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

Department of Translational Medical Bioengineering

Basics of Informatics

Working program of basic discipline (Silabus)

Реквізити навчальної дисципліни	
Level of higher education	***First (bachelor'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	*1th course, spring semester*
The scope of discipline	*5 ECTS credits / 150 hours*
Semester control / Control measures	*Test, Modular Test Work, Calculation and Graphic Work*
Lessons schedule	*According to the schedule on the site http://rozklad.kpi.ua/*
Language of instruction	*English*
Information about course leader / teachers	**Lecturer:** Associate Professor of the Department of TMB Oksana Serhiivna Bohomolova, e-mail – bohomolova@lll.kpi.ua, Telegram - @BohomolovaOksana **Practical:** Associate Professor of the Department of TMB Oksana Serhiivna Bohomolova, e-mail – bohomolova@lll.kpi.ua, Telegram - @BohomolovaOksana
Course placement	*https://do.ipo.kpi.ua/course/view.php?id=419*

Distribution of hours

Semester	Lectures	Practical	Laboratory	Independent Work
spring semester	*36*	*36*	*-*	*78*

Curriculum of the discipline

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

The basis for studying this academic discipline is the process of training and preparing specialists in the field of 163 "Biomedical Engineering" under the educational and professional program (hereinafter referred to as EPP) "Medical Engineering" of the first (bachelor's) level of higher education capable of solving problems in the field of biomedical engineering, related to the development of software products based on the Python language for the application of these skills in the development of databases, data processing, diagnostic information, and computer modeling in biological biotechnical systems in the final certification works of future specialists.

Training in the discipline "Fundamentals of Informatics" is carried out on the basis of a student-centered approach and a strategy of interaction between the teacher and the student with the aim of helping students master the material and develop practical skills.

***General competencies** (OPP was put into effect by the Rector's Order NON/434/2024 of 10.06.2024 p.):*

***ZK 1** - Ability to apply knowledge in practical situations*
***ZK 2** - Knowledge and understanding of the subject area and understanding of professional activities*

ZK 3 *- Ability to communicate in the official national language both orally and in writing*
ZK 4 *- Skills in using information and communication technologies*
ZK 5 *- Ability to conduct research at an appropriate level*
ZK 6 *- Ability to search, process, and analyze information from various sources*
ZK 11 *- Ability to assess and ensure the quality of work performed*

Special (professional) competencies *(OPP was put into effect by the Rector's Order NON/434/2024 of 10.06.2024 p.):*

FK 1 *- Ability to apply engineering software packages for research, analysis, processing, and presentation of results, as well as for automated design of medical devices and systems*
FK 3 - *Ability to study and apply new methods and tools for analysis, modeling, design, and optimization of medical devices and systems*
FK 6 *- Ability to effectively use tools and methods for analysis, design, calculation, and testing in the development of biomedical products and services*
FK 10 *- Ability to apply the principles of modern automated control systems in the production of medical devices, their technical, lgorithmic, informational, and software support*
FK 11 - *Ability to develop, plan, and conduct experiments using specified technical and biomedical techniques, applying mathematical methods in the analysis and modeling of the functioning of living organisms, systems, and processes in biology and medicine, computer processing, analysis, and synthesis of the obtained results.*

The program learning outcomes after studying the discipline "Microprocessor Engineering" are (OPP was put into effect by the Rector's Order NON/434/2024 of 10.06.2024 p.):

PRN 1- *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*
PRN 5 *- Be able to use databases, mathematical and software tools for data processing and computer modeling of biotechnical systems*
PRN 14 *- Analyze the level of compliance with current global standards, evaluate decisions, and formulate tasks for the development of automated control systems considering the capabilities of modern technical and software automation tools for medical equipment*
PRN 20 *- Knowledge and application of research methods in biomedical engineering, methods and tools for organizing and processing experimental data, statistical methods for modeling and simulating processes and systems of physical and biological nature, modern programming technologies and supporting tools, methods for designing digital and microprocessor-based medical systems*
PRN 23 *- Development and implementation of modern diagnostic and therapeutic methods associated with the use of biotechnology, computer, and nanotechnology through the improvement of technical elements of medical devices and systems, as well as medical products, in the process of professional activity*

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

The academic discipline “Fundamentals of Informatics” belongs to the professional training cycle. In accordance with its subject matter, it integrates knowledge from the discipline “Engineering and Computer Graphics.” According to the structural and logical scheme of the specialist training program, the discipline “Fundamentals of Informatics” is closely related to other disciplines of

professional training: Methods of Modeling and Analysis of Biomedical Processes and Systems, Object-Oriented Programming.

3. The content of the discipline

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

Section 1. Basic concepts of programming in Python

Topic 1.1. Technical and software tools for automation: from the history of computers to modern world standards.

Topic 1.2. Systems analysis and decision-making methods: algorithmization of biomedical engineering problems.

Topic 1.3 Modern programming technologies and tools: introduction to Python for engineering problems

Topic 1.4 Data types and working with numbers

Topic 1.5 Automatic control methods: logical structures and decision-making in programming.

Topic 1.6 Information systematization methods: cyclic while structures for process monitoring.

Topic 1.7 Data processing software: sequences, lists, and tuples.

Topic 1.8 Modeling and simulation of physical processes: for loops and iterative processing.

Topic 1.9 Using databases and associative structures: dictionaries and sets in computer science.

Topic 1.10 Information design and transmission standards: strings, coding and report formatting.

Section 2. Fundamentals of computer science and data processing

Topic 2.1 Improvement of technical elements of medical systems: procedural programming and functions.

Topic 2.2 Integration of knowledge of biophysics and electronics: modularity and use of engineering libraries.

Topic 2.3 Mathematical support for modeling biotechnical systems: working with files and data.

Topic 2.4 Evaluation of solutions and analysis of compliance with standards: exception handling and software reliability.

Topic 2.5 Acquisition and analysis of signals and images: data visualization and graphical analysis.

Topic 2.6 Methods of statistical processing of experimental information: working with arrays (NumPy)

Topic 2.7 Computer and nanotechnologies in medical devices: digital information and coding

4. Training materials and resources

Basic literature:

1. Федорін І. В., Основи інформатики та програмування: Конспект лекцій [Електронний ресурс] : навчальний посібник для студ. спеціальності 122 «Комп'ютерні науки» / І. В. Федорін; КПІ ім. Ігоря Сікорського. – Електронні текстові дані (1 файл: 1,09 Мбайт). – Київ: КПІ ім. Ігоря Сікорського, 2023. – 179 с.

2. Федорін І. В., Основи інформатики та програмування: Практичні роботи [Електронний ресурс] : навч. посіб. для студ. спеціальності 122 «Комп'ютерні науки» / І. В.

Федорін; КПІ ім. Ігоря Сікорського. – Електронні текстові дані (1 файл: 0,18 Мбайт). – Київ: КПІ ім. Ігоря Сікорського, 2023. – 89 с.

3. Яковенко А. В. Основи програмування. Python. Частина 1 [Електронний ресурс] : підручник для студентів які навчаються за спеціальністю 122 «Комп'ютерні науки» спеціалізацією «Інформаційні технології в біології та медицині» / А. В. Яковенко ; КПІ ім. Ігоря Сікорського. – Електронні текстові дані (1файл: 1,71 Мбайт). – Київ : КПІ ім. Ігоря Сікорського, 2018. – 195 с. Режим доступу: https://ela.kpi.ua/handle/123456789/25111

4. Костюченко А. О. Основи програмування мовою Python: навчальний посібник. Ч.: ФОП Баликіна С.М., 2020. 180 с. Режим доступу: https://epub.chnpu.edu.ua/jspui/bitstream/123456789/5584/1/%D0%9E%D1%81%D0%BD%D0%BE%D0%B2%D0%B8%20%D0%BF%D1%80%D0%BE%D0%B3%D1%80%D0%B0%D0%BC%D1%83%D0%B2%D0%B0%D0%BD%D0%BD%D1%8F%20%D0%BC%D0%BE%D0%B2%D0%BE%D1%8E%20Python.pdf

5. Інформатика. Основи програмування та алгоритми. Мова програмування С. Лабораторний практикум [Електронний ресурс] : навчальний посібник для здобувачів ступеня бакалавра за освітніми програмами «Інтелектуальні технології радіоелектронної техніки», «Інформаційна та комунікаційна радіоінженерія», «Радіотехнічні комп'ютеризовані системи», «Інформаційне забезпечення роботехнічних систем» спеціальності 172 Телекомунікації та радіотехніки 126 Інформаційні системи та технології / КПІ ім. Ігоря Сікорського ; уклад. С. В. Вишневий, П. Ю. Катін, Є. В. Крилов. – Електронні текстові дані (1 файл: 3,3 Мбайт). – Київ : КПІ ім. Ігоря Сікорського, 2022. – 221 с. – Назва з екрана. Режим доступу: https://ela.kpi.ua/handle/123456789/48158

***Additional literature** (electronic resources):*

1. Ерік М. Пришвидшений курс Python / Маттес Ерік. – Київ: Видавництво Старого Лева, 2021. – 600 с.

2. Васильєв О. Програмування мовою Python / Олексій Васильєв. – Тернопіль: Навчальна книга Богдан, 2019. – 204 с.

3. Naomi Ceder The Quick Python Book 3rd Edition / Naomi Ceder. – NY: Manning Publications Co., 2018 – 432 p.

4. Kenneth A. Lambert Fundamentals of Python: first programs / Kenneth A. Lambert. – NY: Cengage Learning, 2018 – 476 p.

5. Електронний путівник мовою програмування Python. [Режим доступу]: https://pythonguide.rozh2sch.org.ua/

6. Онлайн платформа та БД для вивчення алгоритмів та мов програмування. [Режим доступу] https://leetcode.com/

7. Алгебра логіки. Матеріал з вікіпедії [Режим доступу]: https://uk.wikipedia.org/wiki/Алгебра_логіки

8. Досконалі диз'юнктивна й кон'юнктивна нормальні форми. Лабораторна робота. [Режим доступу]: http://www.berkut.mk.ua/download/knyrik/dm/lab1.pdf

9. The Python Tutorial [Електронний ресурс] – Режим доступу до ресурсу: https://docs.python.org/3/tutorial/index.html.

10. Навчальні матеріали: Python [Електронний ресурс] – Режим доступу до ресурсу: http://www.matfiz.univ.kiev.ua/pages/13.

11. Креневич, А.П. С у задачах і прикладах : навчальний посібник із дисципліни "Інформатика та програмування" / А.П. Креневич, О.В. Обвінцев. – К. : Видавничо-поліграфічний центр "Київський університет", 2011. – 208 с.

12. Збірник задач з дисципліни "Інформатика і програмування" / Вакал Є.С., Личман В.В., Обвінцев О.В., Бублик В.В., Довгий Б.П., Попов В.В. -2- ге видання, виправлене та доповнене – К.: ВПЦ "Київський університет", 2006.– 94 с.

13. E-Olymp [Електронний ресурс] – Режим доступу до ресурсу: www.eolymp.com.

14. Eric Matthes, Python Crash Course, 2nd Edition: A Hands-On, Project-Based Introduction to Programming, 2019, 544 p.

15. Al Sweigart, Automate the Boring Stuff with Python, 2nd Edition: Practical Programming for Total Beginners, No Starch Press, Inc., 2020, 592p.
16. Методичні рекомендації до виконання комп'ютерних практикумів (поточна версія: http://ela.kpi.ua/handle/123456789/19848).
17. Електронний портал інформатики та програмування – https://www.geeksforgeeks.org/
18. Електронний путівник мовою програмування Python – https://pythonguide.rozh2sch.org.ua/
19. Автоматизована інформаційна система «Електронний кампус НТУУ «КПІ» - http://kpi.ua/ecampus
20. Навчальна БД: http://witdba.iptcom.net:8080/apex/
21. Онлайн платформа та БД для вивчення алгоритмів та мов програмування – https://leetcode.com/

Educational content

5. Methods of mastering the discipline (educational component)

№ s/n	Subject	Program learning outcomes	The main tasks	
			Control measure	Deadline
1.	Technical and software tools for automation: from the history of computers to modern global standards.	PRN 14	Practical work 1	1th week
2.	System analysis and decision-making methods: algorithmization of biomedical engineering tasks.	PRN 11	Practical work 2	2th week
3.	Modern programming technologies and tools: introduction to Python for engineering tasks.	PRN 20	Practical work 3	2th week
4.	Data types and working with numbers.	PRN 1	Practical work 4	3th week
5.	Automatic control methods: logical structures and decision-making in programming.	PRN 1	Practical work 5	3th week
6.	Methods of information systematization: while loops for process monitoring.	PRN 20	Practical work 6	4th week
7.	Software for data processing: sequences, lists, and tuples.	PRN 5	Practical work 7	4th week
8.	Modeling and simulation of physical processes: for loops and iterative processing.	PRN 20	Practical work 8	5th week
9.	Use of databases and associative structures: dictionaries and sets in computer science.	PRN 5	Practical work 9	6th week
10.	Standards for formatting and transferring information: lines, encoding, and formatting reports.	PRN 14	Practical work 10	7th week
11.	Improving the technical elements of medical systems: procedural programming and functions. Functions	PRN 23	Practical work 11	8th week

№ s/n	Subject	Program learning outcomes	The main tasks	
			Control measure	Deadline
12.	Integrating knowledge of biophysics and electronics: modularity and the use of engineering libraries.	PRN 1	Practical work 12	9th week
13.	Mathematical support for modeling biotechnical systems: working with files and data.	PRN 5	Practical work 13	10th week
14.	Evaluation of solutions and analysis of compliance with standards: exception handling and software reliability.	PRN 14	Practical work 14	11th week
15.	Acquisition and analysis of signals and images: data visualization and graphical analysis.	PRN 1	Practical work 15	12th week
16.	Methods of statistical processing of experimental information: working with arrays (NumPy).	PRN 20	Practical work 16	13th week
17.	Computer and nanotechnologies in medical devices: digital information and coding	PRN 23	Modular control work Formatting and submission of work, defense of Calculation and graphic work	14th week
18.	Test		Obtaining a credit "automatically" or a credit test	15th week

Practical works

№ s/n	Practical work topic	Duration in hours
1	Evaluation of technical means of automation and architectural solutions of modern computers	2
2	System analysis methods in the construction of decision-making algorithms in medicine	4
3	Use of modern programming tools for solving engineering problems	2
4	Application of the basics of mathematics and computer science to perform computer arithmetic	2
5	Development of algorithms for automatic process control based on logical operators	2
6	Systematization of information using cyclic structures for monitoring biosignals	2
7	Use of software for processing medical data sequences	2
8	Modeling and simulation of processes of physical nature using iterative cycles	2
9	Use of databases and associative arrays for structuring medical information	2
10	Standardization of output and coding of text information in automated systems	2
11	Development of functional elements for improving medical systems	2
12	Integration of knowledge of biophysics and electronics through modular programming	2
13	Mathematical support for data storage and modeling of biotechnical systems	2
14	Analysis of compliance of software with world reliability standards using exception handling	2
15	Storage and analysis of signals and images by means of graphic visualization	2

16	*Methods of statistical processing of experimental information using numerical arrays*	*2*
17	*MCR System analysis and algorithmization of biomedical problems in Python*	*2*

6. Independent student work

Types of independent work *(preparation for classroom sessions, performing calculations based on primary data obtained in laboratory sessions, solving problems, writing essays, performing calculation work, completing homework assignments, etc.):*

Independent work

№ s/n	List of topics and questions for independent study and references to educational literature	Number of hours of independent work by the student
Section 1. Basic concepts of programming in Python List of questions for independent study		
1	SRC 1.1: Evolution of computer architecture and current trends in biomedical computing. [1 P. 5–18; 5 P. 10–2]	*6*
2	SRC 1.2: Algorithm development for diagnostic protocols (block diagrams and pseudocode). [1 P. 22–35; 5 P. 30–42]	*6*
3	SRC 1.3: Configuring virtual environments (venv) and package managers (pip) for engineers. [3 C. 10–20; 4 C. 5–15.]	*4*
4	SRC 1.4 Truth table construction and logical operations in medical decision-making systems. [3 P. 60–75; App. 7, 8.]	*6*
5	SRC 1.5 Interruption of cycles (break, continue) when monitoring critical patient conditions. [3 C. 78–85; 4 C. 65–72]	*6*
6	SRC 1.6 Using associative structures to create symptom databases and medical registries. [3 P. 130–145; 4 P. 110–125]	*4*
7	SRC 1.7 Medical information encoding standards (ASCII, Unicode) and regular expressions. [3 C. 45–58; 4 C. 40–55]	*8*
Section 2. Fundamentals of computer science and data processing List of questions to be considered for independent study:		
8	SRC 2.1: Recursive functions in modeling biological structures (fractals, trees).. [1 P. 130–145; 3 P. 150–165.]	*6*
9	SRC 2.2: Processing CSV and JSON formats for data exchange between medical equipment. [1 P. 150–162; 4 P. 155–168.]	6
10	SRC 2.3: Creating user errors to control software reliability parameters. [3 P. 182–195; 4 P. 130–138]	6
11	SRC 2.4: Setting up graph styles (Matplotlib) for scientific reporting. [4 P. 170–180; App. 14]	6
12	SRC 2.5: Vectorization of computation: moving from loops to matrix operations in NumPy. [Appendix 1, 5]	8
13	SRC 2.6: Lossless compression methods for storing digital radiographs and ECGs. [1 P. 165–175; 11 P. 15–30]	6
Total		78

One of the main types of semester control during the mastering of the discipline "Microprocessor Engineering" is the implementation of calculation and graphic work. Calculation and graphic work is performed in accordance with the requirements, within the period specified by the teacher.

The main purpose of computational and graphic work is to solve a practical problem using the material learned in lectures and independently, and practical skills acquired in practical work. The student can write calculation and graphic work only on the subject agreed with the teacher

Approximate subject of calculation and graphic work:

1. *Development of an algorithm and software module for automated heart rhythm screening.*
2. *Mathematical modeling and visualization of the cooling dynamics of biological materials in cryostores.*
3. *Statistical processing and analysis of the results of strength tests of biomedical implants.*
4. *Designing an automated system for controlling air parameters in operating rooms.*
5. *Developing software tools for calculating and visualizing dose loads in radiotherapy.*
6. *Simulating biological fluid filtration processes in artificial kidney systems.*
7. *Digital processing and analysis of amplitude-frequency characteristics of biomedical signals.*
8. *Creation of an automated database of the technical condition and calibration of medical equipment in the department..*

Requirements for calculation and graphic work:

The CGW includes: title page, introduction, table of contents, main part, conclusions, list of sources used.

The title page of the CGW should contain the following information: name of the university; name of the faculty; name of the department; name of the academic discipline; name of the test; level of higher education; code and name of the specialty; name of the educational and professional program; task variant, student's last name and first name, course, academic group number; supervisor's full name; defense result; year.

The introduction should substantiate the relevance and practical significance of the CGW topic, and define the goal and objectives of the work.

The main part - the CGW topic is revealed by highlighting the main issues, the presentation should be clear, specific, accompanied by necessary explanations with references to sources of information.

References should be indicated by a serial number according to the list of sources used in square brackets, for example, "... in the collection of tasks [3, p.34] ...".

The list of sources used (at least 10 sources) is drawn up in accordance with the current rules.

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 address of the website on the Internet.

The total volume of the CGW can vary from 15 to 20 pages of the main text, which depends on the student's ability to briefly and at the same time comprehensively reveal the topic.

The calculation and graphic work is evaluated according to the criteria: completeness and depth of disclosure of the topic; correctness of calculations; possession of theoretical material; availability of illustrations (diagrams, tables, figures, schemes, etc.); clarity of references to sources of information; quality of the design of the CGW; substantiation of the student's own opinion in the form of a conclusion.

The deadline for submitting the calculation and graphic work for verification: 10 days before the start of the credit session.

The calculation and graphic work is not checked for plagiarism, but must meet the requirements of academic integrity. If academic dishonesty is detected, the work is canceled and not reviewed.

Policy and control

7. Policy of academic discipline (educational component)

Attending classes

Attendance at lectures is optional. Attending practical classes is desirable, as they are used to write express tests / tests, as well as to defend practical work.

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.

Control measures missed

Missed control measures (defense of practical work) must be practiced in the next classes, provided that the task is scheduled for the current lesson, or in consultations.
Omissions of writing a module test and express test are not fulfilled.
Calculation and graphic work, which is submitted for inspection in violation of the deadline is evaluated with a decrease in the number of weight points.

Violation of deadlines and incentive points

Encouragement points		*Penalty points **	
Criterion	*Weight points*	*Criterion*	*Weight points*
Improving practical work	*1 points (for each practical work)*	*Untimely implementation and test of practical work*	*From -0.5 points to -5 points (depending on the delivery date)*
Passing distance courses on topics that are agreed with teachers	*5 points*	*Untimely execution and test of calculation and graphic work*	*From -2 points to -20 points (depending on the construction period)*
Registration of scientific work for participation in the competition of student scientific works	*10 points*		
Writing abstracts, articles, participation in international, national and / or other events or competitions on the subject of the discipline	*5 points*		

** if the control measure 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". Read more: https://kpi.ua/code.

Norms of ethical behavior

Normative principles of behavior of students and employees, defined in sections 2 of the Code of Honor of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute". Read more: 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 National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute" (approved by the order №NON/128/2021 from 20.05.2021) - https://osvita.kpi.ua/index.php/node/182

Inclusive education

The discipline "Medical Microprocessor Systems" can be taught to most students with special educational needs, except for students with severe visual impairments who do not allow to perform tasks using personal computers, laptops and / or other technical means.

Distance learning

Distance learning takes place through the Sikorsky Distance learning Platform «Sikorsky».

Distance learning through additional online courses on certain topics is allowed subject to agreement with students. If a small number of students wish to take an online course on a specific topic, studying the material with such courses is allowed, but students must complete all the tasks provided in

the discipline.

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).

The student provides a document confirming the completion of the distance course (in the case of a full course) or provides practical tasks from the distance course and subject to an oral interview with the teacher on the topics can receive grades for control measures provided for the studied topics (express control / test tasks, practical work).

Performance of practical works, and also performance of settlement and graphic work, is 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. Monitor and evaluate the system of evaluation of learning outcomes (Rating System of Evaluation)

Evaluation system (current control):

№ s/n	Control measure	%	Weight points	Number	Total
1.	Completion and defense of practical assignments	60	4	16	64
2.	Modular test	20	20	1	20
3.	Calculation and graphic assignment	16	16	1	16
4.	Credit assignment 1	80	80	1	80
Total					100

1It is included in the total rating together with the grade for the RGR if the student did not score 60 points for the semester or he wants to improve his grade.

The applicant receives a positive credit score based on the results of the semester work if he has a final rating for the semester of at least 60 points and has fulfilled the conditions for admission to the semester control, which are determined by the RSE.

With applicants who have fulfilled all the conditions for admission to the credit and have a rating score of less than 60 points, as well as with those applicants who want to increase their rating score, at the last scheduled lesson in the discipline in the semester, the teacher conducts a semester control in the form of a credit test or interview.

After completing the credit test, if the score for the credit test is higher than the rating, the applicant receives a grade based on the results of the credit test.

If the score for the credit test is lower than the rating, a "hard" RSE is applied – the applicant's previous rating (with the exception of the scores for the semester individual assignment) is canceled and he receives a grade taking into account the results of the credit test. This option forms a responsible attitude of the applicant to making a decision about taking the credit test, forces him to critically assess the level of his preparation and carefully prepare for the test.

***Calendar control** (CC) - is performed twice a semester as monitoring of the current state of compliance with syllabus requirements.*

The purpose of calendar control is to improve the quality of student learning and monitor the implementation of the schedule of the educational process by students..

Criterion			The first CC	The second CC
Deadline of calendar controls			8th week	14th week
Conditions for obtaining a positive result from the calendar control	Поточний рейтинг		≥ 15 балів	≥ 40 балів
	Implementation of practical work	PW № 1-7	+	+
		PW № 8-16	-	+
	Modular control work		-	+
	Calculation and graphic work		-	-

In case of detection of academic poor quality during training - the control measure is not credited.

Semester certification of students

Mandatory condition for admission to the test		Criterion
1	Current rating	RD ≥ 42
2	Obtaining a positive assessment for the performed calculation and graphic work	at least 60% of the maximum score
3	All practical works are tested	More than 14 points
4	Obtaining a positive assessment for the Modular control work	at least 60% of the maximum score

The results are announced to each student separately in the presence or remotely (by e-mail). Also recorded in the system "Electronic Campus".

Optional conditions for admission to the exam:

1. *Active participation in practical classes.*
2. *Positive results in the first and second assessments.*
3. *Attendance at lectures.*

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

Number points	Assessment on the university scale
100-95	Perfectly
94-85	Very good
84-75	Good
74-65	Satisfactorily
64-60	Enough
Less 60	Unsatisfactorily
Admission conditions are not met	Not allowed

9. Додаткова інформація з дисципліни (освітнього компонента)

Appendix 1. Program learning outcomes (extended form)

In accordance with the Order of the Ministry of Education and Science of Ukraine No. 1204 dated November 19, 2018 "On approval of the standard of higher education in the specialty 163 Biomedical Engineering" for the first bachelor's level of higher education", in Appendix 1 establishes the correspondence of learning outcomes to competencies in the discipline "Basics of Informatics".

Appendix 2. The list of questions for preparation for module control work

The list of questions for preparation for modular control work, and also for preparation for credit is

given in Appendix 2.

Distance learning through additional online courses on certain topics is allowed subject to agreement with students. If a small number of students wish to take an online course on a specific topic, studying the material with such courses is allowed, but students must complete all the tasks provided in the discipline.

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).

The student provides a document confirming the completion of the distance course (in the case of a full course) or provides practical tasks from the distance course and subject to an oral interview with the teacher on the topics can receive grades for control measures provided for the studied topics (express control / test tasks, practical work).

Work program of the discipline (syllabus):

Compiled by *Associate Professor of the Department of Translational Medical Bioengineering, Ph.D. Oksana Serhiivna Bohomolova*

Approved by *the Department of Biomedical Engineering (protocol № 16 of June 21, 2024)*

Approved by *the Methodical Commission of the Faculty of Biomedical Engineering (protocol № 9 of June 26, 2024)*

Appendix 1.
For syllabus of the discipline «Basics of Informatics»

Program learning outcomes (extended form)

As a result of studying the academic discipline "Microprocessor Engineering", students will be able to::

Learning outcomes (PRN)		Compliance of Learning Outcomes with Competencies according to the Higher Education Standard [6]	
		General Competencies (**soft skills**	Special Competencies (**professional**)
ПРН 1	*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*	***ZK 1** - Ability to apply knowledge in practical situations* ***ZK 3** - Ability to communicate in the official national language both orally and in writing* ***ZK 4** - Skills in using information and communication technologies*	***FK 1** - Ability to apply engineering software packages for research, analysis, processing, and presentation of results, as well as for automated design of medical devices and systems* ***FK 10** - Ability to apply the principles of modern automated control systems in the production of medical devices, their technical, lgorithmic, informational, and software support*
ПРН 5	*Be able to use databases, mathematical and software tools for data processing and computer modeling of biotechnical systems*	***ZK 1** - Ability to apply knowledge in practical situations* ***ZK 2** - Knowledge and understanding of the subject area and understanding of professional activities* ***ZK 3** - Ability to communicate in the official national language both orally and in writing* ***ZK 4** - Skills in using information and communication technologies* ***ZK 5** - Ability to conduct research at an appropriate level* ***ZK 6** - Ability to search, process, and analyze information from various sources*	***FK 1** - Ability to apply engineering software packages for research, analysis, processing, and presentation of results, as well as for automated design of medical devices and systems* ***FK 3 -** Ability to study and apply new methods and tools for analysis, modeling, design, and optimization of medical devices and systems* ***FK 6** - Ability to effectively use tools and methods for analysis, design, calculation, and testing in the development of biomedical products and services* ***FK 10** - Ability to apply the principles of modern automated control systems in the production of medical devices, their technical, lgorithmic, informational, and software support*

Learning outcomes (PRN)		Compliance of Learning Outcomes with Competencies according to the Higher Education Standard [6]	
		General Competencies (**soft skills**	Special Competencies (**professional**)
PRN 14	*Analyze the level of compliance with current global standards, evaluate decisions, and formulate tasks for the development of automated control systems considering the capabilities of modern technical and software automation tools for medical equipment*	***ZK 1*** *- Ability to apply knowledge in practical situations* ***ZK 2*** *- Knowledge and understanding of the subject area and understanding of professional activities* ***ZK 3*** *- Ability to communicate in the official national language both orally and in writing* ***ZK 4*** *- Skills in using information and communication technologies* ***ZK 5*** *- Ability to conduct research at an appropriate level* ***ZK 6*** *- Ability to search, process, and analyze information from various sources* ***ZK 11*** *- Ability to assess and ensure the quality of work performed*	***FK 1*** *- Ability to apply engineering software packages for research, analysis, processing, and presentation of results, as well as for automated design of medical devices and systems* ***FK 6*** *- Ability to effectively use tools and methods for analysis, design, calculation, and testing in the development of biomedical products and services* ***FK 10*** *- Ability to apply the principles of modern automated control systems in the production of medical devices, their technical, lgorithmic, informational, and software support*
PRN 20	*Knowledge and application of research methods in biomedical engineering, methods and tools for organizing and processing experimental data, statistical methods for modeling and simulating processes and systems of physical and biological nature, modern programming technologies and supporting tools, methods for designing digital and microprocessor-based medical systems*	***ZK 4*** *- Skills in using information and communication technologies* ***ZK 5*** *- Ability to conduct research at an appropriate level* ***ZK 6*** *- Ability to search, process, and analyze information from various sources*	***FK 1*** *- Ability to apply engineering software packages for research, analysis, processing, and presentation of results, as well as for automated design of medical devices and systems* ***FK 3 -*** *Ability to study and apply new methods and tools for analysis, modeling, design, and optimization of medical devices and systems* ***FK 11 -*** *Ability to develop, plan, and conduct experiments using specified technical and biomedical techniques, applying mathematical methods in the analysis and modeling of the functioning of living organisms, systems, and processes in biology and medicine, computer processing, analysis, and synthesis of the obtained results.*
PRN 23	*Development and implementation of modern diagnostic and therapeutic methods associated with the use of biotechnology, computer,*	***ZK 1*** *- Ability to apply knowledge in practical situations* ***ZK 2*** *- Knowledge and understanding of the subject area and understanding of professional activities*	***FK 6*** *- Ability to effectively use tools and methods for analysis, design, calculation, and testing in the development of biomedical products and services*

Learning outcomes (PRN)		Compliance of Learning Outcomes with Competencies according to the Higher Education Standard [6]	
		General Competencies (**soft skills**	Special Competencies (**professional**)
	and nanotechnology through the improvement of technical elements of medical devices and systems, as well as medical products, in the process of professional activity	***ZK 11** - Ability to assess and ensure the quality of work performed*	***FK 10** - Ability to apply the principles of modern automated control systems in the production of medical devices, their technical, lgorithmic, informational, and software support* ***FK 11 -** Ability to develop, plan, and conduct experiments using specified technical and biomedical techniques, applying mathematical methods in the analysis and modeling of the functioning of living organisms, systems, and processes in biology and medicine, computer processing, analysis, and synthesis of the obtained results.*

[6] Order of the Ministry of Education and Science of Ukraine No. 1204 dated November 19, 2018 "On approval of the standard of higher education in the specialty 163 Biomedical Engineering" for the first bachelor's level of higher education".

Appendix 2.
For syllabus of the discipline «Basics of Informatics»

The list of questions for preparation for module control work,

and also for preparation for test

1. Which computer architecture involves storing programs and data together in memory? (Von Neumann architecture).
2. What property of an algorithm means that it must complete in a finite number of steps? (Finiteness/Effectiveness).
3. What symbol is used in Python for single-line comments? (#).
4. What function is used to output data to the console? (print()).
5. What is the result of executing the operation 7 // 2 in Python? (3).
6. What operator is used to raise a number to a power? (**).
7. What data type is the result of the operation 5 / 2? (float).
8. What is the process of finding and correcting errors in code called? (Debugging).
9. What function converts the string "123" to an integer? (int()).
10. What operator is used to find the remainder of a division? (%).
11. How to write the name of a variable to store pulse rate according to PEP 8? (pulse_rate).
12. What logical operation should be used so that the condition is true only when two requirements are met simultaneously? (and).
13. What will the function type(3.14) return? (<class 'float'>).
14. What symbol is used for the assignment operation? (=).
15. What data type is used for True/False values? (bool).
16. What operator is used to test multiple alternative conditions after if? (elif).
17. What keyword stops the execution of a loop prematurely? (break).
18. What keyword skips the rest of the loop body and goes to the next iteration? (continue).
19. What loop is appropriate to use if the number of iterations is known in advance? (for).
20. Which loop runs as long as the condition remains true? (while).
21. What is the result of range(5)? (A sequence from 0 to 4).
22. How do you check if the number x is between 10 and 20, inclusive? (10 <= x <= 20).
23. What is an "infinite loop" and how is it usually created using while? (while True).
24. What function returns the number of elements in a list? (len()).
25. Is an else block required for an if statement? (No).
26. What brackets are used to denote a list? ([]).
27. How is a tuple different from a list? (It is immutable).
28. What method adds an element to the end of a list? (append()).
29. What data structure uses key-value pairs? (Dictionary/dict).
30. What is the index of the first element in a Python list? (0).
31. How to get the last element of a list L without knowing its length? (L[-1]).
32. Which dictionary method allows you to get the value by key, avoiding an error if it is not there? (get()).
33. What operation is called a "slice"? (Getting part of a sequence, for example L[1:4]).
34. Which method converts the entire text of a string to uppercase? (upper()).
35. How to check if a key exists in a dictionary? (Use the in operator).
36. What keyword begins a function declaration? (def).
37. Which operator returns the result of a function? (return).
38. What are the names of variables defined inside a function? (Local).
39. What code block is used to catch errors (exceptions)? (try ... except).
40. How to import the standard math module? (import math).
41. Which function of the math module calculates the square root? (math.sqrt()).
42. What is a docstring in a function? (The documentation line at the beginning of a function).

43. What file mode should be selected to write data (open) if the file needs to be created or overwritten? ('w').
44. What method reads the entire contents of a text file in one line? (read()).
45. What error will occur when trying to divide a number by 0? (ZeroDivisionError).
46. Which Python library is the standard for working with large numerical arrays in engineering? (NumPy).
47. Which module is used for plotting and visualizing signals? (Matplotlib).
48. What advantage do NumPy arrays have over standard Python lists? (Processing speed and less memory usage).
49. What is the name of the medical image format that is the world standard? (DICOM).
50. What NumPy function should be used to calculate the arithmetic mean of an array? (np.mean()).