/24 dated 06/10/2024):*

The ability to solve complex, specialized problems and practical problems in biomedical engineering and in the process, which provides the use of specific theories and methods of chemical, biological

and medical engineering, and is characterized by the complexity and non-strict terms.

General competencies *(OP put into effect by the Rector's Order NOD/434/24 dated 10.06.2024):*

GC 02 Knowledge and understanding of the subject area and understanding of professional activities .
GC 04 Skills in using information and communication technologies.
GC 06 Ability to search, process, and analyze information from various sources.
GC 10 Skills in conducting safe activities.

Professional competencies *(OP put into effect by the Rector's Order NOD/434/24 dated June 10, 2024):*

PC 03 Ability to study and apply new methods and tools for analysis, modeling, design, and optimization of medical devices and systems.
PC 04 Ability to ensure the technical and functional characteristics of systems and tools used in medicine and biology (for prevention, diagnosis, treatment, and rehabilitation).
PC 05 Ability to apply physical, chemical, biological, and mathematical methods in the analysis and modeling of the functioning of living organisms and biotechnical systems.
PC 08 Ability to conduct research and observation on the interaction of biological, natural, and artificial systems (prostheses, artificial organs, etc.)
PC 12 Ability to ensure and monitor compliance with safety and biomedical ethics when working with medical equipment.

Program learning outcomes *after studying the discipline " Introductory Practice in Medical Engineering " are (OP put into effect by the Rector's Order NOD/434/24 dated 10.06.2024):*

PLO 01 The ability to apply knowledge of the fundamentals of mathematics, physics and biophysics, bioengineering, chemistry, engineering graphics, mechanics, materials resistance and strength, properties of gases and liquids, electronics, computer science, signal and image acquisition and analysis, automatic control, system analysis, and decision-making methods at a level necessary for solving biomedical engineering tasks.
PLO 09 Understand theoretical and practical approaches to the creation and application of artificial biological and biotechnical objects and materials for medical purposes.
PLO 17 Application of knowledge in chemistry and bioengineering to create, synthesize, and apply artificial biotechnical and biological objects.
PLO 18 Understanding of fundamental-applied, medical-physical, and physico-chemical principles governing the functioning of biological objects, as well as bioengineering fundamentals of technologies and equipment for researching human body processes.
PLO 22 Knowledge of general principles and structure of complex biological systems, including the human body and its functions from the perspective of a systemic approach and their utilization in biomedical engineering, as well as basic methods and tools used for quantitative assessment of physiological system functioning.

2. Prerequisites and Postrequisites of the Course (place within the structural and logical framework of the educational programme)

The discipline is interdisciplinary in nature, it is based on most disciplines of the professional training cycle and is the foundation for completing pre-diploma practice and preparing certification work for successful completion of studies in the specialty.

3. Course Content

The main sections and topics that will be covered during the course:

According to the individual calendar plan and work program.

4. Learning Materials and Resources

Basic literature

1. *On approval of the Technical Regulations on medical devices: Resolution of the Cabinet of Ministers of Ukraine dated 02.10.2013 No. 753 (as amended on 30.11.2022). – Text of the document. – Access mode: https://zakon.rada.gov.ua/laws/show/753-2013-%D0%BF .*
2. *On approval of the Technical Regulations on medical devices for diagnostics in vitro : Resolution of the Cabinet of Ministers of Ukraine dated 02.10.2013 No. 754 (as amended on 30.11.2022). – Text of the document. – Access mode: https://zakon.rada.gov.ua/laws/show/754-2013-%D0%BF .*
3. *On approval of the Technical Regulations on active implantable medical devices: Resolution of the Cabinet of Ministers of Ukraine dated 02.10.2013 No. 755 (as amended on 30.11.2022). – Text of the document. – Access mode: https://zakon.rada.gov.ua/laws/show/755-2013-%D0%BF .*
4. *List of national standards, compliance with which provides a presumption of conformity of medical products with the requirements of the Technical Regulations on Medical Products (approved by order of the Ministry of Health of Ukraine) [Electronic resource]. – Access mode: https://www.dls.gov.ua/медичные-выроби/техничные-регламенты/техничный-регламент-шкодо-медичных-вы/перелик-национальных-стандартів-від/ .*
5. *Draft resolution of the Cabinet of Ministers of Ukraine "On approval of the Technical Regulation on medical devices" (based on EU Regulation 2017/745, published for discussion in 2025) [Electronic resource]. – Access mode: https://moz.gov.ua/storage/uploads/ed62a064-a466-47a5-ae7f-44bf53117c51/Проект-постановы-КМУ-745-23.04.2025.pdf .*

Additional literature

1. *Information notice on holding a public discussion of the draft resolution of the Cabinet of Ministers of Ukraine "On approval of the Technical Regulations for medical devices" (harmonization with the MDR) [Electronic resource] / Ministry of Health of Ukraine. – Access mode: https://moz.gov.ua/uk/informacijne-povidomlennya-pro-provedennya-publichnogo-gromadskogo-obgovorennya-proyektu-postanovi-kabinetu-ministriv-ukrayini-pro-zatverdzhennya-tehnichnogo-reglamentu-shodo-medichnih-virobiv .*
2. *Regenerative and biopharmaceutical engineering. Development of a technical file for a medical product [Electronic resource]: a teaching aid for applicants of the second (master's) level of higher education in specialty 163 Biomedical engineering, studying in the educational program "Regenerative and biopharmaceutical engineering" / O. Yu. Galkin, O. B. Besarab, T. M. Lutsenko, O. I. Golembiovska; Igor Sikorsky Kyiv Polytechnic Institute. – Electronic text data (1 file: 1.85 MB) – Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, 2021. – 124 p. – Screen title. https://ela.kpi.ua/handle/123456789/45953 .*
3. *On approval of the Requirements for the design of a dissertation: Order of the Ministry of Education and Science of Ukraine dated January 12 , 2017 No. 40 (as amended by Order of the Ministry of Education and Science of Ukraine dated May 31, 2019 No. 759). More details: https://zakon.rada.gov.ua/laws/show/z0155-17#Text .*

Information resources

1. *Google Class "Medical Engineering Introductory Practice"*
2. *Information service of Igor Sikorsky Kyiv Polytechnic Institute https://document.kpi.ua/ and https://osvita.kpi.ua*
3. *Faculty of Biomedical Engineering https://fbmi.kpi.ua*

The list of information resources includes their sources.

Course Content

5. Methodology for Studying the Course (Educational Component)

No	Topic	PLO	Main tasks	
			Assessment Activity	Completion Time
1.	***Before the start of the internship:***		Individual consultations	
	Agree with the department (head of practice from the department) the place of practice (practice base);		Individual consultations	No later than two months before the start of the internship
	Coordinate tasks on the appropriate topic with the practice manager.		Individual consultations	No later than two weeks before the start of the internship
2.	Arrival of the applicant for internship, registration and receipt of passes (if necessary).		Individual consultations	
3.	Conducting safety and health training, etc.			
4.	Conducting individual organizational events: – familiarization with the scope of practice, knowledge, skills and abilities of the applicant during the practice period; – with the content and technology of the internship; – with the features of searching, collecting and selecting the necessary scientific and practical sources and literature; – requirements for a report on the applicant's completion of the internship program and individual assignment.			1-2 days 1 week[1]
5.	Familiarization with practice facilities			
6.	Familiarization with the features of internships in: - scientific and research institutions, etc.; - diagnostic and in scientific and medical institutions, etc.;			

[1] according to the educational process schedule for the current academic year

No	Topic	PLO	Main tasks	
			Assessment Activity	Completion Time
	- public and private institutions and organizations			
7.	Conducting tours of the institution/organization, familiarizing yourself with the workplace			
8.	Developing a report plan on the topic of the practice		Individual consultations	1-2 days 1 week
9.	Familiarization with the list of literature based on practice: regulatory materials, descriptions, visual aids, etc.		Individual consultations	1-2 weeks
10.	Completion of the internship program and individual assignment with an understanding of theoretical and practical approaches to the creation and application of artificial biological and biotechnical objects and materials for medical purposes , information and principles of the structure of complex biological systems, the basics of technologies and equipment for studying human body processes, systems analysis and decision-making methods at the level necessary for solving biomedical engineering problems with weekly reporting on the implementation of the calendar plan through weekly reports.	PLO 01, PLO 09, PLO 17, PLO 18, PLO 22	Individual consultations	Throughout the practice
11.	As intended, complete additional sections (if necessary)		Individual consultations	Throughout the practice
12.	Diary design for 1 week		Individual consultations	1 week
13.	Diary design in 2 weeks		Individual consultations	2 week
14.	Preparation of the internship report. Submission: – for verification of NPP from the additional section (if necessary); – to the practice manager to check the substantive text of the report and its compliance with the design requirements approved by the department.		Individual consultations	2 week
15.	Receiving feedback on the internship from the internship supervisor. Complete a diary based on the internship (signatures, seals, etc.)		Individual consultations	
16.	Preparation of a defense presentation.		Test	

No	Topic	PLO	Main tasks	
			Assessment Activity	Completion Time
17.	Providing a package of practice documents to those responsible for practice at the department in paper and electronic form (a completed practice diary, practice report, etc.). Additionally, documents specified by the practice manager are provided.			
18.	Defense of the internship by the applicant at a commission appointed by the head of the department (subject or cycle commission)			3 week[2]

Responsibility for organizing, conducting and monitoring students' internships lies with the head of the BMI graduation department. Direct supervision of each student's internship is entrusted to the internship supervisor from the department, who is appointed and approved at the department meeting by the head of the department. Assigning a student an approximate topic for the internship assignment is approved at the department meeting in May of the current year.

The person responsible for practice from the department monitors the implementation of individual calendar plans by students on a weekly basis and reports any violations of deadlines to the head of the department.

In case of failure by a student to comply with the approved calendar plan in a timely manner (without a good reason), a decision may be made at a meeting of the department to deny the student admission to the practice defense and his subsequent expulsion from the university.

Distance learning platform:

For more effective communication in order to understand the structure of the academic discipline "Introductory Practice in Medical Engineering" and master the material, e-mail, Telegram channel, the distance learning platform "Sikorsky" based on the Moodle system KPI-Telecom / GOOGLE WORKSPACE FOR EDUCATION and the service for conducting online meetings Zoom are used , with the help of which:

- ✓ *the efficiency of communication with students increases, convenient feedback is provided;*
- ✓ *the placement, access and exchange of educational material is simplified;*
- ✓ *students' learning tasks are assessed;*
- ✓ *student activity is analyzed.*

6. Independent Student Work

The following types of independent work are planned: preparation and execution of the report and accompanying documents, preparation for the test. A total of 90 hours of independent work are planned.

One of the main types of semester control during the mastering of the academic discipline " Introductory Practice in Medical Engineering " is the execution of a report. The report is executed in accordance with the requirements, within the deadline specified by the teacher.

Aims to master the skills to identify current problems; additional, in-depth study and practical awareness of individual sections of the curriculum; development of skills for independent work with scientific and technical literature.

The main goal of the report is to familiarize yourself with the solution of a practical problem using theoretical material and practical skills acquired during studies in the Bachelor of Biomedical Engineering program.

[2] Within 10 calendar days from the date of completion of the internship

A student can write a report only on a topic agreed upon with the teacher.

Approximate List of Work:

1. According to the topic of the individual assignment.

Detailed requirements for the execution and preparation 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: name of the university; name of the faculty; name of the department; code and name of the specialty; code and name of the educational and professional program;, name of the academic discipline; topic of the report; course, academic group number; surname and name of the student; surname and name of the NPP responsible for the additional section (if necessary); student's certification that the report does not contain borrowings from the works of other authors without appropriate references; year.

The title page is followed by the plan (table of contents) of the report, which should include the following sections: introduction; sections of the main content of the practice and general conclusions for each of them; general conclusions; list of sources used; appendix. The table of contents indicates the page numbers of the beginning of each section on the right. Each section begins on a new page.

The total volume of the report (from the title page to the list of sources used, inclusive, excluding appendices) can vary from 18 to 20 pages, depending on the chosen topic. The volume of the report is determined by the student's ability to briefly and at the same time comprehensively reveal the topic: the relevance of the topic under consideration, current trends and problems, analyze the best foreign and Ukrainian technologies, draw conclusions and substantiate their own proposals and recommendations.

The report is accompanied by an abstract in two languages – Ukrainian and English, indicating keywords.

Mandatory requirement: clear reference to sources of information. All figures, facts, opinions of scientists, quotes, formulas must have references in the form of [2] (the number means the number of the source in the list of references given at the end of the creative work). It is advisable to use tables, diagrams, graphs, charts, etc. The list of sources used (at least 20 sources) is drawn up in accordance with current rules with the obligatory provision of the URL code. If the information is taken from the Internet, it is necessary, as for ordinary literature, to indicate the author, the title of the article, and then provide the URL code or the address of the site on the Internet.

The report is evaluated according to the following criteria: logical plan; completeness and depth of disclosure of the topic; reliability of the data obtained; reflection of practical materials and calculation results; availability of illustrations (tables, figures, diagrams, etc.); clarity of references to sources; design; substantiation of the student's own opinion in the form of conclusions at the end of each main section and general conclusions from the report.

The report is not checked for similarity of text (plagiarism) using public resources, but it must meet the requirements of academic integrity. If academic dishonesty is detected, the work is canceled and not checked.

Diary

The diary is the main document of a higher education student during his internship and must have the following sections:

- ✓ *order for internship;*
- ✓ *a memo with provisions for completing the internship and keeping a diary;*
- ✓ *calendar of internship with individual tasks;*
- ✓ *comments from managers during the internship period, feedback from the manager from the company about the internship by the higher education applicant;*
- ✓ *conclusion of the head of the department on the practice of the higher education applicant with a credit assessment of the practice*

Policy and Control

7. Course Policy (Educational Component)

Class attendance

Attendance at lectures and practical classes is not provided. However, students are recommended to attend individual consultations. The assessment system is focused on obtaining points for student activity, as well as completing tasks that can develop practical skills and abilities.
Missed consultations are not processed.

Missed assessment activities

Omissions of control measures are not implemented.
If academic dishonesty is detected, the work is canceled and not reviewed.

Incentive points

Incentive points	
Criterion	*Weighted score*
Completion of tasks to improve didactic materials for the discipline	*+1 point*
Participation in scientific and scientific-innovative activities (with the provision of relevant documents)	*+10 points*

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". More information: https://kpi.ua/code.

Ethical conduct

The 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". More information: https://kpi.ua/code .

Procedure for appealing the results of control measures

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

The student has the right to appeal the results of the control measure in accordance with the approved regulations on appeals at Igor Sikorsky Kyiv Polytechnic Institute (approved by order No. HOH/128/2021 dated 05/20/2021) - https://osvita.kpi.ua/index.php/node/182

Inclusive learning

The academic discipline "Pre-Graduate Internship" can be taught to most students with special educational needs, except for students with severe visual impairments that do not allow them to complete tasks using personal computers, laptops and/or other technical means.

Distance learning

Distance learning takes place through the Sikorsky Distance Learning Platform.

Distance learning through taking additional online courses on a specific topic is not allowed.

The list of courses is offered by the teacher after students express their desire (since the bank of available courses is updated almost every month).

Control measures can be carried out during independent work of students in remote mode (with the possibility of consulting with the teacher via email, social networks).

Learning in a foreign language

Teaching in English is provided only for foreign students.

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

8. Types of Assessment and Rating System for Learning Outcomes (RSLO)

The evaluation of the results of the internship is carried out on a 100-point scale with mandatory conversion of grades to the university scale (with grades of "excellent", "very good", "good", "satisfactory", "sufficient" or "unsatisfactory").

In accordance with the rating system for assessing student learning outcomes, the 100-point scale of grades for practice is divided into two stages:

Stage I – the applicant's starting points (the applicant's work during the internship) and is worth 40 points;

Stage II – defense of the practice and is worth 60 points.

Calculation of the student's starting points (stage I)

Starting points will be distributed according to the following criteria:

No. s/n	Type of work	Number of points
1	Evaluation of internship completion and calendar plan implementation by applicants: Weekly reports (for 2 weeks) The weighted score of the report is 2 points. Total 2 points x 2 reports = 4 points	4
2	Assessment of the timeliness and completeness of the preparation of supporting documents	6
3	Evaluating a written report 30-28 points "Excellent", (at least 95% of the required information) 27-25 points "Very good", (at least 85% of the required information) 24-22 points "Good", (at least 75% of the required information) 21-19 points "Satisfactory", (at least 65% of the required information) 18 points " Sufficient ", (at least 60% of the required information) 0 points "Unsatisfactory", (does not meet the requirements of "Satisfactory")	30
Total starting points		40

Calculation of points for the defense of the practice (stage II)

Points for defending the practice are awarded according to the following criteria:

Rating	Evaluation criterion	Points
" Excellent "	The applicant clearly and fully disclosed the goal of the practice, the ways to achieve it, and thoroughly substantiated the decisions made. The answers to the questions demonstrate the applicant's ability to professionally defend his or her own point of view, as well as the fact that he or she possesses professional knowledge at a modern level. The illustrative material (presentation) fully, with high clarity, reveals the main provisions of the work being defended. The material was created using modern graphic packages in compliance with the requirements of regulatory documents.	60-56 points
"Very good"	The applicant clearly and fully disclosed the goal of the practice, the ways to achieve it, deeply argues the decisions made, but makes minor errors and assumptions. The candidate can professionally defend his/her own point of view. The answers to the questions are essentially correct, but not always	55-51 points

Rating	Evaluation criterion	Points
	sufficiently complete and well-reasoned. *The illustrative material (presentation) fully, but with insufficient clarity, reveals the main provisions of the work. The material was created using modern graphic packages, there are minor deviations from the requirements of regulatory documents.*	
"Good"	*The applicant clearly and fully disclosed the goal of the practice, the ways to achieve it, deeply argues the decisions made, but makes mistakes and assumptions.* *The candidate can professionally defend his/her own point of view. The answers to the questions are essentially correct, but not sufficiently complete and well-reasoned.* *The illustrative material (presentation) fully, but with insufficient clarity, reveals the main provisions of the work. The material was created using modern graphic packages, there are deviations from the requirements of regulatory documents.*	*50-46 points*
"Satisfactorily"	*The report on the practice is essentially correct, but structured illogically and unclearly.* *The answers to the questions are incomplete, and inaccuracies are suggested in the reasoning behind the decisions made.* *The illustrative material (presentation) does not fully and clearly reveal the main points of the work. The material was created using modern graphic packages, there are significant deviations from the requirements of regulatory documents.*	*45-41 points*
" Sufficient"	*The report on the practice is essentially correct, but it is constructed illogically, unclearly, and has many omissions.* *The answers to the questions are incomplete, and significant inaccuracies are assumed in the reasoning behind the decisions made.* *The illustrative material (presentation) does not fully and clearly reveal the main points of the work. The material was not created using modern graphic packages, and there are significant deviations from the requirements of regulatory documents.*	*40-36 points*
" Unsatisfactory "	*Does not meet the "Satisfactory" criterion*	*0 points*

Assessment is carried out in accordance with the Regulations on the system of assessment of learning outcomes at Igor Sikorsky Kyiv Polytechnic Institute (Approved and put into effect by order of the corresponding year) https://osvita.kpi.ua .

The results are announced to each student individually in the presence of the control event or remotely (by e-mail, in the "Sikorsky" system). They are also recorded in the "Electronic Campus " system.

Violation of task deadlines and incentive points

Conditions for admission to semester control (credit):

1. *Availability of supporting documents*
2. *Having a positive assessment for the report of at least 18 points.*

Optional admission requirements: none

The final scores for the practice defense are summed up and listed in accordance with the table of correspondence of rating scores according to the university scale.

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

Number of points	Grade (university scale)

100-95	*Excellent*
94-85	*Very good*
84-75	*Good*
74-65	*Satisfactorily*
64-60	*Sufficient*
Less than 60	*Unsatisfactorily*
Admission conditions not fulfilled	*Not admitted*

The test is conducted in accordance with the REGULATIONS ON THE PROCEDURE FOR CONDUCTING INTRA-COURSE FOR HIGHER EDUCATION STUDENTS AT IGOR SIKORSKY KPI and the Regulations on the system for assessing learning outcomes at Igor Sikorsky KPI.

9. Additional Course Information (Educational Component)

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

Course syllabus:

Compiled by *Ganna Romanivna Ovcharenko, senior lecturer of the Department of Biomedical Engineering*

Approved *by the Department of Biomedical Engineering (Minutes No. 16 dated 06/21/2024)*

Approved *by the Faculty / Educational and Scientific Institute Methodological Committee (Minutes No. 9 dated 06/26/2024)*